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REPORT TO THE CONGRESS

BY THE COMPTROLLER GENERAL OF THE UNITED STATES

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Cost, Schedule, And Performance Problems Of The Lake Pontchartrain And Vicinity, Louisiana, Hurricane Protection Project

Corps of Engineers (Civil Functions)

Department of the Army

The cost of the Lake Pontchartrain and Vicinity, Louisiana, Hurricane project has quadrupled since 1965 primarily because of inflation. Scheduled completion has been delayed 13 years. In addition, project objectives may not be attained if key elements are not completed as planned.

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COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

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To the President of the Senate and the
Speaker of the House of Representatives

This report describes the status of the Lake Pontchartrain and Vicinity, Louisiana, Hurricane Protection project and suggests ways to improve the construction of this project. It is part of our continuing effort to provide the Congress with information concerning major civil acquisition projects.

Our review was made pursuant to the Budget and Accounting Act, 1921 (31 U.S.C. 53), and the Accounting and Auditing Act of 1950 (31 U.S.C. 67).

We are sending copies of this report to the Secretary of Defense and the Secretary of the Army.

ACTING Comptroller General
of the United States

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COMPTROLLER GENERAL'S
REPORT TO THE CONGRESS

COST, SCHEDULE, AND PERFORMANCE PROBLEMS OF THE LAKE PONTCHARTRAIN AND VICINITY, LOUISIANA, HURRICANE PROTECTION PROJECT

Corps of Engineers (Civil Functions)
Department of the Army

D I G E S T

The Lake Pontchartrain and Vicinity, Louisiana, Hurricane Protection plan--a series of control structures, concrete floodwalls, and levees--is intended to protect the lowlands in the Lake Pontchartrain tidal basin, lying within the greater New Orleans metropolitan area, from flooding by hurricane-induced sea surges and rainfall. Its estimated cost has risen from $85 million in 1965 to $352 million and its completion has been delayed 13 years.

Almost two-thirds of this increase is due to inflation. In spite of this, the project retains a benefit-to-cost ratio of about 13 to 1.

The Federal share of the project cost (70 percent) has increased from $66 million to $242 million. There is a possibility that the Federal share could increase by $85 million more should local jurisdictions be unable to pay their portions. (See p. 14.)

The Corps of Engineers' scheduled completion date has been delayed from 1978 to 1991. While many of the factors are outside the control of the Corps of Engineers, its own belated completion of design, plans, and specifications, has contributed to the delays. (See p. 16.)

GAO evaluated the Corps' estimate of project completion and found that:

--As early as March 1966, the March 1978 completion date was no longer valid; however, the Corps did not revise its completion date officially until January 1971.

--1993 was the most likely completion date. (See p. 18.)

The Corps' scheduling system was not designed to evaluate how individual construction delays affected the overall schedule. While the Corps believes that its present method of scheduling work has not been the cause of extensions in project completion dates, it plans to review this aspect for possible improvement.

The Secretary of the Army should instruct the Corps of Engineers to develop and use a system that will schedule critical construction features to facilitate timely completion of the project.

If the project can be completed as planned, the quality of protection afforded will be essentially unchanged from that originally authorized, although the area protected has been enlarged in response to local interest groups.

However, some local groups oppose construction of the key elements of the project, such as the barrier complexes at the Rigolets and Chef Menteur. If local support is not obtained, construction of key project elements may not be completed and hurricane-induced surges and waves may not be prevented from entering Lake Pontchartrain. (See p. 20.)

CHAPTER 1

INTRODUCTION

This review of the Corps of Engineers' Lake Pontchartrain and Vicinity, Louisiana, Hurricane Protection project is part of the General Accounting Office's continuing effort to provide the Congress with information about major acquisition programs of civil agencies. The main objective was to examine the status and selected management procedures affecting the project.

THREAT TO NEW ORLEANS

New Orleans, located in southeastern Louisiana, is a major metropolitan area with a population in excess of one million. It is also a major national and international commerce center primarily because of the port which, in terms of value of cargo tons, is the second largest in the nation and third largest in the world. The greater New Orleans metropolitan area, composed of Orleans, Jefferson, St. Charles, St. Bernard, and St. Tammany parishes, lies in the lowlands of the Lake Pontchartrain tidal basin. (See map on p. 5.) The dominant topographic feature in the area, Lake Pontchartrain--a shallow landlocked tidal basin approximately 640 square miles in area and averaging 12 feet in depth--connects with the Gulf of Mexico through Lake Borgne and the Mississippi Sound.

The greatest natural threat to the New Orleans area is posed by flooding from hurricane-induced sea surges, waves, and rainfall.

The hurricane surge that inundates coastal lowlands is the most destructive of the hurricane characteristics, accounting for three-fourths of the lives lost from hurricanes. Maximum surge heights experienced along the Gulf and Atlantic coasts range between 10 and 24 feet.

The waves generated by hurricane winds cause a great deal of damage to ships and shore structures. Breaking waves can run up and over shore structures whose crowns are higher than the wave heights. However, the force expended when waves break against structures is the most damaging effect. The rainfall accompanying a hurricane is generally quite heavy and sometimes torrential.

Recent hurricanes in the project area

The Louisiana coastline has been plagued by hurricanes at the rate of about two every 3 years. The Lake Pontchartrain area has been affected by many of these. Two prominent hurricanes were:

--Betsy (September 1965)--This hurricane passed west of New Orleans and caused damage estimated at about $90 million. Most of the damage was related to flooding in the eastern New Orleans area.

--Camille (August 1969)--This hurricane is described as "the most intense storm" ever to hit the United States. Although the storm did not hit New Orleans directly, the flooding conditions were almost the same as those resulting from Betsy. However, because the hurricane did not hit directly and a portion of the Lake Pontchartrain project had been constructed, damage was slight within the project area. (See p. 20.)

Project purpose and description

The Corps designed a model, referred to as the standard project hurricane, that was based on the most severe combination of meteorological conditions considered reasonably characteristic of the coastal region of Louisiana. This model was developed in a study by the Corps with the assistance of the United States Weather Bureau. The frequency of the standard project hurricane is once every 200 to 300 years.

The key project elements intended to prevent hurricane surges and waves from entering Lake Pontchartrain and inundating adjacent areas are the Rigolets, Chef Menteur Pass, and Seabrook complexes along with the levees along the eastern edge of the area.

The Rigolets complex includes a gated control structure, a closure dam, a navigation lock, and a connecting barrier levee which will run north through the complex to Apple Pie Ridge in St. Tammany Parish. The Chef Menteur Pass complex includes a gated control structure, a closure dam, a navigation floodgate, and a barrier levee. A short reach of the Gulf Intracostal Waterway has been rerouted south of the complex. At Seabrook, a navigation lock and a control structure will be constructed with stone dike connections to the shoreline.

Other project features include concrete floodwalls along the banks of the Inner Harbor Navigation Canal, navigation floodgates in two bayous, and protective levees. These new or raised levees are planned for the entire southern shore of the lake from the Bonnet Carre floodway in St. Charles Parish to South Point; New Orleans East, Citrus Back and Chalmette portions of the project. (See following map.)

This project plan was selected from the alternatives considered. The major alternative was a so-called high-level plan which comprised a levee and floodwall system corresponding generally to the levee and floodwall pattern of the selected plan but elevated to a significantly higher level and excluded the complexes at Rigolets and Chef Menteur Pass. The levee heights along Lake Pontchartrain for the high-level plan ranged between 16 and 18.5 feet as opposed to heights of 9.3 to 13.5 feet for the current plan.

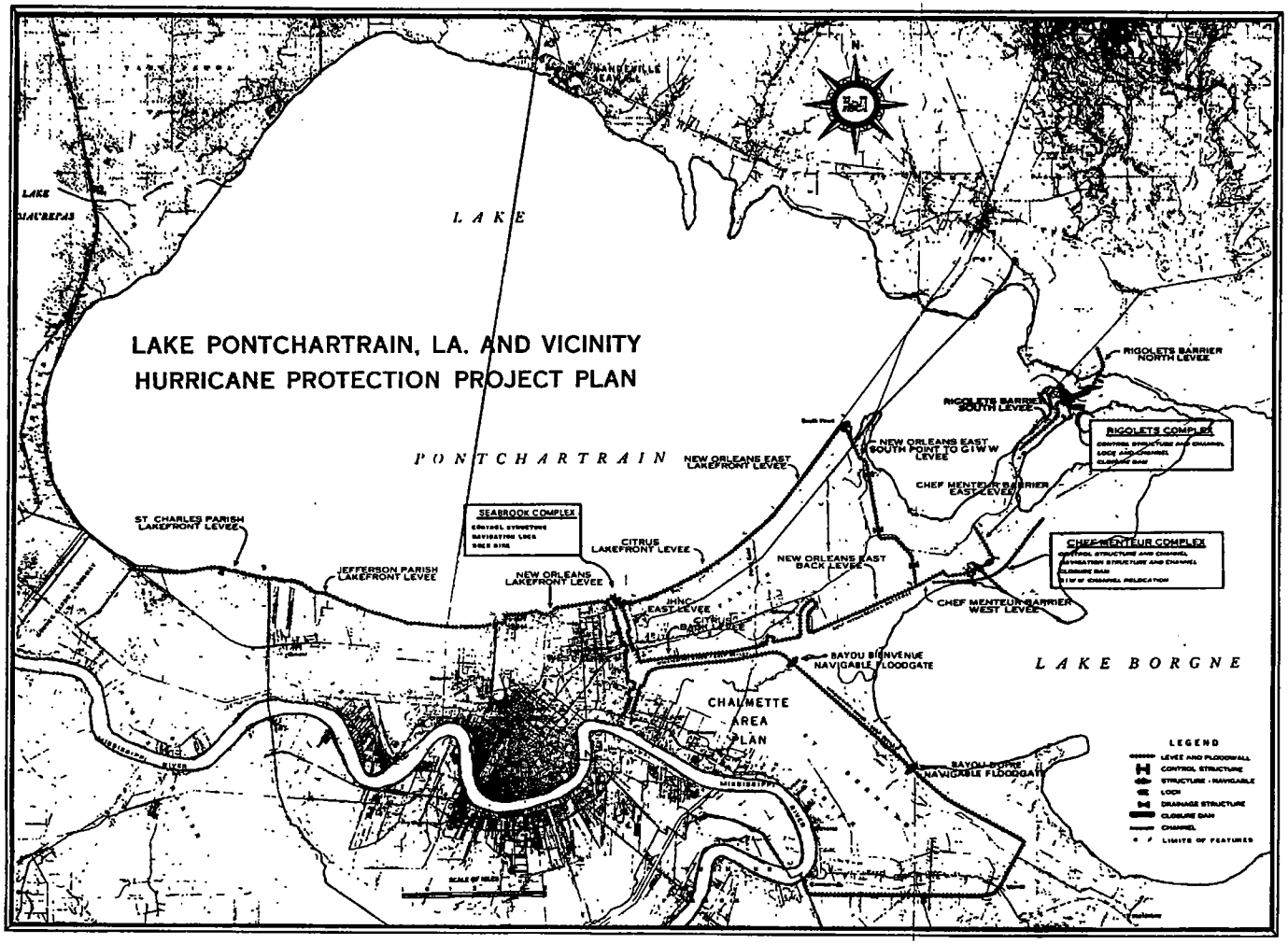
The cost for this high-level plan was estimated at 1-1/2 times that of the selected plan, and construction time was estimated to be longer due to the required levee heights. Considering these two conditions (higher cost and longer construction time), the Corps did not compute a benefit-to-cost ratio for the high-level plan. The high-level plan had other drawbacks including critical foundation problems for the levees which would require a high level of maintenance and rights-of-way that would be more expensive because of the broader levee base required.

While the project is federally authorized (Flood Control Act of 1965--79 Stat. 1073), it is truly a Federal, State, and local effort. The cost will be divided between the U.S. Government, which will provide 70 percent of the total cost, and State and local interests, which will provide the remaining 30 percent. Progress on the project depends on both congressional appropriations and the ability of the designated local assuring agencies to meet the required right-of-way and financial commitments.

In May 1967 the first congressional construction appropriation for the Lake Pontchartrain project enabled the Corps to award its first contract.

SCOPE OF STUDY

The data presented in this report is based on interviews with Corps officials at Corps headquarters and the New Orleans


LAKE PONTCHARTRAIN, LA. AND VICINITY
HURRICANE PROTECTION PROJECT PLAN
LAKE
PONTCHARTRAIN
LAKE BORGNE
RIGOLETS BARRIER NORTH LEVEE
RIGOLETS BARRIER SOUTH LEVEE
RIGOLETS COMPLEX
NEW ORLEANS EAST SOUTH POINT TO GIWW LEVEE
CHEF MENTEUR BARRIER EAST LEVEE
NEW ORLEANS EAST LAKEFRONT LEVEE
SEABROOK COMPLEX
ST. CHARLES PARISH LAKEFRONT LEVEE
CITRUS LAKEFRONT LEVEE
JEFFERSON PARISH LAKEFRONT LEVEE
NEW ORLEANS LAKEFRONT LEVEE
NEW ORLEANS EAST BACK LEVEE
CHEF MENTEUR COMPLEX
CHEF MENTEUR BARRIER WEST LEVEE
BAYOU BIENVENUE NAVIGABLE FLOODGATE
CHALMETTE AREA PLAN
BAYOU DUPRE NAVIGABLE FLOODGATE
LEGEND

district office and review of records and documents these officials made available. Officials of each of the above organizational elements have reviewed this study, and their comments were considered in preparing this report.

CHAPTER 2

PROJECT COST EXPERIENCE

The Congress authorized the Lake Pontchartrain project in 1965. Since then, the estimated cost has more than quadrupled and additional cost growth is anticipated. Despite this cost growth, the project retains a favorable benefit-to-cost ratio because about two-thirds of the cost growth results from inflation that also increased the value of the benefits to be realized.

PROJECT BENEFITS

In the Corps of Engineers' initial studies, the benefits of protecting about 502,000 acres of developed and developable land including the New Orleans metropolitan area, from hurricane-induced flooding were valued at about $53.2 million a year. At the time of the estimates, 21 percent of the property to be protected was existing developments and 79 precent was for future developments. Except for the St. Charles Parish area, future developments were considered inevitable regardless of whether the projected was constructed or not.

In more recent studies the Corps has valued the annual benefit from the project at $189.2 million. However, in these more recent estimates two-thirds of the property to be protected is existing developments and one-third is for future developments.

As a result of the growth in the value of benefits, the project retains a highly favorable--about 13:1--benefit-to-cost ratio despite substantial cost growth. We did not, however, review the reasonableness of the ratio.

COST GROWTH

The estimated cost of the project at the time it was authorized by the Congress in 1965 was about $85 million at December 1961 price levels. The Corps' initial detailed construction cost estimate, prepared shortly after project authorization, increased the total estimated cost to $98 million ($66 million Federal share) and was based on October 1, 1965, price levels. The Corps' estimate to support its fiscal year 1976 budget request is $352 million (Federal share $242 million). The following table relates these three estimates.

Table 2-1
Lake Pontchartrain Project Cost Growth by Project Feature

Cost categories	Cost estimates: Pre-authorization FY 1965 (December 1961 price level)	Cost estimates: Initial construction post-authorization (FY 1966 price level)	Cost estimates: Current (FY 1976)	Cost growth: FY 1962 to FY 1976	Cost growth: FY 1966 to FY 1976	Expenditures through FY 1975: Federal	Expenditures through FY 1975: Local	Expenditures through FY 1975: Total
	(millions)							
Lands and damages	$ 4.9	$ 6.2	$ 17.5	$ 12.6	$ 11.3	$ -	$ 12.6	$12.6
Relocations	1.0	1.1	10.7	9.7	9.6	-	4.0	4.0
Locks	8.6	9.9	36.0	27.4	26.1	-	-	-
Roads	.3	.3	.1	(.2)	(.2)	-	-	-
Channels and canals	(a)	-	3.7	3.7	3.7	.8	-	.8
Breakwaters and seawalls	-	-	2.6	2.6	2.6	-	-	-
Levees and and floodwalls	48.8	56.2	186.3	137.5	130.1	41.0	b/7.9	48.9
Flood control and diversion structures	13.3	15.4	42.8	29.5	27.4	-	-	-
Pumping plant (added in 1975)	-	-	8.5	8.5	8.5	-	-	-
Engineering and design	3.2	3.7	26.8	23.6	23.1	12.2	-	12.2
Supervision and administration	4.7	5.2	17.0	12.3	11.8	3.7	-	3.7
Total	$84.8	c/$98.1	$352.0	$267.2	c/$253.9			c/$82.7
Federal share	$56.2	$65.8	$242.0	$185.8	$176.2	d/$57.7		
Local share	$28.6	$32.3	$110.0	$ 81.4	$ 77.7		$ 24.5	

a/Originals combined with locks and flood control and diversion structures.

b/Consists of $1.6 million in cash contributions from St. Bernard Parish and $6.3 million in "in kind" work from Orleans Parish.

c/Some mathematical computations differ slightly from the totals because of rounding.

d/Excludes $0.5 million in undelivered orders.

REASONS FOR COST GROWTH

Data supporting the Corps' estimates and the reasons for cost growth are shown in the following table.

Table 2-2

Lake Pontchartrain Project Cost Growth
Fiscal Years 1962-76

Reason for growth	Amount	Percent of total growth
	(millions)	
Economic growth	$183.6	68.7
Engineering changes	54.5	20.4
Quantity changes	18.5	6.9
Contingency increases	5.5	2.1
Other (support, estimating, etc.)	5.1	1.9
Total	$267.2	100.0

Economic growth (inflation)

The Corps updates the cost estimate annually to reflect price increases, design changes or additions, and receipt or development of better estimating data; however, future price increase projections and estimates of other cost growth factors are not included. For example, the cost estimate presented for fiscal year 1976 appropriation hearings does not include cost growth beyond July 1, 1974. This complies with the established policy of the Office of Management and Budget that generally prevents allowances for future price increases in budget estimates presented to the Congress. The Corps estimated the amount of cost growth attributable to price increase primarily by applying historical indexes to the uncommitted portions of the project cost estimate. The Corps generally used a 12-percent price increase factor in preparing the preliminary cost estimate for fiscal year 1976 hearings. The 12-percent factor was based on the Engineering News Record construction cost index for 20 major cities. This category also includes increased salaries of Government employees.

Engineering cnanges

Engineering changes, such as changes in dimensions or location of some feature, increased the cost by about $54 million. Examples of such increases include:

--$22 million for increasing the size of the levees based on better definition of the standard project hurricane as furnished by the United States Weather Bureau.

--$6 million for adding the Florida Avenue pumping plant.

--$3 million for the redesigned Seabrook complex.

--$12 million in the Corps' engineering design supervision and administration costs associated with all changes plus some salary increases.

Quantity changes

Examples of quantity changes that expanded the scope of the project include:

--$13 million increase for extending the Chalmette area of the project. This change, requested by local groups, extended the levees in the Chalmette area from Bayou Dupre southward along the Mississippi River-Gulf Outlet to Verret, Louisiana, then westward to Caernarvon, Louisiana, on the Mississippi River. The original levee section westward along Bayou Dupre from the Mississippi River-Gulf Outlet to the Mississippi River and a levee included in another Corps project were deleted. This change added about 18,800 acres to the area protected.

--$5 million increase to relocate the Chef Menteur Pass complex. This relocation, from the north side of Highway 90 to the south side, required revising the levees and relocating the Gulf Intracoastal Waterway channel. As a result, the project will now provide protection to an additional 1,533 acres of newly developed residential property.

Contingency increases

The contingency allowance for the project was increased from 15 percent to 20 percent.

PERCENTAGE OF PROJECT COMPLETION

Project completion status is measured by comparing costs incurred to total estimated project costs. (See table 2-3.) It does not necessarily represent the amount of work completed.

Table 2-3

Percent of Project Completion
Based On the Cost Incurred and Estimated Total Project Cost

End of fiscal year	Cummulative cost incurred (note a)	Estimated total project cost	Percent of completion
	——(millions)——		
1966	$ 1.2	$ 99.1	1.2
1967	2.4	136.2	1.7
1968	9.8	166.0	5.9
1969	14.3	182.0	7.9
1970	26.9	216.0	12.4
1971	42.3	255.0	16.6
1972	54.4	282.0	19.3
1973	64.3	296.0	21.7
1974	72.7	327.0	22.2
1975	82.2	352.0	23.4

a/Excludes undelivered orders.

POTENTIAL AND PROBABLE ADDITIONAL COST GROWTH

The following two circumstances will probably cause additional cost growth.

Additional protection needed in the Orleans Parish Outfall Canals

The Corps told us that an additional major feature, which could cost as much as $60 million, will be necessary and will have to be authorized by the Congress if the project is to be completely effective against a project hurricane.

This feature, which includes the Orleans Parish Outfall Canal, became a recognized necessity when the levee heights had to be revised following Hurricane Betsy. As a result, the pumps that now pump water from the basin area over the levees would not be able to handle the hurricane-induced floodwaters over these elevated levees with 100 percent effectiveness. Options being considered include (1) installing new pumping stations near the lakefront levee and (2) continuing with the present pumping stations which are remote from the levees and raise the outfall canal's embankments from each pumping station to the lakefront levee. A decision has not been made as to which of the alternatives will be selected but preliminary estimates reveal the cost will be from $17 to $60 million.

Local cost share

The act authorizing the project did not specify a cost sharing ratio between Federal and local jurisdictions. However, House document 231 which preceded passage of the act specified that the local share would be 30 percent of the cost including value of land, relocations, easements, and rights-of-way. This 30 percent is exclusive of one-half the cost of the Seabrook Lock which was allocated to a navigation project with all cost to be borne by the Federal Government.

The 30-percent cost sharing plan required local jurisdictions to pay their share either in one lump sum before construction begins or, at a minimum, submit annual payments equal to their share of the cost of work performed each year. In-kind work may be substituted for cash if the work is accomplished in accordance with approved construction schedules. Local groups in the Lake Pontchartrain project area believed that meeting this payment plan would cause extreme hardships. As a result, legislation applying only to this project was enacted permitting deferral of additional local payments until fiscal year 1977. From fiscal years 1977 to 1990, local jurisdictions will be required to pay annually a minimum of one twenty-fifth of their unpaid share plus interest and in 1991 make the necessary payment to complete their 30-percent share of the project cost.

The Corps, in September 1975, prepared a schedule showing the estimated minimum payments required under this legislation. Minimum local payments required during 1977 through 1990 total $.5 to $3 million per year including interest. However, the 1991 "balloon payment" will amount to about $41 million.

CONCLUSION

It is questionable whether local jurisdictions will ever pay their 30-percent share. This conclusion is based on:

--The author of the legislation permitting the deferred payment plan has pledged to seek legislation to completely eliminate local responsibility for any share of the project costs.

--The 1991 balloon payment may strain the financial ability of local jurisdictions. For example, the estimated 1991 payment of $41 million will be at least four times greater than the largest contribution required to date of $10,199,400 1/ in fiscal year 1970. This analysis assumes no additional cost growth or inflation.

If the 30-percent payment by local groups is eliminated or if the local jurisdictions are unable to make their 1991 payment, it could increase the Federal contribution by $85 and $41 million, respectively, based on the current $352 million estimate.

1/Non-Federal expenditures are subject to change until approved by the Corps.

CHAPTER 3

PROJECT SCHEDULE EXPERIENCE

The scheduled completion date for the Lake Pontchartrain project has been delayed from 1978 to 1991 or almost 13 years. The major causes for the delay appear to be outside the Corps of Engineers' control. However, some of the delay has resulted from Corps actions. We believe that the schedule for project completion is optimistic and a completion date after 1993 is more probable.

COMPLETION SCHEDULES

Neither the authorizing legislation in October 1965 nor House document 231 preceding the legislation contained completion estimates for the project. The Corps, in late 1965, prepared completion schedules that showed a project completion date of 1978. This date was maintained and reported to the Congress until 1971, when it was changed to December 1981. The Corps' estimates now show a completion date of 1991.

Table 3-1 shows the Corps' completion estimates at various points in time. The 13-year delay (1978 to 1991) to complete the entire project does not include the St. Charles Parish Lakefront levee nor the Mandeville unit. Both of these units have been deferred indefinitely.

REASONS FOR SCHEDULE CHANGES

According to the Corps, major reasons for delays are:

--Increased construction time for floodwalls, levees, and roads as a result of foundation problems discovered after project initiation. Levees, for example, are constructed in several phases or lifts. During each phase, levee material is embanked and then allowed to settle and consolidate before the next lift is added. The Corps had initially planned to allow an average of about 1 year between lifts for settling and consolidation. However, experience has since shown that an average of about 3-1/3 years between lifts is desirable. A portion of this delay is attributable to revisions in standard project hurricane data which resulted in higher levees. This change caused foundation problems.

--Delays in obtaining rights-of-way for construction of project features as scheduled by the Corps. Rights-of-way are to be provided by local interest. However, these groups have not always agreed with the Corps' construction priorities and plans and have refused to provide the specific rights-of-way requested by the Corps. For example, the Corps requested rights-of-way for the Chef Mentuer complex from Orleans Levee District in April 1971. Levee District officials expressed belief that other portions of the project should have higher priority and offered rights-of-way other than that requested by the Corps. As of November 30, 1975, the requested rights-of-way had not been received.

The Corps has little control over these delays. However, other delays have been under the Corps' control. Among these are delays associated with completion of designs, plans, and specifications.

For example, the plans and specifications for 73 separate project components had 235 schedule changes as of July 1975. At that time, only 27 of the 73 sets of plans and specifications had been completed, indicating that further schedule delays are possible.

Funding not a factor in delays

This project has consistently ranked as first priority within the New Orleans District. Corps officials have informed us that funding has not been a problem. To the contrary, the Corps has not been able to use all moneys allocated. The Corps has been unable to obligate all funds allocated; for example, in several years, 1969, 1970, and 1973, the Corps had unobligated carryovers. The largest was the fiscal year 1973 unobligated carryover of $8.7 million. This large carryover resulted in only $6.4 million being allocated to the project in 1974. (See app. I.)

These examples indicate that funding constraints have not been the major factor in restricting project completion. The major reason for delays appears to be schedule changes.

Table 3-1

Estimated Completion Dates
at Various Points in Time for
the Lake Pontchartrain Project

Project segment	Period covered by estimate							
	1965	FY 1968	FY 1971	FY 1972	FY 1973	FY 1974	FY 1975	FY 1976
Entire project	3/78	6/78	12/78	12/81	12/81	9/82	12/90	3/91
Locks	12/72	(a)	6/75	6/75	9/76	3/78	6/78	9/80
Roads	6/74	(a)	6/74	6/74	6/77	12/81	12/90	3/91
Channels and canals	10/74	(a)	6/77	6/77	6/77	6/78	12/78	6/80
Breakwaters and seawalls	(b)	(b)	(b)	(b)	(b)	3/78	6/78	9/80
Levees and floodwalls:								
Barrier unit	3/78	(a)	(c)	(c)	12/81	12/81	12/90	3/91
New Orleans East unit	11/77	(a)	6/78	12/81	12/81	6/82	3/83	3/83
New Orleans West unit	9/76	(a)	6/78	6/78	12/81	3/82	(d)	(d)
Mandeville unit	(c)	(a)	6/78	6/78	6/75	6/76	6/76	(e)
Chalmette unit	12/77	(a)	6/78	6/78	6/78	9/82	12/85	6/86
Flood control and diversion structures	6/74	(a)	6/76	6/76	6/76	6/78	12/79	6/80
Pumping plant	(f)	(f)	(f)	(f)	(f)	(f)	(f)	6/81
Permanent operating equipment	(b)	(b)	(b)	(b)	(b)	3/78	6/78	9/80

a/According to the FY 1968 estimate, these segments were to be completed after 1971.

b/Not estimated until FY 1974.

c/Not shown.

d/The St. Charles Parish levee portion of this unit has been deferred. However, the foreshore protection for the Jefferson Parish portion will be completed.

e/Deferred indefinitely.

f/Not included until FY 1976.

ANALYSIS OF CHANGES AND ESTIMATE OF COMPLETION

For scheduling project work the Corps uses a Gantt Chart which is essentially a bar chart indicating progress of the work by task, expressed in units of time. It is a generally accepted means of planning and controlling a project; however, it does not determine the critical path nor does it clearly define relationships among the planned activities.

We used the critical path method in evaluating the Corps' completion schedules. This method describes a project in terms of the estimated time to complete each required activity and the relationships between activities. For any given activity, the method identifies the estimated time to perform the activity, what activity must immediately precede the given activity, which operations can be performed simultaneously with the given activity, and which operations cannot be started until the given activity is completed. From these estimates and relationships, it is possible to determine the critical path--that series of activities where any delay will jeopardize attaining the projected completion date.

Our analysis showed that to meet the March 1978 completion date the general design memo for the Barrier Unit (Rigolets and Chef Menteur complexes) had to be started by March 1966, or within 5 months after project authorization. This work was not started on time. Because the general design memo for the Barrier Unit was on the critical path as early as March 1966, the March 1978 completion date was no longer valid. However, the Corps did not officially revise this completion date until January 1, 1971.

We also made an analysis using the critical path method which combined actual completions through October 1975 and the Corps' best estimates of the time to complete the unperformed portions of the project (excluding the elements of the project that are indefinitely deferred). Our analysis showed that a completion date of April 1992, rather than the Corps estimate of March 1991, was possible provided no further delays were encountered. The critical factor in meeting the April 1992 completion date is the completion of the levees for the Chef Menteur complex. This completion date assumed that the right-of-way would be obtained in November 1975 and construction would begin in January 1976. Since the Chef Menteur levees are on the critical path, each delay in obtaining the right-of-way will delay project completion by the same amount.

The Corps is anticipating that local interest will provide the right-of-way for the Chef Menteur levee in the latter part of fiscal year 1976. Assuming this right-of-way is granted as planned, the project's completion date will be delayed 6 months to at least November 1992, with a completion date of 1993 much more likely.

CONCLUSION AND AGENCY COMMENTS

Statistics for this project--first in priority in the New Orleans District--showing unobligated yearend funds indicate that schedule delay, and not funding constraint has been the major factor in restricting project completion. Many delays, such as obtaining rights-of-way, are beyond the control of the Corps. However, our critical path method analysis showed that the Corps' scheduling system was not designed to evaluate the implications on the overall construction schedule of individual construction delays. We believe that such a scheduling system would be advantageous particularly for such a large and highly beneficial project.

In a letter dated May 14, 1976, the Assistant Secretary of the Army for Civil Works stated that while the Corps believes that its present method of scheduling work has not been the cause of extensions in project completion dates, the Corps plans to review this aspect for possible improvement.

RECOMMENDATION TO THE SECRETARY OF THE ARMY

We recommend that the Secretary have the Corps develop a scheduling system that will identify the critical construction features. Its use would aid in completing the project in a timely manner and thereby minimize costs associated with schedule delays.

CHAPTER 4

PROJECT CHANGES INCLUDING BENEFITS

The project as authorized by Congress in 1965 has had changes in scope. The original configuration (structural dimensions, size of levees, and areas protected) has been changed by expansions and engineering revisions. Even so, the purpose of the project has not changed and the degree of protection afforded, if completed as originally planned, will be essentially unchanged.

Several of the project's key features are being seriously challenged by environmentalists and local groups. If these features are eliminated, a reduction in the degree of protection provided under the present plan will result.

BENEFITS REALIZED TO DATE

Though the project is far from completion, the Corps of Engineers estimates that significant benefits have already been realized. For example, an estimated $91 million in damages were prevented during Hurricane Camille in 1969. The levee and floodwall work along the Inner Harbor Navigation Canal prevented damages similar to those caused in 1965 by Hurricane Betsy which pushed waters over the canal banks and flooded the surrounding community.

In addition to preventing damages, Corps officials stated other benefits have been realized in the prevention of loss of life during Camille, reduced cost of flood insurance, and additional employment opportunities associated with project construction.

CHANGES AFFECTING THE DEGREE OF PROTECTION

There are several changes which could reduce the degree of protection afforded. The deferral of the Mandeville Seawall and the St. Charles Parish levees and the possible elimination of the Rigolets and Chef Menteur control structures are a result of serious opposition from environmentalists and local interests. A discussion of each of these subjects follows.

Mandeville Seawall and St. Charles Parish levees

Both the Mandeville Seawall and the St. Charles Parish levees have been indefinitely deferred because of citizen actions. The proposal for repairing the Mandeville Seawall, about 1 mile in length, was not suitable to the local residents. The local residents want the entire seawall replaced, but the Corps says complete replacement cannot be justified.

The St. Charles Parish levees are also opposed by environmentalists. The construction of the levees would result in the loss of wildlife habitat and recreational hunting and implies a large and permanent loss in natural productivity of the estuarine complex associated with Lake Pontchartrain.

Another obstacle was created by the State of Louisiana. The State has included two St. Charles Parish bayous in the Natural and Scenic Rivers System of Louisiana. Any alteration of these bayous which are in the project area would contravene State law.

The justification (benefit) for this feature was almost exclusively land enhancement, which would convert about 25,000 acres of open aquatic marsh to urbanization for long-term human occupation. The Corps is considering an alternative levee alinement for the St. Charles area.

Elimination of Rigolets and Chef Menteur control systems

Over the past several years there has been serious concern in the Corps that the control complexes of Rigolets and Chef Menteur would not be built. Certain local factions have adamantly opposed these structures by refusing rights-of-way for the Rigolets embankments. The elimination of these structures would cause a serious reduction in the protection afforded by the project as currently designed. Should construction of these complexes be stopped, the primary purposes of the project could not be accomplished without redesigning the levees. That is, without the barriers, hurricane-induced surges and waves would enter Lake Pontchartrain unimpeded and threaten inhabitated areas around Lake Pontchartrain. General support of all local groups has not been obtained.

The only alternative to providing the same protection without completing these complexes is the so-called high-level plan. The Corps reevaluated this plan in 1973 when

strong opposition arose against the Rigolets and Chef Menteur complexes. They found that the high-level plan would cost about $100 million more than the total first cost estimate for the accepted plan.

OBSERVATION

Generally, while the avoidance or mitigation of potential adverse environmental effects can result in greater benefits than those lost by project changes, the threat of litigation by environmental groups affect the Lake Pontchartrain project in two ways. First, the litigation has delayed the timely completion of the project. Second, there is the possibility that the control structures of Rigolets and Chef Menteur will not be built which will allow hurricane-induced surges to enter Lake Ponchartrain and spill over the levees as currently designed.

APPENDIX I

10-YEAR BUDGET HISTORY

THE LAKE PONTCHARTRAIN PROJECT

Fiscal year	Estimated capacity to spend	Office Chief Engineer recommendation	Office Management and Budget request	House/Senate conference authorized	Allocated	Unobligated at yearend
	(million)					
1966	$ 0.450	$ -	$ -	$ 0.450	a/$ 0.538	$0.010
1967	1.600	0.450	0.450	1.600	b/ 1.600	-
1968	4.500	4.450	3.260	4.500	c/ 4.086	-
1969	10.800	10.600	7.800	7.566	d/ 6.269	2.583
1970	8.500	9.500	6.000	8.500	e/ 5.260	4.581
1971	12.000	10.750	8.250	14.500	f/ 11.040	-
1972	11.000	15.000	5.555	7.755	g/ 13.946	-
1973	20.000	17.700	20.000	20.000	h/ 14.840	8.739
1974	8.650	6.400	6.400	6.400	i/ 2.660	-
1975	6.500	4.000	3.300	3.300	j/ (2.080)	-
Total funds thru FY 1975					$58.159	

a/Original allocation of $450,000 for preconstruction planning; Office of Chief Engineer provided an additional allotment of $88,000 to the project. The Corps did not request any funds in FY 1966 as their budget was prepared prior to project authorization. Subsequent to authorization, Congress provided funds equal to the Corps' estimated capacity to spend.

b/Includes initial construction funds in the allocation.

c/$500,000 deferred to FY 1969; an additional $86,000 was provided by a transfer from another project.

d/Reduction of $1,297,000 consisting of $1,206,000 applied to savings and slippages; $86,000 allocated to another project; and $5,000 transferred to the Mississippi River Gulf Outlet as of June 30, 1969.

e/Reduction of $3,240,000 consisting of $2,790,000 placed in budgetary reserve to be allocated in FY 1971 and $450,000 applied to savings and slippages.

f/Reduction of $3,460,000 consisting of $460,000 applied to savings and slippages and $3,000,000 placed in budgetary reserve to be allocated in FY 1972.

g/Increase of $6,191,000 composed of a supplemental allocation of $3,245,000; $3,000,000 budgetary reserve from FY 1971 funds, and a reduction of $54,000 for personnel saving based on the President's Economic Program.

h/Reduction of $2,660,000 placed in budgetary reserve to be allocated in FY 1974 and reduction of $2.5 million for savings and slippages.

i/Increase of $2,660,000 from budgetary reserve established in FY 1973 and a reduction of $6,400,000 applied to savings and slippages.

j/Decrease of $5,380,000 consisting of $3,200,000 revoked by Office of Chief Engineer; $1,180,000 transferred to other projects and $1,000,000 applied to savings and slippages.

APPENDIX II

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
WASHINGTON, D.C. 20310

14 MAY 1976

Mr. Henry Eschwege
Director, Resources and Economic
Development Division
General Accounting Office
Washington, D. C. 20548

Dear Mr. Eschwege:

The Secretary of Defense has asked us to respond to your draft report of March 1976 on the Lake Pontchartrain, Louisiana Hurricane Protection Project (OSD Case 4318).

The issues you have considered are both substantial and significant. The report is essentially accurate and clearly reflects the managerial complexity involved in a project of this magnitude. Resolution of issues you have raised about the project are contingent upon future actions by a number of public, private, and governmental groups, with the possible exception of the Orleans Parish Outfall Canal. The Corps of Engineers is reexamining the Outfall Canal in terms of the existing authority that the Corps may have and, also, the best means of providing needed interior drainage.

With regard to the suggestion to develop a CPM type of scheduling system, the Corps does not believe that its present method of scheduling work has been the cause of extensions in project completion dates. However, this aspect will be reviewed for possible improvement.

Thank you for the opportunity to review the draft.

Sincerely,

Victor V. Veysey
Assistant Secretary of the Army
(Civil Works)

PRINCIPAL MANAGEMENT OFFICIALS RESPONSIBLE FOR THE ACTIVITIES DISCUSSED IN THIS REPORT

	Tenure of office	
	From	To
DEPARTMENT OF DEFENSE		
SECRETARY OF DEFENSE:		
Donald H. Rumsfeld	Nov. 1975	Present
James Schlesinger	June 1973	Nov. 1975
William P. Clements, Jr. (acting)	May 1973	June 1973
Elliot L. Richardson	Jan. 1973	April 1973
Melvin Laird	Jan. 1969	Jan. 1973
Clark M. Clifford	March 1968	Jan. 1969
Robert S. McNamara	Jan. 1961	Feb. 1968
DEPARTMENT OF THE ARMY		
SECRETARY OF THE ARMY:		
Martin R. Hoffmann	Aug. 1975	Present
Howard H. Calloway	May 1973	July 1975
Robert F. Froehlke	July 1971	May 1973
Stanley R. Resor	July 1965	June 1971
CHIEF OF ENGINEERS:		
Lt. Gen. J. W. Morris	July 1976	Present
Lt. Gen. William C. Gribble, Jr.	Aug. 1973	June 1976
Lt. Gen. Frederick J. Clarke	Aug. 1969	July 1973
Lt. Gen. William F. Cassidy	July 1965	Aug. 1969

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