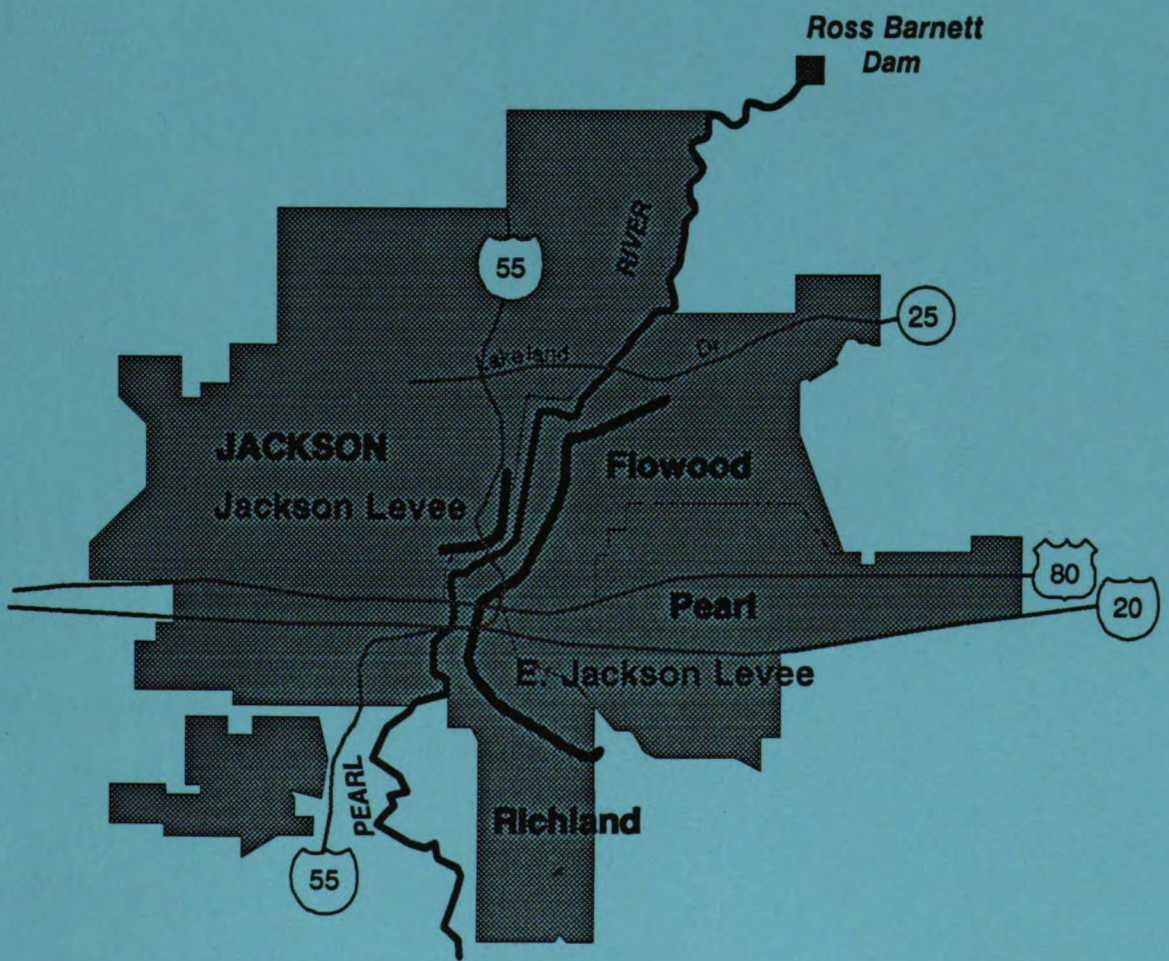
US Army Corps of Engineers
Vicksburg District

FLOOD CONTROL, PEARL RIVER BASIN, MISSISSIPPI

JACKSON METROPOLITAN AREA, MISSISSIPPI

FEASIBLITY REPORT VOLUME III

APPENDIXES 5-8



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JANUARY 1996

JACKSON METROPOLITAN AREA, MISSISSIPPI

APPENDIX 5
SECTION 404(b)(1) EVALUATION

JACKSON METROPOLITAN AREA, MISSISSIPPI

APPENDIX 5
SECTION 404(b)(1) EVALUATION

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APPENDIX 5
SECTION 404(b)(1) EVALUATION

PROJECT DESCRIPTION

LOCATION

1. The primary study area comprises the Pearl River Basin between river mile (RM) 270.0 just south of Byram, Mississippi, and RM 301.77 at the dam of Ross Barnett Reservoir. Municipalities within the study area include Jackson, Flowood, Pearl, and Richland. The study area includes parts of three counties--Madison, Hinds, and Rankin. Major tributaries of the Pearl River within the study area include Richland, Caney, Lynch, Town, and Hanging Moss Creeks. The project study area is shown on Figure 5-1.

PROJECT DESCRIPTION

2. The recommended plan would require approximately 1,024 wooded and 481 cleared acres of rights-of-way. The specific features of this flood control plan are described in the following paragraphs. Details of the levee plans are shown on Plates 4-V-1 through 4-V-17 in Appendix 4.

Northeast Jackson

3. This segment includes 25,075 feet of new levee. Floodgates required include a double 60-inch pipe at station 25+30, a double 12- by 12-foot box culvert at station 110+93, a single 12- by 12-foot box culvert at station 147+18, and a double 48-inch pipe at station 235+51. Approximately 13,500 feet of slurry trench would be required. Approximately 4,000 feet of landside ditch would be required at the upstream end of the levee.

Lakeland Drive Floodwall

4. This segment includes approximately 3,720 feet of floodwall and about 1,165 feet of levee. A single 36-inch pipe structure would be required at station 291+11. Approximately 3,100 feet of slurry trench would be required.

Eubanks Creek

5. This segment includes 1,696 feet of levee with a double 8- by 7-foot box floodgate at station 10+94. Estimated length of slurry trench is 150 feet.

Belhaven Creek

6. This segment includes approximately 1,706 feet of levee. A single 12- by 10-foot box is required at station 9+64. The estimated length of slurry trench is 150 feet.

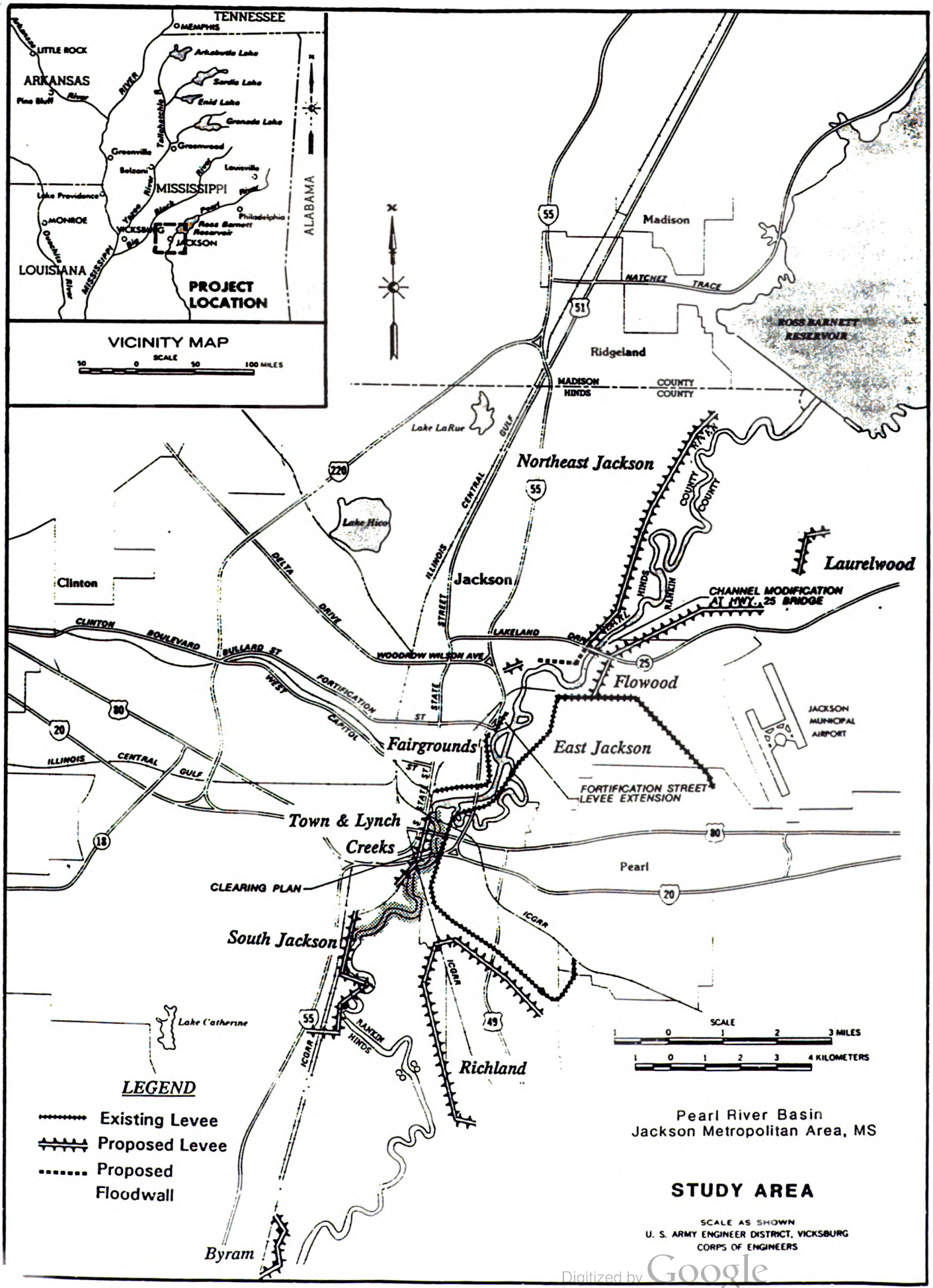

Figure 1

Town and Lynch Creeks

7. This segment includes 7,195 feet of levee. Floodgates required include a triple 12- by 12-foot box at station 16+65 and a triple 12- by 12-foot box at station 65+90. Approximately 2,400 feet of slurry trench would be required along the alignment.

South Jackson

8. This segment includes 19,863 feet of levee. An approximately 1,600-foot connecting ditch would be required along the landside toe upstream of Hardy Creek. A double 48-inch pipe would be required at station 37+79 and a double 9- by 9-foot box at station 165+34. Approximately 7,600 feet of slurry trench is required.

Laurelwood-Flowood

9. This segment includes about 27,924 feet of levee. Floodgates include a double 48-inch pipe at station 41+57, a single 48-inch pipe at station 92+27, a double 6- by 5-foot box at station 175+05, a double 36-inch pipe at station 197+24, and a double 8- by 6-foot box at station 257+94. Approximately 7,250 feet of slurry trench is required.

Richland

10. This segment includes about 26,434 feet of levee. Approximately 3,200 feet of landside connecting ditch is included at the lower end of the levee. Floodgates required include a single 36-inch pipe at station 31+50 and a double 48-inch pipe at station 152+74.

Jackson (Fairgrounds)

11. This segment includes raising the existing levee and adding about 2,600 feet of slurry trench.

East Jackson

12. This segment includes raising the existing levee between its juncture with the lower end of the proposed Flowood levee and its end along Richland Creek. A short levee extension is required at the lower end to tie to high ground. Approximately 15,330 feet of slurry trench is required.

AUTHORITY AND PURPOSE

13. Studies of the Jackson Metropolitan Area, Mississippi, were authorized by congressional resolutions adopted 9 May 1979. These authorizations read as follows:

"Resolved by the Committee on Public Works and Transportation of the House of Representatives, United States, That the Board of Engineers for Rivers and Harbors is hereby requested to review the reports of the Chief of Engineers on Pearl River Basin, Mississippi and Louisiana, published as House Document Number 282, Ninety-Second Congress, Second Session, and other pertinent reports, with a particular view toward determining whether any further improvements for flood damage prevention and related purposes are advisable at this time. The alternatives are to be reviewed with local interests to insure a viable, locally supported project.

Resolved by the Committee on Public Works and Transportation of the House of Representatives, United States, That the Board of Engineers for Rivers and Harbors is hereby requested to review the report of the Chief of Engineers on the Pearl River and Tributaries, Mississippi, contained in House Document 441, 86th Congress, and other reports with a view to determining whether measures for prevention of flood damages and related purposes are advisable at this time, in Rankin County, Mississippi.

Resolved by the Committee on Environment and Public Works of the United States Senate, That the Board of Engineers for Rivers and Harbors, created under Section 3 of the River and Harbor Act, approved June 13, 1902, and is hereby requested to review the reports of the Chief of Engineers on Pearl River Basin, Mississippi and Louisiana submitted in House Document Numbered 92-282, 92nd Congress, 2nd Session and other pertinent reports with a view to determining whether any further improvements for flood damage prevention and related purposes are warranted at this time."

GENERAL DESCRIPTION OF
DREDGED OR FILL MATERIAL

General Characteristics of Material

14. Fill material used in construction would predominantly consist of clay with some silt.

Quantity of Material

15. The quantity of material would consist of 7,167,000 cubic yards of fill material for embankment and 51,570 cubic yards of gravel for the levees. Materials for the floodwalls and floodgates consist of 525,400 cubic yards of fill for temporary cofferdams, 144,000 cubic yards of structural backfill, 13,600 cubic yards of pervious backfill, 49,800 tons of riprap, 9,800 cubic yards of filter stone, 154,000 cubic yards of random backfill, and 25,800 cubic yards of concrete.

Source of Material

16. Fill material would be obtained from onsite borrow areas.

DESCRIPTION OF THE PROPOSED
DISCHARGE SITE(S)

Location

17. The discharge would be at the sites of levee and appurtenant structures construction.

Size

18. Fill areas associated with project construction would total approximately 334 acres.

Types of Sites

19. Sites are located on both cleared and uncleared acreages.

Types of Habitat

20. Habitat types predominantly include bottom-land hardwood wetlands and open lands.

Timing and Duration of Discharge

21. Discharge timing would depend on preconstruction planning and construction activities. Construction is scheduled to begin in 1998 and would require approximately 5 years to complete.

DESCRIPTION OF DISPOSAL METHOD

22. Fill material would be transported and deposited by truck, bulldozer, and/or dragline.

FACTUAL DETERMINATIONS

PHYSICAL SUBSTRATE DETERMINATIONS

Substrate Elevation and Slope

23. The project is located in the Jackson Prairie physiographic subprovince. Ground surface elevations at the construction site would range from an approximate elevation of 240 feet, National Geodetic Vertical Datum, on the Holocene flood plain to 360 feet, National Geodetic Vertical Datum, on the adjacent Tertiary uplands.

Sediment Type

24. Sediments or fill will consist mainly of clays and silts.

Dredged/Fill Material Movement

25. Any movement of fill material would be insignificant.

Physical Effects on Benthos

26. The impacts to benthic organism would primarily be limited to relatively small acreages where interior drainage structures would be constructed. The levee alignment would preclude its having a significant effect on benthic organisms.

Actions Taken to Minimize Impacts

27. Disturbed areas would be revegetated as soon as practical. Fill material not utilized would be placed so as to prevent runoff from entering streams.

WATER CIRCULATION, FLUCTUATION,
CHEMICAL, AND PHYSICAL DETERMINATIONS

Water

28. Construction of project features would have minimal adverse impacts to water quality. However, these impacts would persist until construction is completed and disturbed areas revegetated. Impacts to specific parameters are noted below:

a. Salinity. Not applicable.

b. Water chemistry. During construction, disturbed areas would be subject to increased soil erosion. Eroded material could be transported into tributary streams and into the Pearl River. However, any localized temporary increases in turbidity and suspended solids would diminish when construction activities cease and vegetation is reestablished.

c. Clarity. The localized increases in turbidity caused by construction would have an effect on clarity.

d. Color. No significant effect.

e. Odor. No significant effect.

f. Taste. Not applicable.

g. Dissolved gas levels. Increased organic loadings would increase biological oxygen demand and increase chemical oxygen demand. However, since the Pearl River is highly oxygenated, any change would be very minor.

h. Nutrients. There may be some minor and localized increases in nutrients to the waterway in conjunction with fertilization and revegetation of disturbed areas.

i. Eutrophication. Temporary and minor nutrient increases are not expected to result in appreciable increases in the degree of eutrophication in the waterway.

j. Current pattern and circulation. No significant effects are expected.

k. Velocity. The proposed levee system would result in a slight increase in mean channel velocities.

l. Stratification. No effect.

m. Hydrologic regime. Upon completion, the project would provide protection from a flood which measures 47 feet on the Highway 80 gage.

n. Normal water level fluctuation. The project would only affect those flows with a recurrence interval of 5 years or more. Flows below the top bank of the Pearl River would not be affected in duration or frequency.

o. Salinity gradients. Not applicable.

Actions That Will Be Taken
to Minimize Impacts

29. The adverse impacts to water quality associated with the removal of vegetation would be minimized by seeding disturbed areas after construction. Also, the Corps will implement stormwater runoff measures in accordance with State of Mississippi laws and regulations.

SUSPENDED PARTICULATE/
TURBIDITY DETERMINATIONS

30. The temporary effects of clearing and filling associated with project construction would be an increase in soil erosion. Eroded material may be transported into small tributary streams and into the Pearl River, resulting in increased suspended particulate and turbidity levels in the immediate project vicinity.

a. Light penetration. Sediments released from areas under construction that enter streams may marginally reduce light penetration, the rate of photosynthesis, and primary productivity in the immediate aquatic areas.

b. Dissolved oxygen (DO). Increases in suspended solids may result in decreases in DO. Also, reduction in photosynthesis would reduce DO to a minor degree.

c. Toxic metals and organics. There is the possibility of some mobilization of metal and/or organic contaminants into the water column. However, the potential impact of such mobilization would be minor and transient.

d. Pathogens. No effect.

e. Esthetics. No significant impact to the Pearl River and its tributaries is expected.

f. Pesticides. The nonpoint source of runoff from the surrounding urban area is the primary source of pesticides in the drainage area. Project construction would not significantly affect this.

g. Effects on biota. Periodic reductions in light transmission as a result of erosion associated with construction would reduce photosynthesis and primary production to a minor degree in portions of aquatic areas.

h. Suspension/filter feeders. No significant effect.

i. Sight feeders. No significant effect.

j. Actions taken to minimize impacts. Disturbed areas would be revegetated as soon as possible following construction.

CONTAMINATION DETERMINATIONS

31. Two water quality monitoring stations (downstream side of Ross Barnett Reservoir and Byram) were identified. Data available at the reservoir are limited to the period 1974-1989. Data near Byram were between 1975 and 1992. Table 5-1 displays these data. Summary statistics on heavy metal concentrations (Byram only) are depicted in Table 5-2.

32. The Mississippi Bureau of Pollution Control reported in their 1992 "Water Quality Assessment" that the Pearl River from below the reservoir to the water intake structure "partially supports its public water supply classification and is increasingly threatened by urban runoff and industrial point sources." Water quality data reported at the reservoir indicate that total phosphorous and fecal coliform exceed state benchmark levels. Total phosphorous levels reported at this station ranged from 0.09 to 0.23 milligram per liter (mg/l). The mean concentration, 0.20 mg/l, exceeds the state benchmark of 0.15 mg/l. Fecal coliform concentrations ranged from 1 to 6,000 colonies per 100 milliliters (mL). The state criteria for drinking water supplies are not to exceed 400 colonies per 100 mL. The 75th percentile range was 146 colonies per 100 mL indicating that the states criteria are exceeded less than 25 percent of the time.

33. The Mississippi Bureau of Pollution Control reported that the section of the stream below the water intake to above the Jackson wastewater treatment plant near RM 281 "partially supports its fish and wildlife classification due to urban runoff." The Pearl River at Byram is impacted by the city of Jackson's wastewater treatment plant and urban runoff which results in its supporting the recreation classification.

34. Water quality data reported near Byram indicate that total phosphorous, total kjeldahl nitrogen and fecal coliforms exceed state benchmark levels. Total phosphorous levels ranged from 0.17 to 0.54 mg/l. The 25th percentile

TABLE 5-1
WATER QUALITY DATA

Parameter	Number of Samples	Mean	25% a/	Median	75% b/	Criteria
Pearl River at Ross Barnett Reservoir Station 21MSWQ 02485601						
Temperature (°C)	109	18.9	12	19.8	27	<32.2
Conductivity (umhos/cm)						<500
pH	107	6.6	6.2	6.6	7.0	(6-8.5)
Dissolved Oxygen (mg/l)						>4
Turbidity (NTU)	15	26	23	29	32	
Total Suspended Solids (mg/l)	110	12.9	7	11	16	<1,000
Total Solids (mg/l)						
Total Phosphorous (mg/l)	92	0.20	0.09	0.13	0.23	<0.15
PO4 (mg/l)	16	0.20	0.04	0.07	0.18	
Nitrate (mg/l)	90	0.17	0.04	0.1	0.17	<1
TKN (mg/l)	109	0.91	0.67	0.80	1.10	<1
Ammonia (mg/l)	17	0.27	0.11	0.22	0.41	
Fecal Coliform (#/100 mL)	102	495	10	30	146	<400
Pearl River Near Byram, Mississippi Station 21MSWQ 02486500						
Temperature (°C)	306	22.3	19.5	25.5	27	<32.2
Conductivity (umhos/cm)	186	120	75	140	160	<500
pH	191	6.4	6.1	6.5	6.8	(6-8. 5)
Dissolved Oxygen (mg/l)	179	5.8	4.2	6.1	6.4	<4
Turbidity (NTU)	48	42	26	35	45	
Total Suspended Solids (mg/l)	134	38	19	27	45	<1,000
Total Solids (mg/l)	9	135	105	120	138	
Total Phosphorous (mg/l)	128	0.41	0.17	0.28	0.54	<0.15
PO4 (mg/l)	31	0.285	0.045	0.13	0.36	
Nitrate (mg/l)	127	0.301	0.07	0.18	0.42	<1
TKN (mg/l)	151	1.419	0.9	1.28	1.8	<1
Ammonia (mg/l)	45	0.424	0.08	0.34	0.625	
Fecal Coliform (#/100 mL)	105	1,377	57	170	1,375	<400

a/ Exceeds state benchmarks standards 75 percent of the time.
b/ Exceeds state benchmarks standards 25 percent of the time.

TABLE 5-2
SUMMARY STATISTICS OF HEAVY METALS
(Parts per Billion (μg/l)

Constituent	Mean	Minimum	Maximum	Action Level a/	Period
Arsenic	3.55	9.00	51.0	190.0	1991-1992
Cadmium	2.82	0.03	11.0	0.66	1976-1992
Chromium	0.82	0.10	1.0	120.0	1976-1992
Copper	4.20	0.10	13.0	6.5	1976-1992
Lead	8.20	0.50	23.0	1.3	1976-1992
Mercury	0.80	0.0002	1.0	0.012	1976-1992
Manganese	137.50	0.20	238.0	NS	1976-1992
Nickel	3.23	0.20	5.0	88.0	1976-1992
Zinc	8.00	0.02	10.0	59.0	1976-1992
Aluminum	332.25	207.00	510.0	NS	1991-1992

a/ Action level refers to EPA Freshwater Chronic Criteria.

for total phosphorous was 0.17 mg/l which indicates that phosphorous exceeds the state benchmark of 0.15 mg/l over 75 percent of the time. Total kjeldahl nitrogen ranged from 0.9 to 1.8 mg/l. Total kjeldahl nitrogen exceeded the state benchmark of 1 mg/l over 50 percent of the time. Fecal coliform concentrations ranged from 7 to 20,000 colonies per 100 mL. Fecal coliform concentrations exceeded the drinking water supply criteria over 75 percent of the time.

35. Of the 10 metals reported in Table 5-2, the Mississippi Department of Environmental Quality has not established standards for two (manganese and aluminum). Two of the remaining metals, arsenic and mercury, exceeded the reported human health standard for concentration in water and organisms. Mean arsenic concentration during the 1991-1992 sampling period was 3.55 microgram per liter (μg/l) and mean mercury concentration from 1976 to 1992 was 0.80 (μg/l). State standards for arsenic and mercury are 0.0175 and 0.151 μg/l, respectively. In addition to the reported concentrations of the various heavy metals, low levels of DDT have been found in fish tissue samples.

36. The proposed project would not significantly contribute to or impact area contaminants.

AQUATIC ECOSYSTEM AND
ORGANISM DETERMINATIONS

Effects on Plankton

37. No significant effects.

Effects on Benthos

38. Some benthic organisms would be adversely impacted by deposition of fill material.

Effects on Nekton

39. No significant effects are expected to free-swimming animals.

Effects on Aquatic Food Web

40. No significant effects are expected.

Effects on Special Aquatic Sites

41. The Mayes Lake area of the LeFleur's Bluff State Park complex is within the project area. It consists of several ponds and oxbow lakes. The project would not result in significant adverse impacts to these areas.

a. Wetlands. Approximately 891 acres of bottom-land hardwood wetlands would be adversely impacted by the project.

b. Mudflats. Not applicable.

c. Vegetated shallows. Not applicable.

d. Coral reefs. Not applicable.

e. Riffle and pool complexes. Not applicable.

f. Threatened and endangered species. The proposed project would potentially affect the ringed sawback turtle. In accordance with Section 7(c) of the Endangered Species Act of 1973, as amended, the U.S. Army Corps of Engineers, Vicksburg District, prepared a Biological Assessment for the ringed sawback turtle to address potential impacts to the turtle from implementation of the proposed project. The U.S. Fish and Wildlife Service concurred with the conclusions presented in the Biological Assessment that adverse impacts to the ringed sawback turtle are unlikely as long as nesting beaches and basking areas are not disturbed. The proposed project would not likely disturb nesting or basking areas for the ringed sawback turtle.

g. Other wildlife. Terrestrial habitat and associated wildlife would experience unavoidable adverse impacts associated with the loss of bottom-land hardwood wetlands.

h. Actions to minimize impacts. Environmental design features incorporated into the project would minimize adverse impacts to terrestrial and wetland resources.

42. Levee alignments were designed to leave as much area as possible on the riverside while providing for adequate storage of interior runoff. In addition, an alternative which would involve construction of a levee through Mayes Lakes State Park was rejected in favor of the floodwall adjacent to the businesses just outside the park. The proposed levee would have interfered with planned expansion of camping facilities, introduced an esthetically unpleasing site to the park setting, and contributed to the further fragmentation of bottom-land hardwood habitat in the basin.

43. Other design measures to minimize impacts included shifts in the west bank levee upstream from Lakeland Drive. Just upstream from Lakeland Drive, the alignment was set closer to existing development to reduce impacts to a cypress-tupelo swamp created by beavers. The area could not be avoided entirely, however, due to the width of the proposed levee and proximity of residences. In the area upstream from Hanging Moss Creek, the alignment was shifted to follow the 16th section line to avoid a significant ecological area at the end of Westbrook Road.

44. During initial levee design, the plan incorporated large berms to prevent underseepage. However, after further study, it became evident that use of slurry trenches was preferred due to less damage to terrestrial habitat and lower maintenance costs. Although some borrow areas would be needed for slurry mixing areas, these could be reclaimed and returned to forested habitat.

45. Borrow areas (approximately 778 acres) would be designed to minimize clearing at the work site. The number of access points to each pit would also be minimized. In order to reduce direct impacts and provide habitat diversity, several small (5 to 10 acres) separate borrow pits would be utilized instead of one large continuous pit. Following extraction of borrow material, borrow pits would be modified to provide both shallow and deep water areas, with inclusion of peninsulas and/or islands. Trees and brush piles resulting from clearing would be configured to benefit wildlife instead of burning. Some felled trees would be placed perpendicular to the edge of each pit to provide access and loafing areas for certain wildlife species. Access roads and other disturbed areas around borrow pits would be seeded with wildlife food plants such as lespedeza or clover and replanted to hardwood species. The unavoidable loss of 891 acres of bottom-land hardwood wetlands would be fully compensated for by the reforestation of 1,228 acres of marginal farmland with bottom-land hardwoods.

PROPOSED DISPOSAL
SITE DETERMINATIONS

Mixing Zone Determinations

46. No impact expected.

Determination of Compliance with
Applicable Water Quality Standards

47. The State of Mississippi requires that turbidity levels shall not be exceeded by more than 50 nephelometric turbidity units outside the limits of a 750-foot mixing zone during the time of discharge and that waters be free from toxic or harmful pollutants. Turbidity due to project construction would result from erosion associated with project construction. Any of the eroded material reaching the Pearl River or its tributaries would result in minor turbidities that would be well within state standards.

Potential Effects on Human
Use Characteristics

48. Municipal and Private Water Supply. No significant effect.

49. Recreational and Commercial Fisheries. Approximately 778 acres of aquatic habitat would be created as a result of project construction. This would provide additional opportunities for recreational fishing.

50. Water-Related Recreation. No significant effect.

51. Parks, National and Historical Monuments, National Searches, Wilderness Areas, Research Sites, and Similar Preserves. LeFleur's Bluff State Park complex is within the city of Jackson and project area. It would not be significantly affected by the project.

Determination of Cumulative
Effects on the Aquatic Ecosystem

52. The requirement for deposition of fill material during construction would add a minimal amount of pollutants to the Pearl River and its tributaries. Pollutants would primarily be in the form of increased sediment loads that would result in minor increases in both suspended solids and turbidity.

Determination of Secondary
Effects on the Aquatic Ecosystem

53. Secondary impacts on the aquatic ecosystem would be minimal.

FINDING OF COMPLIANCE FOR FLOOD CONTROL

54. No significant adaptations of the Section 404(b)(1) guidelines were made relative to this evaluation.

55. Deposition of fill material would adversely impact 334 acres of bottom-land hardwood wetlands. The proposed project features were designed to avoid and minimize, to the maximum extent practicable, all wetlands and other waters of the United States. Incorporated into the project's design were levee alignments that would leave as much area as possible on the riverside of the levee while providing for adequate storage of interior runoff and avoiding significant ecological areas; construction of a floodwall rather than a levee through the Mayes Lake State Park, thus preserving esthetics as well as not interfering with a planned park facility expansion; use of a slurry trench rather than large berms to prevent underseepage; and designing borrow areas to improve fish and wildlife habitat. To compensate for project-induced adverse terrestrial habitat impacts, approximately 1,228 acres of marginal agricultural land would be reforested with bottom-land hardwoods.

56. The planned deposition of fill material would not violate any applicable State Water Quality Standards. Further, the planned fill action would not violate the Toxic Effluent Standards of Section 307 of the Clean Water Act.

57. No endangered species or their critical habitat will be impacted by the planned action.

58. The proposed deposition of fill material will not result in significant adverse effects on human health and welfare, including municipal and private water supplies, recreational and commercial fishing, plankton, fish, shellfish, wildlife, and special aquatic sites. The life stages of aquatic life and other wildlife will not be adversely affected. Significant adverse effects on aquatic ecosystem diversity, productivity and stability, and recreation, esthetic, and economic values would not occur.

59. Appropriate steps to minimize potential adverse impacts of the fill action on aquatic systems include cessation of fill activities during extreme flood events.

60. On the basis of the Section 404(b)(1) guidelines, the proposed sites for the deposition of fill material are specified as complying with the requirements of these guidelines.

JACKSON METROPOLITAN AREA, MISSISSIPPI

APPENDIX 6
ECONOMIC APPENDIX

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APPENDIX 6
ECONOMIC APPENDIX

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APPENDIX 6
ECONOMIC APPENDIX

INTRODUCTION

1. This appendix describes the socioeconomic environment and presents the results of an economic evaluation of the flood threat from the Pearl River in the Jackson Metropolitan Area, Jackson, Mississippi. The evaluations are based on overbank flood profiles projected within the municipalities of Jackson, Flowood, Pearl, and Richland. The study area includes parts of three counties--Madison, Hinds, and Rankin. The basic parameters of the analysis include: October 1994 price levels, a discount rate of 7-3/4 percent, and a 100-year project life.

2. Expected flood damages to the residential, commercial, and public sectors were determined for existing conditions and with proposed flood control measures in place using the risk and uncertainty guidance in EC 1105-2-205, Risk Analysis Framework for Evaluation of Hydrology/Hydraulics and Economics in Flood Damage Reduction Studies dated 25 February 1994. The specific purposes of this analysis were to determine the feasibility of providing flood protection for the area and to quantify the uncertainty associated with making the decision to invest in a flood protection project in the Jackson Metropolitan area.

STUDY AREA

STUDY AREA LOCATION

3. The study area consists of the Pearl River Basin between river mile 270.0 just south of Byram, Mississippi, and river mile 301.77 at the dam of Ross Barnett Reservoir. Municipalities within the area include Jackson, Flowood, Pearl, and Richland. The project area includes parts of three counties--Madison, Hinds, and Rankin. Major tributaries of the Pearl River within the study area include Richland, Caney, Lynch, Town, and Hanging Moss Creeks.

STUDY AREA REACHES

4. The study area was divided into 24 reaches. These reaches consisted of 17 reaches protected by new levees, 2 reaches protected by raising existing levees, and 5 reaches that make up the unprotected areas between the levees. Reaches were determined based on hydrologic/hydraulic and economic conditions. Reach boundaries and levee alignments were established to protect existing development with the minimum amount of construction with the least amount of environmental disturbance as possible. Plate 1 shows the location of the existing and recommended levees.

ECONOMIC FLOOD DAMAGE SETTING

5. The study area is primarily affected by headwater flooding from the Pearl River. Headwater flooding is caused by heavy and intense rainfall over the upper Pearl River Basin. Residential and nonresidential structures and related development within and adjacent to the Pearl River flood plain are subjected to flood damages.

6. Prior to 1979, the flood of record was the 1902 flood. The previous modern day flood of record occurred in 1961. These record floods were far surpassed as to flood levels, discharge and damage by the event of 1979, the worst flood in Jackson's history, and by that of May 1983, another major, damaging flood. Because of the severity of these two floods, other floods which occurred between 1979 and 1983 are noted less frequently. Floods with frequencies of 5 to 10 years occurred on 21 March 1980, 14-17 April 1981, 6 December 1982, and 8-9 April 1983. This repeated flooding over the 4-year period caused a great deal of trauma to the citizens in the flood area and, combined with other events, has created intense interest in flood control.

7. During the 1979 flood, there were 1,935 houses and 775 businesses flooded. Damages to these properties were especially severe because the river was above flood stage from 10 to 14 days in some areas. This caused serious disruption to transportation and communications and stymied the capitol city for weeks. The total physical property damage caused by the 1979 flood was estimated at $233 million in 1979 dollars or approximately $440 million in current dollars.

8. In a 2-day period between 12-13 April 1979, rainfall in amounts measuring up to 19.6 inches fell over the headwaters of the Basin. The resulting flood had an observed of 128,000 cubic feet per second (cfs) at the gage in Jackson. The resulting impact to Jackson was devastating. In May 1983, another severe rainfall in the upper Basin generated a peak of 78,600 cfs at the Jackson gage. The frequency of the 1979 and 1983 flood events is estimated to be 200 and 35 years, respectively, at the Jackson gage.

SELECTED PLAN

9. The selected plan consist of the components listed below. A detailed description of this plan is presented in the main report.

a. 21.9 miles of new levees

b. 10.5 miles of existing levee raising

c. 3,720 feet of floodwall

d. 10 gated box structures

e. 9 gated pipe structures

f. 242 acres of floodway clearing

g. 1,228 acres reforestation for mitigation

h. 28 commercial structures acquisition/demolition

10. The net grade of the recommended new and upgraded existing levees equals the Pearl River flow line having a stage of 47.0 feet at the Highway 80 gage. The 10.5 miles of existing levees will be raised 2 to 6 feet. The selected plan reduces 95 percent of total damages and has a 99 percent probability of containing the 1 percent chance flood (100-year event) should it occur. Of particular importance, it has a 96 percent probability of containing the 300-year event, should it occur. Following are the results of the economic analysis of the selected plan:

First Cost ($000)	Annual Cost ($000)	Annual Benefits ($000)	Excess Benefits ($000)	Benefit-Cost Ratio
99,379	9,098	13,912	4,814	1.53

11. The tentatively selected plan would provide protection to 19 of the 24 reaches evaluated. Four of the reaches are riverside of the levees. Only two of these reaches have structures subject to damages. Permanent structures in these reaches will be purchased and removed. Reach W9, referred to as the Byram levee area, was eliminated. The Byram levee is economically infeasible and the only reach that is a separate segment from the tentatively selected plan. The proposed Byram levee is located 8 miles below the tentatively selected plan. Project impacts in the Byram area were evaluated and determined to be insignificant.

SOCIOECONOMIC CHARACTERISTICS

SOCIOECONOMIC CHARACTERISTICS BY PARAMETER

12. The following presents information on the demographic and economic characteristics of Hinds and Rankin Counties, Mississippi. Madison County was not included since less than 1 percent of the county is within the study area.

Population

13. Data from the 1990 Census reflect a population of 342,000 in the two-county area, an increase of 6.7 percent since 1980. Significantly, this two-county area contained 13.3 percent of the state's 1990 population. Especially strong growth occurred in Rankin County, with a 58 percent increase from 1970

to 1980 and 26.3 percent from 1980 to 1990. Table 6-1 displays selected population data for the two counties.

TABLE 6-1
COUNTY POPULATION
JACKSON METROPOLITAN AREA, MISSISSIPPI

County	Population				Percent Change 1980-1990
	1960	1970	1980	1990	
Hinds	187,045	214,973	250,998	254,300	1.3
Rankin	34,322	43,933	69,427	87,700	26.3
Total	221,367	258,933	320,425	342,000	6.7

SOURCE: U.S. Census of Population: 1960, 1970, 1980, and 1990.

Population Distribution

14. The parts of the two-county area in and near Jackson are overwhelmingly urban, while the remainder reflects the rural character of the Pearl River Basin. Census data indicate that 78.5 percent of the counties' residents were classified as urban in 1990, but this number is skewed by Hinds County with its 86.6 percent urban population. In both counties, the urban proportions grew between 1970 and 1980, especially in Rankin County, which more than doubled its percentage. The urban proportions have remained constant through the 1980's. Table 6-2 summarizes pertinent residential statistics.

TABLE 6-2
COUNTY URBAN POPULATIONS, 1990
JACKSON METROPOLITAN AREA, MISSISSIPPI

County	Urban Residents	Percent of Total	1980 Percent
Hinds	220,227	86.6	86.8
Rankin	48,296	55.1	56.3
Total	268,523	78.5	80.2

SOURCE: U.S. Census of Population: 1980 and 1990.

Housing

15. The total number of housing units in the two-county area increased substantially from 1980 to 1990 from 107,886 to 120,881, a gain of 12 percent.

Units increased by 37.2 percent in Rankin County and 5.7 percent in Hinds County. The overall gain in housing of about 12 percent, when compared to the 6.7 percent population rise, results from both smaller families and larger numbers of one-person households.

Employment

16. Between 1980 and 1990, the number of individuals in the labor force grew from 164,342 to 180,536, a gain of 9.85 percent. Rankin County registered the highest growth, 52 percent, compared to 3.45 percent increase in Hinds County. Table 6-3 shows the 1989 distribution of place-of-work employment by major industry group for the two counties. Because of the dominant influence of Jackson, the trade services sectors constitute 53 percent of area employment, followed by government at 24 percent, manufacturing at 10 percent, and all other sectors at 12 percent.

TABLE 6-3
PLACE-OF-WORK EMPLOYMENT, 1990
JACKSON METROPOLITAN AREA, MISSISSIPPI

County	Total	Trade and Services	Government	Manufacturing	Other
Hinds	147,476	80,021	35,835	13,790	17,830
Rankin	33,060	14,910	7,877	5,593	4,680
Total	180,536	94,931	43,712	19,383	22,510

SOURCE: Mississippi Employment Security Commission.

Income

17. With the economic growth in the area, major changes have occurred in the income statistics of the two counties. The 1990 per capita income figures for each county showed increases in excess of 70 percent over the 1980 numbers. In constant dollars, Rankin County's gain was 80.5 percent, from $8,180 to $14,765, with Hinds County increasing 72 percent from $9,151 to $15,753.

Transportation

18. The Jackson transportation system is well developed. In general, the highway system appears to meet the present needs of the area. Interstates 20 and 55 and U.S. Highway 49 serve as major corridors for Jackson. The two major airports in the Basin--Allen C. Thompson and Hawkins Fields--are both located at Jackson. Allen C. Thompson is the larger of the two in total aviation operations. Those two airfields serve the regional passenger, freight, and general aviation needs of residents in the Basin. A railroad system presently exists in the region; however, there has been a loss of both

passenger and freight traffic over the past years. The Illinois Central Gulf Railroad serves the Jackson area. Waterborne commerce has not moved on the Pearl River in the Jackson area in recent times.

Utilities

19. Privately owned utilities serve the Jackson area. Mississippi Power and Light Company is the primary electric power distributor, and United Gas Pipeline Company supplies natural gas. Jackson's water supply is withdrawn from the Pearl River from streamflow provided by Ross Barnett Reservoir. Other urban areas depend on wells located in the immediate area for their water supply. None reported difficulty in maintaining adequate reserves for their consumers. Existing sewage treatment facilities can absorb limited new development with a minimum amount of improvements or additions to existing facilities.

Land Use

20. In 1985, over 23 percent of the 38,300-acre study area flood plain was devoted to urban development. Since that time, urban development, primarily residential and commercial development, has continued within the flood plain. Land use and acreages within the Pearl River flood plain in the Jackson area are provided in Table 6-4.

TABLE 6-4
PEARL RIVER FLOOD PLAIN LAND USE
JACKSON AREA a/
JACKSON METROPOLITAN AREA, MISSISSIPPI

Land Use	Acreage	Percent
Bottom-land Hardwoods	16,479	43.0
Cypress-tupelo	1,046	2.7
Upland Hardwoods	567	1.5
Mixed Hardwoods	2,453	6.4
Pine	1,285	3.4
Cutover Lands	1,417	3.7
Pasture/Old Field	3,425	8.9
Cropland	1,334	3.5
Open Water	1,393	3.6
Urban Development	8,901	23.3
Total	38,300	100.0

a/ From Ross Barnett Reservoir downstream to near Byram (U.S. Fish and Wildlife Service, 1985).

STRUCTURE INVENTORY

STRUCTURAL SURVEYS

21. During reconnaissance studies, a complete structure inventory was conducted in the fall of 1987 and an additional inventory was conducted in October 1989. During feasibility studies, another survey was conducted in the spring of 1991 to identify all new construction that had occurred since the earlier inventory. The structural inventory consisted of 8,181 structures with 6,551 residential and 1,630 nonresidential. Information gathered on each structure consisted of structure value, structure type, first floor elevation, type construction, number of stories, and location. The comprehensive survey, as opposed to a semple, and highly detailed data it produced were critical to this evaluation and enhance the accuracy of study findings.

Structure Values

22. Vicksburg District real estate appraisers determined the values associated with improvements within the flood plain. Each individual structure was visually evaluated. The market data approach was used to derive structure depreciated replacement cost. This approach, once the sales are obtained, is the most cost-effective method of estimating the depreciated replacement cost. Sales of comparable properties, once land is removed, provide a more complete method because depreciation and allowance for location differences are already factored into the value. Special purpose structures; i.e., public buildings, large industrial complexes, and semi-public structures such as hospitals and churches were investigated and estimated either utilizing market data, cost approach (Marshal and Swift, reproduction cost minus depreciation), or obtained from current insured values. Table 6-5 displays the value of residential and nonresidential structures by levee segment.

Structure Elevations

23. Structure elevations were derived from third order surveys using conventional levels for 55 percent of the structures. Approximately 45 percent of the structure elevations were derived from 2-foot contour aerial survey mapping. Table 6-6 displays the number of structures damaged by frequency. Of particular importance is the large number of structures subject to flood damages from events greater than the 100-year event. Figure 6-1 illustrates this concept.

TABLE 6-5
VALUE OF STRUCTURES BY AREA
EXISTING CONDITION
JACKSON METROPOLITAN AREA, MISSISSIPPI
($000)

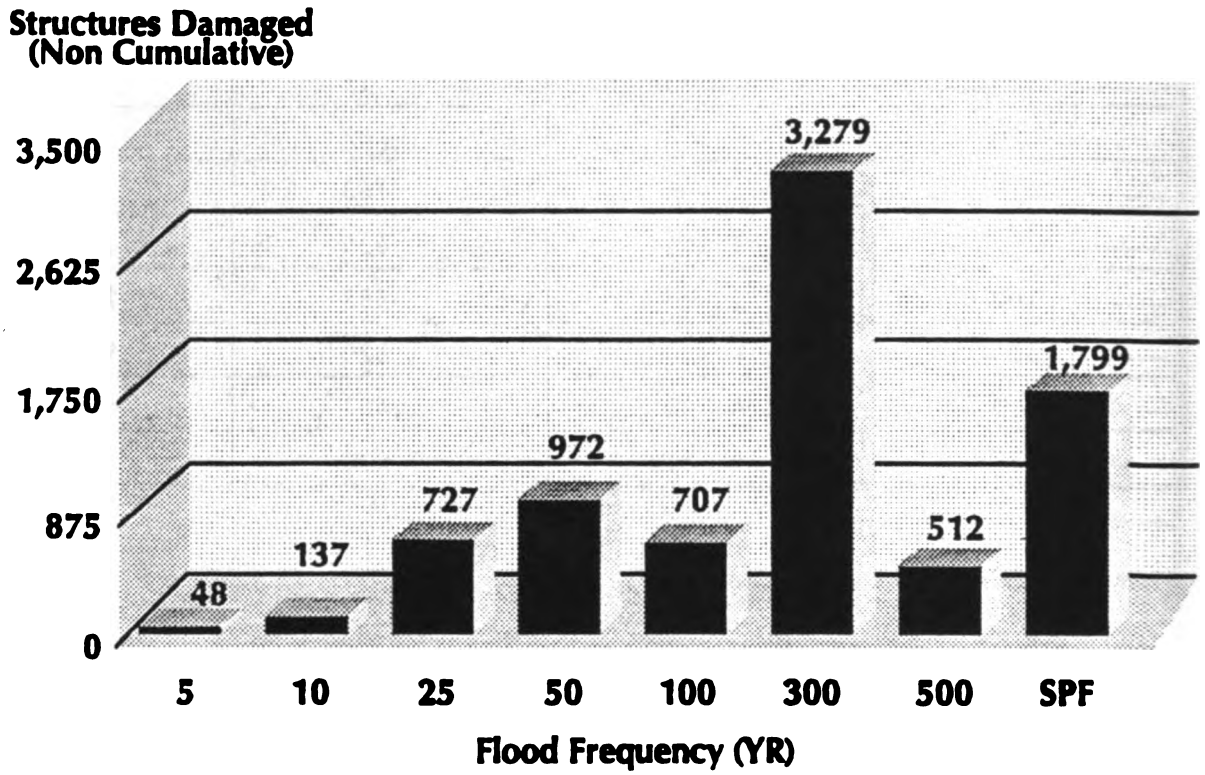
Reach	Residential	Nonresidential	Total
Existing Levee and Belhaven Area			
Fairgrounds	2,299	36,590	38,889
East Jackson	46,891	81,350	128,241
Belhaven	5,110	125	5,235
Town and Lynch Creek Area			
Town and Lynch	7,357	258,822	266,179
Richland and South Jackson Area			
South Jackson	12,276	8,684	20,960
Richland	8,928	4,766	13,694
Above Existing Levee Area			
Northeast Jackson	246,781	42,830	289,611
Flowood/Laurelwood	14,766	62,717	77,483
Floodwall	17,447	13,261	30,708
Total	361,855	509,145	871,000

TABLE 6-6
NUMBER OF STRUCTURES FLOODED BY FREQUENCY
EXISTING CONDITION
RELATIONSHIP OF FLOOD FREQUENCY
JACKSON METROPOLITAN AREA, MISSISSIPPI

Frequency of Occurrence (Freq/Yr)	Residential (#)	Nonresidential (#)	Total (#)
1	0	0	0
2	1	0	1
5	33	15	48
10	143	42	185
25	744	168	912
50	1,459	425	1,884
100	2,008	583	2,591
300	4,550	1,320	5,870
500	4,980	1,402	6,382
SPF	6,551	1,630	8,181

Figure 6-1

Number of Structures Damaged by Frequency
Existing Development
Jackson Metropolitan Area, MS



24. The contribution to average annual flood damages from flooding events of a 100-year magnitude or greater is often relatively small, but such is not the case in the Jackson area. In this case, the contribution to average annual damages from floods ranging from a 100-year event through a SPF event is approximately 62 percent of total average annual flood damages. This is in large part due to the protection afforded by the existing Fairgrounds and the East Jackson Levee. This phenomenon is also true because of the degree of development of the upper portions of the flood plain relative to the development in the lower portions of the flood plain, particularly in the northeast and south Jackson areas. The results of this phenomenon make it imperative that potential solutions to the flooding problem address themselves primarily to substantial reduction of flood stages that occur from flood events greater than the 100-year event.

TRADITIONAL NATIONAL ECONOMIC DEVELOPMENT (NED) ANALYSIS VERSUS RISK ANALYSIS APPROACH

GENERAL

25. This report evaluates the economic impacts of flooding in the Jackson Metropolitan area using the risk analysis procedures described in EC 1105-2-205 dated 25 February 1994. This analysis technique was chosen as the best means of evaluating the uncertainty in the hydrologic/hydraulic and economic conditions in the Jackson Metropolitan area. The following paragraphs briefly review the basic elements of the traditional NED analysis and set forth a general overview of the risk analysis approach.

TRADITIONAL NED ANALYSIS

26. The traditional NED levee analysis involved designing a levee to provide protection against a particular flood event, normally a historical event. Levee height was determined by analyzing flood plain damage potential, damages prevented, and cost for selected levee designs. The plan selected was based on maximizing net national economic benefits. An increment of levee height over the design flood level, "freeboard," was added. The freeboard was provided to ensure performance of the project during occurrence of the design flood.

27. There has been an ongoing debate regarding the economic consideration of freeboard. An economic viewpoint is that a return should be received for the additional increment of expensive investment. A design viewpoint is that freeboard must be provided to ensure the project provides the benefits claimed for all floods up to and including the design flood. In accounting for benefits due to freeboard and thus selecting the plan that maximizes net benefits, the traditional method allowed claiming partial credit for the benefits in the freeboard range.

28. The traditional approach was to make best estimates of flow-frequency, stage-discharge, and stage-damage and several other items and consider uncertainty by application of professional judgment, designing freeboard, and

sensitivity analysis. The basic criticism of the traditional approach is that freeboard is expensive and our studies do not adequately quantify the return expected for the investment.

RISK ANALYSIS APPROACH

29. The new approach abandons the concept of freeboard and, instead, incorporates elements of risk and uncertainty more directly in project formulation, evaluation, and design. This approach accounts for the inherent uncertainty of our hydrologic/hydraulic and economic variables. The basic data are the same except uncertainty is explicitly quantified. A key feature of this analysis is that the levee sizing parameter is design elevation - not the protection provided or risk factor. There is no "design flood" as such, and levee freeboard to account for uncertainty is not added. The results relate to levees that correspond to particular stages at the gage.

30. With new technology, including computer software @RISK, we can now analytically, mathematically handle the risk and uncertainty that was previously difficult to do. The Risk based NED analysis involves deriving a stage-discharge curve, discharge-probability curve, and a stage-damage curve, all with risk and uncertainty incorporated. By integrating these curves, their associated risk and uncertainty, and an annual cost curve, an NED alternative is selected based on levee height instead of a levee design expressed as storm frequency design. This process is discussed and clarified further in the remainder of this appendix.

31. Risk based analysis incorporates risk and uncertainty into the calculation of flood damages for specified events by using a simulation technique in which multiple iterations select from the full range of possible values for each input variable. The resulting mean value and probability distributions provide the decision maker a complete picture of all the possible outcomes.

32. The analysis is accomplished by considering the range of possible values (maximum and minimum values for each input variable in the flood damage calculation) and distribution of the likely occurrence of outcomes over the specified range. The @RISK program uses Monte Carlo simulation to derive the possible variable occurrences. Monte Carlo simulation uses randomly generated numbers to simulate the occurrences of selected variables from established ranges and distributions. In a normal distribution, 68 percent of the occurrences of a particular outcome would be within one standard deviation on either side of the mean (expected value), 95 percent within two standard deviations on either side of the mean, and 99.7 percent within three standard deviations on either side of the mean.

33. The computerized Latin Hypercube sampling technique is used to sample from within the range of values. With each sample or iteration, a value is selected. The sum of all sampled values divided by the number of samples yields the expected value. This routine is accomplished simultaneously for each structure on each variable used to calculate the stage-damage curve.

Once the stage-damage curve and its corresponding standard deviations are developed, it is used with the stage-discharge curve and the discharge-probability curve to determine residual damages for selected levee heights.

34. The risk and uncertainty analysis includes not only the point estimate that is the expected result (or the most likely occurrence of a variable), but also the range of potential outcomes for that variable and the distribution of potential outcomes over that range. The results reflect how the rare and unlikely combinations of possible events affect project formulation.

35. Figure 6-2 displays a schematic diagram of the results of risk and uncertainty modeling from calculating structure value for an individual residential structure. A normal distribution is depicted with a sample mean value of $80,000, standard deviation of .05102 (.10/1.96), and a range plus or minus 10 percent. Assuming there is a 95 percent confidence level, the true mean is within ± 10 percent of the sample mean. This implies a standard deviation for structure values of $80,000 equals 8,000/1.96 or 4,082. The risk model not only evaluates the uncertainty of each variable in this manner, but integrates the uncertainty of all the variables to determine total damage and its corresponding uncertainty given the uncertainty of all the variables.

36. Development of the risk and uncertainty spreadsheet models employed, determination of probability density functions, and estimation of variable parameters and assumptions has been a joint effort among the U.S. Army Corps of Engineers Water Resources Support Center (Institute of Water Resources and the Hydrologic Engineering Center (HEC)), and the Vicksburg District.

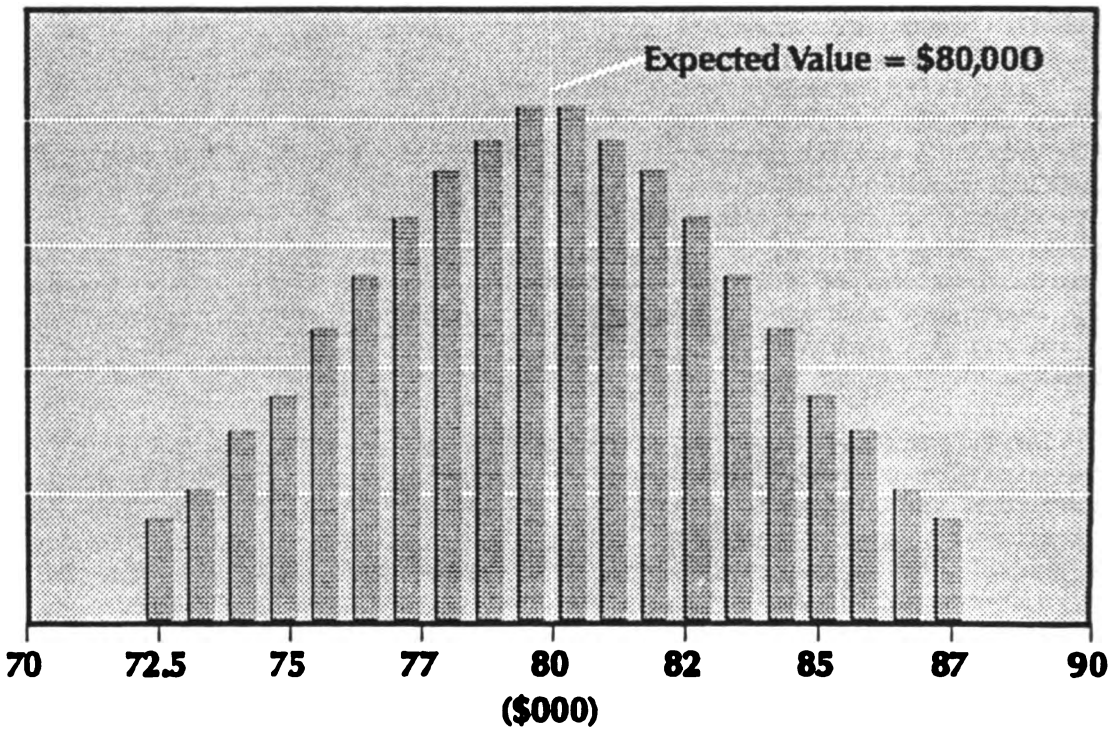
FLOOD DAMAGE EVALUATION USING RISK MODELING

SPREADSHEET (DATA) DEVELOPMENT

37. There were three @RISK simulation spreadsheets employed in the economic evaluation of the Jackson Metropolitan Area Study. The first spreadsheet incorporated the variables necessary to calculate structure stage-damage with risk considered. The second spreadsheet, developed by HEC and known as the project sizing template, integrates the stage-damage curve, stage-discharge curve, and the discharge-probability curve. This spreadsheet provides the basic NED analysis. The third spreadsheet is a modification of the project sizing template for the purpose of evaluating existing levees. The project sizing template results in two principal conclusions--project sizing and project reliability. Project sizing yields the basic NED analysis of levee sizes that corresponds to a particular stage at the gage location. Project reliability results in the probability of a levee height containing frequency flow events.

Figure 6-2
EXAMPLE

STRUCTURE VALUE UNCERTAINTY
Jackson Metropolitan Area, MS



Iteration	Value W/R&U
1	84,036
2	78,765
3	80,810
.	.
.	.
.	.
5,000	82,042
Total	400,053,234
	=
5000	= $80,000

RESIDENTIAL/COMMERCIAL/INDUSTRIAL
STRUCTURE EVALUATION

38. The first step in constructing the @RISK simulation spreadsheets is to identify the sources of uncertainty that affect the calculation of flood damages. These sources involve three basic relationships--stage-damage, stage-discharge, and discharge-probability. The following discussion will focus on the uncertainty involved in the development of the structural stage-damage curve. Refer to Appendix 4 for discussion of variables evaluated for their impact on the latter two relationships, stage-discharge and discharge-probability.

39. Four variables were analyzed for their impact on the stage-damage curve. These include structure value, content value, first floor elevation, and depth-damage relationships. Content value of nonresidential structures was the only variable not evaluated for its risk and uncertainty in the development of the structure stage-damage curve. Only 20 percent of the structures are nonresidential. Part of this uncertainty is captured in varying the structure value, first floor elevation, and the depth-damage relationship.

Structure Value

40. Structure values were determined by real estate appraisers. Using market sales the appraisers estimated the values of residential and nonresidential structures to have an error of plus or minus 10 and 20 percent, respectively. A TNORMAL probability density function was used with the appraised value as the mean, standard normal deviation, and a minimum value of minus 10 percent of the mean and maximum value of plus 10 percent of the mean. A TNORMAL probability density function is a normal distribution that is truncated at each end of the distribution by the limits of the range of possible values established. Nonresidential minimum and maximum were based on a 20 percent estimated error.

First Floor Elevation

41. Risk assessment of structure first floor elevations was based on estimates of error established in EC 1105-2-205, Risk Analysis Framework for Evaluation of Hydrology/Hydraulics and Economics in Flood Damage Reduction Studies, 25 February 1994. Structure elevations were derived by structure using conventional levels for 55 percent of the structures. Approximately 45 percent of the structure elevations were derived from 2-foot contour aerial survey mapping. The standard deviations in feet were .03 and .30 for conventional level and 2-foot aerial survey, respectively. A TNORMAL probability density function was used to describe this variable.

Content and Depth-Damage Values

42. Since 1987, extensive investigations have been made by the Economic and Social Analysis Branch to determine applicable depth-damage relationships to areas within the Vicksburg District. Curves under evaluation have included Huntington (1976), TVA (1982), FIA (1978), and CH2MHill (1980). Flood history, topographic features, socioeconomic conditions, and structural characteristics (e.g., values) are among parameters considered for each study area. In this assessment, it was determined that the freshwater depth-damage relationships developed by CH2MHill, Inc., best conformed to the economic, hydrologic, and physical environments prevalent in Jackson, Mississippi.

43. Background. The depth-damage relationships considered most applicable to the Jackson, Mississippi, area were developed by a contract firm, CH2MHill, Inc., for the New Orleans District in 1979-1980. These curves, based on structural inventories of over 7,000 homes in Jefferson and Orleans Parishes, were derived specifically for utilization in the Lake Pontchartrain Hurricane Protection Project and like areas. Extensive depth-damage surveys were conducted utilizing 125 structures from the original data base. Each structure was visually inspected with estimated expected damages recorded at various levels of inundation. Estimated damages, expressed as a percent of depreciated preflood structure and contents values, were compiled by 0.5-foot increments of flooding to a depth of 15 feet over the ground flood elevation. Curves were further differentiated by structure type and type of flooding (i.e., freshwater versus saltwater flooding). Structure values were aggregated into three basic structure types (i.e., single-story, two-story or greater, and mobile home) by construction type. The freshwater damage curves were determined to be the type applicable to overflow within the Jackson Metropolitan Area.

44. Purpose. The following paragraphs demonstrate the vast similarities between the two study areas. This information supports the application of the CH2MHill depth-damage curves and content values used in the economic evaluation of water resource improvements in the Jackson Metropolitan Area. Due to the proximity of the two areas and the similar climates, construction types, structure values, and socioeconomic and hydrologic characteristics, use of these data was deemed to be appropriate.

45. Similarities in the Areas.

a. General. The study areas under comparison include Jefferson and Orleans Parishes and the city of New Orleans, Louisiana, of the CH2MHill study, and Hinds and Rankin Counties and the city of Jackson, Mississippi, of the Jackson Metropolitan Study. These areas share several common physiographical and socioeconomic characteristics among which include climate, topography, flood history, urbanization trends, etc. In addition, given that

the structures surveyed in both the CH2MHill contract and the Jackson Metropolitan Study Area were predominantly middle class homes of similar construction, income values, etc., there is little basis for any significant differences in depth-damage relationships for the areas.

b. Location and Climate. Jackson, Mississippi, is located 181 miles northeast of New Orleans, Louisiana, along the Pearl River. The geographic locations of both areas, which lie in the Lower Mississippi River alluvial plain, are classified in the central region of the Marshall and Swift Construction Costs Climate map. They are characterized by normally mild climates and have average daily temperatures ranging from lows of 32.7 to 41.8 degrees F in January to 90.6 to 92.4 degrees F in July. Houses within this climate generally have 2- by 4-inch stud construction, minimal wall and ceiling insulation, and single-window glazing. The Jackson area and the area surveyed by CH2MHill conform to these construction practices.

c. Topography. Lands in both areas under comparison are used extensively for urban development. The study areas are basically characterized by very flat to gently rolling lands with slopes ranging from 0 to 2 percent. Elevations in the New Orleans area range from near sea level in the swamplands to approximately 23 feet above sea level along higher grounds. Physiography in the Jackson Metropolitan Study area ranges from flat flood plains to sloping areas up to 300 feet. Both areas have an ample supply of water resources which include lakes, swamps, rivers, bayous, and other tributary systems. Rainfall in the areas is normally abundant and well distributed throughout the year, resulting in a fairly high water table. Annual precipitation ranges from 55.4 to 61.9 inches. Evaporation potential and permeability of the soils in the areas are normally moderate which result in soils that are somewhat poorly drained, dependent on the type of soil and season of the year. Development in these areas usually has poor potential for most urban uses because of its susceptibility to flooding and wetness. Because of the mild climate and high water table, most structures built in these areas are constructed with a foundation depth of about 18 inches and do not have basements.

d. Flood History. Both study areas have been affected by urban flooding caused by heavy and intense rainfall. CH2MHill flood damage to individual components of each structure, such as floor covering, brick veneer, or electrical circuits, was defined as the cost to repair or replace that item, whichever was the least amount. A minimum damage due to silt and flood duration of 1 week at each 6-inch depth interval was derived. It was assumed that there was no wind or current and that the structure does not lift off its foundation. Differences in the flooding in the Lake Pontchartrain study and the Jackson area are that floodwaters from the Pearl River contain large amounts of silt and the larger floods have durations of up to 2 weeks.

46. Socioeconomics.

a. Housing and Structural Characteristics.

(1) Statistics from the 1990 Census reveal the resemblance in housing characteristics between the two study areas. The number of households in New Orleans was estimated to be 188,235 in 1990 as compared to 120,881 in the Jackson area. In view of the population of each area, the number of persons per household (PPH) was very close. PPH ranged from 2.55 for New Orleans and Orleans Parish to 2.82 for Rankin County in Mississippi. Remaining statistics include 2.68 for Jefferson Parish, 2.64 for Jackson, and 2.7 for Hinds County.

(2) In addition to housing numbers, the types of housing construction and residential values are very comparable. In 1990, the difference in median housing values between the two areas was less than 14 percent. Orleans and Jefferson Parishes averaged housing values of approximately $70,550, while Hinds and Rankin Counties were approximately $60,950. Both of these were below the national average of $79,100. Rent values in the two areas were also comparable with $379 in New Orleans and $388 in Jackson.

(3) In a comparison of construction types, the majority of these homes are middle-class residences, ranging in size from 1,200 to 2,000 square feet of living area. Construction types range from older neighborhood pier homes, with hardwood floors, high ceilings, and screened porches to newer brick slab homes located primarily in suburban areas. Most of the data base consisted of homes constructed within the last 20 years, typically one-story, brick veneer, on a slab foundation or piers, and with no basement. According to the Marshall and Swift Residential Estimator Service, the local multiplier for New Orleans (.90), which adjusts the costs of construction for a specific geographic location, is only 4 percent higher than the local multiplier for Jackson (.86), both of which are below the national average.

b. Income. Per capital income values from the 1990 Census ranged from $11,372 for the city of New Orleans to $12,216 for Jackson. Although each of these is well below the national average of $18,660, they are closely equivalent to each other (within 7 percent).

47. Content Values. The above information reveals that the socioeconomic, structural, hydrologic, and physical characteristics of Jefferson and Orleans Parishes, Louisiana, conform closely to those of the Jackson Metropolitan study area. Number of persons per household, types of construction, structure values, local Marshall and Swift Residential local cost of construction multiplier, and per capital income illustrate the comparability of the two areas. The similarities of these areas support the use of structure content value ratios and depth-damage relationships. Table 6-7 illustrates the contents to structure percentage values for the Jackson Metropolitan Area.

TABLE 6-7
CONTENTS TO STRUCTURES PERCENTAGE VALUES
JACKSON METROPOLITAN AREA

Type of Structure	Contents (%)
Residential	60
Commercial	125
Professional	125
Industrial	113
Public	24
Semipublic	24
Recreational	24
Warehouse	125
Mobile home	71

48. Uncertainty Parameters.

a. Content-to-structure values. Residential uncertainty bounds on content value-structure value ratios were based on parameters of survey data from Jefferson and Orleans Parishes, Louisiana, used to establish the depth-damage relationships. Content value to structure value ratios ranged from 48 to 71 percent. This range was used to establish the standard deviation of content value. The standard deviation derived from consultation with the Institute of Water Resources was the difference in the range of content value ratios divided by four (4) and multiplied by the structure value. The four represents four standard deviations of the mean value. Research conducted at the Institute of Water Resources determined that a TLOGNORMAL probability density function fits the national data on content value-structure value ratios. The probability density function formula within the @Risk program is established with a mean, standard deviation, and a minimum and maximum value. The minimum and maximum content values were derived from the range of content values. The standard deviation derived as described establishes the mean content value-structure value ratio.

b. Depth-damage relationship.

(1) The range of the depth-damage relationships was determined from comparison of three depth-damage curves. Depth-damage relationships from surveys conducted by CH2MHill, consultant for the New Orleans District; Huntington depth-damage relationships; and depth-damage relationships developed by the Tennessee Valley Authority were evaluated. An average

standard deviation was determined from comparing the average standard deviations of these relationships for each specific depth. The average standard deviation of these relationships is 25 percent. A TNORMAL probability density function was used to describe this variable. This density function consists of a sample mean value, standard deviation of .12755 (.25/1.96), and a range plus or minus 25 percent. Assuming there is a 95 percent confidence level, the true mean is within ±25 percent of the sample mean.

(2) The Federal Insurance Administration (FIA) contents and structure flood insurance claims data for the Jackson Metropolitan Area (Hinds and Rankin Counties) were also evaluated. Depth/damage curves for contents and structure were developed from the FIA data base. The FIA depth/damage relationships were examined for their affect on project benefits. The FIA depth/damage curves would result in an approximate 11 percent <u>increase</u> in project benefits. The FIA depth/damage curves were not used due to inconsistencies in the data. Table 6-8 presents the detailed structure and content depth/damage curves, based on 1-foot increments, for both the FIA and the CH2MHill curves.

TABLE 6-8
AVERAGE PERCENT STRUCTURE AND CONTENT DEPTH/DAMAGE, BY FOOT
FIA DATA AND CH2MHill
JACKSON METROPOLITAN AREA

Depth of Flood (ft)	Structure Depth/Damage				Content Depth/Damage			
	One-Story		Multistory		One-Story		Multistory	
	FIA Data	CM2MHill Data	FIA Data	CM2MHill Data	FIA Data	CH2MHill Data	FIA Data	CH2MHill Data
-1	8.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0	16.4	10.5	22.0	5.5	16.0	0.0	5.6	0.0
1	33.8	31.5	25.6	18.0	25.7	27.0	21.1	16.0
2	42.4	38.5	34.8	20.0	32.1	44.0	24.2	23.6
3	43.5	40.5	36.6	22.0	34.8	54.0	48.5	28.1
4	44.5	45.8	38.4	25.0	41.5	63.0	50.9	30.3
5	53.1	50.5	40.1	27.0	49.6	68.0	53.2	33.5
6	53.6	53.5	41.9	29.0	62.6	73.0	56.0	35.0
7	54.2	53.5	41.9	29.3	63.7	75.0	58.7	36.0
8	62.1	58.8	41.9	31.5	64.7	78.0	58.7	37.0
9	62.1	58.8	41.9	36.5	65.7	78.0	58.7	37.9
10	62.1	58.8	41.9	44.8	66.7	78.0	58.7	39.3
11	62.1	58.8	41.9	44.8	66.7	78.0	58.7	39.3
12	62.1	58.8	41.9	45.0	66.7	78.0	58.7	39.3
13	62.1	58.8	41.9	46.5	66.7	78.0	58.7	39.3
14	62.1	58.8	41.9	48.5	66.7	78.0	58.7	39.3
15	62.1	58.8	41.9	48.5	66.7	78.0	58.7	39.3
16	62.1	58.8	41.9	48.5	66.7	78.0	58.7	39.3

OTHER DAMAGE/BENEFIT CATEGORIES

49. Three additional damage and two benefit categories were evaluated. The damage categories included emergency costs, road and bridge, and automobiles. The benefit categories evaluated are entitled Federal Flood Insurance and Reduced Fill. Damages and project benefits were also determined for the Savanna Street Wastewater Treatment Plant (SSWWTP).

Emergency Costs

50. Emergency costs include such items as evacuation and reoccupation costs; flood-fighting expenses; costs for emergency shelter and food for evacuees; state and Federal disaster relief; increased expense of normal operations; increased costs of police, fire, and/or military patrol; and losses due to abnormal depreciation of equipment; e.g., fire trucks, patrol cars, bull-dozers, etc., resulting from catastrophic flooding. Specific flood-fighting activities include sandbagging, road barricades, pumps and associated equip-ment, levees, transport of fill dirt, etc., and other requirements resulting from flooding. These are expenses or costs borne by affected residents and property owners, local or state governments or agencies, other Federal agencies, or national organizations.

51. Emergency cost was derived from a survey conducted by the Vicksburg District of the Salvation Army, American Red Cross, Federal Emergency Manage-ment Agency, Mississippi Emergency Management Agency, Civil Defense agencies, and the National Guard. Emergency costs in the State of Mississippi asso-ciated with actual 1990 and 1991 flood events and number of structures affected were used to derive an emergency cost per structure. A stage-damage relationship for evaluation in the risk-based analysis was derived by applying the cost per structure to the number of structures flooded by frequency. Table 6-9 illustrates the cost components of the emergency cost calculations for the Jackson Metropolitan area.

TABLE 6-9
EMERGENCY COSTS ASSOCIATED WITH FLOODING
JACKSON METROPOLITAN AREA, MISSISSIPPI

ITEM	DESCRIPTION	COST PER STRUCTURE a/ ($)
Emergency Relief b/	Emergency aid for shelter, food, and clothing; health, cleaning, and maintenance supplies, etc.	412.00
Evacuation/Reoccupation c/	Evacuation expenses paid by the American Red Cross to relocate each family (or structure flooded) are based on rent or lodging costs for the family for 1 month	336.00
Flood-fighting Expenses d/	Flood-fighting/floodproofing measures include costs of sandbagging, pumps, levees, dirt, visqueen, barricades, tractors, trailers and other miscellaneous equipment	417.00
Emergency Personnel/Rescue & Patrol Operations e/	Emergency operations include expenditures in excess of the normal operating costs of labor and equipment (e.g., rescue and patrol operations; boats, autos, fire trucks, etc.; additional costs associated with mud slides and debris removal)	126.00
TOTAL FLOOD EXPENSES		1,291.00

a/ Costs were provided from reference sources on a cost-per-structure basis. Emergency costs per structure are presented in October 1993 dollars.
b/ The Salvation Army and American Red Cross were interviewed to provide information on relief measures.
c/ The American Red Cross provided information on evacuation expenses.
d/ Several government organizations were surveyed for these statistics, including FEMA, MEMA, Civil Defense agencies, the National Guard, etc.
e/ Costs of rescue and patrol operations were provided by local fire, police, sheriff, and highway departments.

Road and Bridge

52. The overall analysis of transportation facility losses involved determining the number of units adversely impacted by frequency and the application of these data to a loss per unit value for various types of facilities involved. Aerial photographs, topographic maps, hydrologic data, and a delineation of the area affected were utilized in this analysis. In order to calculate these damages, stage-frequency and stage-damage curves were developed for each area. The evaluation also incorporated data from interviews with local officials.

53. The type, location, and number of miles of streets, roads, etc., affected were based on analysis of current aerial photographs and topographic maps on which the impacted area was delineated. The loss value per mile of road was derived through contacts with the street maintenance personnel and county

highway officials in the project area. These officials are very familiar with all aspects of highway/bridge construction, repair, and maintenance cost including those associated with historical flood damage. The county engineers evaluated actual cost estimates of asphalt overlay and minimum patching. A loss value of $26,250 per mile was estimated. The number of miles of roads flooded by the 50-, 100-, 300-, and 500-year events by levee segment area was derived by delineating these events onto quadrangle maps and planimetering highway mileage and applied to the loss value per mile to establish a stage-damage relationship for evaluation in the risk-based analysis. Miles of flood highways ranged from approximately 55 miles from a 50-year event to approximately 120 miles from a 500-year event. There were no road and bridge damages calculated below the 50-year event. Although rerouting traffic costs have occurred from historical flood events, these costs were not included in this analysis. The resulting stage-damage relationships were evaluated within the risk analysis framework.

Automobile

54. The analysis of automobile damages involved determining the number of units (automobiles) impacted and the application of these data to the damage per unit value. Estimation of the number of automobiles per household by frequency in the area was accomplished utilizing the number of automobiles per household, and number of households assumed to be damaged. These values were applied to an average damage per automobile to derive overall damages.

55. Variations in the depth of flooding in these urban areas would result in some automobiles having a higher percentage of damage than others. Therefore it was determined that the damage per automobile should be based on an average of several flood depths and represent potential average damage values. The average damage per automobile was based on the average damage value used in the Ouachita River Basin, Monroe-West Monroe Interim Study, February 1987. Automobile depth-percent damage information used in the Paxton Creek, Harrisburg, Pennsylvania, Study, June 1992; other Baltimore District studies; and the Peachtree-Nancy Creeks Metropolitan Atlanta Area, Georgia, September 1979, by the Savannah District was utilized in the Ouachita River Study. The average damage per automobile ($697) was an average of potential damage of several flood depths. The per automobile damage was applied to only 10 percent of the automobiles subject to flooding, the same percentage used in the Ouachita River Basin, Monroe-West Monroe Interim Study. The $697 per automobile is a conservative estimate of damages when compared to the 1-foot, 10 percent damage per automobile utilized in the Paxton Creek Study. Although automobile damages have occurred to automobile dealerships from historical flood events, these damages were not included in this analysis. The stage-damage relationships developed from this analysis were evaluated within the risk and uncertainty framework.

Federal Flood Insurance

56. Benefits from the reduction in the cost of administering the flood insurance program deals with probable changes in the aerial extent of the 100-year flood plain for the with- versus without-project conditions. The number of structures which would no longer be in the 100-year flood plain, 2,576, was used in the computation of this category of benefits. The current operating cost per policy is $125.00. Municipalities within the project area include Jackson, Flowood, Pearl, and Richland. The main threat of flooding in these cities is from headwater and backwater from the Pearl River. Federal Flood Insurance policies for the municipalities totaled 5,704 in October 1992 and 5,456 policies in August 1994. Although it is difficult to verify the location of each policy, these data are very strong evidence the insurance policies do exist, are consistent from year to year, and exist due to the threat of flooding from the Pearl River. Federal insurance reduction benefits only consist of 2 percent of the total project benefits. Table 6-10 presents policy data for 1992 and 1994 for the study area.

TABLE 6-10
NUMBER OF INSURANCE POLICIES BY MUNICIPALITY
JACKSON METROPOLITAN AREA, MISSISSIPPI

AREA	POLICIES	
	1992	1994
City of Jackson	4,964	4,723
City of Flowood	214	213
City of Pearl	460	457
City of Richland	66	63
Hinds County Unincorporated	217	225
Rankin County Unincorporated	250	220
TOTAL	6,171	5,901

Reduced Fill

57. Reduced fill benefits are derived from the reduction in the cost to fill land to the required level for development on land that will be filled without project construction. The acreage subject to land filling and yardage required to fill to the 100-year event plus 1 foot and the 1979 flood event elevations were determined. These acres are outside the designated floodway and area required for runoff storage. A survey of current landowners was

conducted to verify the acres to be filled and to determine the development timeframe. The survey indicated 60 percent of the acreage subject to fill would be filled after project construction. Although numerous factors affect land development, landowner intentions were considered to be the best barometer of acreage and timeframe of development. The survey revealed acreage was anticipated to be developed within approximately the first 5 to 10 years of the projects life. The acreage subject to fill and ongoing development were demonstrated during the Feasibility Review Conference field trip. Additionally, Plate 6-I 1980 quadrangle map and Plate 6-II current 1992 planimetric map illustrate the rate of development within the area where land filling benefits were evaluated. It should be noted that although other landfilling throughout the project area is occurring, only the area along Lakeland Drive was used to calculate fill benefits.

58. Reduced fill benefits were derived by determining the acreage to be filled by elevation. The cost to fill to the required (100-year plus 1 foot) elevation was then determined. Normally this analysis would be based on filling to the 100-year plus 1 foot elevation, survey information indicated the rule was to fill to the 1979 flood elevation. An estimated 218 acres are to be filled after project construction.

Treatment Plant

59. Flood damages and project benefits were determined for SSWWTP. SSWWTP is the wastewater treatment facility for the Jackson metropolitan area. This area includes the cities of Jackson, Flowood, Pearl, Richland, and Brandon. The treatment plant is currently protected by a non-Federal ring levee. Estimated with- and without-project damages/benefits were derived through field investigations and consultation with the city of Jackson Department of Public Works and SSWWTP personnel. The existing treatment plant levee was evaluated to determine the probable failure and nonfailure points. Flood damages were based on beginning points of damages, estimated damages by flood elevation, historical flood damages, and probabilities of levee failures. The Jackson Department of Public Works engineering staff estimated repair cost to SSWWTP as a result of a flood the magnitude of the 1979 flood would require $20 million. Estimated annual benefits to SSWWTP are $1,253,000.

SUMMARY OF EXPECTED DAMAGES AND BENEFITS

60. In the absence of flood control measures, damages will occur to urban properties, roads and bridges, and automobiles. Additionally, flood-related cost for emergency expenses and cost for administering the Federal Insurance Administration program will occur. Approximately 95 percent of the damages occur to urban properties. Total expected annual damages without flood reduction measures are $11.5 million. Table 6-11 displays the expected annual damages by category and area.

TABLE 6-11
TOTAL EXPECTED ANNUAL DAMAGES BY AREA
EXISTING CONDITION
JACKSON METROPOLITAN AREA, MISSISSIPPI
($000)

Area	Urban	Other a/	FIA Cost	Total
Existing Levee and Belhaven Area				
Fairgrounds	1,365	10	0	1,375
East Jackson	1,975	34	0	2,009
Belhaven	12	1	10	23
Town and Lynch Creek Area				
Town and Lynch	2,789	54	48	2,891
Richland and South Jackson Area				
South Jackson	77	9	14	100 b/
Richland	880	39	34	953
Above Existing Levee Area				
Northeast Jackson	2,137	125	144	2,406
Flowood/Laurelwood	1,388	27	37	1,452
Floodwall	310	8	10	328
Total	10,933	307	297	11,537

a/ Emergency cost, road and bridge, and automobile damage.
b/ Excludes wastewater treatment plant damages ($1,253,000).

IMPACT OF EXISTING LEVEES UPON DAMAGES

61. The Jackson (Fairgrounds) and East Jackson levees were completed in 1968 by the Corps. These protective works consist of two earthen levees, four gated outlets, and two pumping stations. The Jackson levee protects 420 acres and 162 structures in the Fairgrounds area of Jackson on the west side of the river. In 1984, an extension on the north end of the Jackson levee was constructed to prevent flanking of the main levee, as occurred during the record flood of April 1979. This extension is 0.2 mile long and protects an additional 380 acres. The longer East Jackson levee protects 5,870 acres and 1,997 structures, including the town of Pearl and portions of Flowood and Richland. These levees are an integral part of the proposed flood solution.

62. Problems have often arisen in determining the impact of existing levees having uncertain reliability. Specifically, the problem is one of engineering judgment but has implications for benefit evaluation: engineering opinion may differ as to the ability of the levees to contain flows with water surface elevations of given heights. This can lead to difficulty in arriving at a clear, agreed upon without-project condition. The HEC spreadsheet for the evaluation of existing levees is a systematic approach to address indeterminate, or arguable, degrees of reliability.

63. The risk based analysis for the determination of benefits attributable to existing levees utilizes a probable failure point (PFP) and probable non-failure point (PNP). These points were determined based on the procedures outlined in ETL 1110-2-328 and are illustrated on Figure 6-3. All benefits to existing levees are claimed for the area below the PNP and none above the PFP. Benefits between these two points are determined based on the probabilities of failure through this range. For detailed information on the determination of these points refer to Section II of Appendix 4.

64. Total expected annual damage for those areas with existing levees in place is over $3.3 million. Raising an existing levee is generally difficult to economically justify because in most cases the majority of the benefits are attributable to the existing levee. This is not the case for the Jackson existing levees. Not only does the recommended plan of protection dictate raising the Jackson existing levees, the benefits from raising well exceed the cost.

INITIAL BENEFIT-COST ANALYSIS FOR ALL PLANS

SYSTEM APPROACH

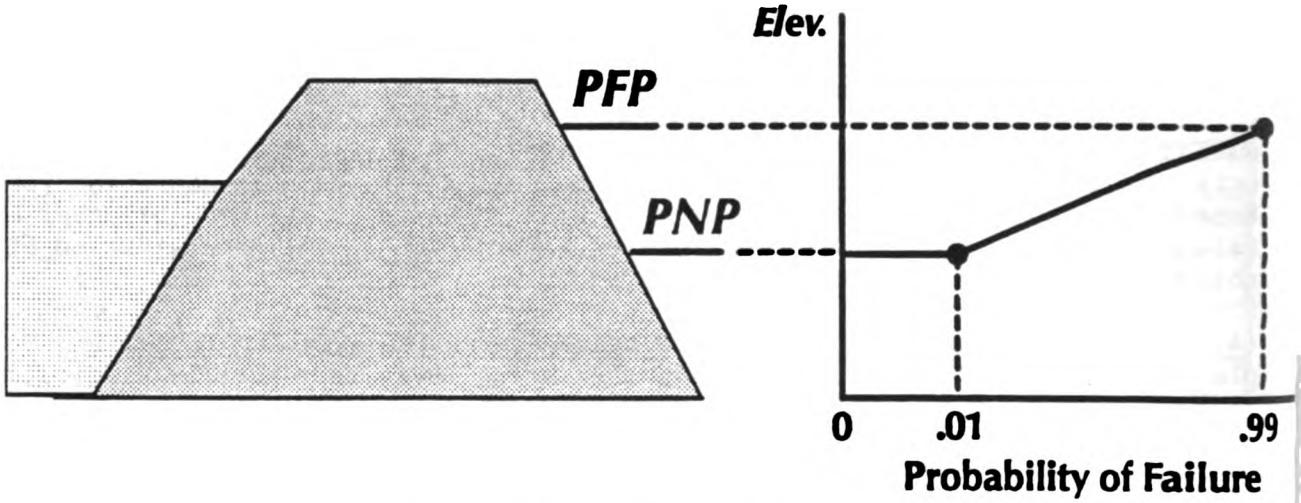
65. Levee segments were evaluated separately with their corresponding damage reaches and cost to account for the construction schedule and individual benefits. Although each levee segment was evaluated, plan formulation resulted in a system approach with each segment representing an integral part of the overall plan. Each segment is dependent physically, hydraulically, and economically and is socially acceptable; i.e., a levee cannot be constructed on one side of the river without a levee on the other side. Levees are scheduled to be constructed so that flood damage is not induced on any area.

CONSTRUCTION SCHEDULE

66. Construction of the Fairgrounds, East Jackson, and Belhaven Creek levee segments will begin in 1998 and end with the construction of the Northeast Jackson, Flowood/Laurelwood, and Floodwall levee segments in 2002. Table 6-12 shows the levee segments, reaches, and construction schedules.

Figure 6-3

RISK BASED EXISTING LEVEE ANALYSIS Jackson Metropolitan Area, MS



$PFP = 41.5 \quad P_f = .99$

$PNP = 36.0 \quad P_f = .01$

TABLE 6-12
LEVEE CONSTRUCTION SCHEDULE
JACKSON METROPOLITAN AREA, MISSISSIPPI

Levee Segment	Construction Start - Finish
Existing Levee and Belhaven Area	
Fairgrounds	1998 - 1999
East Jackson	1998 - 1999
Belhaven	1998 - 1999
Town and Lynch Creek Area	
Town and Lynch	1999 - 2000
Richland and South Jackson Area	
South Jackson	2000 - 2001
Richland	2000 - 2001
Above Existing Levee Area	
Northeast Jackson	2001 - 2002
Flowood/Laurelwood	2001 - 2002
Floodwall	2001 - 2002

COST

67. First costs were developed for three levee plans. The three plans consisted of sizes/heights that were estimated to protect against a 100-year, the 1979 event, and 500-year event. The 1979 flood event was estimated to be a 200-year event on the Pearl River through Jackson. An annual cost curve was developed from these plans. Annual costs of a variety of selected levee sizes were then derived from the annual cost curve. A detailed cost estimate was prepared for the recommended plan derived later in the analysis.

BENEFITS

68. Project benefits are derived by using the stage-damage curve as discussed earlier with the stage-discharge curve and the discharge-probability curve. This is accomplished in the project sizing model. The project sizing model with the @RISK program randomly samples flood events from all possible events. Without-project damages and project residual flood damages are calculated for each sampled event. The model keeps an account of each flood event and corresponding damages from the stage-damage curve. The model accounts for

damages that would occur from these events without the levee plan. Also, each sampled flood event is evaluated for a particular levee height; i.e., levee plan of a given height at the gage. Residual damages occur for flood events that exceed the particular levee height. Project benefits are the difference in the without-levee and with-levee damages. The model not only determines damages/benefits but also determines the corresponding uncertainty. This uncertainty is derived from the uncertainty incorporated during the development of the stage-damage, stage-discharge, and discharge-probability relationships. Expected residual damages and benefits are computed as discussed in paragraph 35 and displayed in Figure 6-2.

SUMMARY OF INITIAL BENEFIT-COST ANALYSIS (ALL PLANS)

Benefits by Category

69. Benefits for seven levee sizes that correspond to selected stages at the Highway 80 gage were evaluated. Table 6-13 itemizes the benefit categories and illustrates category significance in the justification of the project. Urban structures account for 84 percent of the expected annual benefits. Benefits to the urban structures category alone with the recommended plan yield a benefit-cost ratio of 1.4 in the initial screening and 1.3 in the final benefit-cost analysis.

TABLE 6-13
SUMMARY, EXPECTED ANNUAL BENEFITS, BY CATEGORY
PROJECT SIZING
INITIAL SCREENING
JACKSON METROPOLITAN AREA, MISSISSIPPI

Stage at Gage (ft)	Urban Structure ($000)	Other a/ ($000)	Federal Insurance Administration ($000)	Landfill ($000)	Treatment Plant ($000)	Total Benefits ($000)
44.0	10,132	285	297	388	1,253	12,355
44.8	10,742	296	297	388	1,253	12,976
46.0	11,072	303	297	388	1,253	13,313
47.0 b/	11,658	316	297	388	1,253	13,912
47.7	11,865	321	297	388	1,253	14,124
48.8	12,298	332	297	388	1,253	14,568
49.5	12,298	332	297	388	1,253	14,568

a/ Includes emergency cost, roads and bridges, and automobile categories.
b/ Recommended plan.

Project Sizing

70. The results of the risk and uncertainty analysis indicate a significant reduction in potential flood damages in the Jackson Metropolitan area can be achieved with recommended flood-reduction measures. Seven levee sizes that correspond to selected stages at the Highway 80 gage were evaluated. Annual cost ranged from $7.1 million to $9.4 million. Annual benefits range $12.4 million to $14.7 million. A levee that corresponds to 47.0 feet at the gage has the largest excess benefits over cost; i.e., the NED plan. Table 6-14 indicates the results of the initial benefit-cost analysis and the project sizing component of the risk and uncertainty analysis.

TABLE 6-14
SUMMARY, INITIAL BENEFIT-COST ANALYSIS AND PROJECT SIZING
JACKSON METROPOLITAN AREA, MISSISSIPPI

Stage at Gage (ft)	First Cost ($000)	Annual Cost a/ ($000)	Expected Annual Benefits b/ ($000)	Expected Excess Benefits ($000)	Expected Benefit-Cost Ratio
44.0	--	7,135	12,355	5,220	1.73
44.8	68,094	7,505	12,976	5,471	1.73
46.0	--	7,951	13,313	5,362	1.67
47.0 c/	--	8,326	13,912	5,586	1.67
47.7	78,310	8,604	14,124	5,520	1.64
48.8	82,775	9,053	14,568	5,515	1.61
49.5	--	9,485	14,568	5,083	1.54

a/ Based on May 1993 price levels, 7-3/4 percent discount rate, and 100-year project life.
b/ Includes wastewater treatment plant benefits.
c/ Recommended plan.

Project Reliability

71. As discussed earlier, the second component of the risk analysis procedure is project reliability. This addresses the issue of how confident we are in how the project performs. The project reliability component indicates the probability of the levee containing various frequency flow events. Table 6-15 displays the project reliability of selected levee sizes that corresponds to

stages at the Highway 80 gage. The levee that corresponds to 47.0 feet at the gage, the NED levee, will contain the 100-year event 99 percent of the time and the 300-year event 96 percent of the time.

TABLE 6-15
PROJECT RELIABILITY
JACKSON METROPOLITAN AREA, MISSISSIPPI

River Stage at Gage	Probability of Levee Containing Frequency Flow Event				
	50-Year (%)	100-Year (%)	300-Year (%)	500-Year (%)	SPF (%)
44.0	99	95	63	41	17
44.8	99	98	78	59	30
46.0		99	92	78	52
47.0 a/		99	96	89	68
47.7			98	93	76
48.8			99	97	88
49.5			99	98	93

a/ Recommended plan.

Project Performance

72. Project performance in reference to historical flood events is a valuable product of the risk and uncertainty analysis. Table 6-16 portrays the probabilities of occurrence of flood stages of the 1983 and 1979 flood events in comparison to the stage corresponding to top of levee for the recommended plan. The expected annual levee stage exceedance probability of the 1983 flood, a stage of 39.5 feet at the Highway 80 gage, is 2.9 percent; i.e., there is a 2.9 percent chance of a stage of 39.5 feet being exceeded in any year. Also, there is a 25 percent chance of occurrence of a stage of 39.5 feet within 10 years, 59 percent in 30 years, and 77 percent in 50 years. In comparison, the recommended plan, a stage of 47.0 feet at the Highway 80 gage, only has a .13 percent chance of exceedance in any year, a 1 percent chance of occurrence within 10 years, 4 percent in 30 years, and 6 percent in 50 years.

TABLE 6-16
PROJECT PERFORMANCE

Historical Events and Recommended Plan	Target Stage (ft)	Expected Annual Stage Exceedance Probability (%)	Long-Term Risk for Indicated Years (%)		
			10-Year	30-Year	50-Year
1983 Flood	39.5	2.9	25	59	77
1979 Flood	43.3	0.5	5	14	22
Recommended Plan	47.0	0.13	1	4	6

Project Effectiveness

73. Table 6-17 illustrates the project effectiveness in reducing without-project damages. Levee sizes evaluated reduced without-project damages from 83 percent with a levee height that corresponds to 44 feet at the gage to 100 percent with levees with heights that are above 48.8 feet at the gage. The selected plan reduces without-project damages by 95 percent.

TABLE 6-17
PROJECT EFFECTIVENESS
PERCENT REDUCTION IN FLOOD DAMAGES
JACKSON METROPOLITAN AREA, MISSISSIPPI

River Stage at Gage	Total Without-Project a/ Damage ($000)	Total With-Project Damage ($000)	Total Damage Reduced ($000)	Percent Damage Reduced
44.0	12,790	2,007	10,783	84
44.8	12,790	1,449	11,341	89
46.0	12,790	1,145	11,645	91
47.0 b/	12,790	603	12,187	95
47.7	12,790	416	12,374	97
48.8	12,790	13	12,777	100
49.5	12,790	13	12,777	100

a/ Includes wastewater treatment plant benefits.
b/ Recommended plan.

74. The above results of the two components of the risk and uncertainty demonstrates the levee project that corresponds to 47.0 feet at the Highway 80 gage is the selected candidate for the recommended plan. This levee project is the NED levee and also gives desirable protection against not only the 100-year event but also the devastating 1979 flood of record, that the communities fear. The NED levee project would have a 96 percent probability of containing a flood of the magnitude of the 1979 record event. The NED levee project is also effective in the reduction of without-project damages, reducing damages by 95 percent.

SUMMARY OF FINAL BENEFIT-COST ANALYSIS SELECTED PLAN

DETAIL COST

75. The evaluation process of the Jackson Metropolitan feasibility study involved initially formulating and assessing an array of alternative plans, selecting a recommended plan, and a final benefit-cost analysis of that recommended plan to include detailed cost estimates. During the formulation process, cost estimates for three levee sizes were used to develop an annual cost curve. This annual cost curve was used to determine annual cost for the levee sizes evaluated. Annual benefits for each levee size were analyzed with the corresponding annual cost. A detailed cost estimate for the selected plan was then developed. The remainder of this appendix will discuss and display the results of the benefit-cost analysis of the selected plan using the detail cost estimate.

76. First cost of the selected plan increased from an estimated $78.0 million used during formulation to a detail estimate of $99.4 million. The detail cost estimated increased annual cost of the selected plan from $8.3 million during the formulation process to $9.1 million. Cost increases were attributed to items that would be borne by each levee plan evaluated. Therefore, cost of the other levee plans evaluated would increase in proportion to the selected plan. The increase in cost was attributed to the following items:

a. Lands and damages. Acreage requirements increased approximately 19 percent. Cost for easements and improvements resulted in essentially all of the cost increase.

b. Levees. Levee cost increases were due to several factors. Refinements in the levee flow line resulted in a levee 1 foot higher at the upper end of the project. Additionally, levee superiority (i.e., added height to prevent overtopping in critical locations) was also added. Additional soil investigations also resulted in additional cost in the floodwall.

c. Structures. Increases in structure cost were due to additional length required as a result of the increase in levee height. Additional cost resulted from the actual design of the spillways.

d. Preconstruction Engineering and Design and Construction Management. These costs increased proportionally due to the increase in construction cost.

BENEFIT SENSITIVITY SELECTED PLAN

77. A frequently asked question, "How sure are we of the project benefits?" can be addressed within the risk framework. Project analysis conducted within this framework yields expected mean flood benefits and the corresponding standard deviations. Therefore, we have the statistical parameters to make inferences about the data. Figure 6-4 illustrates the selected plan mean benefits of $13,912,000. Also, the benefit probability distribution of the selected plan implies 95 percent confidence the expected annual benefit would be within the range of $6,702,000 and $21,122,000.

PROBABILITY BENEFIT-COST RATIO
GREATER THAN 1.0

78. One of the primary attributes of evaluating a project with risk and uncertainty incorporated is the ability to determine the sensitivity of the project benefit-cost ratio; i.e., probability that the benefit-cost ratio is greater than 1. This calculation illustrates how sensitive the project benefit-cost ratio is to the uncertainty inherent in all variables used to calculate flood damages. The @RISK program evaluates the Hydrology/Hydraulics and Economic variables within the ranges determined and limits set. Individual and combined variable uncertainty are determined for their influence in the calculation of flood damages and the resulting benefits.

79. In an @RISK analysis, the output probability distributions give a complete picture of all the possible outcomes. The probability distribution determines a "correct range" because the uncertainty associated with every input variable has been rigorously defined. Also, a probability distribution shows the relative likelihood of occurrence for each possible outcome. As a result, you no longer just compare desirable outcomes with undesirable outcomes. Instead, you can recognize that some outcomes are more likely to occur than others and should be given more weight in the evaluation. This process has an advantage over the traditional analysis because a probability distribution graphically displays the probabilities and gives a feel for the risk involved. Given the annual cost of the project, the probability of a given benefit-cost ratio can be determined by evaluating the benefit probabilities.

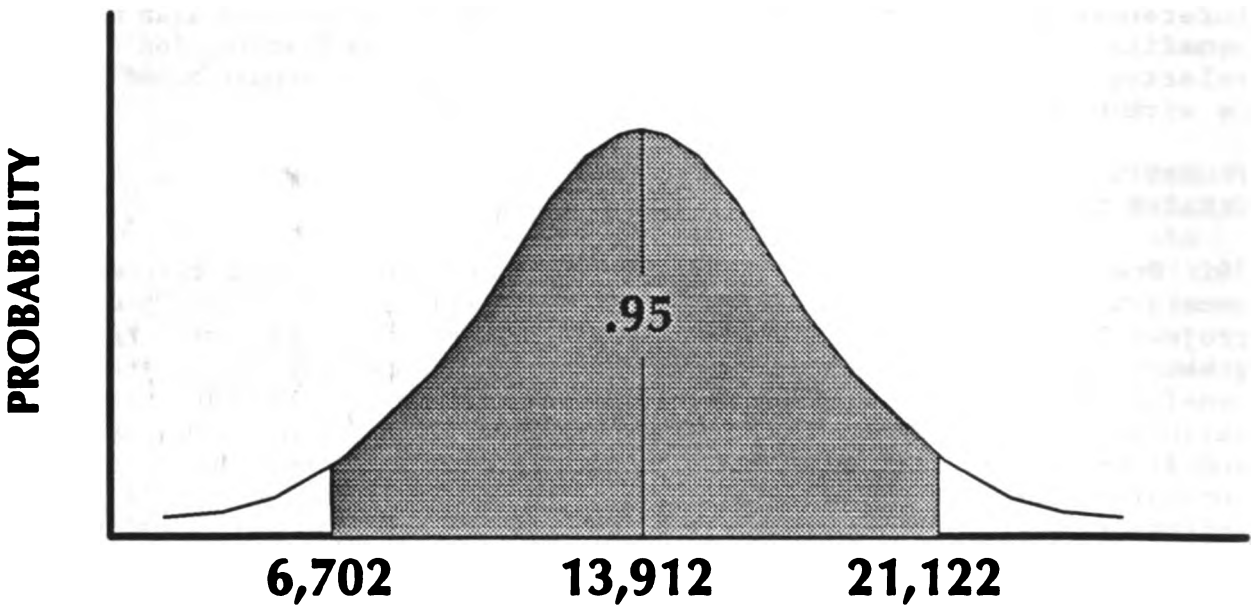
EXPECTED BENEFITS

80. Figure 6-5 displays the selected plan benefits and corresponding probabilities derived within the risk and uncertainty framework. There is an 84 percent probability that expected benefits are greater than annual cost.

Figure 6-4

EXPECTED BENEFITS

95 Percent Confidence Interval
Recommended Levee Plan
Jackson Metropolitan Area, MS

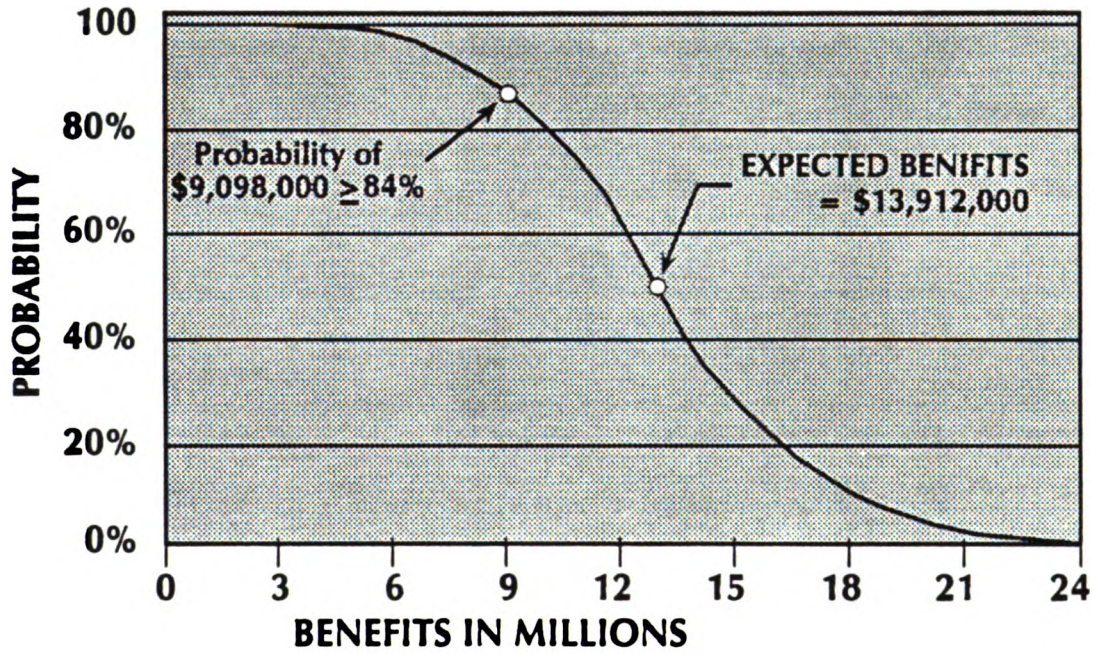


EXPECTED BENEFITS = $ 13,912,000
STANDARD DEVIATION = $ 3,605,000

Figure 6-5

EXPECTED BENEFITS PROBABILITY

Recommended Levee Plan
Jackson Metropolitan Area, MS



EXPECTED BENEFITS = $ 13,912,000

ANNUAL COST = $9,098,000

EXPECTED BENEFIT-COST RATIO

81. The probabilities of possible benefit-cost ratios can be determined by dividing the probable benefits by the annual cost of the selected plan. The benefit probability curve is thus converted to a benefit-cost ratio probability curve. The selected plan has an 84 percent probability the benefit-cost ratio is greater than 1.0. Figure 6-6 displays the selected plan expected benefit-cost ratio probabilities.

82. This appendix has demonstrated project need, explained alternative evaluations and techniques, illustrated plan selection, and displayed selected plan sensitivity. The selected plan meets the study objectives described in the Main Report and would greatly reduce future flood damages in the Jackson Metropolitan Area. Table 6-18 summarizes results of the economic analysis for the selected plan.

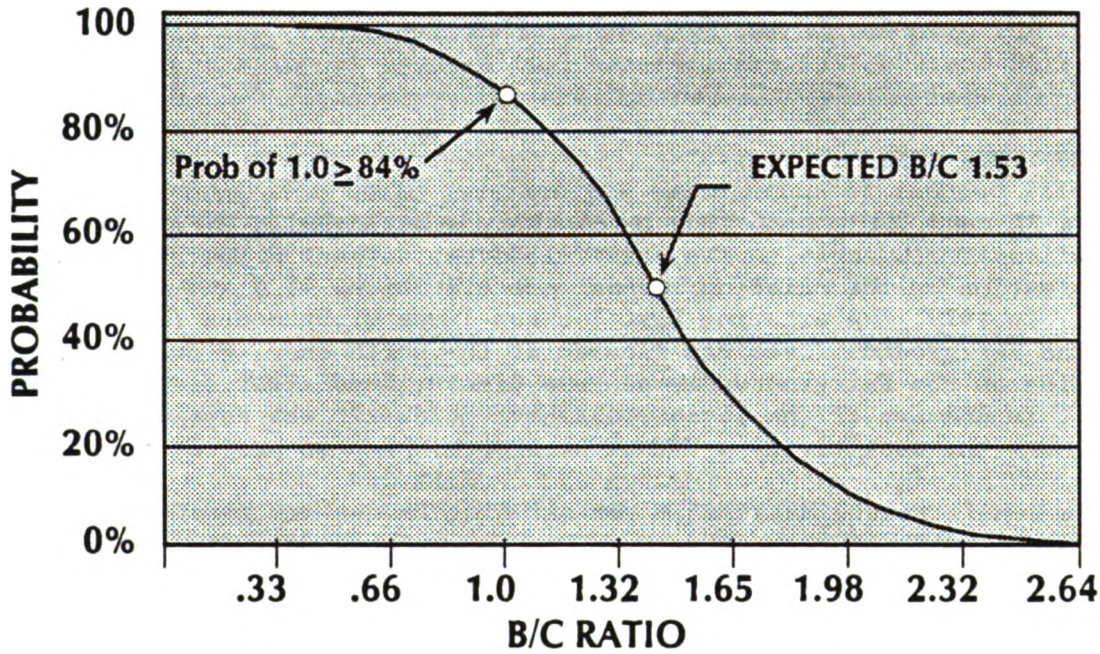
TABLE 6-18
SUMMARY OF RECOMMENDED PLAN
JACKSON METROPOLITAN AREA, MISSISSIPPI

Item	Amount
First Cost ($)	99,379,000
Interest During Construction ($)	16,839,000
Total Investment ($)	116,218,000
Interest ($)	9,007,000
Sinking Fund ($)	5,000
Major Replacement ($)	227
Annual Operation and Maintenance ($)	86,000
Total Annual Cost ($)	9,098,000
Expected Annual Benefits ($)	13,912,000
Excess Benefits ($)	4,814,000
Benefit-Cost Ratio	1.53
Probability of Benefit-Cost Ratio Greater Than 1.0	84 Percent
Project Effectiveness	95 Percent

Figure 6-6

EXPECTED BENEFIT - COST RATIO PROBABILITY

Recommended Levee Plan
Jackson Metropolitan Area, MS



EXPECTED BENEFITS = $ 13,912,000

ANNUAL COST = $9,098,000

EXPECTED B/C = 1.53

SENSITIVITY ANALYSIS

GENERAL

83. The following variables and assumptions were evaluated for their effect on the selected plan.

a. PFP and PNP of existing levees.

b. Reduced fill benefits.

(1) 100-year verses 1979 event elevation.

(2) No reduced fill benefits.

EXISTING LEVEE SENSITIVITY

84. The PFP and PNP of existing levees play a key role in the determination of benefits attributable to the existing levees. The PFP and PNP established for evaluation of the existing levees were elevations 41.5 and 36.0, respectively. In 1979, the existing East Jackson levee withstood a 200-year event while the Fairgrounds levee was flanked at the north end. Flood fight activities on the Fairgrounds levee were discontinued after flanking; therefore, it is unknown if the levee would have held. It was considered prudent to evaluate the sensitivity a PNP of 41.5 would have on project feasibility.

85. The benefits attributable to the existing levees are greater with PFP and PNP of.41.5 and 41.5, respectively. This leaves only $1,263,000 residual damages to be claimed by raising the existing levees. Although benefits to the recommended project are reduced by using 41.5 as the PNP, the proposed project is still economically feasible with a benefit-cost ratio of 1.24. Table 6-19 displays the comparison of the recommended plan with corresponding PFP and PNP's.

TABLE 6-19
SENSITIVITY ANALYSIS
MODIFIED PFP, PNP POINTS ON EXISTING LEVEES
RECOMMENDED LEVEE PLAN
JACKSON METROPOLITAN AREA, MISSISSIPPI

PFP,PNP	Annual Cost ($000)	Annual Benefits ($000)	Excess Benefits ($000)	Benefit-Cost Ratio
41.5, 36.0	9,098	13,912	4,814	1.53
41.5, 41.5	9,098	11,259	2,161	1.24

REDUCED FILL BENEFITS/SENSITIVITY

86. The survey that was conducted to determine the acres subject to fill for development revealed an interesting element. The current and future acreage to be filled is being filled to a level above the required 100-year plus 1 foot elevation (283 feet, National Geodetic Vertical Datum, at Hog Creek on Highway 25). Developers and Real Estate Division personnel indicated land buyers, brokers, and insurance companies demanded acreage to be filled to the higher 1979 flood elevation (285 feet, National Geodetic Vertical Datum, at Hog Creek on Highway 25). Although other areas in the project have and will experience land filling, reduced fill benefits were calculated only for the Flowood area. Average annual reduced fill benefits are $388,000 and $211,000 for filling to the 1979 flood elevation and the 100-year plus 1 foot elevation, respectively.

87. All levee alternatives would generate the same amount of reduced fill benefits. Table 6-20 illustrates the effect on the recommended plan of land filling to the 1979 flood elevation, the 100-year plus 1 foot elevation, and no fill benefits.

TABLE 6-20
SENSITIVITY ANALYSIS
REDUCED FILL BENEFITS
RECOMMENDED LEVEE PLAN
JACKSON METROPOLITAN AREA, MISSISSIPPI

Fill Elevation	Annual Cost ($000)	Annual Benefits ($000)	Excess Benefits ($000)	Benefit-Cost Ratio
1979 Elevation	9,098	13,912	4,814	1.53
100-year + 1	9,098	13,735	4,637	1.51
No Fill	9,098	13,524	4,426	1.49

PERIOD OF ANALYSIS SENSITIVITY

88. The period of analysis used in the evaluation for this major long-term urban project was 100 years. The period of analysis is the lesser of (1) the period of time over which the project would serve a useful purpose or (2) the period of time after which further discounting of beneficial and adverse effects would have no appreciable impact, but limited to 100 years. It is

Federal policy to use a 50-year period of analysis except for large multiple-purpose lakes, major long-term urban flood protection, and main line agricultural levees and hurricane protection which may be estimated to have up to a 100-year project life. (Digest of Water Resources Policies and Authorities, February 1989), (Policy and Guidelines 1.4.12). However, Table 6-21 depicts the sensitivity analysis conducted to illustrate the impact a 50-year period of analysis would have on the project.

TABLE 6-21
SENSITIVITY ANALYSIS
PERIOD OF ANALYSIS (50 vs 100 Years)
RECOMMENDED PLAN
JACKSON METROPOLITAN AREA, MISSISSIPPI

Item	Amount	
	50-Year	100-Year
First Cost ($)	99,379,000	99,379,000
Interest During Construction ($)	16,839,000	16,839,000
Total Investment ($)	116,218,000	116,218,000
Interest ($)	9,007,000	9,007,000
Sinking Fund ($)	221,000	5,000
Major Replacement ($)	227	227
Annual Operation and Maintenance ($)	86,000	86,000
Total Annual Cost ($)	9,314,000	9,098,000
Expected Annual Benefits ($) a/	13,912,000	13,912,000
Excess Benefits ($)	4,598,000	4,814,000
Benefit-Cost Ratio	1.49	1.53
Probability of Benefit-Cost Ratio Greater Than 1.0	84 Percent	84 Percent
Project Effectiveness	95 Percent	95 Percent

a/ Includes benefits to wastewater treatment plant.

ADDITIONAL ECONOMIC ANALYSIS

CLEARING PLANS

89. Four clearing plans were evaluated to determine their impact on flood damage reduction. Only one of the four plans proved to be economically feasible and it was only marginally feasible with a benefit-cost ratio of 1.07. These plans consisted of varying degrees of clearing between river miles (RM) 278.8 and 292.6. These plans were identified as plans D-1 and D-2

and E-1 and E-2. Plan D-1 included total clearing of the flood plain between RM 278.8 and 285.3 while D-2 consisted of selected clearing of this same area. Plan E-1 consisted of total clearing of the flood plain between RM 287.6 and 292.6 plus the area of plan D-1. Plan E-2 consisted of selected clearing between RM 287.6 and 292.6 plus the area of selective clearing in plan D-2. Clearing plans are not a comprehensive solution to area flood problems. Damages reduced are minimal compared to the selected levee plan. Table 6-22 displays the results of the clearing plan evaluations.

TABLE 6-22
SUMMARY - ECONOMIC ANALYSIS a/
CLEARING PLANS
JACKSON METROPOLITAN AREA, MISSISSIPPI

Plan	First Cost ($000)	Annual Cost ($000)	Annual Benefits ($000)	Excess Benefits ($000)	Benefit-Cost Ratio
D-1	7,987	1,136	1,218	82	1.07
D-2	4,963	785	445	(340)	.57
E-1	15,111	2,053	1,684	(369)	.82
E-2	10,346	1,549	829	(720)	.54

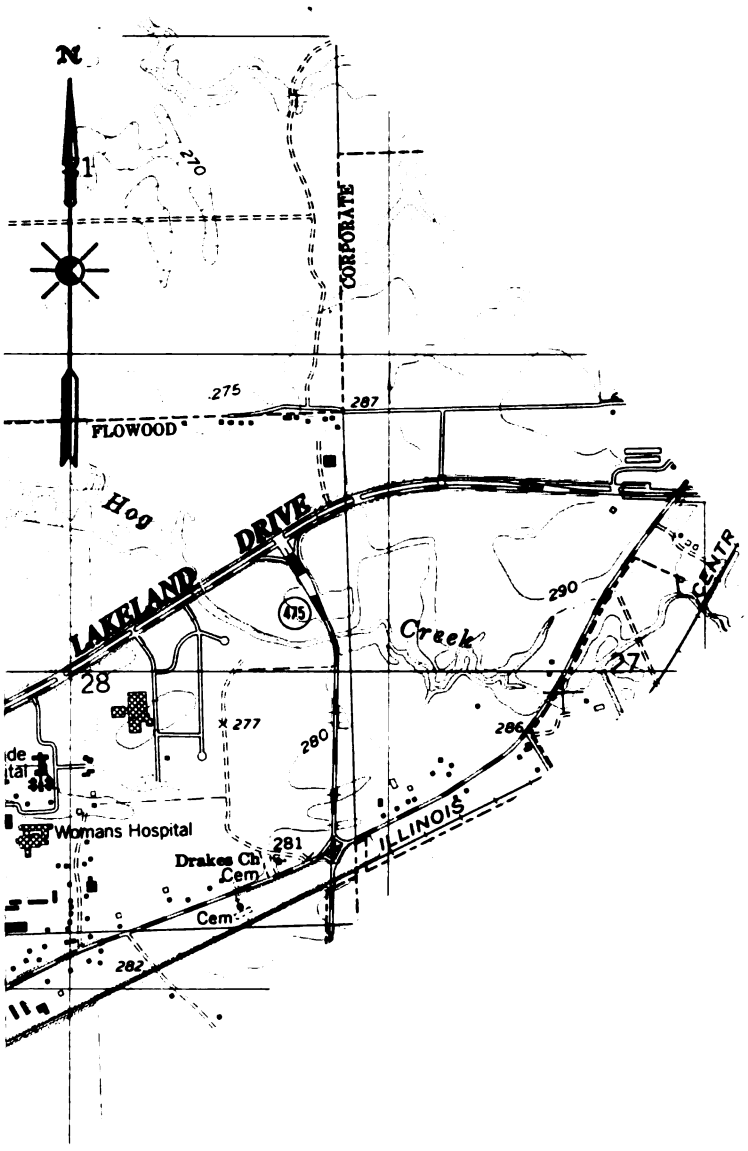
a/ Based on May 1993 price levels, 7-3/4 percent discount rate, and 50-year project life.

PUMP ANALYSIS

90. The addition of pumps to a levee plan must be incrementally justified. The selected levee plan reduces existing damages by 95 percent. The residual damages remaining make it difficult to incrementally justify the addition of pumps. Pumps were evaluated at Hanging Moss Creek, Town Creek, Lynch Creek, Caney Creek, Hog Creek, and Squirrel Branch, but were economically infeasible; i.e., annual benefits less than annual cost.

NONSTRUCTURAL ALTERNATIVES

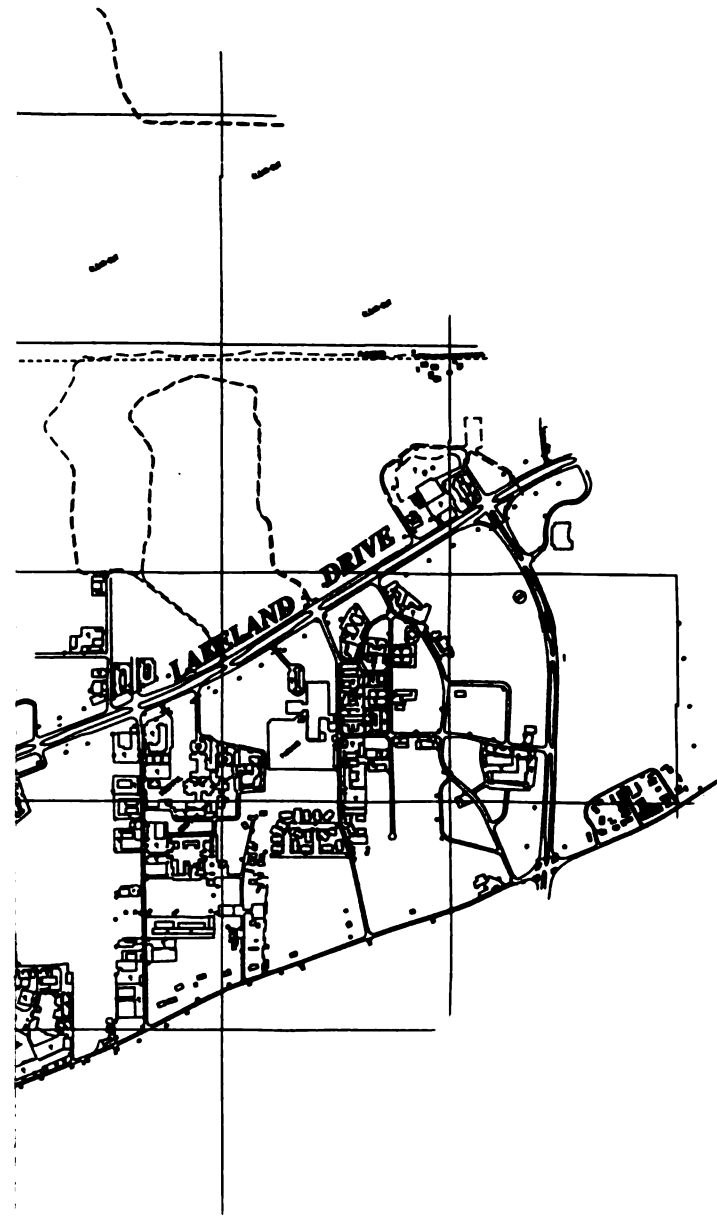
91. Additional analyses conducted in this study were the examination of the potential for using nonstructural measures to alleviate or reduce (without-project conditions) flood damages to residences, commercial and other buildings located in the flood plain of the project area. Nonstructural measures considered were floodproofing, structure raising, small walls, relocation, and acquisition/demolition. The nonstructural measures proved to be impractical. Property owners are not receptive to nonstructural measures, especially those requiring structure raising, relocations, acquisition/demolition, etc.



PEARL RIVER BASIN
JACKSON METROPOLITAN AREA, MS

LAKELAND DRIVE AREA DEVELOPMENT IN 1980

SCALE AS SHOWN
U.S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS

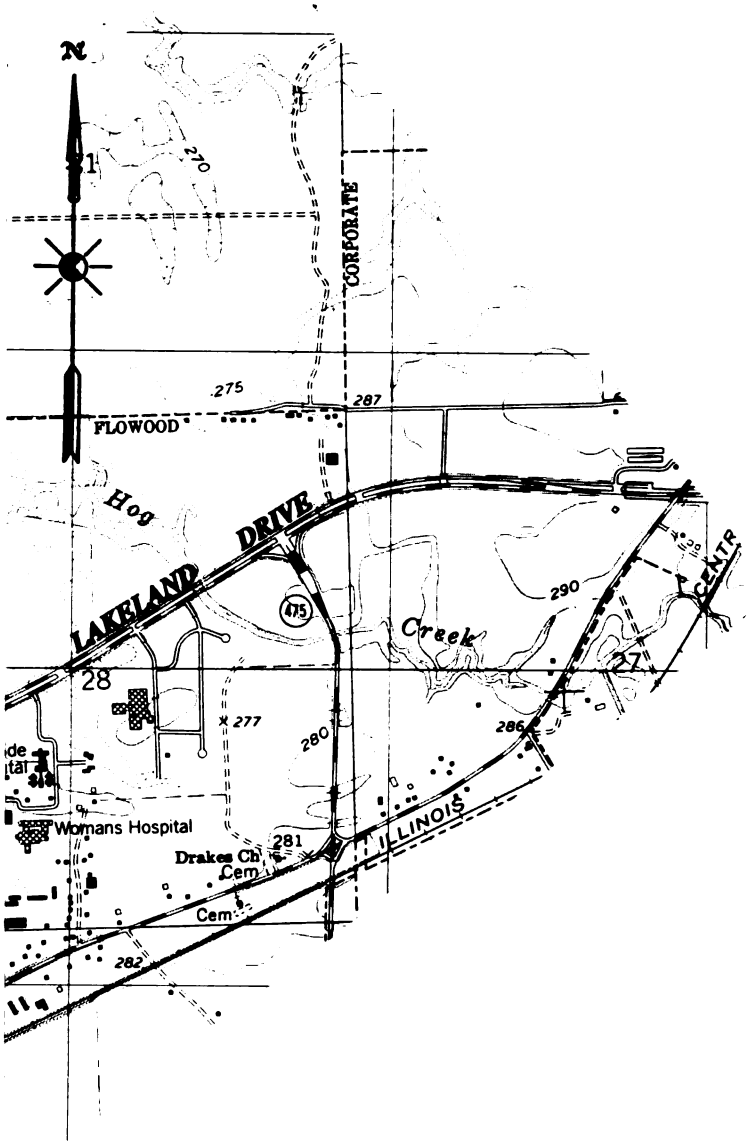


PEARL RIVER BASIN
JACKSON METROPOLITAN AREA, MS

LAKELAND DRIVE AREA DEVELOPMENT IN 1992

SCALE AS SHOWN
U.S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS

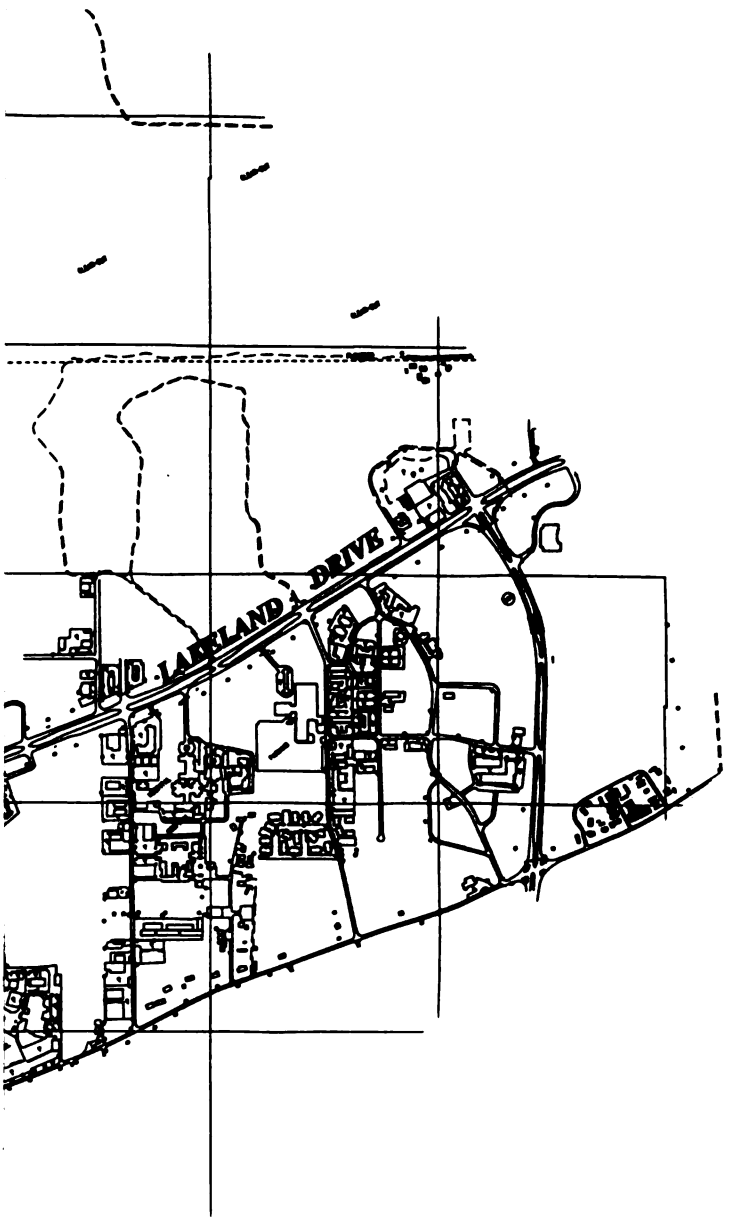
PLATE 6.II



PEARL RIVER BASIN
JACKSON METROPOLITAN AREA, MS

LAKELAND DRIVE AREA DEVELOPMENT IN 1980

SCALE AS SHOWN
U.S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS



PEARL RIVER BASIN
JACKSON METROPOLITAN AREA, MS

LAKELAND DRIVE AREA DEVELOPMENT IN 1992

SCALE AS SHOWN
U.S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS

PLATE 6.II

JACKSON METROPOLITAN AREA, MISSISSIPPI

APPENDIX 7
FISH AND WILDLIFE COORDINATION ACT REPORT

United States Department of the Interior

FISH AND WILDLIFE SERVICE
2525 South Frontage Road, Suite B
Vicksburg, Mississippi 39180-5269

IN REPLY REFER TO:

September 1, 1995

Colonel Gary W. Wright
District Engineer
U.S. Army Corps of Engineers
2101 North Frontage Road
Vicksburg, Mississippi 39180-5191

Dear Colonel Wright:

Enclosed is our Fish and Wildlife Coordination Act (FWCA) Report for the Jackson Metro Flood Control Study, Hinds, Madison, and Rankin Counties, Mississippi. The project is designed to reduce flood damages in the greater Jackson area. Our report concludes there will be no significant impacts to federally listed threatened or endangered species, or fish and wildlife resources if the planning objectives, recommendations, and off site mitigation presented in this report are incorporated into the project. In accordance with provisions of the FWCA, this report should be attached to and made an integral part of your Project Feasibility Report.

In December 1994 the Mississippi Department of Wildlife, Fisheries and Parks (MDWFP) provided comments on the draft FWCA report. MDWFP has been contacted concerning the final report and has elected not to provide additional comments. Their initial letter should become a part of your final report (copy enclosed). Please keep us informed on the status of this project.

If you have any questions, please contact Kathy Lunceford in our office, telephone: 601-629-6617.

Sincerely,

Allan J. Mueller

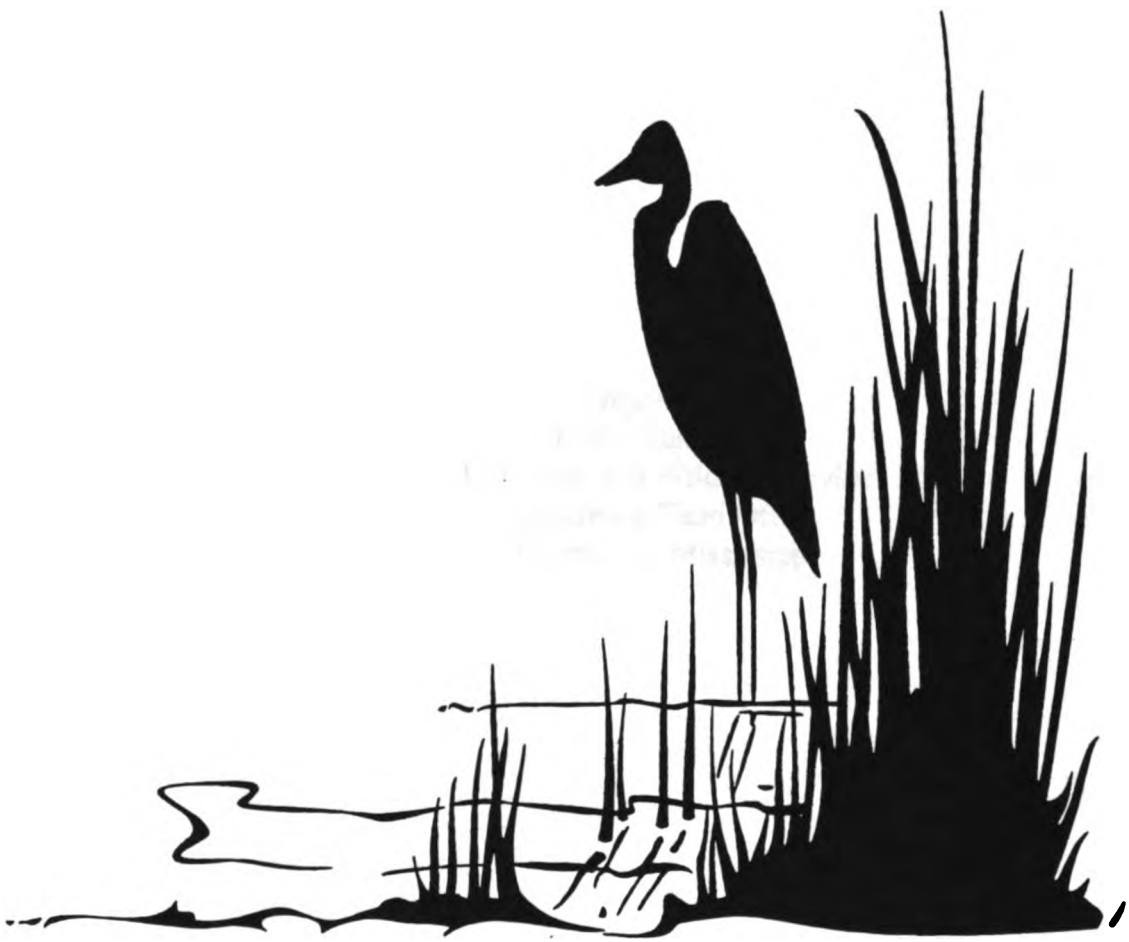
Allan J. Mueller
Field Supervisor

cc: Miss. Dept. of Wildlife, Fisheries and Parks, Jackson, MS
ATTN: Bill Quisenberry
EPA, Atlanta, GA
ATTN: Mike Wylie

JACKSON METRO FLOOD CONTROL STUDY

CITY OF JACKSON

HINDS, MADISON, AND RANKIN COUNTIES, MISSISSIPPI



A Fish and Wildlife
Coordination Act Report

U.S. Fish and Wildlife Service
Vicksburg Field Office

FISH AND WILDLIFE COORDINATION ACT REPORT
JACKSON METRO FLOOD CONTROL STUDY
CITY OF JACKSON
HINDS, MADISON, AND RANKIN COUNTIES, MISSISSIPPI

Prepared by:
Kathy Lunceford
U.S. Fish and Wildlife Service
Vicksburg Field Office
Vicksburg, Mississippi

September 1995

EXECUTIVE SUMMARY

The Jackson Metro Flood Control Study has been authorized by a series of eight resolutions adopted by U.S. House and Senate committees. Four of these resolutions were adopted after a major flood occurrence in the Jackson area in April 1979. The present study seeks to develop alternatives to reduce flood damages in the greater Jackson area (from the Ross Barnett Dam to the city of Byram, in Madison, Hinds, and Rankin Counties, Mississippi). This draft Fish and Wildlife Coordination Act (FWCA) report provides planning objectives and recommendations and is submitted in accordance with the Fish and Wildlife Coordination Act. The final version of this report will constitute the report of the Fish and Wildlife Service (Service) as required by Section 2(b) of the act.

The Pearl River and associated oxbow lakes support a diverse fish fauna including largemouth bass, spotted bass, rockbass, bluegill, longear sunfish, green sunfish, redear sunfish, crappie, and catfish. Striped bass, an important sport fish, have been stocked in Ross Barnett Reservoir for the past several years by the Mississippi Department of Wildlife, Fisheries and Parks and provide a fishery immediately downstream from the reservoir.

Wildlife resources within the Pearl River Basin are dependent upon the diverse floral composition of associated forested wetlands. Bottomland hardwoods comprise the largest habitat type in the floodplain and are highly productive wildlife areas. Of the 490 vertebrate wildlife species occurring within the Pearl River Basin, a higher percentage use bottomland hardwoods as primary habitat (habitat a species depends upon for reproduction and/or feeding during all or a portion of the year) than any other habitat type. Cypress-tupelo gum swamps interspersed with bottomland hardwoods add to the diversity and productivity of the floodplain system. The Jackson Metro study area is unique in that there is significant acreage of high quality bottomland hardwoods adjacent to a major urban area.

The Corps of Engineers (Corps) is evaluating the feasibility of providing flood protection to the Jackson area by constructing a levee system along both sides of the Pearl River within the study area with an expected project life of 100 years. The tentative levee alignments would provide protection to existing structures but also to some undeveloped portions of the floodplain. The Service recommends that any levee alignment be designed to avoid protecting presently undeveloped portions of the floodplain in accordance with the directives of the Executive Order 11988 on Floodplain Management, and the sequential steps contained in the National Environmental Policy Act (42 U.S.C. 4321 et. seq., January 1, 1970, as amended), and the Service Mitigation Policy. Further, the Service recommends that non-

structural features to control flood damages be incorporated into the project in the form of floodplain zoning to prohibit all non-flood compatible development riverside of the levees and within designated flood storage areas landside of the levees.

The Service has developed the following recommendations to minimize the adverse impacts of the proposed project:

1. Mitigate for unavoidable losses of wildlife habitat by rehabilitating degraded wetlands. Mitigation should occur concurrently with construction of the project. Acreage will be determined by a HEP analysis on the proposed mitigation site.

2. Design borrow pits to improve fish and wildlife habitat.

3. Incorporate sediment and erosion control measures during construction of the levees and vegetate all disturbed areas.

4. Monitor sandbars in the Pearl River to determine net changes in size and availability during nesting season for the federally listed threatened ringed sawback turtle (*Graptemys oculifera*) as effected by changes in hydrology of the river.

5. Limit the use of herbicides in the maintenance of the overbank and floodway clearing areas to those approved by EPA and developed specifically for use adjacent to open water.

6. Limit the removal of vegetation on the project area to that necessary for the flood control features of the project. This also includes maintenance activities for the project.

7. Restrictive use zoning or non-development easements should be implemented by the local sponsor, prior to project construction, and contain language stringent enough to ensure that flood prone development does not occur and that undeveloped lands in the floodplain are used for floodwater storage, wildlife, outdoor recreation, and other flood tolerant land uses.

The Service has no objections to the continuation of the Jackson Metro Flood Control Study provided the planning objectives, recommendations, and off site mitigation presented in this report are incorporated into the study.

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INTRODUCTION

This draft report provides comments, planning objectives, and recommendations for the Jackson Metro Flood Control Study. The study is authorized by eight resolutions of the U.S. House and Senate committees, the most recent of which are resolutions adopted by the Senate Environment and Public Works Committee and the House Public Works and Transportation Committee on May 9, 1979. The purpose of the study is to develop alternatives to provide flood protection to the greater Jackson, Mississippi, metropolitan area. The Corps of Engineers (Corps) is presently investigating the feasibility of constructing levees along both sides of the Pearl River to provide flood protection to the greater Jackson Metro area between the Ross Barnett Dam and the city of Byram; Hinds, Madison, and Rankin Counties, Mississippi. The expected life of the project is 100 years. This report has been coordinated with personnel of the Mississippi Department of Wildlife, Fisheries and Parks (MDWFP), and is submitted in accordance with the Fish and Wildlife Coordination Act (FWCA)(48 Stat. 401, as amended; 16 U.S.C. 661-667e). The final version of this report will constitute the report of the U.S. Fish and Wildlife Service (Service) as required by Section 2(b) of the act.

HISTORICAL PERSPECTIVE

Floods are natural events that occur when a river, like the Pearl River, is required to carry more water than can be contained within its banks. The frequency and degree of flooding is related to area, topography, rainfall, soils, and the physical condition of both the floodplain and surrounding uplands. Therefore, at any point in time, the Pearl River is simply responding to the rigid, yet dynamic, set of natural "rules" that determine the nature of its course and capacity.

The Pearl River system is sensitive to changes in the parameters described above. Early and ongoing timber practices, upstream and tributary drainage improvements, alterations to facilitate navigation, and a host of other encroachments of human activities into its floodplain have had two effects:

-- placement of man's activities directly in the path of potential floods, and

-- inducement of the river to flood to a greater degree than it did historically.

Consequently, loss of life and property damages from floods are the direct outcome of the above situations. These tragic consequences have occurred and will continue to occur as long as clearing, developing, and occupation of the floodplain continues. It is evident that nature is responsible for floods while man is responsible for flood damages.

Floodplain development at Jackson has generally entailed complete removal of existing natural vegetation which, in turn, causes a severe reduction of associated fish and wildlife populations. Worse, the Pearl River system has lost the ability to retard flood flows, absorb pollutants, anchor soils, reduce sediment loads, and provide rich recreational and aesthetic resources. The consequences of unwise and unregulated encroachment into the floodplain of the Pearl River at Jackson are evident today. The river now floods more swiftly and to a greater degree than ever before, causing an increased loss of life, property damage, and water quality degradation.

Pre-1979 Flood Control Planning

Interest in flood control for the city of Jackson dates back to the late 1800's. At that time, Jackson was being developed along Town Creek which carried the city's wastes to the Pearl River. During periodic high stages of the Pearl, backwater flooding from Town Creek occurred. This problem was addressed in an early report of the War Department, which later became the Corps of Engineers, contained in House Document 445, 71st Congress. The report stated that flood protection (at that time) would cost in excess of $100 per acre, and that since each acre protected had an average appraised value of less than $100, no federal project could be implemented. The report further stated that although flood events occurred at Jackson 935 days in the 19 years between 1907 and 1926, "...the flood problem at the City of Jackson, however, is considered as local and one which should be and can be handled by officials of that City." Finally, the report indicated that the city's population of 40,000 was troubled by water supply deficiencies during low flow periods on the Pearl River, and that a sandbag dam was periodically emplaced to alleviate the problem.

Flooding and floodplain development continued in Jackson and several years later authorization for a cleared floodway for Jackson was contained in the Flood Control Act of June 22, 1936. City officials, in a resolution adopted October 16, 1936, declined to provide both the necessary rights-of-way and the required agreement to maintain the project, resulting in deauthorization under provisions of Section 3 of the Flood Control Act of December 22, 1944.

Unabated flooding and imprudent floodplain development continued at Jackson. Flood control investigations were again authorized by the River and Harbor Act of 1945 and the Flood Control Act of 1946 (P.L. 526), both of which resulted in the June 30, 1959, Survey Report of the Mobile District, Corps. Interestingly, this report focused solely upon the Pearl River Basin at and above Jackson, stating that flood stage was exceeded at Jackson an average of 3.5 times per year. Also, flood stages on the principle upstream tributaries were exceeded 4 to 7 times per year. The report also indicated that the city of Jackson (at a Public Meeting held December 21, 1947) requested that the Corps provide sufficient flood control to allow the development of 320 acres at the

rapid growth of Jackson, the low-lying lands along the Pearl River and several small tributaries, including Town Creek, are becoming increasingly desirable for residential, commercial, and industrial expansion. Extensive development of the floodplain has already been accomplished... and local efforts to protect that development are inadequate." The District Engineer recommended the construction of what today are known as the Jackson and East Jackson Levees, with pumping plants to relieve interior ponding, to promote and facilitate floodplain development.

During this same period, local interests realized that the low sill water supply pool, constructed in the 1940's was inadequate. Therefore, they began planning for a "water supply reservoir" to be located "about 15 miles north of Jackson". Ross Barnett Reservoir was constructed by the Pearl River Valley Water Supply District to meet the purposes of water supply and recreation. (Further information on Ross Barnett Reservoir is provided in a subsequent section of this report.) The 1959 Survey Report said:

> "Local interests are actively interested in the reservoir project for water supply and recreation that they have undertaken. (Also)...They were very interested in the development of a Federal project at the same site for flood control...In coordinated planning studies, however, it was determined that a Federal development with an allocated 31 feet of flood storage on top of the conservation pool would conflict with their desires. The wide range in pool elevations and frequent fluctuation of the reservoir...would limit their plans for recreational use and the development of adjacent lands. They also desired to initiate construction so that the project could be completed at a much earlier date than would normally be possible with Federal development."

Flooding and floodplain development accelerated at Jackson due to construction of the Jackson and East Jackson Levee system, which was completed in 1968. A new study, basin-wide in scope, was begun. The Pearl River Comprehensive Basin Study was conceived in the 1961 report of the Senate Select Committee on National Water Resources, and was one of the original 15 Type Two Studies selected for implementation by the Interdepartmental Staff Committee of the Ad Hoc Water Resources Council. The Water Resources Council became a permanent body in 1965 and the Pearl River Basin Comprehensive study was completed in 1970. The study stated "In pursuit of the basic conservation objective to provide the best use, or combination of uses, of water and related resources to meet all foreseeable short- and long-term needs, appropriate consideration was given to each of the following objectives and reasoned choices made between them when they conflicted: development, preservation, and well-being of people. Well-being of all the people was the overriding determinant in considering the best use, with the care being taken to avoid development for the benefit of a few or the disadvantage of many."

As a result of the study, the planners recognized the need for a floodplain management program and recommended that the state and local governments adopt pertinent legislation. The Corps, however, was requested to seek Congressional authorization for the design and construction of Ofahoma, Carthage, and Edinburg Dams and Reservoirs which were to be located upstream of Ross Barnett Reservoir. The Corps' 1972 Survey Report found Carthage and Ofahoma Dams to be economically infeasible, in spite of ongoing flooding and floodplain development at Jackson. Authorization for the Edinburg structure and reservoir was recommended.

Although the Corps was the lead agency on the planning team of the previous decade which had recognized the inherent fallacy of unregulated floodplain development, less than two years later, the Corps recommended that Congress authorize a project that required more floodplain development for economic justification. The Edinburg project was subsequently authorized and post-authorization design studies initiated. These latter studies, however, determined that Edinburg Dam and Reservoir was economically infeasible, even with the benefits attributable to "future floodplain development."

Meanwhile, flooding and floodplain development continued at Jackson. The Town Creek floodplain was now covered with buildings. The city was literally built on top of the creek. The Jackson and East Jackson Levees were in place, providing protection against the 100 year flood. Residential and commercial encroachment extended into the floodplain at Lakeland Drive. Federal Flood Insurance became available at a rate approaching subsidy level. At this time, existing development in the floodplain was incurring average annual flood damages of $4,923,000 (U.S. Army 1981).

In April 1979, a storm with an estimated 500 year exceedence frequency dropped nearly 20 inches of rain in the upper Pearl River Basin in less than two days, precipitating the greatest flood ever recorded on the river. Flood waters crested at 15 feet above flood stage on April 17, 1979, causing widespread devastation with damage estimates of up to $200,000,000 at Jackson (U.S. Army 1981). The previously described floodplain development was directly responsible for this damage. The following events support this statement:

1. Even with the floodwater retarding effect of Highway 43, which crosses the north end of the reservoir, Ross Barnett Dam was releasing 125,000 cubic feet of water per second to keep from being overtopped. Although this rate of release attenuated the upstream flood from the 500 year event down to the 200 year event at Jackson, the potential for dam failure was very real since the Ross Barnett project was never designed or built for flood control purposes but for water supply and recreation.

2. The Jackson and East Jackson levees brought about three conditions which added to the severity of the 1979 flood:

   Construction of the levee project induced the development of over 6,000 acres of the floodplain lands.

   The levees constituted an artificial constriction of the floodplain which caused a significant increase in flood stages upstream and a corresponding increase in subsequent damages.

   The Jackson levee was flanked by flood waters at the north end and resulted in severe flooding of the local development it was designed to protect. The East Jackson levee held due to an intensive sand bagging effort, but was nearly overtopped.

3. Numerous other human encroachments into the floodplain including residential development, inadequately designed roads and bridges, a sanitary landfill, and the city's sewage treatment plant were damaged by the flood and contributed to its severity.

The flood of 1979 was a natural event which only magnified and accentuated the consequences of development and changes of the Pearl River floodplain which had occurred during the previous 70 to 100 years.

Post-1979 Flood Control Planning

Even while restoration efforts at Jackson were being initiated, all levels of government began an intensive planning effort to further "control the Pearl." These efforts have centered around control of flood waters rather than addressing man's encroachment into the floodplain.

The city of Jackson, without appropriate authorization required by the Clean Water Act, mobilized bulldozers to begin clearing and burying floodplain vegetation. They failed to recognize that these works would only aggravate and transfer the flood damage problem downstream, rather than resolve it. The Pearl River Basin Development District, with the help of a private firm, formulated flood control measures that could be used to reduce flood damages at Jackson. These recommendations included a cleared floodway, removal of floodplain encroachments, and expansion of the existing levee and channel system.

Finally, several Congressional resolutions directed the Corps to begin intensive

planning to provide flood relief for Jackson as part of its ongoing basin wide comprehensive water resource development study. The Corps proposed several flood control concepts and began a preliminary evaluation of upstream reservoirs. The first stage of planning was completed in October 1981 with the release of the Pearl River Basin Reconnaissance Report which contained an evaluation of four structural flood control measures. Two of these measures, a cleared floodway through Jackson and a "dry" reservoir upstream of Ross Barnett Reservoir, known as Shoccoe Dam, were considered in detail.

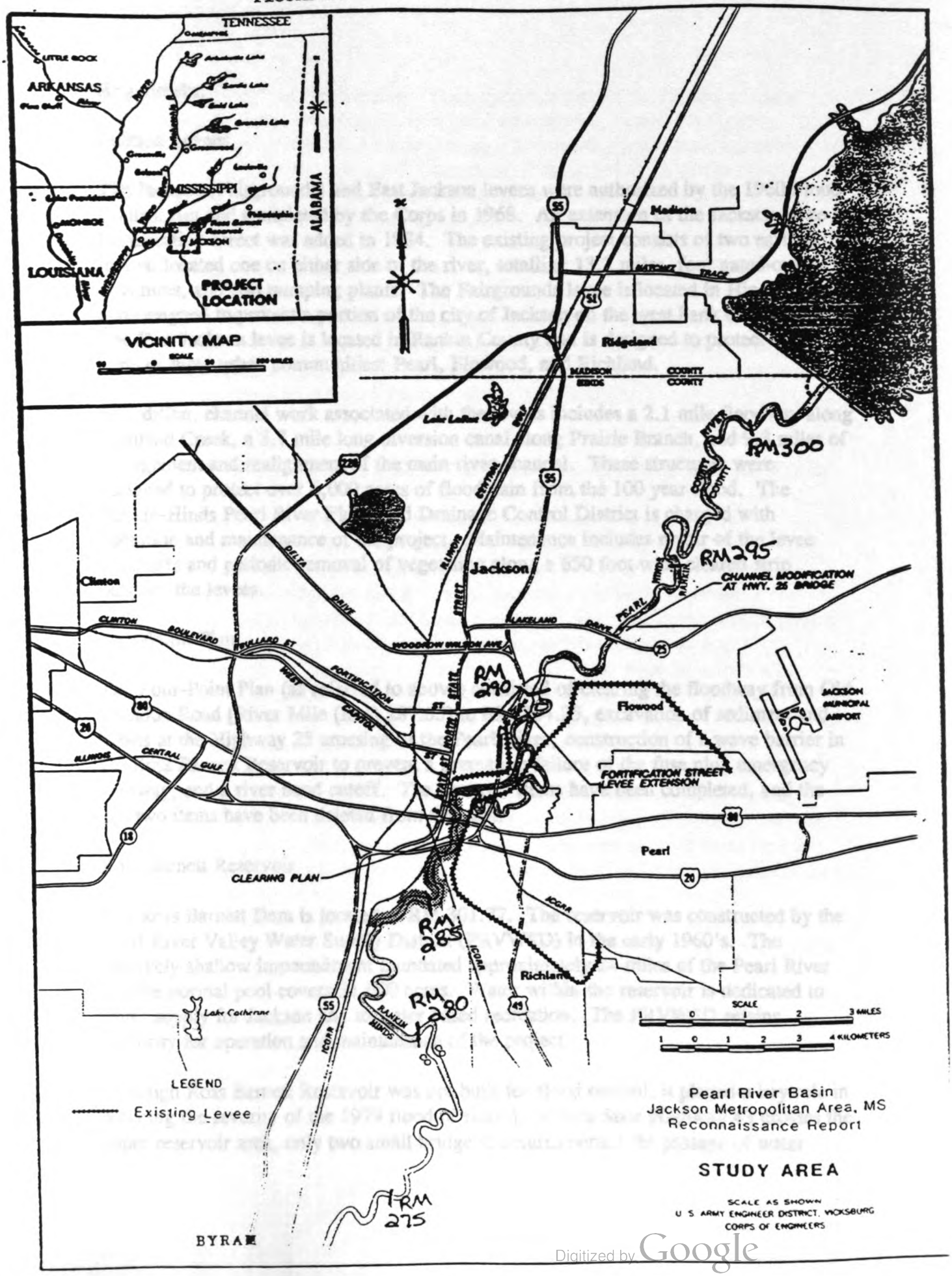
In Fiscal Year 1983, Congress authorized the Four-Point Plan whose primary component was clearing within the floodway. The Service prepared a FWCA report on the plan (Service 1984). The Service also submitted a FWCA report entitled Pearl River Basin Interim Report on Flood Control (Service 1985) to accompany the Corps' Feasibility Report and Environmental Impact Statement (U.S. Army 1984, revised 1985.) These reports evaluated additional clearing of vegetation within the floodway and the Shoccoe Dam and Dry Reservoir. Congressional authorization for construction of Shoccoe Dam and associated project features are contained in the Water Resources Development Act of 1986 (P.L. 99-662.) In response to the General Design Memorandum Study, the Service prepared a FWCA report on the Shoccoe Dry Reservoir Project (Service 1988.) However, the Shoccoe Dam was not constructed due to the lack of a viable local sponsor. Presently, the Corps has no plans to further pursue this portion of the project.

The Corps is currently studying the feasibility of constructing levees along both sides of the Pearl River to provide flood control to the greater Jackson area. The Corps is therefore pursuing the broad problem of flood control at Jackson with structural measures only. This restrictive approach ignores the dual nature of flood damage reduction which must address both the constant encroachment of development on to flood susceptible land as well as the physical control of flood waters. Nevertheless, floodplain development along the Pearl River at Jackson continues.

DESCRIPTION OF STUDY AREA

The Pearl River is formed in Neshoba County, Mississippi, by the confluence of Nanaway and Tallahaga Creeks and flows southwesterly for 130 miles to the vicinity of Jackson, then southeasterly for 233 miles to the head of its outlet channels, the East Pearl and West Pearl Rivers. The Jackson Metro Flood Control Study area consists of the Pearl River floodplain from the Ross Barnett Dam to just south of Byram and includes approximately 31 miles of river and 57,997 acres of land in Madison, Rankin, and Hinds Counties, Mississippi (Figure 1.). The study area is drained by several small creeks which are tributaries of the Pearl River. These include Town, Hanging Moss, Eubanks, Lynch, Richland, Hardy, Caney, Purple, and

FIGURE 1.



Hog Creeks.

Jackson Levees

The Jackson (Fairgrounds) and East Jackson levees were authorized by the 1960 Flood Control Act and completed by the Corps in 1968. An extension of the Jackson levee at Fortification Street was added in 1984. The existing project consists of two earthen levees, located one on either side of the river, totalling 13.2 miles, four gated-outlet structures, and two pumping plants. The Fairgrounds levee is located in Hinds County and designed to protect a portion of the city of Jackson on the west bank of the Pearl. The East Jackson levee is located in Rankin County and is designed to protect all or parts of three urban communities: Pearl, Flowood, and Richland.

In addition, channel work associated with the levees includes a 2.1 mile floodway along Richland Creek, a 3.7 mile long diversion canal along Prairie Branch, and 9.3 miles of enlargement and realignment of the main river channel. These structures were designed to protect over 6,000 acres of floodplain from the 100 year flood. The Rankin-Hinds Pearl River Flood and Drainage Control District is charged with operation and maintenance of the project. Maintenance includes repair of the levee structures and periodic removal of vegetation along a 650 foot wide cleared strip between the levees.

Four-Point Plan

The Four-Point Plan (as referred to above) consisted of clearing the floodway from Old Brandon Road [River Mile (RM) 287.55] to RM 284.25, excavation of sediment and debris at the Highway 25 crossing of the Pearl River, construction of a wave barrier in the Ross Barnett Reservoir to prevent a premature failure of the fuse plug emergency spillway, and a river bend cutoff. The first two items have been completed, and the last two items have been deleted from the plan.

Ross Barnett Reservoir

The Ross Barnett Dam is located at RM 301.77. The reservoir was constructed by the Pearl River Valley Water Supply District (PRVWSD) in the early 1960's. The relatively shallow impoundment inundated approximately 24 miles of the Pearl River and the normal pool covers 31,000 acres. Water within the reservoir is dedicated to water supply for Jackson and to water based recreation. The PRVWSD retains authority for operation and maintenance of the project.

Although Ross Barnett Reservoir was not built for flood control, it played a key role in reducing the severity of the 1979 flood of record. Where State Highway 43 crosses the upper reservoir area, only two small bridge structures permit the passage of water

along the entire length of the crossing. These openings restrict the amount of water which can flow into the main impoundment and downstream. Thus, the highway crossing functions to retard flood water passage which results in increased upstream flooding, but decreased flood stages downstream. This factor, along with a minor amount of flood storage potential (about 1 foot) at the dam, effectively reduced the 500 year flood of April 1979 to a 200 year event at Jackson.

Private Flood Control Efforts

A number of private levees and other flood control structures have been constructed to protect individual buildings. In addition, filling of the floodplain to raise structures above the 100 year flood elevation has occurred and is continuing. A limited number of buildings have been raised with pilings instead of fill material.

FISH AND WILDLIFE RESOURCE PROBLEMS AND PLANNING OBJECTIVES

The major problem in the greater Jackson metropolitan area is the continued encroachment of urban development within the floodplain. Areas where this development is continuing include the Lakeland Drive and Eastover Drive areas in Jackson. Other areas within the floodplain that are under the threat of urban development include areas around Richland, Byram, and wetlands in the eastern portion of Flowood. The new I-20/I-55 Interstates interchange has created a demand for commercial development of wetlands in that area. The Mississippi Department of Transportation has proposed construction of a four lane highway from downtown Jackson, High or Pearl Street, east to the Jackson International Airport. The number of interchanges, and potential for commercial development, is unknown at this time.

Development in these areas results in loss of wildlife habitat values, reduced storage capacity of the floodplain, and increasing flood damages during periods of floods. In turn, the increasing flood damages encourage the development of more flood control projects which further encourage development of the floodplain. A case in point is the development of the floodplain preceding and following the construction of the Fairgrounds and Jackson East levees. Further discussion of Pearl River Basin floodplain development can be found in the Pearl River Cumulative Impact Assessment Report (Gosselink et al. 1989).

The Service acknowledges the need to protect existing urban development from flood damages. However, other needs of the area include the protection of wildlife habitat values, including exisiting habitat for the federally listed threatened ringed sawback turtle (Graptemys oculifera), and the preservation bottomland hardwoods within the Pearl River Basin. Maintaining wildlife habitat and values adjacent to urban areas adds to the overall quality of life of the citizens of the area. In addition, bottomland

hardwood wetlands function as a natural area to store flood waters and to filter and purify the water before it is returned to the Pearl River system. Therefore, there is a need to restrict non-flood compatible development from flood-prone areas. Finally, in order to allow and encourage the citizens of Jackson to use the fish and wildlife resources of the area, there is a need for improved boat access to the Pearl River.

In view of the problems and needs of the study area, the Service has developed the following planning objectives:

1. To provide flood protection to the existing urban development within the study area while minimizing loss of wildlife and fisheries habitat values.

2. To preserve the remaining wildlife and fisheries habitat and other wetland values of bottomland hardwood areas within the study area.

3. To preserve the remaining habitat of the federally listed threatened ringed sawback turtle (*Graptemys oculifera*).

4. To restrict non-flood compatible urban development in the Pearl River floodplain.

5. To promote and encourage the wise use of the fish and wildlife resources of the study area.

FISHERIES RESOURCES

Fishery habitat within the study area includes the Pearl River main stem and tributaries, Ross Barnett Reservoir, a number of oxbow lakes such as Mayes Lake, channel cutoffs such as Crystal Lake, and several other smaller lakes or ponds. In addition, many of the oxbow lakes and sloughs are associated with forested wetlands ecosystems dominated by hardwoods interspersed with cypress-tupelo brakes. This forested wetland complex, in association with the river and its tributaries, sloughs, and oxbow lakes, provides ideal habitat for many fish and wildlife species, resulting in a high species diversity. Water quality in the Pearl River main stem as well as its tributaries and lakes is generally medium to high. The reach of the river flowing from Ross Barnett Reservoir to the upstream end of the Jackson-East Jackson levee remains in a relatively undisturbed state with good water quality as witnessed by the fact that the city of Jackson's drinking and domestic water intake is located on this reach. Water quality in the portion of the river between the levees is reduced due to the influence of the city and its many industrial concerns. However, water quality does recover somewhat downstream of the industrial influences.

The Pearl River and associated water bodies within this portion of the basin support a diverse fishery. Species present include largemouth and spotted bass; rockbass; bluegill, longear, green, and redear sunfish; crappie; and catfish. Hybrid striped bass, an important sport fish, have been stocked in Ross Barnett Reservoir for the past several years by the MDWFP. In addition, significant numbers of hybrid striped bass are taken in the area immediately downstream of Ross Barnett Reservoir. Forage fish diversity is also high in the middle basin. Many species of minnows and darters use the varied habitats of the Pearl and serve as ready food sources for other species. There are 116 freshwater fish species known to occur in the Pearl River Basin (Service 1981).

The fishery resources of the Pearl River and Ross Barnett Reservoir, as well as those of Mayes Lake (located north of the ICG railroad bridge at RM 290.58) and Crystal Lake (located north of U.S. Highway 80), are heavily used by sport fishermen. Their high quality and proximity to a major metropolitan area make these resources especially valuable.

Therefore, the Service has determined that the oxbow lakes and cutoffs within the study area are Resource Category 2 habitat. As defined in the Service Mitigation Policy (published in the Federal Register, Volume 46, No. 15, January 23, 1981), Resource Category 2 habitat is of "...high value for evaluation species and is relatively scarce or becoming scarce on a national basis or in the ecoregion." The mitigation goal for Resource Category 2 habitat is "...no net loss of in-kind habitat value."

The Service classifies the Ross Barnett Reservoir as well as the Pearl River main stem and the largest tributary creeks as Resource Category 3 habitat, defined as habitat "...of high to medium value for evaluation species and is relatively abundant on a national basis..." The mitigation goal for Resource Category 3 is "...no net loss of habitat value while minimizing loss of in-kind habitat value."

Due to their low flows and the impacts of the adjacent urban development, the Service classifies most of the tributary creeks that drain the study area as Resource Category 4, defined as habitat "...of medium to low value for evaluation species." The mitigation goal for Resource Category 4 habitat is to "...minimize loss of habitat value." Due to the continuing urban development that is taking place in the floodplain within the study area, the Service expects that fishery values would decline slightly in the future without the project.

WILDLIFE RESOURCES

Wildlife habitat quality within the study area is high. This is particularly noteworthy considering the proximity to the urban area. Especially productive wildlife habitats

include the wetland areas vegetated with bottomland hardwoods and the cypress-tupelo areas associated with Mayes Lake and Crystal Lake (Pearl River Cutoff). Forested wetland areas vegetated with bald cypress, tupelo gum, red maple, water oak, willow oak, American elm, swamp hickory, green ash, sycamore, and black willow are found along both sides of the Pearl River throughout the study area. These wetlands provide excellent habitat for wildlife as well as contribute to aquatic production. Of the 490 vertebrate wildlife species occurring within the Pearl River Basin, a higher percentage use bottomland hardwoods as primary habitat (habitat on which a species depends for reproduction and/or feeding during all or a portion of the year) than any other habitat type. The floodplain provides high quality habitat for deer, squirrel, wood duck, migratory waterfowl, furbearers, neotropical migratory birds, and a number of other game and nongame species (Service 1981).

In addition to bottomland hardwood habitat, smaller areas of upland hardwoods, mixed hardwood-pine woodlands, pasture, and cropland are present in the study area (Table 1.)(U.S. Army 1994). These habitat types also support a number of game and nongame wildlife populations. Hunting is prohibited in many areas due to the proximity of urban development. Where hunting is permitted, the resources are heavily used.

There are several areas of public lands in the vicinity of the study area:

-Pearl River Waterfowl Refuge and Management Area-MDWFP manages the 4,500 acre area located northwest of Ross Barnett Reservoir.

-Natchez Trace Parkway-The National Park Service manages this area that runs along the west side of the reservoir north of the study area.

-Mayes Lakes-MDWFP manages this area and its associated wetlands as LeFleur's Bluff State Park.

These areas provide opportunities for fishing and non-consumptive uses such as camping, nature photography, bird watching, and hiking to the citizens of the Jackson metropolitan area. Pearl River Management Area allows public hunting for selected game species.

Due to their high biological productivity and the continued loss of bottomland hardwoods to urban and other types of development, the Service classifies the bottomland hardwoods within the study area as Resource Category 2. Upland forests within the study area are classified as Resource Category 3, and cropland and pastureland is classified as Resource Category 4 (see Fisheries Resources section for definition of categories). The Service expects that the wildlife habitat values and

Table 1. Jackson Metro Study Area cover types below the 300 foot contour from Ross Barnett Dam south to Byram.

Cover Type	Acres	Hectares	%
Bottomland hardwoods	31,075	12,576	53.6
Shrub/Cutover	6,368	2,577	11.0
Agriculture/Fallow	5,026	2,034	8.7
Pine-Hardwood	2,113	855	3.6
Grass/Pasture	1,703	689	2.9
Cypress/Tupelo	1,347	545	2.3
Pine Forest	1,181	478	2.1
Open Water	1,262	511	2.2
Sandbar/Bare	141	57	0.2
Urban	7,781	3,149	13.4
Totals	57,997	23,471	100

(U.S. Army 1994)

wildlife populations within the study area will decline in the future without the project due to the continued expansion of the greater Jackson urban area and continued encroachment into the Pearl River Basin floodplain.

ENDANGERED SPECIES

The Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.) requires that an official list of endangered and threatened species be requested for any federal construction project. The Corps requested such a list in a letter dated August 23, 1989, thus entering informal consultation as prescribed by Section 7 of the above act.

The federally listed threatened ringed sawback turtle (*Graptemys oculifera*), a species found only in the Pearl River system, occurs in the study area. On April 23, 1992, the Corps provided this office with a biological assessment addressing the potential impacts to the turtle resulting from implementation of the proposed levee works in the Jackson Metropolitan area. Although none of the project work activities would take place below top banks of the Pearl River, the Service was concerned that changes in hydrology of the river could have indirect adverse impacts on the turtle. Anything that affects the sandbars used by the turtles for nesting could have adverse impacts on the turtle.

On July 19, 1994, the Corps provided additional hydrological data to address these concerns. The construction of the levees would increase the frequency and duration of flooding, however, the proposed overbank clearing should offset these events resulting in only a slight net increase. Water quality would be effected for only a short time during construction. Seeding bare ground immediately following construction should greatly reduce this impact. Based on this information, the Service concurred with the Corps' assessment that the proposed project would not likely have any adverse effect on the turtle.

We recommend that the Corps monitor sandbars in the Pearl River for the first twenty years of the life of the project to determine net changes in their size and availability during the ringed sawback turtle nesting season. This could be accomplished by remote sensing, field inspection, or river gauge data obtained just prior to nesting season (April-May), and following nesting season (August-September). We also recommend that the Corps prepare a brief annual monitoring report so that resource agencies (MDWFP, Service) can evaluate the status of the habitat. If during construction and operation of the project there are any known takes of an individual turtle, a change in duration and frequency of flooding during the nesting season, or a loss of nesting sandbars all work activity must cease until formal Section 7 consultation can be completed.

A threatened bald eagle (*Haliaeetus leucocephalus*) has an active nest in the area of the Ross Barnett Reservoir. The Service concurs with the Corps' determination that the proposed work activities associated with the Jackson Metro Flood Control Project would not have adverse impacts on this species. The federally listed threatened Gulf sturgeon (*Acipenser oxyrhynchus desotoi*) historically was found in the Pearl River, and there are records as recent as 1985 of a capture by a commercial fisherman at Byram, Mississippi. However, the proposed project would not change the integrity of the Pearl River channel and therefore, is not likely to adversely affect the sturgeon.

DESCRIPTION OF SELECTED PLAN

Several alternatives for the Jackson Metro Flood Control Project were studied, including various combinations of levees with floodgates and floodway clearing. The Corps addressed three levels of flood protection: the 100 year flood level, the 1979 flood level, and the 500 year flood level. Levees were proposed for northeast Jackson, Lakeland Drive and Eubanks Creek, Belhaven Creek, Town and Lynch Creeks, South Jackson, Laurelwood and Flowood, Richland, and the existing Fairgrounds and East Jackson levees would be raised.

Two borrow pit location designs were also considered; opposite (pits are located adjacent to the levee) and satellite (pits are located off site). Costs were developed for

six combinations of two variables: level of flood protection and borrow pit location.

Four clearing plans were also evaluated as stand alone separate alternatives. These plans consisted of varying degrees of clearing between RM 278.8 and 292.2. Two of these plans recommended total clearing of the floodplain and two recommended selected clearing. The Corps determined none of these plans to be cost effective, and all were deleted from further consideration.

The selected construction plan approximates the 1979 flood level of protection with opposite borrow pits. The plan also includes numerous floodgates along the levee system as well as overbank and bendway clearing between RM 290.7 and 301.7. This plan requires the construction of 22.6 miles of new levees, raising 10.4 miles of existing levees, with 18 floodgates, and 250 acres of floodway clearing. Construction would be confined to overbank areas of the Pearl River floodplain. Construction features consist of levee embankment, borrow areas along the levee alignment, concrete pipe and concrete box gravity drainage structures at various locations along the levee alignment, clearing across bendways of the Pearl River between Lakeland Drive and the Ross Barnett Reservoir, and clearing along the top bank of the Pearl River between RM 290.6 and 301.7. No clearing, vegetation removal, or construction of any type would occur below top bank of the Pearl River.

Total rights-of-way for the levees, borrow areas, land-side ditches, and over bank clearing would require 1,506 acres. Of this 1,506 acres, 1,025 acres are forested, and 481 acres are open land (Table 2.).

The proposed levees, in conjunction with the existing levees (Jackson and East Jackson Levees) which would be raised to the level of the proposed levees, would provide protection up to the 300 foot contour line for the greater Jackson area. Interior drainage would be provided by floodgates as required. There are no designated flood storage areas within the levees, and drainage would be gravity flow.

Northeast Jackson Levee

The Northeast Jackson Levee would extend from the Jackson Country Club area near County Line Road southward along the west bank of the Pearl River until it reaches Lakeland Drive. From Highway 25, a floodwall would extend south and westward to high ground just east of Eubankds Creek. This floodwall is required because of the highly developed area south of Lakeland Drive and the close proximity to Lefleur's Bluff State Park. This segment includes 25,075 feet of new levee. Floodgates required include a double 60 inch pipe, a double 12 foot by 12 foot box, a single 12 foot by 12 foot box, and a double 48 inch pipe. Approximately 13,500 feet of slurry trench would be required at the upstream end of the levee.

Table 2. Habitat types directly impacted by the selected plan for the Jackson Metro Flood Control Project.

Covertype	acres
bottomland hardwoods	891
mixed pine-hardwoods	60
pine forest	34
cypress swamp	40
grassland/pasture	102
shrubland.cutover	379
total	1506

(U.S. Army 1994)

Eubanks Creek

The Eubanks Creek segment includes 1,600 feet of levee with a double 8 foot by 7 foot box floodgate beginning just south of Lakeland Drive and extending to EuBanks Creek continuing westward to highground. The estimated length of slurry trench is 150 feet.

Belhaven Creek

The Belhaven Creek segment begins north of the existing Fairgrounds levee, and includes the installation of a box culvert under Interstate 55. This segment includes approximately 1,750 feet of levee, and a single 12 foot by 10 foot box. Estimated length of slurry trench is 150 feet.

Town and Lynch Creeks

The Town and Lynch Creeks segment would originate on high ground near the old Brandon Road crossing of the Pearl River (Woodrow Wilson Bridge), and would end at high ground south of Lynch Creek near the old Jackson Packing Company. This segment includes 7,050 feet of levee. Floodgates required include two triple 12 foot by 12 foot boxes. Approximately 2,400 feet of slurry trench would be required along the alignment.

South Jackson Levee

The South Jackson segment starts at high ground south of Bailey Hill, 3/10 mile south

of McDowell Road, and extends along the west bank of the Pearl River to ultimately tie back into high ground just north of the Elton Road interchange on Interstate south. This segment includes 19,900 feet of levee. Approximately 1,600 feet of connecting ditch would be required along the landside toe upstream of Hardy Creek. A double 48 inch pipe and a double 9 foot by 9 foot box would be required. Approximately 7,600 feet of slurry trench is required.

Flowood

The Flowood segment would originate on high ground at a point approximately 0.25 miles west of Fanning Road and 1.25 miles north of Highway 25 (Lakeland Drive) and extends southwesterly around a newly developed residential area. From this point the levee would continue parallel to Lakeland Drive turning southwesterly to follow the east bank of the Pearl River. The levee then would cross Lakeland Drive until intersecting with the East Jackson levee west of Highway 468. These segments include about 27,925 feet of levee. Floodgates include a double 48 inch pipe, a single 48 inch pipe, a double 6 foot by 5 foot box, a double 36 inch pipe, and a double 8 foot by 6 foot box. Approximately 7,250 feet of slurry trench is required.

Richland

The Richland Levee would be "U-shaped" around the city of Richland. It would begin on high ground east of U.S. Highway 49 and extend northwesterly until it intersects the ICGR, then westerly to a point just east of Richland Creek. From this point, the levee extends southerly until it ties into high ground just north at U.S. Highway 49, ICGR, and Old Highway 49. This segment includes about 26,450 feet of levee. Approximately 3,200 of landside connecting ditch is included at the lower end of the levee. Floodgates required include a single 36 inch pipe and a double 48 inch pipe.

Fairgrounds

This segment includes raising the existing levee and adding about 2,600 feet of slurry trench.

East Jackson

This segment includes raising the existing levee between its juncture with the lower end of the proposed Flowood levee and its end along Richland Creek. A short levee extension is required at the lower end to tie to high ground. Approximately 15,330 feet

of slurry trench is required.

General Requirements

In addition to the above flood control features, a segment of overbank clearing would be required. The overbank clearing includes a 100 foot strip along top bank of the Pearl River at strategic locations between RM 290.7 and 301.7. Also included is the maintenance of a 400 foot previously cleared strip across four bendways in this reach and the clearing of a 400 foot strip across two additional bendways. For the project, 168 acres would be newly cleared with maintenance of 74 acres of previously cleared land for a total of 242 acres of overbank clearing. Maintenance of these areas would be achieved by mechanical clearing and herbiciding.

Recreation

Recreation opportunities to be a included in the project are a trail system along the levee with day use areas, a boat launch, a comfort station, a picnic area/pavillions, an open playing field, an amphitheather, and parking.

DESCRIPTION OF IMPACTS

Habitat impacts associated with the project are related to the direct conversion of fish and wildlife habitat to project purposes and to changes in habitat due to operation and maintenance of the project. Those areas newly protected by the levees would still have water flow from the Pearl River on an annual basis, but would not receive the benefits from a major flood event. The floodgates would not be closed until flood events over the five year flooding frequency occurred. In the areas between the levees, hydrology would change when the floodgates are closed, resulting in higher flood levels.

Land would be required for the levees, floodgates, and required project rights-of-way as well as for borrow pits (Table 2.). The selected plan levee alignments traverse forest land, including bottomland hardwood areas, as well as land that is presently cleared. A completed grass-covered levee would provide minimum habitat value while land that is presently forested, especially with bottomland hardwoods, provides habitat of high value. Therefore, there would be a significant decrease in habitat value as forest land is converted to levees. Land that is presently cleared--cropland, pasture, abandoned fields--provides habitat of less value than forest land but of more value than levees so that there would be some loss of habitat value as cleared land was converted to levees.

Forest lands support habitat of significantly higher value than borrow areas. However,

the borrow areas can be constructed in such a way that they could support some fishery habitat value (U.S. Army 1986). During the construction period and until a vegetative cover is established on the levees, the levees and all disturbed areas would be subject to erosion. This eroded material would be carried into small tributary streams and into the Pearl River system. Increased sediment and turbidity can result in decreased light penetration and decreased photosynthesis. High levels of sediment can settle on fish spawning areas and smother fish eggs and larvae. Production of benthic organisms also can be reduced by high levels of sediment. Further, sediments can settle on respiratory surfaces of fish and aquatic organisms and interfere with respiration.

Undeveloped floodplain land that would receive flood protection from water levels exceeding the five year flood event would be subject to conversion to urban development. Areas of presently undeveloped land that would be afforded flood protection include an area west of Richland and a portion of northeast Jackson. These areas are presently composed of both cleared and wooded land, some of which are wetlands, and would be subject to intense pressure from developers. As developed urban land, these areas would have much less value to wildlife. Even if undeveloped forested areas within the protected area were to remain undeveloped, there would be some loss of wildlife habitat value through changes in hydrology and because the areas would become isolated from other forested areas.

The land between the levees, as well as the Pearl River itself, would also be altered and undergo changes in habitat values. Changes in the hydrologic characteristics of the flood plain would be confined to those flows which are in the overbank area of the Pearl River. A flow with a recurrence interval of two years is contained within the top bank. The project would affect those flows with a recurrence interval of five years or more. Flows below the top bank of the Pearl River would not be affected in duration or frequency. As a result, duration and frequency of water levels on any sandbars within the Pearl River would not change, and there would be not adverse affects to the ringed sawback turtle.

Compressing the floodplain and increasing stages between the levees could increase flood flow velocities on the Pearl River. These changes could result in increased areas of bank caving or scour. Areas of bank caving contribute increased sediments and turbidity. Also, there could be a loss of stream bank vegetation which serves to moderate temperatures or, if submerged, serves as substrate for benthic organisms. The overbank clearing of vegetation is an attempt to reduce these velocities within the river channel.

HEP ANALYSIS

The Habitat Evaluation Procedures (HEP) (Fish and Wildlife Service 1980 a,b) were

used to quantify the potential impacts to fish and wildlife species as a result of construction of a comprehensive levee system along the Pearl River. HEP is a habitat based evaluation system that estimates current habitat conditions, predicts future conditions, compares project alternatives, and aids in devising mitigation strategies, all without the need for direct sampling of animal populations.

HEP is based on the fundamental assumption that the quantity and quality of a habitat can be numerically documented and reasonably predicated for future conditions. This numerical description is represented by the Habitat Suitability Index (HSI) and the area of available habitat for a particular species. Multiplying the HSI by the area results in Habitat Unit (HU) data which form the essence of the HEP methodology. These HU's serve not only as the principal units of comparison in HEP, but also as a means of communicating the gains and losses in habitat resulting from management activities and project implementation.

Most federal agencies use annualization as a means to display benefits and costs of a project. Federal projects are evaluated over a period of time that is referred to as the life of the project. This is defined as that period between the time that the project becomes operational and the end of the project economic life. Habitat unit gains or losses are annualized by summing the cumulative HU's across all impact intervals in the period of analysis and dividing the total HU's by the number of years of the economic life of the project. The result of this calculation is called Average Annual Habitat Units (AAHU's).

AAHU's for each evaluation species are calculated by summing HU's for successive years and dividing by the economic life of the project. Determining the net impacts of a proposed alternative requires that two future annualizations be performed and compared to one another. These future predictions are the expected future conditions with the proposed alternative, and the expected future conditions without the proposed alternative. The net impact computation reflects the difference in AAHU's between the future with the project and without the project.

The HEP team (representatives of concerned resource agencies who guide the evaluation, monitor its progress, approve intermediate results, and make necessary direction changes) consisted of individuals from the Fish and Wildlife Service; the Mississippi Department of Wildlife, Fisheries and Parks; and the Corps of Engineers. Evaluation species are used to gauge the extent or magnitude of impacts from a proposed project alternative. It is not logistically feasible to analyze habitat impacts to all of the species that occupy the project area. Selection of a limited number of species from a larger set is necessary. Seven species were selected for the HEP analysis on the Jackson Metro Project. Each of these species reflect the important wildlife values of the various habitats in the study area: barred owl (*Strix varia*), gray squirrel (*Sciurus carolinensis*), Carolina chickadee (*Parus carolinensis*), swamp rabbit (*Sylvilagus*

aquaticus), brown thrasher (*Taxostoma rufum*), eastern meadowlark (*Sturnella magna*), and the slider turtle (*Pseudemys scripta*).

Transects were established and sampled in the project area by Corps and Service staff, and Geo-Marine, Inc., Baton Rouge, Louisiana. A total of nineteen habitat variables were measured on 38 transects with a total of 115 plots.

AAHU's were calculated for the area, with and without the construction project (Table 8, Appendix-HEP). For the selected project alternative, the barred owl, brown thrasher, gray squirrel, swamp rabbit, and Carolina chickadee lost AAHUs (Table 3.). However, the slider turtle and eastern meadowlark gained AAHUs, due to the fact that borrow areas created turtle habitat and levee rights-of-way created meadowlark habitat. A more complete discussion of the HEP procedures, survey data, and computer analyses can be found in Appendix-HEP.

Table 3. Average Annual Habitat Unit (AAHU) analysis for selected species on the project area.*

Evaluation Species	AAHUs No Project	AAHUs Selected Project	Change in AAHUs
Barred Owl	22,621	21,879	-694
Brown Thrasher	2,270	2,163	-161
E. Meadowlark	1,147	1,612	+444
Gray Squirrel	20,586	19,911	-633
Slier Turtle	566	867	+302
Swamp Rabbit	25,946	25,101	-788
C. Chickadee	31,671	30,632	-973

*compiled from Appendix-Hep Tables 8 and 9.

FISH AND WILDLIFE CONSERVATION MEASURES

To address the potential impacts of a project to fish and wildlife resources, the Council on Environmental Quality in 1978 established a sequence of 5 steps:

1. Avoid the impact by not taking a certain action or parts of the action.

2. Minimize impacts by limiting the degree or magnitude of the action and its implementation.

3. Rectify the impact by repairing, rehabilitating, or restoring the affected environment.

4. Reduce or eliminate the impact over time by preservation and maintenance operations during the life of the action.

5. Compensate for the impact by replacing or providing substitute resources or environments.

The Service is concerned over the loss of wetlands in the Pearl River Basin, particularly the Jackson Metro area, and it is our opinion that a no build alternative would be the best for fish and wildlife resources. However, construction of a flood control project for the Jackson Metro area has been authorized by Congress and made a priority for the Vicksburg District Corps. By choosing the selected project alternative, the Corps has minimized the impacts. However, since there are unavoidable losses of wildlife resources associated with this alternative, habitat compensation is appropriate.

Mitigation (compensation) is a process designed to off-set as much as possible the negative effects of a proposed project on wildlife and fisheries resources. Mitigation is defined in the Service Mitigation Policy [Federal Register 46(15):7644-7663 (1981)] as: "the replacement of project-induced losses to fish and wildlife resources, provided such full replacement has been judged by the Service to be consistent with the appropriate mitigation planning goal." The phrase "project-induced losses to fish and wildlife resources" indicates that wildlife resource losses can be assigned directly, indirectly, or cumulatively to a project or series of projects, and that the losses can be documented and quantified. "Full replacement" means that replacement with values less than 100 percent is not considered compensation by this definition, and "...judged by the Service to be consistent with the appropriate mitigation planning goal" refers to the four resource categories discussed in the section Wildlife Resources of this document.

If mitigation is required to offset losses resulting from a project, the acreage required in a management area for adequate compensation depends on the choice of the compensation goal. There are three types of compensation: in-kind, out-of-kind equal, and out-of-kind relative.

In-kind compensation is used for habitat and species in resource category 2. The goal is no net loss of in-kind value. In-kind compensation habitat or species' losses must be replaced with the same habitats or species and at the same level as the losses. No

trade-offs are acceptable.

Out-of-kind equal compensation is assigned to habitat and species in resource category 3; the goal is no net loss of habitat. Gains for any habitats or species that have been judged to be of equal value to those lost can be used to off-set losses.

Out-of-kind relative compensation is to minimize habitat losses in resource category 4. Trade-offs can occur between and among habitats and species and at differential rates, however, a trade-off analysis must be conducted.

Once a compensation goal or goals is selected, the acreage needed for compensation is calculated. For the Jackson Metro Flood Control project, this is done as a final step in the HEP analysis, and is influenced by the present condition of the proposed mitigation site and associated management plan. The estimated AAHU's needed for mitigation for the Jackson Metro Flood Control project are listed in Table 9, Appendix-HEP.

A compensation analysis was done in the HEP analysis to estimate the number of mitigation acres needed to replace the lost AAHU's. Three possible managment plans were proposed for the mitigation site:

1. preservation of existing forested lands (aquisition)

2. natural regeneration of agricultural lands (restoration)

3. planting selected tree species on agricultural lands (reforestation)

Rehabilitation of a degraded wetland includes replacement of hydrology as well as replacement of woody vegetation. Using sites with hydrology and vegetation in place would qualify as preservation and not rehabilitation.

Estimated compensation acres required to offset losses of terrestrial habitat due to the selected plan, based on the above management plans, are as follows*:

Aquisition	14,484 acres
Restoration	1,605 acres
Reforestation	1,228 acres

*These numbers are only an estimate and may change depending on the condition and reforestation potential of the selected mitigation site. Mitigation sites should be selected using the criteria in Table 4. Total acres needed for other studied alternatives are found in Table 12, Appendix-HEP.

The Corps selected the third management plan (reforestation) as the most cost effective.

Several assumptions were made for analysis of this managment plan. No attempt was made to emulate a cover-type composition proportionally similar to that in the study area. Lost wooded areas would be replaced in-kind. However, lost open grasslands and shrublands would be replaced with areas planted in selected hardwood tree species, out-of-kind equal. Also, it was assumed that this plan could provide optimal habitat suitability for most of the evaluation species, with the exception of the slider turtle and the eastern meadowlark. These two species would gain AAHU's as a result of the construction of the flood control project.

To assist the Corps in selecting potential mitigation sites, the Service has developed a hierarchy of criteria to be used to determine land type restoration potential and values. These criteria are divided into four categories, drainage basin location, restorable land type, rehabilitation methods, and specific land location (Table 4). These criteria are listed in ascending numerical order with number 1 being the most desirable. A lower numbered criteria should not be considered until all higher numbered criteria are exhausted.

Additional conservation measures would include the design of the borrow pits and the management of vegetation on the project site. The Corps has developed a methodology for environmental design and construction of borrow pits in riverine areas (U.S. Army 1986). Use of these techniques could reduce impacts to fish and wildlife resources.

Although removal of overbank vegetation is a proposed part of this project, we believe selective vegetation clearing, such as shrub cover, would be as effective as total vegetation removal. The Corps should explore possible options to this work item and future maintenance. There should be limited use of herbicides for removal of vegetation. No vegetation clearing, dredging, or snagging should be allowed below the top banks of the Pearl River.

RECOMMENDATIONS

The Service has developed the following recommendations to minimize the adverse impacts of the proposed project:

1. Mitigate for unavoidable losses of wildlife habitat, as reflected by loss of AAHU's, by rehabilitating degraded wetlands. Mitigation should occur concurrently with construction of the project. Acreage will be determined by a HEP analysis on the proposed mitigation site. The mitigation site should be selected using the criteria found in Table 4. A conservation easement for the life of the project should be recorded on the deed of the mitigation site.

A seventy percent (70%) survival of target tree species must be obtained within five (5) years of the start of site restoration. Tree survival must be verified by a certified forester at the end of each year 1-5.

2. Design borrow pits to improve fish and wildlife habitat as described in the Corps 1986 report "Environmental design considerations for main stem levee borrow areas along the lower Mississippi River".

3. Incorporate sediment and erosion control measures during construction of the levees and vegetate all disturbed areas.

4. Monitor sandbars in the Pearl River to determine net changes in size and availability during nesting season for the ringed sawback turtle as effected by changes in hydrology of the river. This could be accomplished by remote sensing, field inspection, or river gauge data obtained just prior to nesting season (April-May), and following nesting season (August-September) for the first twenty years of the life of the project.

5. Limit the use of herbicides in the maintenance of the overbank and floodway clearing areas, to those specifically developed for use adjacent to open water.

6. Limit the removal of vegetation on the project area to that necessary for the flood control features of the project. This also includes maintenance activities for the project.

7. Restrictive use zoning or non-development easements should be implemented by the local sponsor, prior to project construction, and contain language stringent enough to ensure that flood prone development does not occur and that undeveloped lands in the floodplain are used for floodwater storage, wildlife, outdoor recreation, and other flood sensitive land uses.

SUMMARY OF FINDINGS AND SERVICE POSITION

Due to the increasing urban encroachment into the Pearl River floodplain, the remaining wetland habitat is vital to resident and migratory wildlife species. The proposed Jackson Metro flood control project would directly impact over 1,500 acres of wetlands, of which over 1,000 are wooded. Based on a HEP analysis, 3,249 AAHU's for five selected wildlife species would be lost and must be mitigated by restoring degraded wildlife habitat. The estimated acres required would be 1,228. The

Table 4. Mitigation site selection criteria.

Drainage Basin Location Criteria
1. Lower Pearl River Basin (south of Jackson and west of I-59)
2. Upper Pearl River Basin (north of Jackson)
3. Bogue Chitto River Basin
4. Bayou Pierre River Basin
5. Mississippi Delta-Yazoo River Basin, Sunflower River Basin, etc.
6. Lower Big Black River Basin (west of I-55)
7. Leaf River Basin
Existing Land Use Type Criteria
1. Degraded wetlands in riverine floodplains; ex: abandoned surface mines, actively farmed lands, pasture lands
2. Degraded upland forests in riverine floodplains
3. Cut over forested wetlands
4. Mature bottomland forest
Land Rehabilitation Methods Criteria
1. Wetland restoration including replacement of hydrology and woody vegetation
2. Wetland reforestation where hydrology is in place
3. Reforestation of uplands associated with riverine habitats
4. Preservation of a unique habitat, or a habitat important to a federally listed threatened or endangered species
Specific Land Location Criteria
1. Sites adjacent to state management areas, National Wildlife Refuges, U.S.Forest Service lands, etc., that are managed for fish and wildlife
2. Sites adjacent to existing forested areas
3. Sites adjacent to farmed areas that would provide corridors between wooded areas
4. Sites adjacent to developed residential areas
5. Sites adjacent to developed commercial areas

Service recommends that these impacts should be mitigated within the Pearl River Basin. A conservation easement for the life of the project should be recorded on the deed of the mitigation site.

The Service has concurred with the Corps determination that construction of the Jackson Metro Flood Control project will not adversely impact the federally listed. The Corps anticipates no long term changes in occurrence or duration of flooding below top bank of the river; however, any such changes may adversely affect the ringed sawback turtle. Therefore, these sandbars should be annually monitored for the first twenty years of the life of the project. If there is ever a loss of availability of appropriate nesting sites, formal Section 7 consultation, as authorized by the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.), should be initiated.

The project purpose is to protect existing structures and development from flooding; it should not be used to allow new urban encroachment into the Pearl River floodplain. Easements should be placed on the lands impacted by the project to prevent urban encroachment into undeveloped areas by restricting incompatible floodplain development.

The Service has no objections to the continuation of the Jackson Metro Flood Control Study provided the planning objectives, recommendations, and off site mitigation presented in this report are incorporated into the study.

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Appendix-HEP

prepared by

U.S. Army Corps of Engineers
Vicksburg District

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AN EVALUATION OF IMPACTS TO TERRESTRIAL HABITATS RESULTING FROM LEVEE CONSTRUCTION IN THE JACKSON METROPOLITAN AREA, MISSISSIPPI

PART I: INTRODUCTION

Background and Objectives

1. The Habitat Evaluation Procedures (HEP) (US Fish and Wildlife Service 1980a, b) were used to quantify the potential impacts of constructing a comprehensive levee system along the Pearl River, to provide flood protection to existing development, in the Jackson Metropolitan area (JMA). HEP is a habitat-based evaluation system that allows one to estimate current habitat conditions, predict future conditions, compare project alternatives, and devise mitigation strategies, all without the need for direct sampling of animal populations.

2. The objectives of this work were (1) to determine pre-project (baseline) habitat suitability for selected wildlife species in the JMA, (2) to estimate potential impacts to each species under each project alternative, and (3) to suggest mitigation measures or other design modifications to offset unavoidable habitat losses. Only direct impacts were evaluated. Direct impacts included land clearing, construction, and maintenance activities along the project right-of-way. Impacts due to construction of interior collector ditches, gated drainage structures, and pumping plants were not included.

An Overview of HEP

3. HEP is an accounting system for quantifying and displaying habitat availability for aquatic and terrestrial wildlife. HEP is based on habitat suitability index (HSI) models that quantitatively describe the habitat requirements of a species or group of species. HSI models use measurements of appropriate variables to rate the habitat on a scale of zero (unsuitable) to 1.0 (optimal). In a typical HEP study, a number of evaluation species are chosen for each cover-type of interest in the study area. Species may be chosen because of their ecological, recreational, or economic value, or because they represent groups of species (i.e., guilds) that have similar habitat needs (Roberts and O'Neil 1985).

4. After cover types have been mapped and evaluation species chosen for the study area, habitat variables contained in the HSI models for each species are measured from maps, aerial photographs, or by on-site sampling. HSI values are then calculated, and the initial or baseline number of habitat units (HUs) is determined for each species. One HU is equal to 1 acre of optimal habitat; therefore, the number of HUs for a species is calculated as the number of acres of available habitat times its suitability (HU = HSI x acres).

5. HUs available to each species are estimated for each of several

target years (TYs) over the life of the proposed project (generally 50 to 100 years). Estimates of future habitat conditions are made for the "without project" alternative and for each "with project" alternative. Impacts on each species are then determined by calculating the difference in average annual habitat units (AAHUs) between with- and without-project alternatives. Development of mitigation plans involving trade-offs of one sort of habitat for another may involve the use of relative value indices (RVIs) that express the relative priority or importance of the evaluation species or their habitats (Wakeley and O'Neil 1988).

PART II: STUDY AREA AND METHODS

The HEP Team

6. One of the strengths of the HEP process is the active participation of the concerned resource agencies through formation of a "HEP Team" to guide the evaluation, monitor its progress, approve intermediate results, and make changes in the direction, if needed. For the JMA terrestrial habitat evaluation, the HEP Team consisted of Ms. Marge Harney (US fish and Wildlife Service) (FWS), Dr. John Burris (Mississippi Department of Wildlife, Fisheries, and Parks) (MDWFP), and Mr. Bob Barry (US Army Corps of Engineers, Vicksburg District) (CELMK). Other occasional participants in HEP Team meetings included Mr. Steve Reed and Mr. Greg Ruff (CELMK).

Study Area

7. The study area consisted of the land below the 300-foot contour, on either side of the Pearl River, from the dam at Ross Barnett Reservoir to an arbitrary point downstream of the city of Byram. The 300-foot contour was chosen because this is the elevation at the base of the dam and it represented the area in which the majority of high water events have occurred in the past. Within this area, the HEP Team agreed to concentrate efforts on determining direct impacts of project construction.

Project Alternatives

8. Alternative project plans are summarized in Table 1. The levee plan alternative includes three levels of protection, 100-year flood, 1979 flood-of-record (300-year), and 500-year flood. In conjunction with the levee plan is 250 acres of overbank and bendway clearing to facilitate flows. Overbank clearing involves the removal of all trees and brush within 100 feet of the river bank. Bendway clearing consists of removal of all trees and brush in a 400-foot wide swath across selected bendways. The clearing plan alternative involves partial or total clearing in the floodway. All clearing plans call for periodic maintenance of the cleared area to maintain hydraulic efficiency.

Cover Types

9. The JMA consists largely of bottomland hardwood forests intersparsed with oxbow lakes supporting cypress-tupelo associations. Areas of relatively high ground support pine and mixed pine-hardwood stands. Several large tracts of bottomland hardwoods have been converted to an early-successional shrubland stage as a result of timber industry activity. The JMA has become increasingly urbanized, however most of the development remains outside the 300-foot contour study area. Agricultural areas in the JMA were considered to have little value as wildlife habitat and were, therefore, excluded from the evaluation.

10. Land cover information was derived using LandSat imagery processed through a Geographic Information System (GIS). Forested areas were classified into (1) bottomland hardwoods (BLH), (2) mixed pine-hardwood (MPH), (3) pine forest (PF), and (4) cypress-tupelo swamp (CYP). Areas of grassland, pastures, and hayfields (including existing levees) were combined into a grassland class (GRS). Cutover forest areas and edge areas were combined into the shrubland class (SHR) (Table 2). Due to discrepancies between actual levee alingments and digitized boundaries, the area of each cover type was estimated. Estimates were derived by multiplying the actual right-of-way acreage by the proportion of each cover type in the GIS alignment. This method was also used to determine the area of cover types in clearing plan alternatives.

Evaluation Species

11. With consensus of the HEP Team members, seven species were selected for the habitat evaluation. The combined habitat requirements of these species were believed to reflect the important wildlife values of the various habitats in the study area. Four species -- barred owl (*Strix varia*), gray squirrel (*Sciurus carolinensis*), Carolina chickadee (*Parus carolinensis*), and swamp rabbit (*Sylvilagus aquaticus*) -- inhabit upland forests and forested wetlands in the study area. Barred owls prefer mature forests with closed canopies and large trees; gray squirrels also prefer mature forests, but with a variety and abundance of mast-bearing trees such as oaks and hickories. Carolina chickadees nest in small cavities in live trees or snags and forage in closed forests with abundant tree foliage. Swamp rabbits utilize moist forested habitats with dense understory and fairly open canopy.

12. The brown thrasher (*Toxostoma rufum*) inhabits the edges of grasslands but prefers shrubland areas where it forages for invertebrates in the leaf litter. The eastern meadowlark (*Sturnella magna*) prefers open, grassy areas with nearby singing perches. The slider turtle (*Pseudemys scripta*) is a predominantly aquatic turtle that inhabits virtually all types of water bodies from rivers, ditches, and sloughs to lakes and ponds.

Table 1. Summary of Alternative Plans for the Jackaon Mstropolitan Area Flood Control Feasibility Study.

Item	Levee Plan	Clearing Plan D-1	D-2	E-1	E-2
Raise Existing Levees (mi)	11.2				
Proposed New Levees (mi)	23.7				
Total Clearing (ac)	250	1,402		2,562	
Partial Clearing (ac) 2,225			1,247		
Floodwall (ft)	3,700				

Table 2. Jackson Metro Study Area Cover Types Below 300-ft Contour from Ross Barnett Dam South to Byram.

Cover Type	Acres	Hectares	%
Hardwoods/BLH	31,075	12,576	53.6
Shrub/Cutover	6,368	2,577	11.0
Ag/Fallow	5,026	2,034	8.7
Pine-Hardwood	2,113	855	3.6
Grass/Pasture	1,703	689	2.9
Cypress/Tupelo	1,347	545	2.3
Pine Forest	1,181	478	2.1
Open Water	1,262	511	2.2
Sandbar/Bare	141	57	0.2
Urban	7,781	3,149	13.4
Totals ===>	57,997	23,471	100

Habitat Suitability Index Models

13. Publishod HSI models were available for six of the evaluation species -- barred owl (Allen 1987a), gray squirrel (Allen 1987b), swamp rabbit (Allen 1985), brown thrasher (Cade 1986), eastern meadowlark (Schroeder and Sousa 1982), and slider turtle (Morreale and Gibbons 1986). A model for the Carolina chickadee, developed by Rick Schroeder (USFWS National Ecology Research Center, Fort Collins, CO) for the Upper Steele Bayou Project Reformulation Study (1991) was used in this study. The model was based on an existing HSI model for the black-capped chickadee (*Parus atricapillus*) (Schroeder 1983). Habitat variables used in the seven HSI models are listed in Table 3.

Sampling Scheme

14. Habitat variables contained in the HSI models were measured during August 1992 by a single team composed of one biologist from CELMK and two personnel from Geo-Marine, Inc., Baton Rouge, LA. The sampling scheme was designed to include all habitat types of concern within the proposed levee alignments, overbank and bendway clearing, and clearing plans.

15. Habitat variables were measured within 0.1-acre circular sampling plots located at the beginning, middle, and end of 1000 ft transects. Prior to field work, transects were laid out on 1:16,000 scale aerial photos. Transects on proposed levee alignments were positioned to follow survey lines for cone penetrometer test locations. Transects to evaluate overbank clearing were established within 100 ft of the river's top bank.

Plot Sampling

16. Habitat variables (Table 3) were either estimated directly or calculated later from data collected in the field. All data were collected on a 37-ft radius (0.1 acre) plot. In all, 115 plots were sampled on 38 transects throughout the project area (Table 4).

17. Plots were first classified by cover type and then the tree layer was sampled. The tree layer consisted of all woody plants >20 ft tall, excluding vines. Trees rooted in the plot were classified visually as either overstory or understory, and identified to species. The DBH of each tree was measured to the nearest inch, and the average height of all trees (VHTTR01) was estimated visually and checked occasionally with a clinometer. Tree counts and DBH measurements were later used to calculate the mean DBH of overstory trees (VDBTR01), density of trees >20 inches DBH (VDNTR04), and the number of hard mast species with canopy cover > 1% (VSDHM01).

18. Visual estimates of percent cover were made independently by each sampling team member, compared, and determined by group consensus. In

forested plots, percent cover was estimated separately for all trees (VCVTR01) and hard mast species (VRCHM01). In cypress swamps, cover of emergent herbaceous vegetation (VCVEM03) was estimated. In grassland and shrubland habitats, herbaceous ground cover (VCVHE01), cover of grasses (VRCGR01), shrub cover (woody plants 3-20 ft tall) (VCVSH01), and percent of ground area with leaf litter > 0.5 inches deep (VCVLT03) were estimated. Density of woody stems > 3 ft tall (VDNSH02) was determined by either counting all stems within the plot or by subsampling a portion of the plot and extrapolation.

19. The variable CAV+SNG was estimated by adding the number of trees, living or dead, with one or more cavities >1 inch in diameter, found in the trunk or limbs >4 inches in diameter with the number of snags >4 inches in diameter and ≥ 6 ft tall.

20. The slider turtle model required estimates of mean water depth (WDP01), mean current velocity (WVE01), water temperature (X125V5), and inundation regime (WRE01). WDP01 was estimated by wading into the swamp and estimating depth at various points. Water temperature was measured using a thermometer submersed for at least 1 minute. WVE01 was estimated to be zero since all sample sites were natural impoundments with permanent water. WRE01 was required only for the slider turtle model. Since bottomland hardwood sites were either temporarily or intermittently flooded, the value was optimal for swamp rabbits.

Table 3. HEP Variable Definitions.

Variable	Definition	Evaluation Species*
CAV+SNG	Number trees w/ 1+ cavities plus # snags >4 in dbh	CC
SDIPS01	Mean distance to perch site (ft)	EM
VCVEM03	Percent cover of emergent herbaceous vegetation	ST
VCVHE01	Percent cover of herbaceous vegetation	EM
VCVLT03	Percent of ground area with litter >.5 in deep	BT
VCVSH01	Percent cover of shrubs (woody plants <20 ft tall)	EM
VCVTR01	Percent canopy cover of trees	BO,BT,GS,SR,CC
VDBTR01	Mean DBH of overstory trees (in)	BO,GS
VDNSH02	Density of woody stems > 3 ft tall (#/ac)	BT
VDNTR04	Density of trees with DBH > 20 in (#/ac)	BO
VHTHE03	Mean height of herbaceous canopy (in)	EM
VHTTR01	Mean height of overstory trees (ft)	CC
VRCGR01	Percent of herbaceous canopy cover that is grasses	EM
VRCHM01	Percent of tree canopy cover hard mast species	GS
VSDHM01	Number hard mast species w/ canopy cover > 1%	GS
WDP01	Mean water depth (ft)	ST
WRE01	Water regime code	ST
WVE01	Mean current velocity (ft/s)	ST
X125V5	Water temperature (°F)	ST

* Barred owl (BO), brown thrasher (BT), Carolina chickadee (CC), eastern meadowlark (EM), gray squirrel (GS), swamp rabbit (SR), slider turtle (ST).

Table 4. Terrestrial HEP Sampling Effort in the Jackson Metropolitan Area, Mississippi.

Transect Location	# Transects	# Plots
Northeast Jackson Levee	7	21
Southeast Jackson Levee	3	9
Laurelwood Levee	3	9
Flowood Levee	6	18
Richland Levee	4	12
Overbank Clearing	7	22
Bendway Clearing	2	6
Clearing Plans	6	18
Totals	38	115

PART III. ANALYSIS OF IMPACTS

HSI Determinations and HEP Software

21. HSI models were programmed into a standard spreadsheet program and habitat data for each sample plot in each cover type were entered into models for each appropriate evaluation species. An HSI value for each species on each plot was determined. HSI values for each species were averaged across all plots of similar cover type (Table 5). Average HSI values and cover-type quantities were used as input to the HEP software, provided by the FWS National Ecology Research Center, Fort Collins, CO.

Project Life and Period of Analysis

22. HEP requires that habitat availability for each species be estimated, for each of several target years, over a period of analysis that may include the life of the project plus any additional pre-project impact period. In the JMA, the 100-year economic life of the project begins in 2005, following the six year construction period, and ends in 2105.

23. Work is projected to begin in 1999 and impacts will occur continuously between 1999 and 2005. To try and estimate impacts during construction, impacts were estimated to occur during a 5-year period. It was assumed that 1/5 of all impacts would occur by TY-1 and that all impacts would have occurred by TY-5. This approach slightly overestimated average annual impacts.

Calculating Average Annual Habitat Units

24. AAHUs were determined by annualizing the total HUs available over the 100-year economic life of the project. Impacts of each of the project plans were determined by calculating the net change in AAHUs between with-project and without-project alternatives for each evaluation species. HEP requires that all cover types available to a species be combined and a weighted HSI (weighted on the basis of acreage) be used in the analysis. Therefore, AAHUs for barred owls and Carolina chickadees are for BLH, MPH, and PF combined; for gray squirrels AAHUs are for BLH and MPH combined.

Assumptions

25. For the baseline condition, it was assumed that two large cutover areas (approximately 1,240 total acres) within the study area would naturally succeed to bottomland hardwoods. This assumption was based on the premiss that the landowner would allow forest succession to occur for future timber harvest. It was also assumed that future harvests of timber in the study area would be accomplished on a small scale, or by selective cutting, which would not appreciably change the overall structure of the study area forests. Furthermore, these relatively small, localized changes would be offset by successional changes in undisturbed areas.

Table 5. HSI Values for Evaluation Species: Mean (SE).

Species	COVER TYPE BLH	MPH	PF	CYP	SHR	GRS
Barred Owl	.57 (.04)	.59 (.11)	.60 (.12)			
Carolina Chickadee	.77 (.03)	.85 (.11)	.93 (.04)			
Gray Squirrel	.49 (.03)	.61 (.04)				
Swamp Rabbit	.80 (.02)					
E. Meadowlark						.62 (.14)
Brown Thrasher					.29 (.08)	
Slider Turtle				.33 (.10)		

26. Based on projections made by the Mobile District in the Pearl River Basin Interim Report on Flood Control, it was assumed that additional urbanization would claim 5% of the habitat within the 300-ft contour study area. This assumption is predicated on the fact that little further development would occur below the 300-foot contour as a result of floodplain zoning restrictions and local experience with periodic flooding.

27. Since changes, over time, in many of the habitat variables which the HSI models incorporate (eg: % canopy cover, average dbh, etc.) can be predicted, it is possible to predict how habitat quality changes. For the barred owl, the most limiting variable in the HSI model was average tree diameter. Given the 100-year economic life of the project, and an average diameter growth rate of 2-3 inches per 10-year period, average tree diameter is predicted to increase significantly, thereby increasing the HSI. Habitat suitability for the gray squirrel in the study area is limited by the percent of the canopy composed of hard mast species. Over time, many of the smaller hard mast species would contribute a greater percentage of canopy cover since increases in tree diameter are positively associated with increased canopy cover. This change would increase HSI for gray equirrels.

28. Habitat suitability for Carolina chickadees was primarily limited by average tree height. While average tree height for most stands in the study area is probably at or near maximum, signifcant increases in height in plots where tree height was limiting could increase the overall HSI value for the chickadee. In addition, suitability for chickadees was limited on some plots by lack of suitable snags. Over the 100-year project life the number of suitable snags will probably not be limiting.

29. Habitat suitability for brown thrashers was most limited by the percent of ground area covered with litter at least 1 centimeter deep. Since litter tends to accumulate over time, this value will become less limiting over the life of the project. Thrashers are also limited by tree canopy cover. Since canopy cover is expected to increase, areas which are now suitable for thrashers will decrease in suitability as cutover areas succeed to mature forest. It was assumed that, with the exception of the large cutover areas mentioned previously, shrubland habitat would remain shrubland.

30. Given that suitability would change over time, additional assumptions concerning HSI values were necessary. It was assumed that by the end of the project life: 1) HSI values greater than 0.60 would become 1.00, 2) HSI values from 0.40 - 0.60 would become 0.70, and 3) HSI < 0.40 would become 0.50.

31. For the with-project conditions, it was assumed that all acreage in the levee rights-of-way, associated overbank clearing areas, and total clearing alternatives (Plans D-1 and E-1) would be converted to grassland (GRS) habitat for the life of the project. For selective clearing alternatives (Plans D-2 and E-2), it was assumed that cover-type variables such as percent canopy cover and number of stems per acre would be reduced by 50%. Additionally, all acres of borrow areas were assumed to be converted to aquatic habitats regardless of whether borrow areas were located opposite levees or in satellite areas. Estimates of the amount of clearing for levse alternatives and clearing plans are provided in Tables 6 & 7, respectively. For clearing

plans D-2 and E-2, habitat variables were adjusted, as stated above, and new HSI values calculated for each species for use in the HEP analysis for these alternatives.

PART IV: RESULTS

Levee Plan Alternatives

32. Habitat unit data (AAHUs) for evaluation species for each of the levee alternatives are presented in Table 8. Net changes in AAHUs due to alternatives are found in Table 9. While the barred owl, brown thrasher, gray squirrel, swamp rabbit, and Carolina chickadee lost AAHUs under all levee alternatives, the slider turtle and eastern meadowlark gained AAHUs. This was due to the fact that borrow areas created turtle habitat and levee rights-of-way created meadowlark habitat. Within the three levels of protection, use of satellite borrow areas resulted in lower AAHU losses than use of opposite borrow areas, for those species which lost AAHUs. This was attributed to the smaller size of satellite borrow areas. Actual losses due to borrow pit construction could be considerably less if previously disturbed or low quality habitat areas are selected.

Clearing Plan Alternatives

33. Habitat unit data (AAHUs) for evaluation species for each of the clearing plan alternatives are presented in Table 10. Net changes in AAHUs due to clearing plans are found in Table 11. With the the exception of the eastern meadowlark, all species lost AAHUs under total clearing alternatives. The eastern meadowlark gained AAHUs as a result of cleared areas being maintained in a grassland habitat type through yearly maintenance. The two partial clearing alternatives had lower AAHU losses due to the retention of some habitat value following partial clearing.

Table 6. Acres of Cover Types in Rights-of-Way, Borrow Areas, and Land-Side Ditches, Including Overbank and Bendway Clearing, for Alternative Levee Plans in the Jackson Metropolitan Area Flood Control Feasibility Study.

Cover Type	Levee Plan					
	Opposite Borrow			Satellite Borrow		
	100-Yr	1979	500-Yr	100-Yr	1979	500-Yr
Bottomland Hardwoods	793	891	1,019	544	709	769
Mixed Pine-Hardwood	54	60	69	37	48	52
Pine Forest	30	34	39	21	27	29
Cypress Swamp	35	40	44	24	31	34
Grassland/Pasture	74	102	91	64	78	84
Shrubland/Cutover	277	379	336	238	288	312
Totals	1,263	1,506	1,598	927	1,181	1,280

Areas of cover types were determined by their proportional occurrence in the study area.

Table 7. Acres of Cover Types in Alternative Clearing Plans for the Jackson Metropolitan Area Flood Control Feasibility Study.

Cover Type	Clearing Plan			
	D-1 TOTAL	D-2 SELECTIVE	E-1 TOTAL	E-2 SELECTIVE
Bottomland Hardwoods	1,080	961	1,974	1,854
Mixed Pine-Hardwood	34	30	63	59
Pine Forest	33	29	60	56
Cypress Swamp	98	87	179	169
Grassland/Pasture	1	1	3	2
Shrubland/Cutover	156	138	284	267
Totals	1,402	1,246	2,563	2,407

Areas of cover types were determined by their proportional occurrence in the study area.

Table 8. Average Annual Habitat Units (AAHUs) for Levee Plan Alternatives, Jackson Metropolitan Area Flood Control Feasibility Study.

Evaluation Species	No Action	Opposite Borrow			Satellite Borrow		
		100-YR	1979	500-YR	100-YR	1979	500-YR
Barred Owl	22,621	22,051	21,879	21,889	22,230	22,111	22,068
Brown Thrasher	2,270	2,159	2,163	2,135	2,174	2,154	2,144
E. Meadowlark	1,147	1,585	1,612	1,610	1,459	1,496	1,506
Gray Squirrel	20,586	20,067	19,911	19,920	20,230	20,122	20,083
Slider Turtle	566	780	867	895	725	801	832
Swamp Rabbit	25,946	25,296	25,101	25,111	25,500	25,365	25,316
C. Chickadee	31,671	30,873	30,632	30,645	31,124	30,957	30,897

Table 9. Change in Average Annual Habitat Units (AAHUs) for Levee Plan Alternatives, Jackson Metropolitan Area Flood Control Feasibility Study.

Evaluation Species	Opposite Borrow			Off-Site Borrow		
	100-YR	1979	500-YR	100-YR	1979	500-YR
Barred Owl	-570	-694	-732	-391	-509	-552
Brown Thrasher	-111	-161	-135	- 96	-116	-126
E. Meadowlark	+438	+444	+463	+312	+349	+359
Gray Squirrel	-519	-633	-667	-356	-464	-503
Slider Turtle	+214	+302	+329	+160	+235	+267
Swamp Rabbit	-650	-788	-836	-446	-581	-631
C. Chickadee	-798	-973	-1,025	-547	-714	-774

Table 10. Average Annual Habitat Units (AAHUs) for Clearing Plan Alternatives, Jackson Metropolitan Area Flood Control Feasibility Study.

Evaluation Species	PLAN D-1 No Action	PLAN D-1 Total Clearing	PLAN D-2 No Action	PLAN D-2 Selective Clearing	PLAN E-1 No Action	PLAN E-1 Total Clearing	PLAN E-2 No Action	PLAN E-2 Selective Clearing
Barred Owl	761	3	677	344	1,391	6	1,306	664
Brown Thrasher	64	2	57	13	116	3	109	26
E. Meadowlark	1	587	1	1	2	1,072	1	1
Gray Squirrel	696	3	619	417	1,273	5	1,196	804
Slider Turtle	42	34	38	30	77	62	73	59
Swamp Rabbit	907	6	807	1,008	1,658	8	1,557	1,945
C. Chickadee	1,066	4	948	516	1,948	8	1,829	995

Table 11. Change in Average Annual Habitat Units (AAHUs) for Clearing Plan Alternatives, Jackson Metropolitan Area Flood Control Feasibility Study.

Evaluation Species	Total Clearing PLAN D-1	Selective Clearing PLAN D-2	Total Clearing PLAN E-1	Selective Clearing PLAN E-2
Barred Owl	-758	-333	-1,385	-642
Brown Thrasher	-62	-43	-113	-84
E. Meadowlark	+586	0	+1,070	0
Gray Squirrel	-693	-203	-1,268	-391
Slider Turtle	-8	-7	-15	-14
Swamp Rabbit	-901	+201	-1,650	+387
C. Chickadee	-1,061	-432	-1,940	-834

PART V. COMPENSATION ANALYSIS

Management Plan Scenarios

34. In order to determine compensation acreages, the HEP software compares project-induced habitat unit losses with gains associated with specific management plan scenarios. Plans may be based on existing conditions in a candidate compensation area, or on hypothetical management areas. For this analysis, three hypothetical management plans were developed. Since the slider turtle and eastern meadowlark had net gains in habitat units due to project implementation, they were excluded from the compensation analysis (U.S. Fish and Wildlife Service, ESM 102).

35. The first scenario consisted of acquisition and management of 2,000 acres of forested land. It was assumed that: 1) cover types on the management area occur in the same proportions as those in the Jackson study area; 2) HSI values were similar to those of the study area for without-project conditions, and 3) habitat could be managed to increase HSI values for each evaluation species during the life of the project.

36. The second scenario, restoration, consisted of converting 2,000 acres of agricultural lands to forested land, with a cover-type composition proportionally similar to that in the study area. It was assumed that the restoration effort could provide increase habitat suitability for most evaluation species during the life of the project.

37. The third scenario, reforestation, consisted of converting 1,000 acres of agricultural lands to hardwood forest. No attempt would be made to emulate a cover-type composition proportionally similar to that in the study area, however high-quality hardwood species would be planted. It was assumed that reforestation could provide optimal habitat suitability for most evaluation species during the life of the project.

38. Compensation areas for levee alternatives ranged from 694 acres (100-yr levee, satellite borrow) to 1,228 acres (500-yr levee, opposite borrow) for the reforestation scenario (Table 12). Compensation acres for the restoration scenario ranged from 919 (100-yr levee, satellite borrow) to 1,700 (500-yr levee, opposite borrow). In the acquisition and management scenario, compensation areas ranged from 8,293 acres (100-yr levee, satellite borrow) to 15,338 acres (500-yr levee, opposite borrow). Compensation areas for clearing plan alternatives ranged from 511 acres (Plan D-2, reforestation) to 29,806 acres (Plan E-1, acquisition) (Table 13).

Table 12. Compensation Acres Required to Offset Losses of Terrestrial Habitat Due to Levee Alternatives, Jackson Metropolitan Area Flood Control Feasibility Study.

Levee Plans	Acquisition		Restoration		Reforestation	
	Opposite	Satellite	Opposite	Satellite	Opposite	Satellite
100-YR	11,966	8,293	1,326	919	1,001	694
1979	14,484	10,771	1,605	1,194	1,228	901
500-YR	15,338	11,679	1,700	1,294	1,283	977

Table 13. Compensation Acres Required to Offset Losses of Terrestrial Habitat Due to Clearing Plan Alternatives, Jackson Metropolitan Area Flood Control Feasibility Study.

Clearing Plan Alternative	Acquisition	Restoration	Reforestation
PLAN D-1 -Total	16,296	1,720	1,317
PLAN D-2 -Selective	5,186	672	511
PLAN E-1 -Total	29,806	3,146	2,408
PLAN E-2 -Selective	10,012	1,298	987

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MISSISSIPPI
DEPARTMENT OF WILDLIFE, FISHERIES AND PARKS

SAM POLLES, Ph.D.
Executive Director

December 7, 1994

Mr. Allan J. Mueller
Field Supervisor
U.S. Fish & Wildlife Service
900 Clay Street, Room 235
Vicksburg, MS 39180

RE: Draft Fish and Wildlife Coordination Act Report on Jackson Metro Flood Control Study dated October, 1994

Dear Allan:

Staff with the Department of Wildlife, Fisheries and Parks have reviewed the referenced draft report regarding the Jackson Metro Flood Control Study.

The MDWFP does generally support the draft recommendations designed to minimize the adverse imports of the proposed project. We will continue to work with the project sponsor, COE, USFWS and others in the months ahead as the project moves forward and more detailed decisions are necessary, especially in the areas of mitigation for unavoidable losses of wildlife habitat, levee alignment and nonstructural features to control flood damages.

In reference to the federally listed threatened Gulf sturgeon (acipenser oxyrhynchus desotoi) on page fourteen (14) of the draft report, please note that there are recent records of this species from the lower Pearl River, both in Mississippi (1984) and Louisiana (in the 1990's). Also, Dr. John Burris, who was employed by the DWFP at the time, reported a sturgeon caught by a commercial fisherman at Byram, Mississippi in 1985.

Our staff does concur with the USFWS that the proposed project will not change the integrity of the Pearl River channel and therefore, will not likely adversely affect the sturgeon.

Sincerely,

Bill Quisenberry

Bill Quisenberry
Executive Assistant

BQ:bc

JACKSON METROPOLITAN AREA, MISSISSIPPI

APPENDIX 8
RECREATION REPORT

Addendum to:

Recreation Investigations for the Jackson Metropolitan Area, Mississippi Feasibility Flood Control Study

May 17, 1995

I. NEED FOR REVISIONS

The Recreation Investigations for the Jackson Metropolitan Area, Mississippi Feasibility Flood Control Study were completed in January 14, 1993 and revised in November 1993. The design for the recreation facilities was based upon the preliminary layout of the flood control structures that was in place at the beginning of the feasibility study process. The refinements to the layout and design of the flood control features continued to evolve through most of 1994. Changes to the levee alignments also affected the recreation proposals, primarily in the area of access to the trail system proposed along the levee. As a result of these refinements, the recreation proposal contains inconsistencies which are addressed herein.

In addition, at approximately the time of the completion of the recreation investigations, Policy Guidance Letter No. 36 (PGL #36) was issued. The new guidance in PGL #36 resulted in certain features of the plan no longer being eligible for cost sharing. PGL #36 also directed that any recreation proposals to accompany flood control projects be austere. The conflicts created by this new guidance letter are also addressed herein.

These recommended recreation proposals contain facilities which meet the basic requirements for recreation as allowed within PGL #36 and still meet the projected recreation needs as detailed in the full recreation appendix. The primary feature of the recreation proposal is the trail system which utilizes the alignment of the levee system. Support facilities are those necessary to meet the necessary access requirements of the trail system and provide for the health, safety and welfare of the users of the trail as well as the residents adjacent to the corridor.

The recommended recreation plan includes separate pedestrian and bicycle trails. This was a concern identified during COE review. The plan proposes to utilize the top of the levee for the location of the pedestrian trail. The bicycle trail is to be located at the base of the levee structure on the dry side of the levee where possible.

Investigations related to design standards and safety issues for trail development have identified the evolving need for separate trail development. The top of the

levee structure is of insufficient width to safely accommodate a two-way trail section of sufficient distance across to accommodate both user groups. The safety issue is of primary concern regarding the need for two separate trail systems. Pedestrian user groups, walkers, joggers and runners have been identified to be at risk when utilizing the same trail system as bicycles. Additional concerns have been identified related to recent recreational uses of trails by in-line skaters. Pedestrian design speeds vary from 3 to 7 miles per hour. Design speeds for bicycle trails vary from 20 to 30 miles per hour. In-line skaters are included with the bicycles because of their speed and space requirements. Walkers, and joggers often change their speed and direction almost instantaneously leaving bicyclist insufficient time to react to avoid collisions. Similarly, pedestrians often have difficulty predicting the direction an oncoming bicyclist will take.

The American Association of State Highway and Transportation Officials (AASHTO) published its *Guide for the Development of Bicycle Facilities* in August 1991. The AASHTO guidelines are viewed as the national standard for bikeway design. This manual states that "In general, multi-use paths are undesirable; bicycles and pedestrians do not mix well. Whenever possible, separate bicycle and pedestrian paths should be provided."

AASHTO standards for bicycles alone require a design width of 10 feet with additional shoulder space on both sides for a two-way trail. In-line skaters demand an equally wide trail because of the required wide swing of the skates. The 10 foot width requirement is also a factor in locating the bicycle trail at the base of levee. There in not adequate width on the top of the levee to accommodate this 10 foot minimum and sufficient shoulder for safety purposes. This top of the levee is adequate to accommodate the 8 foot wide pedestrian trail.

II. RECOMMENDED RECREATION PLAN

The recommended recreation plan utilizes the same format as contained in the original recreation appendix. This plan includes a trail system on both sides of the Pearl River with access points at key locations to permit public access. There are significant variations which are described below by levee reach as originally contained in the recreation appendix. This recreation plan results in an overall reduction of 9,300 feet of trail leaving 107,800 feet of trail eligible for cost sharing.

Crossings of roads and railroads utilize the existing bridges as underpasses to connect the trails. These underpasses, located at approximately the level of the 10 year flood in the area of the bridge abutments, are required for safety purposes to prevent pedestrians and bicycles from having to cross major roads and streets. Pedestrian and bicycle crossings are expressly prohibited on the Interstate system. Where this occurs, the trails are proposed to parallel the roads and utilize the

respective rights-of-way for trail connections. This will require permits from the Department of Transportation and railroads. Should this be unattainable, separable lands will be required to connect these trails. Access points are proposed on separable lands with the exception of the "island" utilized by the Lakeland Drive access point.

Specifics of the revised recreation plan are detailed by levee reach.

A. **Reach #1:** Northeast Jackson and Eubanks Creek levee - in Hinds County from the high ground south of Jackson Country Club to Eubanks Creek at LeFleur's Bluff State Park. The revised length of trail contained in Reach #1 on project lands is approximately 4.5 miles long. The revised recreation proposal results in 4,900 feet less trail development than the original plan. This is due to the elimination of the trail north of Westbrook Road. The trail from the area of Eubanks to the northern end of Reach 3 is not on project lands and will be completed by the local sponsor.

The trail system will utilize either the right-of-way of Lakeland Drive or separable lands will be required to carry the trails under the relief bridge. This will be required to avoid pedestrian and bicycle crossings at grade.

The trail begins at a proposed access point at Westbrook Road at station 80+00 (see plate 4-V-1) and continues south to LeFleur's Bluff State Park. One reason for choosing this site is that it is accessed by a major road and is adjacent to local recreation facilities. The access point at Westbrook road contains facilities basic to the functioning of the overall trail system. These facilities include a comfort station, parking for 80 cars, fencing and lighting for security and ancillary support amenities.

This reach includes the section of the floodwall development in the area of LeFleur's Bluff State Park. The section of trail at the floodwall remains as originally proposed in the recreation appendix. This section of the trail is designed to utilize the floodwall by berming to an acceptable level of protection on the wet side of the wall. Other potential connections require the use of some busy local streets with very high traffic counts and is considered unacceptable from a safety standpoint. The wet side of the wall was selected because of the closeness of the wall to some surrounding businesses.

A second access point is proposed at the "island" north of Lakeland Drive between the river and the relief channel (see plates 4-V-3 & 4-V-9). This facility includes a comfort station, parking for 50 cars, fencing and lighting for security and ancillary support amenities. This access point will allow access to trails on both sides of the river. The Lakeland Drive bridge is currently undergoing widening by the Mississippi Department of

Transportation. Local initiative is being utilized to obtain a pedestrian crossing of the river to the east and the relief bridge to the west as a part of this project and thus will connect to the access point.

B. **Reach #2:** Flowood levee - in Rankin County, from the northern end of the levee, now adjacent to Old Fannin Road, to the point at which it joins the existing East Jackson levee. The revised length of trail contained in Reach #2 on project lands is approximately 5.5 miles long. This reach has undergone the most extensive revisions from the original recreation proposal resulting in an additional 14,500 feet of trail. This responds directly to the levee being extended continuously from the Hog Creek area to the Laurelwood Subdivision area. The levee now ends within several hundred feet of Old Fannin Road and provides an opportunity to provide additional access to the trail system at this point. This point is near a fast growing residential area and will provide greater access to the residents of the Barnett Reservoir area and other persons visiting the lake.

The access point near Laurelwood (see plate 4-V-8) is proposed to contain the basic facilities needed for public access to the trail system. This facility includes a comfort station, parking for 50 cars, fencing and lighting for security and ancillary support amenities.

The access at Hog Creek (see plate 4-V-8) is in the same location as proposed by the original recreation plan north of the intersection of Lakeland Drive and Airport Road. This access point now contains facilities only essential to access the trail system. This location (at station 140+00 on the levee) is situated to serve the residential areas in Flowood and portions of Pearl and along the Lakeland Drive corridor as well as persons arriving along Interstate 20. This facility includes a comfort station, parking for 70 cars, fencing and lighting for security and ancillary support amenities.

C. **Reach #3:** Jackson and Belhaven levee on the west side of the river. There is no significant change to the levees that would affect the recreation plan hence the recreation proposal along this reach remains the same. The revised length of trail contained in Reach #3 on project lands is approximately 1.75 miles long.

An access point is proposed at the south end of the levee at station 92+41 (see plate 4-V-5). This facility includes a comfort station, parking for 100 cars, fencing and lighting for security and ancillary support amenities. This access point is proposed in the area of the old City of Jackson public works department storage yard. The site is to be eventually developed as The Meadows because its central open space includes an open meadow, which is to be developed by the local sponsor. This site is very important because

of its' proximity to the downtown area. This point will provide important regional access because of the proximity to Interstate 55 and the numerous downtown hotels and motels.

The area from this access point to the northern point of the Town and Lynch Creek levee (reach #5) is on non-project land and will be completed by the local sponsor.

D. **Reach #4:** Existing East Jackson levee in Rankin County from the southern end of Reach #2 south to Old US Highway 49 at station 470+00. The revised length of trail contained in Reach #4 on project lands is approximately 5.75 miles long. The revised recreation plan results in 4,500 feet less trail on this levee reach. The original plan extended the trail to US Highway 49.

The recommended plan provides a public access point at Old US Highway 49 at station 470+00 (see plate 4-V-13) and avoids an at grade crossing across this road if the trail were continued to New US Highway 49. This facility includes a comfort station, parking for 154 cars, fencing and lighting for security and ancillary support amenities. This access point is important for public access for the residential areas of Richland and portions of Pearl. In addition this site will be important for regional access from users from outside the local tri-county area. This site could be accessed from Interstate 20 and Highway 49 through proper directional signing.

In addition, a public access point at station 350+00 is to be provided at Old Brandon Road (see plates 4-V-4 & 4-V-12) on the east end of the bridge. This facility includes a comfort station, parking for 90 cars, fencing and lighting for security and ancillary support amenities. This access point is important for public access for the residential areas of Pearl, portions of Flowood and downtown Jackson. This site is also important to regional access because of its proximity to the Interstates 55 & 20 and Highway 49. This access point will be more significant if future plans by the local governments are realized to close the Old Brandon Road bridge over the Pearl River. This will allow a pedestrian crossing at this point of the trail system.

E. **Reach #5:** Town and Lynch Creek levee from Old Brandon Road to just south of Lynch Creek in Hinds County. The revised length of trail contained in Reach #5 on project lands is approximately 0.6 miles long. The levee alignments have been shortened resulting in a reduction of 3,700 feet of trail. The southern access point for the trail is now recommended adjacent to Lynch Creek at station 70+00 (see plate 4-V-5) in the area of South Gallatin Street and Interstates 55 and 20. This facility includes a

comfort station, parking for 65 cars, fencing and lighting for security and ancillary support amenities. This access point is very important to provide public access for the residential areas of south Jackson as well as regional access from the Interstates.

F. **Reach #4:** South Jackson levee from just south of the end of Reach #5 to the high ground just south of Caney Creek in Hinds County. No recreational facilities are recommended for this reach. Since reach #7 has been eliminated, utilizing this portion of the levees would not enhance the recreation plan because there is not a good access point for the public and the presence of the sewage treatment plant is a negative factor for recreation users. Public access to the southern end of the trail system will be in reach #5 as described above. This results in the reduction of 7,200 feet of trail from the recreation plan as contained in the recreation appendix.

G. **Reach #7:** Byram levee on the west side of the river in Hinds County. This reach has been eliminated from the flood control project and likewise from the recreation plan. This results in a reduction of 3,500 feet of trail from the original recreation appendix.

III. NEED AND JUSTIFICATION FOR RECREATION DEVELOPMENT

In order to determine the actual need for additional recreation facilities within the Pearl River recreation corridor, a demand survey and analysis was utilized to forecast participation at these proposed facilities. This survey examined, through a telephone survey, several market or recreation segments. The survey and its findings is fully discussed in Section V. - Recreation Demand, Supply and Needs in the full recreation report. The following discussion addresses only key portions of the findings. The full recreation report should be referenced for a detailed explanation of how the benefits for recreation were derived.

First, an overall analysis was made of the total respondents within a 120 mile radius of Jackson. Second, the demand survey was structured to determine recreation demand within a tri-county area which included Hinds, Rankin and Madison counties. A higher ratio of households per capita was examined within this area. Third, the area outside the tri-county area was analyzed to predict the economic benefit of recreation users which would be attracted from outside the immediate vicinity.

The top recreation activities which respondents indicated would be the most important features for the recreation corridor include: walking/nature trail/hiking

trails, bicycle trails, fishing, park/picnic areas, swimming, athletic/gym/exercise area, boating, children's activities, camping, and access/parking.

Approximately three our of four respondents surveyed went walking, hiking, jogging, or running at least once in the past year. The median, or typical respondent ran, hiked, or jogged thirty times in the past year. Respondents in the tri-county area were somewhat more likely to jog or walk than were respondents outside the tri-county area (mean of 75.9 to 61.6). The number of times the respondents indicated that they walked, hiked, jogged, or ran for exercise or recreation per year is as follows:

0 Times	26.1%
1-24 Times	19.9%
25-52 Times	27.2%
Over 52 Times	26.8%

Walking or running was by far the most popular outdoor recreation activity. Not only did respondents provide a mean response of 68.8 times, but jogging/walking was one of only two recreational activities in which at least 50% of the population participated. Picnicking was the other activity with at least a 50% response.

The total annual estimated benefit for the Pearl River recreation corridor was estimated at $51,754,085 and average benefit per visit at $8.26. This projection is based on an annual visitation (activity occasions) of 6.27 million to the recreation corridor and is thoroughly discussed in the full report. This benefit is a conservative estimate.

The travel cost model first determined the benefit that would be achieved from recreational enhancements along the Pearl River flood control corridor based upon claimed visitation to the proposed facilities. Total annual benefit derived using the travel cost model for claimed visitation to the Pearl River corridor was $149,441,913, and the average benefit per visit was $11.97. The benefit derived from actual visitation to existing recreational facilities within the past year by survey respondents was determined to be $19,191,478 with the average benefit per visit $4.58.

The total annual economic benefit and the average benefit per visit was much higher under the claimed visitation model than under the regional (actual) visitation model. In order to provide a more realistic estimate of total benefit, a weighting system was developed and approved that gave three times more importance to actual visitation of regional recreational facilities than to claimed visitation of proposed recreational facilities. Utilizing this weighting system resulted in the total annual estimated benefit of $51,754,085 and an average benefit per visit at $8.26. This assures the conservative nature of the estimate.

In order to meet the needs of the recreation users, the survey determined that certain core facilities must be provided . These include the features identified by the survey as follows:

1. walking/nature trail/hiking trails
2. bicycle trails
3. park/picnic areas
4. access/parking

The recommended recreation plan responds directly to these core needs and addresses other issues identified in the survey such as security by providing lightning and fencing. The 659 total parking spaces proposed at various locations along the corridor can be considered an absolute minimum for visitors from outside the immediate area of the trail. When considering the 6.27 million projected activity occasions to the trail annually, this results in 17,178 visitations daily. Granted, not every visit will be by automobile. However, this level of service will provide parking for only 3.25% of the visitors.

This level of projected daily use also points to the need for controlled public access points. Out of town visitors must be directed to well defined access points through the use of adequate directional signs. These access points will serve as the identity points and the lawful public entry points. The rights of property owners will be best served where clearly defined points of entry are strategically located and maintained. Otherwise, the operations and maintenance of the system will lack the ability to control entry to the trail system and could result in trespassing and objections by local residents. In addition, the basic facilities must include sanitary facilities to prevent users from creating health problems.

Other basic ancillary facilities must include picnic tables, trash receptacles, bicycle racks, shelter buildings and drinking fountains. Picnic facilities were specifically mentioned as a desired activity in the demand survey. The AASHTO standards recommend bicycle racks for protection of bicycles when they must be left unattended. The racks proposed at each access point will provide parking for approximately 10 bicycles. Racks also prevent a safety risk by providing a place to keep large numbers of bikes off the ground and restricted to identified areas. Trash receptacles are required to help control maintenance cost. The shelter buildings provide shade for persons waiting on other users and protection during periods of inclement weather.

IV. COST AND BENEFIT OF THE RECOMMENDED RECREATION PLAN

Following are estimates of recreation development by reach for the revised recreation plan. The total estimated Federal cost for construction of the revised

plan, or that portion of the proposed development eligible for cost sharing, is $9,854,309. Detailed cost estimates for the development of the proposed trail system is contained in Table A and attached hereto. Detailed estimates for the development of the access points are similarly attached in Table B.

LEVEE REACH	ACTIVITY	COST ($)
Reach #1 — Northeast Jackson levee	Trail and trail support	1,379,351
	Westbrook Road access point	451,800
	Lakeland Drive access point	395,521
Subtotal		2,226,672
Reach #2 — Flowood levee	Trail and trail support	1,677,784
	Laurelwood access point	402,577
	Hog Creek access point	586,579
Subtotal		2,666,940
Reach #3 — Jackson and Belhaven Creek levee	Trail and trail support	535,539
	The Meadows access point	380,561
Subtotal		916,100
Reach #4 — Existing East Jackson levee	Trail and trail support	2,180,857
	Old Brandon Road access point	353,521
	Old Highway 49 access point	625,662
Subtotal		3,160,040
Reach #5 — Town and Lynch Creeks levee	Trail and trail support	413,215
	Lynch Creek access point	471,342

Subtotal	**884,557**
Grand Total	**9,854,309**

EVISED COST ESTIMATE OF RECOMMENDED FEATURES OR RECREATION DEVELOPMENT

ABLE A --- TRAILS AND TRAIL SUPPORT

CKSON METROPOLITAN AREA,
SSISSIPPI FEASIBILITY FLOOD
ONTROL STUDY

ATE: 5/17/1995

TRAILS AND TRAIL SUPPORT	UNIT	QUAN.	COST EA.	SUBTOTAL
EACH #1				
NDS AND DAMAGES				
PURCHASE PROPERTY (see note #1)	ACRES	77.30	$100.00	$7,729.57
TIVITY GUIDES AND CONTROLS				
PEDESTRIAN TRAIL	LF.	24050.00	$13.51	$324,915.50
BICYCLE TRAIL	LF.	24050.00	$11.27	$271,043.50
TILITIES				
LIGHTING-HPS-25' POLE @ 200'	EA	120.00	$2,300.00	$276,000.00
UBTOTAL				$879,688.57
ONTINGENCY @ 25%				$ 219,922.14
UBTOTAL				$ 1,099,610.71
LANNING, ENGINEERING, & DESIGN @ 12%				$ 131,953.29
UBTOTAL				$ 1,231,564.00
ONSTRUCTION MANAGEMENT @ 8%				$ 147,787.68
OTAL CONSTRUCTION COST				$ 1,379,351.68
EACH #2				
ANDS AND DAMAGES				
PURCHASE PROPERTY (see note #1)	ACRES	94.01	$100.00	$9,400.83
CTIVITY GUIDES AND CONTROLS				
PEDESTRIAN TRAIL	LF.	29250.00	$13.51	$395,167.50
BICYCLE TRAIL	LF.	29250.00	$11.27	$329,647.50
ITILITIES				
LIGHTING-HPS-25' POLE @ 200'	EA	146.00	$2,300.00	$335,800.00
UBTOTAL				$1,070,015.83
ONTINGENCY @ 25%				$ 267,503.96
UBTOTAL				$ 1,337,519.78
LANNING, ENGINEERING, & DESIGN @ 12%				$ 160,502.37
UBTOTAL				$ 1,498,022.16
ONSTRUCTION MANAGEMENT @ 8%				$ 179,762.66
OTAL CONSTRUCTION COST				$ 1,677,784.82

EACH #3				
ANDS AND DAMAGES				
PURCHASE PROPERTY (see note #1)	ACRES	29.89	$100.00	$2,988.98
CTIVITY GUIDES AND CONTROLS				
PEDESTRIAN TRAIL	LF.	9300.00	$13.51	$125,643.00
BICYCLE TRAIL	LF.	9300.00	$11.27	$104,811.00
TILITIES				
LIGHTING-HPS-25' POLE @ 200'	EA	47.00	$2,300.00	$108,100.00
UBTOTAL				$341,542.98
ONTINGENCY @ 25%				$ 85,385.75
UBTOTAL				$ 426,928.73
LANNING, ENGINEERING, & DESIGN @ 12%				$ 51,231.45
UBTOTAL				$ 478,160.17
ONSTRUCTION MANAGEMENT @ 8%				$ 57,379.22
OTAL CONSTRUCTION COST				$ 535,539.39

EACH #4				
ANDS AND DAMAGES				
PURCHASE PROPERTY (see note #1)	ACRES	122.13	$100.00	$12,213.04
CTIVITY GUIDES AND CONTROLS				
PEDESTRIAN TRAIL	LF.	38000.00	$13.51	$513,380.00
BICYCLE TRAIL	LF.	38000.00	$11.27	$428,260.00
ITILITIES				
LIGHTING-HPS-25' POLE @ 200'	EA	190.00	$2,300.00	$437,000.00
UBTOTAL				$1,390,853.04
ONTINGENCY @ 25%				$ 347,713.26
UBTOTAL				$ 1,738,566.30
LANNING, ENGINEERING, & DESIGN @ 12%				$ 208,627.96
UBTOTAL				$ 1,947,194.26
ONSTRUCTION MANAGEMENT @ 8%				$ 233,663.31
OTAL CONSTRUCTION COST				$ 2,180,857.57

EACH #5					
ANDS AND DAMAGES					
PURCHASE PROPERTY (see note #1)	ACRES	23.14	$100.00		$2,314.05
CTIVITY GUIDES AND CONTROLS					
PEDESTRIAN TRAIL	LF.	7200.00	$13.51		$97,272.00
BICYCLE TRAIL	LF.	7200.00	$11.27		$81,144.00
TILITIES					
LIGHTING-HPS-25' POLE @ 200'	EA	36.00	$2,300.00		$82,800.00
UBTOTAL					$263,530.05
ONTINGENCY @ 25%				$	65,882.51
UBTOTAL				$	329,412.56
LANNING, ENGINEERING, & DESIGN @ 12%				$	39,529.51
UBTOTAL				$	368,942.07
ONSTRUCTION MANAGEMENT @ 8%				$	44,273.05
OTAL CONSTRUCTION COST				$	413,215.12
OTAL REVISED PURCHASE PROPERTY	ACRES	346.46	$100.00		$34,646.46
OTAL REVISED LEVEE TRAIL	LF.	107800.00	$13.51		$1,456,378.00
OTAL REVISED BICYCLE TRAIL	LF.	107800.00	$11.27		$1,214,906.00
OTAL REVISED LIGHTING	EA	539.00	$2,300.00		$1,239,700.00
SUBTOTAL					$3,945,630.46
CONTINGENCY @ 25%				$	986,407.62
SUBTOTAL				$	4,932,038.08
PLANNING, ENGINEERING, & DESIGN @ 12%				$	591,844.57
SUBTOTAL				$	5,523,882.65
CONSTRUCTION MANAGEMENT @ 8%				$	662,865.92
TOTAL CONSTRUCTION COST					**$ 6,186,748.57**

Note #1 - Cost per acre is estimated amount to go from interest acquired for flood control project to fee simple interest.

EVISED COST ESTIMATE OF RECOMMENDED FEATURES OR RECREATION DEVELOPMENT

ABLE B — ACCESS POINTS

ACKSON METROPOLITAN AREA,
ISSISSIPPI FEASIBILITY FLOOD
ONTROL STUDY

ATE: 5/17/1995

/ESTBROOK ROAD ACCESS POINT

ITEM	UNIT	QUAN.	COST EA.	SUBTOTAL
ANDS & DAMAGES, ACQUISITION	9.00	ACRES	$ 1,000.00	$ 9,000.00
ARK CENTER/COMFORT STATION	1.00	EA.	$ 17,500.00	$ 17,500.00
LEARING AND GRUBBING	9.00	ACRES	$ 3,134.00	$ 28,206.00
SPHALT DRIVES	700.00	LF	$ 50.89	$ 35,623.00
SPHALT PARKING LOT W/CURB AND GUTTER	80.00	CARS	$ 500.00	$ 40,000.00
RASSING	8.00	ACRES	$ 1,955.00	$ 15,640.00
AVILION	1.00	EA.	$ 16,100.00	$ 16,100.00
IGNAGE	1.00	LS	$ 25,000.00	$ 25,000.00
' PICNIC TABLE W/GRILL	12.00	EA.	$ 718.75	$ 8,625.00
' BENCH	4.00	EA.	$ 488.75	$ 1,955.00
RASH RECEPTACLE	5.00	EA.	$ 546.25	$ 2,731.25
ICYCLE RACK	2.00	EA.	$ 805.00	$ 1,610.00
ENCING	1600.00	LF.	$ 11.50	$ 18,400.00
VATER TAP AND METER	1.00	EA.	$ 3,640.00	$ 3,640.00
VATER LINE	600.00	LF.	$ 11.21	$ 6,726.00
ANITARY SEWER MANHOLE	3.00	EA.	$ 1,150.00	$ 3,450.00
ANITARY SEWER LINE	600.00	LF.	$ 20.70	$ 12,420.00
IGHTING - 25' POLE	14.00	EA.	$ 2,300.00	$ 32,200.00
IGHTING - 16' POLE	6.00	EA.	$ 1,552.00	$ 9,312.00
UBTOTAL				$ **288,138.25**
ONTINGENCY @ 25%				$ 72,034.56
UBTOTAL				$ 360,172.81
LANNING, ENGINEERING, & DESIGN @ 12%				$ 43,220.74
UBTOTAL				$ 403,393.55
ONSTRUCTION MANAGEMENT @ 8%				$ 48,407.23
OTAL CONSTRUCTION COST				$ **451,800.78**

AKELAND DRIVE ACCESS POINT

ITEM	UNIT	QUAN.	COST EA.	SUBTOTAL
& D, ACQUISITION (See Note #1)	5.00	ACRES	$ 100.00	$ 500.00
ARK CENTER/COMFORT STATION	1.00	EA.	$ 17,500.00	$ 17,500.00
LEARING AND GRUBBING	5.00	ACRES	$ 3,134.00	$ 15,670.00
SPHALT DRIVES	1200.00	LF	$ 50.89	$ 61,068.00
SPHALT PARKING LOT W/CURB	50.00	CARS	$ 500.00	$ 25,000.00

AND GUTTER					
GRASSING	3.94	ACRES	$ 1,955.00	$	7,702.70
PAVILION	1.00	EA.	$ 16,100.00	$	16,100.00
SIGNAGE	1.00	EA.	$ 25,000.00	$	25,000.00
6' PICNIC TABLE W/GRILL	12.00	EA.	$ 718.75	$	8,625.00
6' BENCH	4.00	EA.	$ 488.75	$	1,955.00
TRASH RECEPTACLE	5.00	EA.	$ 546.25	$	2,731.25
BICYCLE RACK	2.00	EA.	$ 805.00	$	1,610.00
FENCING	2400.00	LF.	$ 11.50	$	27,600.00
WATER TAP AND METER	1.00	EA.	$ 3,640.00	$	3,640.00
WATER LINE	200.00	LF.	$ 11.21	$	2,242.00
SANITARY SEWER MANHOLE	3.00	EA.	$ 1,150.00	$	3,450.00
SANITARY SEWER LINE	200.00	LF.	$ 20.70	$	4,140.00
LIGHTING - 25' POLE	8.00	EA.	$ 2,300.00	$	18,400.00
LIGHTING - 16' POLE	6.00	EA.	$ 1,552.00	$	9,312.00
SUBTOTAL				$	252,245.95
CONTINGENCY @ 25%				$	63,061.49
SUBTOTAL				$	315,307.44
PLANNING, ENGINEERING, & DESIGN @ 12%				$	37,836.89
SUBTOTAL				$	353,144.33
CONSTRUCTION MANAGEMENT @ 8%				$	42,377.32
TOTAL CONSTRUCTION COST				$	395,521.65

LAURELWOOD ACCESS POINT

ITEM	UNIT	QUAN.	COST EA.		SUBTOTAL
LANDS & DAMAGES, ACQUISITION	5.00	ACRES	$ 1,000.00	$	5,000.00
PARK CENTER/COMFORT STATION	1.00	EA.	$ 17,500.00	$	17,500.00
CLEARING AND GRUBBING	5.00	ACRES	$ 3,134.00	$	15,670.00
ASPHALT DRIVES	1200.00	LF	$ 50.89	$	61,068.00
ASPHALT PARKING LOT W/CURB AND GUTTER	50.00	CARS	$ 500.00	$	25,000.00
GRASSING	3.94	ACRES	$ 1,955.00	$	7,702.70
SIGNAGE	1.00	LS	$ 25,000.00	$	25,000.00
PAVILION	1.00	EA.	$16,100.00	$	16,100.00
6' PICNIC TABLE W/GRILL	12.00	EA.	$ 718.75	$	8,625.00
6' BENCH	4.00	EA.	$ 488.75	$	1,955.00
TRASH RECEPTACLE	5.00	EA.	$ 546.25	$	2,731.25
BICYCLE RACK	2.00	EA.	$ 805.00	$	1,610.00
FENCING	2400.00	LF.	$ 11.50	$	27,600.00
WATER TAP AND METER	1.00	EA.	$ 3,640.00	$	3,640.00
WATER LINE	200.00	LF.	$ 11.21	$	2,242.00
SANITARY SEWER MANHOLE	3.00	EA.	$ 1,150.00	$	3,450.00
SANITARY SEWER LINE	200.00	LF.	$ 20.70	$	4,140.00
LIGHTING - 25' POLE	8.00	EA.	$ 2,300.00	$	18,400.00
LIGHTING - 16' POLE	6.00	EA.	$ 1,552.00	$	9,312.00
SUBTOTAL				$	256,745.95
CONTINGENCY @ 25%				$	64,186.49

UBTOTAL	$	320,932.44
LANNING, ENGINEERING, & DESIGN @ 12%	$	38,511.89
UBTOTAL	$	359,444.33
ONSTRUCTION MANAGEMENT @ 8%	$	43,133.32
OTAL CONSTRUCTION COST	$	402,577.65

OG CREEK ACCESS POINT

ITEM	UNIT	QUAN.	COST EA.	SUBTOTAL
ANDS & DAMAGES, ACQUISITION	6.43	ACRES	$ 1,000.00	$ 6,430.00
ARK CENTER/COMFORT STATION	1.00	EA.	$ 17,500.00	$ 17,500.00
LEARING AND GRUBBING	6.43	ACRES	$ 3,134.00	$ 20,151.62
SPHALT DRIVES	1700.00	LF	$ 50.89	$ 86,513.00
SPHALT PARKING LOT W/CURB AND GUTTER	70.00	CARS	$ 500.00	$ 35,000.00
RASSING	4.93	ACRES	$ 1,955.00	$ 9,638.15
IGNAGE	1.00	LS	$ 25,000.00	$ 25,000.00
AVILION	1.00	EA.	$ 16,100.00	$ 16,100.00
PICNIC TABLE W/GRILL	12.00	EA.	$ 718.75	$ 8,625.00
BENCH	4.00	EA.	$ 488.75	$ 1,955.00
RASH RECEPTACLE	5.00	EA.	$ 546.25	$ 2,731.25
ICYCLE RACK	2.00	EA.	$ 805.00	$ 1,610.00
ENCING	2800.00	LF.	$ 11.50	$ 32,200.00
VATER TAP AND METER	1.00	EA.	$ 3,640.00	$ 3,640.00
VATER LINE	1800.00	LF.	$ 11.21	$ 20,178.00
ANITARY SEWER MANHOLE	9.00	EA.	$ 1,150.00	$ 10,350.00
ANITARY SEWER LINE	1800.00	LF.	$ 20.70	$ 37,260.00
IGHTING - 25' POLE	13.00	EA.	$ 2,300.00	$ 29,900.00
IGHTING - 16' POLE	6.00	EA.	$ 1,552.00	$ 9,312.00
UBTOTAL				$ 374,094.02
ONTINGENCY @ 25%				$ 93,523.51
UBTOTAL				$ 467,617.53
LANNING, ENGINEERING, & DESIGN @ 12%				$ 56,114.10
UBTOTAL				$ 523,731.63
ONSTRUCTION MANAGEMENT @ 8%				$ 62,847.80
OTAL CONSTRUCTION COST				$ 586,579.42

HE MEADODWS ACCESS POINT

ITEM	UNIT	QUAN.	COST EA.	SUBTOTAL
ANDS & DAMAGES, ACQUISITION	6.00	ACRES	$ 1,000.00	$ 6,000.00
ARK CENTER/COMFORT STATION	1.00	EA.	$ 17,500.00	$ 17,500.00
LEARING AND GRUBBING	6.00	ACRES	$ 3,134.00	$ 18,804.00
SPHALT DRIVES	400.00	LF	$ 50.89	$ 20,356.00
SPHALT PARKING LOT W/CURB AND GUTTER	100.00	CARS	$ 500.00	$ 50,000.00
RASSING	4.71	ACRES	$ 1,955.00	$ 9,208.05
IGNAGE	1.00	LS	$ 25,000.00	$ 25,000.00

\VILION	1.00	EA.	$ 16,100.00	$	16,100.00
PICNIC TABLE W/GRILL	12.00	EA.	$ 718.75	$	8,625.00
BENCH	4.00	EA.	$ 488.75	$	1,955.00
?ASH RECEPTACLE	5.00	EA.	$ 546.25	$	2,731.25
CYCLE RACK	2.00	EA.	$ 805.00	$	1,610.00
:NCING	1700.00	LF.	$ 11.50	$	19,550.00
ATER TAP AND METER	1.00	EA.	$ 3,640.00	$	3,640.00
ATER LINE	400.00	LF.	$ 11.21	$	4,484.00
\NITARY SEWER MANHOLE	3.00	EA.	$ 1,150.00	$	3,450.00
\NITARY SEWER LINE	400.00	LF.	$ 20.70	$	8,280.00
GHTING - 25' POLE	7.00	EA.	$ 2,300.00	$	16,100.00
GHTING - 16' POLE	6.00	EA.	$ 1,552.00	$	9,312.00
JBTOTAL				$	242,705.30
ONTINGENCY @ 25%				$	60,676.33
UBTOTAL				$	303,381.63
LANNING, ENGINEERING, & DESIGN @ 12%				$	36,405.80
UBTOTAL				$	339,787.42
ONSTRUCTION MANAGEMENT @ 8%				$	40,774.49
OTAL CONSTRUCTION COST				$	380,561.91

)LD BRANDON ROAD ACCESS POINT

ITEM	UNIT	QUAN.	COST EA.	SUBTOTAL
ANDS & DAMAGES, ACQUISITION	5.50	ACRES	$ 1,000.00	$ 5,500.00
ARK CENTER/COMFORT STATION	1.00	EA.	$ 17,500.00	$ 17,500.00
LEARING AND GRUBBING	5.50	ACRES	$ 3,134.00	$ 17,237.00
SPHALT DRIVES	200.00	LF	$ 50.89	$ 10,178.00
SPHALT PARKING LOT W/CURB AND GUTTER	90.00	CARS	$ 500.00	$ 45,000.00
;RASSING	4.71	ACRES	$ 1,955.00	$ 9,208.05
IGNAGE	1.00	LS	$ 25,000.00	$ 25,000.00
'AVILION	1.00	EA.	$ 16,100.00	$ 16,100.00
' PICNIC TABLE W/GRILL	12.00	EA.	$ 718.75	$ 8,625.00
' BENCH	4.00	EA.	$ 488.75	$ 1,955.00
'RASH RECEPTACLE	5.00	EA.	$ 546.25	$ 2,731.25
;ICYCLE RACK	2.00	EA.	$ 805.00	$ 1,610.00
'ENCING	1700.00	LF.	$ 11.50	$ 19,550.00
VATER TAP AND METER	1.00	EA.	$ 3,640.00	$ 3,640.00
VATER LINE	400.00	LF.	$ 11.21	$ 4,484.00
;ANITARY SEWER MANHOLE	3.00	EA.	$ 1,150.00	$ 3,450.00
;ANITARY SEWER LINE	400.00	LF.	$ 20.70	$ 8,280.00
.IGHTING - 25' POLE	7.00	EA.	$ 2,300.00	$ 16,100.00
.IGHTING - 16' POLE	6.00	EA.	$ 1,552.00	$ 9,312.00
;UBTOTAL				$ 225,460.30
:ONTINGENCY @ 25%				$ 56,365.08
;UBTOTAL				$ 281,825.38
'LANNING, ENGINEERING, & DESIGN @ 12%				$ 33,819.05

IBTOTAL	$	315,644.42
)NSTRUCTION MANAGEMENT @ 8%	$	37,877.33
ITAL CONSTRUCTION COST	$	353,521.75

'NCH CREEK ACCESS POINT

ITEM	UNIT	QUAN.	COST EA.	SUBTOTAL
NDS & DAMAGES, ACQUISITION	7.20	ACRES	$ 1,000.00	$ 7,200.00
\RK CENTER/COMFORT STATION	1.00	EA.	$ 17,500.00	$ 17,500.00
.EARING AND GRUBBING	7.20	ACRES	$ 3,134.00	$ 22,564.80
;PHALT DRIVES	800.00	LF	$ 50.89	$ 40,712.00
;PHALT PARKING LOT W/CURB	65.00	CARS	$ 500.00	$ 32,500.00
\ND GUTTER				
RASSING	6.15	ACRES	$ 1,955.00	$ 12,023.25
GNAGE	1.00	LS	$ 25,000.00	$ 25,000.00
\VILION	1.00	EA.	$ 16,100.00	$ 16,100.00
PICNIC TABLE W/GRILL	12.00	EA.	$ 718.75	$ 8,625.00
BENCH	4.00	EA.	$ 488.75	$ 1,955.00
RASH RECEPTACLE	5.00	EA.	$ 546.25	$ 2,731.25
CYCLE RACK	2.00	EA.	$ 805.00	$ 1,610.00
ENCING	2800.00	LF.	$ 11.50	$ 32,200.00
ATER TAP AND METER	1.00	EA.	$ 3,640.00	$ 3,640.00
'ATER LINE	800.00	LF.	$ 11.21	$ 8,968.00
\NITARY SEWER MANHOLE	4.00	EA.	$ 1,150.00	$ 4,600.00
\NITARY SEWER LINE	800.00	LF.	$ 20.70	$ 16,560.00
GHTING - 25' POLE	16.00	EA.	$ 2,300.00	$ 36,800.00
GHTING - 16' POLE	6.00	EA.	$ 1,552.00	$ 9,312.00
UBTOTAL				$ 300,601.30
ONTINGENCY @ 25%				$ 75,150.33
UBTOTAL				$ 375,751.63
LANNING, ENGINEERING, & DESIGN @ 12%				$ 45,090.20
UBTOTAL				$ 420,841.82
ONSTRUCTION MANAGEMENT @ 8%				$ 50,501.02
OTAL CONSTRUCTION COST				$ 471,342.84

)LD HWY. 49 ACCESS POINT

ITEM	UNIT	QUAN.	COST EA.	SUBTOTAL
ANDS & DAMAGES, ACQUISITION	21.00	ACRES	$ 1,000.00	$ 21,000.00
ARK CENTER/COMFORT STATION	1.00	EA.	$ 17,500.00	$ 17,500.00
:LEARING AND GRUBBING	21.00	ACRES	$ 3,134.00	$ 65,814.00
.SPHALT DRIVES	450.00	LF	$ 50.89	$ 22,900.50
.SPHALT PARKING LOT W/CURB	154.00	CARS	$ 500.00	$ 77,000.00
AND GUTTER				
;RASSING	19.60	ACRES	$ 1,955.00	$ 38,318.00
;IGNAGE	1.00	LS	$ 25,000.00	$ 25,000.00
'AVILION	1.00	EA.	$ 16,100.00	$ 16,100.00
' PICNIC TABLE W/GRILL	12.00	EA.	$ 718.75	$ 8,625.00
' BENCH	4.00	EA.	$ 488.75	$ 1,955.00

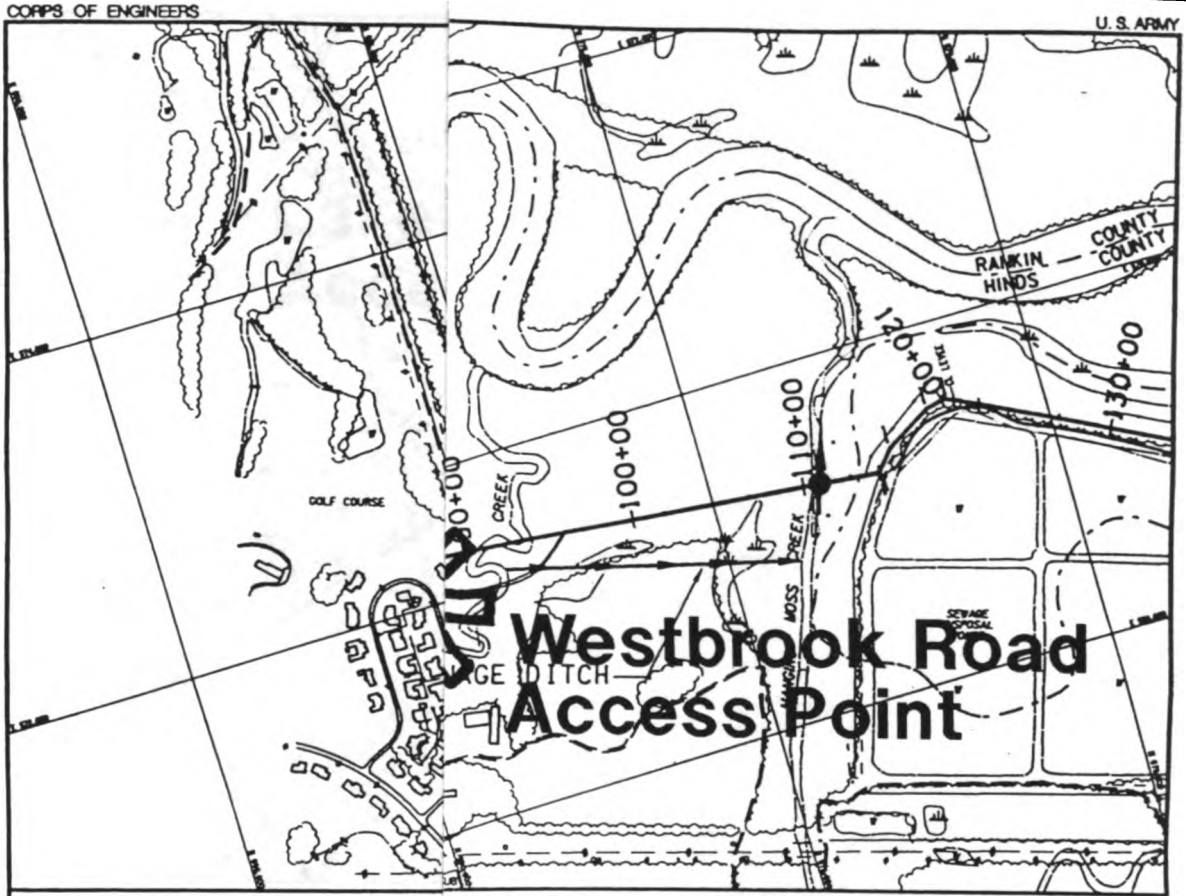
ASH RECEPTACLE	5.00 EA.	$ 546.25	$	2,731.25
CYCLE RACK	2.00 EA.	$ 805.00	$	1,610.00
NCING	4000.00 LF.	$ 11.50	$	46,000.00
ATER TAP AND METER	1.00 EA.	$ 3,640.00	$	3,640.00
ATER LINE	400.00 LF.	$ 11.21	$	4,484.00
NITARY SEWER MANHOLE	3.00 EA.	$ 1,150.00	$	3,450.00
NITARY SEWER LINE	400.00 LF.	$ 20.70	$	8,280.00
GHTING - 25' POLE	11.00 EA.	$ 2,300.00	$	25,300.00
GHTING - 16' POLE	6.00 EA.	$ 1,552.00	$	9,312.00
JBTOTAL			$	399,019.75
ONTINGENCY @ 25%			$	99,754.94
JBTOTAL			$	498,774.69
ANNING, ENGINEERING, & DESIGN @ 12%			$	59,852.96
JBTOTAL			$	558,627.65
ONSTRUCTION MANAGEMENT @ 8%			$	67,035.32
TAL CONSTRUCTION COST			$	625,662.97

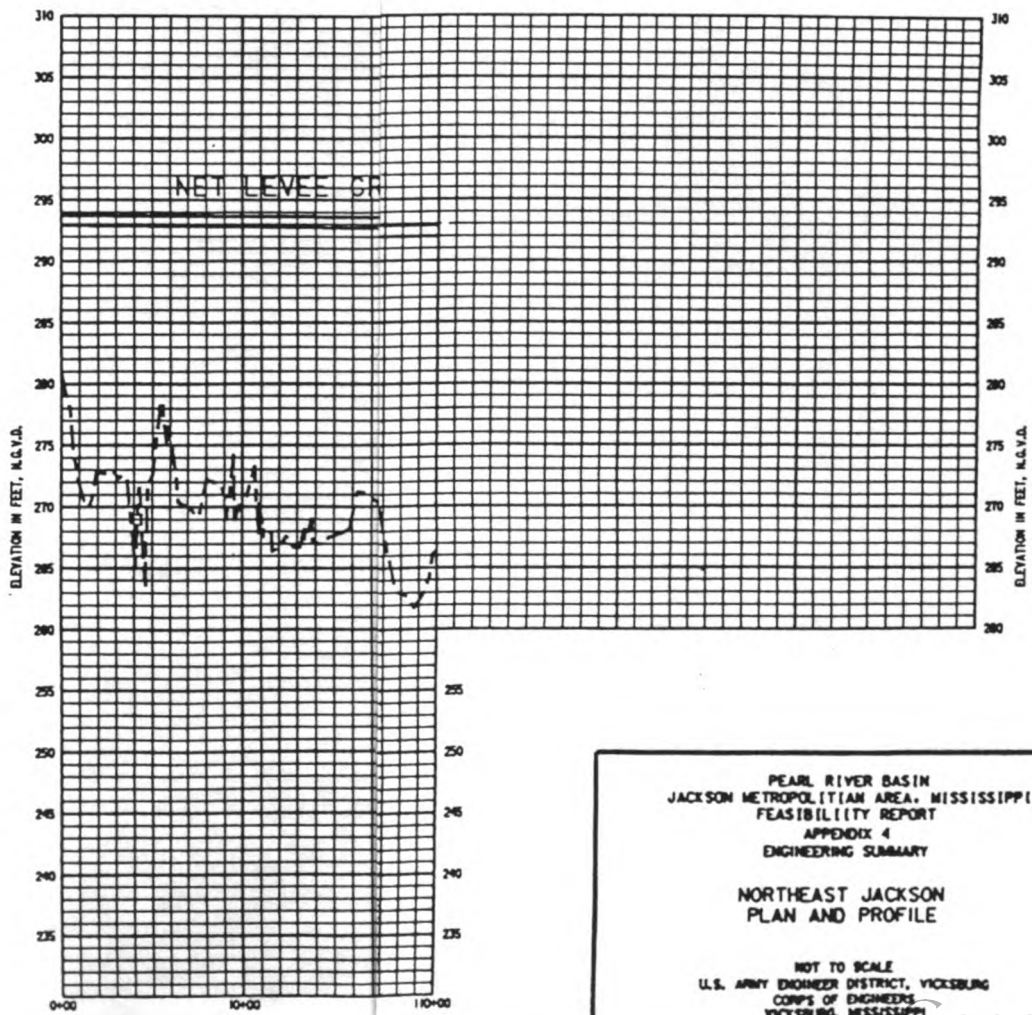
TAL ALL ACCESS POINTS	$ 3,667,568.97

te #1 - Cost per acre is estimated amount to go from interest acquired for flood control project to fee simple interest or to purchase lands for access points where required.

CORPS OF ENGINEERS

U. S. ARMY



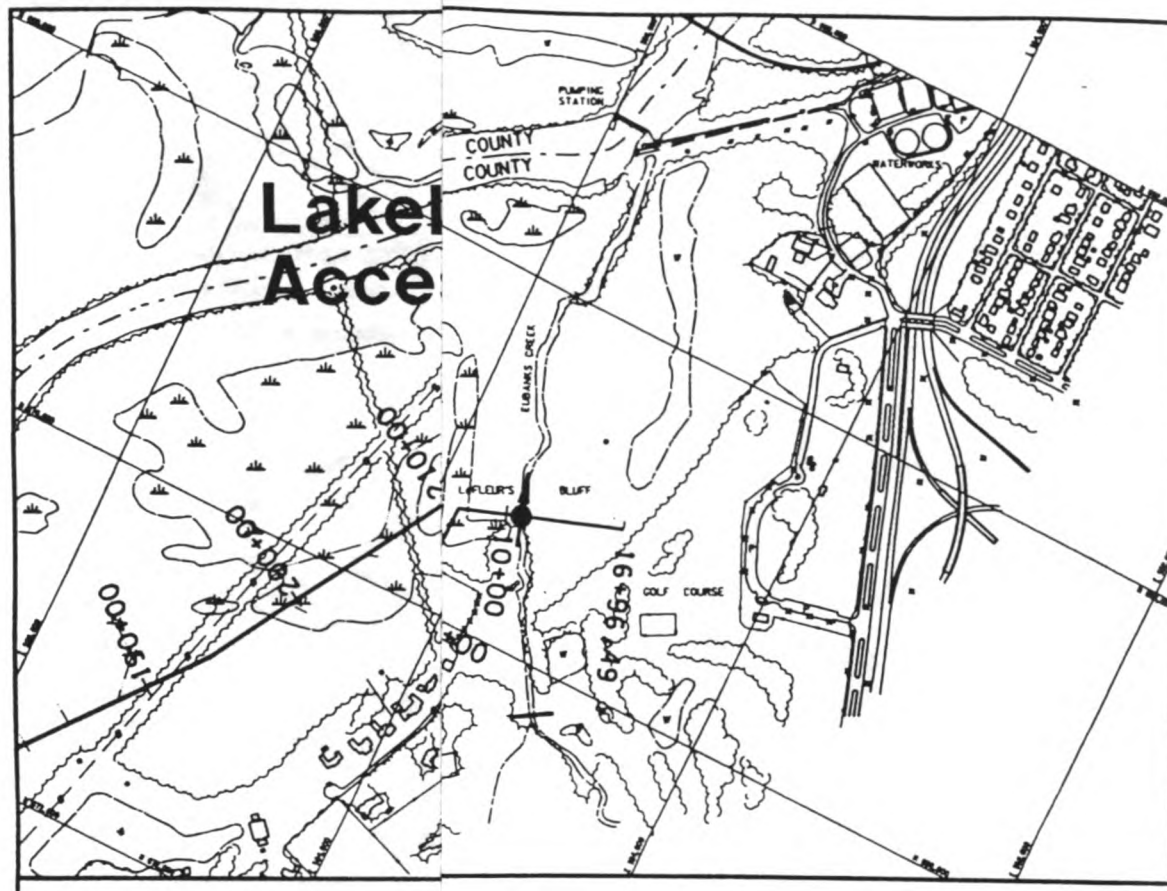


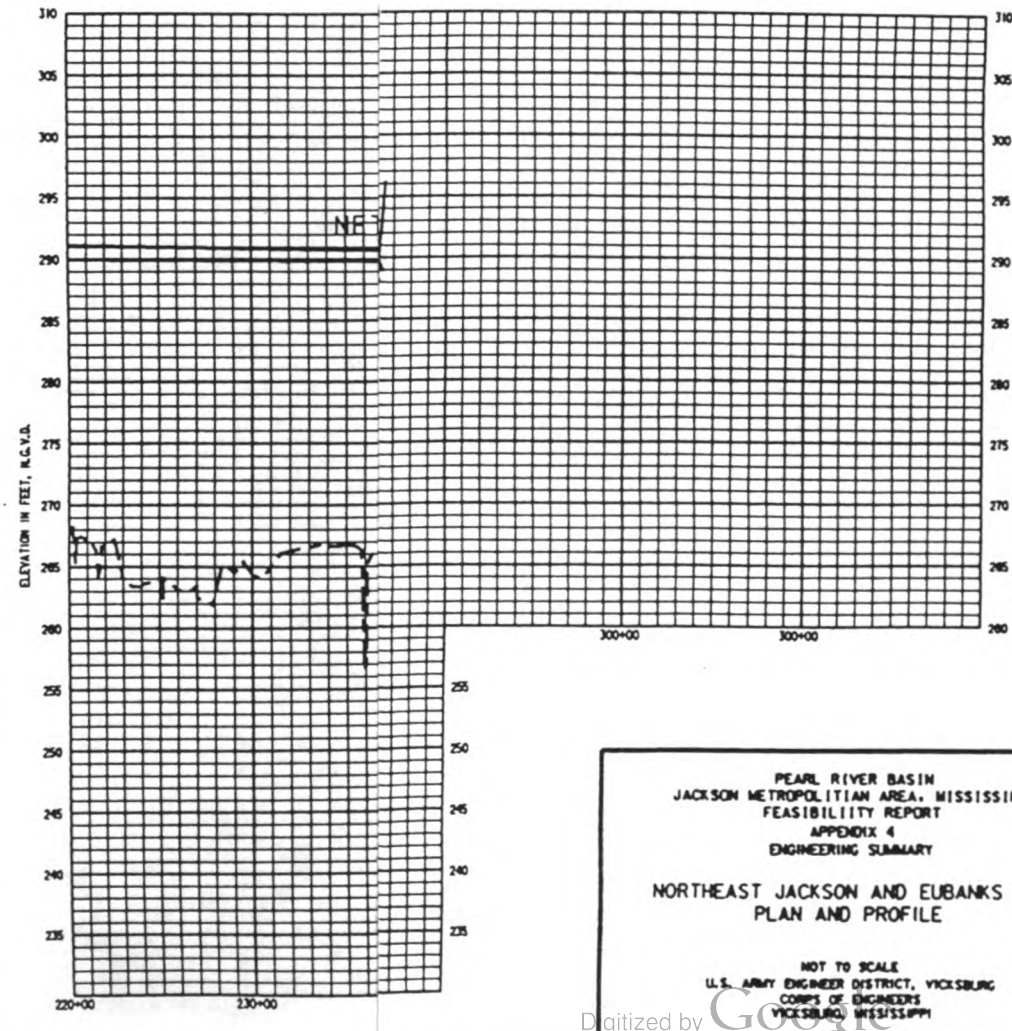
PEARL RIVER BASIN
JACKSON METROPOLITAN AREA, MISSISSIPPI
FEASIBILITY REPORT
APPENDIX 4
ENGINEERING SUMMARY

NORTHEAST JACKSON
PLAN AND PROFILE

NOT TO SCALE
U.S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

PLATE 4-V-1





PEARL RIVER BASIN
JACKSON METROPOLITIAN AREA, MISSISSIPPI
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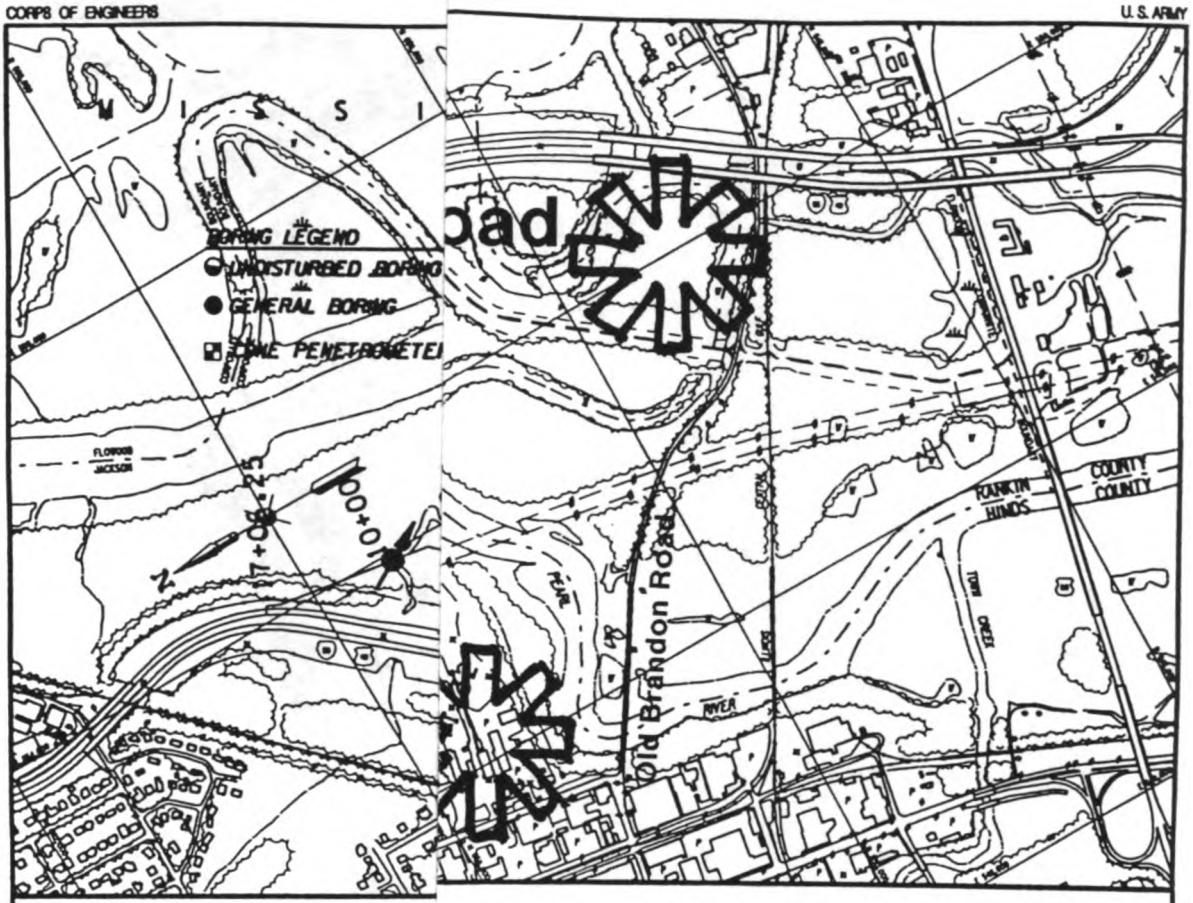
NORTHEAST JACKSON AND EUBANKS CREEK
PLAN AND PROFILE

NOT TO SCALE
U.S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

PLATE 4-V-3

CORPS OF ENGINEERS

U.S. ARMY



PEARL RIVER BASIN
JACKSON METROPOLITIAN AREA, MISSISSIPPI
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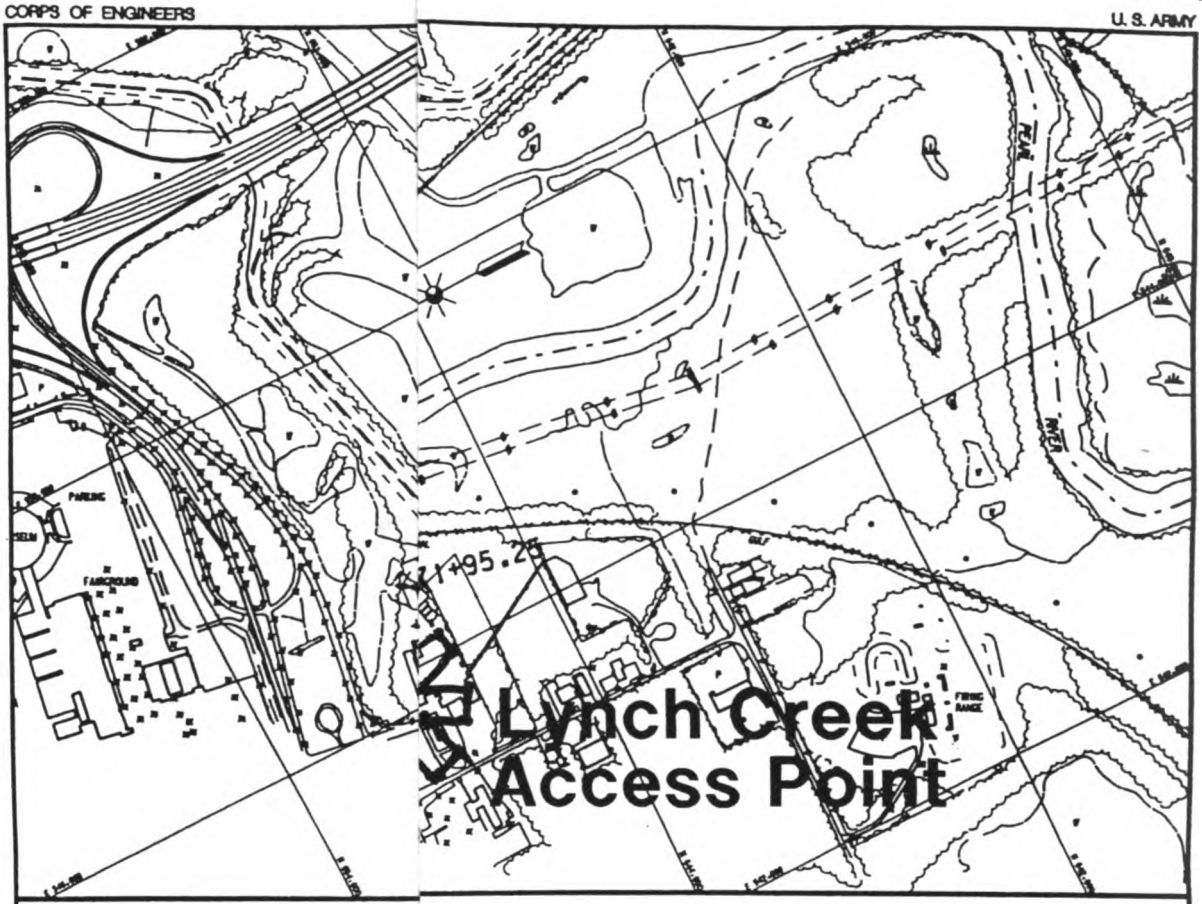
JACKSON AND BELHAVEN CREEK
PLAN AND PROFILE

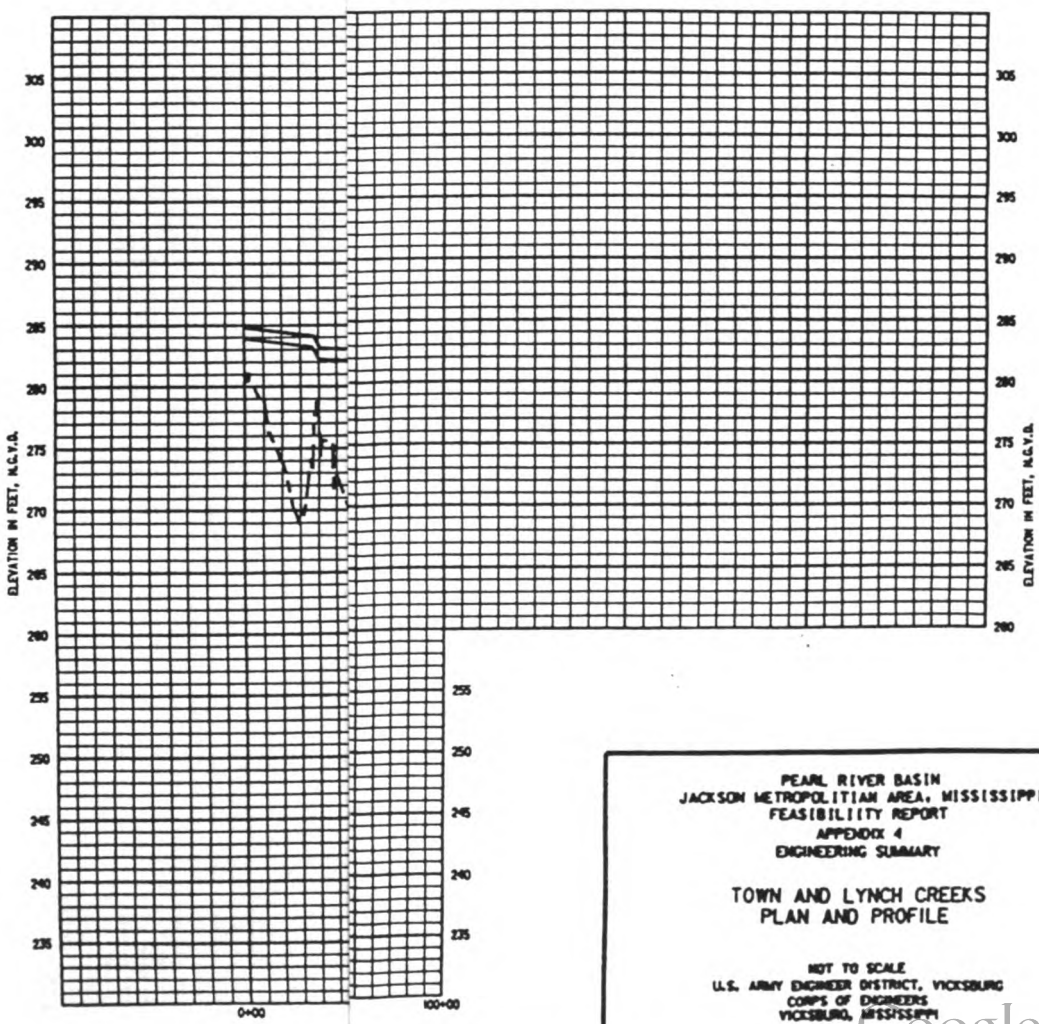
NOT TO SCALE
U.S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

PLATE 4-V-4

CORPS OF ENGINEERS

U. S. ARMY





PEARL RIVER BASIN
JACKSON METROPOLITIAN AREA, MISSISSIPPI
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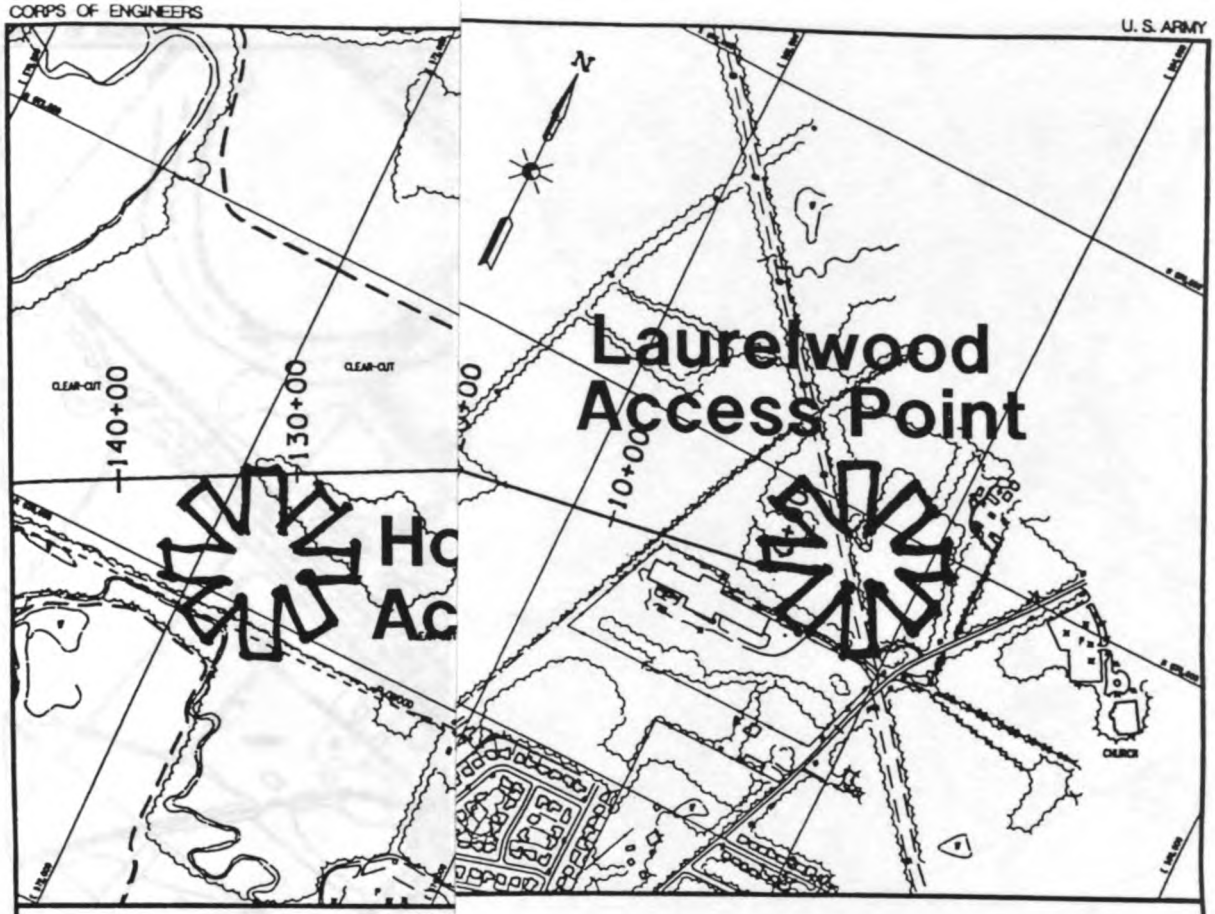
TOWN AND LYNCH CREEKS
PLAN AND PROFILE

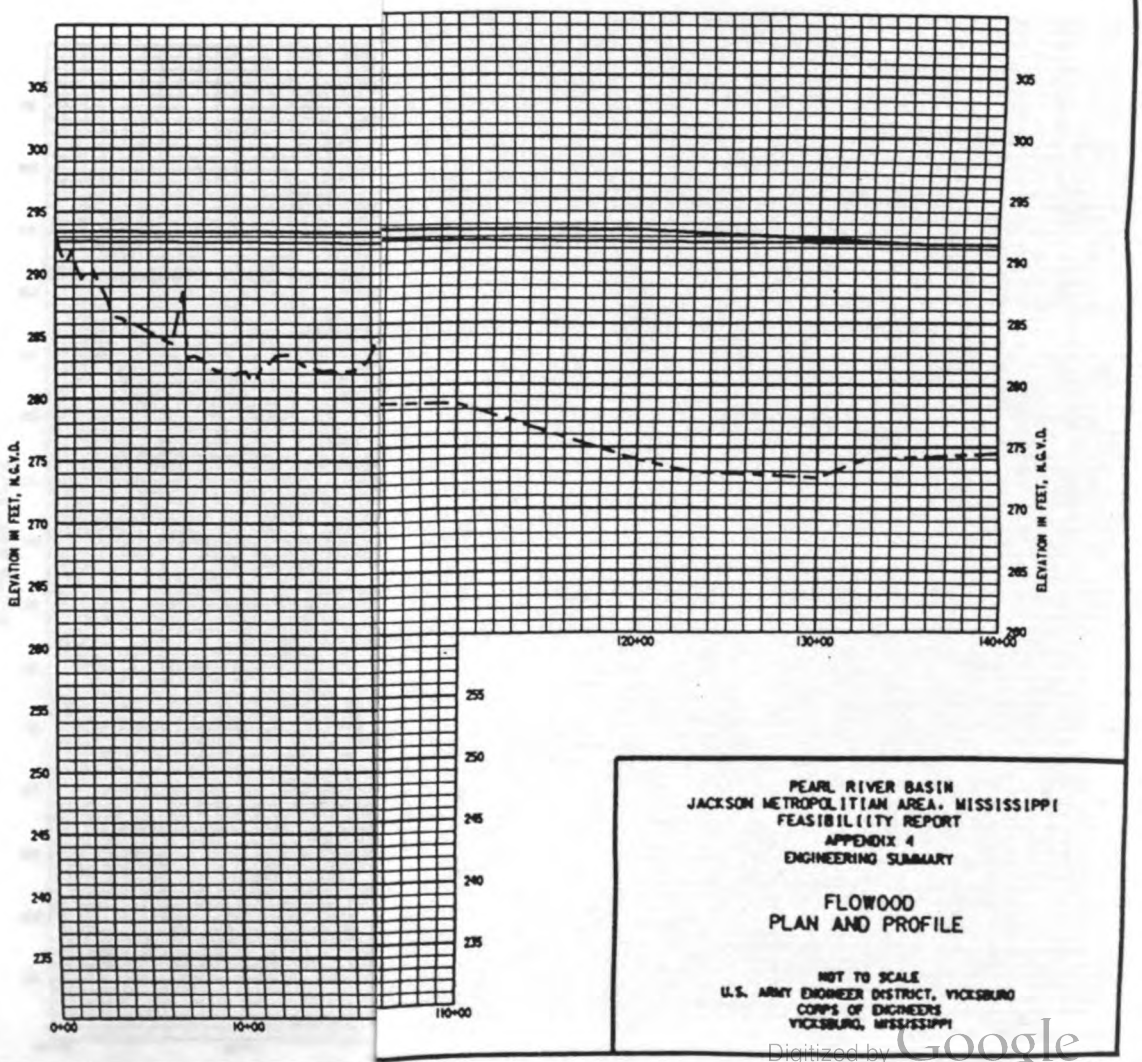
NOT TO SCALE
U.S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

PLATE 4-V-5

CORPS OF ENGINEERS

U. S. ARMY





PEARL RIVER BASIN
JACKSON METROPOLITIAN AREA, MISSISSIPPI
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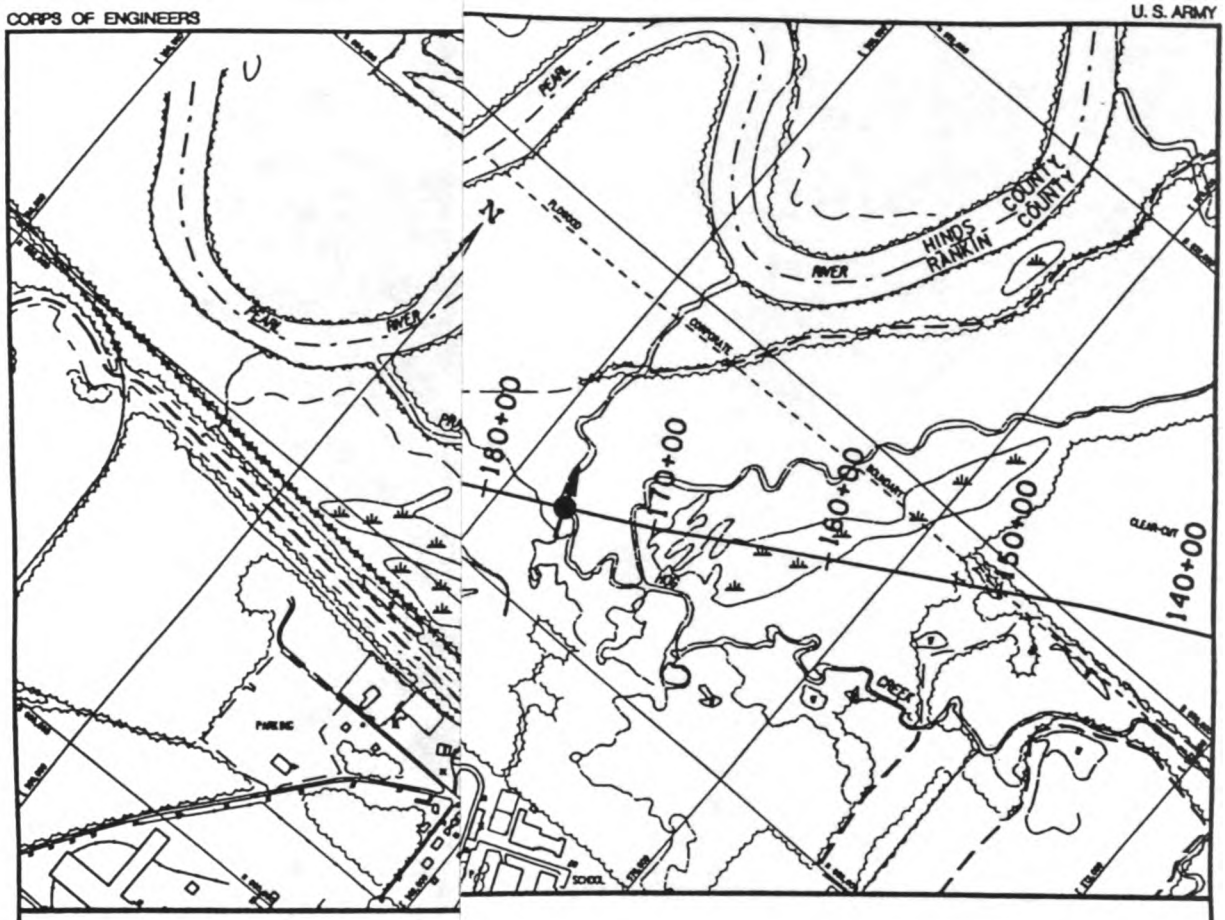
FLOWOOD
PLAN AND PROFILE

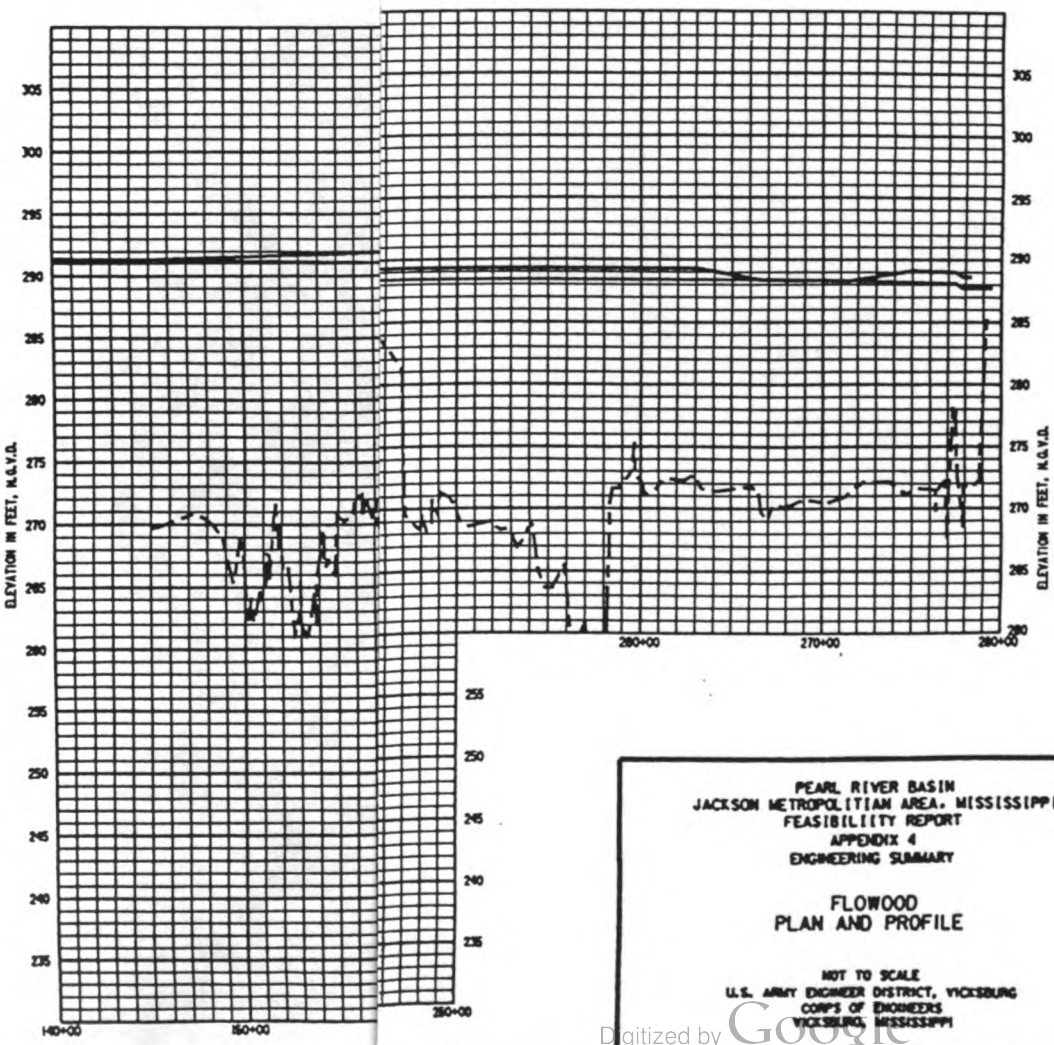
NOT TO SCALE
U.S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

PLATE 4-V-8

CORPS OF ENGINEERS

U. S. ARMY





PEARL RIVER BASIN
JACKSON METROPOLITIAN AREA, MISSISSIPPI
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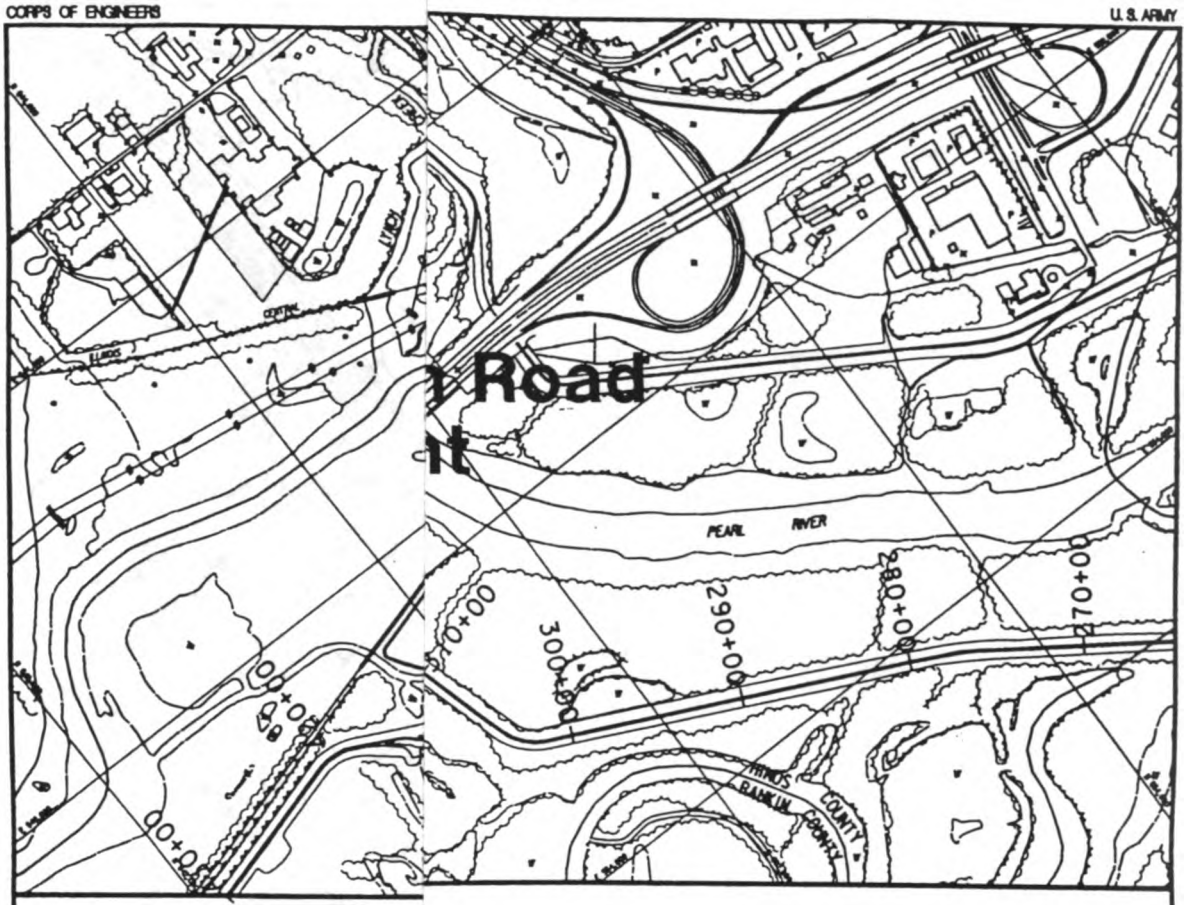
FLOWOOD
PLAN AND PROFILE

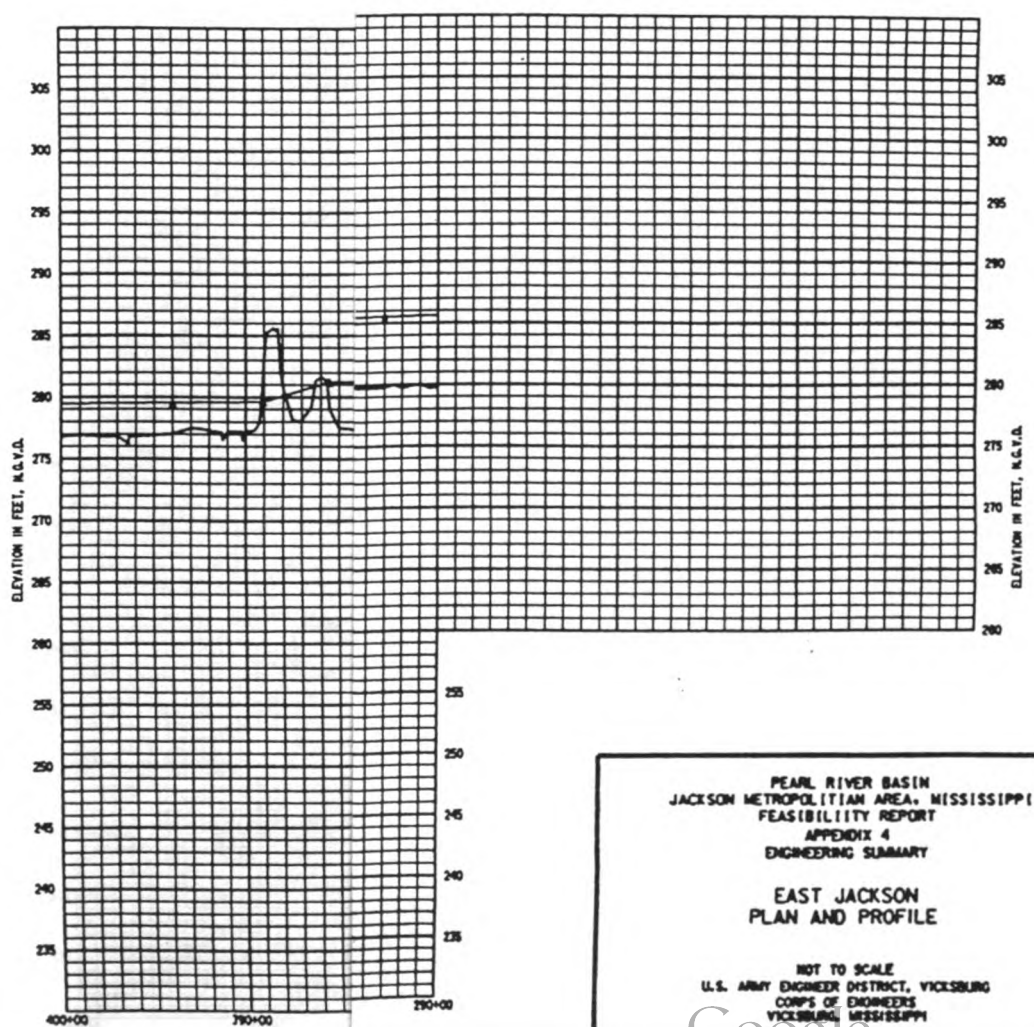
NOT TO SCALE
U.S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

PLATE 4-V-9

CORPS OF ENGINEERS

U.S. ARMY





PEARL RIVER BASIN
JACKSON METROPOLITIAN AREA, MISSISSIPPI
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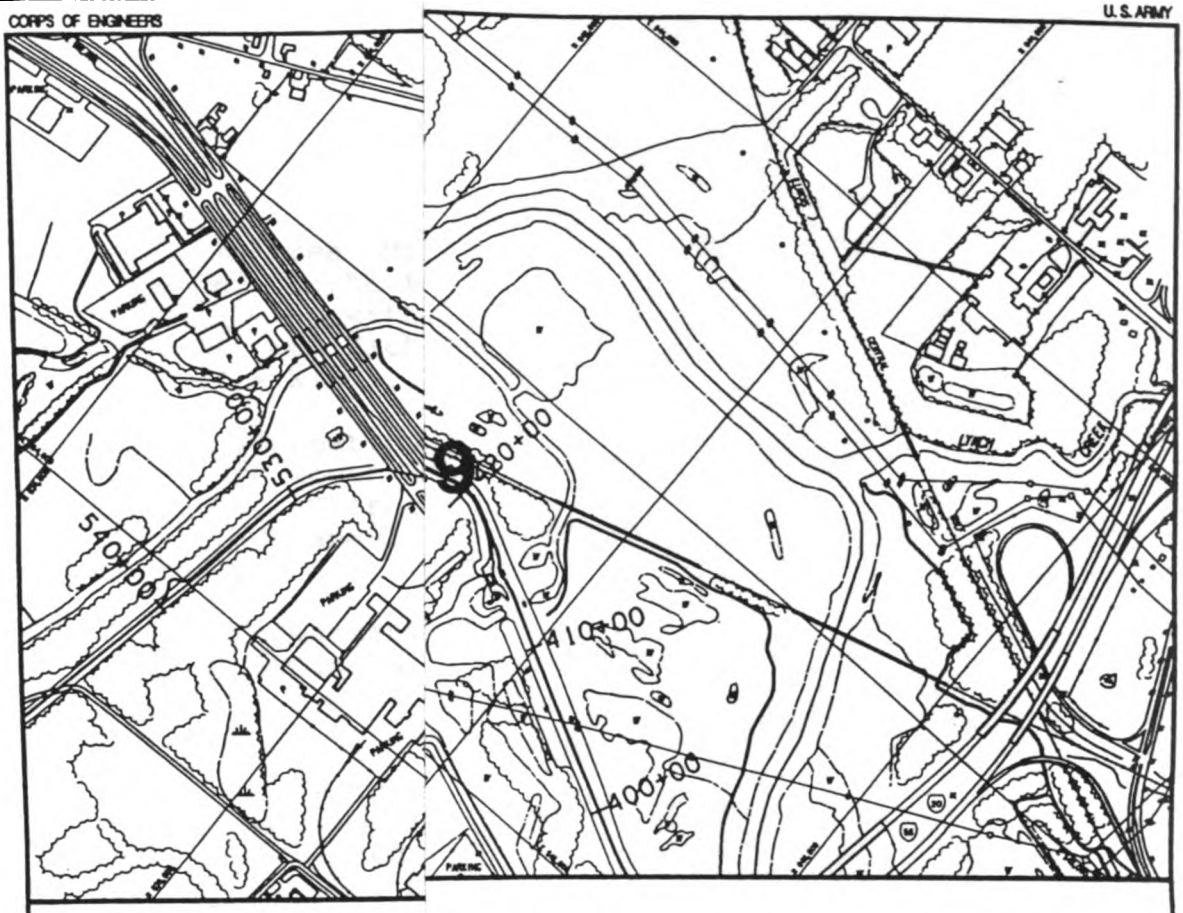
EAST JACKSON
PLAN AND PROFILE

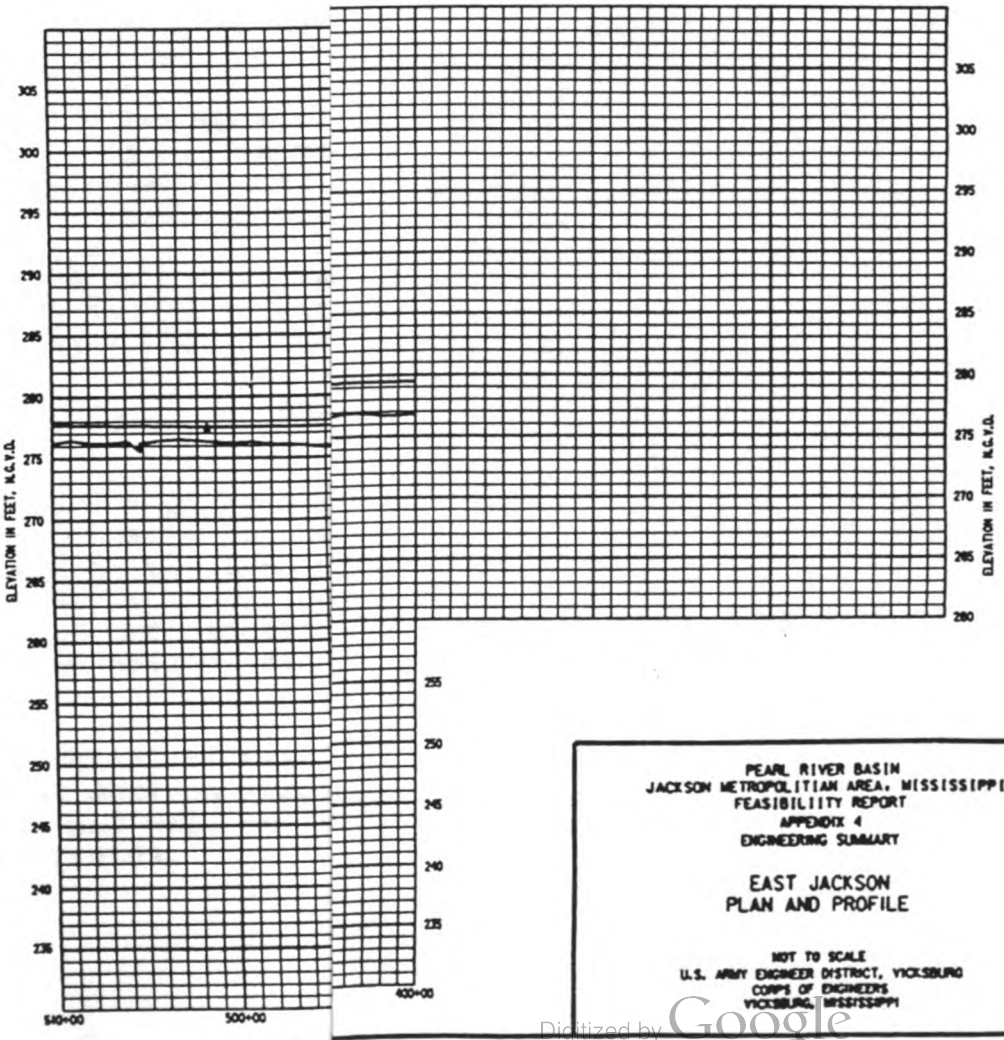
NOT TO SCALE
U.S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

PLATE 4-V-12

CORPS OF ENGINEERS

U.S. ARMY





PEARL RIVER BASIN
JACKSON METROPOLITIAN AREA, MISSISSIPPI
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EAST JACKSON
PLAN AND PROFILE

NOT TO SCALE
U.S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

PLATE 4-V-13

EXECUTIVE SUMMARY

The Jackson Metropolitan Area, Mississippi Feasibility Flood Control Study is located on the Pearl River at Jackson, Mississippi. Municipalities within the study area include Jackson, Flowood, Pearl, and Richland. The study area includes parts of three counties - Hinds, Rankin and Madison.

The area evaluated for recreation development extends from near the Barnett Reservoir dam south to the area of the historic swinging bridge at Byram. This corridor traverses approximately 24 miles. The old river channel is the dividing line between Hinds and Rankin counties.

The primary issue facing recreation development is to provide public access to the river and a trail system while controlling existing defacto recreation uses along private lands adjacent to the river.

The major recreation feature to be cost shared is a continuous trail system which will provide for separate pedestrian and bicycle paths closely associated with the levee development. Access to the trail system will be provided at recreation node sites which will provide for vehicular access and parking. These sites will provide comfort facilities, shelter buildings, exercise facilities, landscaping and other amenities such as benches and picnic tables.

These proposed facilities were determined as the primary priority for recreation from the public participation instruments utilized for this study. Recreation uses must also be compatible with a volatile river prone to frequent flooding.

The upstream section of the recreation corridor from the Barnett Reservoir to LeFleur's Bluff State Park possesses a great number of recreation opportunities. The majority of the land not currently developed either lies within the 100 year flood plain or has been identified as wetlands in which development would be regulated.

Potential sites which will be created by the requirements of the flood control project will include a major site at Lakeland Drive. This parcel is the land north and south of Lakeland Drive between the Pearl River bridge and the relief bridge to the west. The potential for recreation development on this site is excellent because of ease of access, the presence of utilities, and visibility.

A second major potential recreation site is proposed near the ponding area behind Jackson Preparatory School on Hog Creek. This site is large and well suited to more active and intense uses such as play fields.

The middle portion of the recreation corridor contains more intense development on both sides of the river. This section runs from the water treatment plant at the low head dam to the police pistol range at the end of McDowell Road. The east side of the corridor in Flowood is industrial and residential. The west side of this segment in Jackson is residential, commercial, institutional, office buildings and industrial.

The downstream section of the recreation corridor includes Richland on the east side and from the wastewater treatment plant to the Bryam Bridge on the west side. This section is largely undeveloped and is utilized to a large degree for hunting and timber production. The City of Jackson does own approximately 1,100 acres of land at the end of Elton Road. This property could be utilized for passive recreation uses.

In order to determine the actual need for additional recreation facilities within the Pearl River recreation corridor, a demand survey and analysis was utilized to forecast participation at these proposed facilities. This survey examined, through a telephone survey, several market or recreation segments.

First, an overall analysis was made of the total respondents within a 120 mile radius of Jackson. Second, the demand survey was structured to determine recreation demand within a tri-county area which included Hinds, Rankin and Madison counties. A higher ratio of households per capita was examined within this area. Third, the area outside the tri-county area was analyzed to predict the economic benefit of recreation users which would be attracted from outside the immediate vicinity.

The top recreation activities which respondents indicated would be the most important features for the recreation corridor include: walking/nature trail/hiking trails, fishing, park/picnic areas, swimming, athletic/gym/exercise area, boating, children's activities, camping, and access/parking.

The travel cost model for the Pearl River recreation corridor first determined the benefit that would be achieved from recreational enhancements along the Pearl River flood control corridor based upon claimed visitation to the proposed facilities. Total annual benefits derived using the travel cost model for claimed visitation to the Pearl River recreation corridor was $149,441,913, and the average benefit per visit was $11.97.

The benefit derived from actual visitation to existing recreational facilities within the past year by survey respondents was determined under the regional model to be $19,191,478 with an average benefit per visit of $4.58.

The total annual economic benefit and the average benefit per visit was much higher under the claimed visitation model than under the regional (actual) visitation model. In order to

provide a more realistic estimate of total benefit for the Pearl River recreation corridor, a weighting system was used that gave three times more importance to actual visitation of regional recreational facilities than to claimed visitation of recreational facilities constructed along the Pearl River recreation corridor. Using this weighting system, total annual benefit for the Pearl River recreation corridor was estimated at $51,754,085 and average benefit per visit at $8.26.

This projection is based on an annual visitation or activity occasions of 6.27 million to the recreation corridor. The total annual benefit for the recreation corridor with an impoundment was estimated at $80,280,392. With the addition of the water, the activity occasions increase to 8.54 million annually.

The total estimated cost for construction of the base plan, or that portion of the proposed development eligible for cost sharing, is $19,618,481. Non-eligible portions of the base plan total $2,914,476. Additional recreation proposals for the expanded plan portion of the recreation corridor total $13,235,276. The total for development of all recreation features totals $32,853,758.

JACKSON METROPOLITAN AREA, MISSISSIPPI
FLOOD CONTROL STUDY
RECREATION INVESTIGATIONS

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JACKSON METROPOLITAN AREA, MISSISSIPPI
FLOOD CONTROL STUDY
RECREATION INVESTIGATIONS

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I. INTRODUCTION

A. Purpose and Scope

Recreation development, as a part of the Jackson Metropolitan Area, Mississippi Feasibility Flood Control Study, is being investigated in accordance with the guidance of the Corps of Engineers for water resource projects and at the request of the cost sharing partner - the Pearl River Basin Development District (PRBDD). This recreation feasibility analysis includes preliminary recreation development considerations as expressed by the cost sharing partner, the local governments, and the general public through public meetings and responses from telephone surveys.

Further consideration of the project included in this evaluation assesses existing conditions and objectives and describes how project elements may be enhanced, developed, and managed for optimum use and enjoyment in the public interest.

The primary objective of this evaluation is to guide the planning, design, and construction of recreation and related facilities along the Pearl River corridor. The assessment consists of an inventory and analysis of base data and existing conditions along the Pearl River corridor, as well as, the sampling of public recreation desires through public meetings and a scientific sample of the population within the study area.

Recreational needs, and the extent to which natural determinants and social conditions influence or constrain resources development and management, were then assessed and considered in the determination of proposed site development and project facilities.

B. Project Authorization

Studies of the Jackson Metropolitan Area, Mississippi were authorized by congressional resolutions adopted 9 May 1979. Authorization for construction of Shoccoe Dam was contained in Section 401(e) of the Water Resources Development Act of 1986 approved by Congress on November 17, 1986 (Public Law 99-662), Ninety-Ninth Congress, 2nd Session. The purpose of the current feasibility study is to develop an alternative flood control project to the Shoccoe Dam Project.

C. Project Location

Centrally located in the State of Mississippi, the Jackson Metropolitan area is a hub of Interstate, U.S., and State Highways (see Exhibit I). Interstate Highway 20 connects Meridian, Mississippi to the east with Vicksburg, Mississippi to the west. Interstate Highway 55 connects Memphis, Tennessee to

the north with New Orleans, Louisiana to the south. U.S. Highway 80 parallels Interstate 20. U.S. Highway 49 connects Yazoo City, Mississippi to the northwest with Hattiesburg, Mississippi to the southeast. State Highway 25 connects Starkville, Mississippi from the northeast to the Jackson metropolitan area.

The Jackson Metropolitan Area, Mississippi Feasibility Flood Control Study is located on the Pearl River at Jackson, Mississippi (see Exhibit II). The study area comprises the Pearl River Basin between River Mile (RM) 270.0 just south of Byram, Mississippi, and RM 301.77 at the dam of Ross Barnett Reservoir. Municipalities within the study area include Jackson, Flowood, Pearl, and Richland. The study area includes parts of three counties - Hinds, Rankin and Madison. Major tributaries of the Pearl river within the study area include Richland, Caney, Lynch, Town, Purple and Hanging Moss Creeks.

Due to the project's location adjacent to the metropolitan area and near Interstates 20 and 55, and with major city streets crossing the Pearl River (such as Lakeland Drive/Highway 25, Old Brandon Road, Highway 80, and Old Byram Road at Byram), the area near the river can be easily accessed in minutes from any point within the metropolitan area.

D. Major Project Recreation Features

The major recreation feature to be cost shared is a continuous trail system which will provide for separate pedestrian and bicycle paths closely associated with the levee development. Access to the trail system will be provided at recreation node sites which will provide for vehicular access and parking. These sites will provide comfort facilities, shelter buildings, exercise facilities, landscaping and other amenities such as benches and picnic tables.

Pedestrian bridges will provide access across tributary structures where required. Other development outside of project limits, but associated with the project, will be provided by local project sponsors.

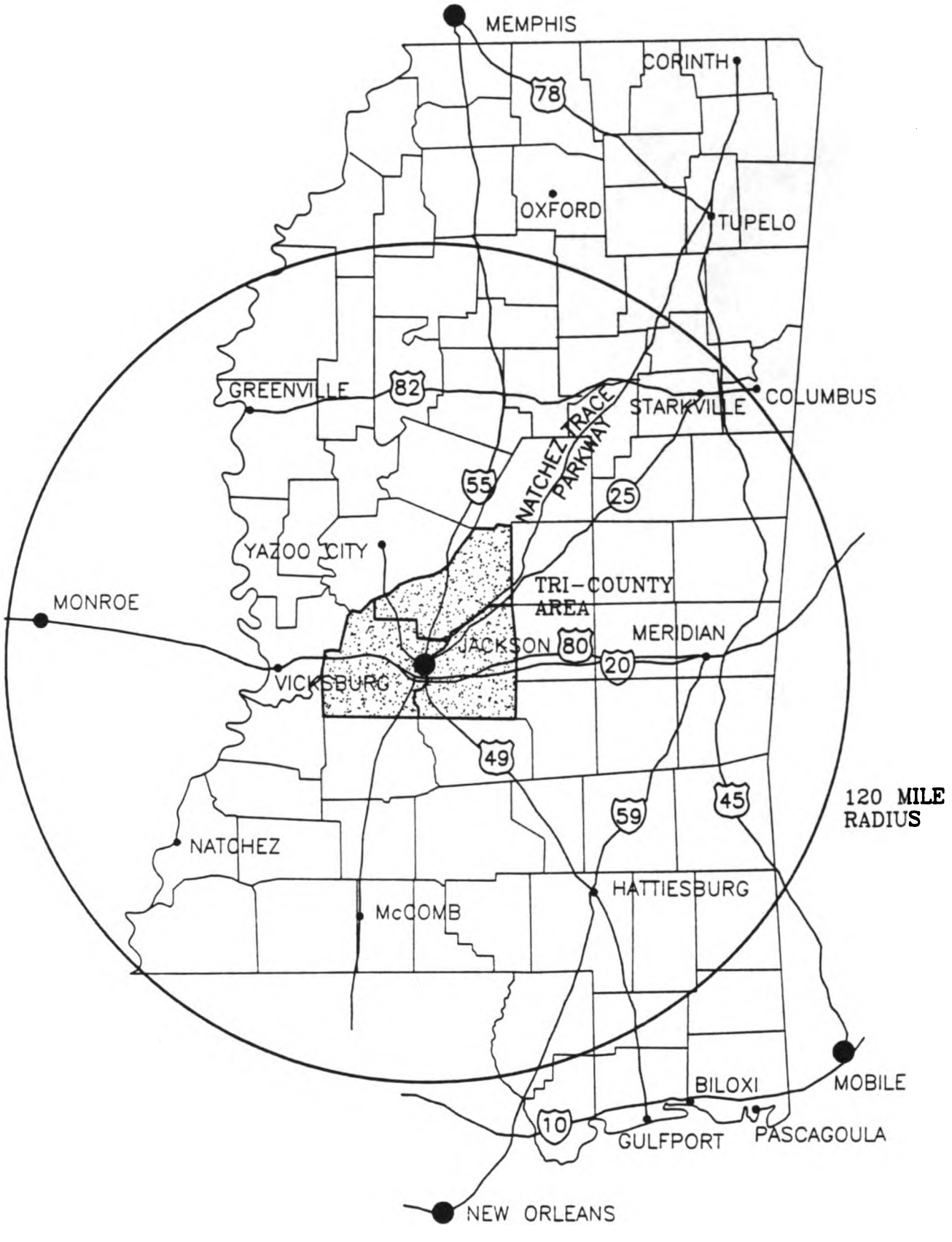


EXHIBIT I

JACKSON METROPOLITAN AREA, MISSISSIPPI
RECREATION FEASIBILITY STUDY

STUDY AREA

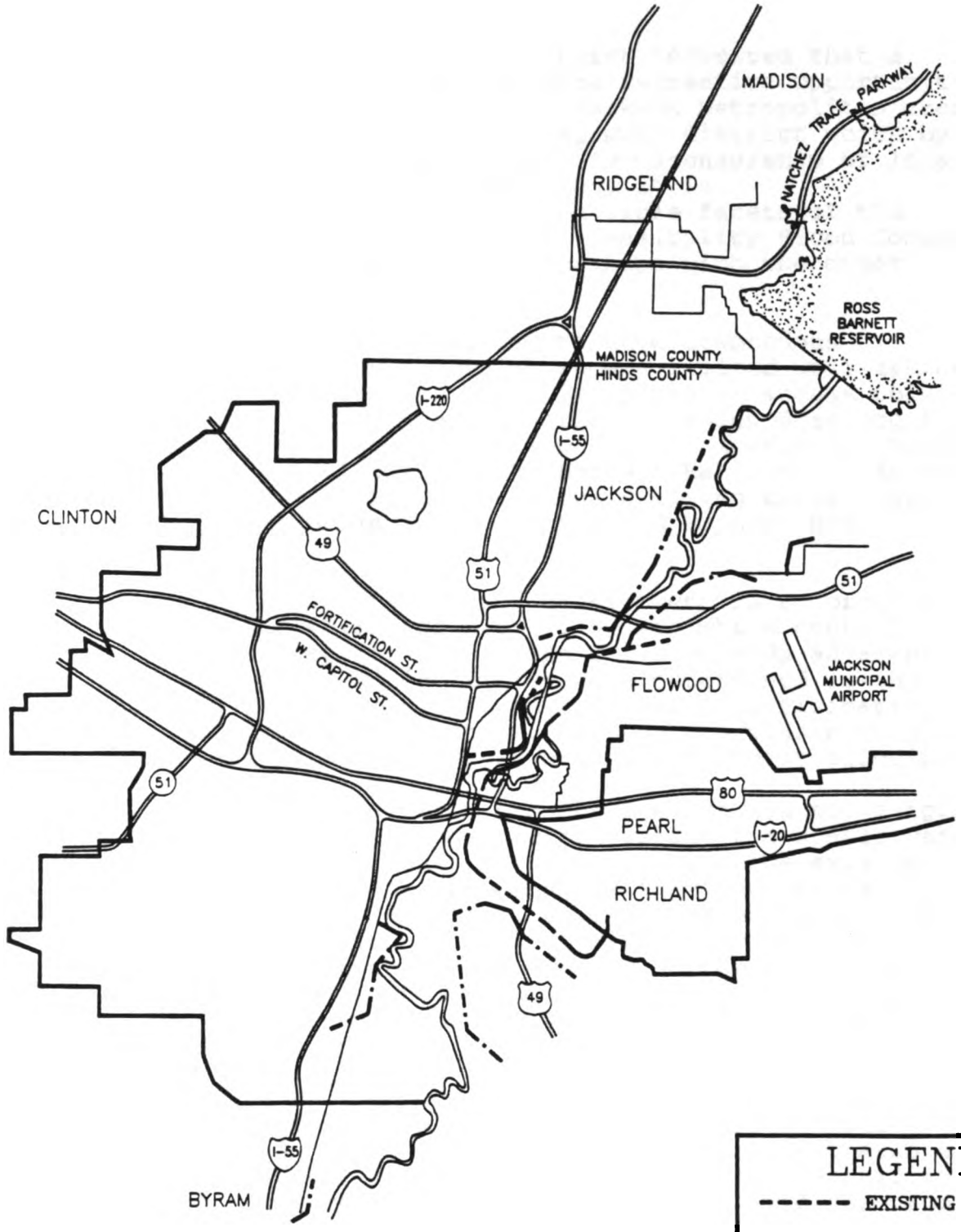


EXHIBIT II

JACKSON METROPOLITAN AREA, MISSISSIPPI RECREATION FEASIBILITY STUDY

VICINITY MAP

II. DESCRIPTION OF THE ISSUE

The Pearl River Basin Development District requested that a recreation plan be developed to maximize recreation opportunities along the Pearl River corridor in the Jackson Metropolitan area. The PRBDD is a multi-county water management district which by Mississippi law has the responsibility for sponsorship of local water development projects. In addition, it is the logical choice to coordinate the multiple facets of the Jackson Metropolitan Area, Mississippi Feasibility Flood Control Study because of their ongoing relationships with the other partners in the project.

This corridor is commonly recognized to have tremendous recreation potential but there is extremely limited utilization for recreation since there are no public parks or access points developed adjacent to the river. Recreation which does occur happens alongside the river on private lands. Access for boating is limited to one boat launch at the Barnett Reservoir. Access below low head dam is limited to persons dragging their boats in and out of the river primarily above the Old Brandon Road bridge.

The primary issue facing recreation development is to provide public access to the river and a trail system while controlling existing defacto recreation uses along private lands adjacent to the river. These proposed facilities were determined as the primary priority for recreation from the public participation instruments utilized for this study. Recreation uses must also be compatible with a volatile river prone to frequent flooding.

Further recreation requests from the PRBDD which are not eligible for federal cost sharing include the provision of a stable water pool created by an impoundment in the area below the existing low head dam which would provide for water related activities adjacent to downtown. In addition, this provision would enhance the views of the river from the only bluff area immediately adjacent to the river which could be obtained for commercial marketplace development. Investigations into the feasibility of a specialty commercial marketplace were also a part of the recreation investigations.

In order to provide an impoundment to create the recreation pool, the required structure must allow for rapid dewatering and unimpeded flow during flood periods. Any solution must also have a design that is soundly engineered and economically justified. After extensive research by members of the consulting team and field investigations of other projects, a rubber fabricated dam was determined to be the most practical and economically justifiable solution to creating a recreation impoundment. Cost, ease of installation, maintenance and durability make this the most practical solution. Our economic analysis of recreation benefits, utilizing the travel cost methodology as detailed in Section 6 of this report, justifies the inclusion of the dam as

part of the expanded overall project. This locally preferred plan contains features such as the dam which are desired by the local sponsors but are beyond the scope of the Corps to cost share.

Difficulties exist in providing a continuous recreation trail on both sides of the flood control project. Existing roads/bridges pose a barrier to a continuous trail system. Where feasible, the trail will go under the various vehicular bridges to maintain a continuous trail system. This will expose the trail to periodic inundation. However, this solution is more desirable from a safety standpoint than providing pedestrian crossings on major thoroughfares.

III. SITE DESCRIPTION AND EVALUATION

A. Existing Conditions

Located between Hinds and Rankin Counties, Mississippi, the section of the Pearl River proposed for recreation development lies at latitude 32 degrees, 20 minutes north. Temperatures range from a January mean of 46.9 degrees F. to a July mean of 80.7 degrees F. Precipitation ranges from an October mean of 2.48 inches to a December mean of 5.46 inches. User days with fair to good conditions average 260 days with rain or snow days averaging 105 days.

The area evaluated for recreation development extends from near the Barnett Reservoir dam south to the area of the historic swinging bridge at Byram. This corridor traverses approximately 24 miles. The width of the corridor, determined by the location of the existing and proposed levees, varies greatly. On the northern and southern extremes, the width expands to as wide as 2 miles and is loosely defined. Adjacent the more congested areas, the width narrows to approximately 1,250 feet with an average width of approximately 2,000 feet. Within this corridor, the river passes through four municipalities; Jackson, Flowood, Pearl and Richland. The old river channel is the dividing line between Hinds and Rankin counties.

The study area consists primarily of low lying, generally level terrain with some minor changes in elevation occurring mostly along the western bank of the river. Other man-made features, such as the existing levee system, transportation corridors, residential, commercial and industrial areas dominate the landscape adjacent to the river.

Soils are generally silt loams and sandy alluvial associations provided from flood situations. The soils of the study area support a bottomland and upland hardwood forest which includes black gum, cypress, maple, sweetgum, sycamore and oaks. Some pine species are found in the higher, well-drained soils. Only relatively small areas of forest land remain undisturbed due to timber production, previous construction of the existing levees, or channel flow improvement projects.

The corridor lies to the east of and generally parallel to Interstate 55. It is also crossed by Interstate 20 and can be viewed from the interstates at various locations. The project can also be viewed from local streets and highways traversing the corridor at Lakeland Drive/Highway 25, Old Brandon Road, Highway 80, and Old Byram Road at Byram. In addition, the corridor can be crossed on the northern end at the Barnett Reservoir Dam. There are three railroad crossings. All views are as diverse as the adjacent land uses described herein.

Future improvements to vehicular circulation are proposed to connect three east-west corridors into a single bridge which will connect to Flowood Drive and Airport Road. These corridors leading from downtown Jackson presently end abruptly at the existing levee. Another connection from Highway 49 is also proposed northward from Highway 80 to connect more directly to Flowood Drive. These road improvements will intersect with the east-west corridor and provide an alternate route from downtown Jackson to Highway 49 South.

In addition, plans are currently being prepared to add two more lanes to the Lakeland Drive bridge.

As currently proposed by the Mississippi State Department of Transportation, neither of the new river crossings will contain pedestrian access. Pedestrian access from one side of the river to the other is not currently available at any point. These two projects could help solve that problem if pedestrian crossings are provided.

Existing recreation activities along the river are limited. Navigation is limited because of frequent low water conditions and resulting debris blockages, the shifting channel of the river which exposes stumps previously located at the shore line, and the presence of the low-head dam at the Jackson water treatment plant. The area above the low-head dam may be accessed by a boat ramp below the Barnett Reservoir Dam. The area below the low-head dam does not have a boat ramp for access. This area below the low-head dam also suffers more pronounced effects of low water, particularly in the channelized section. The area downstream from Interstate 20 also contains numerous stumps and debris.

Water related activities and boating are available within the corridor at LeFleur's Bluff State Park and at the East Jackson ponding area. These facilities provide boating access to water impoundments adjacent to the river corridor but do not provide access to the river itself.

Hunting is a major activity within the more remote areas on the Rankin County side of the river north of Lakeland Drive and south of Interstate 20. Several hunting clubs exist within this area and could impact decisions on locating recreation activities. Portions of the Hinds County side of the corridor, primarily south of Elton Road, are also utilized for hunting.

Typical of activities which may be enhanced by the recreation corridor improvement, the existing levee structure adjacent to the Jackson Downtown YMCA is heavily utilized for walking and jogging.

B. Recreation Segments

The framework for this recreation plan is a system of recreational trails that may be utilized for either walking, jogging, running, or bicycling. The main trail section will be eight feet wide, centered on the ten foot wide levee top, and will accommodate pedestrian walking, jogging and running. A separate trail will be provided at the base of the levee system for use for bicycling and other activities. Motorized vehicles will be prohibited from using the trail systems, with the exception of maintenance vehicles.

This trail system is defined by the different levee reaches, or segments, with which it is associated. The levee reaches with which recreation development is associated are delineated as follows:

Reach #1: Northeast Jackson levee - in Hinds County from the high ground south of Jackson Country Club to Eubanks Creek at LeFleur's Bluff State Park. This reach is approximately 5.8 miles in length.

Reach #2: Flowood levee - in Rankin County, from the northern end of the levee to the point at which it joins the existing East Jackson levee. This reach is approximately 3.6 miles in length.

Reach #3: Existing Fairgrounds levee on the west side of the river. This reach is approximately 0.9 miles in length.

Reach #4: Existing East Jackson levee in Rankin County from the southern end of Reach #2 south to US Highway 49. This reach is approximately 6.6 miles in length.

Reach #5: South Jackson levee from Old Brandon Road to just south of Lynch Creek in Hinds County. This reach is approximately 7.1 miles in length.

Reach #6: South Jackson levee from just south of the end of Reach #5 to the high ground just south of Caney Creek in Hinds County. This reach is approximately 1.3 miles in length.

Reach #7: Byram levee on the west side of the river in Hinds County. This reach is approximately 1.1 miles in length.

Recreation facilities are not proposed on two additional levee segments at Laurelwood and Richland levee. The Laurelwood levee is small and positioned such that residents of the area may easily access the trail system from the proposed park on Lakeland Drive. The residents and community leaders of the City of

Richland expressed their desire not to have a trail or recreation facilities directly associated with the new levee in their city. However, residents of Richland may easily access the trail system at the proposed Richland Creek Park or Old Highway 49 park.

In areas where the levees are not continuous, connector trails will be provided to link the levee reaches. Additionally, handicapped accessible pedestrian bridges are proposed at four locations to allow users to cross the river. These elements will create a continuous trail system connecting several major areas of Metropolitan Jackson. Linkage trails are also proposed to connect existing parks, schools, and residential and commercial areas to the system. Where possible, these trails will be located on lands necessary for the ponding areas of the flood control project. Where this is not possible, additional lands must be acquired by purchase, grant, or recreation easement. Where this occurs, the purchase of these lands will be a local cost.

IV. SITE ANALYSIS, RESTRICTIONS AND OPPORTUNITIES

A. Upper Recreation Corridor

The upstream section of the recreation corridor (see Exhibit III) from the Barnett Reservoir to LeFleur's Bluff State Park possesses a great number of recreation opportunities. The majority of the land not currently developed either lies within the 100 year flood plain or has been identified as wetlands in which development would be regulated.

The Pearl River Valley Water Supply District owns a large parcel of land below the dam which could be utilized for passive recreation uses. A boat ramp and comfort station are presently located on this property.

A 16th section of land primarily on the Rankin County side of the river at the end of Westbrook Road. This land is currently being leased for a hunting area. The Hinds County portion of the 16th section contains mature and varied vegetation which is generally typical bottomland hardwoods and is suitable for passive recreation/educational use.

The City of Jackson owns multiple parcels in the area north of Lakeland Drive. The northern most parcel exists just north of the 16th section of land described above. A second parcel is the old sewage disposal lagoon and the third parcel lies on the west bank of the river just north of Lakeland Drive.

In addition, the largest existing recreation development in the corridor is LeFleur's Bluff State Park. This park is built around the Mayes lake property and Riverside Park on land formerly owned by the City of Jackson and deeded to the State to develop the park. There are a variety of day use activities, a nature trail, tennis, and golf as well as camping, fishing, and boating on Mayes Lake.

In addition, other private recreation facilities exist in the upstream section of the corridor such as riding stables, North East Jackson Soccer Organization, Jackson Country Club and River Hills Tennis Club.

The west side of the river corridor is located adjacent to large residential areas. Use of the land for informal recreation is evident by the large number of trails in use throughout the area. Existing electric and sewer easements in this area are used extensively as trails.

Access to a proposed river corridor trail system can be greatly enhanced by the development of trails along Purple Creek, Hanging Moss Creek, and White Oak Creek. Hanging Moss Creek leads to Parham Bridges Park which currently is utilized heavily by

joggers and walkers. In addition, these creeks connect to the ponding areas which can be utilized as access points for recreation.

The eastern portion of this section of the river corridor is largely undeveloped and contains large tracts of private timber land. The remaining portion along Lakeland Drive is developing as a commercial and office center. Access will also be a problem due to the distance of the river from existing transportation corridors.

Transportation facilities on the upstream portion provide access to the corridor at the Barnett Reservoir dam, Westbrook Road, Lakeland Drive and the roads of Lefleur's Bluff State Park. Other streets which are juxtaposed to the corridor are primarily residential in nature and unsuitable for use to access potentially busy recreation sites.

Potential sites which will be created by the requirements of the flood control project will include a major site at Lakeland Drive. This parcel is the land north and south of Lakeland Drive between the Pearl River bridge and the relief bridge to the west. The occupants of this parcel will have to be relocated as a part of the project requirements. The potential for recreation development on this site is excellent because of ease of access, the presence of utilities, and visibility.

A second major potential recreation site is proposed near the ponding area behind Jackson Preparatory School on Hog Creek. This site is large and well suited to more active and intense uses such as play fields.

B. Middle Recreation Corridor

The middle portion of the recreation corridor (see Exhibit IV) contains more intense development on both sides of the river. This section runs from the water treatment plant at the low head dam to the police pistol range at the end of McDowell Road. The east side of the corridor in Flowood is industrial and residential. The east side also extends into the City of Richland and is similar to the area of Flowood. The west side of this segment in Jackson is residential, commercial, institutional, office buildings and industrial.

A major parcel of public land in this section is the Crystal Lake ponding area. The City of Flowood is currently developing a park on property which they own on the ponding area. The City of Jackson also owns significant amounts of property contiguous to the western portion of the lake.

The City of Jackson owns land and facilities at the water treatment plant. Following completion of the new treatment plant at the Barnett Reservoir, this land could possibly be utilized

for other purposes such as river access. The city also owns land on Jefferson Street where it maintains the City Barn. Plans to relocate the this facility are in place. The city has developed a pistol range adjacent to a former city dump at the east end of McDowell Road. This facility has received a lot of use and the city is currently considering expanding the facility. The State also operates the State Fairgrounds adjacent to I-55 at High Street.

Other private recreation facilities in this section include the YMCA, and Stockett stables. Members of the YMCA currently utilize the levee segment adjacent to that facility for jogging and walking. This levee segment augments the YMCA's outdoor track and other facilities.

Of larger importance to this section of the corridor is its proximity to downtown Jackson. A trail along Town Creek could provide noontime joggers and walkers form offices in downtown Jackson easy access to the trails and other facilities on the corridor.

The river below the low head dam at the Jackson water treatment plant is not very navigable and could be enhanced by the addition of an impoundment in the area of Highway 80/I-20.

The railroad bridge immediately below the water treatment plant could possibly be utilized for pedestrian access across the river if the rails are ever abandoned or an agreement could be reached with the owners.

Transportation facilities which access the river in the middle section of the study area are somewhat limited. Interstates 20 and 55 provide no access to the river. Highway 80 has the potential for access. The bridge at Old Brandon Road is being utilized for river access but users have to drive down the road embankment and drag their boats in and out of the water. The river does come in close proximity to the east end of McDowell Road where a boat ramp could be provided.

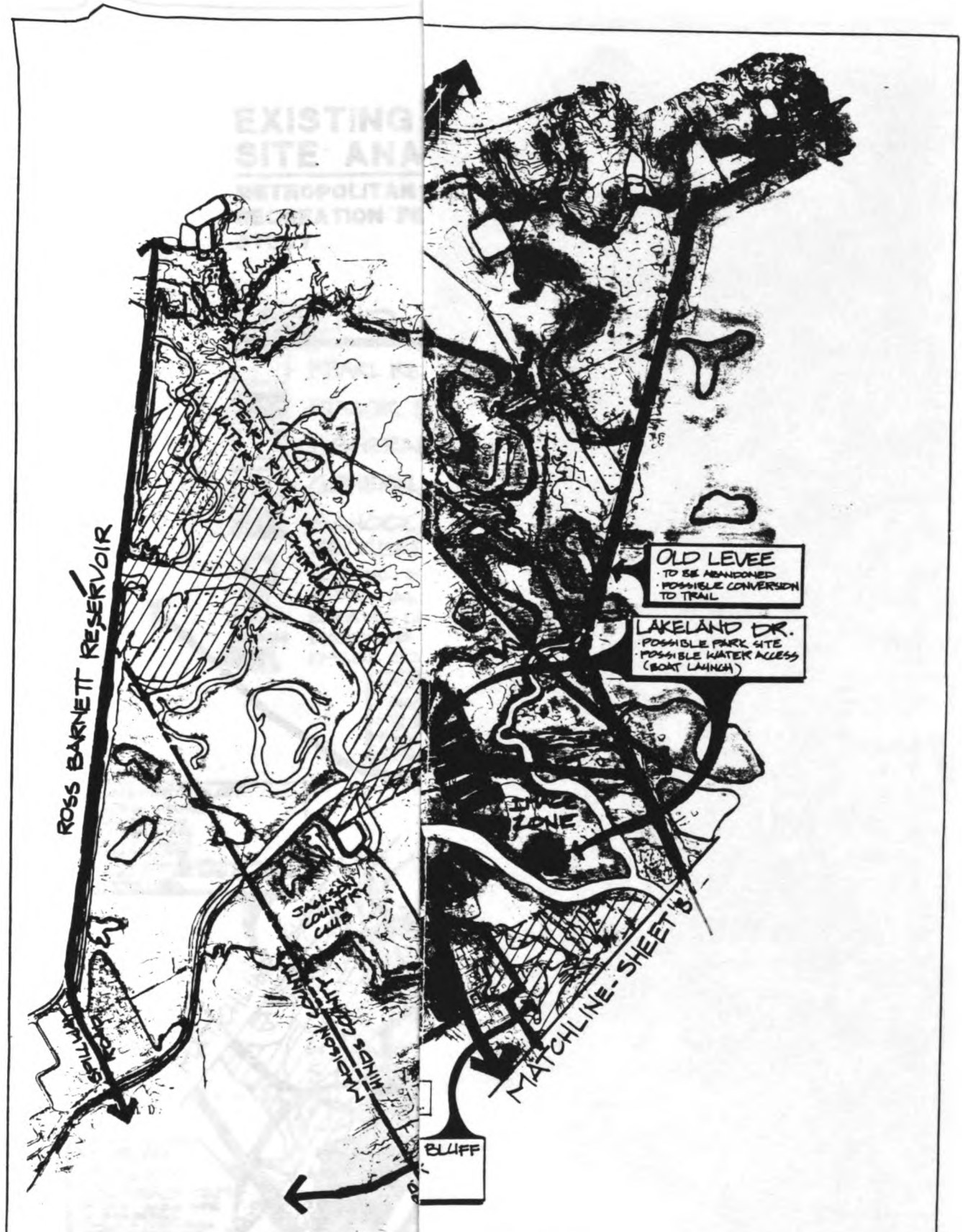
C. Lower Recreation Corridor

The downstream section of the recreation corridor (see Exhibit V) includes Richland on the east side and from the wastewater treatment plant to the Bryam Bridge on the west side. This section is largely undeveloped and is utilized to a large degree for hunting and timber production.

The City of Jackson does own approximately 1,100 acres of land at the end of Elton Road. This property could be utilized for passive recreation uses. Compatibility with the wastewater treatment plant to the north will also have to be examined.

The Swinging Bridge at Bryam is listed on the National Register of Historic Places. Hinds and Rankin Counties own this facility which is no longer open for vehicular use and could be utilized as a recreation facility. In addition, Hinds County owns and operates Parham Bridges Park north of Elton Road and west of Interstate 55.

Transportation access to this area is limited to the eastern end of Elton Road and the Old Byram Road bridge.



EXISTING CONDITIONS SITE ANALYSIS

METROPOLITAN JACKSON RECREATION FEASIBILITY STUDY

EXHIBIT III

EXISTING SITE ANA

METROPOLITAN RECREATION FE STUDY

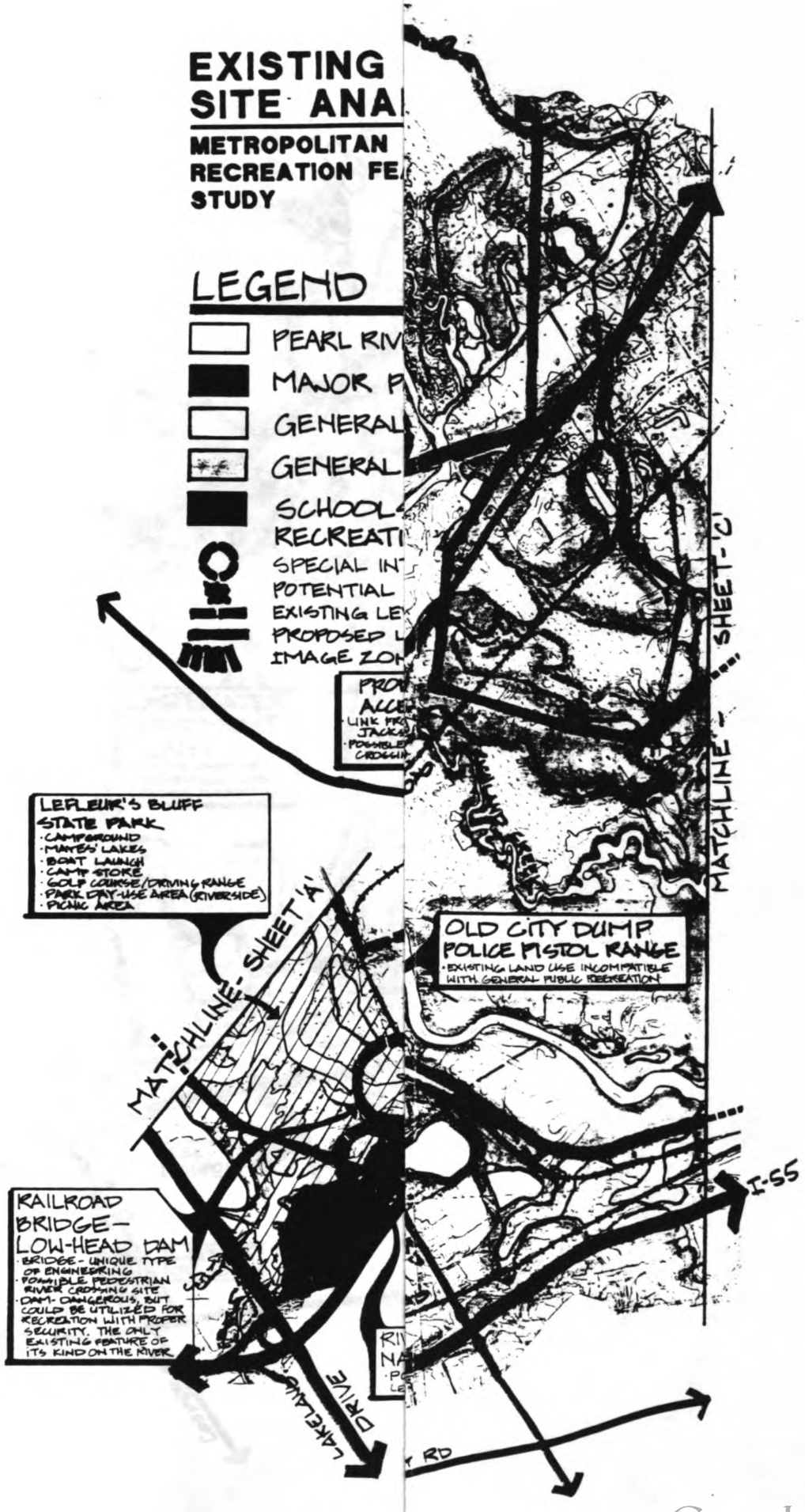
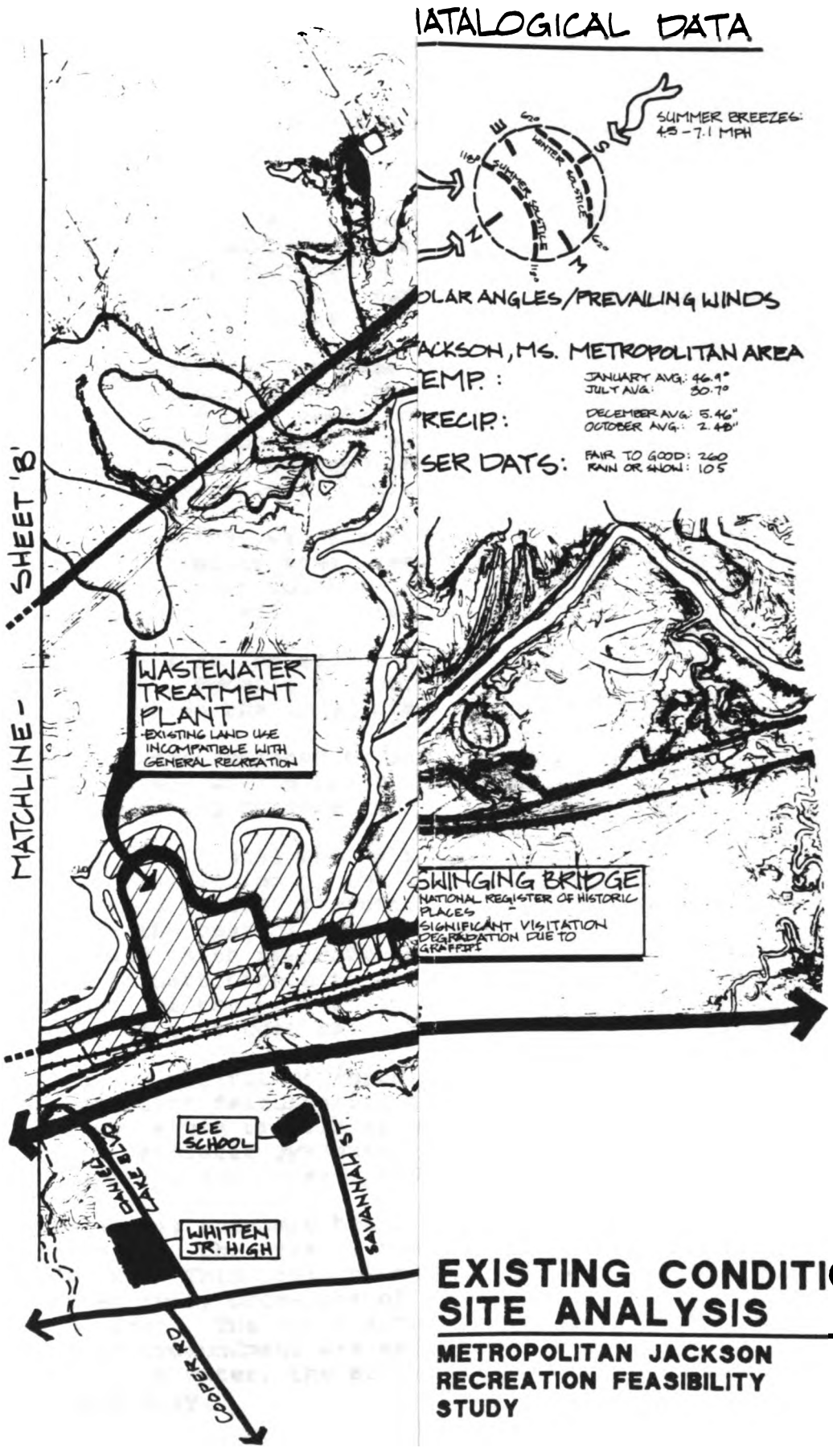


EXHIBIT IV



EXISTING CONDITIONS SITE ANALYSIS

METROPOLITAN JACKSON RECREATION FEASIBILITY STUDY

EXHIBIT V

. RECREATION DEMAND, SUPPLY AND NEEDS

. Introduction

n order to determine the actual need for additional recreation acilities within the Pearl River recreation corridor, a demand urvey and analysis was utilized to forecast participation at hese proposed facilities. This survey examined, through a elephone survey, several market or recreation segments.

irst, an overall analysis was made of the total respondents ithin a 120 mile radius of Jackson (see Appendix B). This istance is based upon past experience utilizing this methodology or determining recreation demand and a reasonable driving istance from the Jackson Metropolitan area. This study area ncluded parts of Mississippi, Louisiana, Alabama and Arkansas.

econd, the demand survey was structured to determine recreation emand within a tri-county area (see Appendix C). These included inds, Rankin and Madison counties. A higher ratio of households er capita was examined within this area.

hird, the area outside the tri-county area was analyzed to redict the economic benefit of recreation users which would be ttracted from outside the immediate vicinity (see Appendix D).

he participants were screened to assure that a representative ix of the population within the study area was being surveyed. his included screening by race, sex, education, etc.

he purpose behind the analysis is to determine the economic enefit of the construction of the recreation facilities to ccompany the flood control project. This benefit is then xamined against the cost of constructing the facilities of ighest demand and which respondents indicated that they would be illing to pay to participate to determine the benefit to cost atio. In order for the project to be eligible for federal cost haring, the benefit to cost ratio must be higher than one/one.

he top recreation activities which respondents indicated would e the most important features for the recreation corridor nclude: walking/nature trail/hiking trails, fishing, park/picnic reas, swimming, athletic/gym/exercise area, boating, children's ctivities, camping, and access/parking.

he projected annual economic benefit of the proposed recreation orridor, based upon the "travel-cost" methodology is estimated o be $51,754,085. This projection is based on an annual isitation or activity occasions of 6.27 million to the ecreation corridor. The total annual benefit for the recreation orridor with an impoundment was estimated at $80,280,392. With he addition of the water, the activity occasions increase to .54 million annually.

B. Research Approach and Methodology

The following analysis report presents the results of a scientific survey conducted by Marketing Research Institute for the Pearl River Basin Development District and the U. S. Army Corp of Engineers. Working in conjunction with Weatherford McDade, Marketing Research Institute surveyed 800 households within a 120 mile radius of Jackson, Mississippi. The objective of the survey was to determine the economic benefits that would result from improving recreational facilities along a designated corridor of the Pearl River in the Jackson Metropolitan Area. Survey researchers measured current recreational behavior and analysts then projected future visitation and economic benefit to the area under study using the travel cost methodology.

The 800 households surveyed were divided into two subgroups. The first subgroup consisted of 400 households within the Tri-county area of Hinds, Rankin, and Madison. The second subgroup consisted of 400 households outside the Tri-county area but within a 120 mile radius of Jackson. Analysis throughout this report will refer to the entire 800 sample as well as to the smaller 400 samples. The survey was conducted by telephone from the offices of Marketing Research Institute between the dates of January 21-25, 1992. MRI's field research facility includes 75 WATS lines, and the company employs over 100 professionally trained survey interviewers. For this particular survey, interviewers screened for the head of the household. Completed interviews were checked for compliance with sample specifications, and MRI computerized all research results.

Survey results for a sample of 800 households provide a sampling error factor of plus or minus 3.5% at the .95 level of confidence. Survey results for the smaller 400 samples provide a sampling error factor of plus or minus 5.0%. Results for various geographical areas and cross-tabulation tables contained within this report will vary in statistical error factor depending upon the number of respondents in each cell. Cells containing fewer than eighty respondents should be generally considered unreliable.

The questionnaire used in this survey was developed by MRI analysts and approved by both the Pearl River Basin Development District and the U. S. Army Corp of Engineers. Marketing Research Institute follows established and accepted procedures for sample selection, survey design, and analysis. All scientific survey research, however, is subject to a margin of error.

C. Analysis & Research Objectives

Analysts for Marketing Research Institute examined all survey results and prepared the following report. The analytical report is based upon actual interviews of 800 households as conducted from the field research facilities of Marketing Research Institute. The survey had the following major research objectives.

1. Determine current recreational visitation patterns in the market area under study.

2. Determine the most popular recreational activities in the market area under study.

3. Project a recreational demand curve for the market area under study using the travel/cost methodology.

4. Project the potential number of visits to proposed recreation facilities along the Pearl River Corridor in the Jackson Metropolitan Area.

5. Project the economic benefit that would result from enhanced recreational facilities along the Pearl River Corridor in the Jackson Metropolitan Area.

This report was prepared using five different software packages: Statpac Gold for statistical analysis, The Claritas Compass Demographic Retrieval System for population figures, Quatro Pro for spreadsheet analysis, Harvard Graphics for drawing demand curves, and Word Perfect 5.1.

D. Demographics

Demographic characteristics are important in survey research for two principal reasons. First, demographics enable survey researchers to confirm the accuracy and validity of the sampling process. Second, demographics provide a valuable means for describing opinion and behavior for specific population groups. Demographic items examined in the Pearl River Basin Development District Survey included state, county or (parish), and zip code of residence address, head of household occupation, respondent age, age of other persons in household, respondent educational attainment, annual household income, sex, and race.

Question 1 asked respondents: "In what state do you live?"

Respondent State			
	Total Sample	Tri-County Area	Outside Tri-County
Mississippi	86.3%	100.0%	72.5%
Louisiana	11.1	-	22.3
Arkansas	1.6	-	3.3
Alabama	1.0	-	2.0

Questions 2 and 3 identified respondent county, or parish, and zip code for residence address. A complete listing of counties, parishes, and zip codes is included in the Data section of this report.

Question 66 asked: "What is the occupation for the head of the household? (If retired or disabled, ask...) What did he or she do before that?" Responses were re-coded into traditional census categories.

Head of Household Occupation			
	Total Sample	Tri-County Area	Outside Tri-County
Professional/Administrative	6.8%	9.3%	4.3%
Sales/Clerical/Technical	45.4	55.0	35.8
Laborer	42.3	32.0	52.5
Agriculture	2.8	0.5	5.0
Unemployed	0.8	0.8	0.8
Other	1.1	1.5	0.8

Question 67 asked: "What is your age?"

Respondent Age			
	Total Sample	Tri-County Area	Outside Tri-County
18-24 Years	10.6%	10.5%	10.8%
25-34 Years	24.5	24.0	25.0
35-44 Years	22.4	24.0	20.8
45-64 Years	26.6	27.8	25.5
65 & Over	15.1	12.8	17.5
Mean	44	43	45
Median	40	40	40
Mode	35	35	32

Question 68 asked: "How many persons in your household, including yourself, are eighteen years or older?"

Persons In Household Eighteen Years Or Older			
	Total Sample	Tri-County Area	Outside Tri-County
One	27.7%	25.4%	30.0%
Two	52.8	50.9	54.7
Three	14.9	17.9	11.8
Four or More	4.7	5.9	3.6
Mean	2	2	2
Median	2	2	2
Mode	2	2	2

Question 69 asked: "How many persons in your household are below the age of eighteen?"

Persons In Household Below Age Eighteen			
	Total Sample	Tri-County Area	Outside Tri-County
Zero	50.0%	49.1%	50.9%
One	18.9	21.4	16.4
Two	20.0	19.1	20.9
Three or More	11.0	10.3	12.0
Mean	1	1	1
Median	0.5	1	0
Mode	0	0	0

Question 70 asked: "What is the highest level of education you have attained to date?"

Educational Attainment			
	Total Sample	Tri-County Area	Outside Tri-County
Less Than High School	16.8%	10.8%	22.8%
High School Graduate	26.0	21.3	30.8
Some College	25.5	25.8	25.3
College Graduate	23.3	31.5	15.0
Post Graduate Degree	6.8	8.8	4.8

Question 71 asked: "What is the approximate annual income for your household?"

Annual Household Income			
	Total Sample	Tri-County Area	Outside Tri-County
Under $10,000	10.8%	8.5%	13.0%
$10,000-$19,999	14.4	9.3	19.5
$20,000-29,999	14.1	13.2	15.0
$30,000-39,999	11.3	9.5	13.0
$40,000-49,999	7.0	7.3	6.8
$50,000-74,999	14.5	17.3	11.8
$75,000 And Over	5.1	8.0	2.3
No Reply	22.9	27.0	18.8
Mean	33,109	38,918	27,889
Median	28,000	35,000	25,000
Mode	50,000	50,000	30,000

Question 72 asked: "And, your sex is male or female?"

Respondent Gender			
	Total Sample	Tri-County Area	Outside Tri-County
Male	37.5%	37.8%	37.3%
Female	62.5	62.3	62.8

Question 73 asked: "And, your race is black, white, or other?"

Respondent Race			
	Total Sample	Tri-County Area	Outside Tri-County
White	63.0%	63.3%	62.8%
Black	36.6	36.5	36.8
Other	0.3	0.3	0.3

For the entire 800 sample, slightly over 86% of households surveyed were in Mississippi, while 11% were in Louisiana, 1.6% were in Arkansas, and 1% were in Alabama. Approximately 52% of households surveyed were white collar, while 42% were blue collar, and 3% were agricultural households. Mean respondent age was 44 years, and median age was 40 years. The typical household included two persons 18 years of age or older. Half of all households included children below the age of 18. Approximately 30% of respondents surveyed had graduated from college, while just over 81% had graduated from high school. Mean household income was $33,109, and median income was $28,000.

The male to female ratio was somewhat skewed for two reasons. First, survey researchers did not ask for male respondents specifically but simply screened for the head of the household. Second, there is an increasing number of single females with and without children who are heads of household. The Claritas Compass Demographic System indicates that the actual male and female population over the age of 18 is within about 7%. The survey responses that differ by gender are pointed out throughout the report. The survey sample consisted of 63% white households and 37% black households. Marketing Research Institute has compared survey demographic characteristics with characteristics of the population at large. The research company is satisfied that the survey sample is an accurate representation of the larger population. Differences in the 800 sample and the two smaller 400 samples are indicated in the preceding tables.

E. Recreation Visitation Behavior

The initial section of the questionnaire examined recreational visitation patterns. The sequence began with question 4, which asked: "During the past year did you engage in outdoor recreation? That includes both in town and out of town locations such as parks, rivers, lakes, campgrounds, hiking trails, wildlife refuges, or hunting and fishing areas."

Engaged In Outdoor Recreation			
	Total Sample	Tri-County Area	Outside Tri-County
Yes	54.3%	57.5%	51.0%
No	45.6	42.5	48.8
Uncertain	0.1	0.0	0.3

Approximately 54% of all households surveyed participated in some type of outdoor recreation during the past year. Responses for the two sub-samples were similar.

A follow up question asked respondents to name the places they visited. As the table below indicates, individuals surveyed visited a variety of locations. Individuals sometimes responded with specific place names, such as Ross Barnett Reservoir, and sometimes responded with generic names, such as "small lake in

Madison County." Analysts grouped responses into twenty categories. Specific place names receiving at least 1% total mention are listed. Responses receiving less than 1% total mention are combined to form larger more inclusive categories.

Most frequently visited recreation sites included lakes, local parks, and state or national parks. The specific site receiving the largest total mention was Ross Barnett Reservoir, followed by Roosevelt State Park. The most notable difference between the two sub-samples was the propensity of tri-county residents to visit Ross Barnett Reservoir as compared to households outside the tri-county area. Approximately 11% of tri-county households surveyed had visited Ross Barnett Reservoir in the past year, compared to only 2% of households outside tri-county. Households outside the tri-county area were more likely to have visited another lake, 27%, than were tri-county area households, 11%.

Outdoor Recreation Sites Visited			
	Total Sample	Tri-County Area	Outside Tri-County
Lake	18.4	11.0	26.5
Local Park	12.9	12.6	13.2
National/State Park	12.0	11.9	12.2
Out Of State	7.7	7.4	8.1
Ross Barnett Reservoir	6.3	10.5	1.8
Beach/Coast	6.1	7.4	4.7
Hunting Area	5.2	4.0	6.5
River	4.6	2.4	7.0
Campground	4.0	3.6	4.4
Roosevelt State Park	3.7	6.2	1.0
Mountains	2.6	2.1	3.1
Vicksburg	2.0	3.1	0.8
Ball Field	1.9	2.9	0.8
Le Fleur's Bluff	1.9	3.6	0.0
Zoo	1.9	1.4	2.3
Amusement Park	1.7	1.9	1.6
Paul B. Johnson	1.6	0.7	2.6
Country Club	1.1	1.9	0.3
Golf Course	1.1	1.2	1.0
Walking Track	0.9	1.2	0.5
Other	2.4	3.1	1.6

Respondents were then asked a series of seven questions for each recreation site named. The first question in the series was: "How many times did you visit (facility named) in the past year?"

Number Of Visits			
	Total Sample	Tri-County Area	Outside Tri-County
1-2 Times	48.8%	51.7%	45.7%
3-6 Times	25.1	22.4	28.1
Over 6 Times	26.1	26.0	26.2
Mean	11.6	11.9	11.4
Median	3	2	3
Mode	1	1	1

Nearly half of all respondents who named a specific recreation site when asked if they had participated in outdoor recreation during the past year visited the location in question only one or two times. On the other extreme, approximately one-fourth of recreation respondents were frequent visitors, with seven or more visits per location named. The median number of visits was 3, while the mean was 11.6.

Responses to this question varied widely based upon the specific location visited. For instance, respondents who visited the Ross Barnett Reservoir during the past year went an average of seventeen times, while respondents who visited a local park went an average of 18 times. On the other hand, respondents who visited a state or national park went an average of only four times, and respondents who went to a beach or coastal destination went an average of only three times.

The next question asked: "How long did you usually stay?" As the table below indicates, slightly over 37% of persons who participated in an outdoor recreation activity during the past year remained at the location named for half a day or less, and 27% stayed all day. Approximately 22% stayed at their outdoor recreation destination at least overnight but less than three days, which includes weekend visitors, and 13% stayed at their particular recreation site for at least three days.

Length Of Stay			
	Total Sample	Tri-County Area	Outside Tri-County
One-Half Day Or Less	37.7%	36.4%	39.2%
Full Day	26.9	26.3	27.6
Overnight-2 Days	22.1	23.1	21.1
3 Days Or More	13.2	14.2	12.1

The next question asked: "Counting yourself, how many people went with you each time?"

Number Of Visitors Per Visit			
	Total Sample	Tri-County Area	Outside Tri-County
One	10.6%	10.9%	10.2%
Two	26.4	26.0	26.0
Three	14.7	17.2	12.0
Four	19.2	17.0	21.6
Over Four	29.1	28.9	29.4
Mean	5.9	5.6	6.3
Median	3	3	4
Mode	2	2	2

The median number of visitors per outdoor recreation activity, including the respondent, was 3, while the mean was 6. Approximately 11% of persons participating in outdoor recreation activities in the past year did so alone. On the other end of the spectrum, approximately 29% participated in outdoor recreation activities with groups of five or more. Again, group size varied significantly depending upon the recreation destination. Analysts also examined descriptive statistics for groups having ten persons or less to get a feel for the number of persons traveling per vehicle. Groups of ten persons or less had a median of three visitors per visit and a mean of 3.5.

The next question asked: "How far is (facility named) from your place of residence?"

Distance From Residence			
	Total Sample	Tri-County Area	Outside Tri-County
0-12 Miles	30.9%	28.6%	33.2%
13-25 Miles	13.8	11.1	16.6
26-50 Miles	14.7	16.8	12.4
51-75 Miles	6.5	6.2	6.9
76-100 Miles	7.0	6.9	7.1
Over 100 Miles	27.1	30.4	23.8
Mean	168.5	166.7	170.4
Median	40	45	26
Mode	10	5	10

pproximately 31% of visits to recreation locations were made ithin 12 miles of the respondent's home, and 45% of visits were ade within 25 miles. Just over 27% of outdoor recreation ctivities occurred at locations over 100 miles from the espondent's place of residence. The median distance for outdoor ecreation was 40 miles. When trips in excess of 500 miles are liminated, the mean distance traveled per visit becomes 67 miles, nd the median distance becomes 27 miles. One-third of these rips were made within 12 miles of the respondent's household, and alf were made within 25 miles. Only 19% exceeded 100 miles. hese figures probably offer a more reliable indicator of espondent tendencies to visit locations such as the Pearl River ecreation Development.

he next question asked: "How did you travel there?" Travel by ar or truck was by far the most popular form of transportation.

Means Of Transportation			
	Total Sample	Tri-County Area	Outside Tri-County
Car/Truck	90.8%	87.6%	90.9%
Air	3.5	4.3	2.6
Camper/RV	3.4	4.5	2.1
Walk	2.4	2.1	2.6
Bus	1.5	1.2	1.8
Boat	0.1	0.2	0.0

Length Of Stay			
	Total Sample	Tri-County Area	Outside Tri-County
One-Half Day Or Less	37.7%	36.4%	39.2%
Full Day	26.9	26.3	27.6
Overnight-2 Days	22.1	23.1	21.1
3 Days Or More	13.2	14.2	12.1

The next question asked: "Counting yourself, how many people went with you each time?"

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	Total Sample	Tri-County Area	Outside Tri-County
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13-25 Miles	13.8	11.1	16.6
26-50 Miles	14.7	16.8	12.4
51-75 Miles	6.5	6.2	6.9
76-100 Miles	7.0	6.9	7.1
Over 100 Miles	27.1	30.4	23.8
Mean	168.5	166.7	170.4
Median	40	45	26
Mode	10	5	10

Approximately 31% of visits to recreation locations were made within 12 miles of the respondent's home, and 45% of visits were made within 25 miles. Just over 27% of outdoor recreation activities occurred at locations over 100 miles from the respondent's place of residence. The median distance for outdoor recreation was 40 miles. When trips in excess of 500 miles are eliminated, the mean distance traveled per visit becomes 67 miles, and the median distance becomes 27 miles. One-third of these trips were made within 12 miles of the respondent's household, and half were made within 25 miles. Only 19% exceeded 100 miles. These figures probably offer a more reliable indicator of respondent tendencies to visit locations such as the Pearl River Recreation Development.

The next question asked: "How did you travel there?" Travel by car or truck was by far the most popular form of transportation.

Means Of Transportation			
	Total Sample	Tri-County Area	Outside Tri-County
Car/Truck	90.8%	87.6%	90.9%
Air	3.5	4.3	2.6
Camper/RV	3.4	4.5	2.1
Walk	2.4	2.1	2.6
Bus	1.5	1.2	1.8
Boat	0.1	0.2	0.0

The next question asked: "Why did you go there?" As the following table indicates, survey respondents gave numerous reasons for visiting outdoor recreation sites. Analysts recoded responses into sixteen distinct categories plus an all encompassing other category. The most frequently mentioned reason for visiting an outdoor recreation site was fishing, mentioned by 17.6%. Other responses with greater than 10% total mention included friends/family/children and vacation/get away/relax.

Reason For Visit			
	Total Sample	Tri-County Area	Outside Tri-County
Fishing	17.6	13.8	21.0
Friends/Family/Children	14.3	13.1	14.3
Vacation/Get Away/Relax	12.7	16.0	8.6
Hunting	7.4	5.7	8.6
Recreation/Fun	7.3	8.1	6.2
Sightseeing	5.9	6.0	5.7
Camping	5.9	5.0	6.8
Picnic	5.0	3.8	6.2
Boat/Water	4.8	4.3	4.9
Scenery	4.1	4.5	3.6
Sports	3.5	5.5	1.3
Business	3.0	3.1	2.9
Walk/Hike	2.9	3.1	2.6
Golf	2.0	2.6	1.3
Swimming	2.0	1.2	2.9
Beach	1.3	1.7	0.8
Other	2.4	2.4	2.4

The next question asked: "What are the main features that attracted you to that facility?

Attracting Features			
	Total Sample	Tri-County Area	Outside Tri-County
Fishing	13.9%	9.2%	18.8%
Boat/Water	13.8	14.5	12.8
Scenery	9.0	9.7	8.1
Nature/Hike	6.9	8.7	4.7
Recreation	6.8	6.8	6.8
Easy Access	6.4	7.0	5.2
Sightseeing	5.8	7.0	4.4
Camping	4.9	5.3	4.4
Hunting	4.8	3.4	6.3
Sports/Games	4.4	5.3	3.4
Friend/Family	3.6	4.4	1.8
Picnic	3.4	2.9	3.9
Animals	3.1	1.7	4.7
Swimming	3.0	2.4	3.6
Beach	2.3	2.9	1.6
Peace/Quiet	2.1	2.4	1.8
Golf	2.0	2.7	1.3
Mountains	1.3	1.2	1.3
Other	3.9	2.5	5.1

The two most frequently mentioned features attracting visitors to specific recreation locations were fishing, mentioned by 13.9%, and some combination of boat or water, mentioned by 13.8%. Scenery was the third most frequently mentioned attracting feature, with 9% total mention. The next question asked: "Not including your transportation expenses, how much, if any, did you have to pay to visit and use the facility each time? That includes user fees, meals, hotels, etc."

Visitation Expenses			
	Total Sample	Tri-County Area	Outside Tri-County
$0	31.6%	32.2%	31.0%
$1-10.00	18.8	15.0	22.5
$10.01-25.00	12.7	13.6	11.8
$25.01-50.00	10.6	9.9	11.3
$50.01-75.00	2.5	3.4	1.6
$75.01-100.00	4.6	5.9	3.3
$100.01-200.00	8.2	7.9	8.5
Over $200.00	11.0	12.1	9.9
Mean	97.70	114.69	81.17
Median	10	15	10
Mode	0	0	0

Approximately 50% of survey respondents who participated in outdoor recreation during the past year paid $10.00 or less per visit, including nearly one-third who paid $0 per visit, and 63% who paid $25.00 or less. The median expense per visit was $10.00 while the mean was $97.70. Respondents in the tri-county area spent more than respondents outside the tri-county area. The median expenditure per visit in the tri-county area was $15.00, while the median for respondents living outside the tri-county area was $10.00. The mean expenditure per visit for tri-county respondents was $114.69, while the mean for respondents living outside the tri-county area was $81.17. (Mean expenditure per visit for persons traveling less than 500 miles was $55.11, and median expenditure was $9.50.)

F. Participation in Recreational Activities

Items 46-61 in the survey presented respondents with a list of activities and asked them to indicate how many times they participated in each during the past year. The questionnaire sequence was introduced by the following: As I read the following list of activities, please tell me how many times you participated in each during the past year. Please use a specific numeric response if possible. For instance, if you participated in a certain activity once a week, you might respond fifty or fifty-two times for the entire year. If you did not participate in a certain activity, simply respond "zero times."

Question 46 asked: "First, how many times did you walk, hike, jog, or run for exercise or recreation?"

Walk, Hike, Jog, Or Run			
	Total Sample	Tri-County Area	Outside Tri-County
0 Times	26.1%	22.3%	29.9%
1-24 Times	19.9	21.0	18.7
25-52 Times	27.2	26.1	28.4
Over 52 Times	26.8	30.6	23.0
Mean	68.8	75.9	61.6
Median	30	30	25

Walking/Jogging was a very popular recreational activity. Approximately three out of four respondents surveyed went walking, hiking, jogging, or running at least once in the past year. The median, or typical respondent ran, hiked, or jogged thirty times in the past year. As the table indicates, respondents in the tri-county area were somewhat more likely to jog or walk than were respondents outside of the tri-county area. Demographic analysis reveals that respondents in white collar households were more likely to walk or jog than were respondents in blue collar households. Respondents 65 years of age and older went jogging or walking more than any other group.

Question 47 asked: "Next, how many times did you go camping?"

Times Gone Camping			
	Total Sample	Tri-County Area	Outside Tri-County
0 Times	77.4%	78.4%	76.4%
1-2 Times	9.9	9.5	10.3
3-6 Times	5.8	5.3	6.3
Over 6 Times	6.9	6.8	7.0
Mean	1.7	1.6	1.8
Median	0	0	0

Approximately one out of four households went camping in the past year. The typical respondent did not go camping at all in the past year.

Question 48 asked: "Next, how many times did you go on a picnic?"

Times Gone On A Picnic			
	Total Sample	Tri-County Area	Outside Tri-County
0 Times	49.7%	45.4%	54.1%
1-2 Times	18.3	22.3	14.3
3-6 Times	18.8	19.3	18.3
More Than 6	13.2	13.0	13.3
Mean	3.3	3.5	3.1
Median	1	1	0

Half of all households surveyed went on a picnic in the past year, and the typical respondent went one time.

Question 49 asked: "Next, how many times did you go swimming?"

Times Gone Swimming			
	Total Sample	Tri-County Area	Outside Tri-County
0 Times	58.7%	57.0%	60.3%
1-2 Times	6.8	8.3	5.3
3-6 Times	7.9	7.8	8.0
More Than 6	26.6	26.9	26.4
Mean	12.9	15.5	10.4
Median	0	0	0

Slightly over 41% of respondents surveyed went swimming in the past year, and one quarter went swimming at least seven times. While the median response was 0, the mean was 12.9. Respondents between the ages of 18 and 24 went swimming most frequently. There was also a significant difference in response between black and white households, with respondents in black households providing a mean response of 2.7 times, and respondents in white households providing a mean response of 19 times.

Question 50 asked: "Next, how many times did you go boating?"

Times Gone Boating			
	Total Sample	Tri-County Area	Outside Tri-County
0 Times	69.4%	67.3%	71.4%
1-2 Times	8.5	11.3	5.8
3-6 Times	6.9	6.5	7.3
More Than 6	15.2	14.8	15.5
Mean	5.6	5.9	5.2
Median	0	0	0

Approximately 30% of individuals surveyed went boating in the past year. The median response was 0, and the mean response was 5.6 times. Not surprisingly, respondents in higher income households went boating more frequently than did respondents in lower income households.

Question 51 asked: "Next, how many times did you go hunting?"

Times Gone Hunting			
	Total Sample	Tri-County Area	Outside Tri-County
0 Times	74.6%	78.9%	70.3%
1-2 Times	3.1	3.3	3.0
3-6 Times	4.9	4.8	5.0
More Than 6	17.4	13.0	21.8
Mean	5.9	4.9	7.0
Median	0	0	0

Approximately one out of four respondents surveyed went hunting in the past year, with a median response of 0 times and a mean of 5.9 times. Respondents in agricultural occupations were more likely than respondents in other occupational groups to go hunting. Males also went hunting much more frequently than did females, and whites hunted more frequently than did blacks.

Question 52 asked: "Next, how many times did you go fishing?"

Times Gone Fishing			
	Total Sample	Tri-County Area	Outside Tri-County
0 Times	52.9%	54.1%	51.6%
1-2 Times	9.6	12.3	7.0
3-6 Times	11.2	12.0	10.3
More Than 6	26.3	21.6	31.1
Mean	10.1	8.1	12.1
Median	0	0	0

Approximately one out of two respondents surveyed went fishing in the past year, and slightly over one-fourth went fishing at least seven times. Respondents outside the tri-county area fished more frequently than did respondents living in the tri-county area. For example, 31% of respondents outside the tri-county area went fishing at least seven times in the past year, and the mean response for households outside the tri-county area was 12.1 times. On the other hand, approximately 22% of respondents within the tri-county area went fishing seven times or more last year, and the mean response was 8.1 times. Males went fishing more frequently than did females.

Question 53 asked: "Next, how many times did you go canoeing or kayaking?"

Times Gone Canoeing or Kayaking			
	Total Sample	Tri-County Area	Outside Tri-County
0 Times	93.8%	94.3%	93.3%
1-2 Times	4.4	4.3	4.5
3-6 Times	1.5	1.5	1.5
More Than 6	0.4	0.0	0.8
Mean	0.2	0.1	0.3
Median	0	0	0

Less than 7% of the total population went canoeing or kayaking in the past year. The mean response was only 0.2 times.

Question 54 asked: "Next, how many times did you ride a bicycle?"

Times Rode Bicycle			
	Total Sample	Tri-County Area	Outside Tri-County
0 Times	66.3%	63.3%	69.3%
1-2 Times	5.5	8.0	3.0
3-6 Times	7.0	8.5	5.5
More Than 6	21.2	20.1	22.3
Mean	10.9	9.6	12.3
Median	0	0	0

Approximately one-third of respondents rode a bicycle in the past year, and one out of five rode at least seven times. The mean response was 10.9 times. Respondents below the age of 45 rode more frequently than did older respondents. Blacks also rode more frequently than did whites.

Question 55 asked: "Next, how many times did you ride a motorbike or ATV?"

Times Rode Motorbike Or ATV			
	Total Sample	Tri-County Area	Outside Tri-County
0 Times	85.5%	88.0%	83.0%
1-2 Times	3.5	3.0	4.0
3-6 Times	2.3	3.0	1.5
More Than 6	8.8	6.0	11.5
Mean	4.4	2.2	6.6
Median	0	0	0

Only 15% of respondents surveyed rode a motorbike or ATV in the past year. The mean response was 4.4 times. Respondents living outside the tri-county area rode more frequently than respondents living within the tri-county area. Respondents between the ages of 18 and 34 rode more frequently than did older respondents.

Question 56 asked: "Next, how many times did you play softball?"

Times Played Softball			
	Total Sample	Tri-County Area	Outside Tri-County
0 Times	78.2%	78.2%	78.3%
1-2 Times	5.1	6.0	4.3
3-6 Times	5.4	5.5	5.3
More Than 6	11.3	10.3	12.3
Mean	4.0	2.8	5.2
Median	0	0	0

Approximately 22% of respondents played softball in the past year. The mean response was 4.0 times. Respondents below the age of 45 were much more likely to play softball than were older respondents.

Question 57 asked: "Next, how many times did you go shoot at an archery range?"

Times At An Archery Range			
	Total Sample	Tri-County Area	Outside Tri-County
0 Times	93.0%	93.5%	92.5%
1-2 Times	1.5	1.5	1.5
3-6 Times	1.9	1.5	2.3
More Than 6	3.6	3.5	3.8
Mean	1.3	1.3	1.4
Median	0	0	0

Seven percent of respondents shot at an archery range in the past year, with a mean response of 1.3 times.

Question 58 asked: "Next, how many times did you play golf?"

Times Played Golf			
	Total Sample	Tri-County Area	Outside Tri-County
0 Times	85.5%	82.8%	88.3%
1-2 Times	3.1	4.0	2.3
3-6 Times	2.6	3.8	1.5
More Than 6	8.8	9.5	8.0
Mean	5.0	5.9	4.1
Median	0	0	0

Approximately 15% of individuals surveyed played golf in the past year, with a mean response of 5.0 times. Respondents in households with an annual income of at least $40,000 played golf much more frequently than did respondents in lower income households. Whites also played golf much more frequently than did blacks.

Question 59 asked: "Next, how many times did you attend a museum or amphitheater?"

Times Attended A Museum Or Amphitheater			
	Total Sample	Tri-County Area	Outside Tri-County
0 Times	52.9%	44.3%	61.5%
1-2 Times	22.1	25.0	19.3
3-6 Times	16.8	20.0	13.5
More Than 6	8.3	10.8	5.8
Mean	2.6	2.7	2.5
Median	0	1	0

Almost half of all households surveyed attended a museum or amphitheater in the past year. The mean response was 2.6 times.

Question 60 asked: "Next, how many times did you go bird watching or observing other wildlife or plants?"

Times Gone Bird Watching Or Observing Wildlife Or Plants			
	Total Sample	Tri-County Area	Outside Tri-County
0 Times	68.8%	67.6%	69.9%
1-2 Times	7.0	10.3	3.8
3-6 Times	7.8	8.3	7.3
More Than 6	16.4	13.8	19.0
Mean	17.5	14.3	20.7
Median	0	0	0

Approximately 31% of respondents went bird watching or observing other wildlife or plants in the past year. The mean response was 17.5 times. Older respondents observed nature much more frequently than did younger respondents. White respondents were also more likely than black respondents to go bird watching.

Question 61 asked: "Next, how many times did you practice nature photography or nature sketching or painting?"

Times Practiced Nature Photography Or Nature Sketching Or Painting			
	Total Sample	Tri-County Area	Outside Tri-County
0 Times	86.2%	86.3%	86.2%
1-2 Times	3.3	3.3	3.3
3-6 Times	4.9	5.5	4.3
More Than 6	5.6	5.0	6.3
Mean	2.4	2.7	2.1
Median	0	0	0

Approximately 14% of individuals surveyed practiced nature photography or nature sketching or painting in the past year. The mean response was 2.4 times.

The following table rank orders each of the sixteen activities examined based upon the mean number of times respondents participated in each activity.

Mean Annual Participation			
	Total Sample	Tri-County Area	Outside Tri-County
1. Walk, Hike, Jog, Or Run•	68.8	75.9	61.6
2. Bird Watching, Observing Nature•	17.5	14.3	20.7
3. Swimming•	12.9	15.5	10.4
4. Bicycle•	10.9	9.6	12.3
5. Fishing•	10.1	8.1	12.1
6. Hunting	5.9	4.9	7.0
7. Boating•	5.6	5.9	5.2
8. Golf	5.0	5.9	4.1
9. Motorbike/ATV	4.4	2.2	6.6
10. Softball	4.0	2.8	5.2
11. Picnic•	3.3	3.5	3.1
12. Museum/Amphitheater•	2.6	2.7	2.5
13. Nature Photography/Painting	2.4	2.7	2.1
14. Camping	1.7	1.6	1.8
15. Archery Range	1.3	1.3	1.4
16. Canoeing/Kayaking	0.2	0.1	0.3

• = At least 30% participation.

As the preceding table indicates, walking or running was by far the most popular outdoor recreation activity. Not only did respondents provide a mean response of 68.8 times, but jogging/walking was one of only two recreational activities in which at least 50% of the population participated. Nearly 75% of all respondents went walking or jogging in the past year. (Picnic was the other activity with at least a 50% response. However, the mean response for picnic was only 3.3 times.) In addition to jogging/walking and picnicking, the above activities in which at least 30% of the population participated included bird watching/observing nature, swimming, biking, fishing, boating, and attending a museum or amphitheater.

G. Visitation of Proposed Recreational Enhancements to the Pearl River Flood Control Corridor

A significant component of the survey involved questions addressing three enhancements to the Pearl River flood control site. The first of these was question 62 which asked: "Development of a recreational complex that would allow persons to participate in activities like those described above is being considered for the

Jackson Metropolitan Area in Jackson, MS. If such an area were developed, offering all such activities as you enjoy, how many times per year do you think you would visit?"

Anticipated Annual Visitation: Pearl River Recreational Corridor			
	Total Sample	Tri-County Area	Outside Tri-County
0 Times	16.7%	10.9%	22.3%
1-2 Times	25.4	16.4	34.0
3-6 Times	27.2	30.1	24.4
7 Or More	30.7	42.6	19.4
Mean	10.2	13.6	6.9
Median	3	5	2
Mode	0	2	0

Approximately 83% of individuals surveyed responded that they would visit a recreational corridor in the Jackson Metropolitan Area at least once annually. The mean response was 10.2 times, and the median response was 3 times. As would be expected, tri-county residents would be more likely to visit the recreational corridor than would residents outside the tri-county area. Tri-county residents provided a mean response of 13.6 times and a median response of 5 times compared to mean and median responses of 6.9 times and 2 times for households outside the tri-county area.

A follow up question asked: "If the project is developed, what would be the three most important features to include to convince you to use the facility?"

Most Important Features For A Recreation Corridor			
	Total Sample	Tri-County Area	Outside Tri-County
Walk/Nature Trail/Hike	28.8%	35.0%	22.5%
Fishing	20.3	16.5	24.0
Park/Picnic Area	16.3	16.8	15.8
Swimming	16.3	17.8	14.7
Athletic/Gym/Exercise Area	13.6	13.8	13.5
Boating	11.4	10.8	12.0
Children's Activities	8.3	9.8	6.8
Camping	8.1	7.0	9.3
Access/Parking	6.9	9.5	4.3
Golf	6.8	7.5	6.0
Staff Upkeep/Clean	6.4	8.3	4.5
Museums	6.3	5.3	7.3
Zoo/Animals	5.4	5.0	5.8
Low Cost	5.0	6.5	3.5
Hunting	4.9	2.0	7.8
Bicycling	4.4	5.3	3.5
Safety	3.9	4.3	3.5
Tennis	3.5	4.3	2.8
Auditorium	3.0	2.3	3.8
Canoeing	2.4	2.5	2.3
Classes	2.3	2.5	2.0
Restaurants	1.6	1.5	1.8
Archery	1.5	0.8	2.3
Peaceful/Restful	1.4	2.0	0.8
Amusement Park	1.3	1.0	1.5
Horses To Ride	1.1	1.3	1.0
Other	9.0	7.8	10.3
None/No Reply	20.0	18.0	22.0

Individuals surveyed named walking/hiking areas or nature trails as the single most important feature to include to convince them to use the proposed recreation corridor. Approximately 29% of all

respondents named walking or hiking areas. Walking/hiking areas were especially important to tri-county respondents, with 35% total mention, as compared to respondents outside the tri-county area, with 23% total mention. The second most important feature to include was fishing. One out of five respondents surveyed named fishing. Other features which received at least 10% total response included park/picnic area, swimming, some type of athletic/exercise area or gymnasium, and boating.

Question 64 asked: "The project site could also include an impoundment, or dam, which would ensure that one section of the river had a steady water level. An impoundment would create opportunities for various boating and fishing activities. If an impoundment were included, how many more times per year, if any, do you think you would visit the project site?"

Additional Annual Visitation With Impoundment

	Total Sample	Tri-County Area	Outside Tri-County
0 Times	44.0%	41.4%	46.5%
1-2 Times	15.2	12.3	18.1
3-6 Times	19.9	20.7	19.2
More Than 6 Times	20.9	25.6	16.3
Mean	6.1	7.2	5.0
Median	2	2	1
Mode	0	0	0

Adding an impoundment would have a positive effect upon visitation to the proposed recreation corridor. Fifty-six percent of respondents surveyed replied that they would visit the site more frequently if an impoundment ensured a steady water level, and 21% would visit an additional seven times or more. Use of the facility would increase especially among tri-county residents. Analysts also examined responses for persons who earlier in the survey indicated that they had visited the Ross Barnett Reservoir, or another lake or river during the past year for recreation. These individuals provided a mean response of 7.3 additional times and a median response of 2 additional times they would visit the recreation site if it included a steady water level with boating and fishing activities.

One final survey item, Question 65, asked: "Another possibility is the addition of a commercial marketplace, with shops, restaurants, and hotels included at the project site. If the project were expanded to include commercial establishments, how many more times, if any, do you think you would visit each year?"

Additional Annual Visitation With Commercial Marketplace			
	Total Sample	Tri-County Area	Outside Tri-County
0 Times	29.0%	24.5%	33.3%
1-2 Times	16.9	12.8	20.9
3-6 Times	22.7	21.5	23.8
More Than 6 Times	31.4	41.1	22.0
Mean	9.2	12.0	6.6
Median	3	5	2

The addition of a commercial marketplace would have a significant impact upon visitation. Seven out of ten respondents surveyed replied that they would visit the site at least one additional time per year if it included a commercial marketplace, and 31% would visit seven or more additional times. Forty-one percent of tri-county respondents replied that they would visit an additional seven times or more, and 22% of respondents outside the tri-county area would visit an additional seven times or more. The mean response for increased visitation with a commercial marketplace was 9.2 times, and the median response was 3 times.

5.8 Travel Cost: Regional Model

This section of the analysis report presents the economic benefits that would be achieved from recreational enhancements along the Pearl River Basin flood control corridor based upon actual, historical visitation of recreational facilities. To determine total economic benefit and average benefit per visit, research analysts employed the travel cost method as outlined in the National Economic Development Procedures Manual for recreation. Analysts followed the NED travel cost method exactly as it appears in the manual, with the only exception being that the research company used a regional travel model to determine visitation patterns, while the manual employed a site specific model. The reason for this difference is that researchers did not have access to visitation figures for a specific recreation facility. Instead, the research company relied on a scientific survey of 800 households to determine visitation by distance to various outdoor recreational facilities. The Research Approach and Methodology section of this report contains a detailed discussion of sampling procedures.

Survey respondents were asked if they had visited any park, river, lake, campground, hiking trail, wildlife refuge, or hunting and fishing area for recreation in the past year. They were then asked the name of the destination or facility they visited and how far

that destination was from their place of residence. Analysts then divided all destination sites into 25 mile increments, with the last increment being 101-120 miles. (Approximately one out of four survey respondents visited an outdoor recreation location greater than 120 miles from their place of residence. However, since households surveyed were only drawn from within a 120 mile radius of Jackson, Mississippi, analysts used the 120 mile cut off.)

Outdoor Recreation Distance Zone And Use Estimate		
Zone (Miles)	Annual Visitors	Percent Dist. Of Visitors
0-25	350	60.2%
26-50	115	19.8
51-75	51	8.8
76-100	55	9.5
101-120	10	1.7
Total	581	100

To determine per capita use by zone in the site specific model, the number of visitors per zone is divided by the total population for that zone. Although per capita use by zone was determined in the same manner for the regional travel model in this report, the survey also allowed researchers to determine per capita *visit* by zone, which provides a more accurate indicator of visitation. Each survey respondent was asked how many times he/she visited each facility, which allowed analysts to calculate total visits per zone. The total number of visits per zone was then divided by the population for that zone to determine per capita visit by zone. The two tables which follow present per capita use and per capita visit by zone. The first table is presented merely to imitate the table appearing in the NED procedures manual. The second table is the important one. The population for each zone is 800, because each survey respondent had the opportunity to visit a recreational destination in each zone; i.e., from 0 to 120 miles away.

Per Capita Use by Zone			
Zone	Annual Visitors	Population	Per Capita Use By Zone
0-25	350	800	.44
26-50	115	800	.14
51-75	51	800	.06
76-100	55	800	.07
101-120	10	800	.01

Per Capita Visit by Zone			
Zone	Annual Visitors	Population	Per Capita Visit By Zone
0-25	7,490	800	9.36
26-50	694	800	.87
51-75	404	800	.51
76-100	160	800	.20
101-120	52	800	.07

The next step involved projecting total visits by zone to the Pearl River flood control corridor under study. This was accomplished by multiplying the total population of each zone by the visits per capita. The Claritas Compass Demographic Retrieval System was used to determine population per zone. The system used county population figures. In cases where counties split zones, the county was assigned to that zone where it's centroid fell.

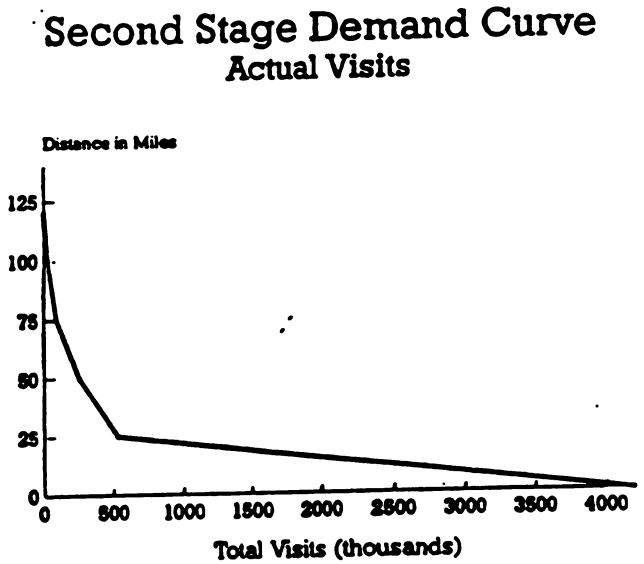
Derivation of Expected Visitation

Zone	Counties	Population	Visits Per Capita	Visits For Rec.
0-25	3	399,155	9.36	3,737,089
26-50	7	181,849	.87	157,760
51-75	18	253,144	.51	127,845
76-100	24	688,332	.20	137,236
101-120	21	524,104	.07	34,067
Total	-	-	-	4,193,996

After determining visitation by zone, it is necessary to calculate the "second stage day use demand schedule." This is done by sequentially increasing the distance from the point of origin to the point of destination until visitation drops to zero, and then combining the total number of visits at each added distance. In other words, at zero added miles, total visitation will be identical to the numbers in the table above: 9.36 (399,155) + .87 (181,849) + .51 (253,144) + .20 (688,332) + .07 (524,104) = 4,193,996. Since per capita visits decrease as distance increases, total visitation will decrease as twenty-five mile increments are added. For example, adding 25 miles to zone 1 decreases visits per capita from 9.36 to 0.87, and adding 25 miles to zone 2 decreases visits per capita from .87 to .51. Thus, at 25 miles added distance, total visitation would be .87 (399,155) + .51 (181,849) + .20 (253,144) + .07 (688,332) + 0 (524,104) = 533,330. This continues until total visitation is reduced to zero.

Second Stage Day Use Demand Schedule						
Added Miles	Visits By Origin					Total Visits
	1	2	3	4	5	
0	3,737,089	157,760	127,845	137,236	34,067	4,193,996
25	346,279	91,839	50,471	44,742	0	533,330
50	201,584	36,256	16,454	0	0	254,295
75	79,582	11,820	0	0	0	91,402
100	25,945	0	0	0	0	25,945
120	0	0	0	0	0	0

The numbers from the first and last column of the above table, added miles and total visits, are used to plot the "second stage day use demand curve." The area under the curve is the visitors' consumer surplus, or the additional amount they would be willing to pay but do not have to pay to use the recreation corridor.



The next step is to convert distance to cost, or milage increments to dollars. To do this, analysts must determine the variable motor vehicle costs, which is average cost of travel per person per mile, and the value of travel time, or opportunity costs. According to the Internal Revenue Service, the average cost of travel is $.28 per mile. Survey data indicated that the mean number of people traveling to a recreational facility was 3.5, so the vehicle cost per person per mile is $.28/3.5, or $.08 per mile.

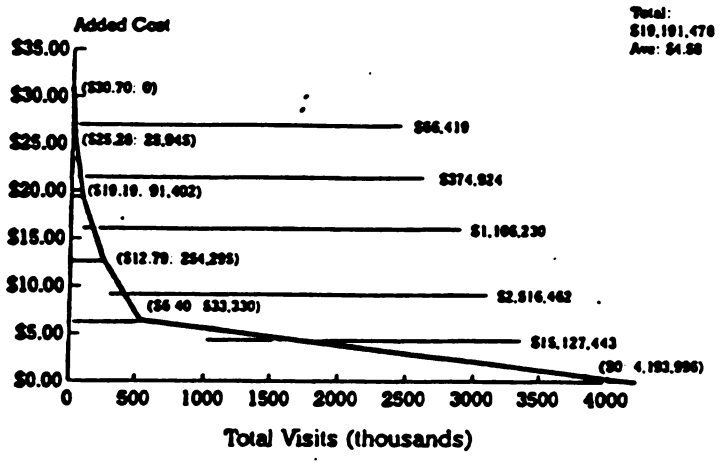
The value of travel time per hour (opportunity cost) is calculated as 1/3 x the average hourly wage rate for adults, and 1/12 x the average hourly wage rate for children (NED manual, F.J. Cesario). The average hourly wage rate for Mississippi was $8.38/hour in 1990 (MS State Employment Security Commission, labor of market information), so the value of travel time per hour was $8.38/3 = $2.79 for adults, and $8.38/12 = $.70 for children.

Total cost is determined by adding the time cost of travel to the vehicle cost per person. The time cost of travel is figured by dividing round trip distance by average speed and multiplying times the value of travel time per hour. Research analysts used an average speed of 45 (NED manual). According to the Claritas Compass System, 69.7% of persons living within 120 miles of Jackson are 18 years and over, and 30.3% are younger than 18. These figures were used to estimate the number of adults and children traveling per vehicle; thus, the time cost of travel at 25 miles (zone 1) is .697 (50/45 x $2.79) + .303 (50/45 x $.70) = $2.40. The time cost of travel was then added to the vehicle cost per person, $.08/mile x 50 miles, or $4.00, for a total cost of $6.40 at 25 miles.

Travel Cost				
Increments (Miles)	Roundtrip Mileage	Time Cost Of Travel ($)	Vehicle Cost Per Person ($)	Total Cost
25	50	$2.40	$4.00	$6.40
50	100	4.79	8.00	12.79
75	150	7.19	12.00	19.19
100	200	9.58	16.00	25.58
120	240	11.50	19.20	30.70

The total cost figures above are then used to plot the "day use benefit estimation" graph. This graph simply substitutes cost for distance and determines the relationship between cost and total visits. Total benefit is the area under the demand curve and is determined by breaking the area under the curve into trapezoids, determining the area of each, and summing the totals. Average benefit per visit is determined by dividing the total benefit by the number of visits estimated at zero additional miles. As the following graph indicates, total annual day use benefit using the regional travel model for the Pearl River flood control corridor is $19,191,478, and the average benefit per visit is $4.58.

Day Use Benefit Estimation
Actual Visits



I. Travel Cost: Pearl River Recreation Corridor

This section of the analysis presents the economic benefits that would be achieved from recreational enhancements along the Pearl River Basin flood control corridor based on claimed visitation to the proposed facilities as well as historical visitation of other outdoor recreation facilities.

In addition to measuring current recreation visitation behavior, the survey asked respondents if they would visit recreation facilities constructed along the Pearl River flood control corridor in Jackson, Mississippi.

Specifically, Question 62 asked: "Development of a recreational complex that would allow persons to participate in activities like those described above is being considered for the Jackson Metropolitan area in Jackson, MS. If such an area were developed, offering all such activities as you enjoy, how many times per year do you think you would visit?" Analysts used responses to this question in the travel cost methodology to calculate total economic benefit and average benefit per visit based on claimed visitation to the Pearl River recreation corridor.

Base Facility Distance Zone Use Estimate		
Zone (Miles)	Annual Visitors	Percent Dist. Of Visitors
0-25	320	52.2%
26-50	39	6.4
51-75	54	8.8
76-100	109	17.8
101-120	91	14.8
Total	613	100

Per capita usage and per capita visitation by zone were determined in the same manner used for the regional travel cost model. The only difference was the population was no longer 800 for each zone, but was based on the number of people responding to the survey who lived in each zone.

Per Capita Use by Zone			
Zone	Annual Visitors	Population	Per Capita Use By Zone
0-25	320	400	.80
26-50	39	46	.85
51-75	54	76	.71
76-100	109	155	.70
101-120	91	123	.74

Per Capita Visit by Zone			
Zone	Annual Visitors	Population	Per Capita *Visit* By Zone
0-25	4,352	400	10.88
26-50	456	46	9.92
51-75	702	76	9.24
76-100	491	155	3.16
101-120	428	123	3.48

Total visitation by zone was then determined by multiplying population per zone by per capita visit per zone.

Derivation of Expected Visitation

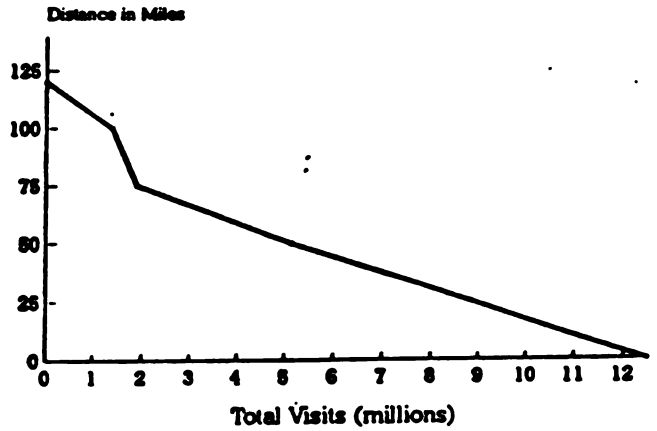
Zone	Counties	Population	Visits Per Capita	Visits For Pearl
0-25	3	399,155	10.88	4,342,806
26-50	7	181,849	9.92	1,803,863
51-75	18	253,144	9.24	2,338,251
76-100	24	688,332	3.16	2,178,238
101-120	21	524,104	3.48	1,822,433
Total	-	-	-	12,485,591

"Second stage day use demand schedule" is then calculated in the same manner as before.

Second Stage Day Use Demand Schedule						
Added Miles	Visits By Origin					Total Visits
	1	2	3	4	5	
0	4,342,806	1,803,863	2,338,251	2,178,238	1,822,433	12,485,591
25	3,959,444	1,679,711	801,078	2,393,493	0	8,833,725
50	3,686,932	575,464	880,241	0	0	5,142,637
75	1,263,132	632,332	0	0	0	1,895,464
100	1,387,956	0	0	0	0	1,387,956
120	0	0	0	0	0	0

The numbers from the first and last column of the preceding table, added miles and total visits, are then used to plot the "second stage day use demand curve." The area under the curve is the visitors' consumer surplus, or the amount they would be willing to pay but do not have to pay to use the recreation corridor.

Second Stage Demand Curve
Claimed Visits: Base Facility

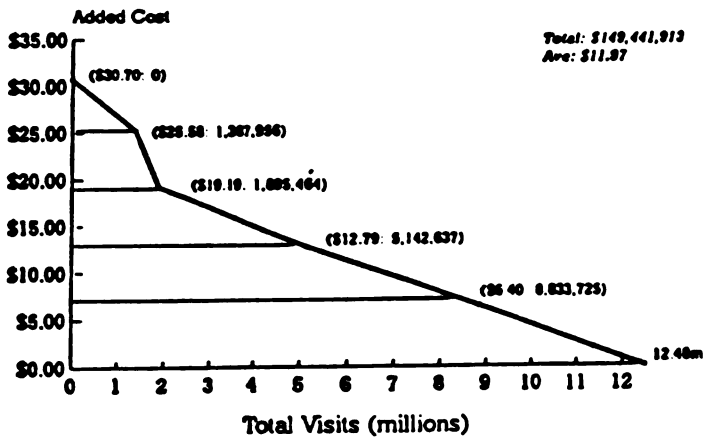


Next, distance is converted to cost using the same formulas as before. Total cost is the sum of vehicle costs per person and the time cost of travel. Since distances have not changed, the figures in the following table are the same as those in the preceding section.

Travel Cost				
Increments (Miles)	Roundtrip Mileage	Time Cost Of Travel ($)	Vehicle Cost Per Person ($)	Total Cost
25	50	$2.40	$4.00	$6.40
50	100	4.79	8.00	12.79
75	150	7.19	12.00	19.19
100	200	9.58	16.00	25.58
120	240	11.50	19.20	30.70

The total cost figures above are then used to plot the "day use benefit estimation" graph. The following graph substitutes cost for distance and determines the relationship between cost and total visits. Total benefit is the area under the demand curve.

Day Use Benefit Estimation
Claimed Visits: Base Facility

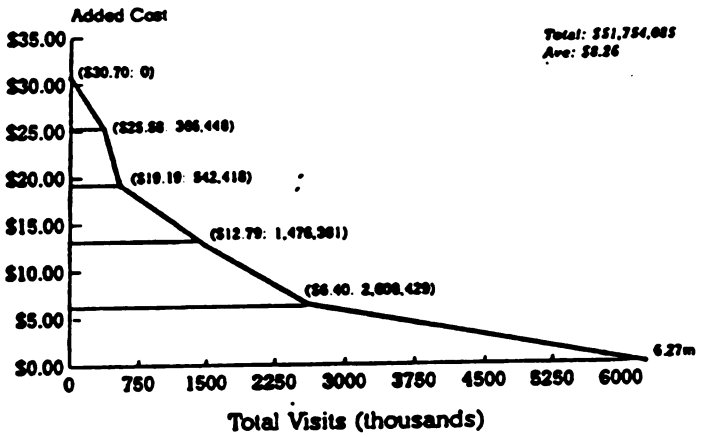


As indicated in the preceding graph, total annual benefit using the claimed visitation model for the Pearl River recreation corridor is $149,441,913, and average benefit per visit is $11.97. Total economic benefit and average benefit per visit are much higher under the claimed visitation model than under the actual visitation model. The true demand curve most likely lies somewhere in between.

In order to provide a more realistic estimate of total benefit for the Pearl River recreation corridor, analysts used a weighted average to determine a new demand curve. The research company applied a similar technique to the feasibility study conducted for the Monroe County Park Commission in 1986 when examining potential visitation and economic benefit for the proposed Blue Bluff Park near Aberdeen, Mississippi, and for the Sowashee Creek project in 1989. To determine a more realistic demand curve, analysts added actual visitation times .75 (75% of actual visitation) and estimated visitation times .25 (25% of estimated visitation) for each cost. In other words, rather than giving equal weight to both actual visitation and estimated visitation, analysts considered actual visitation patterns three times as important as estimated visitation patterns. Of course, the percentages could be changed, so that more or less weight was given to actual visitation. The following figures were used to plot the weighted demand curve.

Total Cost	Total Visits
$30.70	0
25.88	366,448
19.19	542,418
12.79	1,476,381
6.40	2,608,429
0.00	6,266,895

Day Use Benefit Estimation
Weighted Visits: Base Facility



Total annual benefit for the Pearl River recreation corridor under the weighted demand curve is $51,754,085, and average benefit per visit is $8.26.

5.10 Summary Of Travel Cost for the Pearl River Recreational Corridor

The travel cost model for the Pearl River recreation corridor first determined the benefit that would be achieved from recreational enhancements along the Pearl River Basin flood control corridor based upon claimed visitation to the proposed facilities. Visitation was determined from responses to question 62, which read: "Development of a recreational complex that would allow persons to participate in activities like those described above is being considered for the Jackson Metropolitan area in Jackson, MS. If such an area were developed, offering all such activities as you enjoy, how many times per year do you think you would visit?" Total annual benefit derived using the travel cost model for claimed visitation to the Pearl River recreation corridor was $149,441,913, and the average benefit per visit was $11.97.

The benefit deriving from actual visitation to existing recreational facilities within the past year by survey respondents was determined in the preceding section of the report entitled "Travel Cost: Regional Model." The total annual benefit under the regional model was $19,191,478 and the average benefit per visit was $4.58.

The total annual economic benefit and the average benefit per visit was much higher under the claimed visitation model than under the regional (actual) visitation model. In order to provide a more realistic estimate of total benefit for the Pearl River recreation corridor, analyst used a weighting system that gave three times more importance to actual visitation of regional recreational facilities than to claimed visitation of recreational facilities constructed along the Pearl River recreation corridor. Using this weighting system, total annual benefit for the Pearl River recreation corridor was estimated at $51,754,085 and average benefit per visit at $8.26.

K .. Travel Cost: Pearl River Recreation Corridor with Impoundment

The survey questionnaire also examined visitation to the Pearl River recreation corridor with the inclusion of an impoundment. Question 64 in the survey asked respondents: "The project site could also include an impoundment, or dam, which would insure that one section of the river had a steady water level. An impoundment would create opportunities for various boating and fishing activities. If an impoundment were included, how many more times per year, if any, do you think you would visit the project site?" Analysts incorporated responses from this question into the travel cost methodology to calculate total economic benefit and average benefit per visit based on claimed visitation to the Pearl River recreation corridor when that facility included a steady water level.

Distance Zone Use Estimate: Impoundment		
Zone (Miles)	Annual Visitors	Percent Dist. Of Visitors
0-25	328	51.6%
26-50	39	6.1
51-75	56	8.8
76-100	117	18.4
101-120	96	15.1
Total	636	100

Per capita usage and per capita visitation by zone were determined in the same manner used for the regional travel cost model. The only difference was the population was no longer 800 for each zone, but was based on the number of people responding to the survey who lived in each zone.

Per Capita Use by Zone			
Zone	Annual Visitors	Population	Per Capita Use By Zone
0-25	328	400	.82
26-50	39	46	.85
51-75	56	76	.74
76-100	117	155	.75
101-120	96	123	.78

Per Capita Visit by Zone			
Zone	Annual Visitors	Population	Per Capita Visit By Zone
0-25	6,822	400	17.06
26-50	905	46	19.67
51-75	1,086	76	14.29
76-100	995	155	6.42
101-120	739	123	6.01

Total visitation by zone was then determined by multiplying population per zone by per capita visit per zone.

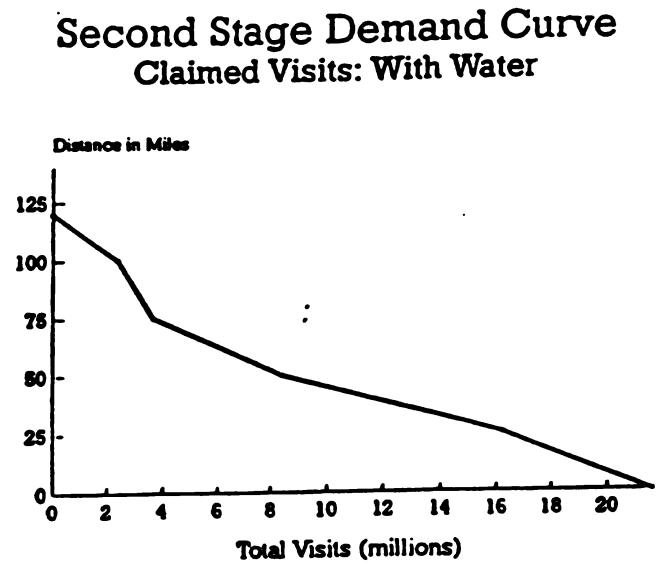
Derivation of Expected Visitation

Zone	Counties	Population	Visits Per Capita	Visits For Water
0-25	3	399,155	17.06	6,807,988
26-50	7	181,849	19.67	3,576,891
51-75	18	253,144	14.29	3,618,627
76-100	24	688,332	6.42	4,416,427
101-120	21	524,104	6.01	3,149,737
Total	-	-	-	21,569,669

"Second stage day use demand schedule" is then calculated in the same manner as before.

Second Stage Day Use Demand Schedule						
Added Miles	Visits By Origin					Total Visits
	1	2	3	4	5	
0	6,807,988	3,576,891	3,618,627	4,416,427	3,149,737	21,569,669
25	7,851,205	2,599,484	1,624,205	4,136,707	0	16,211,601
50	5,705,816	1,166,767	1,521,334	0	0	8,393,916
75	2,561,030	1,092,868	0	0	0	3,653,898
100	2,398,824	0	0	0	0	2,398,824
120	0	0	0	0	0	0

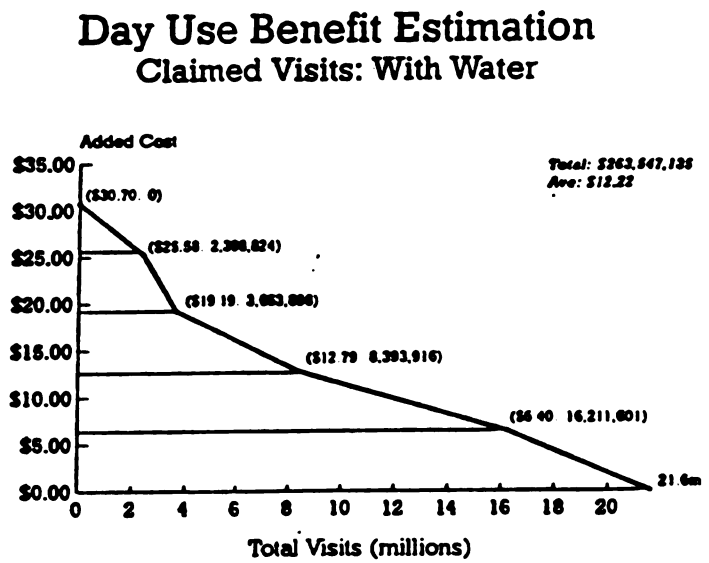
The numbers from the first and last column of the preceding table, added miles and total visits, are then used to plot the "second stage day use demand curve." The area under the curve is the visitors' consumer surplus, or the amount they would be willing to pay but do not have to pay to use the recreation corridor.



Next, distance is converted to cost using the same formulas as before. Total cost is the sum of vehicle costs per person and the time cost of travel. Since distances have not changed, the figures in the following table are the same as those in the preceding section.

Travel Cost				
Increments (Miles)	Roundtrip Mileage	Time Cost Of Travel ($)	Vehicle Cost Per Person ($)	Total Cost
25	50	$2.40	$4.00	$6.40
50	100	4.79	8.00	12.79
75	150	7.19	12.00	19.19
100	200	9.58	16.00	25.58
120	240	11.50	19.20	30.70

The total cost figures above are then used to plot the "day use benefit estimation" graph. The following graph substitutes cost for distance and determines the relationship between cost and total visits. Total benefit is the area under the demand curve.

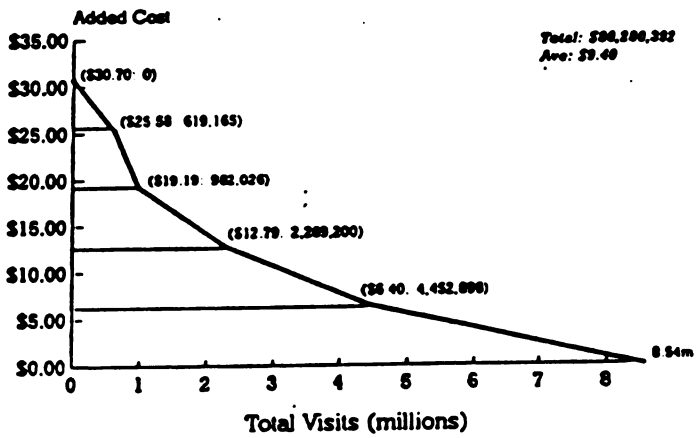


As indicated in the preceding graph, total annual benefit using the claimed visitation model for the Pearl River recreation corridor with impoundment included is $263,547,135, and average benefit per visit is $12.22. Again, total economic benefit and average benefit per visit are much higher under the claimed visitation model than under the actual visitation model. Therefore, analysts once again used a weighted demand curve.

Analysts added actual visitation times .75 (75% of actual visitation) and estimated visitation times .25 (25% of estimated visitation) for each cost. In other words, rather than giving equal weight to both actual visitation and estimated visitation, analysts considered actual visitation patterns three times as important as estimated visitation patterns. Of course, the percentages could be changed, so that more or less weight was given to actual visitation. The following figures were used to plot the weighted demand curve.

Total Cost	Total Visits
$30.70	0
25.58	619,165
19.19	982,026
12.79	2,289,200
6.40	4,452,898
0.00	8,537,914

Day Use Benefit Estimation
Weighted Visits: With Water



Total annual benefit for the Pearl River recreation corridor with impoundment included under the weighted demand curve is $80,280,392, and average benefit per visit is $9.40.

5.12 Travel Cost: Pearl River Recreation Corridor with Commercial Marketplace

A final question in the survey was included to measure the impact on the Jackson Metropolitan area of a commercial marketplace along the Pearl River Basin flood control corridor. Specifically, question 65 asked: "Another possibility is the addition of a commercial marketplace, with shops, restaurants, and hotels included at the project site. If the project were expanded to include commercial establishments, how many more times, if any, do you think you would visit each year?" Analysts incorporated responses from this question into the travel cost methodology to calculate total economic benefit and average benefit per visit based on claimed visitation to the Pearl River recreation corridor when that facility included a commercial marketplace.

Distance Zone Use Estimate: Commercial Marketplace		
Zone (Miles)	Annual Visitors	Percent Dist. Of Visitors
0-25	338	51.1%
26-50	41	6.2
51-75	58	8.8
76-100	123	18.6
101-120	102	15.4
Total	662	100

Per capita usage and per capita visitation by zone were determined in the same manner used for the regional travel cost model. The only difference was the population was no longer 800 for each zone, but was based on the number of people responding to the survey who lived in each zone.

Per Capita Use by Zone			
Zone	Annual Visitors	Population	Per Capita Use By Zone
0-25	338	400	.85
26-50	41	46	.89
51-75	58	76	.76
76-100	123	155	.79
101-120	102	123	.83

Per Capita Visit by Zone			
Zone	Annual Visitors	Population	Per Capita *Visit* By Zone
0-25	8,653	400	21.63
26-50	1,123	46	24.42
51-75	1,583	76	20.83
76-100	1,587	155	10.24
101-120	877	123	7.13

Total visitation by zone was then determined by multiplying population per zone by per capita visit per zone.

Derivation of Expected Visitation

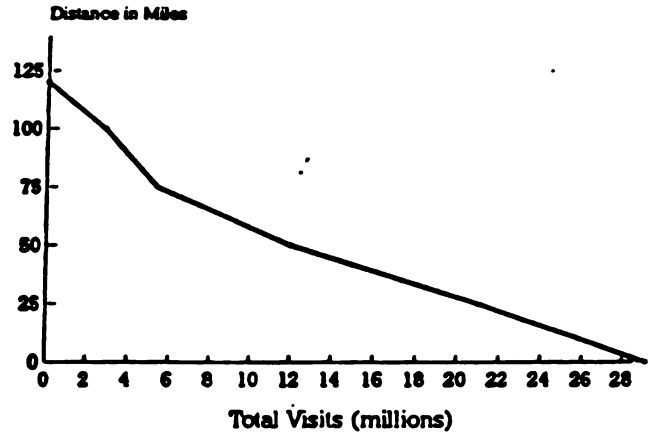
Zone	Counties	Population	Visits Per Capita	Visits For Market
0-25	3	399,155	21.63	8,634,521
26-50	7	181,849	24.42	4,441,069
51-75	18	253,144	20.83	5,274,055
76-100	24	688,332	10.24	7,046,299
101-120	21	524,104	7.13	3,737,756
Total	-	-	-	29,133,701

"Second stage day use demand schedule" is then calculated in the same manner as before.

Second Stage Day Use Demand Schedule						
Added Miles	Visits By Origin					Total Visits
	1	2	3	4	5	
0	8,634,521	4,441,069	5,274,055	7,046,299	3,737,756	29,133,701
25	9,748,059	3,788,680	2,591,378	4,908,982	0	21,037,100
50	8,316,079	1,861,547	1,805,349	0	0	11,982,975
75	4,086,060	1,296,894	0	0	0	5,382,953
100	2,846,657	0	0	0	0	2,846,657
120	0	0	0	0	0	0

The numbers from the first and last column of the preceding table, added miles and total visits, are then used to plot the "second stage day use demand curve." The area under the curve is the visitors' consumer surplus, or the amount they would be willing to pay but do not have to pay to use the recreation corridor.

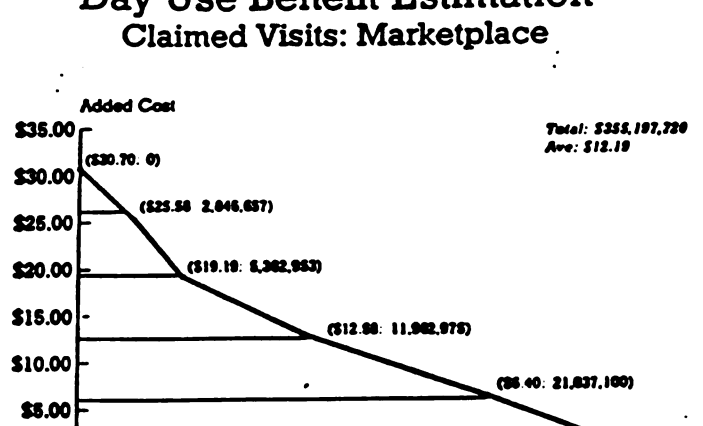
Second Stage Demand Curve
Claimed Visits: Marketplace



Next, distance is converted to cost using the same formulas as before. Total cost is the sum of vehicle costs per person and the time cost of travel. Since distances have not changed, the figures in the following table are the same as those in the preceding section.

Travel Cost				
Increments (Miles)	Roundtrip Mileage	Time Cost Of Travel ($)	Vehicle Cost Per Person ($)	Total Cost
25	50	$2.40	$4.00	$6.40
50	100	4.79	8.00	12.79
75	150	7.19	12.00	19.19
100	200	9.58	16.00	25.58
120	240	11.50	19.20	30.70

The total cost figures above are then used to plot the "day use benefit estimation" graph. The following graph substitutes cost for distance and determines the relationship between cost and total visits. Total benefit is the area under the demand curve.



As indicated in the preceding graph, total annual benefit using the claimed visitation model for the Pearl River recreation corridor with inclusion of a commercial marketplace is $355,197,720, and average benefit per visit is $12.19. Since the survey did not examine current visitation patterns to existing commercial marketplaces, analysts did not construct a weighted demand curve in this instance.

M. Summary of Travel Cost for the Pearl River Recreational Corridor with Impoundment and with a Commercial Marketplace

The benefit that would be achieved from adding an impoundment to the Pearl River recreation corridor was determined from responses to question 64, which read: "The project site could also include an impoundment, or dam, which would insure that one section of the river has a steady water level. An impoundment would create opportunities for various boating and fishing activities. If an impoundment were included, how many more times per year, if any, do you think you would visit the project site?"

Analysts incorporated responses from this question into the travel cost model to calculate total economic benefit and average benefit per visit based on claimed visitation to the Pearl River recreation corridor when that facility included a steady wa Total annual benefit using the travel cost model for claimed visitation to the Pearl River recreation corridor with an impoundment was $263,547,135 and average benefit per visit was $12.22.

In order to provide a more realistic estimate of total benefit for the Pearl River recreation corridor with an impoundment, analysts used a weighting system that gave three times more importance to actual visitation of regional recreational facilities (as determined using the travel cost model for regional recreation

facilities) than to claimed visitation of recreational facilities, including an impoundment, constructed along the Pearl River recreation corridor. Using this weighting system, total annual benefit for the Pearl River recreation corridor with an impoundment was estimated at $80,280,392 and average benefit per visit at $9.40.

The benefit that would be achieved from adding a commercial marketplace to the Pearl River recreation corridor was determined from responses to question 65, which read: "Another possibility is the addition of a commercial marketplace with shops, restaurants, and hotels included at the project site. If the project were expanded to include commercial establishments, how many more times, if any, do you think you would visit each year?"

Analysts incorporated responses from this question into the travel cost model to calculate total economic benefit and average benefit per visit based on claimed visitation to the Pearl River recreation corridor when that facility included a commercial marketplace. Total annual benefit using the travel cost model for claimed visitation to the Pearl River recreation corridor with a commercial marketplace was $355,197,720 and average benefit per visit was $12.19. Since the survey did not examined current visitation patterns to existing commercial marketplaces, analysts did not construct a weighted demand curve in this instance.

N. Existing Recreation Facilities

When comparing the proposed facilities and activities for the Pearl River corridor to those available within the 120 mile study area and in particular within the tri-county study area, the uniqueness of this proposed facility is readily apparent.

First the size of the recreation facility sets it apart. This is particularly important because of the juxtaposition to the Jackson metropolitan area. While several facilities may share recreation elements such as picnic tables, shelter buildings, comfort facilities, and necessary support facilities such as parking, lighting, etc., no other facility comes close to comparing with the 29.5 miles of continuous and separate trails for both jogging and bicycling. Within this 29.5 miles of proposed trails there is only one pedestrian/vehicular conflict where the trail crosses old Highway 49 within one mile of the terminus.

With the base facility projections for annual visitation estimated at 6,266,895, the recreation corridor and its supporting facilities are obviously going to fill a large unmet need within the study area.

The City of Jackson does have limited similar facilities. There are a total of 10 jogging/walking trails at various parks over the City of Jackson varying in length from 1/3 mile to 1 mile in length. There are no visitation numbers available for these facilities. In addition, the Downtown YMCA has a 1 mile track immediately adjacent to the Fairgrounds levee segment. The members of the YMCA also utilize the approximately 1.25 miles of existing levee as a trail. The City of Madison also has a 1 mile jogging trail.

The Ross Barnett Reservoir has a trail which is approximately 3 miles in length and is partially dedicated to pedestrian use. The trail alternates operating space with several vehicular streets and must cross numerous streets along its length. In addition, pedestrians must share the trail with bicyclists.

Visitation figures for Mississippi and Federal recreation facilities in the study area are for total visits to each park or recreation area. Other figures for individual facility use within each park is not available. These visitation figures show the relative interest in recreation at similar facilities and may be compared to the projected activity occasions of the recreation corridor of 6.27 million. The total annual visitation for the recreation corridor with an impoundment was estimated at 8.54 million annually.

The visitation totals for state and federal areas are as follows:

STATE PARK	1991 ANNUAL VISITATION[1]
Roosevelt	239,779
Holmes County	43,040
Paul B. Johnson	331,512
Percy Quinn	1,035,899
John Kyle	354,725
LeFleur's Bluff	322,131
George Cossar	268,089
Hugh White	159,472
Clarko	89,913
Leroy Percy	43,304
Legion	31,099
Naniah Waiya	16,792
Natchez	21,868
Great River Road	17,627
Florewood	23,148
Golden Memorial	8,618
Casey Jones	6,038

FEDERAL PARK	1991 ANNUAL VISITATION[2]
Enid Lake	1,431,485
Grenada Lake	3,556,069
Vicksburg National Military Park	910,493[3]

O. Recreation Needs

Recreation demand is generally measured against similar existing facilities to prescribe the need for new facilities. This comparison must be gauged against existing usage of these similar facilities to determine if the new facilities will adversely impact their operations. However, in this case no single facility or combination of facilities within the study area is similar enough in nature to the recreation corridor for a direct comparison. This leads to the conclusion that the recreation

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[1]Source: Mississippi Department of Wildlife, Fisheries, and Parks.
[2]Source: U.S. Army Corps of Engineers, Vicksburg District.
[3]1992 Annual Visitation, Source: National Park Service, Vicksburg, Mississippi

corridor, by its implementation, will meet a generally unmet need for this type of facility. This is supported by the estimated 6.27 million activity occasions stated in the demand analysis.

However, there are other ways to express the recreation need for the Pearl River recreation corridor.

The danger of overcrowding and overusing a facility brings about the need to determine the carrying capacities of certain amenities. This determination is necessary to preserve the quality of the recreation experience while offering a broad range of recreation opportunities.

The carrying capacity of a facility is the maximum level of use that can occur at the facility without downgrading the quality of the experience, at either the physical or social levels. Carrying capacity can be derived from observation, or from planning guidelines. Both methods have been incorporated into this study.

Once the capacity of the facility is derived, it can be measured against existing facilities and known demand. Section V of this report: Recreation Demand, Supply, and Needs, gives the derived demand for certain of the proposed facilities. This data has been compared to existing supply by facility across the state. The derivation of the carrying capacities is shown below.

The need for recreation, in this case, may be best stated in terms of the carrying capacity of the facilities as measured against the other known measures of the same type facility. The Mississippi State Comprehensive Outdoor Recreation Plan (SCORP) can be utilized for comparison purposes for key activities.

KEY RECREATION ACTIVITIES:[4]

Jogging, Walking, Hiking Trail:

a. Unit of measure: 1 mile of trail.

b. Participants accommodated: 140.68 persons per hour. (Based on a perceived comfort envelope of 300 square feet per person at a speed of 260 ft. per minute) Formula: Trail width / Perceived comfort envelope x speed or 8'/300 S.F. x 260 ft. per min. = 6.93 persons per minute x 20.3 minutes per mile = 140.68 persons per hour.

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[4]Source: Mississippi State Comprehensive Outdoor Recreation Plan, 1985 and 1990, and Sowashee Creek General Design, Recreation Development Plan, Mobile District, Corps of Engineers, 1990.

c. Daily turnover rate: 4.25 hrs. (3 hours peak usage + (5) 1/4 capacity hours per day = 4.25)

d. Average length of season: 260 days.

Therefore: 140.68 persons per hour x 4.25 hours x 260 days per 1 mile of trail = 155,451 activity occasions per year per mile.

The project contains 29.5 miles of trail which yields a carrying capacity of 4,585,816 activity occasions per year.

The weighted demand curve results in the total claimed visitation to the project of 6,266,895, of which 75%, or 4,700,171 survey respondents participated in this activity. The typical respondent ran, hiked, or jogged thirty times last year. This results in a total of 141,005,130 activity occasions proposed to be met by this facility.

The Mississippi SCORP reflects a statewide demand of 221,100,000 activity occasions for jogging, running or walking for exercise. Therefore, this trail would meet 63.8% of the Mississippi statewide demand. This does not consider the percentage of the respondents which would be coming from outside Mississippi to utilize these facilities.

Bicycling:

a. Unit of measure: 1 mile of trail.

b. Participants accommodated: 52.8 persons per hour. (Based on a perceived comfort envelope of 800 square feet per person (riders 50 feet apart) at a speed of 880 ft. per minute (10 miles/hour). Formula: Trail width / Perceived comfort envelope x speed or 8'/800 S.F. x 880 ft. per min. = 8.8 persons per minute x 6 minutes per mile = 52.8 persons per hour per mile.

c. Daily turnover rate: 4.25 hrs. (3 hours peak usage + (5) 1/4 capacity hours per day = 4.25)

d. Average length of season: 260 days

Therefore: 52.8 persons per hour x 4.25 hours x 260 days / 1 mile of trail = 58,344 activity occasions per year per mile.

Based upon the same 29.5 miles of trails used in calculating the jogging, hiking and walking carrying capacity is utilized in calculating the bicycle use, then the project yields a bicycling carrying capacity of 1,691,976 activity occasions per year.

Of the 6,266,895 visits derived from the weighted visitation, 33% claimed to participate in this activity. This means a participation in bicycling of 2,068,075. The mean response in terms of participation was 10.9 times. This nets 22,542,017 activity occasions. Compared to the state demand of 50,200,000, this facility will supply 44.9% of the statewide demand. Once again, this does not account for the out-of-state visitors.

Picnicking:

a. Unit of measure: 1 picnic site.

b. Participants accommodated: 1 family (3.3 persons) at any one time

c. Daily turnover rate: 0.57.

d. Average length of season: 28 weeks.

e. Weekly use: 4 times.

Formula: 3.3 persons accommodated x 4 times weekly use x 28 weeks per season / 1 picnic site = 369.60 activity occasions per year.

The publication Guidelines for Understanding and Determining Optimum Carrying Capacity, by The Urban Research Development Corp. for the Bureau of Outdoor Recreation (now HCRS) was used in calculating the optimum carrying capacity of the sites as follows:

The total acreage allotted for picnic areas, both on project lands and locally developed lands, was 32.72 acres.

Medium density (13 sites per acre) = 425 sites, or 157,080 activity occasions per year.

The claimed participation for the study area was 50% percent of the total sample of 6,266,895, or 3,133,448. The above formula states that a picnic site will accommodate 3.3 persons at any one time. The mean number of times the respondents went picnicking was 3.3 times. Therefore, the demand in activity occasions within the study area is 3,133,448 x 3.3 / 3.3 = 3,133,448.

Total demand by activity occasion for picnic facilities according to the Mississippi SCORP was 13,900,000. Total supply statewide by activity occasion was 4,185,810. Unmet demand is therefore 9,714,190 activity occasions.

Therefore, providing the medium optimum density to this project would fall short of the project demand by 2,976,368 activity occasions and of the statewide demand by 6,580,742 activity occasions.

Site Amenities

Some facilities and amenities have no published standards for allocation. In these cases, past experience has been used to determine acceptable densities. They are as follows:

Bicycle racks:	2 per parking lot	
	2 per comfort station	
Benches:	4 per comfort station	
	2 per pavilion	
	8 per outdoor classroom	
Grills:	1 for every 2 picnic tables	
Trash receptacles:	1 per pavilion	
	1 for every 4 picnic tables	
	2 per comfort station	
	2 per park center	
	2 per amphitheater (minimum)	
	2 per bank of tennis courts	
	2 per ballfield	
Lighting:	16' poles:	100 feet on center - park trail
	25' poles:	200 feet on center - levee trail (dry side only)
		100 feet on center - parking lots

The conclusion which can be drawn from this analysis is that the facilities proposed for the recreation corridor do not exceed the proven demand as stated within this study, nor do they exceed the demand as stated by the Mississippi SCORP, and they do not compete directly with any existing recreation area or facility because of the unique nature of the proposed recreation corridor.

VI. PLAN OF DEVELOPMENT

A. Design Philosophy and Intent

The Jackson Metropolitan Area flood control project will create a recreation corridor for the Pearl River bounded on both sides by levees or flood walls. The proposals for recreation development will create a pedestrian and water resource linkage from just south of the Barnett Reservoir to Byram and will cross a diverse mixture of land use. The project bisects the Jackson Metropolitan area and parallels in close proximity Interstate 55.

This plan will provide a recreation amenity for both local residents and visitors. A proposed structure would retain water during non-flood conditions to provide a stable pool and would also enhance the aesthetic quality of the flood project area. In addition, the project sponsors realize the potential for this project to enhance the "sense of place" for the entire metropolitan area.

Part of the viability of the recreation plan is its cohesiveness with the flood control improvements. The flood control project will provide a unique opportunity to provide linkages through the metropolitan area which previously have been impossible to attain. The land which will be required to build the levees will provide a low cost opportunity to provide recreation facilities because most of the cost of the land is a sunk cost. This recreation facility could not be built without this infrastructure because the land required to accomplish the recreation corridor development would be impossible to assemble singly for recreation purposes. The City of Jackson has assembled several parcels of land utilized by this plan for recreation development in past efforts to provide recreation along the Pearl River. However, any efforts they, or others, might initiate to provide the linkages attainable by this plan would never be realized without the benefits of the flood control project.

First, the land on which the trail system rests would be subject to such frequent inundation that the trail would be rendered unusable because of increased operations and maintenance cost and the inability to safely utilize the corridor for recreation. In addition, the cost of constructing the trails as a local initiative at an elevation similar to that provided by the flood control project would prove to be prohibitive. Thus, the trail system and support facilities gain much of their benefit or value from the modification of the flood plain. This is because the higher elevations for the trails provided by the flood control project will significantly increase the usability, in terms of activity occasions, and decrease the need for flood related maintenance of the trails.

Assume the trail (without the flood control project) is inundated at elevation 262.0 N.G.V.D., which is slightly above bankfull capacity at the Highway 80 gage. During the period of record (1938-1991), this elevation was exceeded 948 days during the 53 year period. This equates to about an average of 18 days per year. Therefore, over a 20 year period the trail could be expected to be inundated about 360 days. Given this frequency of inundation of the trail system without the protection of the flood control project, recreation will suffer significant loss of usefulness.

For each day of flood inundation means a net annual loss for jogging, walking and hiking alone of 9,761,886 activity occasions (141,005,130 annual projected activity occasions for jogging, walking and hiking divided by 260 days per year times 18 events). The travel cost methodology utilized in this study (see Appendix B) to project recreation demand shows that the proposed recreation development will generate an average benefit of $8.26 per visit. This will mean a net loss of $1,612,663,567 over a 20 year period.

While the flood control project is being built to specifically benefit the local residents, the recreation project, because of the uniqueness of the area it traverses and the unmatched recreational opportunities which it presents, make it a regional facility drawing participants from a much wider base. As shown in Section V.G - Visitation of Proposed Recreational Enhancements to the Pearl River Flood Control Corridor, the area outside the tri-county area provided a mean response of 6.9 visits and a median response of 2 times compared to mean and median responses of 13.6 and 5 times for households in the tri-county area. Thus the benefit will be realized over a much broader basis and provide a regional focus for the recreation development.

This uniqueness includes many opportunities for the local communities and citizens to sponsor activities, such as running events, which will take advantage of the facility's one-of-a-kind nature. This increased circle of use extents to clubs for jogging, running, bicycling, volksmarching, bird watching, and walking.

It is also unlikely that eminent domain procedures would be initiated by local governments to acquire land solely for recreation development. This is particularly evident when viewed in the light of the fact that the recreation development will pass through parts of two counties and four municipalities. In addition, the likelihood of acquiring local and private legislation to facilitate recreational operation and maintenance requirements is much stronger because of the cohesive nature of the flood control project.

In addition to overcoming the difficulties of land acquisition and construction solely for recreation development, the cost of wetlands mitigation must also be added should the recreation be

developed without benefit of the flood control project. The flood control project not only helps in overcoming the difficulties of land acquisition and costs of construction, operation and maintenance, it will also help make the recreation facilities a reality by assisting in the cost of mitigating the cost impacted by such a facility. If the recreation project was to be constructed by local initiative, all of the mitigative cost would have to be borne by the local authorities. By having most of the facilities on project lands, mitigation efforts will be cost shared and local costs reduced to a point of being manageable.

The Paseo del Rio in San Antonio, Texas, Chattanooga River Park, Chattanooga, Tennessee, and Town Lake Park in Austin, Texas, served as examples to create a foundation for future development which focuses upon the river as a natural resource and recreational amenity as well as the mainstay which relates these activities to increased commercial growth.

Discussions of recreation development proposals for each levee segment are as follows:

B. Reach #1: Northeast Jackson Levee

The northernmost terminus of the trail system (see Exhibit VI) will be located in the vicinity of the Westbrook Road property presently owned by the City of Jackson. This property on the dry side of the levee lies almost completely within the ponding area required for Purple, White Oak, and Hanging Moss Creeks. Westbrook Road Park (see Exhibit IX) will consist of an access road running north along the dry side of the levee, parking for 240 cars, a comfort station, picnic facilities for both family and group picnicking, and an access point to the main levee trail. Additional land will be required to provide access to this park. There will also be an internal park trail system connecting the various elements of the park.

Active recreation areas in the park include a fishing pier at the small lake on the northern end of the property, and an open play field. All of these activities will lie on the dry side of the levee.

There will be two occasions for crossing the levee; to gain access to the main trail system, and to access the wet side of the levee. The wet side will be home to an interpretive trail system, a small educational amphitheater, a boardwalk, and a canoe and tube drop-off and pick-up area. These developments will be designed for minimum impact on this environmentally sensitive area.

Base plan amenities to be located at this site include:

ITEM	QUANTITY
Picnic Table	74
BBQ Grill	37
Playground	1
Trash Receptacle	28
Bench	14
Bicycle Rack	4
Picnic Pavilion	5
Parking (no. of cars)	240

The Westbrook Road Park site will be enhanced greatly by the proposed development of the Avery property and other property to the north by the City of Jackson. In order to provide additional public access directly from Old Canton Road to the terminus of the trail system, the city should acquire and develop this property. This will help to minimize traffic in residential areas for access to the park. In addition, the property is planned to be utilized for active recreation uses.

Immediately south of the Westbrook residence at the end of Westbrook Road is a tract of 16th section school land. The portion on the Hinds County side of the river contains mature and varied species of trees and other vegetation and is accessible for recreation/education purposes. Facilities proposed for this site include car and bus parking, access to the wet side of the levee where trails will connect an outdoor classroom with interpretive center and exhibits.

The next recreation node moving downstream from Westbrook Road is the old sewage lagoon site. This area is proposed for waterfowl observation from the trail as well as interpretative activities associated with regenerative aspects of the natural environment.

The Lakeland Drive Park will utilize the land between the Pearl River bridge and the relief bridge on Lakeland Drive. Pedestrian access must be accomplished to coincide with the widening of Lakeland Drive by the Mississippi Department of Transportation in order for this park to succeed. Otherwise an independent bridge will have to be constructed over the Pearl River and the relief bridge in order to safely connect the trails on both sides of the river. This is the northernmost opportunity for this to occur.

Lakeland Drive Park (see Exhibit X) will contain ample parking for public access to the trail system. In addition, a boat launch is to be provided for access to the river above the low head dam at the Jackson water treatment plant. Access from the portion of the site north of Lakeland Drive to the south parcel of the site may be accomplished for both pedestrians and vehicles under the Highway 25 bridge. This road and trail will be subject

to periodic inundation. Other facilities and activities will include parking, group picnic pavilions, an internal trail, an amphitheater, and a comfort station.

The Lakeland Drive Park, because of its good access and central location, should receive high utilization for access to the trail system. In addition, most of the site is above all but the largest floods. The amount of parking and support facilities should adequately support events such as running events and small festivals.

Base plan amenities to be located at this site include:

ITEM	QUANTITY
Picnic Table	67
BBQ Grill	19
Ballfield	1
Playground	1
Trash Receptacle	27
Bench	8
Bicycle Rack	8
Picnic Pavilion	2
Parking (no. of cars)	260

The trail system south and west of Lakeland Drive Park will utilize a special section to mesh with the proposed flood wall. The flood wall is necessary to not displace the businesses in the area. In order to provide sufficient room for both pedestrian and bicycle trails, a trail system must be built above the lake and wetlands immediately behind the flood wall. Here again this trail section will be subject to periodic inundation.

The next area the trail will pass through is LeFleur's Bluff State Park. This will provide an excellent opportunity to tie the opportunities of the state park with the corridor recreation. The park contains camping, day use activities, golf, nature trail, tennis, comfort station, camp store, and parking. As the trail crosses Eubanks creek, the levee ties into high ground in the park and the trail is proposed, at local cost, to continue at the base of the bluffs in the park and connect to the next reach at the existing Fairgrounds levee.

This lower end of this levee reach also has proposed a bridge to cross the Pearl River to connect users to the east side of the river. The location of this bridge is in the area of the Jackson water treatment plant (see Exhibit VII) on land owned on both sides of the river by the City of Jackson. This crossing is important for several reasons. It will provide an intermediate turning point for users not desiring to utilize the entire length of the trail. It will aid greatly in the maintenance and security aspects of the system by providing an intermediate crossing. In addition, the water treatment plant, following it

replacement, may be utilized as a historic public interest point. The site may also be utilized as a public access point to the recreation corridor.

Another potential recreation point exist at the point the abandoned railroad corridor crosses Airport Road. This could be an important terminus if a trail is extended along the abandoned railroad right-of-way. Additional investigations will be necessary to determine the feasibility of this corridor extension.

C. Reach #2: Flowood Levee

The terminus park for the east side of the corridor (see Exhibit VI) is the Lakeland Drive Corridor Park. This park is a large multi-use recreation complex located in the proposed ponding area behind Jackson Prep School. The complex is to contain multi-purpose sports fields, baseball fields, tennis courts, group picnic facilities, comfort stations, a lake on the dry side of the levee and trails which connect the facilities with the land on the wet side of the levee and the river itself as well as other passive uses. This area encompasses land from Hog Creek on the east to Mississippi Wholesale Furniture Co. on the west.

The layout of the park as shown on Exhibit X is designed to utilize lands in the ponding area which are already disturbed for active uses and maintain the remaining wetlands for passive park uses.

Base plan amenities to be located at this site include:

ITEM	QUANTITY
Picnic Table	57
BBQ Grill	29
Ballfield	12
Playground	2
Trash Receptacle	58
Bench	22
Bicycle Rack	20
Picnic Pavilion	3
Parking (no. of cars)	900

The trails will continue from this park to the south by crossing under the Lakeland Drive bridge. The land immediately south of the bridge can be used for additional trail development and a small amount of parking. The trails then continue south on the levee to the point where they connect with reach #4, the Existing East Jackson Levee.

D. Reach #3: Existing Fairgrounds Levee

The trail will utilize the existing levee (see Exhibit VII) where possible. The levee from Fortification Street to Pearl Street is proposed to be utilized as the base for the connector road to access the High Street crossing of the Pearl River which will extend to the airport in Rankin County. This project is proposed by the Mississippi Department of Transportation and construction is anticipated within the next 5 to 6 years. Therefore the trail will have to utilize the wet side of the levee to avoid the streets as well as pass under the new bridge. Current plans for the bridge do not include any provisions for pedestrian crossings. The recreation plan must place a priority on the provision for access from both sides of the river for pedestrians and bicyclists. Access will need to be provided within this area for the YMCA.

South of Pearl Street the trail will pass under the Interstate 55 bridge and move back to the top of the levee. At the point the levee reaches high ground at the City of Jackson maintenance site there is a major recreation/commercial/entertainment center complex proposed.

The city barn site is proposed for removal by the City of Jackson to accommodate the floodway of the river. This site can be utilized for passive recreation activities such as picnicking with the provision of several group picnic pavilions. However, the main feature of this site which will be a locally sponsored project is the "Meadow" which is to be a large open, bowl shaped area in the northwest corner of the site. Because the area is in a floodway, a temporary movable stage can be utilized to provide for entertainment during festivals and activities such as "Jubilee Jam", the "Red Beans and Rice Festival" or others.

The backdrop for the "Meadow" will be the Pearl River and the stable water pool created by the inflatable dam located below the Old Brandon Road bridge approximately 400 feet downstream.

Since the primary purpose of the improvements to the Pearl River is flood control, this dam, which is proposed for recreational purposes is one which can be fully deflated when dewatering of the river is required. The dam is to be operated in stages of inflation for intermediate or normal conditions. An inflatable bladder structure will provide lower construction costs and lower long term operating costs. The pool of water created by the dam will vary in depth from approximately 10 feet at the dam to an increase of one inch at the low head dam at the Jackson water treatment plant. This recreational pool may be used for boating and other water related recreation purposes. Should water quality become questionable, the dam may be deflated and re-inflated to recharge the pool with fresh water. Total deflation of the dam (air filled) is projected to occur in

approximately 30 minutes. Section V, (I) gives additional details concerning this design feature which will be a locally sponsored project.

Another recreation possibility which exist with the construction of the dam is provision of a canoe/kayak chute around the structure. This would allow users to experience a limited amount of swift water which would fall approximately 10 feet over a distance of 300 feet.

Officials with the Town of Flowood have expressed a desire to close the Old Brandon Road Bridge following the construction of the new bridge at High Street. This will allow the use of the bridge for pedestrian and bicycle use and will serve as the southern most connection of the trails on both sides of the river.

The recreation/commercial/entertainment center complex (see Exhibit XI & XIX) proposed adjacent to the river between Jefferson and Commerce Street would provide entertainment activities, dining, and shopping for visitors. None of the developmental suggestions for this center are proposed for cost sharing. This concept was explored in the demand analysis portion of the economic investigations and was shown to potentially receive a large number of visitors and equally great economic benefit for the Jackson Metropolitan area. The area currently is being utilized for commercial activities, such as automobile repair shops, which could easily be relocated into a more industrial area.

The significance of this area is that this site is the only location adjacent to downtown and its support facilities, following completion of the levees, whereby a visitor can overlook the river from a shop, restaurant or other entertainment activity. The existing businesses in the area will have to be evaluated as to their willingness to relocate or their desire to remain in the area. Several older large buildings do exist in the area which have potential for adaptive reuse. In addition, the rail which run through the site could be used for a trolly system to connect the district to other activity areas in the metropolitan area. The implementation of the recreation/commercial/entertainment center complex will require the participation of the Jackson Redevelopment Authority.

E. Reach #4: Existing East Jackson Levee

The trail along the Existing East Jackson Levee (see Exhibit VII) is proposed to connect to the west levee trail at the Old Brandon Road bridge. Public access to the trail will be provided with limited parking adjacent to Old Brandon Road and through a connection to Crystal Lake Park by a pedestrian bridge over the

old river channel. Crystal Lake Park, developed by the Town of Flowood, (see Exhibit XI) presently has comfort facilities and parking which can be utilized by this connection.

Additional access parks are proposed at Richland Creek Park adjacent to Highway 49 and Old Highway 49 Park. Both of the parks will provide parking and a limited amount of support facilities. The trail crossing at Old Highway 49 is the only point on the proposed trail system where the trail will make a grade crossing of the road. There in not a feasible location to take the trail under the road.

Base plan amenities to be located at Richland Creek Park include:

ITEM	QUANTITY
Picnic Table	12
BBQ Grill	6
Trash Receptacle	5
Bench	4
Bicycle Rack	1
Parking (no. of cars)	116

Base plan amenities to be located at Old Highway 49 Park include:

ITEM	QUANTITY
Picnic Table	26
BBQ Grill	13
Ballfield	3
Playground	1
Trash Receptacle	14
Bench	4
Bicycle Rack	4
Parking (no. of cars)	154

Another site with potential for development lies between the Pearl River and the intersection of Interstates 20 and 55. The site is currently underutilized and could be made into a significant commercial recreation site or other mixed commercial and residential use. The proposed trail will be adjacent to this site. The visibility of this site and access to the recreation corridor could greatly enhance the overall economic viability of a mixed use development.

F. Reach #5: South Jackson Levee

Immediately south of the commercial center and Old Brandon Road is Town Creek (see Exhibit VII) . This creek is suitable for development as a trail extension into the edge of the downtown area at the municipal auditorium. At that point Town Creek goes underground through a tunnel. However, this point of entry is close to a large number of office buildings which could utilize the link along the creek to access the trail system on the

levees. The character and typical cross section of areas of Town Creek (see Exhibit XIX) are similar to the Paseo del Rio in San Antonio, Texas. This project would be locally sponsored.

As the trail continues south, it passes under the I-55 and I-20 bridge and returns to the top of the levee as soon as possible. This section of trail leads to another possible trail connection which may connect the corridor to Battlefield Park utilizing Lynch Creek. Once again, this locally sponsored project will need additional investigations.

Another public access is proposed at the intersection of McDowell Road and Gallatin Street (see Exhibit XII) adjacent to the city pistol range. This park will provide for parking and a limited amount of support facilities such as picnic tables and a comfort station.

Base plan amenities to be located at this site include:

ITEM	QUANTITY
Picnic Table	22
BBQ Grill	11
Playground	1
Trash Receptacle	8
Bench	8
Bicycle Rack	4
Picnic Pavilion	2
Parking (no. of cars)	65

As the trail proceeds south, the levee is tied into high ground below the pistol range and the trail must proceed along the flood plain.

G. Reach #6: South Jackson Levee

The trail picks up the levee system once again between McDowell Road and Savannah Street (see Exhibit VIII) and follows the western edge of the Jackson wastewater treatment plant. South of the plant, the levee turns into high ground once again below Caney Creek and the trail utilizes City of Jackson's Elton Road property. This 1,100 acre parcel is the largest site available for recreation on the corridor. However the entire site is in the floodway, the flood plain and/or wetlands. Limited active and passive uses are proposed because of these factors and the parcel's remoteness.

The proposed recreation uses for the Elton Road property include primitive camping, parking, boat launch, comfort station, an archery range, a ropes course and a paintball course. The park is proposed to have controlled access with an entry point building and be locked after normal hours. The trail continues

through the Elton Road property to the point where it parallels the railroad right-of-way and eventually connects to the Byram levee.

H. Reach #7: Byram Levee

The Byram Road park (see Exhibit XVI) utilizes land on both sides of the river for recreation and focuses on the historic swinging bridge. This park is the southern terminus for the trails system. The park is proposed to contain parking, comfort station and a limited amount of support facilities.

Base plan amenities to be located at this site include:

ITEM	QUANTITY
Picnic Table	9
BBQ Grill	5
Playground	1
Trash Receptacle	4
Bench	4
Bicycle Rack	4
Parking (no. of cars)	25

I. Proposed Water Impoundment

One of the features proposed within the river corridor is a water impoundment within the top bank of the Pearl River that would be a part of the expanded river corridor development. Neel-Schaffer, Inc., Engineers, Jackson, Mississippi prepared the following assessment of this type impoundment. No site specific surveys, soil borings or design analysis has been made. The objective of this impoundment was to create an 8' to 12' pool within the river that would extend from a location below Old Brandon Road (Woodrow Wilson Bridge) up-river to the low head dam at the City of Jackson water intake tower.

The data used to make this assessment consists of quad maps of the area, surveys prepared in 1991 by Waggoner Engineering for the Corps of Engineers Hydrologic Engineering Center, HEC-2 Water Surface Profile, Generalized Computer Program. This HEC-2 model utilizes the surveys that were obtained from the Corps of Engineers and is the model used by Neel-Schaffer, Inc. for the City of Jackson. It should be noted that some variation exists in the Waggoner surveyed cross sections and the HEC-2 model cross sections.

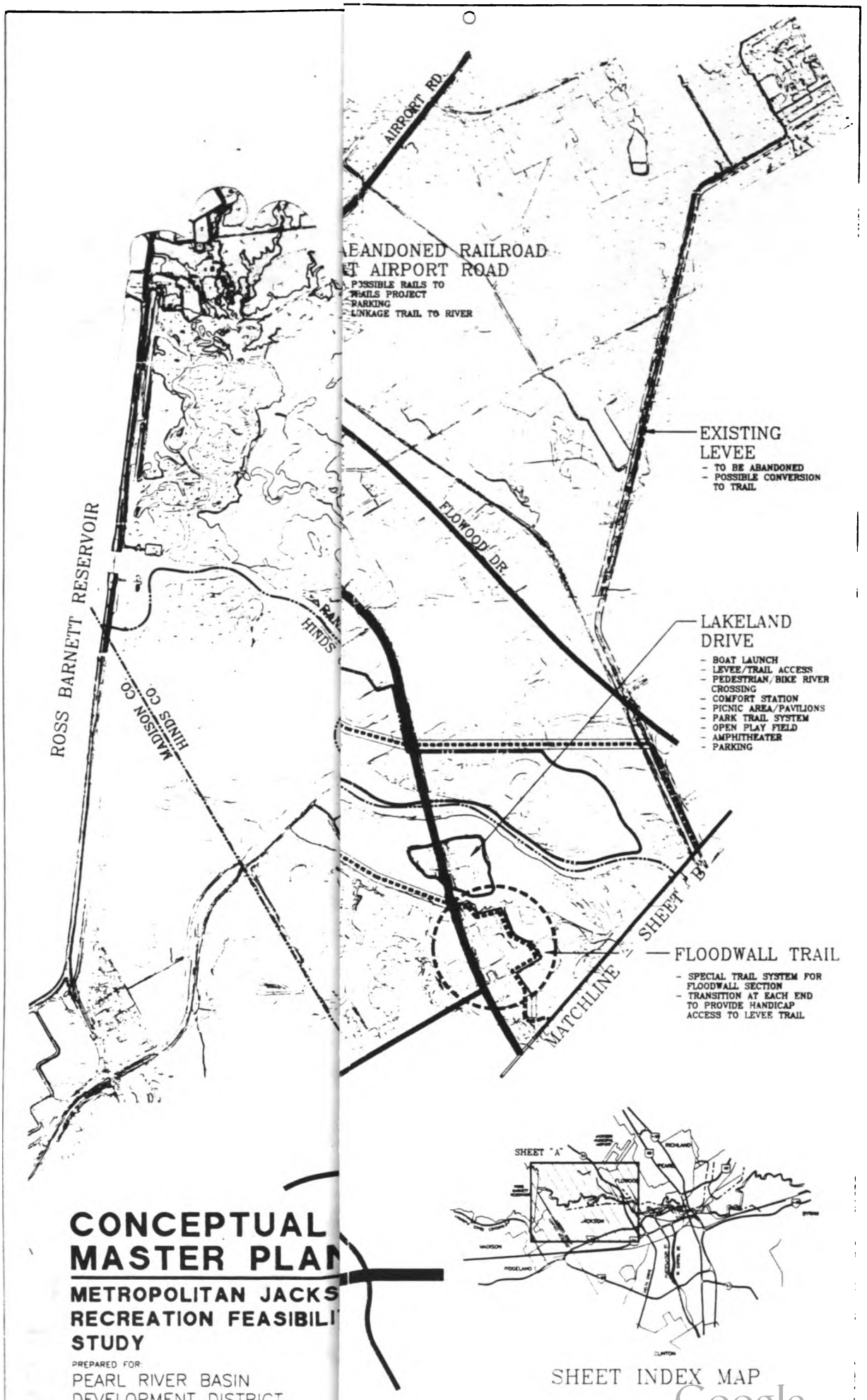
Two types of structures were considered to create this impoundment. One was an inflatable rubber dam (see Exhibit XX) and another was a rigid drop structure or weir. Since the rubber dam is completely deflatable, it would have no effect on the hydraulics of the river system at higher river stages when the dam in its deflated position. The rigid drop structure would

remove some of the existing flow area of the channel section. The HEC-2 model was used to determine the effect of this rigid structure. The location of the structure was placed at River Mile 287.328 with the drop structure weir at elevation 242. The peak discharge from various frequencies ranged from Q_2 = 26,800 to Q_{100} = 106,000. Some increase in stages occurred for flows below 10,000 cfs; however, the computer model did not reveal any difference in flood stages due to this rigid structure for floods above 10,000 cfs. All flow is contained within the proposed City of Jackson levee system with the structure in place.

Both the HEC-2 model surveys and the surveys prepared by Waggoner Engineering were reviewed to determine an average width of channel upstream and downstream of the proposed structure location at River Mile 287.328. A structure width of 140' bottom width and channel top bank elevation 255 was selected. The existing average channel bottom is elevation 234 and the structure weir that was studied has a crest elevation of 242. With more detail surveys and study, it may be probable that the weir could be raised several feet. Increased weir depth of the inflatable dam can be accomplished without significant hydraulic effects. Based on very preliminary data, it is estimated that the rigid drop structure would cost approximately $2,000,000. The major advantage of the concrete structure would be durability and long life together with low maintenance. A stepped trajectory weir would provide pleasing aesthetics for the structure.

The disadvantage of the rigid structure is a reduced flow area for discharge below 10,000 cfs. This type of structure would also require considerable energy dissipation due to the overfall. A rigid structure could also present public relations problems due to constructing a blockage in the river flow area.

Based on data obtained from inflatable dam suppliers of previous projects, is estimated that this type structure could be installed for approximately $1,250.000. The advantage of this type structure is that there is no effect on the hydraulics of the present river system. The pool depth can be varied as required and pool depths up to 12' may be easily designed with only a moderate increase in cost. These structures have been used both in the United States and worldwide. Approximately 100 structures have been constructed in the United States and 1,500 structures have been constructed worldwide. The major disadvantages of the inflatable dam are the expected life and increased maintenance. The expected life to the inflatable bag is 30 years and it can be replaced based on today's prices for approximately $350,000. The rubber bag can have holes easily patched; however, long cuts would require the bag be removed and vulcanized. Ceramic coatings are available that greatly reduce the risk for cuts in the bag.



CONCEPTUAL MASTER PLAN

METROPOLITAN JACKSON RECREATION FEASIBILITY STUDY

PREPARED FOR:
PEARL RIVER BASIN DEVELOPMENT DISTRICT
SEPTEMBER, 1992

EXHIBIT VI

SHEET INDEX MAP

CASEY'S LANE
- BOARDWALK
- LAKE ACCESS
- PARK TRAIL SYSTEM
- WATERFOWL OBSERVATION AREA
- RECLAMATION PROJECT

CONNECTOR TRAIL
- THIS PORTION OF TRAIL IS LOCATED WITHIN THE AREA PROTECTED BY THE LEVEE DEVELOPMENT. PORTIONS OF THIS TRAIL WOULD BE INUNDATED PERIODICALLY.
- RIVER CROSSING
- TRAIL

LEFLEUR'S BLUFF STATE PARK
- COORDINATE WITH STATE DEPARTMENT OF WILDLIFE, FISHERIES, AND PARKS TO DEVELOP LEVEE TRAIL ACCESS THROUGH PARK.
- TIE IN TO EXISTING NATURE TRAIL AT RIVERSIDE PARK

NEW RICHLAND LEVEE

FLOWOOD DR.

RANKIN CO.
HINDS CO.

MATCHLINE "SHEET "C"

MATCHLINE "SHEET "

LAKELAND DR.

McDOWELL RD.

I-55

CONNECTOR TRAIL
- NECESSARY DUE TO BREAK IN LEVEE SYSTEM. COULD BE LOCATED WITHIN OR NEAR RAILROAD RIGHT OF WAY

NORTH

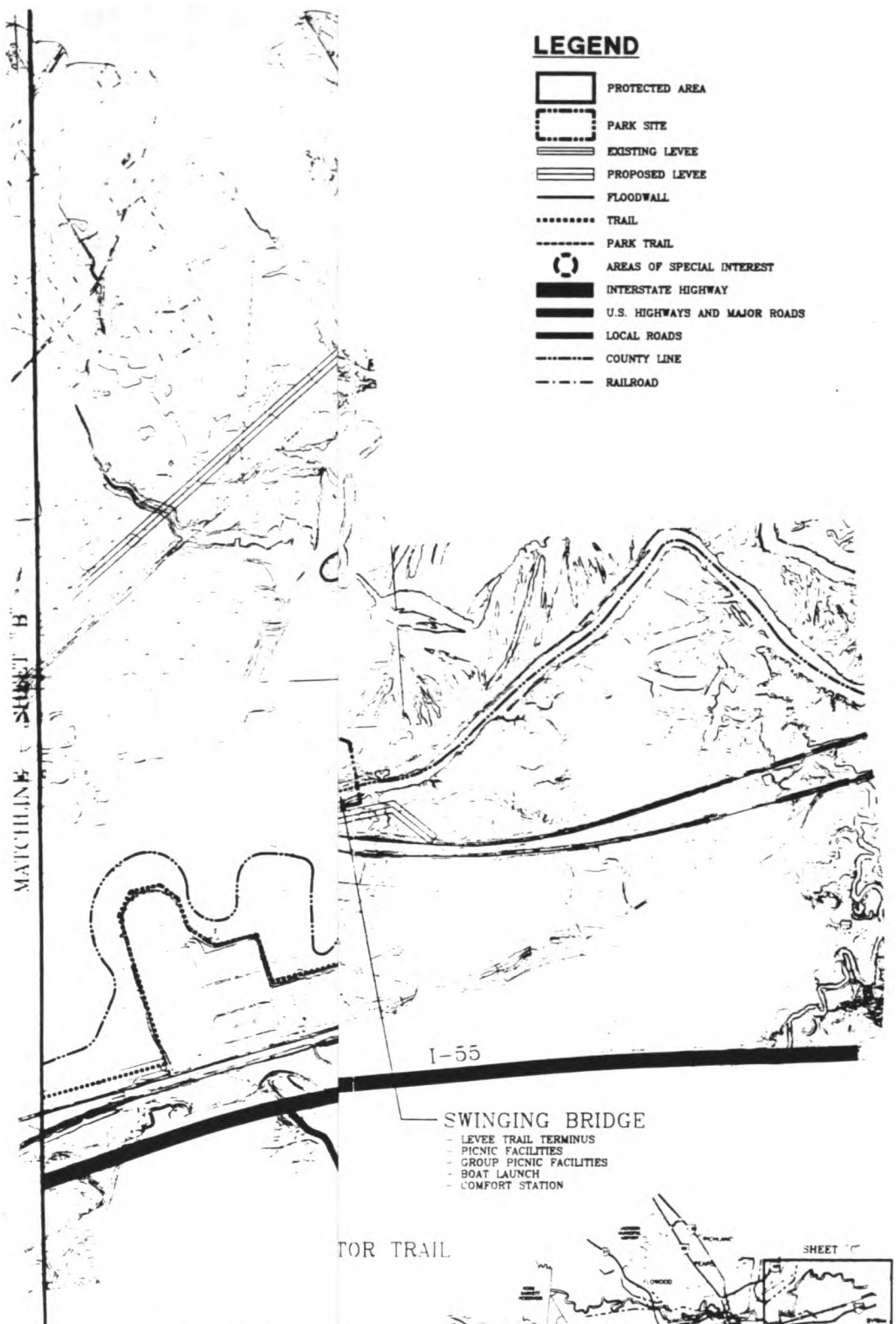
0 1000' 2000' 3000'
SCALE IN FEET

PREPARED BY:
Weatherford McDade, Ltd.
PLANNING CONSULTANTS - LANDSCAPE ARCHITECTS

PREPARED FOR:
PEARL RIVER BASIN DEVELOPMENT DISTRICT
SEPTEMBER 1992

D PARK

EXHIBIT VII



CONCEPTUAL MASTER PLAN

METROPOLITAN JACKSON RECREATION FEASIBILITY STUDY

SHEET INDEX MAP

CONCEPT
SITE PLA

METROPOLITAN
RECREATION FE
STUDY

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DEVELOPMENT DISTR
SEPTEMBER, 1992

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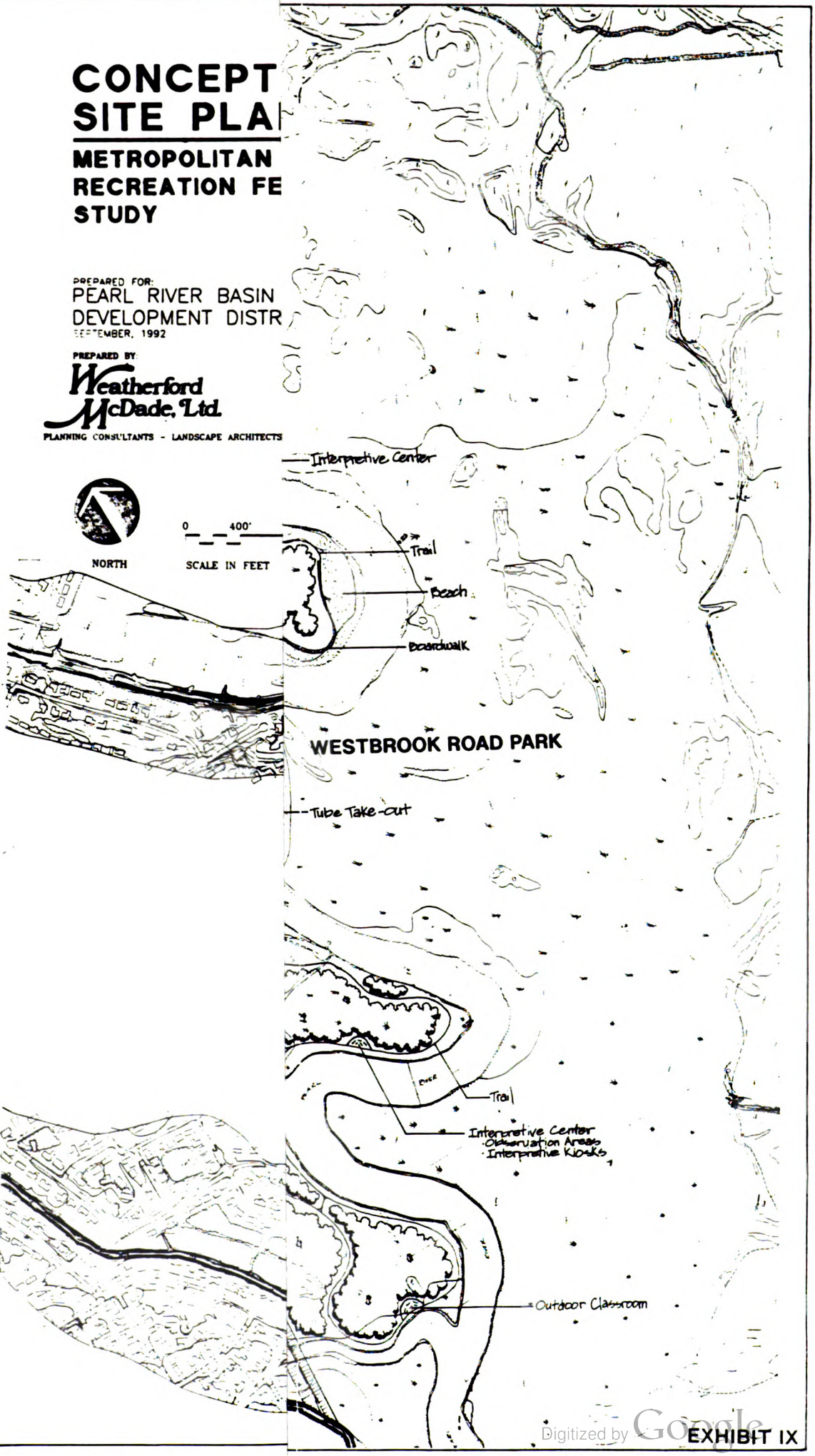
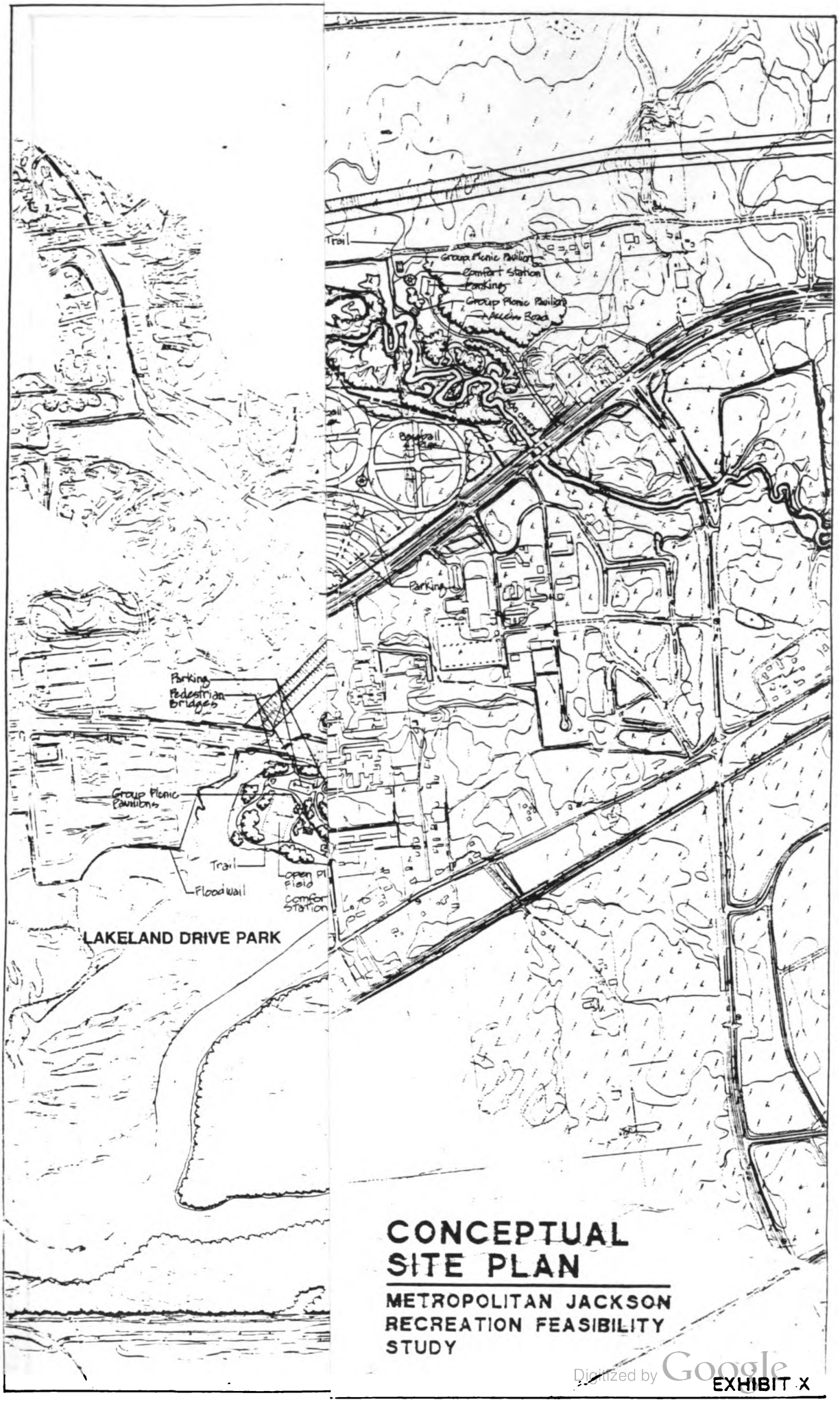


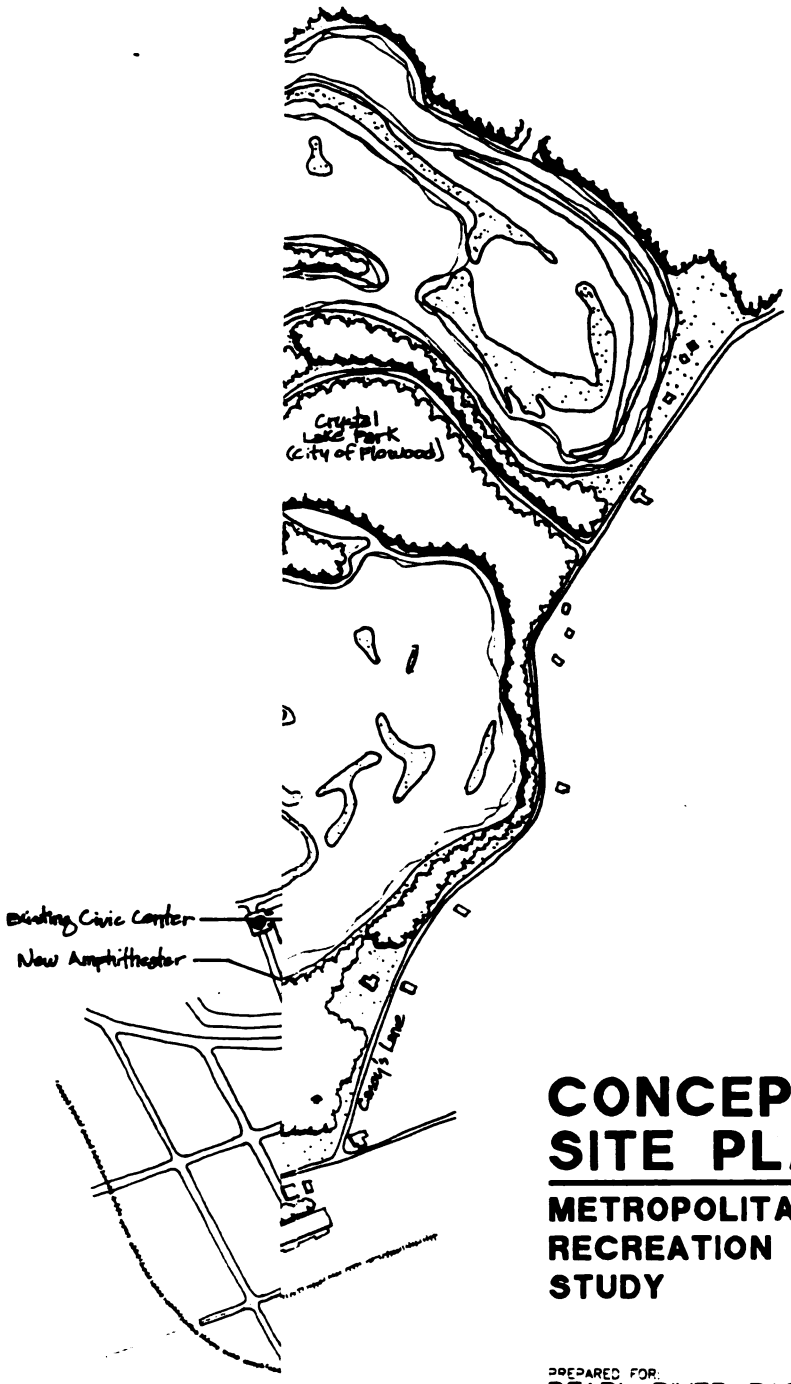
EXHIBIT IX



CONCEPTUAL SITE PLAN

METROPOLITAN JACKSON RECREATION FEASIBILITY STUDY

EXHIBIT X



CONCEPTUAL SITE PLAN

METROPOLITAN JACKSON RECREATION FEASIBILITY STUDY

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PEARL RIVER BASIN DEVELOPMENT DISTRICT
SEPTEMBER, 1992

PREPARED BY:
Weatherford McDade, Ltd.
PLANNING CONSULTANTS - LANDSCAPE ARCHITECTS

NORTH

0 400 800 1200
SCALE IN FEET

EXHIBIT XI

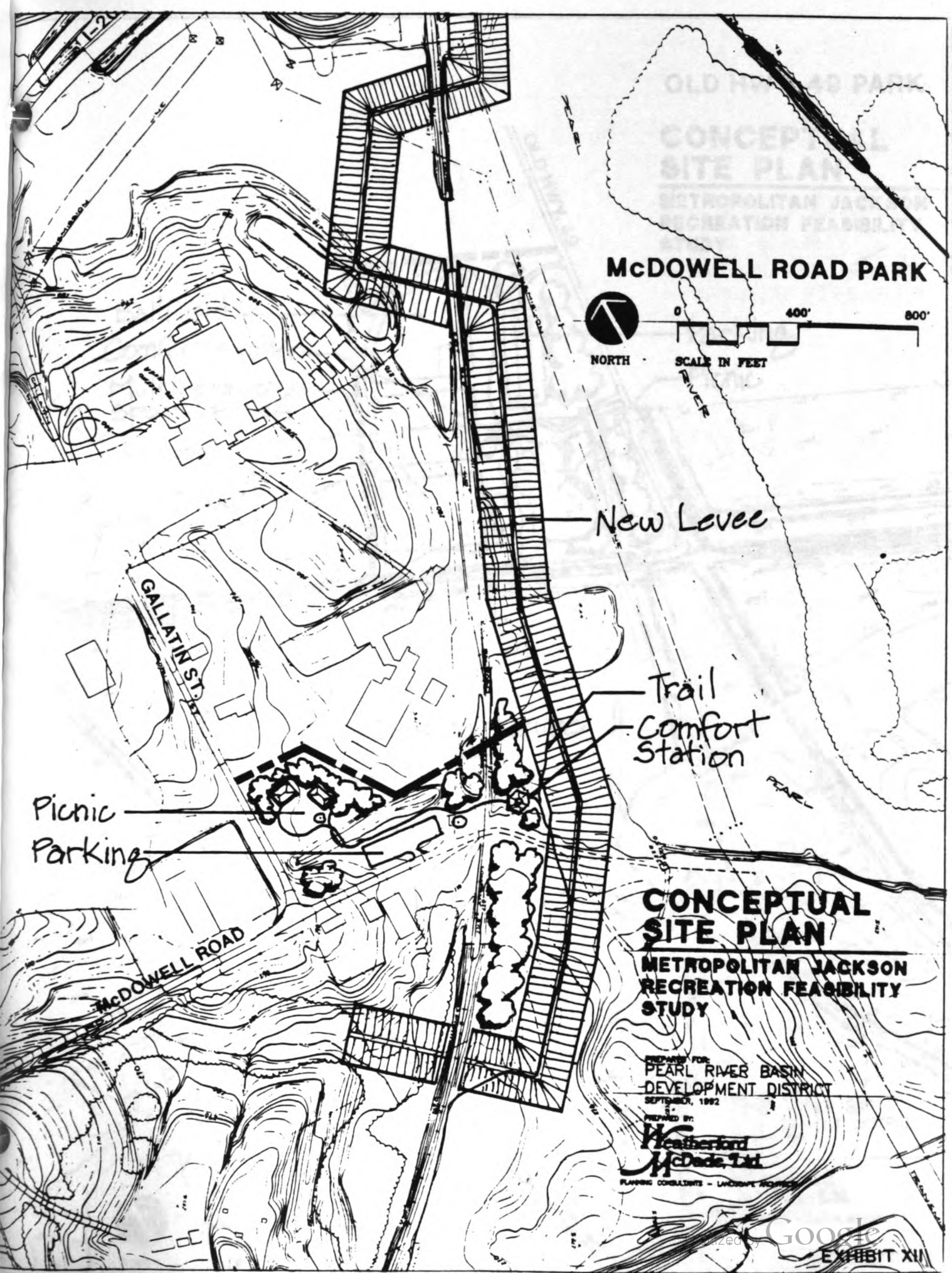
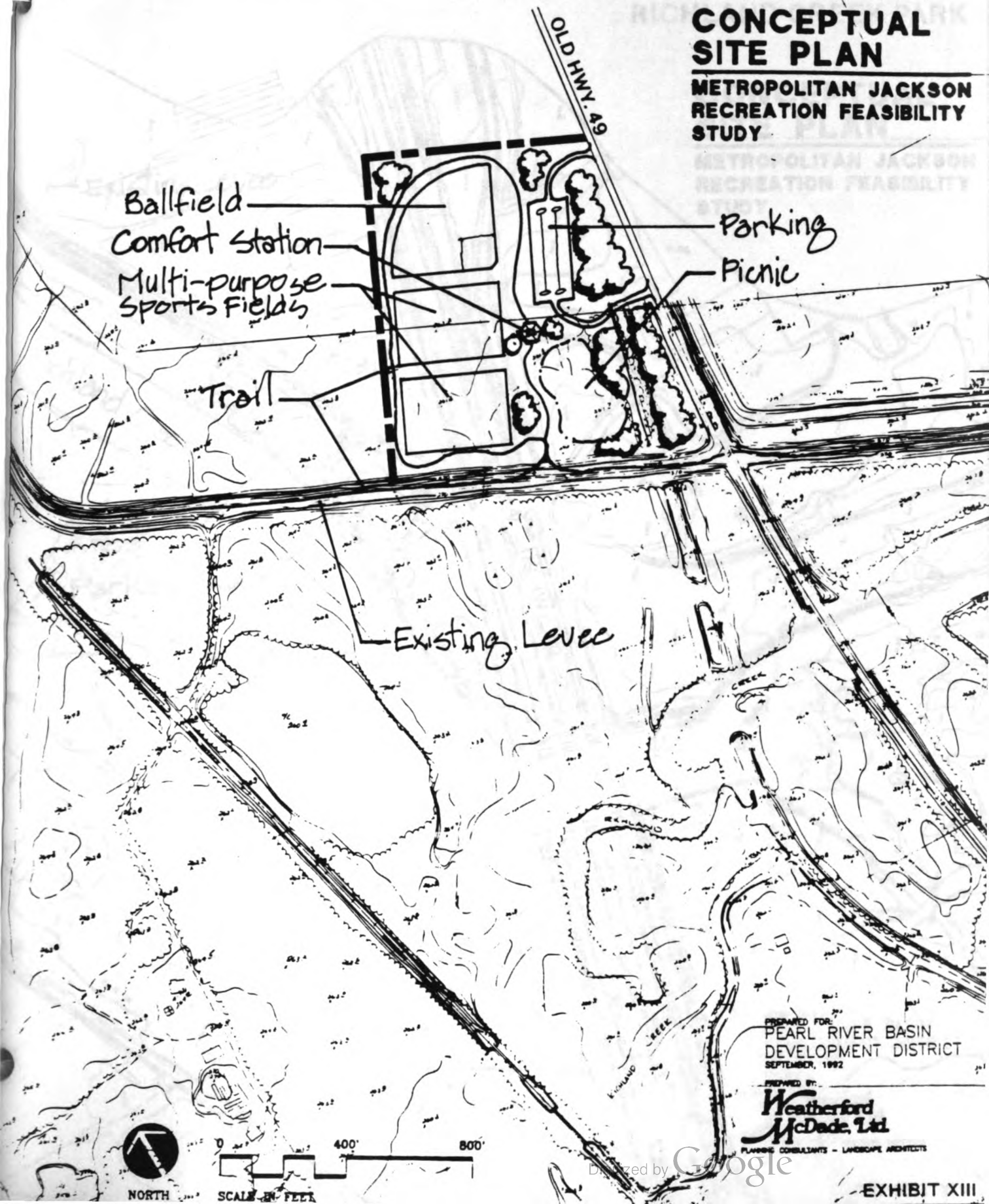


EXHIBIT XII

OLD HWY. 49 PARK

CONCEPTUAL SITE PLAN

METROPOLITAN JACKSON RECREATION FEASIBILITY STUDY



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PEARL RIVER BASIN DEVELOPMENT DISTRICT
SEPTEMBER, 1992

PREPARED BY:
Weatherford McDade, Ltd.
PLANNING CONSULTANTS - LANDSCAPE ARCHITECTS

EXHIBIT XIII

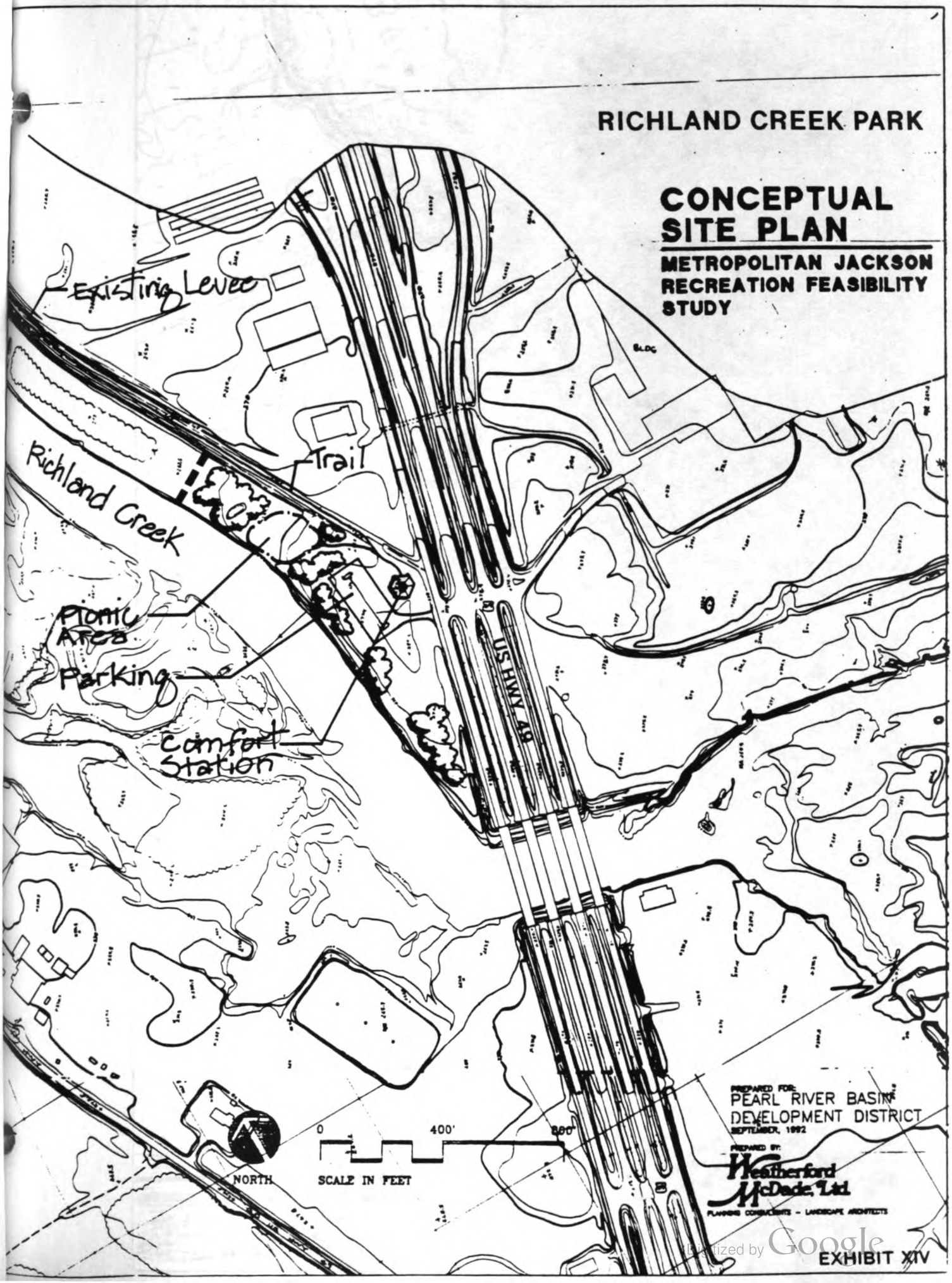


EXHIBIT XIV

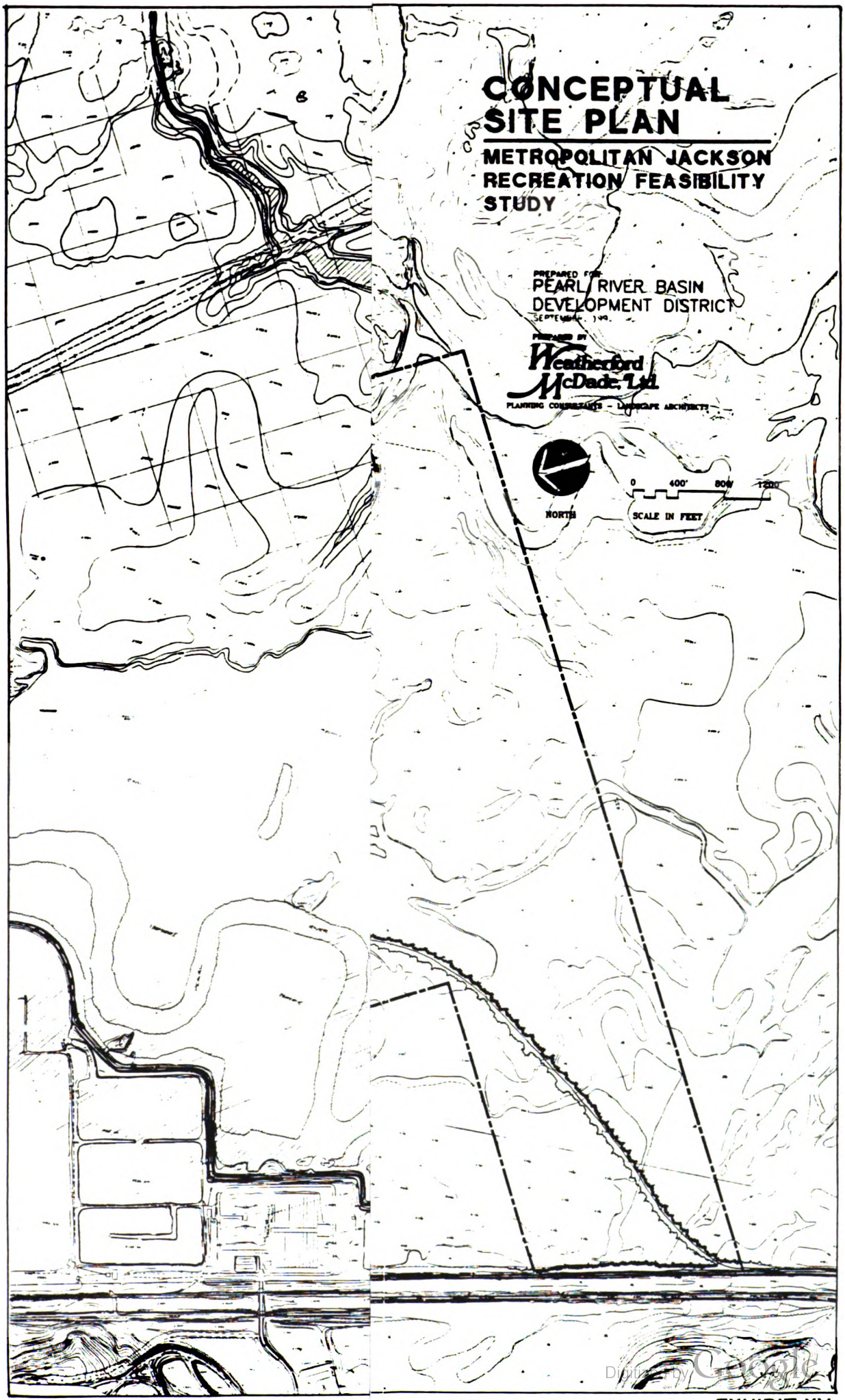

CONCEPTUAL
SITE PLAN
METROPOLITAN JACKSON
RECREATION FEASIBILITY
STUDY
PREPARED FOR
PEARL RIVER BASIN
DEVELOPMENT DISTRICT
PREPARED BY
Weatherford
McDade, Ltd.
PLANNING CONSULTANTS - LANDSCAPE ARCHITECTS
NORTH
0
400'
800'
1200'
SCALE IN FEET

EXHIBIT XV

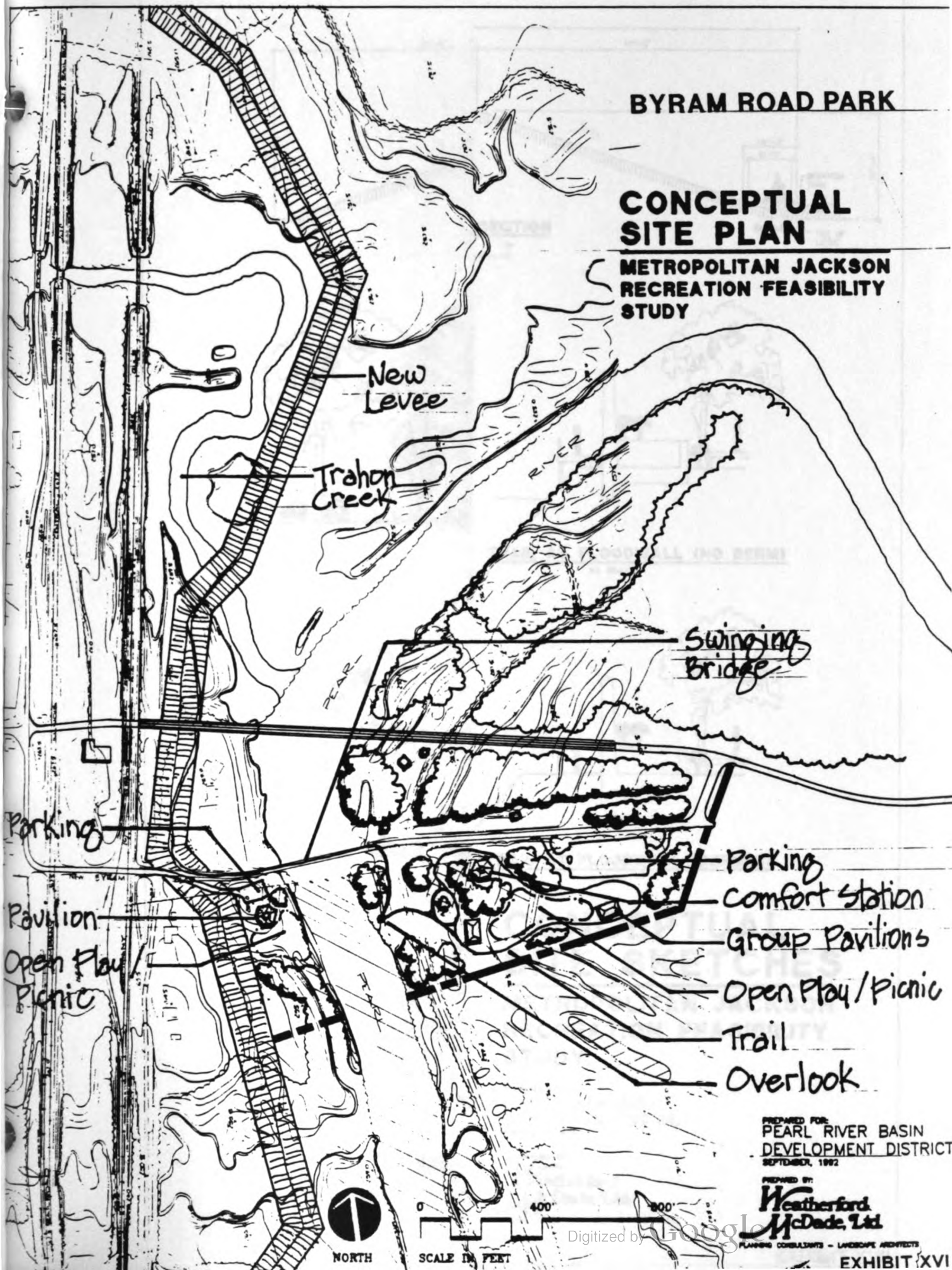
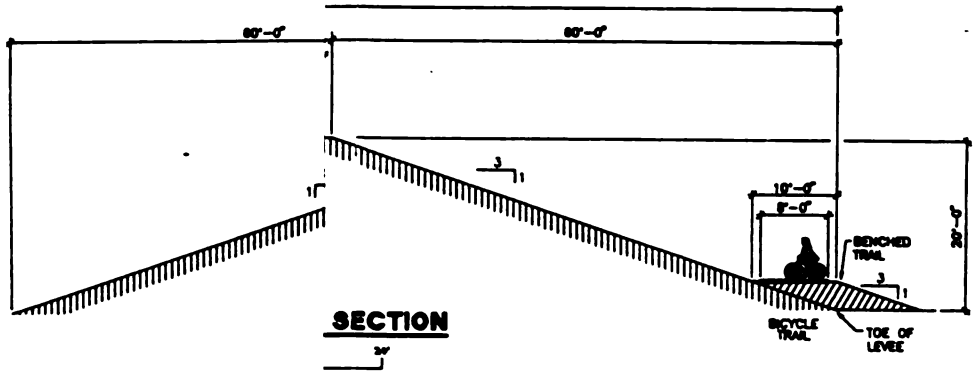
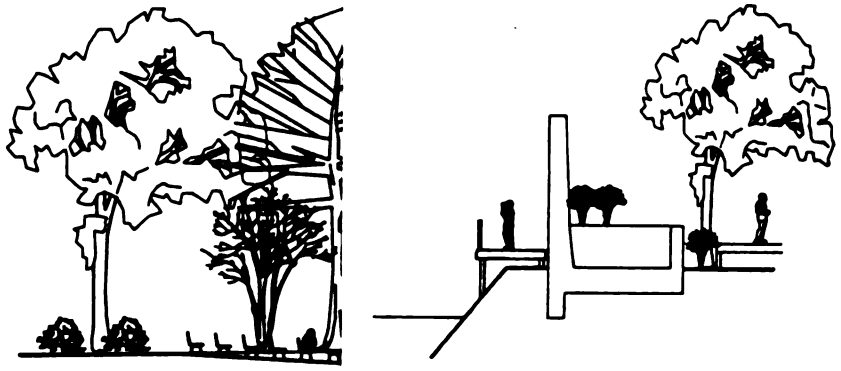


EXHIBIT XVI

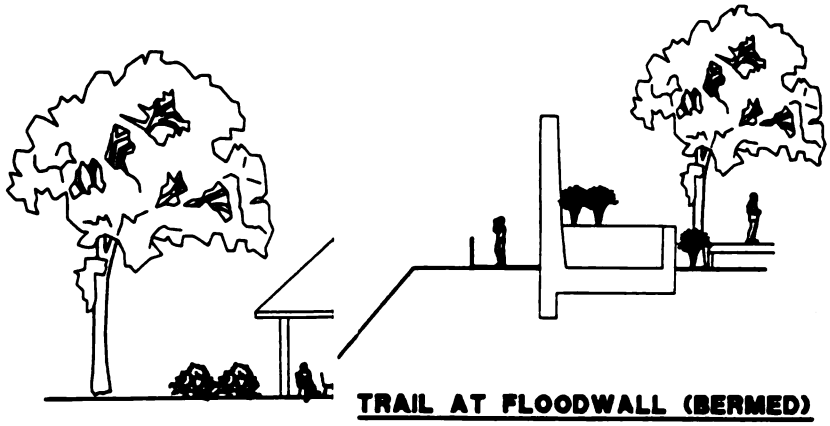


SECTION



TRAIL AT FLOODWALL (NO BERM)

NO SCALE



TRAIL AT FLOODWALL (BERMED)

NO SCALE

INTERP

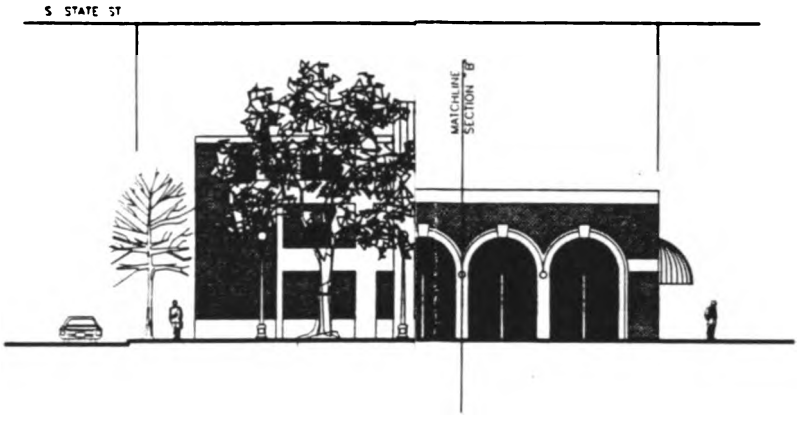
CONCEPTUAL SITE SKETCHES

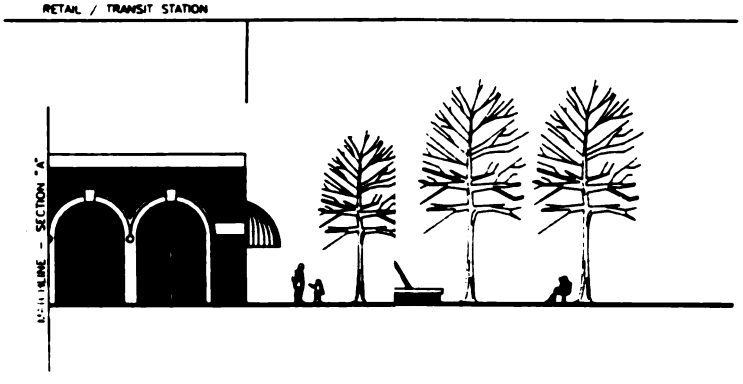
METROPOLITAN JACKSON RECREATION FEASIBILITY STUDY

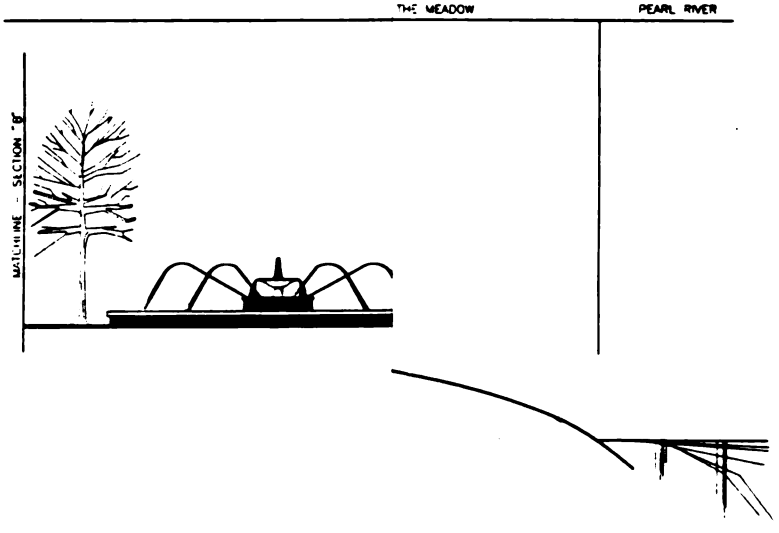
PREPARED FOR:
PEARL RIVER BASIN
DEVELOPMENT DISTRICT
SEPTEMBER, 1992

PREPARED BY:
Weatherford McDade, Ltd.
PLANNING CONSULTANTS - LANDSCAPE ARCHITECTS

EXHIBIT XVII







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SEPTEMBER 1992

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McDade, Ltd.
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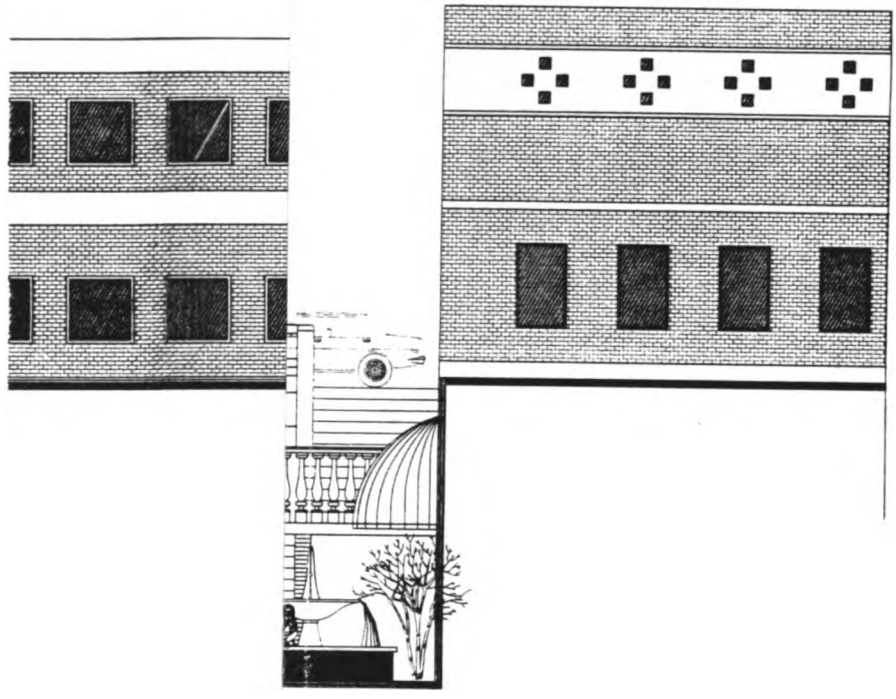
CONCEPTUAL SKETCHES

METROPOLITAN JACKSON RECREATION FEASIBILITY STUDY

SCALE: 1" = 10'-0"

EXHIBIT XVIII



PREPARED FOR
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DEVELOPMENT DISTRIC
SEPTEMBER, 1992

PREPARED BY
Weatherford
McDade, Ltd.
PLANNING CONSULTANTS - LANDSCAPE ARCHITEC

CONCEPTUAL SKETCHES

METROPOLITAN JACKSON RECREATION FEASIBILITY STUDY

SCALE

EXHIBIT XIX

EXHIBIT XX

IX. COST SHARING FOR RECREATION DEVELOPMENT

According to US Army Corps of Engineers Policy Guidance Letter No. 30, cost-shared facilities must be located on land required for the base project, except for certain items required for general public safety (access, parking, potable water, sanitation, and related items). These lands are known as separable lands. In these cases, additional land may be acquired at local cost, and the facilities located thereon will be eligible for cost-sharing.

The local sponsor cannot claim any credit (for recreation cost-sharing) for funds spent on the acquisition of lands required for the basic project.

Recreational facilities cannot be cost shared on any land unless it is acquired fee simple. Land that only requires a permanent easement for the base project is not eligible for cost-shared recreation development.

In cases where the land required for the base project is not sufficient to allow recreation development, or where only permanent easements are required for the base project, the difference in real estate interest (the cost of upgrading from permanent easement to fee simple purchase) may be included as part of the local sponsor's cost share. Credit would be given to the local sponsor for the difference between the permanent easement cost and the fee simple cost. This does not include real estate interest in temporary construction easements, or permanent easements required for borrow and disposal areas.

X. APPENDICES

APPENDIX A - DEMAND SURVEY INSTRUMENT

INFORMATION:

Pearl River Basin Development District

2304 Riverside Drive
Post Office Box 5332
Jackson, Mississippi 39216
Phone 601/354-6301

An Agency of the State of Mississippi

Sponsor Position Statement
on
Policy Guidance Letter No. 36

On October 1, 1991, the Recreation Investigation was initiated as a part of the Jackson Metropolitan Area, Mississippi Feasibility Study by the signing of the contract between Weatherford/McDade, Ltd. and the local sponsor, the Pearl River Basin Development District. The contract was to run for 11 months and be completed on August 31, 1992. Prior to the initiation of the contract, the Corps provided the sponsor and the consultant with copies of ER 1165-2-400, 9 August 1985, Recreation Planning, Development, and Management Policies and ER 1105-2-100, 28 December 1990, Planning Guidance. The consultant was already aware of the requirements contained in these documents because of their successful completion of a similar study element on a project under the jurisdiction of the Mobile District, U.S. Army Corps of Engineers.

On October 8, 1992, a draft of the final report was presented to the Corps for their review and comment. For all intents and purposes, the study process was completed at that time. The public participation, conceptual planning, questionnaires, sampling, statistical analysis, final planning, engineering and cost estimating had been completed and reviewed by Corps District and Division personnel at several interim points.

On November 16, 1992, the sponsor received a copy of Policy Guidance Letter No. 36 dated October 21, 1992. This letter was dated 13 days after the draft of the final report was submitted for review. This letter refines earlier Corps policy and raises questions about activities shown in the completed study which are allowable for Corps cost-sharing which were not questioned under the interim reviews and previous guidance (the guidance under which the entire study process was completed).

The requirements of Policy Guidance Letter No. 36 should not be applied to this study because they were not in force prior to the study being finalized. Additionally, changing the policy upon which the study was based would invalidate much of the study process including the public participation; the questionnaire upon which the Travel Cost Methodology and eventually the benefits were based; design computations; and operation and maintenance computations. If these items were to be re-evaluated, the bulk of the study would have to be completely reworked, thus adding time and additional cost to the overall Feasibility Study. The local sponsor feels that if this were done, the Corps, the sponsor and the flood control project itself would lose a considerable amount of credibility in the local area.

In summary, the local sponsor feels that the full application of the guidance shown in Policy Guidance Letter No. 36 would be detrimental to the recreational aspects of the project as well as the entire flood control project.

VII. RECREATIONAL RESOURCE MANAGEMENT

One of the problems facing the operation and maintenance of the Pearl River recreation corridor is the continuity needed for day-to-day operations. The corridor passes through four cities, and unincorporated portions of three counties. In addition, the Pearl River Basin Development has limited authority of the river as well as the Jackson Levee Board. The Pearl River Water Valley Supply District has authority of that portion adjacent to the Ross Barnett Reservoir dam.

In order to provide for the orderly operations an agreement must be formulated between all parties included above to provide for operations, maintenance, security and other necessary developmental control regulations in order to provide for the long term success of the project. This agreement may require enabling legislation to accomplish this requirement.

Operations and maintenance cost as follows contain annually amortized expenses for the initial cost of the equipment required to maintain the recreation corridor. This may be facilitated by the leasing of the equipment and paid through the annual O&M budget.

VIII. COST ESTIMATES

A. Introduction

The quantitative data supplied herein is apportioned by the levee reaches identified in Section VI. Within each reach, item are identified and given quantities and unit costs. The first section of each reach contains data for the base study only: these are items that are eligible for Federal cost sharing. This is followed by a summary of these items, giving a subtotal, and then adding a contingency percentage (25%), a planning engineering and design percentage (12%), and a construction management percentage (%5).

This portion of the estimate is followed by the same type breakdown of items that should be considered to be part of the base study, yet are not eligible for Federal cost sharing. These have been limited to items essential for the cohesiveness of the overall project. They are then summarized in the same format as the first category.

Each of the seven reaches is subjected to the same breakdowns and summaries, and then the entire base project is summarized and totalled. Finally items included in the Expanded Plan are given which are the elements and facilities not necessary for a cohesive base project, but included for consideration in long-range planning efforts. These quantities are given in more general categories, and then subtotaled and subjected to the same add-ons (contingencies, etc..) as the base study.

One item that should be noted is the category of Lands and Damages. Several instances call for the need to acquire extra land. The estimate shows a portion of this extra land as being eligible for Federal cost sharing. It is felt that this land falls under the heading of "Separable Lands," that is, lands necessary to provide access to the facility for the insurance of the public's health and safety.

B. Sources for Estimated Construction Cost

Construction cost information associated with this project has been compiled from several sources, foremost of which is Means Sitework Cost Data for 1992. Data has also been compiled from various professionals in the construction industry, consulting engineers, and past experience. The major categories of cost data are given below. References are given where applicable.

(M) = taken from Means Sitework Cost Data 1992. Percentage reflects Mississippi Cost factor of estimated unit.

COST ESTIMATE SUPPORT DATA 11/3/92

Lands and Damages -

(a) Purchase property - non eligible - $2,000/AC: Averaged from $5/sf cost of property in downtown Jackson area to $300/ac cost for low-lands (swamp) away from City.

(b) Purchase property - eligible - $100/AC: As directed by Vicksburg C.O.E. Represents the difference between minimum real estate requirement (lease) and fee simple purchase.

Clearing and Grubbing

Average cost from $1,081 for light to $4,370 for heavy (m) x 92% + 15% overhead and profit = $3,134.33/AC.

Thinning Wooded Area (Brush)

Clearing brush by hand $2400/ac (m) x 92 % + 15% overhead profit = $2,539.20.

General Excavation (grading)

Average from major excavation to light grading = $2.50/sy + 15% profit and overhead = $2.88/sy.

Tap and Meter

$3,640 includes City of Jackson charge for standard 4" meter and Contractor's profit and overhead of 15%.

Water Mains w/ Fittings

6" Θ PVC Class C 900 - $12.50 (M) x 78% + 15% Overhead and Profit = $11.21/lf.

Hose Bib

Includes 2 - 4"x4" treated posts w/spring loaded bib, key operated bib, concrete slab, floor drain, gravel sump, and 1" ⌀ rigid galv. sched. 40 pipe. $500 LS + 15% overhead and profit + $575.00.

Fire Hydrants

Key operated 3-way fire plug w/6" service - $1,000 ls + 15% overhead and profit = $1,150.

Sewer Line

8" PVC pipe placed up approved bedding material - $23/lf (M) x 78% plus 15% overhead and profit = $20.70/ lf.

Manhole

48" O/ , 0'-6' depth precast w/C.E. cover - $1000 l.s. + 15% overhead and profit = $1,150.00.

Walks

(a) 8' Wide Concrete Trail = Sq. ft. costs of Clearing and grubbing and Earthwork (before O&P) and concrete at $1.50/sf + $14.35 + 15% Overhead and profit = $16.50/sf. Used where there is a high potential for scouring and erosion due to inundation (under bridges) or slopes.

(b) 8' wide Asphalt Trail = Sq. ft costs of Clearing and Grubbing and Earthwork (Before O&P) and 2" surface course asphalt at $75/ton (1 sq. yd. 1" deep = 110 lbs.) = $7.75 + O&P at 15% = $8.91/lf.

(c) 8' wide Levee trail = 2 1/2" surface course asphalt w/8" granular subbase - sq. ft. cost for clearing and grubbing and earthwork (before O&P), granular material at $9.00/cy, and surface course asphalt at $75/Ton = $11.75 plus 15% O&P = $13.51/lf.

(d) Bicycle Trail - 10' wide w/2" surface course asphalt - sq. ft. costs (as above) and surface course asphalt as above = $12.56 + 15% overhead and profit = $14.44/lf.

Asphalt Parking and Drives

(a) 24' wide with subbase - sq. ft. costs of clearing and grubbing and earthwork, 6" of clay gravel base @ $11.00/cy, 3 1/2" asphalt base course @ $45/Ton and 1 1/2" surface course asphalt @ $55/T = $44.25 + 15% overhead and profit = $50.89/lf.

(b) Asphalt Paving w/Subbase - Same as above, but figured on a square yard basis = $26.00 + 15% overhead and profit = $29.90/sy.

Parking Lot with Curb and Gutter

Same design as above - $395.20 (m) x 92% + 15% overhead and profit = $419.75/car.

Irrigation

Complete system with 40' stream rotors, piping, valves, controller = $6,000 + 15% overhead and profit = $6,900.00/ac.

8' Wide Pedestrian Wood Bridge

System as per page 327 of (m) = ($10.44/sf x 8) x 92% = 65.00 + 15% overhead and profit = $74.75/lf.

Wood Pier/Boat Dock (8x30')

Average of low and high range (m) $26.77/sf x 240/sf x 76% = $5,000 + 15% overhead and profit = $5,750.00.

Structures

(a) Comfort station 15' x 15' complete @ $67.50/sf + 15% overhead and profit = $17,500 wood and CMU with asphalt shingle roof, slab on grade.

(b) Park Center - 15' x 15' as above = $17,500.

(c) Picnic Pavilion - 14' x 20' complete at $50.00/sf + 15% overhead and profit = $16,100. Wood construction with asphalt shingle, open air, slab on grade.

(d) Kiosk - 60" O/ concrete pipe with fitting and roof structure - 10' of 60" O/ concrete pipe @ $162/lf + 6 cy concrete fitting @ $300/cy and roof and miscellaneous at $2,580 = $6,000 + 15% overhead and profit = $6,900.00

(e) Amphitheater - set allowance of $100,000/ea. Sizes, seating, paved or not, stage, equipment vary....

Chain Link Fence w/Gate

6' Tall @ $10/lf + 15% overhead and profit = $11.50 lf.

Site Furnishings

(a) United R-38 standard trash receptacle with liner on 3' square concrete pad. Cost includes unit, shipping, installation = $475 + 15% overhead and profit = $546.25.

(b) 6' Columbia Cascade wood/steel bench w/ 3' x 6' concrete pad. Costs include unit, shipping, installation, clearing, earthwork = $425 + 15% overhead and profit = $488.75.

(c) Columbia Cascade 7 unit cycle loops bike rack w/5'x 10' concrete pad. Types of costs as per (b) = $700 + 15% overhead and profit = $805.00.

Multi-purpose Ballfield

320 feet square area - square ft. costs for clearing and grubbing and earthwork and grass seeding at $1,700/ac + 15% overhead and profit = $31,337.50.

Picnic Items

(a) Iron Mountain Forge 6' picnic table with treated wood planks and galvanized steel frame on an 8' x 10' concrete slab. Costs include clearing and grubbing, earthwork, unit, shipping and installation. = $475 + 15% overhead and profit = $546.25.

(b) Iron Mountain Forge Model #200-X grill on a 2' square concrete pad. Costs as described above = $150 + 15% overhead and profit = $172.50/ea.

Playground Equipment

Allowance averages $10,000/park site, dependent upon sizes and quantities. Profit and overhead included.

Signage

Allowance of $25,000/each, dependent upon sizes and quantities. Profit and overhead included.

Boat Launch

Allowance of $28,750. Range from single to multiple lanes (up to shallow draft fishing boats) dependent upon site conditions.

Lighting

(a) High Pressure Sodium accessed shoebox fixture mounted on 16' painted steel pole, including service and controls - $1,350/ea + 15% overhead and profit = $1,552.50.

(b) Same as above, except 25' pole = $2,000 ea + 15% overhead and profit = $2,300.00.

Grassing

Bermuda seeding 80 lbs/ac, ground preparation, lime at 1,000 lbs/ac, 13/13/13 fertilizer at 300 lbs/ac and straw mulch at 1 1/2 tons/ac = $1,700 + 15% overhead and profit = $1,955.00/ac.

Trees

Average cost of 10'-12' tree with 1 3/4" caliper, including excavation, planting soil, metal stake, guying, and fertilizer = $135 + 15% overhead and profit = 155.25/ea.

Shrubs

Average cost per square foot of planting area with 3 gal shrub, 4" pine bark soil additive, fertilizer (5-5-5), root stimulator, pre-emerge weed control, and 2" deep pine pole peelings = $5.00 + 15% overhead and profit = $5.75/sf.

COST ESTIMATE

PROJECT: JACKSON METROPOLITAN AREA, MISSISSIPPI
FEASIBILITY FLOOD CONTROL STUDY
RECREATION INVESTIGATIONS
PEARL RIVER BASIN DEVELOPMENT DISTRICT
JACKSON, MISSISSIPPI

DATE: September, 1992

REVISED: January, 1993

BASE STUDY

CODE	ITEM	UNIT	QUANTITY	COST EA.	SUBTOTAL
LEVEE REACH 1 - NORTHEAST JACKSON LEVEE					
ELIGIBLE ITEMS					
01.-.-.-	LANDS AND DAMAGES				
01.0.A.-	PURCHASE PROPERTY	AC	125.00	$100.00	$15,700.00
		SUBTOTAL LANDS AND DAMAGES			$15,700.00
14.-.-.-	RECREATION FACILITIES				
14.0.A.-	MOBILIZATION AND DEMOBILIZATION (DISTRIBUTED IN COSTS SHOWN BELOW)				
14.0.C.-	PERMANENT ACCESS ROADS AND PARKING				
14.0.C.B	SITE WORK				
14.0.C.B	CLEARING AND GRUBBING	AC	4.00	$3,134.33	$12,537.30
14.0.C.B	GRADING	SY	16,700.00	$2.88	$48,012.50
14.0.C.B	ASPHALT DRIVES				
	24' WIDE DRIVE W/ SUBBASE				
	3-1/2" BASE COURSE AND				
	1-1/2 SURFACE COURSE ASPH.	LF	5,300.00	$50.89	$269,703.75
		SUBTOTAL ACCESS ROADS AND PARKING			$330,253.55
14.0.1.-	PARKING LOTS AND SERVICE ROADS				
14.0.1.B	SITE WORK				
14.0.1.B	CLEARING AND GRUBBING	AC	3.50	$3,134.33	$10,970.14
14.0.1.B	GRADING	SY	16,500.00	$2.88	$47,437.50
14.0.1.B	ASPHALT PARKING AND SERVICE ROADS				
14.0.1.B	ASPHALT PAVING W/ SUBBASE				
	3-1/2" BASE COURSE AND				

	1-1/2 SURFACE COURSE ASPH.	SY	1,093.00	$29.90	$32,680.70
14.0.1.B	PARKING LOT W/CURB & GUTTER	CAR	500.00	$419.75	$209,875.00
			SUBTOTAL PARKING LOTS AND SERVICE ROADS		$300,963.34
14.0.2.-	SITE GRADING AND LANDSCAPING				
14.0.2.B	SITE WORK				
14.0.2.B	CLEARING AND GRUBBING	AC	3.50	$3,134.33	$10,970.14
14.0.2.B	THINNING WOODED AREA	AC	20.00	$2,539.20	$50,784.00
14.0.2.B	GRADING	SY	36,450.00	$2.88	$104,793.75
14.0.2.B	BERMUDA SEEDING	AC	1.50	$1,955.00	$2,932.50
14.0.2.B	TREES (10'-12'/ 1-3/4" CAL.)	EA	500.00	$155.25	$77,625.00
14.0.2.B	SHRUBS (W/ BED PREP & MULCH)	SF	1,000.00	$5.75	$5,750.00
14.0.2.B	SIGNAGE	LS	1.00	$25,000.00	$25,000.00
14.0.2.Q	MECHANICAL				
14.0.2.Q	IRRIGATION	AC	11.10	$6,900.00	$76,590.00
			SUBTOTAL SITE GRADING AND LANDSCAPING		$354,445.39
14.0.3.-	ACTIVITY GUIDES AND CONTROLS				
14.0.3.B	SITE WORK				
14.0.3.B	CONCRETE TRAIL (8' WIDE)	LF	1,645.00	$16.50	$27,146.61
14.0.3.B	ASPHALT TRAIL (8' WIDE) (2" SURFACE COURSE)	LF	11,800.00	$8.91	$105,167.50
14.0.3.B	LEVEE TRAIL (8' WIDE) 8" GRANULAR SUBBASE W/2.5" SURFACE COURSE ASPHALT	LF	28,150.00	$13.51	$380,376.88
14.0.3.B	BICYCLE TRAIL (10' WIDE) (2" SURFACE COURSE)	LF	28,150.00	$11.27	$317,250.50
14.0.3.B	CHAIN LINK FENCE (6') W/GATE	LF	4,290.00	$11.50	$49,335.00
14.0.3.B	AMPHITHEATER	LS	1.00	$100,000.00	$100,000.00
14.0.3.F	WOOD AND PLASTIC				
14.0.3.F	PEDESTRIAN WOOD BRIDGE (8'W)	LF	400.00	$74.75	$29,900.00
			SUBTOTAL ACTIVITY GUIDES AND CONTOLS		$1,354,176.49
14.0.4.-	DAY USE AREAS				
14.0.4.B	SITE WORK				
14.0.4.B	PICNIC ITEMS				
14.0.4.B	6' PICNIC TABLE WOOD/ GALV.F	EA	141.00	$546.25	$77,021.25
14.0.4.B	PEDESTAL GRILL	EA	56.00	$172.50	$9,660.00
14.0.4.B	BOAT LAUNCH	LS	1.00	$28,750.00	$28,750.00
14.0.4.B	MULTI-PURPOSE BALLFIELD (320')	EA	1.00	$31,337.50	$31,337.50
14.0.4.B	PLAYGROUND EQUIPMENT	EA	2.00	$10,000.00	$20,000.00
14.0.4.B	SITE FURNISHINGS				
14.0.4.B	TRASH RECEPTACLE	EA	54.00	$546.25	$29,497.50
14.0.4.B	BENCH - 6'	EA	22.00	$488.75	$10,752.50
14.0.4.B	BICYCLE RACK - 7 UNIT	EA	12.00	$805.00	$9,660.00

14.0.4.F	WOOD AND PLASTIC				
14.0.4.F	PICNIC PAVILION (14'x20')	EA	2 7.00	$16,100.00	$112,700.00
	SUBTOTAL DAY USE AREAS				$329,378.75
14.0.N.-	BUILDINGS, PROJECT OPERATIONS				
14.0.N.B	PARK CENTER	EA	2.00	$17,500.00	$35,000.00
	SUBTOTAL BUILDINGS, PROJECT OPERATIONS				$35,000.00
14.0.P.-	BUILDINGS, PUBLIC USE				
14.0.P.-	COMFORT STATION (15'X15')	EA	2.00	$17,500.00	$35,000.00
	SUBTOTAL BUILDINGS, PUBLIC USE				$35,000.00
14.0.6.-	UTILITIES				
14.0.6.B	SITEWORK				
14.0.6.B	MANHOLE 48" STANDARD 0'-6' DEPTH	EA	6.00	$1,150.00	$6,900.00
14.0.6.Q	MECHANICAL				
14.0.6.Q	TAP & METER	LS	2.00	$3,640.00	$7,280.00
14.0.6.Q	WATER MAINS W/FITTINGS 6" PVC CLASS C 900	LF	3,800.00	$11.21	$42,607.50
14.0.6.Q	HOSE BIB	EA	12.00	$575.00	$6,900.00
14.0.6.Q	FIRE HYDRANTS	EA	3.00	$1,150.00	$3,450.00
14.0.6.Q	SEWER LINE				
14.0.6.Q	8" PVC BEDDED	LF	2,550.00	$20.70	$52,785.00
14.0.6.R	ELECTRICAL				
14.0.6.R	HPS AREA LIGHT 16' POLE	EA	400.00	$1,552.50	$621,000.00
14.0.6.R	HPS AREA LIGHT 25' POLE	EA	140.00	$2,300.00	$322,000.00
	SUBTOTAL UTILITIES				$1,062,922.50

SUMMARY COST ELIGIBLE ITEMS	
SUBTOTAL ALL ITEMS	$3,516,876.68
CONTINGENCY @ 25%	$879,219.17
SUTOTAL	$4,396,095.84
PLANNING ENGINEERING AND DESIGN @ 12%	$527,531.50
SUBTOTAL	$4,923,627.35
CONSTRUCTION MANAGEMENT @ 8%	$393,890.19
TOTAL ELIGIBLE ITEMS REACH 1	$5,317,517.53

NON - ELIGIBLE ITEMS				
LAND ACQUISITION	AC	15.00	$2,300.00	$34,500.00
CLEARING AND GRUBBING	AC	1.00	$3,134.33	$3,134.33
GENERAL EXCAVATION (GRADING)	SY	1,350.00	$2.88	$3,881.25

8' WIDE ASPHALT TRAIL				
(2" SURFACE COURSE)	LF	2,400.00	$8.91	$21,390.00
LIGHTING (INCLUDING SERVICE)				
HPS AREA LIGHT 16' POLE	EA	24.00	$1,552.50	$37,260.00

SUMMARY NON - COST ELIGIBLE ITEMS	
SUBTOTAL ALL ITEMS	$100,165.58
CONTINGENCY @ 25%	$25,041.39
SUTOTAL	$125,206.97
PLANNING ENGINEERING AND DESIGN @ 12%	$15,024.84
SUBTOTAL	$140,231.81
CONSTRUCTION MANAGEMENT @ 8%	$11,218.54
TOTAL NON - ELIGIBLE ITEMS REACH 1	$151,450.35

REACH 1 SUMMARY	
COST - ELIGIBLE ITEMS	$5,292,565.75
COST - NON - ELIGIBLE ITEMS	$151,450.35
TOTAL COST REACH 1	$5,444,016.10
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COST ESTIMATE BASE STUDY

CODE	ITEM	UNIT	QUANTITY	COST EA.	SUBTOTAL
LEVEE REACH 2 - FLOWOOD LEVEE					
ELIGIBLE ITEMS					
01.-.-.-	LANDS AND DAMAGES				
01.0.A.-	PURCHASE PROPERTY	AC	371.00	$100.00	$37,100.00
		SUBTOTAL LANDS AND DAMAGES			$37,100.00
14.-.-.-	RECREATION FACILITIES				
14.0.A.-	MOBILIZATION AND DEMOBILIZATION (DISTRIBUTED IN COSTS SHOWN BELOW)				
14.0.C.-	PERMANENT ACCESS ROADS AND PARKING				
14.0.C.B	SITE WORK				
14.0.C.B	CLEARING AND GRUBBING	AC	6.50	$3,134.33	$20,373.11
14.0.C.B	GRADING	SY	30150	$2.88	$86,681.25
14.0.C.B	ASPHALT DRIVES				
	24' WIDE DRIVE W/ SUBBASE				
	3-1/2" BASE COURSE AND				

	1-1/2 SURFACE COURSE ASPH.	LF	8000	$50.89	$407,100.00
14.0.C.B	VEHICULAR BRIDGE	LF	50	$1,200.00	$60,000.00
			SUBTOTAL ACCESS ROADS AND PARKING		$574,154.36
14.0.1.-	PARKING LOTS AND SERVICE ROADS				
14.0.1.B	SITE WORK				
14.0.1.B	CLEARING AND GRUBBING	AC	12.50	$3,134.33	$39,179.06
14.0.1.B	GRADING	SY	60,500.00	$2.88	$173,937.50
14.0.1.B	ASPHALT PARKING AND SERVICE ROADS				
14.0.1.B	ASPHALT PAVING W/ SUBBASE 3-1/2" BASE COURSE AND 1-1/2 SURFACE COURSE ASPH.	SY	1,390.00	$29.90	$41,561.00
14.0.1.B	PARKING LOT W/CURB & GUTTER	CAR	900.00	$419.75	$377,775.00
			SUBTOTAL PARKING LOTS AND SERVICE ROADS		$632,452.56
14.0.2.-	SITE GRADING AND LANDSCAPING				
14.0.2.B	SITE WORK				
14.0.2.B	CLEARING AND GRUBBING	AC	76.50	$3,134.33	$239,775.86
14.0.2.B	THINNING WOODED AREA	AC	16.00	$2,539.20	$40,627.20
14.0.2.B	GRADING	SY	25,150.00	$2.88	$72,306.25
14.0.2.B	BERMUDA SEEDING	AC	36.00	$1,955.00	$70,380.00
14.0.2.B	TREES (10'-12'/ 1-3/4" CAL.)	EA	410.00	$155.25	$63,652.50
14.0.2.B	SHRUBS (W/ BED PREP & MULCH)	SF	640.00	$5.75	$3,680.00
14.0.2.B	SIGNAGE	LS	1.00	$25,000.00	$25,000.00
14.0.2.Q	MECHANICAL				
14.0.2.Q	IRRIGATION	AC	27.50	$6,900.00	$189,750.00
			SUBTOTAL SITE GRADING AND LANDSCAPING		$705,171.81
14.0.3.-	ACTIVITY GUIDES AND CONTROLS				
14.0.3.B	SITE WORK				
14.0.3.B	CONCRETE TRAIL (8' WIDE)	LF	200.00	$16.50	$3,300.50
14.0.3.B	ASPHALT TRAIL (8' WIDE) (2" SURFACE COURSE)	LF	35,840.00	$8.91	$319,424.00
14.0.3.B	LEVEE TRAIL (8' WIDE) 8" GRANULAR SUBBASE W/2.5" SURFACE COURSE ASPHALT	LF	14,750.00	$13.51	$199,309.38
14.0.3.B	BICYCLE TRAIL (10' WIDE) (2" SURFACE COURSE)	LF	14,750.00	$11.27	$166,232.50
14.0.3.B	CHAIN LINK FENCE (6') W/GATE	LF	16,250.00	$11.50	$186,875.00
14.0.3.F	WOOD AND PLASTIC				
14.0.3.F	PEDESTRIAN WOOD BRIDGE (8'W)	LF	260.00	$74.75	$19,435.00
			SUBTOTAL ACTIVITY GUIDES AND CONTOLS		$894,576.38

14.0.4.-	DAY USE AREAS				
14.0.4.B	SITE WORK				
14.0.4.B	PICNIC ITEMS				
14.0.4.B	6' PICNIC TABLE WOOD/ GALV.F	EA	57.00	$546.25	$31,136.25
14.0.4.B	PEDESTAL GRILL	EA	29.00	$172.50	$5,002.50
14.0.4.B	MULTI-PURPOSE BALLFIELD (320')	EA	12.00	$31,337.50	$376,050.00
14.0.4.B	PLAYGROUND EQUIPMENT	EA	2.00	$10,000.00	$20,000.00
14.0.4.B	SITE FURNISHINGS				
14.0.4.B	TRASH RECEPTACLE	EA	58.00	$546.25	$31,682.50
14.0.4.B	BENCH - 6'	EA	22.00	$488.75	$10,752.50
14.0.4.B	BICYCLE RACK - 7 UNIT	EA	20.00	$805.00	$16,100.00
14.0.4.F	WOOD AND PLASTIC				
14.0.4.F	PICNIC PAVILION (14'x20')	EA	3.00	$16,100.00	$48,300.00
		SUBTOTAL DAY USE AREAS			$539,023.75
14.0.N.-	BUILDINGS, PROJECT OPERATIONS				
14.0.N.B	PARK CENTER	EA	1.00	$17,500.00	$17,500.00
		SUBTOTAL BUILDINGS, PROJECT OPERATIONS			$17,500.00
14.0.P.-	BUILDINGS, PUBLIC USE				
14.0.P.-	COMFORT STATION (15'X15')	EA	4.00	$17,500.00	$70,000.00
		SUBTOTAL BUILDINGS, PUBLIC USE			$70,000.00
14.0.6.-	UTILITIES				
14.0.6.B	SITEWORK				
14.0.6.B	MANHOLE 48" STANDARD 0'-6' DEPTH	EA	15.00	$1,150.00	$17,250.00
14.0.6.Q	MECHANICAL				
14.0.6.Q	TAP & METER	LS	2.00	$3,640.00	$7,280.00
14.0.6.Q	WATER MAINS W/FITTINGS 6" PVC CLASS C 900	LF	6,600.00	$11.21	$74,002.50
14.0.6.Q	HOSE BIB	EA	16.00	$575.00	$9,200.00
14.0.6.Q	FIRE HYDRANTS	EA	4.00	$1,150.00	$4,600.00
14.0.6.Q	SEWER LINE				
14.0.6.Q	8" PVC BEDDED	LF	6,550.00	$20.70	$135,585.00
14.0.6.R	ELECTRICAL				
14.0.6.R	HPS AREA LIGHT 16' POLE	EA	508.00	$1,552.50	$788,670.00
14.0.6.R	HPS AREA LIGHT 25' POLE	EA	74.00	$2,300.00	$170,200.00
		SUBTOTAL UTILITIES			$1,206,787.50

SUMMARY COST ELIGIBLE ITEMS	
SUBTOTAL ALL ITEMS	$3,801,624.99
CONTINGENCY @ 25%	$950,406.25
SUTOTAL	$4,752,031.23

PLANNING ENGINEERING AND DESIGN @ 12%				$570,243.75
SUBTOTAL				$5,322,274.98
CONSTRUCTION MANAGEMENT @ 8%				$425,782.00
TOTAL ELIGIBLE ITEMS REACH 2				$5,748,056.98
NON - ELIGIBLE ITEMS				
LAND ACQUISITION	AC	22.60	$2,000.00	$45,200.00
SUMMARY NON - COST ELIGIBLE ITEMS				
SUBTOTAL ALL ITEMS				$45,200.00
CONTINGENCY @ 25%				$11,300.00
SUTOTAL				$56,500.00
PLANNING ENGINEERING AND DESIGN @ 12%				$6,780.00
SUBTOTAL				$63,280.00
CONSTRUCTION MANAGEMENT @ 8%				$5,062.40
TOTAL NON - ELIGIBLE ITEMS REACH 2				$68,342.40
REACH 2 SUMMARY				
COST - ELIGIBLE ITEMS				$5,292,565.75
COST - NON - ELIGIBLE ITEMS				$68,342.40
TOTAL COST REACH 2				$5,360,908.15

COST ESTIMATE BASE STUDY

CODE	ITEM	UNIT	QUANTITY	COST EA.	SUBTOTAL
LEVEE REACH 3 - EXISTING FAIRGROUNDS LEVEE					
ELIGIBLE ITEMS					
01.-.-.-	LANDS AND DAMAGES				
01.0.A.-	PURCHASE PROPERTY	AC	9.00	$100.00	$900.00
	SUBTOTAL LANDS AND DAMAGES				$900.00
14.-.-.-	RECREATION FACILITIES				
14.0.A.-	MOBILIZATION AND DEMOBILIZATION (DISTRIBUTED IN COSTS SHOWN BELOW)				
14.0.2.-	SITE GRADING AND LANDSCAPING				
14.0.2.B	SITE WORK				

14.0.2.B	CLEARING AND GRUBBING	AC	1.00	$3,134.33	$3,134.33
14.0.2.B	GRADING	SY	4,950.00	$2.88	$14,231.25
14.0.2.B	SIGNAGE	LS	1.00	$25,000.00	$25,000.00
			SUBTOTAL SITE GRADING AND LANDSCAPING		$42,365.58
14.0.3.-	ACTIVITY GUIDES AND CONTROLS				
14.0.3.B	SITE WORK				
14.0.3.B	CONCRETE TRAIL (8' WIDE)	LF	1,850.00	$16.50	$30,529.63
14.0.3.B	LEVEE TRAIL (8' WIDE) 8" GRANULAR SUBBASE W/2.5" SURFACE COURSE ASPHALT	LF	2,600.00	$13.51	$35,132.50
14.0.3.B	BICYCLE TRAIL (10' WIDE) (2" SURFACE COURSE)	LF	2,600.00	$11.27	$29,302.00
			SUBTOTAL ACTIVITY GUIDES AND CONTOLS		$94,964.13
14.0.6.-	UTILITIES				
14.0.6.R	HPS AREA LIGHT 16' POLE	EA	45.00	$1,552.50	$69,862.50
14.0.6.R	HPS AREA LIGHT 25' POLE	EA	13.00	$2,300.00	$29,900.00
			SUBTOTAL UTILITIES		$99,762.50

SUMMARY COST ELIGIBLE ITEMS	
SUBTOTAL ALL ITEMS	$220,626.63
CONTINGENCY @ 25%	$55,156.66
SUTOTAL	$275,783.28
PLANNING ENGINEERING AND DESIGN @ 12%	$33,093.99
SUBTOTAL	$308,877.28
CONSTRUCTION MANAGEMENT @ 8%	$24,710.18
TOTAL ELIGIBLE ITEMS REACH 3	$333,587.46

NON - ELIGIBLE ITEMS				
LAND ACQUISITION	AC	36.50	$2,000.00	$73,000.00
CLEARING AND GRUBBING	AC	25.00	$3,134.33	$78,358.13
GENERAL EXCAVATION (GRADING)	SY	20,350.00	$2.88	$58,506.25
8' WIDE CONCRETE TRAIL	LF	18,275.00	$16.50	$301,583.19
LIGHTING (INCLUDING SERVICE) HPS AREA LIGHT 16' POLE	EA	182.00	$1,552.50	$282,555.00

SUMMARY NON - COST ELIGIBLE ITEMS	
SUBTOTAL ALL ITEMS	$794,002.56
CONTINGENCY @ 25%	$198,500.64
SUTOTAL	$992,503.20
PLANNING ENGINEERING AND DESIGN @ 12%	$119,100.38
SUBTOTAL	$1,111,603.59
CONSTRUCTION MANAGEMENT @ 8%	$88,928.29

TOTAL NON - ELIGIBLE ITEMS REACH 3	$1,200,531.87
REACH 3 SUMMARY	
COST - ELIGIBLE ITEMS	$5,292,565.75
COST - NON - ELIGIBLE ITEMS	$1,200,531.87
TOTAL COST REACH 3	$6,493,097.63

COST ESTIMATE BASE STUDY

CODE	ITEM	UNIT	QUANTITY	COST EA.	SUBTOTAL
LEVEE REACH 4 - EXISTING EAST JACKSON LEVEE					
ELIGIBLE ITEMS					
01.-.-.-	LANDS AND DAMAGES				
01.0.A.-	PURCHASE PROPERTY	AC	147.00	$100.00	$14,700.00
	SUBTOTAL LANDS AND DAMAGES				$14,700.00
14.-.-.-	RECREATION FACILITIES				
14.0.A.-	MOBILIZATION AND DEMOBILIZATION (DISTRIBUTED IN COSTS SHOWN BELOW)				
14.0.C.-	PERMANENT ACCESS ROADS AND PARKING				
14.0.C.B	SITE WORK				
14.0.C.B	CLEARING AND GRUBBING	AC	.50	$3,134.33	$1,567.16
14.0.C.B	GRADING	SY	1,600.00	$2.88	$4,600.00
14.0.C.B	ASPHALT DRIVES				
	24' WIDE DRIVE W/ SUBBASE				
	3-1/2" BASE COURSE AND				
	1-1/2 SURFACE COURSE ASPH.	LF	600.00	$50.89	$30,532.50
	SUBTOTAL ACCESS ROADS AND PARKING				$36,699.66
14.0.1.-	PARKING LOTS AND SERVICE ROADS				
14.0.1.B	SITE WORK				
14.0.1.B	CLEARING AND GRUBBING	AC	2.00	$3,134.33	$6,268.65
14.0.1.B	GRADING	SY	7,750.00	$2.88	$22,281.25
14.0.1.B	ASPHALT PARKING AND SERVICE ROADS				
14.0.1.B	ASPHALT PAVING W/ SUBBASE				

	3-1/2" BASE COURSE AND				
	1-1/2 SURFACE COURSE ASPH.	SY	1,600.00	$29.90	$47,840.00
14.0.1.B	PARKING LOT W/CURB & GUTTER	CAR	260.00	$419.75	$109,135.00
			SUBTOTAL PARKING LOTS AND SERVICE ROADS		$185,524.90
14.0.2.-	SITE GRADING AND LANDSCAPING				
14.0.2.B	SITE WORK				
14.0.2.B	CLEARING AND GRUBBING	AC	16.00	$3,134.33	$50,149.20
14.0.2.B	GRADING	SY	40,550.00	$2.88	$116,581.25
14.0.2.B	BERMUDA SEEDING	AC	16.00	$1,955.00	$31,280.00
14.0.2.B	TREES (10'-12'/ 1-3/4" CAL.)	EA	86.00	$155.25	$13,351.50
14.0.2.B	SHRUBS (W/ BED PREP & MULCH)	SF	80.00	$5.75	$460.00
14.0.2.B	SIGNAGE	LS	1.00	$25,000.00	$25,000.00
14.0.2.Q	MECHANICAL				
14.0.2.Q	IRRIGATION	AC	111.00	$6,900.00	$765,900.00
			SUBTOTAL SITE GRADING AND LANDSCAPING		$1,002,721.95
14.0.3.-	ACTIVITY GUIDES AND CONTROLS				
14.0.3.B	SITE WORK				
14.0.3.B	ASPHALT TRAIL (8' WIDE)				
	(2" SURFACE COURSE)	LF	3,350.00	$8.91	$29,856.88
14.0.3.B	LEVEE TRAIL (8' WIDE)				
	8" GRANULAR SUBBASE W/2.5"				
	SURFACE COURSE ASPHALT	LF	34,800.00	$13.51	$470,235.00
14.0.3.B	BICYCLE TRAIL (10' WIDE)				
	(2" SURFACE COURSE)	LF	34,800.00	$11.27	$392,196.00
14.0.3.B	CHAIN LINK FENCE (6') W/GATE	LF	1,900.00	$11.50	$21,850.00
			SUBTOTAL ACTIVITY GUIDES AND CONTOLS		$914,137.88
14.0.4.-	DAY USE AREAS				
14.0.4.B	SITE WORK				
14.0.4.B	PICNIC ITEMS				
14.0.4.B	6' PICNIC TABLE WOOD/ GALV.F	EA	38.00	$546.25	$20,757.50
14.0.4.B	PEDESTAL GRILL	EA	19.00	$172.50	$3,277.50
14.0.4.B	MULTI-PURPOSE BALLFIELD (320')	EA	3.00	$31,337.50	$94,012.50
14.0.4.B	PLAYGROUND EQUIPMENT	EA	1.00	$10,000.00	$10,000.00
14.0.4.B	SITE FURNISHINGS				
14.0.4.B	TRASH RECEPTACLE	EA	19.00	$546.25	$10,378.75
14.0.4.B	BENCH - 6'	EA	8.00	$488.75	$3,910.00
14.0.4.B	BICYCLE RACK - 7 UNIT	EA	8.00	$805.00	$6,440.00
			SUBTOTAL DAY USE AREAS		$148,776.25
14.0.P.-	BUILDINGS, PUBLIC USE				

14.0.P.-	COMFORT STATION (15'X15')	EA	2.00	$17,500.00	$35,000.00
		SUBTOTAL BUILDINGS, PUBLIC USE			$35,000.00
14.0.6.-	UTILITIES				
14.0.6.B	SITEWORK				
14.0.6.B	MANHOLE 48" STANDARD 0'-6' DEPTH	EA	4.00	$1,150.00	$4,600.00
14.0.6.Q	MECHANICAL				
14.0.6.Q	TAP & METER	LS	2.00	$3,640.00	$7,280.00
14.0.6.Q	WATER MAINS W/FITTINGS 6" PVC CLASS C 900	LF	800.00	$11.21	$8,970.00
14.0.6.Q	HOSE BIB	EA	4.00	$575.00	$2,300.00
14.0.6.Q	FIRE HYDRANTS	EA	4.00	$1,150.00	$4,600.00
14.0.6.Q	SEWER LINE				
14.0.6.Q	8" PVC BEDDED	LF	800.00	$20.70	$16,560.00
14.0.6.R	ELECTRICAL				
14.0.6.R	HPS AREA LIGHT 16' POLE	EA	381.00	$1,552.50	$591,502.50
14.0.6.R	HPS AREA LIGHT 25' POLE	EA	174.00	$2,300.00	$400,200.00
		SUBTOTAL UTILITIES			$1,036,012.50

SUMMARY COST ELIGIBLE ITEMS	
SUBTOTAL ALL ITEMS	$3,373,573.14
CONTINGENCY @ 25%	$843,393.28
SUTOTAL	$4,216,966.42
PLANNING ENGINEERING AND DESIGN @ 12%	$506,035.97
SUBTOTAL	$4,723,002.39
CONSTRUCTION MANAGEMENT @ 8%	$377,840.19
TOTAL ELIGIBLE ITEMS REACH 4	$5,100,842.58

NON - ELIGIBLE ITEMS				
CLEARING AND GRUBBING	AC	11.00	$3,134.33	$34,477.58
8' WIDE ASPHALT TRAIL (2" SURFACE COURSE)	LF	4,950.00	$8.91	$44,116.88
PEDESTRIAN WOOD BRIDGE (8'W)	LF	280.00	$74.75	$20,930.00
LIGHTING (INCLUDING SERVICE) HPS AREA LIGHT 16' POLE	EA	50.00	$1,552.50	$77,625.00

SUMMARY NON - COST ELIGIBLE ITEMS	
SUBTOTAL ALL ITEMS	$177,149.45
CONTINGENCY @ 25%	$44,287.36
SUTOTAL	$221,436.81
PLANNING ENGINEERING AND DESIGN @ 12%	$26,572.42
SUBTOTAL	$248,009.23
CONSTRUCTION MANAGEMENT @ 8%	$19,840.74
TOTAL NON - ELIGIBLE ITEMS REACH 4	$267,849.97

REACH 4 SUMMARY

COST - ELIGIBLE ITEMS	$5,292,565.75
COST - NON - ELIGIBLE ITEMS	$267,849.97
TOTAL COST REACH 4	$5,560,415.72

COST ESTIMATE BASE STUDY

CODE	ITEM	UNIT	QUANTITY	COST EA.	SUBTOTAL
	LEVEE REACH 5 - SOUTH JACKSON CREEK - WEST SIDE				
	ELIGIBLE ITEMS				
01.-.-.-	LANDS AND DAMAGES				
01.0.A.-	PURCHASE PROPERTY	AC	32.50	$100.00	$3,250.00
	SUBTOTAL LANDS AND DAMAGES				$3,250.00
14.-.-.-	RECREATION FACILITIES				
14.0.A.-	MOBILIZATION AND DEMOBILIZATION (DISTRIBUTED IN COSTS SHOWN BELOW)				
14.0.1.-	PARKING LOTS AND SERVICE ROADS				
14.0.1.B	SITE WORK				
14.0.1.B	CLEARING AND GRUBBING	AC	.50	$3,134.33	$1,567.16
14.0.1.B	GRADING	SY	1,900.00	$2.88	$5,462.50
14.0.1.B	ASPHALT PARKING AND SERVICE ROADS				
14.0.1.B	ASPHALT PAVING W/ SUBBASE 3-1/2" BASE COURSE AND 1-1/2 SURFACE COURSE ASPH.	SY	80.00	$29.90	$2,392.00
14.0.1.B	PARKING LOT W/CURB & GUTTER	CAR	65.00	$419.75	$27,283.75
	SUBTOTAL EARTHWORK				$36,705.41
14.0.2.-	SITE GRADING AND LANDSCAPING				
14.0.2.B	SITE WORK				
14.0.2.B	CLEARING AND GRUBBING	AC	1.40	$3,134.33	$4,388.06
14.0.2.B	GRADING	SY	12,700.00	$2.88	$36,512.50
14.0.2.B	BERMUDA SEEDING	AC	1.40	$1,955.00	$2,737.00
14.0.2.B	TREES (10'-12'/ 1-3/4" CAL.)	EA	60.00	$155.25	$9,315.00
14.0.2.B	SHRUBS (W/ BED PREP & MULCH)	SF	40.00	$5.75	$230.00
14.0.2.B	SIGNAGE	LS	1.00	$25,000.00	$25,000.00

14.0.2.Q	MECHANICAL				
14.0.2.Q	IRRIGATION	AC	.25	$6,900.00	$1,725.00
	SUBTOTAL SITE GRADING AND LANDSCAPING				$79,907.56
14.0.3.-	ACTIVITY GUIDES AND CONTROLS				
14.0.3.B	SITE WORK				
14.0.3.B	CONCRETE TRAIL (8' WIDE)	LF	60.00	$16.50	$990.15
14.0.3.B	ASPHALT TRAIL (8' WIDE) (2" SURFACE COURSE)	LF	1,600.00	$8.91	$14,260.00
14.0.3.B	LEVEE TRAIL (8' WIDE) 8" GRANULAR SUBBASE W/2.5" SURFACE COURSE ASPHALT	LF	10,600.00	$13.51	$143,232.50
14.0.3.B	BICYCLE TRAIL (10' WIDE) (2" SURFACE COURSE)	LF	10,600.00	$11.27	$119,462.00
14.0.3.B	CHAIN LINK FENCE (6') W/GATE	LF	1,100.00	$11.50	$12,650.00
14.0.3.F	WOOD AND PLASTIC				
14.0.3.F	PEDESTRIAN WOOD BRIDGE (8'W)	LF	60.00	$74.75	$4,485.00
	SUBTOTAL ACTIVITY GUIDES AND CONTOLS				$295,079.65
14.0.4.-	DAY USE AREAS				
14.0.4.B	SITE WORK				
14.0.4.B	PICNIC ITEMS				
14.0.4.B	6' PICNIC TABLE WOOD/ GALV.F	EA	22.00	$546.25	$12,017.50
14.0.4.B	PEDESTAL GRILL	EA	11.00	$172.50	$1,897.50
14.0.4.B	SITE FURNISHINGS				
14.0.4.B	TRASH RECEPTACLE	EA	8.00	$546.25	$4,370.00
14.0.4.B	BENCH - 6'	EA	8.00	$488.75	$3,910.00
14.0.4.B	BICYCLE RACK - 7 UNIT	EA	4.00	$805.00	$3,220.00
14.0.4.F	WOOD AND PLASTIC				
14.0.4.F	PICNIC PAVILION (14'x20')	EA	2.00	$16,100.00	$32,200.00
	SUBTOTAL DAY USE AREAS				$57,615.00
14.0.N.-	BUILDINGS, PROJECT OPERATIONS				
14.0.N.B	PARK CENTER	EA	.00	$17,500.00	$.00
	SUBTOTAL BUILDINGS, PROJECT OPERATIONS				$.00
14.0.P.-	BUILDINGS, PUBLIC USE				
14.0.P.-	COMFORT STATION (15'X15')	EA	1.00	$17,500.00	$17,500.00
	SUBTOTAL BUILDINGS, PUBLIC USE				$17,500.00

14.0.6.-	UTILITIES				
14.0.6.B	SITEWORK				
14.0.6.B	MANHOLE 48" STANDARD				
	0'-6' DEPTH	EA	3.00	$1,150.00	$3,450.00
14.0.6.Q	MECHANICAL				
14.0.6.Q	TAP & METER	LS	1.00	$3,640.00	$3,640.00
14.0.6.Q	WATER MAINS W/FITTINGS				
	6" PVC CLASS C 900	LF	500.00	$11.21	$5,606.25
14.0.6.Q	HOSE BIB	EA	3.00	$575.00	$1,725.00
14.0.6.Q	FIRE HYDRANTS	EA	2.00	$1,150.00	$2,300.00
14.0.6.Q	SEWER LINE				
14.0.6.Q	8" PVC BEDDED	LF	500.00	$20.70	$10,350.00
14.0.6.R	ELECTRICAL				
14.0.6.R	HPS AREA LIGHT 16' POLE	EA	123.00	$1,552.50	$190,957.50
14.0.6.R	HPS AREA LIGHT 25' POLE	EA	53.00	$2,300.00	$121,900.00
			SUBTOTAL UTILITIES		$339,928.75

SUMMARY COST ELIGIBLE ITEMS	
SUBTOTAL ALL ITEMS	$829,986.37
CONTINGENCY @ 25%	$207,496.59
SUTOTAL	$1,037,482.96
PLANNING ENGINEERING AND DESIGN @ 12%	$124,497.96
SUBTOTAL	$1,161,980.91
CONSTRUCTION MANAGEMENT @ 8%	$92,958.47
TOTAL ELIGIBLE ITEMS REACH 5	$1,254,939.39

NON - ELIGIBLE ITEMS				
LAND ACQUISITION	AC	2.00	$2,000.00	$4,000.00
CLEARING AND GRUBBING	AC	1.50	$3,134.33	$4,701.49
GENERAL EXCAVATION (GRADING)	SY	2,750.00	$2.88	$7,906.25
8' WIDE ASPHALT TRAIL				
(2" SURFACE COURSE)	LF	4,900.00	$8.91	$43,671.25
LIGHTING (INCLUDING SERVICE)				
HPS AREA LIGHT 16' POLE	EA	49.00	$1,552.50	$76,072.50

SUMMARY NON - COST ELIGIBLE ITEMS	
SUBTOTAL ALL ITEMS	$136,351.49
CONTINGENCY @ 25%	$34,087.87
SUTOTAL	$170,439.36
PLANNING ENGINEERING AND DESIGN @ 12%	$20,452.72
SUBTOTAL	$190,892.08
CONSTRUCTION MANAGEMENT @ 8%	$15,271.37
TOTAL NON - ELIGIBLE ITEMS REACH 5	$206,163.45

REACH 5 SUMMARY	
COST - ELIGIBLE ITEMS	$5,292,565.75

COST - NON - ELIGIBLE ITEMS	$206,163.45
TOTAL COST REACH 5	$5,498,729.20

COST ESTIMATE BASE STUDY

CODE	ITEM	UNIT	QUANTITY	COST EA.	SUBTOTAL
LEVEE REACH 6 - SOUTH JACKSON LEVEE - WEST SIDE					
ELIGIBLE ITEMS					
01.-.-.-	LANDS AND DAMAGES				
01.0.A.-	PURCHASE PROPERTY	AC	54.00	$100.00	$5,400.00
	SUBTOTAL LANDS AND DAMAGES				$5,400.00
14.-.-.-	RECREATION FACILITIES				
14.0.A.-	MOBILIZATION AND DEMOBILIZATION (DISTRIBUTED IN COSTS SHOWN BELOW)				
14.0.2.-	SITE GRADING AND LANDSCAPING				
14.0.2.B	SITE WORK				
14.0.2.B	GRADING	SY	18,900.00	$2.88	$54,337.50
14.0.2.B	SIGNAGE	LS	1.00	$25,000.00	$25,000.00
	SUBTOTAL SITE GRADING AND LANDSCAPING				$79,337.50
14.0.3.-	ACTIVITY GUIDES AND CONTROLS				
14.0.3.B	SITE WORK				
14.0.3.B	LEVEE TRAIL (8' WIDE) 8" GRANULAR SUBBASE W/2.5" SURFACE COURSE ASPHALT	LF	16,700.00	$13.51	$225,658.75
14.0.3.B	BICYCLE TRAIL (10' WIDE) (2" SURFACE COURSE)	LF	16,700.00	$11.27	$188,209.00
	SUBTOTAL ACTIVITY GUIDES AND CONTOLS				$413,867.75
14.0.6.-	UTILITIES				
14.0.6.R	ELECTRICAL				
14.0.6.R	HPS AREA LIGHT 16' POLE	EA	167.00	$1,552.50	$259,267.50
14.0.6.R	HPS AREA LIGHT 25' POLE	EA	84.00	$2,300.00	$193,200.00

SUBTOTAL UTILITIES	$452,467.50

SUMMARY COST ELIGIBLE ITEMS	
SUBTOTAL ALL ITEMS	$951,072.75
CONTINGENCY @ 25%	$237,768.19
SUTOTAL	$1,188,840.94
PLANNING ENGINEERING AND DESIGN @ 12%	$142,660.91
SUBTOTAL	$1,331,501.85
CONSTRUCTION MANAGEMENT @ 8%	$106,520.15
TOTAL ELIGIBLE ITEMS REACH 6	$1,438,022.00

NON - ELIGIBLE ITEMS				
LAND ACQUISITION	AC	9.00	$2,000.00	$18,000.00
CLEARING AND GRUBBING	AC	3.00	$3,134.33	$9,402.98
8' WIDE ASPHALT TRAIL (2" SURFACE COURSE)	LF	26,150.00	$8.91	$233,061.88
PEDESTRIAN WOOD BRIDGE (8'W)	LF	100.00	$74.75	$7,475.00
LIGHTING (INCLUDING SERVICE) HPS AREA LIGHT 16' POLE	EA	262.00	$1,552.50	$406,755.00

SUMMARY NON - COST ELIGIBLE ITEMS	
SUBTOTAL ALL ITEMS	$674,694.85
CONTINGENCY @ 25%	$168,673.71
SUTOTAL	$843,368.56
PLANNING ENGINEERING AND DESIGN @ 12%	$101,204.23
SUBTOTAL	$944,572.79
CONSTRUCTION MANAGEMENT @ 8%	$75,565.82
TOTAL NON - ELIGIBLE ITEMS REACH 6	$1,020,138.61

REACH 6 SUMMARY	
COST - ELIGIBLE ITEMS	$1,438,022.00
COST - NON - ELIGIBLE ITEMS	$1,020,138.61
TOTAL COST REACH 6	$2,458,160.61

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COST ESTIMATE BASE STUDY

CODE	ITEM	UNIT	QUANTITY	COST EA.	SUBTOTAL

LEVEE REACH 7 - BYRAM LEVEE
ELIGIBLE ITEMS

01.-.-.- LANDS AND DAMAGES

01.0.A.-	PURCHASE PROPERTY	AC	3.00	$100.00	$300.00
	SUBTOTAL LANDS AND DAMAGES				$300.00
14.-.-.-	RECREATION FACILITIES				
14.0.A.-	MOBILIZATION AND DEMOBILIZATION (DISTRIBUTED IN COSTS SHOWN BELOW)				
14.0.C.-	PERMANENT ACCESS ROADS AND PARKING				
14.0.C.B	SITE WORK				
14.0.C.B	CLEARING AND GRUBBING	AC	.50	$3,134.33	$1,567.16
14.0.C.B	GRADING	SY	850.00	$2.88	$2,443.75
14.0.C.B	ASPHALT DRIVES				
	24' WIDE DRIVE W/ SUBBASE				
	3-1/2" BASE COURSE AND				
	1-1/2 SURFACE COURSE ASPH.	LF	250.00	$50.89	$12,721.88
	SUBTOTAL ACCESS ROADS AND PARKING				$16,732.79
14.0.1.-	PARKING LOTS AND SERVICE ROADS				
14.0.1.B	SITE WORK				
14.0.1.B	CLEARING AND GRUBBING	AC	.50	$3,134.33	$1,567.16
14.0.1.B	GRADING	SY	400.00	$2.88	$1,150.00
14.0.1.B	ASPHALT PARKING AND SERVICE ROADS				
14.0.1.B	ASPHALT PAVING W/ SUBBASE				
	3-1/2" BASE COURSE AND				
	1-1/2 SURFACE COURSE ASPH.	SY	160.00	$29.90	$4,784.00
14.0.1.B	PARKING LOT W/CURB & GUTTER	CAR	15.00	$419.75	$6,296.25
	SUBTOTAL PARKING LOTS AND SERVICE ROADS				$13,797.41
14.0.2.-	SITE GRADING AND LANDSCAPING				
14.0.2.B	SITE WORK				
14.0.2.B	GRADING	SY	400.00	$2.88	$1,150.00
14.0.2.B	BERMUDA SEEDING	AC	.50	$1,955.00	$977.50
14.0.2.B	TREES (10'-12'/ 1-3/4" CAL.)	EA	30.00	$155.25	$4,657.50
14.0.2.B	SHRUBS (W/ BED PREP & MULCH)	SF	40.00	$5.75	$230.00
14.0.2.B	SIGNAGE	LS	1.00	$25,000.00	$25,000.00
14.0.2.Q	MECHANICAL				
14.0.2.Q	IRRIGATION	AC	.25	$6,900.00	$1,725.00
	SUBTOTAL SITE GRADING AND LANDSCAPING				$33,740.00
14.0.3.-	ACTIVITY GUIDES AND CONTROLS				

14.0.3.B	SITE WORK				
14.0.3.B	LEVEE TRAIL (8' WIDE)				
	8" GRANULAR SUBBASE W/2.5"				
	SURFACE COURSE ASPHALT	LF	3,250.00	$13.51	$43,915.63
14.0.3.B	BICYCLE TRAIL (10' WIDE)				
	(2" SURFACE COURSE)	LF	3,250.00	$11.27	$36,627.50
			SUBTOTAL ACTIVITY GUIDES AND CONTOLS		$80,543.13
14.0.4.-	DAY USE AREAS				
14.0.4.B	SITE WORK				
14.0.4.B	PICNIC ITEMS				
14.0.4.B	6' PICNIC TABLE WOOD/ GALV.F	EA	9.00	$546.25	$4,916.25
14.0.4.B	PEDESTAL GRILL	EA	5.00	$172.50	$862.50
14.0.4.B	PLAYGROUND EQUIPMENT	LS	1.00	$11,500.00	$11,500.00
14.0.4.B	SITE FURNISHINGS				
14.0.4.B	TRASH RECEPTACLE	EA	4.00	$546.25	$2,185.00
14.0.4.B	BENCH - 6'	EA	4.00	$488.75	$1,955.00
14.0.4.B	BICYCLE RACK - 7 UNIT	EA	4.00	$805 00	$3,220.00
			SUBTOTAL DAY USE AREAS		$24,638.75
14.0.P.-	BUILDINGS, PUBLIC USE				
14.0.P.-	COMFORT STATION (15'X15')	EA	1.00	$17,500.00	$17,500.00
			SUBTOTAL BUILDINGS, PUBLIC USE		$17,500.00
14.0.6.-	UTILITIES				
14.0.6.B	SITEWORK				
14.0.6.B	MANHOLE 48" STANDARD				
	0'-6' DEPTH	EA	2.00	$1,150.00	$2,300.00
14.0.6.Q	MECHANICAL				
14.0.6.Q	TAP & METER	LS	1.00	$3,640.00	$3,640.00
14.0.6.Q	WATER MAINS W/FITTINGS				
	6" PVC CLASS C 900	LF	500.00	$11.21	$5,606.25
14.0.6.Q	HOSE BIB	EA	2.00	$575.00	$1,150.00
14.0.6.Q	FIRE HYDRANTS	EA	1.00	$1,150.00	$1,150.00
14.0.6.Q	SEWER LINE				
14.0.6.Q	8" PVC BEDDED	LF	500.00	$20.70	$10,350.00
14.0.6.R	ELECTRICAL				
14.0.6.R	HPS AREA LIGHT 16' POLE	EA	32.00	$1,552.50	$49,680.00
14.0.6.R	HPS AREA LIGHT 25' POLE	EA	16.00	$2,000.00	$36,800.00
			SUBTOTAL UTILITIES		$110,676.25
	SUMMARY COST ELIGIBLE ITEMS				
	SUBTOTAL ALL ITEMS				$297,928.33

CONTINGENCY @ 25%	$74,482.08
SUTOTAL	$372,410.41
PLANNING ENGINEERING AND DESIGN @ 12%	$44,689.25
SUBTOTAL	$417,099.66
CONSTRUCTION MANAGEMENT @ 8%	$33,367.97
TOTAL ELIGIBLE ITEMS REACH 7	$450,467.63

REACH 7 SUMMARY

COST - ELIGIBLE ITEMS	$450,467.63
COST - NON - ELIGIBLE ITEMS	$.00
TOTAL COST REACH 7	$450,467.63

SUMMARY - BASE PLAN	ELIGIBLE	NON-ELIGIBLE	TOTAL
REACH 1	$5,292,565.75	$151,450.35	$5,444,016.10
REACH 2	$5,748,056.98	$68,342.40	$5,816,399.38
REACH 3	$333,587.46	$1,200,531.87	$1,534,119.33
REACH 4	$5,100,842.58	$267,849.97	$5,368,692.55
REACH 5	$1,254,939.39	$206,163.45	$1,461,102.84
REACH 6	$1,438,022.00	$1,020,138.61	$2,458,160.61
REACH 7	$450,467.63	$.00	$450,467.63
TOTAL COST BASE PLAN	**$19,618,481.79**	**$2,914,476.65**	**$22,532,958.44**

EXPANDED PLAN - ALL ITEMS ARE NON - ELIGIBLE

LANDS AND DAMAGES				
PURCHASE PROPERTY	AC	468.00	$2,000.00	$936,000.00
EARTHWORK (GENERAL ITEMS NOT FIGURED INTO SPECIFIC ELEMENTS)				
CLEARING AND GRUBBING	AC	55.00	$3,134.33	$172,387.88
GENERAL EXCAVATION (GRADING)	SY	50,900.00	$2.88	$146,337.50
WATER SYSTEM				
TAP & METER	LS	3.00	$3,640.00	$10,920.00
WATER MAINS W/FITTINGS				
6" PVC CLASS C 900	LF	9,050.00	$11.21	$101,473.13
HOSE BIB	EA	10.00	$575.00	$5,750.00
FIRE HYDRANTS	EA	5.00	$1,150.00	$5,750.00
SEWER SYSTEM				
SEWER LINE				

8" PVC BEDDED	LF	9,050.00	$20.70	$187,335.00
MANHOLE 48" STANDARD				
0'-6' DEPTH	EA	24.00	$1,150.00	$27,600.00
PAVING				
WALKS				
8' WIDE CONCRETE TRAIL	LF	47,100.00	$16.50	$777,267.75
8' WIDE ASPHALT TRAIL				
(2" SURFACE COURSE)	LF	28,150.00	$8.91	$250,886.88
8' WIDE OFF-ROAD TRAIL	LF	22,100.00	$2.30	$50,830.00
ASPHALT PARKING AND DRIVES				
24' WIDE DRIVE W/ SUBBASE				
3-1/2" BASE COURSE AND				
1-1/2 SURFACE COURSE ASPH.	LF	10,750.00	$50.89	$547,040.63
ASPHALT PAVING W/ SUBBASE,				
3-1/2" BASE COURSE AND				
PARKING LOT W/ CURB AND GUTTER	CAR	756.00	$419.75	$317,331.00
SITE AMENITIES				
PEDESTRIAN WOOD BRIDGE (8'W)	LF	1,430.00	$74.75	$106,892.50
WOOD PIER/ BOAT DOCK (8'x30')	LS	2.00	$5,750.00	$11,500.00
STRUCTURES				
COMFORT STATION (15'x15')	EA	4.00	$17,500.00	$70,000.00
PICNIC PAVILION (14'x20')	EA	5.00	$16,100.00	$80,500.00
KIOSK	EA	32.00	$6,900.00	$220,800.00
AMPHITHEATER	LS	1.00	$100,000.00	$100,000.00
CHAIN LINK FENCE (6') W/GATE	LF	11,300.00	$11.50	$129,950.00
SITE FURNISHINGS				
TRASH RECEPTACLE	EA	47.00	$546.25	$25,673.75
BENCH - 6'	EA	46.00	$488.75	$22,482.50
BICYCLE RACK - 7 UNIT	EA	20.00	$805.00	$16,100.00
PICNIC ITEMS				
6' PICNIC TABLE WOOD/ GALV.F	EA	108.00	$546.25	$58,995.00
PEDESTAL GRILL	EA	54.00	$172.50	$9,315.00
PLAYGROUND EQUIPMENT	LS	1.00	$11,500.00	$11,500.00
SIGNAGE	LS	3.00	$25,000.00	$75,000.00
LIGHTING (INCLUDING SERVICE)				
HPS AREA LIGHT 16' POLE	EA	282.00	$1,552.50	$437,805.00
HPS AREA LIGHT 25' POLE	EA	250.00	$2,300.00	$575,000.00
BOAT RAMP	EA	1.00	$25,000.00	$25,000.00
INFLATATBLE DAM, FOUNDATION				
AND CONTROLS	LS	1.00	$1,250,000.00	$1,250,000.00
GRASSING AND PLANT MATERIAL				
GRASSING (INCL. FERT. & PREP.)				
BERMUDA SEEDING (>1 AC)	AC	11.00	$1,955.00	$21,505.00
TREES (10'-12'/ 1-3/4" CAL.)	EA	250.00	$155.25	$38,812.50
SHRUBS (W/ BED PREP & MULCH)	SF	380.00	$5.75	$2,185.00

SUMMARY EXPANDED PLAN	
SUBTOTAL ALL ITEMS	$6,825,926.00
CONTINGENCY @ 25%	$1,706,481.50
SUTOTAL	$8,532,407.50
PLANNING ENGINEERING AND DESIGN @ 12%	$1,023,888.90

SUBTOTAL	$9,556,296.40
CONSTRUCTION MANAGEMENT @ 8%	$764,503.71
TOTAL - EXPANDED PLAN (NON - ELIGIBLE ITEMS)	$10,320,800.11

NOTE: REDEVELOPMENT OF THE DOWNTOWN COMMERCIAL CENTER AND TOWN CREEK PARK NOT INCLUDED IN THIS ESTIMATE.

PROJECT SUMMARY

	ELIGIBLE	NON - ELIGIBLE
BASE PLAN	$19,618,481.79	$2,914,476.65
EXPANDED PLAN	$.00	$10,320,800.11
TOTALS	$19,618,481.79	$13,235,276.77
TOTAL PROJECT COST		**$32,853,758.55**

M. Operations and Maintenance Cost

1. Introduction

The operation and maintenance of this facility should be assigned to an organization specifically created for the task. Because of the complexity of the project, quantities and costs were broken down by levee reach, as identified in Section VI of the study. In some cases, costs were evenly distributed between the reaches. In other cases, the costs were pro-rated. This was done where practical due to the volumes involved.

Major categories of operations and maintenance include the following:

GRASS MOWING

Two different types of turf maintenance are required for the project. The first is defined as the areas requiring a high level of detailed mowing, as around buildings and on ballfields, which should be done with push-type mowers and small riding mowers. The other is the land which should be mowed with larger tractor reel-type and gang mowers. A general spatial evaluation of the project yields a rough ratio of 10% push mowing, 50% small riding mowing, and 40% tractor type mowing. The task is broken down into three categories: labor, equipment, and materials. The data contained in the charts following this introductory section is derived from The Park and Recreation Management Manual, City of Jackson, Ms., Division of Human Development and Recreation, October, 1983.

LITTER REMOVAL

Grass mowing and litter removal are the two main labor intensive tasks. These tasks are performed in a cyclical manner, with the mowing dropping off in frequency during the fall and winter. Common practice is to allow the same crews to do both tasks, with the time for completion being allocated throughout a cycle. For example, the entire project should experience a complete mowing and litter removal cycle in two weeks time. The tasks should be proportioned through this cycle. 3.5 days per week were allocated for mowing, and 1.5 days per week for litter removal. Reviewing man-hour requirements for these tasks yields a total labor force of 14 persons for these tasks.

The need for flexibility in the allocation of labor due to possible programming elements within the project prompts the even distribution of this task across the seven levee reaches. Again, the task is broken down into three categories: labor, equipment, and materials, and the man hour data contained in the charts is derived from The Park and Recreation Management Manual, City of Jackson, Ms., Division of Human Development and Recreation, October, 1983. Equipment costs are derived from Means Site Work Cost Data, 1992.

TREE AND SHRUB MAINTENANCE

These tasks are seasonal in nature, occuring only as necessary. Costs are per plant, and derived from The Park and Recreation Management Manual mentioned above.

LIGHTING

Maintenance of the lighting system is pro-rated over a 25 year life cycle of the system.

IRRIGATION

Experience shows that irrigation systems can be maintained for an average of 5% of their initial construction cost.

ELECTRICAL CONSUMPTION

Electrical consumption consists of three categories: Building lighting and power, area lighting, and street lighting. Until the project is more fully developed, the extent of more specialized power needs is not known. Lighting is the major source of power consumption, with an allowance for miscellaneous power being made. Prices and rates of consumption given below are derived from Mississippi Power and Light Company's recommendations.

WATER CONSUMPTION

Water consumption is calculated at the standard rate for the City of Jackson, realizing that other municipalities and counties will have portions of the project under their jurisdictions. The Water Consumption chart contained in this section shows the breakdown of usage and fees, both for actual gallonage, and meter charges. Meters are allocated by park site and reach.

PERSONNEL

The level of sophistication and the multiple municipal jurisdictions of this project indicate that the system be operated under one system manager, with the help of two assitant managers (one for operations and one for programming). Personnel costs were developed through the evaluation of other municipal park systems and the Mississippi Department of Wildlife, Fisheries, and Parks.

Rangers are distributed over the entire project, with the ability to be concentrated as needed. Maintenance personnel costs are included in the task unit prices, with breakdowns as to manhours provided in the charts following this introductory section.

2. Estimates of Time by Task

SCHEDULE OF MAJOR WORK ACTIVITIES WITH
ESTIMATE OF TIME FOR GROUNDS MAINTENANCE BY TASK

TASK	UNIT	STANDARD (MAN HRS.)
GRASS MOWING		
Mowing, hand and power (improved areas):		
Power mower, 18" to 22"	1,000 SF	0.11
Power mower, 27" to 30"	acre	3.12
Power mower, 30" to 32"	acre	2.75
Riding mower, 72"	acre	1.92
Mowing, tractor:		
Reel, 3-gang, 7 ft.	acre	0.37
Reel, 5 gang, 12.5 ft.	acre	0.31
Rotary, 5 ft.	acre	0.90
Rotary, 6 to 8 ft.	acre	0.64

*Based on a 3.5 day work week for this task, and an overall project completion time for the task of 2 weeks (7 work days). The project is estimated to require a 10/50/40 split between 27"-30"power mowing/72" riding mower/6-8 ft. tractor mowing. The length of the mowing season is April 1 to October 31, or 214 days. This gives 16 complete mowing cycles per season. See accompanying spreadsheet for more detailed data.

LITTER REMOVAL

Pick up and remove litter from parks and trail system

Labor cost:	14 laborers x 12 hrs./week =	168 hrs./week
	52 weeks/year x 168 hrs./week =	8736 hrs./year
		x 6.00/hr.
	Total annual labor cost	$52416.00

Equipment cost:	
Cushman type maintenance cart = $15,000.00 ea.	
One cart per 2 laborers = 7 carts	
7 year life cycle = $15,000.00 / 7 = $2,142.86/yr.	
replacement cost/year/cart x 7 carts=	$15,000.00/yr.
5% annual repair and maintenance	
$15000.00 x 5% /yr./cart x 7 carts =	$5,250.00/yr.
Miscellaneous (trash bags, tools, etc.)	$1,500.00/yr.
Total annual equipment cost	$21,750.00/yr.
Total annual litter removal cost	**$74,166.00**
Total annual litter removal cost, prorated over seven levee reaches = $74,166.00 / 7 =	**$10,995.14**

TREE MAINTENANCE

Chip pruned tree limbs (per tree)	each		0.08
Prune trees (large)	each		2.80
		Total	2.88

SHRUB MAINTENANCE

Prune Shrubs (deciduous)	each		0.20
Prune Shrubs (evergreen)	each		0.13
		Total	0.33

**Source: Park and Recreation Management Manual, City of Jackson, Mississippi, Division of Human Development and Recreation, October, 1983

LIGHTING

25 Year life cycle cost

IRRIGATION

Calculated at 5% of cost

ELECTRICAL CONSUMPTION

Size of fixture = 250 watts
Hours per day of use = 12
Days per year of use = 365
Therefore, 250 watts x 12 hours = 3000 watt-hours, or 3.0 kwh.
An additional .6 kwh, or 20% was added for ballast and miscellaneous power consumption, giving a total of 3.6 kwh per fixture per day.
3.6 kwh x 365 days = 1314 kwh per fixture per year.
This was then calculated at $0.10 per kilowatt hour, as recommended by Mississippi Power and Light.

MANAGEMENT PERSONNEL

Manager (annual salary w/benefits)

Level 1	$18,763.44
Level 2	$20,224.44
Level 3	$22,353.36
Level 4	$24,690.96

Ranger (annual salary w/benefits)

Level 1	$12,105.48
Level 2	$13,378.56
Level 3	$14,776.92
Level 4	$15,006.60

Maintenance personnel (annual salary w/benefits)

Supervisor	$15,152.64

Worker 2 $11,226.88
Worker 4 $13,712.52

Comparing these positions to comparable ones across the region yields the following annual salaries:

System Manager: $35,000.00
Assistant Managers (2) $24,500.00
Rangers (3 per park) $15,000.00

Source: Mississippi Department of Wildlife, Fisheries, and Parks.

3. Grass Mowing Calculations by Reach

REACH 1	-	125 AC.						
27-30 IN. POWER MOWER	@	10%	=	12.50	X	3.12	HRS/ACRE	= 39.00
72 IN. RIDING MOWER	@	50%	=	62.50	X	1.92	HRS/ACRE	= 120.00
6-8 FT. ROTARY TRACTOR	@	40%	=	50.00	X	.64	HRS/ACRE	= 32.00
							TOTAL HRS.	191.00

PER CYCLE:

191 HRS./	56 DAYS	=	3.41	MAN LABORERS

ANNUAL:

191 HRS.X	16 CYCLES	=	3056.00	MAN HRS.	
3056 HRS.		X	$6.00	/HOUR	= $18,336.00

ANNUAL EQUIPMENT COSTS:

27-30 IN. POWER MOWER	12.50	X	$3.05	/ACRE	= $38.13
72 IN. RIDING MOWER	62.50	X	$30.50	/ACRE	= $1,906.25
6-8 FT. ROTARY TRACTOR	50.00	X	$30.50	/ACRE	= $1,525.00
			TOTAL EQUIPMENT COST		$3,469.38

MATERIALS COST:

FERTILIZER @ 100 LBS./ACRE	125	X	$20.00	/ACRE	= $2,500.00
			TOTAL MATERIALS COST		$2,500.00
			==========		
			TOTAL COST REACH 1		**$24,305.38**
			TOTAL ANNUAL COST/AC.		**$194.44**

REACH 2	-	180 AC.						
27-30 IN. POWER MOWER	@	10%	=	18.00	X	3.12	HRS/ACRE	= 56.16
72 IN. RIDING MOWER	@	50%	=	90.00	X	1.92	HRS/ACRE	= 172.80
6-8 FT. ROTARY TRACTOR	@	40%	=	72.00	X	.64	HRS/ACRE	= 46.08
							TOTAL HRS.	275.04

PER CYCLE:

275.04 HRS./	56 DAYS	=	4.91	MAN WORKERS

ANNUAL:

275.04 HRS.X	16 CYCLES	=	4400.64 MAN HRS.			
4400.64 HRS.			X	$6.00 /HOUR	=	$26,403.84

EQUIPMENT COSTS:

27-30 IN. POWER MOWER	18.00	X	3.05 /ACRE	=	$54.90
72 IN. RIDING MOWER	90.00	X	30.50 /ACRE	=	$2,745.00
6-8 FT. ROTARY TRACTOR	72.00	X	30.50 /ACRE	=	$2,196.00
			TOTAL EQUIPMENT COST		$4,995.90

MATERIALS COST:

FERTILIZER @ 100 LBS./ACRE	180	X	20.00 /ACRE	=	$3,600.00
			TOTAL MATERIALS COST		$3,600.00
			==========		
			TOTAL COST REACH 2		**$34,999.74**
			TOTAL ANNUAL COST/AC.		**$194.44**

REACH 3 - 9 AC.

27-30 IN. POWER MOWER	@ 10%	=	.90	X	3.12 HRS/ACRE	=	2.81
72 IN. RIDING MOWER	@ 50%	=	4.50	X	1.92 HRS/ACRE	=	8.64
6-8 FT. ROTARY TRACTOR	@ 40%	=	3.60	X	.64 HRS/ACRE	=	2.30
					TOTAL HRS.		13.75

PER CYCLE:

		MAN			
13.75 HRS./	56 DAYS	=	.25 WORKERS		

ANNUAL:

13.75 HRS.X	16 CYCLES	=	220.03 MAN HRS.		
220.03 HRS.			X $6.00 /HOUR	=	$1,320.19

EQUIPMENT COSTS:

27-30 IN. POWER MOWER	.90	X	3.05 /ACRE	=	$2.75
72 IN. RIDING MOWER	4.50	X	30.50 /ACRE	=	$137.25
6-8 FT. ROTARY TRACTOR	3.60	X	30.50 /ACRE	=	$109.80
			TOTAL EQUIPMENT COST		$249.80

MATERIALS COST:

FERTILIZER @ 100 LBS./ACRE	9	X	20.00 /ACRE	=	$180.00
			TOTAL MATERIALS COST		$180.00
			==========		
			TOTAL COST REACH 3		**$1,749.99**
			TOTAL ANNUAL COST/AC.		**$194.44**

REACH 4 - 111 AC.

27-30 IN. POWER MOWER	@ 10%	=	11.10	X	3.12 HRS/ACRE	=	34.63
72 IN. RIDING MOWER	@ 50%	=	55.50	X	1.92 HRS/ACRE	=	106.56
6-8 FT. ROTARY TRACTOR	@ 40%	=	44.40	X	.64 HRS/ACRE	=	28.42
					TOTAL HRS.		169.61

PER CYCLE:

		MAN			
169.61 HRS./	56 DAYS	=	3.03 WORKERS		

ANNUAL:

169.61 HRS.X	16 CYCLES	=	2713.73 MAN HRS.		
2713.73 HRS.			X $6.00 /HOUR	=	$16,282.37

EQUIPMENT COSTS:

27-30 IN. POWER MOWER	11.10	X	3.05 /ACRE	=	$33.86
72 IN. RIDING MOWER	55.50	X	30.50 /ACRE	=	$1,692.75
6-8 FT. ROTARY TRACTOR	44.40	X	30.50 /ACRE	=	$1,354.20
			TOTAL EQUIPMENT COST		$3,080.81

MATERIALS COST:

FERTILIZER @ 100 LBS./ACRE	111	X	20.00 /ACRE	=	$2,220.00
			TOTAL MATERIALS COST		$2,220.00
					==========
			TOTAL COST REACH 4		**$21,583.17**
			TOTAL ANNUAL COST/AC.		**$194.44**

REACH 5 - 32.50 AC.

27-30 IN. POWER MOWER	@ 10%	=	3.25	X	3.12 HRS/ACRE	=	10.14
72 IN. RIDING MOWER	@ 50%	=	16.25	X	1.92 HRS/ACRE	=	31.20
6-8 FT. ROTARY TRACTOR	@ 40%	=	13.00	X	.64 HRS/ACRE	=	8.32
					TOTAL HRS.		49.66

PER CYCLE:

49.66 HRS./	56 DAYS	=	.89 MAN WORKERS

ANNUAL:

49.66 HRS.X	16 CYCLES	=	794.56 MAN HRS.		
794.56 HRS.		X	$6.00 /HOUR	=	$4,767.36

EQUIPMENT COSTS:

27-30 IN. POWER MOWER	3.25	X	3.05 /ACRE	=	$9.91
72 IN. RIDING MOWER	16.25	X	30.50 /ACRE	=	$495.63
6-8 FT. ROTARY TRACTOR	13.00	X	30.50 /ACRE	=	$396.50
			TOTAL EQUIPMENT COST		$902.04

MATERIALS COST:

FERTILIZER @ 100 LBS./ACRE	32.50	X	20.00 /ACRE	=	$650.00
			TOTAL MATERIALS COST		$650.00
					==========
			TOTAL COST REACH 5		**$6,319.40**
			TOTAL ANNUAL COST/AC.		**$194.44**

REACH 6 - 54 AC.

27-30 IN. POWER MOWER	@ 10%	=	5.40	X	3.12 HRS/ACRE	=	16.85
72 IN. RIDING MOWER	@ 50%	=	27.00	X	1.92 HRS/ACRE	=	51.84
6-8 FT. ROTARY TRACTOR	@ 40%	=	21.60	X	.64 HRS/ACRE	=	13.82
					TOTAL HRS.		82.51

PER CYCLE:

82.51 HRS./	56 DAYS	=	1.47 MAN WORKERS

ANNUAL:

82.51 HRS.X	16 CYCLES	=	1320.19 MAN HRS.		
1320.19 HRS.		X	$6.00 /HOUR	=	$7,921.15

EQUIPMENT COSTS:

27-30 IN. POWER MOWER	5.40	X	3.05	/ACRE	=	$16.47
72 IN. RIDING MOWER	27.00	X	30.50	/ACRE	=	$823.50
6-8 FT. ROTARY TRACTOR	21.60	X	30.50	/ACRE	=	$658.80
			TOTAL EQUIPMENT COST			$1,498.77

MATERIALS COST:

FERTILIZER @ 100 LBS./ACRE	54	X	20.00	/ACRE	=	$1,080.00
			TOTAL MATERIALS COST			$1,080.00
			TOTAL COST REACH 6			**$10,499.92**
			TOTAL ANNUAL COST/AC.			**$194.44**

REACH 7 - 3 AC.

27-30 IN. POWER MOWER @ 10%	=	.30	X	3.12	HRS/ACRE	=	.94
72 IN. RIDING MOWER @ 50%	=	1.50	X	1.92	HRS/ACRE	=	2.88
6-8 FT. ROTARY TRACTOR @ 40%	=	1.20	X	.64	HRS/ACRE	=	.77
					TOTAL HRS.		4.58

PER CYCLE:

		MAN		
4.58 HRS./	56 DAYS	=	.08	WORKERS

ANNUAL:

4.58 HRS.X	16 CYCLES	=	73.34	MAN HRS.		
73.34 HRS.		X	$6.00	/HOUR	=	$440.06

EQUIPMENT COSTS:

27-30 IN. POWER MOWER	.30	X	3.05	/ACRE	=	$.92
72 IN. RIDING MOWER	1.50	X	30.50	/ACRE	=	$45.75
6-8 FT. ROTARY TRACTOR	1.20	X	30.50	/ACRE	=	$36.60
			TOTAL EQUIPMENT COST			$83.27

MATERIALS COST:

FERTILIZER @ 100 LBS./ACRE	3	X	20.00	/ACRE	=	$60.00
			TOTAL MATERIALS COST			$60.00
			TOTAL COST REACH 7			**$583.33**
			TOTAL ANNUAL COST/AC.			**$194.44**

SUMMARY

TOTAL LABORERS NEEDED:		**14.04**		
TOTAL MANHOURS:		**12578.50**		
ANNUAL LABOR COSTS:	$6.00 HR.X	12578.50	MAN HOURS	= $75,471.00

EQUIPMENT COSTS:

27-30 IN. POWER MOWER	51.45	X	3.05	/ACRE	=	$156.92
72 IN. RIDING MOWER	257.25	X	30.50	/ACRE	=	$7,846.13
6-8 FT. ROTARY TRACTOR	205.80	X	30.50	/ACRE	=	$6,276.90
			TOTAL EQUIPMENT COST			$14,279.95

MATERIALS COST:

FERTILIZER @ 100 LBS./ACRE	514.50	X	20.00	/ACRE	=	$10,290.00
			TOTAL MATERIALS COST			$10,290.00

TOTAL ANNUAL MOWING COST: $100,040.95

4. Water Consumption For Irrigation By Reach

November 4, 1992

WHERE AVG. FLOW= (GPM)

$$\frac{27{,}154 \times \text{IRR. REQ. (INCHES/ WK.)} \times \#\text{ OF ACRES (TURF \& PLANTED)}}{\text{HRS./DAY AVAILABLE} \times \text{DAYS/WK. AVAILABLE} \times \text{SYSTEM EFFICINCY} \times 60\text{ MIN. (CONSTANT)}}$$

GALLONS PER DAY= GPM x 60 (MIN./HR.) x HRS. OF OPERATION PER DAY

GALLONS PER WEEK= GPD x DAYS PER WEEK IN OPERATION

GALLONS PER YEAR= GPW x 36 WEEKS (MARCH THROUGH OCTOBER)

IDEAL STANDARDS:
IRRIGATION REQUIREMENT= 1 INCH/ WEEK
HRS./DAY AVAIL= 8 (10 PM TO 6 AM)
DAYS PER WEEK AVAILABLE= 4 (MAX - EVERY OTHER DAY)
SYSTEM EFFICIENCY= 1 (100%)

CITY OF JACKSON
WATER SERVICE
RATES: $1.04 / 100 CUBIC FEET
MIN. BI-MONTHLY
SERVICE CHARGE
FOR WATER METER
LARGER THAN 2" $70.00
MIN. BI-MONTHLY
SERVICE CHARGE
FOR SEWER $69.92

ABBREVIATIONS: C.F. = CUBIC FEET

QUANTITY CALCULATIONS

REACH#	ACREAGE	GPM	GPD	GPW	GPY	C.F./YR.
1	11.10	156.98	75,352.35	301,409.40	10,850,738.40	1,450,633.48
2	27.50	388.92	186,683.75	746,735.00	26,882,460.00	3,593,911.76
3	NONE					
4	111	1569.84	753,523.50	3,014,094.00	108,507,384.00	14,506,334.76
5	.25	3.54	1,697.13	6,788.50	244,386.00	32,671.93

6	NONE					
7	.25	3.54	1,697.13	6,788.50	244,386.00	32,671.93

==========

COST CALCULATIONS

REACH#	C.F./YR.	$/100 C.F.	MIN. MO. COST FOR SERVICE (/METER)	ANNUAL COST
1	1,450,633.48	1.04	69.96 (2 METERS)	$15,226.51
2	3,593,911.76	1.04	69.96 (2 METERS)	$37,516.60
3	NONE			
4	14,506,334.76	1.04	69.96 (2 METERS)	$151,005.80
5	32,671.93	1.04	69.96 (1 METER)	$409.75
6	NONE			
7	32,671.93	1.04	69.96 (1 METER)	$409.75
		TOTAL ANNUAL COST		$204,568.41

5. Operating And Maintenance Costs

NOVEMBER 6, 1992

REVISED JANUARY 6, 1993

REACH NO. 1 - NORTHEAST JACKSON LEVEE

ITEM	QUAN.	UNIT	@	EXTENDED
TRASH COLLECTION				
LABOR	1,248.00	HRS	$6.00	$7,488.00
EQUIPMENT	1.00	LS	$2,892.86	$2,892.86
MATERIALS	1.00	LS	$214.29	$214.29
GRASS MOWING				
LABOR	3,056.00	HRS	$6.00	$18,336.00
EQUIPMENT	1.00	LS	$3,469.38	$3,469.38
MATERIALS	125.00	AC	$20.00	$2,500.00
TREE MAINTENANCE	500.00	EA	$2.88	$1,440.00
SHRUB MAINTENANCE	1,000.00	EA	$.33	$330.00
LIGHTING 25 YR. LIFE CYCLE				$32,800.00

IRRIGATION @ 5% COST				$3,300.00
WATER CONSUMPTION	1.00	LS	$15,226.51	$15,226.51
ELEC. CONSUMPTION	709,560.00	KWH	$.10	$70,956.00
TRAIL & BRIDGES @ 1% COST				$10,300.00
PARK SYSTEM MANAGER (ENTIRE PROJECT/NO. OF REACHES)				$5,000.00
PARK MGR.	.28	REACH	$25,000.00	$7,000.00
PARK RANGERS	3.00	REACH	$15,000.00	$45,000.00
TOTAL ANNUAL OPERATING AND MAINTENANCE COSTS				$226,253.04

REACH NO. 2 - FLOWOOD LEVEE

ITEM	QUAN.	UNIT	@	EXTENDED
TRASH COLLECTION				
LABOR	1,248.00	HRS	$6.00	$7,488.00
EQUIPMENT	1.00	LS	$2,892.86	$2,892.86
MATERIALS	1.00	LS	$214.29	$214.29
GRASS MOWING				
LABOR	4,400.64	HRS	$6.00	$26,403.84
EQUIPMENT	1.00	LS	$4,995.90	$4,995.90
MATERIALS	180.00	AC	$20.00	$3,600.00
TREE MAINTENANCE	410.00	EA	$2.88	$1,180.80
SHRUB MAINTENANCE	640.00	EA	$.33	$211.20
LIGHTING 25 YR. LIFE CYCLE				$26,872.00
IRRIGATION @ 5% COST				$8,250.00
WATER CONSUMPTION	1.00	LS	$37,516.60	$37,516.60
ELEC. CONSUMPTION	607,068.00	KWH	$.10	$60,706.80
TRAIL & BRIDGES @ 1% COST				$5,100.00
PARK SYSTEM MANAGER (ENTIRE PROJECT/NO. OF REACHES)				$5,000.00
PARK MGR.	.28	REACH	$25,000.00	$7,000.00
PARK RANGERS	3.00	REACH	$15,000.00	$45,000.00
TOTAL ANNUAL OPERATING AND MAINTENANCE COSTS				$242,432.29

REACH NO. 3 - EXISTING FAIRGROUNDS LEVEE

ITEM	QUAN.	UNIT	@	EXTENDED
TRASH COLLECTION				
LABOR	1,248.00	HRS	$6.00	$7,488.00
EQUIPMENT	1.00	LS	$2,892.86	$2,892.86
MATERIALS	1.00	LS	$214.29	$214.29
GRASS MOWING				
LABOR	220.03	HRS	$6.00	$1,320.18
EQUIPMENT	1.00	LS	$4,995.90	$4,995.90
MATERIALS	9.00	AC	$20.00	$180.00
TREE MAINTENANCE	.00	EA	$2.88	$.00
SHRUB MAINTENANCE	.00	EA	$.33	$.00
LIGHTING 25 YR. LIFE CYCLE				$3,470.00
IRRIGATION @ 5% COST				$.00
ELEC. CONSUMPTION	76,212.00	KWH	$.10	$7,621.20
WATER CONSUMPTION	1.00	LS	$.00	$.00
TRAIL & BRIDGES @ 1% COST				$7,825.00

PARK SYSTEM MANAGER (ENTIRE PROJECT/NO. OF REACHES)				$5,000.00
PARK MGR.	.28	REACH	$25,000.00	$7,000.00
PARK RANGERS	3.00	REACH	$15,000.00	$45,000.00
TOTAL ANNUAL OPERATING AND MAINTENANCE COSTS				$93,007.43

REACH NO. 4 - EXISTING EAST JACKSON LEVEE

ITEM	QUAN.	UNIT	@	EXTENDED
TRASH COLLECTION				
LABOR	1,248.00	HRS	$6.00	$7,488.00
EQUIPMENT	1.00	LS	$2,892.86	$2,892.86
MATERIALS	1.00	LS	$214.29	$214.29
GRASS MOWING				
LABOR	2,713.73	HRS	$6.00	$16,282.38
EQUIPMENT	1.00	LS	$3,080.81	$3,080.81
MATERIALS	111.00	AC	$20.00	$2,220.00
TREE MAINTENANCE	86.00	EA	$2.88	$247.68
SHRUB MAINTENANCE	80.00	EA	$.33	$26.40
LIGHTING 25 YR. LIFE CYCLE				$34,500.00
IRRIGATION @ 5% COST				$33,300.00
WATER CONSUMPTION	1.00	LS	$151,005.80	$151,005.80
ELEC. CONSUMPTION	729,270.00	KWH	$.10	$72,927.00
TRAIL & BRIDGES @ 1% COST				$7,760.00
PARK SYSTEM MANAGER (ENTIRE PROJECT/NO. OF REACHES)				$5,000.00
PARK MGR.	.28	REACH	$25,000.00	$7,000.00
PARK RANGERS	3.00	REACH	$15,000.00	$45,000.00
TOTAL ANNUAL OPERATING AND MAINTENANCE COSTS				$388,945.22

REACH NO. 5 - SOUTH JACKSON LEVEE (FROM OLD BRANDON RD. TO LYNCH CR.)

ITEM	QUAN.	UNIT	@	EXTENDED
TRASH COLLECTION				
LABOR	1,248.00	HRS	$6.00	$7,488.00
EQUIPMENT	1.00	LS	$2,892.86	$2,892.86
MATERIALS	1.00	LS	$214.29	$214.29
GRASS MOWING				
LABOR	794.56	HRS	$6.00	$4,767.36
EQUIPMENT	1.00	LS	$902.04	$902.04
MATERIALS	32.50	AC	$20.00	$650.00
TREE MAINTENANCE	60.00	EA	$2.88	$172.80
SHRUB MAINTENANCE	40.00	EA	$.33	$13.20
LIGHTING 25 YR. LIFE CYCLE				$10,880.00
IRRIGATION @ 5% COST				$7.50
WATER CONSUMPTION	1.00	LS	$409.75	$409.75
ELEC. CONSUMPTION	231,264.00	KWH	$.10	$23,126.40
TRAIL & BRIDGES @ 1% COST				$1,420.00
PARK SYSTEM MANAGER (ENTIRE PROJECT/NO. OF REACHES)				$5,000.00
PARK MGR.	.28	REACH	$25,000.00	$7,000.00
PARK RANGERS	3.00	REACH	$15,000.00	$45,000.00
TOTAL ANNUAL OPERATING AND MAINTENANCE COSTS				$109,944.20