LOWER PEARL RIVER REPORT

Prepared by Alan Huffman
for the Mississippi Attorney General's Office

in cooperation with
the Mississippi Governor's Office
the Mississippi Department of Environmental Quality
the Mississippi Department of Wildlife, Fisheries and Parks
and the Pearl River Basin Development District
with special assistance from Margie Robertson Ferguson

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INTRODUCTION

The issue of water diversions along the lower Pearl River became a significant public concern in the early 1970s. In the years since, many state and federal agencies and individuals have expended great energy in seeking to resolve the numerous diversion-related problems.

In 1980, the Mississippi Attorney General's Office filed suit against the U.S. Army Corps of Engineers in U.S. District Court seeking a reallocation of flows along the lower Pearl, with the primary goal of enabling industrial development and barge traffic on what had been the river's historic channel along the Mississippi-Louisiana state line. Environmental problems resulting from the Corps' diversion of water from the eastern channel to Louisiana's western swamps, which were at the forefront of many local residents' concerns, were a secondary consideration in the lawsuit.

When the State of Louisiana joined the lawsuit on the side of the Corps, the dispute shifted to the jurisdiction of the U.S. Supreme Court. The Mississippi Attorney General's Office prepared documentation for a Supreme Court suit, but none was filed. The issue of Mississippi's entitlement to lower Pearl waters subsequently languished through several changes in local, state and federal administrations and the death of the chief proponent of flow restoration, Picayune resident and environmental activist Mansfield Downes.

Today, more than a century after the first signs of trouble appeared along the lower Pearl, and more than 30 years after Mississippi officials first objected to the lack of federal attention to the matter, the issue of flow restoration along the lower river remains unresolved. Environmental degradation resulting from the diversions, meanwhile, has grown considerably worse.

A November 1989 Corps reconnaissance study requested by Mississippi and Louisiana, released in March 1990, concluded that there were no problems with flows along the lower Pearl requiring federal attention; the agency therefore chose not to proceed with feasibility studies of potential reallocations. The State of Louisiana concurred with the Corps' findings.

Gov. Ray Mabus toured the river in November 1989 along with representatives of Attorney General Mike Moore, local state legislators, officials with the Department of Environmental Quality, Department of Wildlife, Fisheries and Parks and Pearl River Basin Development District, the news media and others. Against the backdrop of the completely dry Pearl River shoals, Gov. Mabus pledged his support for correcting the low flow problems resulting from the diversions. Subsequent discussions between Gov. Mabus and Louisiana Gov. Buddy Roemer failed to produce any common ground between the two states regarding the

lower Pearl, however, which left the State of Mississippi with few avenues of relief other than filing suit if flows were to be restored.

In February 1990, with the assistance of the Governor's Office and the state agencies involved, Attorney General Moore contracted to have lower Pearl environmental studies prepared to help formulate and support a state position on the issue. This report is the product of that contract.

As the report was being finalized, negotiations with either Louisiana or the Corps were still considered a remote possibility. But those hopes had already faded by late August, when low water caused a major fish kill along the Walkiah Bluff bend of the river. The fish kill prompted some Mississippi residents to construct an illegal dam across Louisiana's Icebox Bayou in an effort to restore flows through the bend, and many decried what they perceived as an unwillingness of state officials to act. In reality, a lawsuit had already been prepared; all that stood in the way of its being filed was a last-ditch effort by Gov. Mabus to convince Gov. Roemer to negotiate.

Entitlement is still the linchpin of the state's legal position, though the emphasis now is on the environmental impacts of the flow alterations made or allowed by the Corps. The purpose of this report is to gauge the impacts of all the alterations, attempt to assign responsibility for them, identify data needs and consider possible plans for minimizing, mitigating or repairing the environmental damage.

Simultaneous to the drafting of the report, the Department of Wildlife, Fisheries and Parks performed intensive studies of fisheries and other aquatic species along the river; the agency also provided financial support and boats and personnel for the gathering of legal evidence. The Department of Environmental Quality provided financial assistance and performed pollution studies and recorded flow measurements along the river. The Governor's Office and the Pearl River Basin Development District provided financial support toward the completion of this report. The results of the state's ongoing studies, which are nearing completion, will be included in an updated appendix.

It is hoped that through the combined efforts of concerned individuals and responsible government agencies, a final resolution to the longstanding flow problems along the lower Pearl is forthcoming.

1. EXECUTIVE SUMMARY

The Pearl is described as "one of Mississippi's major rivers" in a 1989 area land use report by the Coastal Ecology Institute of Louisiana State University.

The winding, sandy-shored river originates in Neshoba County, cuts a swath through Mississippi's heartland and--technically -- empties into Lake Borgne on the state's western border. It brushes only briefly against Louisiana's coastal swamps.

The drainage basin of the Pearl covers an area of 8,760 square miles, including all or part of 23 Mississippi counties and parts of three Louisiana parishes, according to a 1975 U.S. Army Corps of Engineers' report.

By almost any measure, it is primarily a Mississippi watercourse.

Yet highway signs and maps notwithstanding, the Pearl ultimately belongs to Louisiana. The river has disappeared from Mississippi for a distance of nearly 30 miles inland from the coast, and will soon disappear from another 17 miles upstream. The reason: diversion from its natural bed by the U.S. Army Corps of Engineers, which has for more than a century built and abandoned dams and channels without addressing the environmental, economic or hydrological consequences.

After reaching its greatest size and highest value for recreation and commerce, the Pearl vanishes into a series of Louisiana bayous and sloughs upstream from its natural mouth--the cumulative result of more than a century of manipulation by the Corps. The remainder of its natural bed is either dry, going dry or capable of carrying only flood flows and the runoff of a Mississippi tributary, Hobolochitto Creek. The Pearl that appears on maps as the boundary between Mississippi and Louisiana no longer exists from the shoals downstream, and within a decade will cease to exist downstream of Wilson Slough unless emergency action is taken. The ultimate conduit for the lost water is the West Pearl River, formerly a lesser, separate waterway arising in Louisiana's coastal swamps; the West Pearl has grown from a sluggish bayou to a much enlarged and rapidly eroding river.

The diversion of water from the Pearl to the West Pearl, which began a century ago and is escalating today, has deprived Mississippi of a potential water supply, riparian rights granted at statehood, recreational and industrial access and sites and valuable fish and wildlife habitat. It has also disturbed the natural balance of one of North America's more complex and abundant surviving freshwater swamps.

The environmental problems resulting from the diversions are complex and far reaching, and effect Louisiana as well as Mississippi. But the vast majority occur in Mississippi and effect Mississippians.

Among the worst problems facing the lower Pearl basin today as a result of the diversions:

- The river's eastern marshes are becoming increasingly saline, with subsequent losses in freshwater aquatic habitat and increased coastal erosion. The impact on the oyster resource is unknown at this time, but the Corps in its 1989 Lower Pearl River Basin Flow Distribution study noted that a reallocation of flows would benefit oyster habitat along the East Pearl. If nothing else, the preservation of coastal wetlands would seem of national importance, and worthy of a reallocation of flows.

- Inland freshwater lakes, swamps and wetlands are going dry or filling with silt in the eastern floodplain and being scoured by flood flows to the west. Loss of adequate low flow has restricted industrial and recreational development and limited access to existing natural areas.

- An otherwise natural tributary of the Pearl, Hobolochitto Creek, is polluted as a result of diminished flows that reduce its capability to dilute municipal, industrial and agricultural discharges. The creek provides the only low flow to the interstate river channel below the shoals, and has as its primary source during low flows the sewage discharge from the city of Picayune.

- The Pearl will soon be captured by Wilson Slough and diverted fully into Louisiana, where the Corps plans to build levees to reduce chronic flooding problems. The diversion will exacerbate problems throughout the delta area. The impacts of a capture of the Pearl by Wilson Slough would include abandonment of the Walkiah Bluff Water Park, which provides the only public boat ramp in Pearl River County and is a major access point to the Bogue Chitto National Wildlife Refuge. Environmental degradation downstream of Wilson Slough would compare to what now exists in the East Pearl below the shoals. That damage includes diminished water volumes and low dissolved oxygen levels at low flows. The area of degraded habitat would include parts of the Bogue Chitto refuge and Louisiana's Pearl River Wildlife Management Area. A capture would also cut off waterfront property, both within game preserves and on private land.

The destabilization of the lower Pearl ecology and hydrology is the direct result of the Corps' on-again, off-again involvement in the basin. Since assuming responsibility for the river's flow in the 1880s, the agency has built and abandoned

works without considering either the short-term or cumulative impacts of its work.

Prior to the Corps' intervention in the lower Pearl, the main channel of the river remained in the eastern floodplain downstream from what's known as Old River, southeast of Bogalusa, Louisiana. Although Old River and the West Pearl were auxiliary watercourses to the Pearl, it was along the main channel that the state boundary was drawn, which gave Mississippi and Louisiana an equal share of the lower river and the natural resources it provided.

Man-caused diversions began in the mid 19th century with a manmade logjam at the area known as the shoals. In 1880, the Corps decided to allow the log jam to remain in the shoals even though it had blocked navigation and forced the river's flow into Holmes Bayou and what today is known as Wilson Slough. The blockage, which the Corps later made permanent with a dam, also caused the Bogue Chitto River to reverse its flow and drain into the West Pearl rather than the main Pearl River, according to historic accounts.

In the late 19th and early 20th centuries the Corps dammed several lower Pearl bayous, ostensibly to prevent diversions into the West and East Pearl rivers. The agency then abandoned the works and left the river to fend for itself against the powerful and unpredictable currents that had been unleashed -- only to return in the 1930s to build a grandiose and ill conceived barge canal along the West Pearl to Bogalusa. In the 1940s and '50s, ignoring the low flow problems that had developed, the Corps dredged the river and cut off more bends, which sped the flow and arguably made the West Pearl more attractive as a route to the Gulf. The overall result was continued upheaval for the entire lower Pearl.

Because of the Pearl's complex hydrology and the legal issue of states' water rights, federal agencies have been reluctant to address concerns about lower Pearl diversions and related water needs in the delta area. There is disagreement over who was technically responsible, how serious the problems are and when the critical changes were made. In many cases, manmade actions prompted natural changes that were in turn augmented or otherwise manipulated by man.

Mississippi voiced concern over low flows in the eastern delta as early as 1957. But the Corps, interested primarily in maintaining navigation along the West Pearl canal, has never addressed the problem. The U.S. Fish and Wildlife Service, while acknowledging environmental problems in the eastern delta, has not sought reparations. The State of Louisiana has expressed satisfaction with the status quo, citing a well developed fish and wildlife economy dependent upon existing flows.

Although the delta has experienced heydays of lumbering, navigation and industrial development, its highest value today is for fish and wildlife habitat. The public, in Mississippi, Louisiana and beyond, has a vested interest in protecting that habitat, since the majority of area land is already in public ownership, managed by wildlife agencies in Mississippi and Louisiana and by the U.S. Fish and Wildlife Service, and further land acquisition is expected.

Given the value of the habitat, it would seem logical to look at the lower Pearl ecosystem as a whole and allocate flows accordingly. Congress recognized the importance of the fragile balance in its 1979 resolution funding Corps water re-allocation reconnaissance studies. The resolution instructed the Corps to investigate "enhancing the ecological condition of the study area and ensuring adequate surface water supplies to the Lower Pearl Basin to meet future demands." The Corps' conclusions earlier this year that there was no need for federal intervention to meet those goals was based on the reasoning that low flows were a "recreational problem" for which the agency had no responsibility. Although members of the state's congressional delegation continue to push for further Corps studies, it seems unlikely that the agency will encourage the effort, or that if it does, will reach conclusions that are satisfactory to the State of Mississippi. Meanwhile, the damage to the ecosystem and the state of Mississippi, much of it longstanding, continues to mount.

Compared with others in the South, the Pearl remains a relatively "natural" river. Its delta is largely timbered and its system of deltaic tributaries and distributaries is reminiscent of the flow regime that existed before man's intervention.

But long-term changes in lower Pearl flows today threaten the sanctity of the interstate wilderness, and the delta's apparently natural characteristics belie serious ecological problems. Because the extent of the damages from the Corps' actions and inactions is only now becoming clear, concerns are growing alongside the area's population and resulting pressures for development and hunting and fishing lands.

Mississippi has a strong case for seeking a halt to the current Wilson Slough diversion, but the case for a full reallocation of flows is more complex. Because the Corps is unwilling to repair the damage at the shoals, and unwilling to repair a failed dam that once prevented the upstream diversion at Wilson Slough, the state must decide for itself whether to seek emergency action at Wilson Slough and at least partial restoration from the shoals downstream.

The obstacles facing any reallocation effort, emergency or otherwise, are considerable. Even given the breadth of obvious impacts, Mississippi lacks strong scientific evidence to support its case that the state's environment has been degraded. Another potential problem is the cost of the work: should the state succeed, cost sharing might be required. And there is always the possibility that the Corps, once engaged, would be dangerous force to reckon with considering the fragility of the delta ecosystem.

In its favor, the state holds the water quality certification permit needed by the Corps to resume dredging along the barge canal, as well as title to at least part of the location of the breakout at Wilson Slough, which apparently does not lie entirely in Louisiana as was previously believed. The state also has the Corps' current mandate to protect wetlands in its favor. And as an environmental restoration project prompted by improper, and in some cases unauthorized, work by the Corps, reallocating flows in the lower Pearl under court order should not require a favorable benefit-to-cost ratio.

The questions facing the state are how to go about forcing a reallocation and what type and degree of reallocation would be most desirable. A decision on what route the state should take hinges on several complicated environmental and legal considerations. Reversing the environmental damage brought on by the Corps, for instance, would require a measure of new environmental damage -- channelization, damming of free flowing streams, clearing of bottomland hardwoods and disposal of dredge spoil. While water rights are at issue, the ecological importance of the delta must be the paramount consideration.

The Pearl delta is basically a wilderness island in an old developed area. While hostile conditions historically protected the delta from conventional development pressures, its location nonetheless made it attractive for other types of exploitation and manipulation. The river's floodplain, which was generally considered too low for agriculture, was stripped of its virgin timber in the late 19th century; its bayous, too numerous and sluggish for easy navigation, were cleared, dammed and otherwise altered beginning in the mid-19th century to enable steamboat commerce and the floating of saw logs to mills. Today, the proximity of the delta to urban areas has fueled second home development, with a resulting increase in the value of riverfront property and corresponding problems with sewage disposal.

To protect the integrity of the surviving Pearl River delta ecosystem and restore lost resources would require a massive effort, and the process would be controversial. It would require the restoration of feeder bayous that once nourished the river's deep swamps, the re-watering of dead or dying streams and the reduction of flows through now flood-scoured waterways. It would

require the construction of dams, sills and channels and the mitigation of resulting environmental damage.

Further disrupting the flow of the unstable delta could create conflicts within the environmental community and between the states, and raise legal questions unrelated to the environment. It's likely that any reallocation plan would be hotly debated, even among Mississippi interests, and there are no guarantees that anyone would be satisfied with the results. Not surprisingly, Corps officials have been reluctant to embark upon such an endeavor.

The ecology of the region is undoubtedly suffering, however, and the state's goal should be a state-of-the-art environmental restoration project that both treats the delta as an environmental whole and restores the state's historic rights.

Since it is unlikely that the federal government will come to Mississippi's aid without a lawsuit, and since so much is at stake, it is the recommendation of this report that the state either negotiate a compromise with Louisiana or take appropriate legal action to ensure at least a 50-50 reallocation of flows.

2. THE NATURAL RIVER

The Pearl today is a poor facsimile of the intricate natural river system found by the French explorers in the late 17th century.

The Pearl prior to man's intervention was a changeable but intricately balanced river system, providing a rich mixture of riverine, stream, swamp and marsh habitat that likewise posed significant obstacles to navigation and to the exploitation of the basin's resources.

Historically, the lower Pearl River system has been characterized by flows that alternate within a balanced network of channels, cutoffs, logjams and overflow swamps. Easily eroded soils and easily deflected currents have given the river an exaggerated tendency to meander, and flood surges and ocean tides have created primary and secondary watercourses that crisscross the delta, acting as either tributaries or distributaries depending on flow conditions. Some of the channels naturally flow only during high water conditions. The primary regulators of flow were current velocity, elevation and naturally occurring logjams. What remains of the lower Pearl's natural characteristics heighten its value today.

When the French and Spanish explorers came upon the Pearl River, they found a clear, natural waterway flowing through a deep and complicated swamp into Lake Borgne. The Pearl system included a labyrinth of channels, bayous and swamps as well as a short, parallel waterway, the West Pearl, which was an impenetrable cypress brake that exchanged flows with the Pearl and the Bogue Chitto River before emptying into the Rigolets.

According to the 1971 Preliminary Engineering Report by the Pearl River Basin Development District, the early explorers found the river alluring. It was sufficiently large and at the time was pristine, its banks timbered and fairly stable throughout the basin. Pearls found on its banks were taken home to France as evidence of the river's purity and abundance.

"In the late fall of 1699, Francois de Bienville, while exploring the area from Mobile Bay to the Mississippi River, stopped for a while at the mouth of the Pearl River, which he so named because of the pearls discovered on its banks," the 1971 report noted.

The early explorers were somewhat bewildered by the maze of swamps that made up the Pearl River delta. Connecting bayous and sloughs could flow either way, and their surfaces in many instances were blocked by log jams. Those log jams, which controlled and balanced flows and prevented the capture by the

smaller waterways of an inordinate share of the river's flow, were a major hindrance to navigation.

In the "Journal of Paul du Rit" covering the Spring of 1700, du Rit described entering the inhospitable Pearl River delta "through very bad roads, mud, thorns, bogs, creeks, heat," accompanied by Indian guides. The group embarked in a canoe on a small stream "beset by so many branches that we are often in danger of being overturned," du Rit wrote.

"We shall follow the current of the Riviere aux Perles without any desire to stop to search for pearls," du Rit wrote. On May 4, 1700, he noted that the flotilla had to break through driftwood. Eventually, he wrote, "We arrived at one of the two mouths of the river where it was impossible either to sleep or to eat because of the mosquitoes."

In "Fleur de Lys and Calumet," Andre Penicaut, a French explorer, gives the Indian name for the Pearl, Taleatcha (rock river), as well as the French, and notes, "In it we found some of those shells, or cockles, about which I have already spoken, with which the savages scrape their boats after they have been burned. In these cockles, pearls are found. We gave two dozen of them to M. de Bienville, who was with us." Passing inland on the river, the Frenchman found that the water was "very good to drink and is of great help for all Frenchmen who come through these parts, for the water of Lake Ponchartrain is tainted with tidal salt water that comes into it."

Regis du Roullet did an exhaustive survey of the entire river for France in 1732. In du Roullet's 1732 map of the Pearl River showing Indian settlements, bluffs and bars, there is no indication of the West Pearl, although numerous westward bayous are depicted. Du Roullet noted that sandbars and log jams posed problems to navigation, even by pirogue. A rise in the river made things easier as he embarked near the current Leake-Neshoba County line, and he wrote, "But for that I should not have been able to get around the trees that had fallen and lay across the river..." Du Roullet, who measured distances by comparing them to the range of various bullets, unfortunately recorded few landmarks that survive today. At what may have been the river's relatively deep chasm near Byram, du Roullet observed, "Bluffs on both sides," and later added, "The river becomes broader than it has been and one can say that it is very beautiful if it continues the same. It has the width of a good lead bullet gunshot." He described twice killing buffalo on sandbars, including one where a colonist he met from New Orleans reported having killed one a few days before.

Among the surviving landmarks from du Roullet's day are Red Bluff, just north of the delta region. Others more difficult to pinpoint are the ford where the Choctaw trail crossed on its way

to the village of the Natchez and an Indian camp on an eastern bluff. Du Roullet noted several "false openings," sandbars and bayous leading away from the river which eventually returned. At confusing junctures, he explored and marked crosses on trees to direct travelers to the correct channel. The markings became more numerous in the lower reaches, where du Roullet made note of "a bayou that is like a part of the river."

At one point du Roullet found the entire river blocked by a logjam. He had to cut his way through the remains of an opening recently made by the New Orleans colonist, he wrote. Du Roullet almost always chose the left, or easternmost forks as he travelled downstream, although at one point he chose a left fork because the water was slack and the right fork was swift. At another point, he noted, "There is on the right a branch of the river the mouth of which is barred by an obstacle of driftwood and one takes the branch that is on the left." Further downstream, he encountered a three-pronged branch and bore to the left. The two branches that went off to the right eventually re-entered the river, he noted.

Approaching the coast, du Roullet remarked that a left branch led to the former village of the Biloxi Indians and travellers were advised to bear to the right, go "the distance of a pistol shot" and take a branch to the left and then a branch to the right. Near the point where the branch went to the old Biloxi Indian site, numerous bayous left the river on the western bank and then several downstream on the eastern side. The river there was very wide, he wrote.

The naturalist William Bartram, who passed along the Mississippi coast in 1775, was troubled by infected eyes but nonetheless described in great detail the beautiful vegetation of the Pearl River islands, including orchards of cultivated fruit trees. Bartram was aboard a "large trading boat" owned by a Frenchman with plantations on the Pearl River. The boat traveled the East Pearl River, which was then the main route into the interior.

In "The Journal of Andrew Ellicot," Ellicot described crossing the Pearl, or "Halfway River," in 1798-1799.

"On Saturday, the 17th of November, we arrived at the cane brake on the west side of the Pearl River, and on the 18th were employed in opening a road to the river, making rafts, and ferrying our baggage over," Ellicot wrote. He described difficulties traversing the swamps, many of which were "so deep that we had to cross on rafts."

"The small streams of water that rise among the sandy hills are remarkably pure, clear and light," Ellicot wrote.

On the 23rd a light skiff was sent up from the mouth of the river to bring supplies and "to examine the state of navigation," Ellicot wrote. But the supplies were left on a bluff above the mouth of the river because the river itself was impassable due to rafts of logs, Ellicot wrote. The explorers built canoes while they waited for the rafts to be cleared.

"Our passage down the Pearl River was extremely disagreeable," Ellicot wrote on Jan. 17, 1799, describing cold rain falling onto uncovered canoes. He noted that the Pearl was navigable for small craft "many miles north of the boundary. It is remarkably crooked, and full of logs and lodged trees; which are at present very injurious to navigation." Below the "Indian house (marked on the map)," he wrote, the river "begins to divide into a number of branches, some of them maintain an open channel until they unite again with the main branch; and others are lost in the swamp. Those branches appear so nearly of the same size, that a person not acquainted with the river, will be as likely to take a wrong, as a right one." Ellicot wrote that the river was influenced by tides a few miles above what had been a trading post at latitude 30 21' 30".

"In consequence of the water extending over such a considerable space," Ellicot noted in 1799, "it never acquires a sufficient head to force away the lodged timber, which in two places extend across the river. The upper raft is of considerable magnitude, and covered with grass and other herbage, with some bushes." In order to pass such jams, Ellicot's group had to cut channels through, he wrote.

Channel openings during the period: occasional log rafts, by Indians and early explorers.

Channel closures: the main channel and secondary channels of the river, by occasional natural log jams.

3. EARLY HISTORY OF THE RIVER

The first permanent settlers, primarily of English descent, made the first lasting impacts on the hydrology and ecology of the lower Pearl River basin. They saw the Pearl as an important avenue into new territory and a route from those lands to New Orleans markets.

According to the 1971 report, Louisiana Territorial Gov. W.C.C. Claiborne submitted a proposal to Congress defining the Pearl River as the western boundary of the Mississippi Territory in 1812. The same year, the Mississippi Territorial government passed an act aimed at improving navigation on the Pearl "from New Columbia on down." Each man subject by law to work on public roads who lived within five miles of the river was proscripted to help clear the Pearl of snags for five days of the year. The act was signed by the speaker of the House, president of the Legislative Council and Territorial Gov. David Holmes.

By 1817, the 1971 report found, commerce on the Pearl had increased enough for the state to borrow $4,000 to improve navigation. It is not clear what measures were taken. The report concluded: "As an indication of the importance of the Pearl River as a means of travel, when the present site of Jackson was selected as the State Capitol in 1821, it was accessible by the Pearl, but the nearest road, the Natchez Trace, was some 10 miles away."

In J.F.H. Claiborne's "Historical Account of Hancock County," the author described Pearlington in 1814 as an early commercial center. "Pearl River, from a point 20 miles below Columbia, to Monticello, was settled by wealthy planters, chiefly from South Carolina, who sent their cotton down in barges, shipped it to New Orleans on schooners, and brought back their supplies," Claiborne wrote. Pearlington later became a booming lumber mill town.

In 1828, the Mississippi Legislature authorized Marion County to fund navigation improvements on the river. Again, the measures are unknown. The first record of volume shipping was a steamboat -- the Choctaw, in 1835; the boat hauled cotton from Jackson to New Orleans.

As cotton production, river traffic and logging of the virgin forests intensified, interest grew in improving the river. By and large, improvement meant removal of obstacles that were also components of the Pearl's complex hydrological balance.

The Mississippi Legislature declared the Pearl navigable in 1844 and authorized a $500 fine for "any person or persons who

may, at any time, in any manner, place any obstruction in the way of free navigation of said stream." (Laws, 1844, Chapter 61.)

At the time of man's first significant alterations of the Pearl, the river still followed its natural course along the eastern floodplain. According to the original township surveys, which date from about 1820 to 1850, there was no diversion down Wilson Slough, said Picayune resident Mansfield Downes, the late authority on the Pearl who gave a lengthy statement to state Assistant Attorney General Oscar Mackey in 1978. Downes told Mackey that the main Bogue Chitto originally emptied into the Pearl upstream from Walkiah Bluff. Downes said older area residents remembered Holmes Bayou before the Wilson Slough diversion as a deep, swift stream about 40 feet wide. Indian Bayou, which branched from Holmes Bayou, flowed year round and fed a large part of Honey Island Swamp before returning to the East Pearl, Downes said.

"Prior to 1850, the route taken by river traffic, which undoubtedly followed the main flow of the stream, was by way of the East Pearl River," the 1971 report found. "The Corps of engineers established this fact during their survey of 1879 by testimony of river men; this fact is also indicated by the stream cross-section and establishment of the former flourishing towns of Pearlington, Logtown and Gainesville on that branch with little development on any other branches. During this time the Bogue Chitto discharged into the Pearl River about 1.5 miles above the bifurcation into the East and West Pearl Rivers. It is probable that both Bogue Chitto and West Pearl were boomed to divert floating logs to East Pearl River, it being customary to collect logs during low water periods in the East Pearl River below Holmes Bayou and above the mouth of Hobolochitto (Abolo Chitto on some early maps) for floating out at next high water."

The opening of channels and the booming of logs were exaggerated versions of natural processes along the lower river, but as such they disrupted its flow regime. Booms were set up as holding pens for logs being cut from the area's virgin forests. They were routinely made along lesser bayous and streams and adjacent to mills, but sometimes were placed in navigable waters. The booming constituted a radical rearrangement of the river's everpresent log jams, and together with the desnagging of channels had a profound impact on flows. Above all others, a boom placed at the shoals in the mid 19th century, just west of Hobolochitto Creek, had far reaching ramifications.

"About 1850 a rise in the Hobolochitto caused backwater in the East Pearl and deposited sand and silt over a large quantity of logs boomed in the East Pearl between Holmes Bayou and the mouth of the Hobolochitto," the 1971 report found. "This and subsequent similar occurrences restricted the channel such that practically all the low water flow of the East Pearl River was

transferred to Holmes Bayou, forcing most river traffic to take the route through Holmes Bayou. Holmes Bayou was so difficult to navigate it often took river boats four days to traverse the bayou."

Judging from the age of the trees on the banks of the old channel through the shoals, the river had been twice as wide in the 1850s, Corps surveyor H.C. Collins noted in 1879. Collins offered this version of the incidents leading up to the change: "Soon after 1850, a very large run of logs was boomed in the 5 miles below Home Bayou and Abolo Chitto. Pearl River was falling and Abolo Chitto was rising very fast, making slackwater on this 5 miles and strong current below it. As Abolo Chitto fell suddenly, corners of crib logs stuck on the bank and others ran on top of them. Sand settled in the interstices and no attempt was made to get the logs out at the high water season; but the next fall the head of the rise brought down more sand and mud on top, and the logs had become soaked and did not rise. So this 5 miles had a pavement of logs on its bottom. With the rise two steamboats which attempted to get through were snagged and sank. Three times again, before the war, was this 5 miles boomed full of logs and left over summer -- the greater part of them in each instance being there yet -- at each time raising the bed at least the thickness of an average log and narrowing in the edges, on which willows began to grow."

Many questions remain about the booming of the shoals. Was the diversion intentional, as a means of shortening the route to the coast? Why didn't the Corps or anyone else attempt to remedy the problem? Why weren't the booms removed, and why were additional booms added after navigation problems developed?

After the Civil War, boomed logs sank at the shoals "once or twice," and as late as 1879 a boom had recently sunk above Abolo Chitto, Collins noted. The latter boom, he wrote, "will about complete the closure of this part of the river..." Holmes Bayou, by contrast, was nowhere less than 5 feet deep, and fed by swamps to the west, he wrote.

In a statement given to Mackey on Jan. 3, 1978, Downes said he believed the original log jam at the shoals was placed there intentionally. "There is something strange about this business of that much of the river being dammed full of saw logs," he said. "The way the old timers told me about the way they ran saw logs, they didn't lose that many logs at one time. It seems that there could have been something deliberate there." The fact that logs were boomed and sunk three more times before the Civil War and again at the time of the Corps' 1879 river survey is further indication of intent, Downes said.

The 1971 report found that, "The West Pearl River, between the river division and where it is rejoined by Holmes Bayou,

flowed through dense cypress swamp and over rock shoals, making navigation in this part of the river impossible." After the jamming of the shoals around 1850, boats followed the main river, or East Pearl River, to Holmes Bayou, then passed through Holmes Bayou back into the West Pearl on down to its mouth. "With the West Pearl taking a lot of water, considerable shoaling took place and sand bars formed in Holmes Bayou," posing new problems, the report found.

"During this period the Pearl could be navigated only during high water and various attempts were made to improve navigation," the 1971 report found. "Holmes Bayou, about 7 miles long and then only about 40 feet wide, was the most troublesome part. Prior to the Civil War an unsuccessful attempt was made to block Farr's Slough (Fair, Ferris, etc.) to divert more flow through Holmes Bayou and the State of Louisiana had moved to develop a channel up through the West Pearl River route; however, it is not clear if this was undertaken or the route merely explored."

Despite the increasing influence of man on the flow of the lower Pearl, efforts to exploit the river and its resources were fitful and unorganized.

In 1852, the Commissioners of the Southern District of the Pearl River was formed in Mississippi to promote development of swamplands along the river.

Soon after, in his notes and the 1854 "Report on the Agriculture and Geology of Mississippi," (noted in "The Journal of Mississippi History") Benjamin L.C. Wailes wrote that the lower Pearl swamps and pine forests were uncleared and used primarily for ranging cattle. Wailes described "handsome live oaks" on the bluffs where the village of Napoleon was situated, but added, "Stopped for a short time at Pearlington, a scattering and (sic) dingy French-looking village on another bluff within eight miles of the mouth of the river, with the salt marsh on the opposite side, and extending down to the lake." Wailes in 1852 described Sea Island Cotton plantations on the highlands adjacent to the Pearl River marshes.

In the book "Progress of the Races: Short History of Four Towns on Pearl River," author Etienne William Maxson wrote that, "Before the Civil War, all the cotton raised on Pearl River was brought down the river on flatboats to an old farm and ginned at the historic landing known as 'The Gin,' after which the cotton was shipped to New Orleans on schooners and steamboats."

The 1971 report noted that, "Shortly before the war the States of Louisiana and Mississippi jointly appropriated $10,000 for cleaning out Holmes Bayou, which was accomplished." The question this poses for the state today is: what precedent was set by the state's initial support for a diversion through Holmes

Bayou? The report continues: "With the outbreak of the war in 1861, the Confederates closed Holmes Bayou by cutting all large trees from the banks across the bayou to prevent an attack by Federal gunboats on Jackson, thereby cutting off river traffic altogether."

In 1871, the Pearl River Improvement and Navigation Company was formed by the Legislature to improve navigation to Jackson by removing obstructions and deepening channels. The act was repealed a year later.

Authorized work on the river varied from Mississippi to Louisiana, and unauthorized work sometimes ran counter to official goals as locals sought specific changes. But for all the efforts aimed at improving navigation, the river remained difficult to traverse. An 1878 act noted that navigation was "greatly impeded on the southern end of the river by fallen trees and snags..."

Openings: Holmes Bayou, apparently as a result of human intervention.

Closures: Farr's Slough, which later reopened, by the state of Mississippi. The shoals; by human intervention in concert with natural factors.

4. INTERVENTION BY THE U.S. ARMY CORPS OF ENGINEERS

By the late 19th century, the lower Pearl was suffering many ills as a result of erosion and clearing upstream and lumber operations in the delta. Exploitation was then in full swing. In his 1954 article, Maxson wrote that the Poitevent & Favre Lumber Co. owned three mills at Pearlington in the late 19th and early 20th centuries. "They owned the East Louisiana Railroad in Saint Tammany Parish, which carried passengers and supplied the mills with logs, dumping them into West Pearl River, a few miles from Floranville, Louisiana, where they drifted with the current to the great boom they kept on Middle River, a mile from Pearlington," Maxson wrote. The logs were then towed to the mills on the East Pearl River, he wrote.

In a collection of 1964 historical essays on the lower Pearl titled "Pearl River: Highway to Gloryland," Samuel Grady Thigpen recalled a boat trip from Gainesville downstream "to where we could course over into West Pearl." The trip, which required poling boats upstream, took three to four months to reach Pool's Bluff, a distance he estimated at 25 miles by air and 75 by river. Pool's Bluff effectively marks the beginning of the Pearl delta.

A ferry had begun operating at Pool's Bluff in 1814, over which part of Jackson's army crossed on its way to New Orleans, Thigpen noted.

Thigpen described how lumber companies often dug canals to float logs to mills near Gainesville, and quoted an "Aunt Blue" Davis saying that she could recall the steamboat Carrie B. passing Gainesville on its way to Picayune. He also quoted elderly Sam Russ, a native of Pearlington, saying that all the mill logs came down the Pearl. "They came from both sides of the river from as far away as Monticello and Georgetown...I have seen logs extend from the boom in Pearlington five miles up the river, with many thousands of logs in reserve for the sawmill," Russ was quoted saying. "These logs were so thick in the water that a man could walk across the river on them. All logs were branded with the name of the shipper and with the name of the mill to which they had been sent."

Thigpen wrote that the Pearl "was so important as a transportation artery back in the old days that the U.S. Government kept a boat on the river to keep it cleaned out for safe navigation. The boat was known locally as the Snag Boat." The first was named the Warrior, the last the Pearl, he wrote. Thigpen quoted Russ, who worked on the Pearl, saying it took up to three months to traverse the seven miles through Holmes Bayou -- the most treacherous section of the lower river. Snag boat workers sometimes were dispatched to the sites of sudden channel changes and had to subsist in the wilderness while doing the

emergency work, and sometimes used dynamite to open channels, he wrote.

The Corps made a survey of the entire river in March and April 1879 for the purpose of obtaining a navigable channel 5 feet deep at low water from Jackson to the mouth. There is no indication of Mississippi's stance regarding the plan, which was later found impracticable and amended to provide shallower depths.

In the 1879 "Report of the Chief of Engineers," H.C. Collins wrote, "My party consisted of 2 rodmen, 1 oarsman and 1 cook, besides myself, and we had 3 small skiffs and a very small covered flatboat on which to eat and sleep; it was rowed by the cook."

In his report, Collins recalled the river's early history: "Settlements were made on the lower portion of the river during the latter half of the last century, and it then received its name from the absolute purity of its water, which was so clear that the bottom could be seen at depths of 10 to 15 feet, except during short periods at the head of a rise; but even then it was good drinking water," he wrote. "This character is retained within the memory of the old inhabitants and even up to 1850 it was a comparatively clear stream during the greater portion of the year. Since then the channel has been shortened by cutoffs in almost every place where it was easy to make them; and as cutoffs were made the current at once increased and began to wear away its banks in bends and so to increase in length. This made further cutoffs easy, and they still further increased the wearing away of the bank in bends, each in turn reacting until the entire character of the river has been changed from being a slow running clear stream, with few snags or logs in its channel, with permanent banks, very crooked in its course, it is true, but with a good navigable channel, to a rapid torrent during freshets, and almost as muddy as the Mississippi River."

Collins' party could still see evidence of the flood of 1874, when the river reached unprecedented levels and caused widespread property damage, he wrote. He noted that the river's floodplain, formerly well populated, was being abandoned as a site for homes because of increased flooding.

Descending from Carthage, Collins arrived at Pool's Bluff, noting that the site was one of the earliest settlements on the river. "This is the last bluff on this side above Bogue Chitto swamp, and here begins the third section of the river, which will be far more difficult to improve than that above," he wrote.

Collins documented current and looming problems, including the blockage of the shoals, which led to the opening of a breakout into the West Pearl in the vicinity of Wilson Slough and

the reversal of the flow of the Bogue Chitto away from the Pearl. He gave a detailed account of a critical reach of the river: "At the end of the 249th mile two bayous leave on the right bank; one more at the beginning of the 251st mile. About the middle of the 252nd mile an old river enters from the east, bringing water which had before escaped into the east swamps. On the 253rd mile several bayous leave on the right bank. On the 255th mile is a cutoff bayou of small size across a bend. On the 256th mile are five large bayous leaving on the right bank, and two small cutoffs across a bend.

"On the 260th mile Black Creek enters from the east. Both banks are low and swampy. At the beginning of the 262nd mile Bogue Chitto once entered Pearl River from the west, but now Pearl River water runs with a strong current up the same channel some distance, and, with Bogue Chitto water, passes into the new swamp channels on the south side, and only returns to the (illegible) mile, passing through the west side of the valley through unexplored bayous. On the 262nd mile three bayous leave on the right bank. About the middle of the 264th mile two large bayous leave on the right bank at the west end of a long bend. The upper one is 50 feet wide and the lower one 80 feet. Both are very deep. Booms have been placed across their heads, and a large raft has collected in the head of each, but so great is the fall in the bayous that more than two thirds of the river, already much diminished by 19 bayous and the channel of the Bogue Chitto, escapes to the west channels. This is called the head of West Pearl. Nowhere for 10 miles above it had there been a channel of less than 8 feet depth, but immediately below it the water is but scant 2 feet over a hard sand bar more than a half mile long. Down to the head of West Pearl banks are caving in every bend, but below it they are not worn, in the bends, and willow banks opposite are advancing fast. From the head of West Pearl the river runs east a mile across a bend: from the middle of the 263rd mile to the 265th mile is but 600 feet, and a bayou choked at its head with drift now crosses. In case it is decided to clear West Pearl, the river should be closed and a cutoff made here, as a dam would not stand at the present caving bank where the head is." Thus, Collins correctly predicted that a dam alone would fail to prevent the diversion; the Corps ultimately chose to fill the lower bend, but only to dam the upper bend, and the dam did fail. Collins continued: "At the end of the 265th mile is Walkiah Bluff, the home of Mr. Lesley, who has run a steamboat or rafted logs on the river for many years. He said it was since 1850 and owing to the closure of the old Pearl River that West Pearl Channel broke through and Bogue Chitto changed its course to the west side of the valley... Previous to this discharge to westward, Mr. Lesley said there was never any shoal in the reach above his place, where is the present bar, and that the river banks were entirely without the encroaching belt of willows before that time; that the present shoal and partial closure immediately followed the breaking out of West Pearl, as that

followed the partial closure of the river between Home Bayou and the mouth of the Abolo Chitto, 5 miles below on the old river."

Lesley's home was just downstream from Lesley's Ditch, which was dug by locals at the head of West Pearl, cutting off the West Pearl breakout.

The Corps followed Collins' recommendation to widen Lesley's Ditch to enable navigation through the cutoff and reduce the diversion into the West Pearl.

Below Walkiah Bluff the river channel in 1879 was narrower than above and continually shoaling. "At the end of the 271st mile a third of the remaining water runs to the eastward through Farr's Slough, which empties into Abolo Chitto a few miles below," Collins wrote." A dam was built across the head of this slough by Captain Poiterent, for the State of Mississippi, but the light, sandy land cut out around it, and its has increased its current."

The only place on the East Pearl where the banks were caving below the head of West Pearl was around mile 273, Collins noted. Below there, Parker's Slough left on the right bank and then Twin Bayous, also on the right.

"At the time the survey was made there was a 3-foot rise but there was with it but 2 feet in the channel of the old Pearl River, while just above was 6 to 7 feet, and in Home Bayou, which (at mile 277) leaves to the right, the depth was the same." Collins said the East Pearl below Holmes Bayou was only about a foot and a half deep and clogged with cypress and pine logs resting on the bottom. "For half a mile farther I walked on logs which were on the bottom, and I was told that it continued so down to Abolo Chitto. I abandoned the attempt to go down the old channel, finding it to be impossible with less than a 7-foot rise." This was the area known as the shoals.

Collins was unable to explore the West Pearl, but said Holmes Bayou looked like a promising navigation channel with improvements. "The State of Louisiana once made a cut up through the bayous and swamps on the west side, trying to get to the river above, but it was a failure. They then had Home Bayou cleaned out; all snags and overhanging trees were taken out, and to this is owing all the navigation there is at present on the river." Following this route, the river, though filled with logs, eventually made its way to the western bluffs, far from its original route, then divided into West Pearl and Middle rivers.

"Vessels run up the East Pearl to Pearlington and Gainesville, but there is no navigable connection with upper Pearl River," Collins wrote.

Maj. C.W. Howell offered a footnote to Collins' account in 1879 acknowledging the need for corrective action along the river: "Perhaps no stream in this country has had its character so entirely changed within the past 50 years as this." The changes he attributed to "increasing cultivation of its bottom lands and of efforts to straighten its course... As natural consequences, the planters have been driven by flood from the bottom lands, which they denuded of their protecting forests and undergrowth, and the commercial value of the river has been virtually destroyed for a time by the attempts made to improve it by shortening it."

Howell also suggested improving Holmes Bayou as a navigation route.

The U.S. House in 1879 simultaneously considered funding improvements along the Pearl to aid navigation from Carthage to the Gulf and to clear out obstructions at the mouth and funding to improve navigation along the West Pearl. Congress in 1880 passed legislation authorizing the improvements, and the 1971 report noted that a $95,940 project was adopted by the Corps the same year to remove snags, stumps, roots, logs, trees and to close run-out bayous including Farr's Slough, the head of West Pearl, the East Pearl at Holmes Bayou, Twin Bayous, etc.

In December 1884, when the river was at a considerably lower stage than it had been in 1880, the Corps found that a 5-foot channel was not practicable but that a 2-foot channel was, so the project was modified. The Act of Congress authorizing the project in 1880 called for "construction, repair, completion and preservation...for improving Pearl River below Jackson, Mississippi..."

Although the Corps assumed responsibility for correcting the lower Pearl's problems, the agency made no effort to reopen the shoals. There is no debate in the Congressional Record to illuminate the decision making process, and it's unclear if a conscious decision was made to divert the main flow into Louisiana. The agency's sole aim appears to have been maintaining the status quo for navigation.

In the "Report of the Chief of Engineers, U.S. Army," for 1882, Maj. Amos Stickney noted that hired crews removed snags along the lower river and closed 12 "runout" bayous. "The object of the work during the past year was to prevent the loss of water from the river between the point where the West Pearl leaves the river and the foot of Homes Bayou, Homes Bayou being now the navigable channel. When the loss of water has been prevented by the effectual closure of all outlets, it is expected that this shoal will entirely disappear, thus removing one of the most serious obstructions to low water navigation."

In an 1884 report, Maj. A.N. Damrell noted that there was plenty of water in the West Pearl but that the river was "nothing but a cypress swamp; no channel exists and navigation is impossible." Damrell estimated that two thirds of the Pearl's water was at that time being lost to the head of the West Pearl. "Owing to its low banks, both above and below the head of West Pearl, as also to the great depth, nearly 50 feet at the head, it would be very difficult to close it up there effectually, as at almost every freshet the strong current would cut its way through, either above or below, and the shoaling process in East Pearl would continue and no relief to navigation would be given."

Damrell predicted that the East Pearl would be closed altogether unless a canal was cut across a strip of land 800 feet wide above the head of West Pearl into the East Pearl. "The advantages that may be gained by the opening of this cutoff can be easily perceived," he wrote. Work on the cutoff, which utilized Leslie's Ditch, was begun in 1884 and resulted in more than half of the river's flow being restored to the East Pearl at Wilson Slough. The Corps placed a "heavy drift of logs" at the head of the West Pearl and felled several large trees into the lower end of the old river bend and the East Pearl subsequently began deepening naturally, Damrell wrote. Holmes Bayou was desnagged and the manmade logjam at the head of West Pearl was increased by August 1884.

The Leslie's Ditch cut -- two miles above the head of West Pearl -- was 1,200 feet long, 100 feet wide and 1 foot below low water stage, the Damrell report found. By 1900, the cut was 250 to 300 feet wide and 6 feet deep at low water with the old river bed filled in.

In the second phase of a 1979 report for the State of Mississippi, hydrologist C.F. Hains concluded that the cutoff was made in the vicinity of present day Wilson Slough. He wrote that the upper end of Wilson Slough was originally a bend of the Pearl and part of the state line. The bend was severed when Lesley's Ditch was built and the lower reach later filled and planted with willows. The Wilson Slough dam was built later.

In his statement given to Mackey, Downes said Wilson Slough is actually just south of the upper part of the old bend the Corps severed with Leslie's Ditch. At the time, Wilson Slough was small and connected the bend with the West Pearl system at high water. The Corps filled the lower end of the bend with manmade log jams and trees, but neglected to dam the upper part until Wilson Slough began to capture the flow, and then the dam failed, Downes said. He said that part of Wilson Slough is actually in Mississippi.

"But of course, now, some of the Louisiana interests claim that Wilson Slough is the West Pearl and always has been -- that

there has always been a division of the river where Wilson's Slough is now, but our documentation and engineer documentation proves that there was not," Downes said. Notably, some maps in the St. Tammany, Louisiana courthouse in Covington identify the head of present day Wilson Slough as the East Bogue Chitto River. Most maps, including the official survey maps of the U.S. Geological Survey, incorrectly show the state line following the Corps cutoff rather than the original river bend.

Corps documents indicate that 1,531 trees were felled into the old bend at Leslie's Ditch to augment the dam, but Downes claimed to have possession of a letter from the Mobile District stating "that trees caved in and drifted down and filled the bend."

As problems mounted at the head of West Pearl and downstream on the East Pearl, navigation work on the river continued. In 1885, the Corps improved the river by contract to Monticello. In 1886 and 1887, Holmes Bayou was cleared by hired labor and widened to 100 feet, which made it navigable two feet above low water, the 1971 report found. To provide more flow for Holmes Bayou, the head of the West Pearl was closed and Farr's Slough dammed unsuccessfully prior to 1879, again in 1887, and successfully in 1909 -- despite Farr's Slough having been declared navigable by the Hancock County Board of Supervisors on Sept. 7, 1885. (The area later became part of Pearl River County.)

By February 1887, Damrell wrote, the timbers of the Confederate gunboat "Arrow" had been cut to low water level and with the initial closure of Farr Slough by 1888, the river was open via Holmes Bayou from the Rigolets to Jackson.

According to the Corps' 1896 report, cited in the 1971 development district report, the West Pearl for 25 miles upstream from the mouth was used by towboats, schooners and steamboats. Upstream to Monticello, the river was used by steamboats and for rafting logs when there was sufficient water.

"The project of 1880, modified in 1885, resulted in considerable improvement of the river for high water navigation from the mouth of the West Pearl through Holmes Bayou into the East Pearl on up to above Rockport," the 1971 report concluded.

"The East Pearl River between Holmes Bayou and Hobolochitto Creek deteriorated after 1850 to such a point that an 1896 Corps of engineers report stated that the East Pearl River turning off at the head of Holmes Bayou 'is not and never has been navigable for boats and from the head down, the river being nearly filled up with logs, rafts, willows and cottonwoods and scarcely any water passes through at less stage than 6 feet.' However, as indicated earlier, there is strong evidence that the East Pearl

River, from its mouth in Lake Borgne through the shoals on up toward Bogalusa, was the main navigation route." The report also noted that area residents claimed to remember steamboats traversing the shoals as late as 1900, including one who said he rode the Carrie B. through the shoals as a boy around the turn of the century.

The Bogue Chitto was desnagged by the Corps in 1898, which presumably increased its flow -- a flow that was diverted from the East Pearl to the West.

According to the chief engineer's 1899 report, desnagging upstream from Holmes Bayou was then under way and the river was navigable to Monticello. The same year, the Corps widened and deepened the channel at the mouth of the East Pearl. Still, no effort was made to reopen the connection at the shoals.

One possible reason for abandoning the shoals, given by historian Pat Galloway at the Mississippi Department of Archives and History, is that more than river currents were shifting at the time. Galloway said the south Mississippi lumber industry had begun to languish by the turn of the century, with the center shifting westward to St. Tammany Parish. And yet the Corps seemed to waver in its resolve to keep Holmes Bayou open for navigation.

In the "Report of the Chief of Engineers, U.S. Army," for 1900, Maj. Rossell noted that between May 1899 and January 1900, about 61 miles of the river was improved above Holmes Bayou. "Holmes Bayou, which forms a part of Pearl River, is about 7 miles long, and is at present more in need of working than any other part of the river; it is much obstructed by trees and snags." It's not clear why the Corps put off the work on Holmes Bayou while doing work above and below, and there is unfortunately no debate on the subject in the Congressional Record.

In 1900, there was a record flood on the Pearl. Thigpen wrote that the 1900 flood was higher than the disastrous 1874 flood, which swept away homes, fences, people and livestock. "Both the loggers and the mills lost many thousands of logs in the 1900 flood," he quoted resident Warren W. Seal saying.

Thigpen wrote that the flood dispersed a great volume of logs throughout the floodplain, but that the problem of lost logs was perennial. "On the trip down obstructions in the river would often slow down the rafts or sometimes stop their progress altogether... One winter the rains did not come and the water stayed so low that the men had much trouble getting their logs to the booms. Many of the rafts ran aground in low water. After waiting weeks and weeks for the water to rise some of the men, hungry and tired, gave up and went home, forfeiting their

interest in the logs which had cost them so much in time and hard work."

Thigpen wrote that his wife made a trip aboard the steamboat City of Demopolis from Columbia to Pearlington around the turn of the century. The boat in 1903 hit a snag on Holmes Bayou and sank. "Pearl River was navigable only when there was a good flow of water," he wrote. "After the railroad came through in 1884 river traffic dwindled on the Mississippi side but there was still the usual traffic from the Louisiana side of the river until the new railroad was built into Bogalusa in 1908." Log floating on the river increased until about 1918, he wrote.

In 1903, assistant engineer David G. Anderson wrote in "Report of the Chief of Engineers, U.S. Army," that Holmes Bayou had become blocked by log jams and overhanging trees, and was no longer open to navigation.

In 1904, the Corps built a revetment across Moore's Bayou to prevent a cutoff above Walkiah Bluff, and dammed the East Pearl at the shoals in 1909-10. In the report of Maj. Jervey in 1910, Jervey noted, "Ferris Slough which formerly opened out of the Pearl River and carried off much of the water needed in the channel was dammed raising the water level (low water level) about one foot... A dam 117 feet long, 20 feet wide with an average height of 15 feet was built across the outlet known as the head of the East Pearl River (the shoals)." Downes said the shoals dam was built by the dredge Black Warrior.

In his deposition, Archie Thigpen of Picayune said the Corps built a dam across the shoals around 1910. The dam, like the one at Farr's Slough, eventually failed, but the shoals dam was later repaired, he said.

In a videotape made on Nov. 30, 1983, Downes said the shoals dam was downstream from the head of the log blockage, and was designed to block a natural breakover bypassing the jam. The river naturally was attempting to circumvent the log jam but was prevented from doing so by the Corps work. Downes said a pirogue could pass through the shoals although the "pavement of logs" was still evident; the logs were later salvaged by local timber interests, he said.

Thigpen, in a statement also made to Mackey in 1978, said the shoals and Farr Slough dams were later breached by locals with explosives. Thigpen said light boats had traveled through the shoals until the dam was built.

The dams were built with timbers, sand, logs, driftwood--"anything they could reach out in the river to pick it up and lay it in on the back side of it," Thigpen said.

The Corps dredged the existing channel at the mouth of the East Pearl 9 feet deep and 1.3 miles long in 1910-1911.

At the same time, and until about 1915, the Corps continued routine desnagging of the river below Rockport. In 1916, the Corps began a water hyacinth eradication program in the East Pearl and Middle River, removing a boom of logs that prevented the plants from passing into saltwater and being killed. Desnagging the river was suspended in 1916.

The Corps afterward began to withdraw from the lower Pearl for a time.

"No commerce is shown for Pearl River for the years 1919 and 1920," according to "Rivers and Harbors -- Mobile, Ala. District." The report noted that "the utilization of this river as a means of transportation has ceased."

In a July 1980 letter to Willis Ruland, chief of the environment and resources branch of the Mobile District, Downes took the agency to task for starting its work and then abandoning it. He wrote that "up until 1850 the East Pearl River along the delta was a deep, tranquil and stable river..." Later cutoffs and desnagging efforts sped the flow, which exaggerated the river's tendency to change course, he wrote. "In summary, reports, statements and observations indicate that the initial blockage of the shoals and the forcing of the East Pearl River through Holmes Bayou resulted in a scouring of the West Pearl channel with the effect of changing the gradient of the channels on the western side of the Delta to an extent that has caused a continuing series of diversions above the shoals and to the westward. Mr. Collins found in 1879 that the length of the river had been reduced by one tenth by cutoffs, thereby increasing the velocity of the current and aiding these diversions."

In an affidavit filed in Mobile on December 30, 1980, Nathaniel McClure IV, manager of the Corps district's litigation unit, acknowledged that the Corps built earthen dams at Farr's Slough and the shoals and diverted water through Holmes Bayou. He also noted that a dam was built across the head of Farr's Slough "by Capt. Poiterant for the State of Mississippi," but that it failed (account in 1879 survey).

Openings: Leslie's Ditch, near head of West Pearl, by the Corps; and Holmes Bayou, by the Corps. The Corps also sped the flow of the entire river below Monticello and opened the Bogue Chitto.

Closures: Farr's Slough; the head of West Pearl; East Pearl at the shoals; Twin Bayous; etc. All by the Corps.

5. NEGLECT OF MAN-ALTERED SYSTEMS IN THE PEARL RIVER DELTA

The 1971 report stated that up until 1918, an estimated 90 percent of the tonnage on the river was rafted logs. "With the decline of commerce and work on improvement stopping in 1916, few records were maintained after about 1918," the report found. By 1933, "changes in the river as a result of manmade structures, practices and work had changed the course of the river to such an extent that the main river flow below the bifurcation into the East and West Pearl Rivers was by the East Pearl into Holmes Bayou, then via Holmes Bayou and West Pearl to the Rigolets. The only water of consequence at low water flows in the East Pearl River came from the Hobolochitto Creek."

Notably, Mississippi and Louisiana officials and lumber businessmen objected to the Corps' decision to abandon maintenance of the Pearl navigation project, which included keeping Holmes Bayou open. U.S. Rep. Pat Harrison testified before the Board of Engineers for Rivers and Harbors in 1916 that problems would result from abandoning the Pearl, and argued that commerce along the river would soon rebound.

"I beg to call the board's attention to the fact that while the commerce has diminished it has been for the reasons cited, but along this stream there is now a very marked increase in population and industry," Harrison said.

In testimony before the board, Ernest Lee Jahncke, of New Orleans, said in 1916 that his company's sand and gravel boats had attempted to travel the river in recent years with the help of its own snagboat, but had abandoned that practice as too costly.

"The government has spent considerable money in building a dam on East Pearl River to divert the water to the West Pearl, but that has been unsuccessful and no improvements have been made, as far as we can see, from the mouth of the river up to where the river becomes large." Jahncke complained that the Corps allowed sunken log rafts to remain in the river channels.

In a letter from "Mssrs. Stockstill Bros." of Picayune dated July 20, 1916, George H. Stockstill wrote the Board of Engineers for Rivers and Harbors: "Gentlemen: We wish to protest against the proposed abandonment of improvements of Pearl River, Miss., from Rockport to its mouth for the reason that such abandonment would be detrimental to our interests to a great extent... Please allow a public hearing on this matter, and give us an opportunity to present our claims fully."

Mississippi's position at the time the 1980 lawsuit was being filed was that the Corps abandoned the project in 1916

without authorization from Congress. The authorization to abandon Pearl River navigation below Rockport came with the River and Harbor Act of Sept. 22, 1922. But Mobile District Col. Drake Wilson said in a July 20, 1974 public hearing on the West Pearl Navigation Channel in Slidell, Louisiana, before the Governor's Council on Environmental Quality, that navigation works on the Pearl had simply been shelved. Citing the original project from the mouth to Edinburgh, Wilson said, "This project is still on our books, and it amounts now only to a snagging project and has not been funded in some years. We did some work on it, I think, about 10 years ago under an emergency authorization in hopes that some boat traffic -- small boat traffic -- to Jackson would develop. Very little did develop."

Even prior to the cessation of work, the Corps' structures had begun to deteriorate.

In deposition before the Southern District Court of Mississippi in September 1979, John E. Watkins, of Picayune, recalled walking across the dam at Wilson Slough. He said on one trip he noticed that about 10 feet at the south end of the dam had eroded away, "and it started blowing out and it just kept blowing out wider and wider as the years went by." Watkins said a lumber company at Pearl River Station dammed Farr's Slough to get enough water to float logs down Holmes Bayou.

William Andrew Watkins Sr. of Pearl River County had a similar recollection in his deposition, and said he "knew at the time that sooner or later we'd have trouble. And I have been in favor over 20 or 25 years now of this being fixed so we'd still hold our river."

Local residents breached the shoals dam after the Corps abandoned maintenance, Downes said in his videotape. In his deposition, Downes said he walked with his family to the shoals dam in 1924.

Downes said he noticed that as the Walkiah Bluff leg of the river began to slow, Wilson Slough increased in velocity, its banks eroding. Breakover Slough, a natural diversion, connected Farr Slough with Hobolochitto Creek, restoring some flow to the East Pearl in the early 1940s, but the route had closed by 1972, he said. Downes estimated that water levels at Walkiah Bluff dropped two feet at low flow between 1970 and 1978.

Under questioning by Assistant U.S. Attorney Burtt, Downes was asked if it were not possible for a river to change course naturally. "Depends on the degree of change, I would say," Downes replied.

Openings: Wilson Slough dam, Breakover Bayou, shoals dam, Farr's Slough dam. By natural erosion or local breaching.

Closures: Shoals dam (Corps), Breakover Bayou (natural), Farr's Slough (Corps), Wilson Slough (Corps).

Reopenings: Wilson Slough dam, by erosion; shoals dam, by locals.

6. LATE 20TH CENTURY ALTERATIONS

The Corps launched a flurry of navigation projects nationwide in the 1930s, and again turned its eyes to the lower Pearl. This time, however, the agency chose to avoid the problems encountered in the natural river between Holmes Bayou and Pool's Bluff by constructing a manmade canal.

The 1971 report states that a project was adopted by the River and Harbor Act of Aug. 30, 1935, to provide a 6-foot navigation channel from the mouth of West Pearl River to Bogalusa. The project was completed in 1953 at a cost in excess of $8 million and included cutoffs, 3 locks and dams, a 20-mile-long lateral canal, a sill at Pool's Bluff and a cutoff of the old mouth of the Bogue Chitto.

It seems safe to assume that the diversion of the Bogue Chitto increased the flow of the West Pearl, which would lead to scouring of the channel. Mobile District Col. Drake Wilson told a July 20, 1974 public hearing in Slidell, Louisiana, that deepening the West Pearl for navigation sped the river's flow.

Wilson stopped short of saying that dredging the West Pearl made it a more attractive route to the Gulf, but, he said, "I might digress a moment and say that when you first come in and deepen a channel for navigation, you have some effects that you might not expect. When we first came in here, or started contemplating this, the natural channel in the West Pearl below Lock #1, or the intersection of Holmes Bayou, was about 7 feet in depth at low water. When you open that up for a guaranteed 7 foot depth all the way up, you actually reduce the depth at about mile 30, which is about at Holmes Bayou. Whereas, before we started the work, the available depth there was about 4 feet, after we did the work it was only about two feet. The reason is, that after the channel work the water can run off more rapidly, and so the water levels drops."

Judging from Wilson's statements, dredging caused water to flow more swiftly through the West Pearl channel. Other Corps officials have claimed that dredging effects only depths and not levels or velocity.

According to the Corps' 1989 study, the navigation project "consists of a channel from the mouth of the West Pearl for 58 miles to the mouth of Bogalusa Creek at Bogalusa. The channel is seven feet deep at low water with a bottom width of 100 feet in river sections and 80 feet in the canal section, with locks of 65 by 310 foot inside dimensions."

The Mississippi Board of Water Commissioners, in a letter to the Corps from water engineer Jack W. Pepper dated May 2, 1957, noted that low flows in the area of the state line were a

problem, but stopped short of protesting the lateral canal. "Pearl River, the state boundary between Mississippi and Louisiana, has been neglected to the extent that the water that should be flowing down this stream has been allowed, and possibly encouraged, to flow through Holmes Bayou and other streams from Pearl River into West Pearl River," Pepper wrote. The board later gave its approval to continued work on the canal, but passed a resolution detailing the problems in the East Pearl and asking for a Corps study and a return of flows.

Also in 1957, Assistant Attorney General Matthew Harper Jr. wrote Assistant District Engineer Lt. Col. R.O. Miller in Mobile on May 21 that "the Governor's office and this office are in receipt of numerous complaints by the citizens of Pearl River and Hancock counties of the lowering of the water level in East Pearl River brought about by the diversion of the waters of Pearl River. The lowering of the water level has resulted in the loss of income from many fishermen along East Pearl River and has reduced the probability of the affected Counties obtaining new industries."

F.G. Turner, assistant chief of the Mobile District's engineering division, wrote Harper back on June 7, 1957 that studies of the effects of deepening the barge canal were under way, and, "Those opposed to the modification...testified that further deepening of the channel would result in diversion of water from East Pearl River, contending that the existing project itself had resulted in such diversion of natural flow."

During the debate over deepening the barge canal, Harper submitted to the Corps affidavits of residents making a formal protest of the Corps' actions. Among them were affidavits of George R. DeForest, a St. Tammany Parish resident who owned land in Pearl River County along the East Pearl and who claimed construction of the barge canal permanently lowered water levels there; R.E. Steen, who owned a fishing camp on the East Pearl in Pearl River County and who voiced similar complaints; T.R. Pearson Sr., a lifelong resident of Pearl River County; state game warden Hugo Shaw; Albert Jarrell, Vaudie Jarrell and Rayford Lee, who owned a fishing camp on the East Pearl; and W.A. Lumpkin, district supervisor for the Mississippi Game and Fish Commission.

DeForest said he bought his 160 acres because of the river's navigability and "due to the fishing available and the possibility of use for irrigation purposes." He complained that "the water level was considerably lowered in East Pearl River due to diversion of water (for the barge canal) and it has remained considerably lower since that time. Thus, my property has been damaged by the actions of the U.S. Corps of Engineers in establishing this channel, and it naturally follows that the

proposed further dredging of the artificial channel will further damage my property in the same respects as the present damage."

Said Steen: "In about 1952 when the U.S. Corps of Engineers established a deepwater channel from West Pearl River to Bogalusa, Louisiana, there was a period of about three weeks when the river was almost dried up completely, and Jarrell Creek was dried up, so that all of the fish were killed. There has been no fishing in that area of the river since then. Prior to that time Jarrell Creek was a wonderful place to fish, and so was that portion of the river. Immediately after the water was shut off from the river, and a small portion of it was allowed to flow back into it, the water level dropped more than two feet, and never since then, except when there is flood water in the river, has it been possible to operate a motor on a boat in Jarrell Creek, due to the low level of the water.

"As a direct and proximate result of the action of the U.S. Corps of Engineers, we have been deprived of our fishing grounds and of a substantial portion of our water resources."

Pearson said in his affidavit, "All of the fishermen in this area suffered a blow when our fishing grounds were ruined 'overnight' by the opening of the channel and the immediate lowering of the level of the water in East Pearl River.

"Pearl River lies wholly within the State of Mississippi for many miles, and only touches on two parishes in the State of Louisiana, and it appears that immediately when the river touches Louisiana, the Federal Government has assisted the Louisianians to take it wholly away from us, and to divert the water from it into a Louisiana Channel constructed at Federal expense."

The Corps in 1960 concluded that eight cutoffs along the West Pearl below Lock 1 could be justified as a means of improving navigation, but that dredging a 9-foot channel and building a canal to Picayune could not, the 1971 report stated.

In 1961, 325,171 tons of cargo moved on the lateral barge canal, the 1971 report found. For the same year, 45,195 tons moved on the East Pearl waterway.

In 1963-1964, the 1971 report stated, NASA dredged a channel 12 feet deep and 150 feet wide from the Intracoastal Waterway through Little Lake to Gainesville to serve the NASA Test Facility. NASA pays the Corps to maintain the canal. Hancock County built a 2-mile Port Bienville Industrial Canal from the East Pearl River in 1971.

The Corps' 1989 Lower Pearl River Basin Flow Distribution Study reported that maintenance dredging on the Lateral Canal ceased in 1972 "after a major decline in usage. The project has

since been reanalyzed under current economic conditions and maintenance dredging was determined to be economically justified. Maintenance dredging was resumed in December 1988." Notably, the Corps found the resumed dredging justified "based on feedback we have received from the business people near Bogalusa and the surrounding area..." The cost of the work is projected to be about $800,000 the first year and $365,000 every two to three years thereafter, according to a 1985 Vicksburg District fact sheet on resumption of maintenance dredging along the West Pearl. By 1974, the Corps had spent $8.4 million on the project.

In 1974, public sentiment was strong for deauthorizing the canal, but the Corps simply shelved the project. There were proposals to use the impoundments for recreation, allowing the Lock 3 lake to dry up by removing the sill in the natural Pearl River; and to remove the gates and allow the river to flow through the canal.

Mobile District Col. Drake Wilson said opening the canal to Pearl River flows would not be desirable. The water now going over Pool's Bluff sill would run down the canal "very rapidly," he said. "The water that would flow over the sill and into the old channel would be virtually nil, that is, there wouldn't be any. And so, the only water in the old channel would be that which came into it from other sources below Pool's Bluff sill... So, that course of action has some rather dire effects on the old river. It also has some rather dire effects on the lateral canal, because the lateral canal was not designed for that velocity of water, and it would soon scour away and begin to meander, and begin to go all over the landscape. So, that's not a very desirable course of action."

Interestingly, the "undesirable" scenario Wilson portrayed -- of the old channel going dry while the new channel was scoured -- is exactly what the Corps allowed to happen first at Holmes Bayou and the shoals and now is allowing to happen at Wilson Slough.

In its 1989 Lower Pearl River Basin Flow Distribution Study, the Corps divided its new plan of navigation improvement into three sections: the West Pearl from the mouth to Holmes Bayou, with a seven foot depth and 100 foot width; the canal section, from mile 28.5 to mile 48.7 at Pool's Bluff, with a channel seven feet deep and 80 feet wide; and the river section from Pool's Bluff to mile 58 at Bogalusa Creek, "to be obtained by dredging, snagging and easing of bends." The modifications, provided for by the 1966 River and Harbor Act, provided for the construction of cutoffs and "easing of bends" at eight locations below Lock 1 with no increase in project depth, the report said. But the modification "is currently inactive," the report added.

To resume dredging, the Corps would have to redeposit channel sediments at nine locations, according to Robert Seyfarth, chief of the water quality branch of the Mississippi Bureau of Pollution Control. Seyfarth said the Corps originally proposed moving from 30,000 to 50,000 cubic yards of primarily sand at each location, but later said the figures reflected needs if the project had been continually maintained, which it had not. The Corps now says the project will require considerably more dredging, which will require a reevaluation of Mississippi's water quality permit.

During the time the canal was temporarily abandoned, local interest was rekindled in restoring the East Pearl flow.

In 1972 and 1973, with funds from the Hancock County Board of Supervisors, equipment from the city of Picayune and participation of the Pearl River County Development Association, Downes supervised the cleaning out of debris and sedimentation at the head of Breakover Bayou. The result was a low flow boatway, which has since closed again, he said. The Corps' Mobile District later admonished Downes for doing the work without necessary permits. Downes said those involved took the position that the Corps had illegally dammed Farr Slough to begin with.

The U.S. Fish and Wildlife Service's 1988 Low Flow Allocation Report noted that the Corps in 1975 failed to complete a study of navigation to Picayune/Nicholson, but that early evaluation showed marginal feasibility. The Corps' Mobile District, in a September 1975 "Plan of Study on Pearl River Basin, Miss. & La.," noted that sponsors of the requested project asked the Corps "to proceed with immediate emergency repairs on Wilson Slough and Moore's Bayou, to make a complete study and correct deficiencies on Pearl River and bring water and water freight to Picayune and Pearl River County." The report noted that the Pearl River Basin Development District requested "implementation of corrective measures at Holmes Bayou to restore East Pearl River to its true channel..." and continued flow past Walkiah Bluff Water Park. The South Mississippi Ecology Society, the report said, also asked that the sill at Pool's Bluff be removed, the lateral canal deauthorized, Holmes Bayou returned to its 1817 flow and flows restored to Keller Bayou, Catfish Lake, Twin Bayous, West Bayou, Farr Slough (through Breakover Bayou) and the shoals.

A Corps memo dated November 15, 1978 concerning the hydraulic studies in the Walkiah Bluff area noted that "except for information obtained from residents near Walkiah Bluff, there does not appear to be any indication that significant changes in flow distribution are taking place in this reach of the Pearl River. Nevertheless, this study is warranted to see if the low flow problems can be mitigated." The memo noted that "although Dr. Whittle did not recommend a specific alternative, he seems to

lean toward a submerged sill across the upper end of Wilson Slough as having the least detrimental effects." The memo also noted that increased flows toward Walkiah Bluff could have a detrimental effect on bank stability and could lead to claims of property damage.

Interestingly, the Jackson Daily News on December 16, 1982 reported that Louisiana officials were pondering what to do about a log jam that reportedly stretched from bank to bank about five miles downstream from Pool's Bluff Sill. The log jam, in a horseshoe bend, was said to be 600 to 900 feet long and remained even after the Louisiana Department of Public Works set off 75-lb. and then 175-lb. dynamite charges. The concern was that the river might change course, according to the article. A Clarion-Ledger article dated December 19 said officials planned to use cranes to pull the log jam apart. Had the river broken out in the area of the jam, it likely would have followed the course of Gum Bayou, judging from the map, and returned upstream of Wilson Slough. Would the Corps have stopped it if it had broken out?

Openings: West Pearl lateral barge canal, by the Corps; East Pearl-NASA navigation channel, by the Corps for NASA; West Pearl River cutoffs, by the Corps; Breakover Bayou, by locals.

Full or partial closures: sills, locks and dams between Pool's Bluff and the mouth of Holmes Bayou, by the Corps; Breakover Bayou, by natural changes.

7. CURRENT FLOW CONDITIONS

"In recent times," the 1988 U.S. Fish and Wildlife Service report said, "an increasing portion of Pearl River flows have been diverted to the West Pearl River via Wilson Slough, which, for all practical purposes, has become the main channel of the Pearl River." This is in contrast to the Corps' conclusions in the 1989 report.

The 1988 report noted that hydrological information, except regarding the West Pearl, "is rather scant and general, especially with regard to critical low flows... (but) it is acknowledged that the study area is experiencing significant changes..." The 1989 LSU draft report on land use in the lower Pearl basin noted: "Unfortunately there are no long term (hydrologic) records below Bogalusa on the Pearl River, so data for the large wetland system of the lower Pearl R., in the vicinity of the Slidell metropolitan area, are lacking."

The 1988 report found that the Pearl River retains 91 percent of its flow after passing over Pool's Bluff Sill, but 75 percent of that base flow is returned to the West Pearl via Wilson Slough and a companion stream, Bradley Slough. "The majority of the remaining 25 percent of base flow is subsequently captured by Holmes Bayou and returned to the West Pearl River."

The most recent low flow measurements for the lower Pearl were taken on September 26, 1989 and were listed in the Corps report. At the time, there was a flow of 2,130 cubic feet per second (cfs) above Wilson Slough, of which approximately 1,790 cfs, or 84 percent of the flow, was recorded 1,500 feet below the mouth of Wilson Slough, compared to 340 cfs, or 16 percent, remaining in the Pearl River below the bifurcation with Wilson Slough. (Flows in Wilson Slough and in the Pearl below Wilson Slough were calculated and not actually measured. In an earlier calculation, found in the March 25, 1916 "Reexamination of Pearl River, Below Rockport, Miss.," the Mobile District engineer noted that "the discharge of Pearl River at a point about one-half mile above Wakiah [sic] Bluff, 50 miles above the mouth, was, by very rough methods, found to be about 1,542 cubic feet per second at mean low water. This excludes 931 cubic feet per second diverted into West Pearl River above this point." The engineer, Lt. Col. C. Keller, offered the disclaimer that the overall flow was likely less than the estimated amounts.) On September 26, 1989, 137 cfs was flowing into Moore's Bayou, 177 cfs at the entrance to the new breakout at Icebox Bayou and a total of 82 cfs in the Pearl River at Walkiah Bluff. By August 20, 1990, the flow past Walkiah Bluff had dropped to 2.4 cfs, according to preliminary readings taken by the state Bureau of Land and Water Resources.

By comparison, other 1989 measurements include: 2,040 cfs in the Pearl above Wilson Slough; 1,450 cfs in Wilson Slough; 560

cfs in the Pearl below Wilson Slough; 99 cfs at the entrance to Moore's Bayou; and 451 cfs (calculated) at Walkiah Bluff.

The Corps' 1989 report noted that all remaining flow from the Pearl exits the system at Holmes Bayou.

The first phase of Hains' 1979 study contains the following flow measurements, in cubic feet per second:

Location	Measurements (by Corps)			(by Hains)
	5/20/76	7/1/76	4/6/78	10/25/79
Pearl River at Bogalusa	15,900	4,900	---	2,800**
Inferred diversion	---	---	---	222
East Bogue Chitto Boatway	---	---	---	22
Pearl above Wilson Slough	9,490	4,320	5,196	2,557
Wilson Slough	4,640*	2,360*	2,838*	1,630*
Pearl below Wilson Slough	4,850*	1,960*	2,358*	927
Moore's Bayou	---	---	483	111
Pearl below Walkiah Bluff	---	---	1,875	816
Moore's Bayou Outlet	---	---	483*	111*
Pearl below Moore's Bayou	4,850	1,960	2,358	927
Farr's Slough	---	---	---	40.5*
Pearl below Farr's Slough	---	---	---	886

* Discharge Measurement
** Preliminary estimate based on gage reading of 8.52 feet at Bogalusa, or approximately 2,800 cfs. Final figures were to be furnished by the U.S. Geological Survey after the agency's 1980 water year computations were complete.

The Corps' 1989 report contains the following flow measurements:

Source	Date	In Wilson Slough			Below W.S.			At W.S.
Whittle	20 May 76	4,640	(49%)	+	4,850	(51%)	=	9,490
	1 Jul 76	2,360	(55%)	+	1,960	(45%)	=	4,320
	6 Apr 78	2,838	(55%)	+	2,358	(45%)	=	5,196
Hains	25 Oct 79	1,630	(64%)	+	927	(36%)	=	2,560
	11 Jun 80	2,710	(57%)	+	2,040	(43%)	=	4,700
	14 Jun 80	2,260	(59%)	+	1,550	(41%)	=	3,810
USGS	27 Jul 83	2,060	(65%)	+	1,120	(35%)	=	3,150
	1 Nov 83	1,450	(71%)	+	560	(28%)	=	2,040
Vicksburg	7 May 86	2,110	(76%)	+	680	(24%)	=	2,790
District	9 Oct 86	1,420	(81%)	+	340	(19%)	=	1,760
	12 Jul 88	1,800	(79%)	+	480	(21%)	=	2,280
	30 Aug 88	1,720	(71%)	+	690	(29%)	=	2,410

(Sums equal 100 percent except for possible slight statistical discrepancies, according to the report.)

The 1989 report added: "Approximately .5 mile downstream of Wilson Slough, a small quantity of flow bypasses Walkiah Bluff Park by flowing through Moore's Bayou. The only available flow measurement for Moore's Bayou is that made by George P. Whittle in 'Study of Localized Flow Distribution Patterns Within the East Pearl River System,' October 1978. Mr. Whittle measured 483 cfs in Moore's Bayou on 6 April 1978. On that same day, he measured 2,838 cfs in Wilson Slough and 5,196 cfs upstream of the Wilson Slough-Pearl River junction.

"Some water leaves the Pearl River approximately 7 river miles downstream of the Wilson Slough disributary at Farr's Slough. The only flow measurements available for Farr's Slough are those offered by C.F. Hains, 'Reconnaissance and Evaluation of Recent Changes in the Lower Pearl River Basin between the States of Mississippi and Louisiana,' 30 July 1980. Actual measurements of 41 and 256 cfs were recorded on 25 October 1974 and 12 June 1980, respectively. Observation of Farr's Slough during reconnaissance trips by Corps engineers revealed a 'trickle' of water in the month of August and a small flow at a higher stage in December.

"Analysis of gaged low data allows an inference to be made as to the distribution of flow between Wilson Slough and the Pearl River. The available data indicate that during lower flows, Wilson Slough captures approximately 70 to 80 percent of the existing flow. Absolute determination of the distribution was not possible due to the limited number of flow measurements available. However, these data indicate that Wilson Slough captures an increasing percentage of the Pearl River flow as the total flow above Wilson Slough decreases. This study assumes that 75 percent of the 7-day Q10, or 1,050 cfs, quantified 900 feet downstream of Wilson Slough, is captured by Wilson Slough and 25 percent, or 360 cfs, continues through the Pearl River. As discussed above, during periods of dry weather, essentially all of the flow contained in the Pearl River system at the head of the shoals flows through Holmes Bayou to the West Pearl River. Based on a 7-day Q10 frequency flow, this quantity is approximately 320 cfs." (p. A-3 - A-7).

Aside from the changes in flow in the East Pearl and Wilson slough, there are at least two other areas where impacts are being felt. In 1983, the Corps breached the levee above lock 2 on the lateral canal, changing the course of the Bogue Chitto. And with continuing development in the floodplain and increased flows down the West Pearl, flooding problems have worsened in the Slidell area. The Corps expects to begin construction on a levee system for Slidell to reduce flooding problems there at a cost of $26.6 million. The problem was first studied in 1981.

8. THE LOWER PEARL ENVIRONMENT TODAY

After more than a century of manipulation by man, the Pearl delta remains a significant natural area, and with navigation assured via the lateral canal, its value for fish and wildlife habitat and recreation generally takes precedence over other uses.

The delta area, made up of a mixture of lake, swamp, riverine and marsh habitats, is one of the largest freshwater swamps remaining in North America, but little energy has been expended on determining which components of that ecosystem are most in need of protection, the extent of past damage, the degree to which they are vulnerable to future damage, the potential for mitigating past impacts and minimizing future impacts and the dangers of reallocating flows.

"While there has been development on its periphery, the lower Pearl River Basin is a hydraulically and biologically complex area that presently remains functionally intact," the 1988 Low Flow Allocation report of the U.S. Fish and Wildlife Service stated. About 85 percent of the area is in bottomland hardwoods and the remainder in marsh. "The low stream gradient and broad, flat floodplain of the lower Pearl River have produced extensive meanders, natural and manmade cutoffs, oxbow lakes, overflow channels, sloughs, bayous and distributaries," the report said.

"The hydrology of the lower basin is vital to the maintenance of all habitats located therein," the report found. "By direct extension, therefore, hydrology of the lower basin is one of the key factors related to the well-being of the fish and wildlife that reside there. Yet the hydrological specifics of the lower basin are very poorly known, particularly from a quantitative standpoint."

The Fish and Wildlife Service drew similar conclusions in its report a year before. According to the 1987 U.S. Fish and Wildlife Service report, "Planning Aid Report on Pearl River Basin, Mississippi and Louisiana, Navigation to Nicholson, MS," there was concern that dredging a channel inland would extend the tidal influence inland.

"Long term seasonal flow curves for <u>specific</u> stream reaches have apparently not been developed," the 1987 report concluded. "In gross terms, it is acknowledged that the study area is experiencing significant changes; the eastern portion is subject to progressively less base flow, while the middle and western portion of the area are gaining in base flows. That the various habitats of the study area are responding to these changes is beyond question. However, quantitative analysis of habitat

response will not be possible until the hydrological dynamics are quantified."

The 1988 report acknowledged that natural and manmade changes have greatly altered the flow of the lower Pearl River, resulting in "a 'problem' that exists only during low flow periods."

"Not coincidentally, the varied interests of two States, and the fate of an exceedingly diverse ecosystem, are at stake," the report concluded.

About 75 percent of the delta area is already in public hands, which, the 1988 report stated, "attests to the immense public value of the study area." Mississippi's Old River Wildlife Management Area comprises 15,000 acres; the Bogue Chitto National Wildlife Refuge, 28,000 acres; and Louisiana's Pearl River Wildlife Management Area, 41,000 acres. In addition, officially designated Louisiana wild and scenic rivers include the Bogue Chitto, West Pearl and Morgan rivers and Bradley Slough, Wilson Slough and Holmes Bayou. The 1981 Pearl River Basin Reconnaissance Report prepared by the Corps' Mobile District (prior to transfer of jurisdiction to the Vicksburg District) noted that the Bogue Chitto River is also a Louisiana natural and scenic river, and is in the Department of the Interior's Southeastern Rivers Inventory.

Reduced freshwater flows in the East Pearl have led to myriad environmental problems that are worsening due to the Corps' refusal to intervene. Those problems include a loss of recreation access, saltwater intrusion, poor water quality, low capacity for wastewater disposal and potential loss of development opportunities associated with navigation and municipal/industrial water supply, the 1988 report found.

Among the general environmental concerns in the area cited in the 1988 report are the clearing of bottomland hardwoods along the river, which causes streambank erosion; sedimentation in channels; nutrient reduction; and turbidity. The question that must be asked is, how would a rediversion affect these?

According to the 1988 report, there are 133 fish species in the lower basin, including 17 used for commercial purposes, and due to population growth, fishing pressures are increasing. In estuarine areas alone, 13.3 million pounds of harvestable fish and shellfish were calculated to exist.

The Corps' 1989 study described four types of wetlands in the lower Pearl area: palustrine (lake shores, channel banks, estuaries, very old and shallow oxbows); riverine (within river channels); lacustrine (open oxbow lakes); and estuarine (tidal marshes).

Those wetlands provide refuge from high current velocities and serve as potential feeding, breeding and nursery habitat for aquatic life.

Marsh damage

The 1988 report noted that the coastal marshes of the Pearl are experiencing rapid land loss. Part of the problem is attributed to "natural deltaic processes which have been greatly accelerated by structural water development," including levees and canals, the report concluded. Normal deltaic processes include construction, abandonment and destruction phases. "Reduction of overbank flooding and distributary flow not only allows physical breakdown of the marsh areas, it also reduces freshwater inflows to the marsh; salinity increases due to saltwater intrusion are the result," the report found. Among other impacts, salinity increases reduce winter waterfowl habitat and the carrying capacity for furbearing animals, the report found.

The 1988 report noted that "the serious decline in marsh and swamp habitats is expected to continue in the future. Although Mississippi has much less coastal wetland area than Louisiana, losses over the next two decades could be significant." Citing Eleuterius-1973, the report estimated losses in Mississippi of up to 5,500 acres as a result of oil and gas development, residential development, clay mining and flood control and navigation. Eleuterius, in his 1972 "The Marshes of Mississippi," estimated there were 66,931 acres of marsh in the state, but projected 27,000 would be filled for industry by 1990.

LSU's draft report on the Pearl, submitted in May 1989, documented a 15 percent loss in total marsh at the mouth of the Pearl between 1956 and 1978; a 78 percent loss in freshwater marsh during the same time period; a 75 percent loss of swamp forest; and a 44 percent loss in beach area.

The Fish and Wildlife Service's 1980 "Planning Aid Report on the Louisiana and Mississippi Estuarine Areas Study" noted that, "One of the most damaging aspects of the loss of fresh and intermediate marsh is the elimination of valuable waterfowl wintering habitat." The report noted that "fresh and intermediate marshes are the most productive for sport hunting and fur harvest, while saline marshes are the least productive."

"The fish and wildlife resources of the Pearl River estuarine area are of great ecological and economic importance," the Fish and Wildlife Service concluded in its 1988 report. "These wetlands (and the surrounding uplands) constitute vital habitat for perhaps the most varied species assemblage in Mississippi and Louisiana."

In its 1989 report, the Corps conceded that "the increasing extent of upstream saltwater intrusion on the lower East Pearl River has been identified as a problem impacting the study area... This has caused a reduction in the freshwater fishery and loss of vegetation dependent on fresh water." The Corps blamed the NASA channel for much of the problem.

The river's tidal wetlands are part of a fragile system that includes Lake Borgne, Lake Ponchartrain, Lake Maurepas, Breton Sound and the extreme western part of the Mississippi Sound, and under current conditions, salt wedges can exist as far upstream as Gainesville and White Kitchen, Louisiana, according to the 1988 report.

The 1985 Mississippi-Louisiana Estuarine Areas report, addressing a project slated for the Bonnet Carre spillway on the Mississippi River, noted that a lack of annual fresh water and sediment from the river led to land subsidence, compaction, erosion and saltwater intrusion.

In his deposition, Norton Haas of Bay St. Louis said the loss of water in the East Pearl had affected fisheries in the marshes. "All we've got now is the ebb and flow of the tide," Haas said. "And I was in the fishing business, like I told you, and it would be such a wonderful thing for the oysters, the greatest industry we got, and they're gone. We've lost it... because we didn't have proper water."

Tommy Vandevender, fisheries chief for the state Bureau of Marine Resources, said his agency has no data on the impact of diversions on the oyster fishery or on saltwater intrusion. Oyster landings aren't reported by specific areas and pollution has damaged reefs coastwide; in addition, water does flow from the West Pearl into Lake Borgne. Vandevender said the closest reef is the Point St. Joe Reef at the pass leading out of Lake Ponchartrain to Lake Borgne.

According to the Fish and Wildlife Service's 1980 "Planning Aid Report on the Mississippi and Louisiana Estuarine Areas Study," the Point St. Joe Reef is open for dredging "some years... During years of low freshwater inflow and high salinity, oyster drills and other predators are abundant. Oyster populations on this reef are now lower than in previous years." The reef is east of the East Pearl mouth.

Among the important estuarine species of the Pearl, according to the Corps' 1979 report are oysters; blue crab; penaeid shrimp; gulf menhaden; striped mullet; spotted seatrout; red drum; Atlantic croaker; and sheepshead. According to the Corps' 1975 report, commercially important brown and white shrimp use the river as a nursery area.

Declining freshwater habitat

The Corps' 1989 report found that 800 cfs is required to keep saltwater intrusion below U.S. 90 on the East Pearl, while the salt wedge currently "stays consistently downstream" of U.S. 90 on the West Pearl. The report found that saltwater has moved upstream of Gainesville on some occasions and that it is found upstream of U.S. 90 for half the year. "This has caused a reduction in the freshwater fishery and loss of vegetation dependent on fresh water," the report found.

The diversion of freshwater from the East Pearl is also affecting fisheries upstream from the saltwater wedge, said John Burris, chief of the education and environmental services branch of the Mississippi Department of Wildlife, Fisheries and Parks. Burris participated in fish surveys along the Pearl in the early '80s.

Among the important freshwater species according to the Corps' 1979 report: largemouth bass; spotted bass; bluegill; redear sunfish; warmouth; black crappie; white crappie; channel catfish; flathead catfish; smallmouth buffalo; carp; crayfish; and bullfrog.

The Department of Wildlife, Fisheries and Parks completed a survey of fisheries along the Pearl from Columbia to Interstate 10 in April 1990. Biologists David Robinson and Kenneth Rich interviewed 744 fishermen between March and August 1988, 72.7 percent fishing with "active gear." The river was initially divided into two sections, above and below Bogalusa Landing, but the lower section was subdivided at Walkiah Bluff (erroneously described as Walkout Bluff in the report) because of low water conditions; Robinson noted that up to 12 miles of the lower section were impassible for part of the year. Dominant fish were channel catfish and largemouth and spotted bass.

Tom Holman, a fisheries biologist with the DWF&P's Turcotte Fisheries Lab, said the study showed significant differences in species composition above and below the shoals. The survey found 295 fishermen in the 21 miles between Pool's Bluff and Wilson Slough; 47 in the 6.5 miles between Wilson Slough and Farr Slough; and 597 in the 28.5 miles between Farr Slough and Logtown. Catfish were the dominant catch above the shoals, with bluegill, redear, longear and bass predominating downstream. The catch downstream of the shoals came primarily from the lower reaches of the river; 98 percent of all species caught with active gear and 73 percent of all species caught with nets and trot lines, were caught in Hancock County, the report found.

"The richness of species is overwhelming at Pool's Bluff," Burris said. "But that's not the case by the time you reach

Walkiah Bluff." Burris said there needs to be a critical analysis of the area that includes the shoals and the Hobolochitto. "That's virtually not a fisheries any longer," he said. "There are serious problems with the effluent from the city of Picayune. At that point, a quarter to half of the flow comes from the city of Picayune, and the water is degraded down to its influence by slower water. I have been down it twice and I have seen not one fish." Burris also said the area between Wilson Slough and the shoals supported commercial catfishing and mussel collecting as recently as 1982.

In his deposition, E.L. (Leff) Robbins, of Picayune, said he has noticed a decline in freshwater fisheries on the Mississippi side of the swamp. "The fishing is not good," he said. "It's less fish than we used to have... Well, I think that part of the problem is from lack of water because the type fishing I did in Catfish Lake area was for white perch and bass, and the water gets hot and shallow and they just don't bite like they used to." In a statement made to Mackey in 1978, Robbins said water ran through Keller, Parker and Twin Bayous as late as the 1950s and '60s. "Catfish Lake was probably considered by the local people who know how to get there the best place in Pearl River County, in the lower Pearl River, to fish, because it was fresh water out of Pearl River all time and now there is not enough water in Catfish Lake to fish." Robbins said Farr Slough ceased running in 1978.

Downes, in his statement to Mackey in 1978, agreed. When it was running, Farr Slough was about the size of the Hobolochitto, or "Bolie," as the locals call it, so when it stopped running the lower East Pearl lost half of its flow, Downes said. Catfish Lake is now too shallow even to boat, Downes said. "Catfish Lake is a dying system at present simply because of a lack of water caused by the river level dropping due to the diversion above Walkiah down Wilson Slough, the water level has dropped to the extent that Keller Bayou only flows in flood water, and there are months there when Catfish Lake doesn't get any floodwaters -- it becomes stagnated and it's a dying system." Also dying are Twin Bayous, and West Bayou, which Twin Bayous nurtured, Downes said.

The blockage at the shoals and diversions upstream may also be effecting populations of Atlantic sturgeon, which are listed as endangered in Mississippi; however, there isn't enough data to draw conclusions, said Dr. Donald Jackson, an ichthyologist at Mississippi State University. In a 1987 study of the fish in the Pearl and Pascagoula river systems, Jackson reported that sturgeon had been found in some abundance below the shoals but not above. Jackson himself found no sturgeon in the Pearl, but had reports from fishermen of sturgeon being captured. The species, which can live up to 60 years and grow to lengths of up to 17 feet, "requires suitable riverine, estuarine and coastal habitat to complete its life cycle," Jackson wrote. "Construction

of dams and channelization has severely altered riverine environments and hydrological cycles." Jackson noted that in the summer of 1985, "63 juvenile to sub-adult sturgeons were collected in... a single location of the lower Pearl River," near the NASA Test Site. He wrote that some residents of the Walkiah Bluff area reported seeing large schools of sturgeon moving upstream in years past, and he found a dead sturgeon in the area.

Overall, the delta area provides habitat for several endangered species. According to the Corps' October 1981 "Pearl River Basin Reconnaissance Report," nine federally endangered species are known or expected to occur in the Pearl River basin: the American alligator, brown pelican, bald eagle, Arctic peregrine falcon, red cockaded woodpecker, ivory-billed woodpecker, Bachman's warbler, red wolf and Florida panther. In addition, the black pine snake, frecklebelly madtom, freckled darter, crystal darter and 21 species of plants are under federal status review; and the black bear, which is considered rare in Mississippi, is found in the lower basin. The ringed sawback turtle, Eastern indigo snake and gopher tortoise have since been added to the federal list as either endangered or threatened, and the rainbow snake and black bear added to the Mississippi list, according to the 1989 LSU draft report.

The 1981 report outlines the relative abundance of the species in the basin. Brown pelicans are limited to coastal bays and inlets. Alligators range throughout the basin, and are particularly common in the coastal marshes. Eagles have been recorded at Picayune and are known to breed near White Kitchen, Louisiana Red cockaded woodpeckers range sporadically throughout the basin. The red wolf is likely extinct. The only records of the Florida panther are from Hancock County, near the NASA Test Facility; there were 13 reported sightings between 1968 and 1976 which "indicates there may still be localized individuals or a population in the lower basin," according to the Fish and Wildlife Service's 1981 Resource Inventory of the Pearl River Basin.

There is no question that the diversions are having a detrimental impact on mussels, which are the best indicator of any river's health and were the original source of the river's name. Paul Hartfield, an invertebrate biologist with the U.S. Fish and Wildlife Service in Jackson, surveyed mussel populations in the Walkiah Bluff area in 1986 when he was curator of invertebrates for the Mississippi Museum of Natural Science, part of the Department of Wildlife, Fisheries and Parks, and found very productive mussel beds. During an April 23, 1990 survey of the Pearl from Walkiah Bluff to the shoals and from the shoals via the old Pearl bed (now Hobolochitto Creek) to I-59, radical differences were found in mussel assemblages although habitat was similar.

In the estimated two miles surveyed downstream from the shoals, Mississippi Museum of Natural Science curator of invertebrates Bob Jones found no live "unionid," or native North American mussels. Two shells each of yellow sandshell mussels and fragile papershell mussels and abundant corbicula, an Asiatic invader, were found. Fragments of unionid shells were found on one sand and gravel shoal. "Habitat appeared to be suitable for unionid mussels, with numerous stable sandy-gravel shoals and islands separated by firm mud banks," Jones wrote. "One possible reason for the absence of unionid mussels might be extremely low water levels during summer months." In the area surveyed upstream from the shoals, recently dead native mussels were numerous on gravel bars and live mussels were found in the shallows. The dead mussels had been left stranded by falling river levels. Jones found 15 species of unionid mussels. At the time of the survey, the Pearl stood at 8.5 feet at the Pearl River Turn-around on I-59.

The Pearl below the shoals is narrow and winding, its channel occasionally blocked by jams and interspersed with cypress trees. Abundant mussel habitat exists but populations are limited by low flows and pollution, Jones said; the river had an odor of sewage on the day of the survey. The flow of the true Pearl River entering Hobolochitto Creek was insignificant, owing to the small size (about 10 feet across) of the channel. As a result, few mussels were found and those were primarily "invaders," or exotic species. Part of this degraded environment is in the Bogue Chitto National Wildlife Reserve. By contrast, the Pearl above the shoals is wide and mussels are abundant. Even though low flows have been reduced by the Wilson Slough diversion, the river bottom in the vicinity of Walkiah Bluff was, before the August 1990 fish kill, for all practical purposes a continuous mussel bed, with a great diversity of species. This habitat will be lost if the capture of the Pearl at Wilson Slough is allowed to take place.

The 1989 report noted that while the city of Picayune currently is able to discharge its treated waste into the East Pearl, "city officials express major concerns that problems do exist in the area and/or there is potential for problems in the near future." Those problems include considerable expenditures for new treatment facilities.

Randy Reid, with the Bureau of Pollution Control's monitoring section, said the East Pearl is being monitored to see if Picayune's discharges are having a negative impact. Reid said the city of Picayune's discharge permit was recently reissued over a local bass club's objections that the river was unable to dilute the discharge without a reallocation of flows. Reid said the permit was issued with a "reopening clause," and the bureau agreed to do a water quality study, using dissolved oxygen, conductivity and salinity as measures. Following that

superficial study, the bureau will decide whether to do an intensive study, he said. If a problem is found, it's likely the bureau will recommend that it be corrected within three years--possibly before the issue of flow reallocations is resolved.

Bud Collier of Picayune, vice president of the Picayune Bass Club, said local residents want to bring attention to the problem because the Pearl is basically dead from the discharge pipe to Highway 11 for six months of the year. He said the river there would be stagnant if not for the discharge. Collier added, however, that due to concerns about the environmental impacts, the fishermen do not want all of the West Pearl's flows. About 35 percent of the flow would suffice without wreaking total havoc on both the East and West Pearl systems, he said.

U.S. Environmental Protection Officials would likely resist using the pollution problems along the East Pearl as a justification for reallocating any flows. The sentiment expressed by one EPA official is that the agency would rather see Picayune install better treatment than receive increased flows in which to discharge. Better treatment would simply mean different treatment, however, and removing the discharge would remove the only extant current, so the problems would not be solved.

Damage extending to west

The U.S. Fish and Wildlife Service's Jan. 27, 1981 report, "A Resource Inventory of the Pearl River Basin -- Mississippi and Louisiana," was conducted, according to the authors, "to point out how the ecosystems in the basin interact biologically and thereby produce the diversity and abundance of fish and wildlife populations found there. This ecosystem approach must be followed when developing flood control and other similar projects if we are to maintain and increase wildlife and fisheries production for future generations."

Downes, who first stressed the need for a comprehensive ecological balance in the Pearl delta in 1968, said the Louisiana swamps are suffering, too. Under natural conditions the East Pearl slowly fed those swamps, and now they are being scoured by floodwaters, he said. In his 1983 videotape, Downes said Twin Bayous no longer feed the western swamps from Farr's Slough since Breakover Bayou has filled in (as a result of the diversion at Wilson Slough.)

M.O. Pigott, in interviews with the author in April 1990, said changes in the course of the Bogue Chitto following Louisiana's breaching of the canal levee have caused scouring of swamp channels and subsequent draining of wetlands to the west. Cypress roots there are now exposed head high above high water, he said. Similar problems elsewhere are related to the increased

flow down an increasingly swift and eroded Wilson Slough, which is ecologically and hydrologically unstable. Pigott said rapidly falling water has destabilized banks throughout the delta, which has led to erosion, which in turn leads to siltation.

"They cut the levee below Lock 2, above Joiner Lake, and after that, the Bogue Chitto flooded the East Pearl and had to go down the western swamp, so it cut a new channel to Little River," Pigott said. "Now it's cutting V-ditches and blowing all the guts out of the swamp, draining tupelo swamps with new, deep channels. Before, the water was breaking slowly over a soft, mud swamp... Now we're losing thousands of acres of tupelo and cypress swamps in the Bogue Chitto National Wildlife Refuge. On the East side, the swamps are filling in. We're losing lowland hardwoods. And the rapid falls are causing erosion on the East Pearl."

An Aug. 28, 1990 tour clearly showed that the West Pearl headwaters are "blowing out" and that cypress and tupelo swamps in Louisiana are going dry as a result. Mazes of bayous through the forest were dry depressions criss-crossed with alligator tracks, while the primary drainages were deep chasms filled with fallen trees and mud. Pigott said at the time that the erosion will ultimately cause further breakouts from the East Pearl to the west and destroy habitat in the wildlife refuge.

Andrew Watkins, who gave Mackey a statement in 1978, said Wilson Slough is having a major impact on virtually all waterways to the south. "When it changes that it changes a lot of the bayous below there, doesn't it? Some of the water that goes down Indian Bayou, it won't go down it, it's going to affect the whole ecology of the islands," he said.

Because the East Pearl is the boundary, Louisiana swamps to the east of the West Pearl are also degraded under current conditions, since entire wetlands systems are disappearing.

Overall health of delta area in jeopardy

While the East Pearl channels and swamps are going dry, other pressures are coming to bear on the resources of the lower Pearl. New Orleans East proposes piping drinking water from the West Pearl across Lake Ponchartrain. The city of Slidell, Louisiana, which suffers severe flooding of residential areas, seeks further flood control works along the West Pearl River. The Corps proposes further dredging along the Pearl and West Pearl rivers to resume navigation along the barge canal. And local interests are vehemently pushing for preservation of the status quo in the West Pearl swamps. With these and other added pressures, the health of the overall delta area is threatened.

In his deposition, Downes said he noticed in 1979 that even flood replenishment has been reduced in the eastern swamps as a result of man's intervention. Downes said 1979 flooding in the East Pearl was less severe than in the West Pearl, which inundated low lying areas around Slidell.

Downes began keeping a log of Pearl River flows around 1970 when, he said, water levels at Walkiah Bluff "began to drop drastically" as a result of the Wilson Slough diversion. During Downes' deposition, Assistant U.S. Attorney L.K. Travis objected to references to a "diversion," saying, "We don't acquiesce at this juncture that there was a diversion."

Downes said he began writing the Corps requesting historical information and interviewing older residents after "seeing the deterioration and the ecological balance being destroyed and riparian rights of the State of Mississippi to the main channel of the Pearl being depleted and destroyed."

In his letter to Ruland, Downes noted that humpback blue catfish and buffalo fish have virtually disappeared from the upper Pearl River delta. "There seems to be a strong relationship between the reduction of these particular species and the disappearance of the vast beds of freshwater mussels that used to be in the upper channels of the delta," he wrote.

Downes said the ecological balance of the overall delta ought to be the paramount consideration. "The eastern side of the Pearl coastal delta is drying up and it is my opinion a dying ecosystem, due to the lack of water," Downes said in 1978. He added: "Our proposals are to restore the river back to the shoals, would again make Big Indian Bayou have a low flow, which would in turn nurture a considerable section of Honey Island, part of which belongs to the Louisiana Wildlife and Fisheries as a game refuge... Then, there are other bayous that a raise in the level in the Pearl River, by closing the diversion at Wilson Slough, would cause these bayous to again have low flows."

Downes said restoring water to the eastern swamps would help the marshes as well. "Now, when we have a dry season, the brackish water will push above Mike's River. It's not natural," he said in 1978. "You still catch a lot of bass in the East Pearl System -- Waste House Bayou, they catch a lot of bass, but these guys that are going and catching a dozen or so bass now, if they could see the string of bass that came out of there 35 years ago. It just takes all of them years to see the change -- that's the way it is. The ecosystem is being degraded and what's happening, it just takes those years to see it."

Downes felt the environmental argument for restoring flows was sufficient. "We would have the main channel or the Pearl on the high side, the eastern side of the valley, and then the

distributary bayous would be going to the west," he said. "The Pearl coastal delta would be better nurtured then; wildlife and fish habitat, timber and everything for that matter. All of the water is being shunted to the western side now...

"Pearl River was put there in the last ice age, I guess, 10,000 years ago, and it stayed in one place for all those many centuries until the tinkerers, in the form of the white man, came in," he said. "The Choctaws didn't disturb it. The tinkerers, the white man tinkerers, the Corps of engineers actually, and it stayed on the high side of the valley for centuries, and the distributary bayous nurtured the Pearl coastal delta and it stayed that way for all those centuries until man came in there with his logging, structural measures, cutting across bends and shortening the river, generally screwing it up."

Added Andrew Watkins in his statement to Mackey in 1978: "All the old lakes and all of the bayous through there are filling in... Used to be wonderful places to fish."

Bottomland forests suffering

Although there is little data to support the claims, many residents say cypress swamps in the western basin are suffering from channel scouring that exposes roots and allows other species to compete due to the loss of standing water. Willows, for instance, are crowding out cypress seedlings. In the East, meanwhile, the lack of water is allowing the same species to supplant the cypresses, and some say pines are invading the swamp.

"Due to the diversion of the eastern channels to the westward," Downes wrote in his letter to Ruland, "the eastern side of the delta is gradually losing its deep swamp characteristics prevalent 50 years ago with the resulting intrusion of high swamp and upland vegetation on the eastern side such as red gum and slash pine and a reduction in cypress. However, logging practices must be taken into consideration in any final evaluation."

The Mississippi Forestry Commission does not have documentation to either support or refute Downes' claim.

9. PROJECTIONS

What will happen if current conditions continue? Of immediate concern is that Mississippi will lose more of the river it was granted at statehood. And the only method for preventing the loss of the river is the same one for restoring the resource that has already been lost downstream of the shoals: reallocation of flows.

"Any redistribution of flow could have significant beneficial and adverse impacts," the Corps' 1989 report found. The report noted that maintaining flow on the East Pearl during low flow conditions would improve water quality.

The 1971 report estimated that continued population growth in the Pearl River delta area will increase demand for water consumption and corresponding discharges, and for navigation and recreation.

The most recent statistics available from the Mississippi Institutions of Higher Learning (formerly Research and Development Center) project the population of Pearl River County to grow from the current 41,000 to 43,400 by 1995 and the population of Hancock County to grow from the current 34,600 to 37,900 by the same year. The Mississippi Official and Statistical Register 1988-1992 offers some variations on current populations and projects the population by the year 2000: Pearl River County, currently 39,552, to grow to 42,213; and Hancock County, 33,039, to grow to 38,016.

The 1980 Pearl River Basin Reconnaissance Report by the Corps' Mobile District noted that water consumption is expected to show large increases in Hancock County and St. Tammany Parish in the future.

In his report to the State of Mississippi in 1979, hydrologist C.F. Hains wrote that the Walkiah Bluff bend appears to be dying. "This bend is in a late stage of meander development with the characteristically narrow neck indicative of maximum meanders," Hains wrote, adding, "the reduced energy in the water now flowing in this area creates conditions conducive to rapid sedimentation which in turn further restricts the flow in Walkiah Bluff and thereby forces even more water through Wilson's Slough and Moore's Bayou." Hains noted that, whereas the West Pearl historically resembled the Bogue Chitto River, "now it is beginning to develop the exaggerated bends characteristic of the Main Pearl River."

"In fact," Hains wrote, "the water in the Main Pearl River had a tendency to flow into the west because the West Pearl River was slightly lower in elevation."

According to historic accounts, the West Pearl did not have a deep, flowing channel -- which would have allowed it to take advantage of that tendency -- before the Corps intervened. The situation was similar to the Yazoo-Mississippi Delta in that the main watercourse was at a higher elevation than its tributary/distributary, but had a greater velocity which kept it from being captured by the secondary watercourse (the Yazoo, in the case of the Delta.)

The deep, flowing channel of the East Pearl was kept scoured by runoff from the hills, while the more sluggish tributaries entering from the west contributed only sediments and swamps to the lesser West Pearl River. The result was a higher, faster flowing eastern channel which occasionally dumped overflows into the labyrinthine swamps and maze of channels to the west.

Today, however, the eastern channels have been filled with sediments as a result of diversions to the west, and the western channels have been "blown out" by faster currents.

In the Corps' 1975 final environmental impact statement for "Pearl River, Mississippi and Louisiana (Maintenance)," the agency noted that the higher elevations in the lower Pearl basin are eroded, with sandbars common. "According to local sources, the West Pearl River exhibits a characteristic fairly common in streams of this of its type, that is, to create shoaled areas and sandbars impassable to virtually all watercraft." This tendency, which worked to prevent a shift of the main channel to the west, may explain the fervor of Louisiana residents to retain as much of the water volume as possible."

Marion Stewart, with the Mississippi Bureau of Land and Water Resources, said flow readings along the Pearl are taken "irregularly" and that the Corps has agreed to do the monitoring. Stewart said the Corps' interest is primarily in flood control and not low flows. The U.S. Geological Survey contracts with the state to take flow measurements.

The Fish and Wildlife Service proposes studying seasonal stage frequency, duration and area throughout the system; flow velocity, direction and percent of total throughout at high, median and low flows; seasonal inflow volumes and corresponding outflow volumes; sedimentation rates; and seasonal depth to water tables.

Department of Environmental Quality Director Jimmy Palmer said the most current flow information is in the Corps' 1989 report. But, he said, "At all stages there is demonstrable evidence of capture" of the Pearl at Wilson Slough.

The Corps' 1989 report noted that Wilson Slough captures 75 percent of the Pearl's low flow and Holmes Bayou the remaining 25 percent. "The expected future condition is that all low flow in the Pearl River will continue to flow into the West Pearl River. Should Wilson Slough capture more of the Pearl River flow, the problems discussed herein will be magnified. The worst case scenario would be a total capture by Wilson Slough of all flow of the Pearl River. If this should occur, the Walkiah Bluff Water Park would no longer have water access, and resources and activities relying on flow from the Pearl River would be lost or damaged. The Pearl River, from the head of Wilson Slough through Holmes Bayou to the West Pearl River, would essentially become a dry streambed."

While information is limited, the 1989 report noted that "long-time local residents contend that Wilson Slough is indeed gradually capturing more of the Pearl River flow." The report stated that the data are too limited to establish a trend, but acknowledged that between 1976 and 1988 the available figures "reflect that at lower flows, a greater percentage of the total flow passes through Wilson Slough." The amount ranges from a low of 49 percent to a high of 81 percent.

Downes wrote Ruland that diversions were occurring between Richardson's Landing and Bogalusa and Pool's Bluff Sill, which he said were evidently caused by the obstruction of the river by the sill. Diversion from the Main Pearl into the Henleyfield Old River system "not only threatens the volume of the flow in the Main Pearl but pours Bogalusa Creek and Coburn Creek polluted waters into the Old River system in low water periods with detrimental effects," Downes wrote.

10. POSSIBILITIES FOR RESTORATION

According to the 1988 Fish and Wildlife Service report, "several alternative low flow allocations have been considered." The plans differ in the percentage of flows allocated to the east and west and in location of work. "All plans would rely on a combination of water control structures and channel improvements to allocate low flows," the plan said.

Any work, and particularly emergency efforts to prevent the further capture of the Pearl by Wilson Slough, would require some kind of structure at Wilson Slough. Depending on the extent of the reallocation, a structure would likely be required at Holmes Bayou and at Moore's Bayou.

Any reallocation would require continued maintenance to prevent breakouts and shoaling -- to provide for a manmade balance that would be contrary to both the natural and prevailing conditions in the delta. The environmental consequences, both beneficial and adverse, could be significant.

Should any action be deemed justified, it would likely be at Wilson Slough, since the environmental consequences of taking no action are greater there and the consequences of taking action are less.

In his 1979 report, Hains noted that the Corps in its 1978 Whittle report ("Study of localized flow distribution patterns within the East Pearl River system," BER report no. 223-112) gave the highest marks to placing a structure across Wilson Slough to provide two more feet of water at Walkiah Bluff during low flows. The Corps in its 1989 report confirmed that those were the findings of the Whittle report, but added that no recommendation was made "in consideration of the unknown present or future uses of Wilson slough."

Without a structure at Wilson Slough, the myriad environmental problems that beset the Pearl south of Picayune would creep northward to Wilson Slough. With a structure, Mississippi could at least retain a vestige of the river and the swamp ecosystem it supports between Wilson Slough and the shoals.

Averting catastrophe at Wilson Slough would not be a panacea, however. The simple construction of a structure there would not correct the complex problems facing the lower basin. A complete resolution of the problems would require at least a partial restoration of flows downstream from the shoals in the East Pearl, and possibly at Moore's Bayou to protect Walkiah Bluff from going dry. The primary considerations are how to go about restoring at least a partial flow in those areas, and how much is enough.

The 1971 report considered only alternatives that would provide for a minimum of two feet of water at low flow and a 50-foot unobstructed bottom width.

The 1988 report considered flow allocations of 100 percent to the East Pearl/0 percent to the West; 50/50; 30 percent/70 percent; and 0 percent/100 percent. All would require a dam at Moore's Bayou and fixed, submerged structures at Wilson Slough and at Holmes Bayou near the head of the shoals or on the Pearl at the head of Farr Slough. "The actual percentage of flows would be determined by the design crest elevation of the structure," the report said, adding, "Maintenance dredging would likely be required under any reallocation of flows alternative. The frequency, method, and disposal areas required for such maintenance work will be investigated during feasibility studies." The Corps concluded in its 1989 report, however, that feasibility studies were not justified.

The 1989 report considered diversions of 100 percent to the east; 50/50; 30 percent to the east; and existing conditions, or 100 percent to the west. The alternatives include placing a control structure at Moore's Bayou to restrict flows now bypassing Walkiah Bluff; a 3.5 mile canal through the shoals; a 5-mile channel through Farr's Slough; and structures in Wilson Slough and Holmes Bayou to reduce flows to the West Pearl.

The report said that based on computer modeling done for the proposed East Pearl navigation project, stages on the East Pearl as a result of the diversions would be increased from 0.2 to 1.4 feet, depending on the alternative chosen. "This increase in stages would reduce the channel excavation quantities required to extend navigation from the NASA test facility upstream to Nicholson on the East Pearl River," the report found.

Computer modeling done on the West Pearl indicated that a 100 percent diversion to the east would result in maximum stage reductions of less than 0.5 feet downstream of U.S. 90 to near two feet at the mouth of the West Pearl Navigation Canal. The 100 percent diversion would probably lead to increased dredging of the canal upstream from I-59, the report concluded, although, "The other diversion alternatives would have minimal impacts on West Pearl River Navigation." It is interesting to note that the Corps chose not to estimate West Pearl stage reductions for the 30 and 50 percent diversion alternatives, since they would have been significantly less -- particularly since the report pointed out that, "the 100 percent diversion alternative is not a viable plan and was included for comparative purposes only."

Interestingly, the Louisiana Wildlife and Fisheries Commission suggested in the 1975 report that the Corps combine its West Pearl maintenance project with the East Pearl navigation project and route traffic up the East Pearl to Holmes Bayou and

from thence along the barge canal to Bogalusa. This would involve a major excavation project and likely would be unacceptable both environmentally and economically.

Wilson Slough

At what is known as the head of Wilson Slough, the current state line on most maps is drawn through an 1884 Corps cutoff of Leslie's Bend on the Pearl River. This is the case with the most recent topographic quadrangle maps issued by the U.S. Geological Survey. The line should follow the old bend of the river, which was cut off and partially filled and dammed by the Corps. This was the state boundary at the time of statehood, and would not change with the river because the change was sudden and manmade, i.e., an "avulsion" as opposed to an "accretion."

Ownership maps in Pearl River County courthouse records indicated the state line following Leslie's Ditch until 1983-84, when, apparently, reappraisal was done. After 1984, the land inside the old bend was included in Pearl River County tax rolls, but it's unclear if anyone has actually paid taxes on the land; efforts failed to locate the parcel or any adjacent parcel in St. Tammany Parish.

Although the current use of the land for wildlife habitat would not likely be effected, claiming this 70-80 acre parcel--and with it, at least part of the head of Wilson Slough -- is necessary to clearly establish the state line and state jurisdiction. The U.S. Fish and Wildlife Service draws its boundaries along the Leslie's Ditch cut -- and not the correct state line, but the Fish and Wildlife Service bought the land from Bennett York of Hattiesburg as part of a Mississippi parcel valued at $5.4 million.

John Rea, land surveyor with the Refuge and Wildlife division of the U.S. Fish and Wildlife Service, provided documents in May 1990 which indicate that some of the land on the west side of the Pearl River is in fact in Mississippi. The parcel is included in the Bogue Chitto National Wildlife Refuge and refuge officials had assumed it was in Louisiana. Rea said, however, that the Fish and Wildlife Service carries what's known as Tract 106a on its books as being in Mississippi.

On an 1828 map in the Fish and Wildlife Service's files, "the salient depicted in the bend of the Pearl River and being the southwest portion of Section 19 appears to be the same as that tract designated FWS Tract (106a)," Rea wrote in a May 25, 1990 letter.

Rea also provided a copy of the title to the property in question, known as Simon Favre Claim No. 19. The description

read simply, "T. 5 S., R. 18 W., St. Stephens Meridian: In Section 19, all lying westerly of the Pearl River as it now flows, containing 70.00 acres, more or less."

If it is found that the map is simply drawn incorrectly, then the state will have the lever of controlling part or all of the head of Wilson Slough, which appears to cut through the old peninsula of Mississippi land into the old filled bend.

The exact location of the state line in relation to the head of Wilson Slough may not be clear even if the question of title is clearly established. It's possible that Wilson Slough is south of the old river bend, since the breakout began at the south end of the dam, and the dam itself may have been built south of the original state line as the Pearl at that location would likely have been migrating southward.

Downes told Mackey the slough is slightly south of the upper part of the old bend, which is now timbered, and this seems to be the case in some aerial photographs. There are no clear delineations, however, and the case could be made that any southward movement was accretion, which would cause the state line to move southward as well -- that is, if the waterway were technically the Pearl River, which forms the boundary; it's not clear what this waterway is, since it goes by many names. Downes noted in his 1983 video that the slough appeared then to be migrating northward, toward the old upper part of the bend, so the question may have been resolved by now.

If Wilson Slough were deemed the true Pearl River, a boundary dispute could follow.

Farr's Slough/Breakover Bayou to Hobolochitto Creek/East Pearl

According to the 1971 report, an unobstructed waterway once existed through Farr's Slough reach, which was declared legally navigable by the county board of supervisors. However, an earthen dam with cypress pilings was built across the mouth of Farr's Slough in the early 20th century.

Removing the dam would be easy but considerable further excavation would be required to facilitate a diversion to the East Pearl. According to the 1971 report, sufficient fall exists to maintain the channel, but a potential disadvantage is a possible change in the river's course, which would cause flooding problems downstream.

The report concluded that the bottom of Farr's Slough behind the dam is approximately 10 feet higher than the bottom of Breakover Bayou, which is about 1,500 feet downriver. To build a

waterway there would require "considerable snagging and some dredging," the report found.

Cost of work utilizing the original bed of Farr's Slough: $125,000 to $250,000 in 1971.

According to the 1971 report, small boats could pass through the Breakover Bayou/Farr's Slough reach in 1971, but at low flow log jams and trees obstructed the flow, which was estimated at 900 cfs. Therefore, the flow from the main Pearl to the East Pearl has not been gone for 100 years, as some maintain.

The channel through Breakover Bayou and Farr's Slough would be the most feasible route for restoring flow to the East Pearl, but the channel would not likely scour itself sufficiently to preclude regular maintenance, the report found.

"It is our considered opinion that a minimum channel improvement program accomplished in several stages could be implemented to achieve the objectives for a pleasure boatway in this area (Breakover Bayou) without immediately disturbing the flow in the Pearl River to a point that would cause undue concern in the vicinity of Holmes Bayou," the report concluded. The report recommended initial desnagging work from Farr's Slough down Hobolochitto Creek to the mouth of the shoals, which would require removal of up to 1,000 visible trees and logs, excluding the log jam at Breakover Bayou.

The second phase of work would require "a minimum program for channel improvement." At least four reaches would have to be widened, "several" should be deepened and five small islands would have to be removed. "No straightening will be required as the scenic value of the winding stream should be retained," the report said.

The report cited as disadvantages potential legal ramifications since the area is not on the state boundary, and possible increases in flooding downstream.

Cost of work utilizing Breakover Bayou: $90,000 to $180,000 in 1971.

The Corps' 1989 report said the Farr's Slough route would require a weir in the Pearl River downstream from the head of Farr's Slough rather than at the head of Holmes Bayou. Farr's Slough itself would be excavated to a 50-foot bottom width for five miles, for a total amount of 430,000 cubic yards of excavation. Channel improvements and rights-of-way would require 175 acres of land, 129 acres of which are bottomland hardwoods and 46 acres of which are stream and streambed. The spoil would be placed beside the channel, the report said. Because of the larger amount of required excavation, the cost of this route

would be higher, the report concluded: about $3.8 million plus $377,000 in annual operating costs for the 100 percent diversion allocation; $3.6 million plus $359,000 annually for the 50 percent allocation; or $3.5 million and $349,000 annually for 30 percent. It's interesting to note that the Corps' estimated annual operating expenses for the various alternatives varies as much as $28,000, even though the only difference is the height of the weirs initially constructed.

Of note: during an April 23, 1990 survey of the river, water was travelling through Breakover Bayou into Farr's Slough at a stage of 8.5 feet on the I-59 Pearl River Turn-around gauge.

The shoals via a canal to the East Pearl

According to the 1971 report, this was the original route of the Pearl River and forms the boundary between Mississippi and Louisiana. The section is about 3 miles long. An earthen dam partially blocks the flow now, as well as sediments deposited following the log jam. One problem, which may have exacerbated the original diversion, is that Hobolochitto Creek sometimes backs up into this reach. It's possible the reach historically filled with silt and logs during such periods and then was scoured out by falling water levels. Continued dredging would likely be required today, and to a greater extent than the other alternatives, the report found.

The report found that "there would be no assurance that at high stage the river might not revert to this channel and leave little water remaining at lower stages for Holmes Bayou, although this is rather improbable when considering the history of this reach of the river." The report further found that the Pearl River channel at the time was approximately one and a half feet deeper at the head of the shoals than at the confluence with Hobolochitto Creek, which "could possibly account for a chain of circumstances helped by the natural evolution of things historically, but due mainly to the acts of man, that caused abandoning this reach of the river to the forces of nature." The report cites as an advantage that this alternative would restore the river "as history proves it was," but could divert the flow from Holmes Bayou and would be high-maintenance.

The 1971 report suggested that a cutoff might be built across an old shoals bend to save approximately 3,600 feet, which would shorten the distance to about 2.4 miles. If maintenance costs proved unacceptable for a shoals canal, sills could be placed at either end to hold a constant water level without disturbing low flows "unduly" through Holmes Bayou, the report found; an added cost would be boat lifts or small locks, however.

"The initial cost of clearing and dredging the shoals area would be high due to the filling that has occurred through the years," the report said. "There are indications at the head of the shoals that silting has exceeded nine feet in depth. It appears that approximately three feet of silting has occurred at the foot of the shoals...

"Probably in early days, while the shoals carried commercial river traffic on the East Pearl, this reach was difficult to traverse due to its tortuous nature and rapidly changing bottom conditions," the report found. "If measures to maintain it were implemented they would have been costly and probably rather ineffective."

The ecological impact of the excavation could be minimized by damming the work area above and below during construction, the report said.

Cost: $500,000 to $1 million in 1971 for the canal alone.

The 1988 report found that "preliminary analysis indicates that the shoals route will likely be preferred from a cost standpoint; further surveys would be conducted during feasibility investigations in order to confirm the route selected." As stated earlier, the Corps chose not to proceed with feasibility studies.

In its 1989 report, the Corps considered a system of weirs and channel improvement to divert flows through the shoals. Sheet pile and riprap weirs would be built across Wilson Slough and Holmes Bayou and an earthen plug installed in Moore's Bayou. The shoals channel would be three miles long. The report found that such a diversion -- for 100 percent of the flow to the east -- would require 125 acres of wooded land and the excavation of 300,000 cubic yards of soil to be deposited to one side of the channel; the cost would be about $3.2 million plus $315,000 in annual operating expenses for all the work -- not just the canal. For a 50/50 diversion, crest elevations of the weirs would be reduced; the cost would be about $3 million plus $299,000 annually. For a 30 percent diversion to the east, weirs would be lower still and the project would cost about $2.9 million plus $290,000 annually.

The Corps in the 1989 report selected a bottom width of 50 feet for the channel through the shoals and the same for the channel through Farr Slough. Palmer said in his response to the report that a bottom width of 20 to 25 feet might suffice.

During the April 23, 1990 survey of the river, eddies were working against the bank at the upstream end of the shoals, indicating a tendency of the river to follow its old route.

Environmental consequences of further work

There are several questions that must be considered when looking at possible reallocation of flows in the lower Pearl basin. How large an area of wetlands would be destroyed by the work? How large an area of wetlands would be created? Would streambank erosion be a problem? Sedimentation? How many acres of bottomland hardwoods would have to be cleared and burned? What would be the impact on water quality? Where would dredge spoil be disposed of? Would flooding in Mississippi increase? Would saltwater intrusion occur in Louisiana? Would wildlife habitat overall be improved? What would be the effect on outdoor recreation? Would aquatic habitat in the delta be improved overall by a diversion?

Historically, low flows were very low in the western swamps, and reproducing such a scenario would have significant negative environmental impacts today, particularly since a well-established fish and wildlife economy is dependent on water to the west. Likewise, diverting the entire low flow of the river into the East Pearl basin would unleash flooding and erosion problems there and could lead to claims of property damage.

Therefore, although many residents and some officials would like to see a 100 percent re-diversion to the lower East Pearl, the negative environmental impacts would likely outweigh the benefits.

Proponents of a 100 percent diversion may feel the state has sold itself short in seeking less, and likewise some state residents can be expected to object to any reallocation based on the potential environmental consequences.

As an indication of the kind of objections that might be raised by a diversion on the Mississippi side, Roy Baxter of Pearlington said in a May 14, 1975 public meeting on the Pearl proposal that he was against any type of channelization. "According to the press, some people are saying that the East Pearl River is drying up," Baxter said. "This is absolutely not true in our area -- we have more water now than we know what to do with, and even during the dry season we have plenty of water because we are a tide water stream... Some damage has already been done by cutting through natural bends during the river work that was done for NASA. Our river at Pearlington gets higher and has more current during high water periods than it had before this partial channelization... What may be good for you people up here will be extremely detrimental to we people on the southern end. All we have to look forward to is mud and floods."

George F. Riess made the following statement at the same meeting: "I am opposed to this project and trust that you will find it obviously unfeasible for the following reasons, among others: 1. The public interest is not sufficiently served by the project; rather, private interests will prejudice the legitimate interests of the public. 2. Diversion of the water away from Holmes Bayou would obviously have severely detrimental effects upon the magnificent Honey Island Swamp, draining it and altering its natural ecology. The Honey Island Swamp is widely used by both hunters and fishermen and is very literally a sportsman's paradise. Its loss to the citizens of Mississippi and Louisiana would be devastating. Finally, I am opposed to any and all needless channelization, as the Corps certainly should be, in that it destroys fish and wildlife and inevitably other areas which are dependent upon that fish and wildlife."

The Ocean Springs chapter of the Sierra Club at the same meeting expressed reservations about the impact of a diversion on the Honey Island Swamp. The group also voiced concern about the potential for industrial development and resulting pollution if a diversion took place.

Dredging, which would be required under most scenarios, would have significant impacts on the East Pearl swamps, including the loss of bottomland hardwoods and associated wildlife habitat in the areas of excavation and possibly, sites used for the disposal of dredge spoil. Any dredging project can be expected to at least temporarily increase turbidity and reduce dissolved oxygen, thereby decreasing the fisheries carrying capacity downstream. In addition, dredging generally damages the aesthetics of effected reaches and air quality can be negatively effected while work is under way.

The 1988 report called for assessing the environmental impacts of a proposed reallocation in feasibility studies that the Corps chose not to do. "In order to properly assess and quantify these impacts (and the corresponding population/species response), the Service would conduct detailed impact investigations using the Habitat Evaluation Procedures and FORFLO simulations during feasibility planning," the report said. "Water and sediment quality, particularly in proposed construction/maintenance dredging areas, would be assessed for potential hazards to fish and wildlife resources."

The 1988 report said specific environmental impacts are impossible to project without feasibility studies, but identified the following general impacts as common to all structural alternatives:

- Permanent and temporary bottomland hardwood forest losses due to channelization, spoil disposal and construction access;

- Permanent bottomland hardwood gains as a result of in-channel regeneration;

- Permanent aquatic habitat losses due to reduction of in-channel wetland area, channelization, spoil disposal, structure placement and access;

- Permanent aquatic habitat gains due to the construction of new channels and replacement of flows;

- Permanent and temporary water quality losses, including turbidity caused by construction and maintenance, flow reduction at Moore's Bayou, and saltwater intrusion on the West Pearl if the flow there is reduced by more than 50 percent;

- Permanent and temporary water quality gains as a result of reduced saltwater intrusion in the East Pearl and increased assimilative capacity in same;

- Permanent and temporary estuarine/nearshore marine losses due to decreased freshwater input on western areas and saltwater intrusion on the West Pearl if flows reduced by more than 50 percent;

- Unknown fresh, brackish and saltwater impacts;

- Restoration of recreational access at Walkiah Bluff.

Although the Pearl River Basin Development District has no statistics for use of the water park, the Corps, in its 1989 report, included a table estimating usage for 1995. The Corps estimated that Walkiah Bluff can be expected to host 11,242 annual picnickers; 8,760 annual campers; 18,980 annual boaters; and 18,250 annual fishermen; for a total annual visitation of 57,232. The only estimates for hunting in the area available from the Department of Wildlife, Fisheries and Parks relate to the Old River Wildlife Management Area, upstream from Walkiah Bluff; the department estimates that in the 1988-1989 fiscal year, 1,531 man-days were recorded based on hunter registrations, which are believed to be conservative because many hunters do not register.

The 1989 report concluded that a diversion would not adversely affect water quality in the West Pearl, nor would saltwater intrusion increase there. Saltwater fisheries could be extended as far inland as Pearl River, Louisiana, under a 100 percent diversion, with the extent of freshwater sport fisheries reduced overall but improved in some areas. With the 30 and 50 percent diversions, the West Pearl freshwater fisheries would actually be improved due to reduced stream velocities, the report found.

The 1989 report found that, depending on the alternative selected, environmental impacts in the East Pearl could include: improved oyster habitat due to displacement of the saltwater wedge by freshwater; a 65-acre increase in freshwater habitat in the vicinity of the shoals or an overall reduction in freshwater habitat in Farr Slough; and overall improvements in freshwater mussel habitat.

"As a result of these environmental studies, it appears that an alternative could be formulated that would be in compliance with all applicable environmental protection statutes and other environmental requirements, and would correct saltwater intrusion problems on the East Pearl River and enhance the fish and wildlife resources of the study area," the report concluded. The latter indicates that the fish and wildlife resources would be improved overall in the lower Pearl basin.

While the Corps has not considered the impact of dredging the East Pearl to reallocate flows, the agency found in its 1975 report that dredging operations along the West Pearl "have resulted in reinforcement of natural sand banks and beaches by deposition of the dredged material in existing sand beach areas. Additionally, the dredged material has been used to fill eroding places on the river bottom and banks to retard bank caving... There will be a localized degradation of aesthetics in the vicinity of the disposal areas."

It should be noted that the Corps has a dubious history of recognizing the environmental consequences of its work, and has found that the volume of dredge spoil that will be created by resumed maintenance practices south of Bogalusa will preclude bank disposal.

In its response to the Corps' 1975 findings, the National Wildlife Federation wrote that bank disposal would have an adverse impact on fish and shellfish habitat, even though the spoil is primarily sand. The Corps itself found no problems with disposal along the West Pearl at the time the initial alterations were being made. It's possible disposal would not have to be done in uplands away from sensitive wetlands, which would greatly increase the cost of the work.

A potential problem of diverting water that was identified in the 1989 report is the capture of more flow by certain watercourses than would be anticipated. In addition, the construction of weirs would restrict recreational access, and increased flow in the Pearl River could require bank stabilization measures and fish and wildlife mitigation, the report found.

It is unclear what effect a rediversion would have on water quality in the East Pearl. Excavation in the shoals area and

bank erosion would have at least a temporary impact on turbidity, and the problems would be exacerbated if a major flood occurred before the river stabilized.

In its March 1990 assessment of proposals to restore the Kissimmee River to its pre-channelized state, the South Florida Water Management District concluded that soil erosion could be minimized through "armoring," presumably with a material such as riprap. The concern was that sediments would enter Lake Okeechobee downstream when old canal sections of the Kissimmee were backfilled. One of the reasons that sedimentation is expected to remain localized along the Kissimmee, however, is that the river is divided into pools by navigation locks which act as sediment barriers. No such barriers would exist along the East Pearl. Under three of the four Kissimmee River proposals, "velocities would be generated in original river channels that would cause significant stream bank erosion under frequent flow conditions," the report concluded. As a result, "Control of turbidity during construction should be investigated during detail design of any selected plan," the report found.

The 1989 report also warned that navigation along the Lateral Canal might require more dredging following a diversion, but conceded that would be unlikely. If that were the case, it would seem to indicate that operation of the canal is affecting low flows on the Pearl. Vicksburg District spokesman Michael Logue was quoted in the March 2, 1990 Picayune Item saying that low water conditions and shoaling have been problems in the canal, but that water flowing down Wilson Slough or Holmes Bayou is not needed to ensure navigation on the canal. "The West Pearl is totally tide-influenced below where it joins the canal," Logue said. "It depends on the tides for its depth."

In the first phase of his report prepared for the State of Mississippi in 1979, Hains noted there was some concern that the entire river would continue its flow into breakout bayous on the west side even if Wilson Slough were blocked. Hains said that although Wilson Slough was a bend of the Pearl cut off when the Corps built Leslie's Ditch, "logs and fill material were placed in the lower part of the bend to force water through Leslie's Ditch for improved navigation. It appears that Wilson Slough developed subsequent to these events breaking out of the old bend above this barrier and flowing into the Bogue Chitto and on to join the West Pearl River." Wilson Slough "today is a steep, high velocity system with rapidly eroding banks. It carries a heavy load of fine sandy sediment and shifty gravel along its channel bottom. There are often standing waves and mild hydraulic jumps indicating supercritical conditions at some points."

Hains wrote that because the Pearl River is considerably lower than Keller, Parker and Twin Bayous, "it may be difficult

to restore flow in all these places without creating further havoc in the system. If the channel base is significantly lowered, it may be necessary to channelize the shoals area and the other bayous in order to achieve the desired flow." To determine the outcome would require detailed geologic studies of channel materials and meander patterns, he concluded. These have not been done.

Downes said low flows in the West Pearl would not be a problem if sills were built across Wilson Slough and Holmes Bayou. In a Sept. 26, 1984 letter to Rep. Wootsie Tate, Downes argued that the following distributaries historically had contributed to the West Pearl and would continue to do so after the sills were built: Upper East Bogue Chitto; Lower East Bogue Chitto; Middle Bogue Chitto; Briarpatch Bayou; Kellar Bayou; Parker Bayou; Twin Bayous; and Indian Bayou. "The historical bank level dam across the head of Wilson Slough Breakout bend (period 1911-12, 1928-31) restored and maintained flows at low water stages through these distributary bayous, said bayous being vital to nurturing associated lake systems and the general area," Downes wrote. "The pleadings of the state of Mississippi do not include restoration of confluence of the Bogue Chitto River into the boundary stream (as existed prior to the closing of "shoals" section) (H.C. Collins Report, Corps of Engineers records), the whole of the Bogue Chitto system being yielded to the state of Louisiana. In addition, the pleadings provide for a connecting boatway between Pearl River and Bogue Chitto River systems, that, due to existing gradients, would yield water from Pearl River." Downes said Mississippi should seek to stabilize low flows and prevent the capture of the Pearl by Wilson Slough, which would change the course of a boundary stream.

The 1988 report concluded that "the impacts of reallocating low flows would be significant and will affect fish, wildlife and related resources of the study area. Unfortunately, there is far too little known about the hydrology and habitat response of the lower Pearl River to enable accurate evaluation of impacts that will occur as the direct or indirect result of hydrological modifications."

The 1989 report noted that West Pearl River, Holmes Bayou and Wilson Slough are designated part of the Louisiana Natural and Scenic Rivers System and, "any decrease in flow down these watercourses could be viewed as detracting from their scenic beauty." Downes countered that Holmes Bayou is going dry now and that the West Pearl and Wilson Slough are suffering erosion as a result of excessive flows. In addition, if it is found that what is now Wilson Slough is actually an old bend of the Pearl within the boundary of Mississippi, then the question of wild and scenic river status will be irrelevant since the designation would end at the state line. It should also be noted that Louisiana allows maintenance dredging of the West Pearl to facilitate its barge

canal, although the waterway is designated wild and scenic and channelization, clearing, snagging and channel realignment are prohibited there.

The primary concern of Louisiana is that water rights will be lost if the river is restored to the east and that the existing environment to the west will be degraded. There is concern not only for the natural and scenic rivers but for the economy that depends on the environment of the West Pearl: hunting, fishing, mussel shell gathering for trade to Japan and Honey Island swamp tours, among others.

In its 1975 report, the Corps noted: "According to local sources, the West Pearl River exhibits a characteristic fairly common in streams of this type, that is, to create shoaled areas and sandbars impassable to virtually all watercraft. This results in the river becoming unusable without maintenance. It is not uncommon for local fishermen to have to push the smallest bateau and flatbottomed boats for considerable distances, thereby greatly diminishing commercial and recreational value of the river."

Any future work in the area would have to comply with the U.S. Environmental Protection Agency's stringent new wetlands protection guidelines. The EPA Region 6 Office in Dallas is working on an advanced identification study of wetlands in the area now. Bill Kirshner, with the Region 6 wetlands division, said the study focuses on disposal sites for dredge spoil--mostly sand -- along the canal. The wetlands map prepared using existing data and added field work is complete, he said, but has not been published. The boundaries of the study area are Louisiana 21 from Bogalusa to Slidell over to the state line along the East Pearl.

Potential openings: The shoals, Farr's Slough, Breakout Bayou.

Potential closures: Wilson Slough, East Bogue Chitto River, Moore's Bayou, Holmes Bayou.

11. JUSTIFICATIONS FOR FUTURE WORK

In his 1979 report on the lower Pearl for the State of Mississippi, Hains wrote that "because the Pearl is a very active river, channel abandonment and new channel creation can be expected to take place. However, man's intervention through construction of artificial levees and excavation have altered the process in ways that adversely affect land ownership in the area." Unfortunately, the evidence to support those contentions is scant.

The Corps cited the lack of lower Pearl environmental data in its decision not to look at the issue further. Although the paucity of data would seem impetus enough to warrant further federal studies, it's likely that the state will have to provide compelling evidence of its own.

That evidence could be used to force the Corps to make reparations in the form of a reallocation of flows, or to encourage an interstate compact with Louisiana for the same purpose. The argument could be made that restoring flows to the eastern swamps would provide for a larger area of fish and wildlife habitat, increasing the overall carrying capacity of the Pearl River delta. Replacing lost resources would improve environmental conditions in the delta area qualitatively, which would result in better conditions quantitatively. Both states would therefore be better able to utilize the expanded resources and market the area as a whole as a destination for a "fish and wildlife" or outdoors experience. Currently, a well developed fish and wildlife economy is limited to the western swamps.

From Mississippi's perspective, the lack of data weakens the legal argument for restoration of flows and increases the risk involved with asking the Corps to begin manipulating a fragile river system. The potential exists for the state to find itself in an anti-environment role in a battle with the Corps.

The U.S. Fish and Wildlife Service previously recommended that studies be done on the impact of the diversions. In May, U.S. Senator Trent Lott requested that the Fish and Wildlife Service initiate the work. Senator Lott also wrote to EPA's Greer Tidwell asking for assistance in convincing the Fish and Wildlife Service to do the studies.

In his May 10, 1990 letter to Tom Olds, assistant regional director of the Fish and Wildlife Service in Atlanta, Senator Lott explained that the Corps lacked the data needed to proceed with feasibility studies, and asked that the Service provide the environmental data. "I would like to request that the Fish and Wildlife Service conduct these studies to determine and obtain information which would better identify the environmental

problems, develop solutions and assess potential impacts," he wrote. "Examples of the types of studies that are needed are habitat mapping, marsh modeling, bottomland hardwood forest succession modeling, water quality modeling, and low flow hydrology."

The Mississippi Wildlife Federation, which can be expected to take an active interest in any proposal for the lower Pearl, is also pushing for congressional funding of studies. On April 10, 1990, federation director Gerald Barber wrote Vicksburg District Engineer Skidmore and noted the scarcity of "baseline environmental information on the lower Pearl."

"It is our intention to contact Congress and request money to fund the gathering of environmental data, as per your recommendation," Barber wrote.

EPA officials have expressed reservations about becoming embroiled in an interstate water rights dispute, but have shown an interest in existing environmental problems and the potential for correcting them through flow alterations. There is some concern that the information might be provided, at great expense, and the Corps would still maintain that the work did not contribute to the national economy and therefore was not within the agency's authority to construct. Should the studies be authorized, there is concern that local cost sharing would be a considerable stumbling block, since Louisiana has no apparent interest in anything other than the status quo.

The Corps maintains that there is no need for further gathering of data because the benefits would go to recreation, which the 1989 report maintains is not a federal responsibility.

"A water resources development plan for flow redistribution in the Lower Basin was found economically feasible," the report found. "However, the overwhelming preponderance of benefits was accrued to recreation." The Corps did not consider potential lost revenues as a result of declining East Pearl development in its economic analysis.

Notably, the Corps in its 1975 final environmental impact statement for "Pearl River, Mississippi and Louisiana (Maintenance)," said that the study area "has abundant wildlife, and many other natural attributes which are not susceptible to quantification... the Louisiana portion of the study area has a higher degree of development of its recreational resources."

The Corps has used the argument that it builds only flood control and navigation projects in rejecting other work--notably, the Kissimmee River restoration project in Florida. Yet the agency often touts the recreational benefits of its projects, using them to tilt dubious benefit-to-cost ratios in their favor,

and has constructed projects unrelated to flood control or navigation.

In its 1985 Mississippi and Louisiana Estuarine Areas report on diverting freshwater from the Mississippi River through the Bonnet Carre spillway upstream from New Orleans, the Corps projected significant benefits to oyster harvests. The $57 million project, which would divert flows from the Mississippi to Lake Ponchartrain and thence the Mississippi Sound, would also benefit commercial fishing, recreation and wildlife and related businesses, the Corps found.

"The economy of the study area is founded on a base of natural resources that include commercially important minerals and a variety of fish and wildlife resources," the report found. It noted that "extremely important commercial activities of the area center around fish and wildlife resources." The annual value of "estuarine-dependent fisheries" -- primarily oysters, shrimp and menhaden -- was $52 million between 1963 and 1978, the report found.

In justifying the proposed diversion at Bonnet Carre, the Corps in its 1985 report noted that, "Methods to distribute fresh water and sediment in a manner that will reduce saltwater intrusion into historically freshwater area are desired."

"Of the structural plans, preliminary studies showed that freshwater diversion on an areawide scale would best alleviate saltwater intrusion problems," the report found. A diversion "would establish favorable salinity conditions, enhance vegetative growth, reduce land loss and increase commercial and sport fish and wildlife productivity."

The Corps estimated the diversion at Bonnet Carre would increase oyster harvests in Louisiana by 5.6 million pounds and in Mississippi by 1.9 million pounds. "The productivity of white shrimp, blue crab, croaker and menhaden should greatly increase," the report found. "Commercial catfishing in Lakes Maurepas and Ponchartrain would be significantly improved. The diversion of fresh water would reduce the saltwater intrusion that kills marsh vegetation and creates open water. Sediments and nutrients in the diverted water would enhance growth of vegetation and revitalize some areas of marsh and reduce land loss. About 10,500 acres of marsh and wooded swamp would be saved over the 50-year project life."

In outlining projections "without conditions," the Corps stated, "If no action is taken to ameliorate the rate of habitat deterioration in the study area, approximately 91,000 acres of marsh and 86,000 acres of wooded swamp would be lost by the year 2040 due to the natural processes of subsidence, compaction and

erosion as well as man's developmental activities including leveeing, channelization and petroleum exploration."

The report went on to say: "Habitat deterioration in the study area would adversely affect productivity of fish and wildlife resources and lead to declines in populations of alligators, furbearers and important shellfish and finfish species. These declines in production would adversely affect employment and earnings in the commercial fish and wildlife industries.

"The decreases in fish and wildlife productivity throughout the study area would cause a reduction of outdoor recreational opportunities," the report found. Based on man-day projections, the Corps concluded that without the project "increasing future demands with a diminishing resource base would result in higher levels of need than currently exist." Similar conclusions could be made about the East Pearl.

The Fish and Wildlife Service, in its July 1977 "Value of Wetlands and Bottomland Hardwoods" report, assigned monetary values to Louisiana fish and wildlife resources that, while larger than one would expect to find in Mississippi, could be used to quantify the wetlands resources of the East Pearl.

The 1977 report assigned the following values to Louisiana marsh and swamp resources: $114.6 million for shrimp, crab, oysters and fish; and $8.2 million for furbearers' pelts and $1 million for furbearers' meat. The report assigned the following values for so-called "man-days" spent in marshes and swamps: $1.50 for general recreation; $1.50 to $2 for wildlife oriented recreation; $1.50 to $2 for fishing; $2 to $3 for small game hunting; and $6 to $9 for large game hunting (including waterfowl and deer).

Notably, the Corps strayed from its usual reliance on quantitative data to support the Bonnet Carre work. Citing freshwater diversions to the Barataria and Breton Sound basins that claimed savings of nearly 100,000 acres of marsh, the Corps noted that fisheries, wildlife and recreational benefits were responsible for only about 7 percent of the monetary benefits, with oysters contributing the rest. "Nevertheless," the report notes, "the wetlands and related productivity which would be saved by the proposed project are important from a qualitative standpoint, probably far more important than the meager monetary benefits which could be attributed to them would indicate." The report adds that "a number of other beneficial impacts would occur to fisheries which cannot be easily quantified in monetary terms, even though they are highly significant from a qualitative standpoint."

The report further justified the work by projecting increases in hunting and water related activities and found that the diversion would, among other things, prevent a lowering of the "quality of the fishing experience by minimizing the reduction in the 'expected catch.'" Enhancing habitat conditions would increase sport hunting opportunities by 10,000 man-days in 2040 valued at $70,000, the report found. Without the project, expected losses in habitat will cause estimated hunting losses of 160,919 man-days valued at $1 million annually.

The Bonnet Carre report concluded: "The plan would create favorable salinity conditions, save 10,541 acres of marsh and wooded swamp, increase oyster production by 7,500,000 pounds, and provide additional access to recreation resources. The plan would increase Louisiana's and Mississippi's average annual oyster harvest by 33 percent and 98 percent, respectively. The national oyster harvest would increase by 13 percent. The plan also provides many intangible benefits. Habitat conditions for noncommercial and nongame species and productivity of wooded swamps and associated fish and wildlife would be improved. Business opportunities in commercial and sport fisheries and wildlife industries and related support industries would increase."

In its 1989 report, the Corps rejected environmental enhancement or recreation as viable reasons for reallocating flows along the lower Pearl. The agency used the same rationale in refusing to build the restoration project along Florida's Kissimmee River, citing the guidelines of the Water Resources Council and Section 122 of the River and Harbor and Flood Control Act of 1970 to conclude that the project was not in the economic interest of the nation.

"Although these plans and measures are expected to provide substantial benefit within the lower Kissimmee River Basin, these alternative plans of action do not qualify for Federal implementation under current guidelines," the Corps concluded in its September 1985 report, Central and Southern Florida Kissimmee River, Florida Final Feasibility Report and Environmental Impact Statement. "These guidelines state that a plan recommending Federal action is to be the plan with the greatest net economic benefit, consistent with protecting the nation's environment. Plans evaluated in this report, while generally beneficial for environmental concerns, do not contribute to the nation's economic development. No net National Economic Development benefits have been identified with implementation of these modifications."

The report went on to state, "Overall criteria was provided by the Water Resources Council's **Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies** published March 10, 1983." While the

guidelines provide for funding only when there is a net economic benefit, "This single Federal objective does not preclude the formulation and evaluation of plans which reduce net NED benefits in order to further address other Federal, State and local concerns not addressed in the NED plan," the report found.

Section 122 of the River and Harbor and Flood Control Act of 1970 -"requires that possible adverse economic, social and environmental affects relating to any proposed project be fully considered in the planning process and that the final decisions be made in the best overall public interest," according to the Kissimmee report.

The Water Resources guidelines are more detailed and include provisions for special situations. According to the guidelines published in the Federal Register on March 22, 1982, during the comment period, "Contributions to national economic development are increases in the net value of the national output of goods and services, expressed in monetary units. Contributions to NED are the direct benefits and costs that accrue in the planning area and the rest of the nation. Contributions to NED include increases in the net value of those goods and services that are marketed, and also of those that may not be marketed."

The guidelines state that a plan recommending federal action "is to be the alternative plan with the greatest economic benefit (the NED plan), unless the Secretary of a department or head of an independent agency grants an exception to this rule. Exceptions may be made when there are overriding reasons for recommending another plan, based on other Federal, State, local or international concerns." Of the four criteria for evaluation of plans -- national economic development, environmental quality, regional economic development and other social effects -- only the NED is required. The environmental quality "account," as it is called in the guidelines, "shows effects on ecological, cultural and aesthetic attributes of significant natural and cultural resources that cannot be measured in monetary terms."

"Beneficial effects in the NED account are increases in economic value of the national output of goods and services from a plan; the value of output resulting from external economies caused by a plan; and the value associated with the use of otherwise unemployed or under-employed labor resources," according to the guidelines published in the Register.

Among the goods and services categories included in the NED account: municipal and industrial water supply; agricultural floodwater, erosion and sedimentation reduction; agricultural drainage; agricultural irrigation; urban flood damage reduction; hydropower; inland navigation; deep draft navigation; recreation; commercial fishing; and "other categories of benefits for which procedures are documented in the planning report and which are in

accordance with the general measurement standards paragraph (b) of this section."

The guidelines provide for projects that enhance recreation, commercial fishing and water supply, and particularly when optional goals such as the environmental quality account are met. The guidelines state that ecological attributes "are components of the environment and the interactions among all its living (including people) and nonliving components that directly or indirectly sustain dynamic, diverse, viable ecosystems."

Despite its findings on the Kissimmee project and lower Pearl feasibility study, the Corps was able to justify the Bonnet Carre project on the basis of environmental enhancement. According to the 1985 report, the Mississippi River Commission found "that the recommended project is primarily for the enhancement of fish and wildlife resources and is therefore subject to the existing policy of cost sharing, 75 percent federal and 25 percent non-federal."

In a June 19, 1990 letter to U.S. Senator Trent Lott, Lee DeHihns, writing on behalf of EPA Region IV Administrator Greer Tidwell, also disagreed with the Corps' rationale in not proceeding further with Pearl River studies.

"On the basis of the information presently available, we believe that there is a real potential for significant long-term wetland, fish/wildlife, and water quality degradation to the lower East Pearl River area (downstream of Picayune, Mississippi) if low flow conditions are worsened by increased hydrological shunting from the East Pearl to the West Pearl River," DeHihns wrote. "Moreover, Region IV disagrees with the COE's interpretation of its water resource principles and guidelines that there is limited federal interest in the distribution issue because the primary benefits would accrue to recreation (environment) rather than to more traditional flood control or navigation aspects. Further degradation of low flow water quality conditions in the subject reach of the East Pearl can be expected to result in additional sewage treatment costs for existing industries and municipalities as well as possible restrictions to future economic development in the adjacent area. Based on experience with previous, similar situations, we believe there is sufficient latitude with the COE's policy for it to continue limited investigations on the Lower Pearl. This would be particularly true if these investigations were limited to just determining the benefits of precluding the west channel from capturing the entire flow of the river."

Mississippi Department of Environmental Quality Director Jimmy Palmer wrote Col. Skidmore in September 1989 that the Corps is continuing to alter the environment of the East Pearl with its West Pearl works. The Corps' lower Pearl reconnaissance report

"inadequately addressed the effect of the continued dredging below the confluence of Holmes Bayou and the Lateral Canal on the increased flows in Wilson Slough," Palmer wrote. "This dredging could contribute to continued and increased degradation of Wilson Slough and thus cause the capture of more and more of the flow that normally goes down Farr Slough and the shoals at higher stages..."

Palmer wrote that the Corps' mandate exceeds its traditional role: "Low flow maintenance, as well as stabilization of flows at higher stages, is as essential to water resources management as navigation, flood control and other conventional issue areas." Palmer also noted that the Pearl is an interstate boundary and, "There is great historic and cultural significance in this fact alone, and the loss of flows in the lower reaches of the Pearl River is already creating profound impacts. Aside from specific sites having unique historic or cultural value, the overall significance of the Pearl River in the lives and lifestyles of Mississippi and Louisiana citizens is inescapable and must be further considered."

Ironically, it was former Corps District Engineer Charlie Blalock who urged Mississippi and Louisiana officials to seek a congressional resolution to study environmental enhancement, water supply and state riparian rights -- the specific issues the Corps ultimately said were irrelevant to their mission. Blalock made the suggestion in a May 22, 1978 letter after it became apparent that an ongoing study would not find enough basis in navigational benefits; he even included a draft of the suggested resolution, which was ultimately adopted.

Mike Davis, executive director of the Pearl River Basin Development District, objected to the 1989 report's findings and asked the Corps how its engineers had chosen 150 cubic feet per second as the amount of water that should flow over a dam considered for Holmes Bayou, and how they had selected a 50-foot bottom width for all channels. The response of the Corps: "The rational for selecting 150 cfs as the flow to be maintained through Holmes Bayou for all alternatives was somewhat arbitrary and could be changed... The rationale for selecting the bottom width of 50 feet for the Shoals channel was based upon the largest channel which could potentially be needed. A small channel would possibly be sufficient."

The Department of Wildlife, Fisheries and Parks also objected to the conclusions of the 1989 report. In his response, Director Vernon Bevill wrote: "Lack of sufficient flow has radically changed the ecology of the Pearl River below Picayune... Resolution of this dilemma and its economic implications is paramount to the health and ecological well being of this vital stream and the region. It is much more than a recreational issue."

Palmer said that if the issue of Mississippi's entitlement to the waters of the Pearl can overshadow arguments in favor of Louisiana's "prior economy," the next hurdle will be how to correct the problem. If the court deems the reallocation justified, it won't matter if there is a positive benefit-to-cost ratio, he said. Once the proper avenue is chosen, the next question will be who will pay for the work.

Palmer also said there may be an environmental parallel to existing economy argument; he said the Attorney General's Office argued in the Yalobusha case that dredging would destroy a man-altered ecosystem that had recovered, and that in re-dredging the river the Corps, though authorized to do the work, would have been removing a natural resource on which the state had come to depend. Palmer contended the state's Yalobusha argument was the opposite of what would be argued in the case of the lower Pearl, since the state would be asking the Corps to resume maintenance of previously built works. But the argument could be made that the man-altered ecosystem of the lower Pearl has never recovered, in fact has become less stable, while the Corps has continued to intervene to the detriment of the environment elsewhere in the basin.

The state, in fact, is dependent on a declining resource.

Assigning responsibility

To force the Corps to pay for the necessary work, there must be proof of adverse impacts, proof of responsibility and proof that the damages require reparation under federal law.

Should the state have to come up with funds, it's possible money earmarked for the Bonnet Carre spillway diversion could be used, said Robert Seyfarth with the state Bureau of Pollution Control. Mississippi has committed approximately $4 million to the project, but Louisiana is waffling on its part. Perhaps, Seyfarth said, the East Pearl work could be justified as a shellfish restoration project.

The Corps has never accepted responsibility for the problems that now exist along the lower Pearl. The Corps attributes initial problems along the lower Pearl to timber operations, although Downes argued that even problems caused by timber operations fall under the Corps' jurisdiction.

"I think the running of saw logs and the mishandling of saw logs that took place on the river is the responsibility of the Corps," Downes said in his deposition. "It seems to me that they had jurisdiction over commerce and that was the beginning of the diversions, evidently, these guys running logs, and this will be borne out in the records of the Corps there that you will read if

they had a deep bend in the river and they wanted to get rid of it, in high water they just started cutting a ditch across the neck of the bend and eliminated it." Shortening the river created rushes of water that eroded the banks and caused further changes of course, log jams and sedimentation, he said.

It's also possible that the Corps could be held responsible for the loss of flow to the East Pearl for having opened the West Pearl, and for exacerbation of environmental damage resulting from the loss of flow for having participated in the construction and maintenance of the deepwater channel to NASA, which contributes to saltwater intrusion there. The Corps could therefore be held responsible for mitigating damage resulting from its lateral canal operations and maintenance dredging on the East Pearl.

Problems with Corps cooperation on the Kissimmee project have not been resolved, said Kent Loftin, project manager for the South Florida Water Management District, during a June 27, 1990 interview. Loftin said the Corps' Jacksonville District refused to spend appropriations on the Kissimmee even though they came from a bill that mentioned the Kissimmee. The state then requested funds directly from Congress to do the work, which Congress granted: $2 million the first year, $300,000 the next and $4 million the next. The Corps still refused to spend the money on the Kissimmee, Loftin said, because the project was not listed as a line item appropriation.

Since then, however, the Office of Management and Budget agreed to commit $6 million to the Kissimmee. The state of Florida, meanwhile, is try to get an amendment to the 1990 Water Resources Act which would authorize the project, which would require the state and the Corps to petition Congress for funds annually.

12. CONCLUSIONS AND RECOMMENDATIONS

The primary objective is to prevent the capture of the Pearl at Wilson Slough, and beyond that, to reestablish the pre-diversion hydrologic character of as much of the delta ecosystem as possible.

After that, the main emphasis should be on seeing that the Corps does not do more damage in the process of correcting past mistakes.

Mississippi can sue to force the Corps to return the flows; present evidence so compelling that Louisiana will agree to an interstate compact; or attempt to do the work at the shoals, Farr's Slough or Wilson Slough itself.

In all likelihood, the only avenue of relief is the U.S. Supreme Court. The state could make the case that it has a right to a share of the lower Pearl water, including potential water-related development and recreation and the ecosystem that water supports.

One potential danger of forcing the Corps to redivert water into the East Pearl River is that the agency could simply continue its historic pattern of dubious achievement, further manipulating the delta ecosystem without satisfactory regard for the environmental consequences. Although the state, if successful, would be able to force a reallocation of flows, the structural engineering used to achieve that reallocation would be the responsibility of the Corps. Once compelled to do the work, it's possible the Corps would overbuild its dams and canals and line fairly pristine banks with riprap. The state of Mississippi conceivably could find itself in the position of having sued the Corps to do the work and then having to sue the Corps to prevent environmental damage. Therefore, the state's legal argument must specify the methods and locations of the work to be done, as well as the manner in which the work will be done.

The primary argument for restoring flows is the state's entitlement to a share of the lower Pearl waters. That entitlement encompasses the ecosystem, recreation and development potential directly dependent upon that water supply. For the purposes of formulating a legal argument, the state necessarily must have a specific project goal.

Many area residents say they will not be satisfied with anything short of a 100 percent diversion back to the East Pearl River, but in all likelihood this is an unrealistic goal. The economics of the West Pearl area and the potential for environmental damage in both the East and the West offer compelling arguments against a 100 percent re-diversion back to the historic channel. The state could seek such a diversion and

then settle for less, but even then it must decide in advance what would be an acceptable settlement.

The recommendation of this report is that the state seek a 70 percent diversion of low flows down the East Pearl at Wilson Slough, with 70 percent of the resulting East Pearl flow diverted through the shoals. The plan would include dams at Moore's Bayou and Icebox Bayou to prevent the cutoff of the Walkiah Bluff bend.

Such a diversion would allow 30 percent of low flows to continue down Wilson Slough, to be rejoined at the mouth of Holmes Bayou by 30 percent of the flow diverted to the Walkiah Bluff bend (approximately 21 percent). The East and West Pearl rivers would therefore carry approximately 50 percent of the overall low flows to their respective mouths. The percentages are for flows of approximately 2,000 cubic feet per second, with the percentages to the West Pearl increasing as flows increase.

The diversions would require sills at Wilson Slough and Holmes Bayou, the aforementioned dam at Moore's Bayou and a 3.2 mile channel which would follow the natural meanders of the original Pearl through the shoals. Although the Corps considered disposing of dredge spoil alongside the channel, which would require the clearing of a small amount of bottomland hardwoods, a more environmentally sound method would be to dispose of the spoil at an appropriate upland site. The state should also require reforestation of work areas with appropriate vegetation and the monitoring of channel flows to gauge fish and wildlife impacts and the potential for breakouts that might require remedial work.

The argument can be made that the sacrifice of a small amount of wetlands to construction would enable the restoration of a much larger area of wetlands that currently suffer from either a lack of water or scouring by floods. It is presumed that the U.S. Environmental Protection Agency, which regulates the alteration of wetlands, would acquiesce to such a holistic approach to wetlands preservation in the lower Pearl River basin.

Because this will set a precedent in environmental restoration, the state should make every effort to ensure that the work is done in the most environmentally sound manner. It's possible some of the traditional components of diversion and/or erosion control projects -- long rock dikes and straight, graded channels -- could be supplanted by more sensible and less damaging components such as artificial log jams and biodegradable bank matting. Because of the dubious attention the project will likely receive, the project should be a showcase of environmental restoration technology, designed to protect one of the nation's most valuable and fragile wetlands ecosystems after more than a century of abuse. Some of the best technical ideas may be found in Florida's Kissimmee River restoration project, since the state

is attempting to completely rebuild a lost river system and the ecology it supported before the Corps entered in.

APPENDIX

Data needs and sources

Coastal land loss acreages can be calculated in the marsh areas using Landsat imagery, said Ren Clark of Delta Data Systems, Inc., in Picayune. Clark has superimposed historic and current maps along with Landsat "thematic mapper imagery" and aerial photography to show surface water and vegetative changes and land disturbance. Landsat imagery is only available for the past five years and extends only as far upstream as Interstate 12, but even within those time and geographic constraints, coastal erosion is evident in the marshes. Clark said Delta Data Systems can utilize high altitude aerial photography to augment Landsat and give a longer time frame, but would require funding for an indepth study or could provide specific data on a fee basis.

The Mississippi Automated Resource Information system, or MARIS, also has Landsat capability. Director Paul Davis said the department, which works on a fee basis, has done lower Pearl basin work using 1987 Landsat imagery for Louisiana State University and could make the information available to us free of charge. The information, he said, is "digitized on backup tapes." LSU was primarily interested in land use, vegetative cover and wetlands soils as a measure of bottomland hardwood losses. MARIS also has 9" x 9" color prints of 1972 and 1973, and 1973 land use maps which were "hand interpreted" from high altitude aerial photographs. The department has the capability to overlay various photographs dating as far back as 1940 to uncover and illustrate trends. MARIS has copies of the original public lands surveys, and can digitize old maps and superimpose them on new ones. MARIS can take the oldest Landsat imagery possible and classify acres from 1973 to 1989. The classification can include plant communities but not species, Davis said. The information can be viewed on computer screens, maps and in printouts. MARIS can make "temporal comparisons" of Landsat in the study area between 1973 and 1987. The 1989 imagery would have to be bought, with the cost anywhere between $1,600 to $5,000 depending on what type was ordered. Davis said the EPA is using high altitude aerial photography in its assessment of wetlands in the Jackson-area Pearl River floodplain because the resolution is better than Landsat.

In addition, the Mississippi Highway Department buys Landsat imagery every five or 10 years, Davis said. The department keeps the negatives on file and can produce black and white photos, he said.

Davis said NASA flew photo missions over the Gulf Coast in November 1988. The photos are available through the Earth Science Information Center at the Stennis Space Center; talk to Hank Svalack, 688-3541. Aerial photography is also available through the U.S. Geological Survey's EROS Data Center in Sioux

Falls, S.D., beginning in 1942. In addition, the Corps' Vicksburg District has flown photography missions over the basin for many years, and at 10,000 to 20,000 foot elevations rather than 60,000 feet as with NASA; the contact is Ronnie Ford, 634-5707. Tobin Research is another source: telephone 512-223-6203.

County-level statistics on forest changes can be gotten from the Mississippi Forestry Commission, which annually breaks down forest types by acre, Davis said. Large timber companies could break the acreages down further, Davis said. Unfortunately, the Forestry Commission data are tabular and do not reveal trends on specific sites.

We have a significant archive of maps and photographs of our own, including the most recent infrared aerial photography, aerial views dating to 1940 and maps dating to the French period.

Significant actions and dates and responsible parties

The main vehicle for manmade change along the lower Pearl has been the U.S. Army Corps of Engineers. But there have been other interventions. The following is a brief history of the most significant actions and inactions by the Corps and others along the lower river.

The Corps:

- Failed to remove the circa 1850 logjam at the shoals.

- Desnagged the river from the mouth of the West Pearl to Jackson and dredged the mouth of the East Pearl.

- Filled the bend of the river at Lesley's Ditch, later dammed Wilson's Slough and did not repair the dam when it failed.

- Dammed Farr's Slough, the shoals, Twin Bayous and several other "runout" bayous and repaired the dams at Farr's Slough and the Shoals.

- Desnagged and opened the Bogue Chitto River to navigation. Dammed the West Bogue Chitto.

- Built the Lateral Canal, bisecting the Bogue Chitto, and built sills at Pool's Bluff and on the Bogue Chitto.

- Dredged the West Pearl River below the Lateral Canal and the Main Pearl above Pool's Bluff Sill.

- Concluded that navigation along the East Pearl was not feasible and that diverting water into the East Pearl for other purposes was not feasible.

- Failed to correct the growing diversion at Wilson's Slough.

- Recommended levees to protect Slidell from flooding.

- Dredged the lower East Pearl for NASA navigation.

There are other responsible parties as well.

The State of Mississippi:

- Attempted to improve the Pearl River for navigation during territorial and early statehood days.

- Jointly appropriated funds with Louisiana to clear Holmes Bayou for navigation.

- Attempted to dam Farr's Slough.

- Asked the Corps in 1957 to study diverting water back into the East Pearl.

- Began a recreational boatway and park system from Jackson to the river's mouth.

- Asked the Corps, jointly with Louisiana, to look into flow problems along the lower Pearl.

The State of Louisiana:

- Jointly appropriated funds with Mississippi to clear Holmes Bayou for navigation.

- Attempted to open a channel through the West Pearl swamps.

- Asked the Corps, jointly with Mississippi, to look into flow problems along the lower Pearl.

- Included most rivers and large bayous in the lower Delta in its wild and scenic rivers program.

Others, including local residents, steamboat operators and loggers:

- Intentionally or inadvertently closed the shoals with log jams.

- Temporarily blocked the head of West Pearl, the mouth of the Bogue Chitto and numerous bayous with log booms.

- Dug ditches to cut off bends of the river to improve navigation.

- Cleared Breakover Bayou at Farr's Slough to allow water to flow into the East Pearl.

- Dammed Icebox Bayou to increase flows past Walkiah Bluff.

The Confederate Army:

- Felled trees into Holmes Bayou to prevent Union gunboats from traversing the river to Jackson.

Based on historic accounts and depositions, the clearing of south and central Mississippi's virgin forests and the cutoffs of bends led to erosion and increased currents in the Pearl. Beyond that, relationships of various diversions is conjectural.

The following is an outline of probable causes and effects gleaned from residents and officials who believe the Corps is primarily at fault.

The 1850 log jam at the shoals caused breakouts at Wilson Slough and Holmes Bayou and reversed the flow of the Bogue Chitto River. The breakout at Wilson Slough caused siltation in the Walkiah Bluff bend of the river, which prompted breakouts at Moore's Bayou and Icebox Bayou. Siltation at Walkiah Bluff led to siltation in Holmes Bayou, which caused further scouring of Wilson Slough. Cutoffs along the West Pearl increased the flow through the Wilson Slough.

The reversal of the Bogue Chitto's flow led to further enlargement of Wilson Slough and further reduction of flows down the Walkiah Bluff reach. Desnagging the Bogue Chitto for navigation increased its velocity, which contributed to the scouring of the West Pearl.

Opening Holmes Bayou increased siltation at the shoals. Damming Farr's Slough and the shoals reduced the flow into the East Pearl River and Hobolochitto Creek. Dredging the mouth of the East Pearl while thus reducing the freshwater flow led to saltwater intrusion.

Chronology of events along the lower Pearl

1824. Corps given authority by Congress to maintain navigable watercourses of the nation.

1850. Closure of the shoals by logs.

Just prior to the Civil War. Mississippi and Louisiana jointly appropriated $10,000 for clearing Holmes Bayou. Downes noted that this must have been private subscription because there is no Mississippi legislative record of an appropriation or any such action. In 1859, Mississippi attempted to dam Farr's Slough but the dam failed.

During the Civil War. Confederate military felled trees into Holmes Bayou to block Union gunboats.

1879. Collins survey found Bogue Chitto reversed and Wilson Slough capturing flow. Attempts still being made to navigate the shoals at high water.

1880. Holmes Bayou route for navigation began.

1883. Head of West Pearl, or lower end of bend that is now Wilson Slough, dammed.

1884. Congress appropriated funds to dredge bar at mouth of East Pearl.

1885. Lesley's Ditch improved. Hancock County Board of Supervisors declared Farr's Slough navigable.

1887. Lesley's Ditch made navigable; dam across Wilson Slough or head of West Pearl has washed out.

1888. Lower end of bend at Wilson Slough filled.

1889. Head of West Bogue Chitto dammed; navigation established on East Bogue Chitto.

1900. Fixed bridge built at Rockport.

1904-1905. Head of Moore's Bayou dammed.

1906. Rockport bridge washed out.

1910. Breakout at the Shoals, or head of East Pearl, dammed; Farr's Slough dammed.

1910-1911. Dam across the Shoals repaired.

1911-1912. Breakout at Wilson Slough dammed.

1916. Corps considered abandoning navigation improvement below Rockport. Local interests in Mississippi and Louisiana protested.

1922. Congress deauthorized project to improve river from the mouth of the river to Jackson.

1937. Corps recommended construction of lateral barge canal.

1953. Canal completed.

1957. Mississippi officials asked the Corps to study low flow problems along the East Pearl.

1960. The Corps decided to cut off several bends along the West Pearl.

1963-64. NASA dredged a channel on the lower East Pearl.

1972-73. Breakover Bayou ceased to flow. Maintenance of canal ceases.

1980. Mississippi Attorney General A.F. Summer filed suit against the Corps in U.S. District Court to force a re-diversion of the lower Pearl.

1981. Corps began to study flooding in Slidell area. Proposes doing no further studies of low flows in East Pearl.

1983. Corps authorized breaching canal levee above lock 2 which leads to rechanneling of Bogue Chitto.

1984. Louisiana allowed to intervene in Mississippi lawsuit, which automatically shifted the jurisdiction to the U.S. Supreme Court. Although the brief was prepared, a Supreme Court suit was never filed.

1986. Mississippi and Louisiana agreed to cooperate on a Corps low flow allocation study along the lower Pearl. The Department of Natural Resources granted the Corps a water quality permit to renew dredging on the river to Bogalusa.

1988. Corps announced it would resume dredging on the lateral canal.

1990. Corps study concluded that while blocking the breakout at Moore's Bayou would be cost effective, recreation was not an agency mandate and other diversions were not economically feasible. Vicksburg District Engineer Col. Frank Skidmore announced that diversions will no longer be considered. A fish

kill at Walkiah Bluff caused by low water prompted locals to build an illegal dam across Louisiana's Icebox Bayou.

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