DEPARTMENT OF THE ARMY

LAKE PONTCHARTRAIN, LOUISIANA AND VICINITY
AND
MISSISSIPPI RIVER - GULF OUTLET, LOUISIANA

SEABROOK LOCK

DESIGN MEMORANDUM NO. 1, GENERAL

New Orleans District, Corps of Engineers
New Orleans, Louisiana

Prepared by
Buffalo District, Corps of Engineers

FEB.
JANUARY 1969

LMNED-PP

Lake Pontchartrain, La. & Vic and Miss. River-Gulf Outlet, La. Seabrook Lock Design Memorandum No.1 General

Ch, Operations Div
Ch, Construction Div
Area Engineer N.O. A/O

Ch, Engr Div

11 Feb 69
Mr.Galloway/jb/430

1. A copy of Design Memorandum No. 1 General Seabrook Lock, as submitted 6 Feb 69, is inclosed for your information.

2. Comments of higher authority on the subject GDM will be furnished when they are made available.

JEROME C. BAEHR
Chief, Engineering Division

Incl
as

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P. O. BOX 60267
NEW ORLEANS, LOUISIANA 70160

LMNED-PP

6 February 1969

SUBJECT: Lake Pontchartrain, Louisiana and Vicinity, and Mississippi River-Gulf Outlet, Louisiana, General Design Memorandum No. 1, Seabrook Lock

Division Engineer, Lower Mississippi Valley
ATTN: LMVED-TD

1. The subject general design memorandum, prepared by the Buffalo District, is submitted herewith for review in accordance with the provisions of ER 1110-2-1150 dated 1 July 1966.

2. Approval of the memorandum is recommended.

1 Incl (16 cys)
Subject DM

/s/ Herbert R. Haar, Jr.
HERBERT R. HAAR, JR
Colonel, CE
District Engineer

LAKE PONTCHARTRAIN, LOUISIANA AND VICINITY
AND
MISSISSIPPI RIVER-GULF OUTLET, LOUISIANA
DESIGN MEMORANDUM NO. 1 - GENERAL
SEABROOK LOCK

STATUS OF DESIGN MEMORANDA

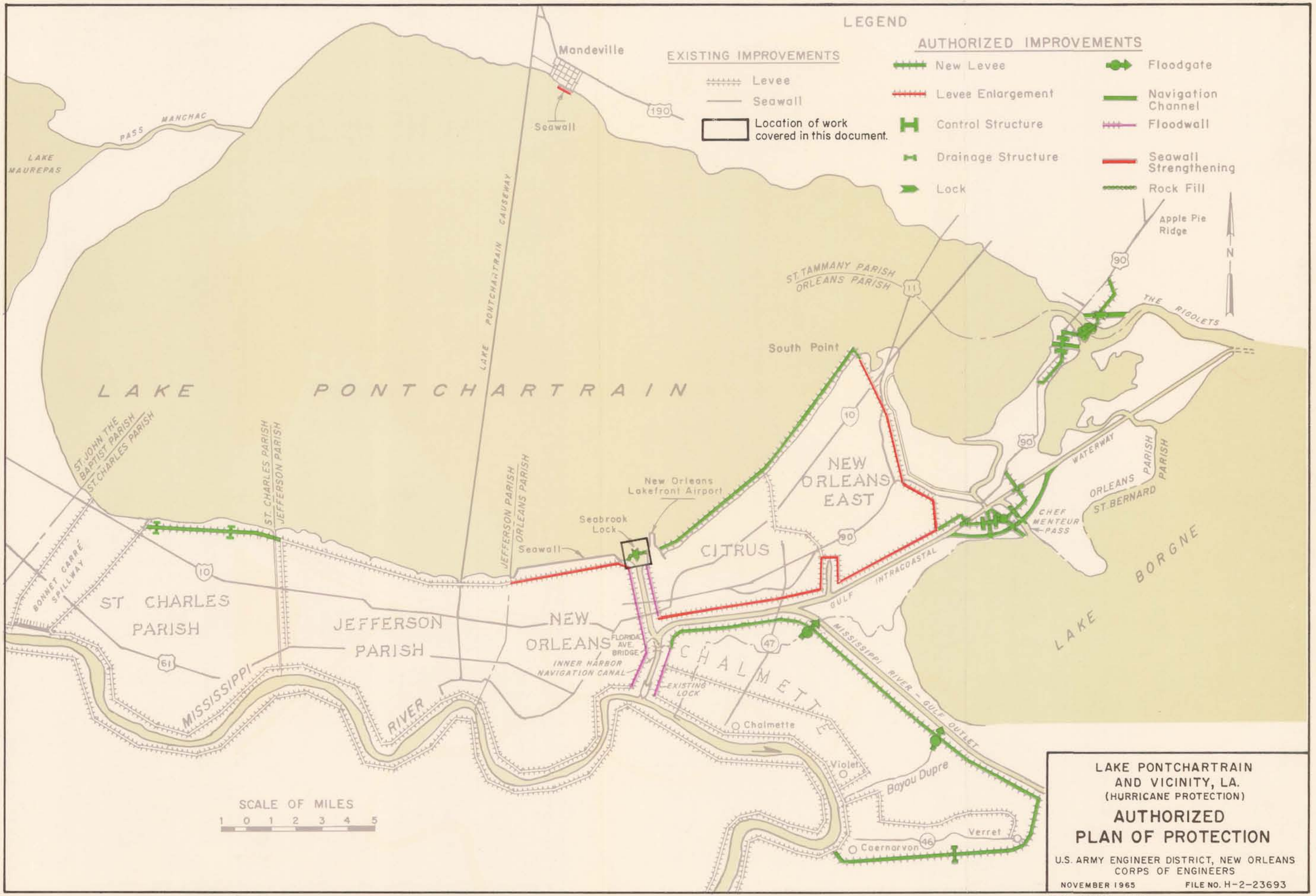
Design Memo No.	Title	Status
1	Hydrology and Hydraulic Analysis	
	Part I - Chalmette	Approved 27 Oct 66
	Part II - Barrier	Approved 18 Oct 67
	Part III - Lakeshore	Submitted 30 Sep 68
	Part IV - Chalmette Extension	Approved 1 Dec 67
2	Lake Pontchartrain Barrier Plan, GDM, Advance Supplement, Inner Harbor Navigation Canal Levees	Approved 31 May 67
2	Lake Pontchartrain Barrier Plan, GDM, Citrus Back Levee	Approved 29 Dec 67
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 1, Lake Pontchartrain Barrier, Rigolets Control Structure, Closure Dam, and Adjoining Levees	To be rescheduled subsequent to contract modification
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 2, Lake Pontchartrain Barrier, Rigolets Lock and Adjoining Levees	Scheduled 28 Feb 69
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 3, Lake Pontchartrain Barrier, Chef Menteur Complex	Scheduled 28 Feb 69
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 4, New Orleans East Back Levees	Scheduled Aug 69

STATUS OF DESIGN MEMORANDA (cont'd)

Design Memo No.	Title	Status
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 5, Orleans Parish Lakefront Levees	Scheduled Apr 70
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 6, St. Charles Parish Lakefront Levees	Scheduled Aug 69
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 7, St. Tammany Parish, Mandeville Seawall	Scheduled Feb 71
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 8, IHNC Remaining Levees	Approved 6 Jun 68
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 9, New Orleans East Levee from South Point to GIW	Scheduled Mar 69
3	Chalmette Area Plan, GDM	Approved 31 Jan 67
3	Chalmette Area Plan, GDM, Supplement No. 1, Chalmette Extension	Submitted 21 Oct 68
4	Lake Pontchartrain Barrier Plan and Chalmette Area Plan, GDM, Florida Avenue Complex, IHNC	Not scheduled
5	Chalmette Area Plan, DDM, Bayous Bienvenue and Dupre	Approved 10 Oct 68
6	Lake Pontchartrain Barrier Plan, DDM, Rigolets Control Structure and Closure	To be rescheduled subsequent to contract modification
7	Lake Pontchartrain Barrier Plan, DDM, Chef Menteur Control Structure and Closure	Scheduled 30 Jan 70

STATUS OF DESIGN MEMORANDA (cont'd)

Design Memo No.	Title	Status
8	Lake Pontchartrain Barrier Plan, DDM, Rigolets Lock	Scheduled 31 Mar 70
9	Lake Pontchartrain Barrier Plan, DDM, Chef Menteur Navigation Structure	Scheduled 30 Jan 70
10	Lake Pontchartrain Barrier Plan, DDM, St. Charles Parish Drainage Structure	Scheduled Jan 70
11	Beautification	Not scheduled
12	Source of Construction Materials	Approved 30 Aug 66
1	Lake Pontchartrain, La., and Vicinity, and Mississippi River-Gulf Outlet, La., GDM, Seabrook Lock	Submitted 6 Feb 69
2	Lake Pontchartrain, La. and Vicinity, and Mississippi River-Gulf Outlet, La., DDM, Seabrook Lock	Scheduled Apr 69



LAKE PONTCHARTRAIN
AND VICINITY, LA.
(HURRICANE PROTECTION)

AUTHORIZED PLAN OF PROTECTION

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

NOVEMBER 1965 FILE NO. H-2-23693

REV. APRIL 1968

LAKE PONTCHARTRAIN, LOUISIANA AND VICINITY
AND
MISSISSIPPI RIVER - GULF OUTLET, LOUISIANA
DESIGN MEMORANDUM NO. 1 - GENERAL
SEABROOK LOCK

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AND
MISSISSIPPI RIVER - GULF OUTLET, LOUISIANA

SEABROOK LOCK
DESIGN MEMORANDUM NO. 1, GENERAL

PERTINENT DATA

Components of Seabrook Lock unit of the Lake Pontchartrain Barrier Plan	
Navigation Lock	
Rock and shell dam (between lock and barrier)	
Supplemental flow structure (thru dam)	
Lock dimensions	**Feet**
Width	84
Length, usable	800
Length, between pintles	860
Length, guide wall	860
Lock elevations	**Feet, m.s.l.**
Top of lock walls and gates	13.5
Gate sills	-15.8 (-15.0 m.l.g.)
Lock floor	-16.8 (-16.0 m.l.g.)
Type of gates	Sector
Rock and shell dam	**Feet, m.s.l.**
Controlling elevation (crest)	7.2
Supplemental flow structure	
Number of openings	2
Width of each opening, feet	15.5
Elevations, feet, m.s.l.	
Top of bulkheads	7.2
Bulkhead sills	-15.8 (-15.0 m.l.g.)
Hydraulic design criteria	**Feet**
Max. differential head, IHNC to lake	16.0
Max. reverse head, lake to IHNC	4.0
Estimate of cost	
Federal	$10,222,000
Non-Federal	2,078,000
	$12,300,000

LAKE PONTCHARTRAIN, LOUISIANA AND VICINITY
AND
MISSISSIPPI RIVER - GULF OUTLET, LOUISIANA
DESIGN MEMORANDUM NO. 1 - GENERAL
SEABROOK LOCK

PROJECT AUTHORIZATION

1. Authority. The Flood Control Act approved 27 October 1965 (Public Law 89-298) authorized a project for hurricane-flood protection on Lake Pontchartrain, Louisiana, substantially in accordance with the recommendations of the Chief of Engineers in House Document No. 231, 89th Congress, 1st session, except that the recommendations of the Secretary of the Army in that document shall apply with respect to the Seabrook Lock feature of the project.

2. The total project as so authorized comprises two individual plans of improvement:

a. The Lake Pontchartrain Barrier Plan, of which the Seabrook Lock unit is a part; and

b. The Chalmette plan.

3. With specific respect to Seabrook Lock, the authorization provides for construction, operation and maintenance of a dual-purpose (navigation and hurricane protection) structure at the lakeward terminus of the IHNC (Inner Harbor Navigation Canal) in the vicinity of Seabrook Bridge in New Orleans, Louisiana. It contemplates that first costs for the lock be apportioned equally to the two purposes, and shared accordingly between the United States and non-Federal interests. It contemplates that annual costs for operation and maintenance of the lock be borne entirely by the United States.

4. The Secretary of the Army, in his letter dated 28 June 1965, noted that the "...Bureau (of the Budget) also discusses cost sharing for the Seabrook facility, and expresses the opinion that under existing circumstances standard methods of cost sharing are inapplicable; consequently, the viewpoint of the Bureau of the Budget is to allocate the cost of the Seabrook feature equally between navigation and hurricane protection. This allocation of costs would result in the additional cost of $687,000 to the local interests and a corresponding reduction in the cost to the United States for the Seabrook Lock. With the understanding that this apportionment of costs would not unduly delay construction, I concur in the views of the Bureau of the Budget...." As previously pointed out, the project was authorized with the proviso that

"...the recommendation of the Secretary of the Army in (House Document Numbered 231, Eighty-ninth Congress) shall apply with respect to the Seabrook Lock of the project...."

5. Local cooperation. The conditions of local cooperation pertinent to the Lake Pontchartrain Barrier Plan (of which the Seabrook Lock is a feature), as specified in the report of the Board of Engineers for Rivers and Harbors and concurred in by the Chief of Engineers, are as follows:

"...That the barrier plan for protection from hurricane floods of the shores of Lake Pontchartrain...be authorized for construction,... Provided that prior to construction of each separable independent feature local interests furnish assurances satisfactory to the Secretary of the Army that they will, without cost to the United States:

" (1) Provide all lands, easements, and rights-of-way, including borrow and spoil-disposal areas, necessary for construction of the project;

" (2) Accomplish all necessary alterations and relocations to roads, railroads, pipelines, cables, wharves, drainage structures, and other facilities made necessary by the construction work;

" (3) Hold and save the United States free from damages to the construction works;

" (4) Bear 30 percent of the first cost, to consist of the fair market value of the items listed in subparagraphs (1) and (2) above and a cash contribution presently estimated at $14,384,000 for the barrier plan and $3,644,000 for the Chalmette plan, to be paid either in a lump sum prior to initiation of construction or in installments at least annually in proportion to the Federal appropriation prior to start of pertinent work items, in accordance with construction schedules as required by the Chief of Engineers, or, as a substitute for any part of the cash contribution, accomplish in accordance with approved construction schedules items of work of equivalent value as determined by the Chief of Engineers, the final apportionment of costs to be made after actual costs and values have been determined;

" (5) For the barrier plan, provide an additional cash contribution equivalent to the estimated capitalized value of operation and maintenance of the Rigolets navigation lock and channel to be undertaken by the United States, presently estimated at $4,092,000, said amount to be paid either in a lump sum prior to initiation of construction of the barrier or in installments at least annually in proportion to the Federal appropriation for construction of the barrier;

" (6) Provide all interior drainage and pumping plants required for reclamation and development of the protected areas;

" (7) Maintain and operate all features of the works in accordance with regulations prescribed by the Secretary of the Army, including levees, floodgates and approach channels, drainage structures, drainage ditches or canals, floodwalls, seawalls, and stoplog structures, but excluding the Rigolets navigation lock and channel and the modified dual-purpose Seabrook Lock; and

" (8) Acquire adequate easements or other interest in land to prevent encroachment on existing ponding areas unless substitute storage capacity or equivalent pumping capacity is provided promptly;

"Provided that construction of any of the separable independent features of the plan may be undertaken independently of the others, whenever funds for that purpose are available and the prescribed local cooperation has been provided...."

6. The conditions of local cooperation pertinent to the navigation project (of which Seabrook Lock is a feature as explained in paragraph 4, above), as specified in the report of the Board of Engineers for Rivers and Harbors and concurred in by the Chief of Engineers, are as follows:

" (1) Provide without cost to the United States and upon request of the Chief of Engineers, all lands, easements, and rights-of-way, including borrow and spoil-disposal areas, required for construction, operation, and maintenance of the project; and

" (2) Hold and save the United States free from damages due to the construction works."

INVESTIGATIONS

7. The interim survey report of the District Engineer, New Orleans District, titled "Hurricane Study of Lake Pontchartrain, Louisiana and Vicinity," dated 21 November 1962, and contained in the project document, outlined the basic protection plan recommended for Lake Pontchartrain basin, discussed the relationship between that plan and the need for a navigation lock at Seabrook, and outlined the dual function of the lock. It contemplated a lock of the same size and in the same location as described herein.

8. Subsequent to completion of the project document studies, a special study was authorized to determine the optimum controlling elevation of the rock and shell dike at Seabrook Lock. The special study recognized the beneficial effects, as demonstrated by Hurricane Betsy

in 1965, of allowing waters from the MR-GO (Mississippi River - Gulf Outlet) to flow into Lake Pontchartrain under certain storm conditions. The New Orleans District Report on Controlling Elevation of Seabrook Lock, presented in Appendix A, was approved by the Chief of Engineers on 12 January 1967, subject to consideration of such modifications as may be indicated by results of studies on the effects of the MR-GO on hurricane surges and the elevation of wind tides along the south shore of Lake Pontchartrain. Results of these studies revealed that no modifications to the approved report were necessary.

9. Since initiation of preconstruction planning for the project, the New Orleans District has completed an investigation of the need for a supplemental flow structure through the barrier at Seabrook Lock and an investigation of tidal hydraulics pertinent to design of the Seabrook Lock unit of the project. Results of these studies are presented in Appendices B and D, respectively of this design memorandum. The Buffalo District has completed preliminary design studies directed toward determination of the types of construction to be used and selection of the arrangement and configuration of components of the Seabrook Lock unit. The Mobile District has completed preliminary design studies of cathodic protection. Results of these studies are also presented in this design memorandum.

10. A program of site investigations, including topographic surveys of the area and a series of 20 foundation borings at the lock location and along the alinement of the dam, has been completed. Laboratory analysis of samples obtained from the borings have been made to determine strength, weight, consolidation and permeability characteristics of the foundation materials. Results of these investigations have been assembled and will be presented in Seabrook Lock Design Memorandum No. 2, Detailed Design.

LOCAL COOPERATION

11. Requirements. The pertinent conditions of local cooperation as specified by the authorizing law are cited in paragraphs 5 and 6.

12. Status. On 2 November 1965, the Governor of the State of Louisiana designated the State of Louisiana, Department of Public Works, as "...the agency to coordinate the efforts of local interests and to see that the local commitments are carried out promptly...." By State of Louisiana Executive Order dated 17 January 1966, the Board of Levee Commissioners of the Orleans Levee District was designated as the local agency to provide the required local cooperation for all portions of the "Lake Pontchartrain, La. and Vicinity," project in Orleans, Jefferson, St. Charles, and St. Tammany Parishes. Assurances covering all of the local cooperation required for the Lake Pontchartrain Barrier Plan were requested through the Department of Public Works from the Board of Levee Commissioners of

the Orleans Levee District on 21 January 1966, and a satisfactory act of assurances, supported by a resolution of the Board of Levee Commissioners of the Orleans Levee District dated 28 July 1966, was approved and accepted on behalf of the United States on 10 October 1966. The principal officers currently responsible for the fulfillment of the conditions of local cooperation are as follows:

Mr. Leon Gary, Director
State of Louisiana
Department of Public Works
Baton Rouge, Louisiana 70804

Mr. Milton E. Dupuy, President
Board of Levee Commissioners
Orleans Levee District
Room 200, Wild Life and Fisheries Building
418 Royal Street
New Orleans, Louisiana 70130

13. Views of local interests. The Board of Levee Commissioners of the Orleans Levee District represents local interests and is in agreement with the general plan. The estimated non-Federal contribution applicable to the work presented herein is $2,078,000. The intention and capability of the local sponsor to provide the required non-Federal contribution has been amply demonstrated.

LOCATION OF PROJECT AND TRIBUTARY AREA

14. The MR-GO provides a deep draft navigation route from the Gulf of Mexico to New Orleans. It connects, via the GIWW (Gulf Intercoastal Waterway), with the IHNC. The latter terminates at the Mississippi River to the south and at Lake Pontchartrain to the north. Thus, direct access from the Gulf to the Lake exists, for navigation and tidal effects. The several channels, and their relationship to the Seabrook Lock site at the northerly terminus of the IHNC, are shown on accompanying plate 1.

15. The Seabrook Lock unit of the project will contribute the desired lake salinity control and hurricane barrier capability, consistent with related riparian concerns, and will provide the aid and control needed by navigation for safe passage between Lake Pontchartrain and the IHNC.

DATUM PLANES

16. All elevations used in this memorandum are in feet and refer to m.s.l. (mean sea level), except those noted as referring to m.l.g. (mean low gulf). Zero datum plane for m.l.g. is 0.78 feet below zero datum plane for m.s.l.

PROJECT PLAN

17. The general plan for the Seabrook Lock unit of the project is shown on accompanying plate 2. There are three basic components: the navigation lock; the rock and shell dam between lock walls and adjacent sections of the Lake Pontchartrain barrier; and the supplemental flow structure through the dam.

18. The lock chamber will be 84 feet wide by 860 feet long between gate pintles. Usuable length of the chamber will be about 800 feet. Gates will be of the sector type. Top of lock walls and gates will be at elevation 13.5; gate sills at elevation -16.3; and lock floor at elevation -16.8. The lock will be located far enough out into Lake Pontchartrain to permit navigation to bypass the site during construction. This will be accomplished by maintaining a temporary navigation channel between the landward gate bay cofferdam and the existing dolphin and curved guard wall at the northwest approach to Seabrook Bridge. After construction this channel will be closed by a guide wall connecting the lock wall to the existing guard wall.

19. In addition to the three functions originally contemplated - service as a unit of closure in the Lake Pontchartrain hurricane-protection barrier; control of salinity introduced to the lake during high tides; and passage of navigation during high and low tides - the lock will be capable of a fourth function. It will be designed so that, during hurricane-generated high stages in the MR-GO and the IHNC, the lock gates may be opened and the structure used as an outlet facility to afford stage-damage relief for some of the industries along the IHNC.

20. The rock and shell dam, which will connect the lock with shore, will have a controlling (crest) elevation of 7.2.

21. The supplemental flow structure through the dam, east of the lock, will have twin openings, each 15.5 feet wide. Closure will be effected with steel bulkheads. The bulkhead sills will be at elevation -15.8. Top of the bulkheads, when fully installed, will be at elevation 4.2. (See Appendix B for determination of required supplemental flow area).

DEPARTURES FROM PROJECT DOCUMENT PLAN

22. The project plan departs from the project document plan in the following principal respects:

a. Lowering of the control elevation. Top elevation of the dam has been reduced from elevation 13.2 to 7.2. The basis therefor is covered in Appendix A.

b. Inclusion of the supplemental flow structure. The need for this structure which had no counterpart in the project document plan, to maintain flows acceptable to riparian uses thereof by compensating for deficiencies which would otherwise result from interruptions to flow during lockage periods, is covered in Appendix B. The supplemental flow structure will also complement the stage-relief capability of the lock cited in subparagraph c, below.

c. Consideration of the lock as an outlet facility. The need for the lock to function as a relief outlet for hurricane-generated high stages in the IHNC is covered in Appendix D.

d. Raising of lock walls. In the project document plan it was contemplated that top of lock walls lakeward of the barrier be at elevation 7.2. Later re-evaluation of the considerations involved led to the conclusion that top of walls should be at least 10 feet above normal high tides (see paragraph 18, LMNED-PP letter dated 19 October 1966, Appendix A). Based on records for the period 1922-1965 at nearby locations, the mean elevation of the annual high tides at Seabrook, excluding hurricane tides, is estimated to be 3.5. Thus, the project plan provides that the top of wall will be 10 feet higher, at elevation 13.5.

e. Change in type of lock walls. In the project decument plan it was contemplated that lock walls (between gate bays) would be cantilever structures, constructed of prestressed concrete piles. Based on preliminary studies of alternative designs, discussed subsequently in paragraph 37, it is now contemplated that the walls will be gravity structures, of parallel steel sheet pile wall construction. The change is proposed in consideration of cost savings that are expected to be realized, and the functional superiority of the parallel wall structure.

HYDROLOGY AND HYDRAULICS

23. Climatology. The climatology and hydrology for the entire Lake Pontchartrain, Louisiana and Vicinity project area were presented in Design Memorandum No. 1 - Hydrology and Hydraulic Analysis, Part I - Chalmette, approved 27 October 1966.

24. Flow regimen. The Lake Pontchartrain Barrier Plan is based upon limiting the entry of hurricane-driven waters into Lake Pontchartrain and in order that this may be accomplished, the MR-GO--IHNC link must be controlled. The barrier plan also provides means for controlling flow from Lake Pontchartrain into the IHNC during hurricanes which produce conditions critical to the south shore of Lake Pontchartrain. Hurricane surges cause sufficient inflow into Lake Pontchartrain through the MR-GO and the Chef Menteur and Rigolets Passes to raise the lake level 4 to 6 feet, depending on the stage and duration of the surge in Breton Sound and

Lake Borgne. Hurricane generated wind tides combine with these increased lake levels to produce high stages at the lock site. With Seabrook Lock and related structures at Chef Menteur and Rigolets Passes in place, hurricane overflow will increase lake levels less than 0.6 foot. Wind tides combining with the 0.6-foot rise, rainfall, and stream runoff will produce a much lower maximum stage in Lake Pontchartrain.

25. Prior to construction of the MR-GO, the salinity regimen in Lake Pontchartrain was largely controlled by the interaction between surface runoff entering it and tidal inflows from Lake Borgne via the Rigolets and Chef Menteur Pass. The 30-foot deep IHNC channel was connected to Lake Borgne by the GIWW through the Rigolets and Chef Menteur Pass, but, because of the relatively small, shallow cross section (12 feet by 125 feet) of the waterway, this connection exerted little influence on salinities in Lake Pontchartrain. Construction of the MR-GO established a large, deep (36 feet by 500 feet) direct connection with the highly saline waters of Breton Sound. Tidal flow in the MR-GO reaches Lake Pontchartrain via the IHNC, and salinities in the lake and in the marsh adjacent to the MR-GO have increased significantly since its completion. Unless means are provided to restore a favorable salinity regimen, major damage to marine life in the lake and in the marsh traversed by the MR-GO may be anticipated.

26. A related problem deriving from the construction of the MR-GO is the generation of excessive tidal currents in the IHNC. The increased currents produce navigation difficulties and aggravate scour problems at bridges and along harbor developments.

27. A supplemental flow structure was necessitated to assure that the flow regimen agreed to by riparian users located along the IHNC and the U. S. Fish and Wildlife Service is attained without interruption (see Appendices B and C). This structure will be installed on the east flank of the lock along the alignment of the rock dike to supplement tidal exchanges reduced by lockages. The structure will remain open for all normal tidal fluctuations but will require special operation during hurricanes (refer to Appendix D).

28. Study of various alternatives leads to the conclusion that control of salinity in Lake Pontchartrain, management of excessive currents in the IHNC, and control of flow from the canal to Lake Pontchartrain during hurricane periods can be best achieved by a control structure at Seabrook. Inasmuch as navigation between Lake Pontchartrain and the IHNC must be preserved, a lock is essential.

29. Hydraulics of lock and supplement flow structures. Development of hydraulic details of Seabrook Lock will be guided by EM 1110-2-1604, "Hydraulic Design, Navigation Locks," and reports on lock model studies. New model tests are not contemplated; reasonable assumptions for design

of this lock and its appurtenant facilities can be made based on results of past model studies of locks of similar size and lift. Principal considerations are outlined below:

a. Navigation lift variations. When channel velocities are less than three feet per second the gates will be held open. When they reach three feet per second, in either direction, the lock will be placed in operation. Normal lifts will range from 0 to an extreme of four feet.

b. Design stages. The normal tidal range is about 1.0 foot in the IHNC and 0.5 foot in Lake Pontchartrain, however south winds raising tides in Breton Sound can produce higher tides in the IHNC or northwest winds can raise the stage on the lake side of the lock. Also, hurricanes on various tracks create greater design heads for certain conditions.

(1) The controlling elevation of 13.5 feet was established for the lock chamber, guide walls, and gates. This is based on a requirement for 10 feet of freeboard above normal high water. Further, the lock walls and gate walkways will be high enough to permit personnel to work thereon under the most extreme conditions of wind and tide for which the lock will be operated since the plan of operation during hurricanes prescribes that the lock be manned (refer to Appendix D). During brief periods at the storms peak intensity, the lock will be inaccessible by vehicle because the only access route, a roadway atop the rock dike, will be submerged.

(2) The maximum reverse head was determined to be 4 feet which resulted from stages on the Lake Pontchartrain side of 4.0 feet and on the IHNC side of 0.0 foot. This differential stage occurs under normal conditions with northwest winds blowing across the lake. Studies indicated that the maximum reverse head generated by hurricanes, 8.0 feet in the lake and 6.9 feet in the IHNC for the SPH (Standard Project Hurricane), was less critical.

(3) The maximum design water elevation is 11.45 feet on the IHNC side of the lock and 8.5 feet on the Lake Pontchartrain side. These stages are not coincident but are produced by the SPH on two different tracks critical to the project area (refer to Appendix D).

(4) The maximum differential head across the structure occurs as a result of the SPH crossing the project area on a precise track which produces stages in Lake Borgne as high as 10.5 feet and a coincident low stage of -7.9 feet in Lake Pontchartrain. The probability that the SPH will traverse the project area on this precise track is remote, consequently a design differential head with an occurrence frequency of once in 100 years was chosen. The stages at the lock site causing this head are 9.6 feet in the IHNC and -6.4 feet in the lake (refer to Appendix D).

(5) A controlling elevation of 7.2 for the rock dike is optimum insofar as limitation of hurricane-generated flows in the IHNC is concerned. Lower elevations would permit earlier overtopping, greater canal velocities, and higher Lake Pontchartrain stages. A detailed discussion of this determination is presented in Appendix A.

c. Wave data. The parameters which determine wave characteristics are the fetch length, windspeed, duration of wind, and the average depth of water over the fetch. In determining the design wave characteristics, it was assumed that steady state conditions prevail; i.e., the windspeed is constant in one direction over the fetch and blows long enough to develop a fully risen sea. The windspeed (U) is the average velocity over the fetch (F) is obtained from isovel patterns for the synthetic hurricane chosen as being critical to the location of interest. The average depth of fetch (d) is the average depth of water as shown by the charts and maps for the area plus the increase in water elevation caused by wind setup. Data necessary to determine design wave characteristics in the vicinity of the structures are shown in table 1.

TABLE 1
DATA USED TO DETERMINE WAVE CHARACTERISTICS

F - Length of fetch	5 miles
U - Windspeed	85 m.p.h.
swl - Stillwater level	8.5 ft. at structure site 8.0 ft. avg. for 5-mi. fetch
d - Average depth of fetch	23.6 ft.

The significant wave height (H_s) and wave period (T) were determined from the data in table 1 above. The equivalent deepwater wave height (H_o') was determined from table D-1 of Technical Report No. 4 prepared by the Coastal Engineering Research Center, June 1966, which relates d/L_o to H/H_o'. The deepwater wave length (L_o) was determined from the equation: $L_o = 5.12\ T^2$. Wave characteristics for the design hurricane which are pertinent to the design of the structure are shown in table 2 below:

TABLE 2
WAVE CHARACTERISTICS - DESIGN HURRICANE

H_s	- Significant wave height	8.0 ft.
T	- Wave period	7.1 sec.
L_o	- Deepwater wave length	258 ft.
d/L_o	- Relative depth	0.09147
Hs/H_o'	- Shoaling coefficient	0.9406

TABLE 2 (Cont'd)

H_o'	- Deepwater wave height	8.51 ft
H_o'/T^2	- Wave steepness	0.169
d_b	- H_o' breaking depth	10.34 ft.
H_{10}	- Average of highest 10% of all waves	10.16 ft.
H_1	- Average of highest 1% of all waves	13.36 ft.

d. Gates. Since the lock will be subject to reversals of head, and considering the anticipated range of heads, sector gates will be most suitable for this installation - performing the dual functions of service gates and devices for filling and emptying the lock. The rate of gate opening, with attendant acceleration of flows into or out of the lock chamber, will be of considerable importance. Chamber turbulence for various operating conditions will be investigated in detail and reported on in Design Memorandum No. 2.

e. Lock and supplemental flow structure. Average channel velocities through the lock chamber, supplemental flow structure, and in their approach and exit areas, estimated on the basis of backwater computations for the critical conditions listed below, will be used to determine the need for stone or concrete protection in the areas of concern (and the desirability of stilling basins).

Elevations, m.s.l.	(1)	(1)	(2)	(2)
IHNC	0.0	0.0	4.2	9.6
Lake Pontchartrain	4.0	4.0	-6.4	-6.4
Operation (3)				
Lock	closed	open	open	closed
Supl. flow structure	open	open	open	closed

(1) Water surface elevations for non-hurricane conditions.

(2) Water surface elevations for the 100-year storm, with minimum level in Lake Pontchartrain (hurricane conditions).

(3) Operation of lock and supplemental flow structure, as described here, is that which results in the most critical flow conditions. It is not necessarily the operation that would cause critical stability or structural loadings.

f. Stilling basins. Lake bottom materials in the vicinity of the lock are highly erodible. In view of this, and estimated critical average exit velocities, it is contemplated that stilling basins will be required lakeward of both the lock chamber and the supplemental flow structure. Studies to date indicate that similar facilities will not be required on the gulfward side; adequate protection against critical exit velocities when flow is in that direction appears possible with stone paving. A detailed presentation of velocity considerations pertinent to requirement of stilling basins (and other protection where elsewhere required) will be contained in Design Memorandum No. 2.

FOUNDATION CONDITIONS AND SEEPAGE

30. A foundation exploration program sufficiently comprehensive to support detailed design studies was completed in 1966. It included a series of borings at the project site followed by laboratory analyses and tests of samples to determine soil shear strengths, consolidation characteristics, permeability coefficients, classification and density data. As indicated in paragraph 9, detailed results of this program will be presented in Design Memorandum No. 2.

31. The foundation at and near the lock site generally consists of a sandy layer of Recent Bay Sound deposits overlain in some places by variable Lacustrine deposits and underlain by Recent Nearshore Gulf Deposits and the uppermost Pleistocene Prairie Formation strata, both of which are predominantly clayey. The next layer beneath them, another stratum of the Pleistocene Prairie Formation, is dense sand. All identifiable layers penetrated by borings are widely variable in thickness.

32. Investigations have been made to determine the feasibility of placing reinforced concrete gate bays directly on the lake bottom or, where excessive lake bottom depths prevail, on sand or shell fill. Although this type of foundation would be most economical it does not appear to be practicable in view of the foundation conditions and estimated loadings.

a. Characteristically, the Bay Sound deposit sands are of a loose nature (standard penetration test - less than 10 blows per foot) and do not meet requirements for use in supporting a raft structure. Compaction of this submerged material so as to obtain a significant increase in density is practically impossible.

b. Differential settlement could be expected in the underlying clays, with detrimental effects on the gate bays. This would be further aggravated by the influence of unequal loading caused by the rock and shell dam adjacent to the landward gate bays.

Consequently, it is planned to support the gate bays on piling. Because of the inherent susceptibility of the underlying clays to consolidation under load, it is contemplated that the piling will extend through the clays, and the long-term pile loadings distributed entirely to the lower level sand strata within the Pleistocene Prairie Formation. To insure that the foundation piles will reach and transmit to the Pleistocene Prairie sand, the design long-term loadings, a series of pile tests designed to meet the foundation conditions peculiar to this site will be conducted early in the construction phase. A typical test will consist of driving a metal pipe pile through overlying materials to Zone 2 of the Pleistocene Prairie Formation; washing all material out of the pile so that an empty casing is obtained; driving the timber test pile through the casing and into the Zone 2 sands; and load testing the pile by conventional jacking methods. A test of this kind will provide reliable data concerning the load carrying capability of the stratum to which the long-term loads are intended to be transmitted. The lengths of permanent service piles will be based on information obtained from these tests.

33. The Lacustrine deposits which lie on the lake bottom (soft to very soft silt and clay) are considered incompetent and inadequate for use as foundation material due to their extremely high water contents and significant quantities of decaying organic matter. They will be removed wherever they occur beneath a gravity structure supported directly on the soil.

34. The upper strata of foundation materials are sufficiently permeable to require that, where hydraulic head differentials will some day exist, cutoff walls must be placed through them and extended to the underlying impervious clayey layers. During detailed design of the lock the permeability data already obtained in the laboratory will be utilized to develop a construction dewatering system for each gate bay area. Computations indicate that a permanent pressure relief system will not be required under the gate bay.

DESCRIPTION OF PROPOSED STRUCTURES AND IMPROVEMENTS

35. General. The lock wall will be designed for loads due to water levels in the IHNC and Lake Pontchartrain as listed below:

a. Extreme maximum lakeward loading. IHNC at elevation 9.6 with concurrent lake elevation of -6.4.

b. Extreme maximum gulfward loading. IHNC at elevation 5.5 with concurrent lake elevation of 7.5. Waves assumed acting on lake side.

c. Normal maximum lakeward loading. IHNC at elevation 4.0 with concurrent lake elevation of 0.0.

d. Normal maximum gulfward loading. IHNC at elevation 0.0 with concurrent lake elevation of 4.0.

Above-normal design stresses will be used for conditions "a" and "b". Normal design stresses will be used for conditions "c" and "d". Condition "a" is taken from 100-year frequency hydrographs for a hurricane on the most adverse track. Condition "b" assumes Group II loadings as defined in EM 1110-1-2101.

36. Structures will be designed for hawser pull or boat impact, as appropriate, in accordance with the following schedule:

a. Guide and guard walls. 1,000 pounds per foot of wall applied in either direction.

b. Sector gates. 120,000 pound boat impact applied as a concentrated load, except that skin plate and intercoastals will not be designed for such load.

c. Lock chamber walls. 1,000 pounds per foot of wall due to vessel inside the chamber and applied in either direction, or 3,000 pounds per foot of wall due to vessel outside the chamber and applied as an impact loading under storm conditions.

37. Lock walls. Preliminary designs and estimates were made for four alternative lock chamber walls which could, in each case, be constructed in the wet. The four types of wall considered were:

a. Cantilever type constructed of prestressed concrete cylinder piles with concrete filler between piles.

b. A cantilever type similar to that described in the preceding subparagraph except that a reinforced, cast-in-place, concrete superstructure would be used in lieu of the portions of the cylinder piles that would project above water surface.

c. Gravity type, filled, parallel steel sheet pile walls with tie rods and wales.

d. Gravity type, filled, cellular steel sheet pile walls.

Because of the corrosive nature of the water at this site all walls in which steel would comprise an exposed structural element were assumed to require sand blasting followed by a zinc-rich primer and coal tar epoxy coatings.

38. Comparative estimates indicate that the parallel steel sheet pile wall would be the most economical by a substantial margin. Descriptions, work sketches and cost estimates for each type of wall are included in Appendix E.

39. General features of the proposed wall are shown on plate 3. It will consist of two rows of sheet piling tied together with a wale and tie rod system. It will be filled with clam shells and will be fendered on both sides. Riprap fill was considered because of its inherently greater ability to withstand vessel impact. It was not selected because the foundation material does not have adequate strength to withstand the heavier loads riprap would impose. All steel components will be protected from corrosion. Shell fill, protected from scour by concrete or riprap, will be placed on both sides of the wall to enhance its stability. One of the sheet pile rows will extend down through the more pervious sandy layers into the underlying clays to form a cutoff wall. The walls will not be designed for stability in the unwatered condition as unwatering of the chamber after construction is not anticipated.

40. Gate bays and gate bay construction methods. The gate bays will be conventionally shaped reinforced concrete frames with tops at elevation 13.5 and sills at elevation -15.8. Each gate bay will be designed as a monolithic unit, supported by piles, with pile load intensity determined by analyzing the relationship of each pile to the pile group and to the resultant of all forces acting thereon using the method of elastic center as given in Andersen's "Substructure Analysis and Design", second Edition, 1948. As discussed in paragraph 32, the selection of piles as the supporting medium is based on the proximity of underlying clay layers and on the impracticability of preparing, under water, a suitable raft type soil foundation. Appendix E contains a brief description of three types of bearing piles that have been investigated, and comparative estimates of cost therefor. Based on the investigations made, timber piles have been selected for this project.

41. Each gate bay will be approximately eighty feet long and about one hundred ninety feet wide. Recesses will be provided for needle beams and girder on each end for use in future unwatering work. Provision will be made at top of wall for gate machinery and control shelters.

42. Two methods of constructing and placing the gate bays will be studied. The first will be based on conventional on-site construction within unwatered cofferdams of either cellular or single braced wall type. The second will be based on construction of the lower portion of each gate bay at a dewaterable shoreline site, placing needle beams and girders to form a floatable chamber, then towing the floating gate bays to the lock site and sinking them to their precise final positions. Top

portions of the gate bays would then be constructed, thus ballasting them, and the bays could be unwatered and erection of gates and machinery accomplished. Problems anticipated with both construction alternatives will be reflected in their estimated costs. Selection of a construction method will be made prior to completion of the Design Memorandum No. 2 and will be discussed in detail therein.

43. Guide and guard walls. Guide walls will be constructed of timber pile bents connected with a wooden walkway and fendered on the channel side. They will form straight extensions of both ends of the easterly lock wall. A curved guard wall at the northerly end of the west lock wall will assist vessel alinement prior to entry into the chamber. The guide and guard walls at the north end of the lock will terminate at steel sheet pile dolphins. Tops of the dolphins and the guide and guard wall walkways will be at elevation 13.5.

44. Dewatering system. Each end of each gate bay will be provided with recesses to receive a needle support girder and vertical needle beams. The support girders will be designed for this lock; the required needles will, when needed, be drawn from storage at other locks in the New Orleans District. Only two girders will be furnished; thus, only one gate bay may be dewatered at a time. The dewatering will be accomplished with portable pumps brought to the site when an occasion for dewatering arises.

45. Sector gates. Radial gates of the sector type will be used, similar in design and function to those already in use at other locks in the New Orleans District. They will have a top and confining elevation of 13.5 to match adjacent walls, and will be so detailed that gate leaf removal can be accomplished by floating plant without dewatering the gate bays. Gates will be designed for various combinations of dead load, boat impact and the previously described water loads. Cathodic protection will be provided.

46. Sector gate machinery. The gate machinery will consist of an electric motor driven hydraulic pump, oil reservior, valves and accessories, piping, hydraulic motor, electrically-operated brake, speed reducer, angle drive unit, idler gear, rack and limit switch. The rack will be mounted on the sector gate and the angle drive unit will be mounted in an open recess in the sector gate bay so that the idler gear will engage the rack to operate the sector gate. All other equipment will be located in an adjacent watertight recess. A floating shaft will extend from the angle drive unit through a watertight bulkhead to the speed reducer. The speed reducer, brake and hydraulic motor will be mounted on a common machinery base and the hydraulic pumping unit consisting of the electric motor, double pump, valves and accessories will be mounted on the oil reservoir near the speed reducer assembly. The limit switch will be driven by a speed changer which will be connected to the reducer output shaft. The double pump will drive the hydraulic motor at either fast or slow speed to operate the gate

at approximately 20 feet per minute for a 3 minute cycle or at approximately 4 feet per minute for slow operations at the beginning and end of a cycle or when otherwise required or desired.

47. Control shelters. One story control shelters to house control desks and the control panels will be constructed on the westerly side of each gate bay. Floor elevations will be coincident with top of lock walls, 13.5, which is above maximum high water. Both sector leaves of both gates will be controllable from each shelter.

48. Approach channels. Existing depths and channel widths are adequate for navigation needs during and after construction. No approach channel excavation will be required. As described in Appendix D, it is anticipated that the lock will be opened during certain storm occurrences in order to relieve high stages in the IHNC by permitting outflows to the lake. These outflows will produce very high velocities over portions of the approach channels, the lock floor, and through the supplemental flow structure. These areas will, therefore, be protected from erosive forces by concrete and riprap.

49. Rock and shell dam. Control of flows to and from Lake Pontchartrain will be established by the rock and shell dam, the lock, and the supplemental flow structure integral with the dam. Top elevation of the dam, which is the controlling elevation of the lock unit, has been established at 7.2 as discussed in Appendix A. The dam will provide access to the lock from both shores. It will be constructed of a clam shell core with riprap and derrick stone protection designed in accordance with the methods outlined in the U. S. Army Coastal Engineering Research Center's Technical Report No. 4 titled "Shore Protection Planning and Design", to withstand wave forces. A steel sheet pile cutoff wall, extending from top of dam to the underlying clayey Nearshore Gulf Deposits, will connect from shore to shore and will be continuous through both portions of the dam and under the supplemental flow structure and the gate bay. A shell-surfaced roadway access ramp to the west lock wall and a parking area adjacent to the gate bay will be provided. Location of these features and the expected cross section of the dam are shown on plates 2 and 3.

50. Supplemental flow structures. Appendix B establishes the need for and cross sectional area of the supplemental flow structure to be incorporated in the barrier at Seabrook Lock. The purpose of this structure is to insure that flows between Lake Pontchartrain and the IHNC can, under varying conditions of lockage frequency, be maintained at the programmed operational regimen agreed to by interested parties. The structure will be composed of twin waterway openings adjacent to the landward gate bay and closeable, either wholly or in part, by steel bulkheads. Bulkheads will not be sealed. Each bulkhead will act as a series of simple beams which will accept loads from either direction. They will be placed and removed by land plant crossing the easterly end of the dam from the New Orleans Airport side. General features of the supplemental flow structure are shown on plates 2 and 3.

51. Access bridge. The supplemental flow structure described above will introduce a discontinuity in access across the dam crest to the easterly side of the lock. Consequently, a medium duty access bridge will be provided over each opening of the structure. Each span will be designed for a truck crane handling the closure bulkheads. A stair will be provided to permit personnel access from top of dam, elevation 7.2, to top of wall, elevation 13.5. A stair will also be provided for access from the westerly section of the dam to the west lock wall.

52. Stilling basins. As indicated in paragraph 29, stilling basins will be needed on the lakeward sides of both the lock chamber and the supplemental flow structure. Calculations show that the energy gradients through the two are such, under certain conditions of flow toward the lake, that energy dissipation by hydraulic jump must be permitted. The stilling basins will be designed to control and localize the jump within the basins (which will be of concrete construction), thus preventing undermining of the lock and appurtenant structures. General features of the stilling basins are shown on plate 2.

53. Operations and maintenance buildings. Operations and maintenance buildings will consist of a 6'x8' oil and paint storage building and a 20'x60' main building, both located on the west lock wall. The main building will be partitioned for radio room, lockmaster's office, toilet, store room, entry, locker room, work room and an equipment room housing the standby generator. Approximate locations of buildings are shown on plate 2.

54. Protective structures. Daily tidal flows to and from Lake Pontchartrain, as described in Appendix B, will result in constantly varying currents through the supplemental flow structure. The effect of these currents on marine plant or small craft would be if not mitigated in some manner, to draw them into or through the restrictive opening(s) of the flow structure. The new guide wall will prevent such occurrences when flow is from the canal to the lake but when flow is reversed no such protective device is available. Consequently it is planned that a timber pile barrier wall, similar in construction to the guide and guard walls but without a walkway, will be built so that a protective screen connecting the lock wall and the shore will be formed. Vessels will thus be prevented from being drawn into the supplemental flow structure from either direction.

55. Exposure of the lock chamber walls, lakeward gate bay and lock stilling basin to the open lake waters renders them vulnerable to damage from drifting or uncontrolled vessels particularly during storms. The lock chamber walls will be designed to resist resulting impact loads, assumed to be 3,000 pounds per linear foot in intensity during storm attack, but the lakeward gate bay and lock stilling basin cannot practicably be designed to resist such forces. Consequently, protective dolphins will be placed as shown on plate 2 to intercept any potentially damaging craft.

Other dolphins will be placed at the end of the lakeward guide and guard walls so as to protect those structures from collision damage if approaching tows are improperly positioned.

56. Fire protection. A 200 gpm electric-motor-driven fire pump will be provided. One hose outlet and hose reel will be provided at each side of each gate bay and at the middle point of each lock wall.

57. Potable water. Potable water is available from the west side of the lock. Connection to the existing water main will be made and potable water will be piped across the access bridge to the operation and maintenance buildings on the east lock wall.

58. Sewage treatment. Sewage will be disposed of through a direct connection to the city sewer system. The new sewer will be run from the toilet room in the main operations and maintenance building, down the access ramp, along the westerly portion of the dam and then to the nearest point in the city lines.

59. Electrical. The lock will be electrically operated from the two control shelters, one at each end of the lock. The shelters will be electrically heated. Power will be obtained at the voltage supplied by the local utility, and transformed as required for the proper utilization voltages. Switchboards, of the motor-control center type, containing circuit breakers, and necessary control items for the gates, lights, and other circuits will be installed at the most practical locations, probably in each control shelter. Gates will be controlled through manually operated swithces located on consoles in each control shelter. Each gate will be controllable from both consoles, and local controls for testing and maintenance will be provided for the gate machinery on the non-operating wall. To aid in trouble-shooting, each gate circuit will contain switches to completely isolate the several control loops from the balance of the circuit. To insure that hydraulic jump during high water conditions occurs only in the stilling basin, interlocks (with suitable bypass controls) will insure that the gate at the canal end cannot be opened unless the gate at the lake end is closed.

Lighting on the lock wall will be by means of mercury vapor or similar units sized and spaces to provide approximately one foot-candle. An engine-driven generator, sized to operate the fire pump and essential lighting, will be installed for emergency use. For use in maintenance and testing, a sound-powered, common-talking, non-ringing test telephone circuit, with at least two plug-in hand telephones, will be installed, with jack boxes located wherever control and/or power conductors terminate.

60. Liquified petroleum gas system. An L.P. gas system will be provided for supplying gas fuel to the engine generator set and space heaters in the main operations and maintenance building. The system will be designed for using butane or propane gas or mixtures of these gases.

A 1,000 gallon (water capacity) storage tank will be located above ground on the west lock wall near the main operations and maintenance building. The system will be in accordance with National Fire Protection Association Standard No. 58, and ASME codes.

61. Corrosion control system. Salinity data obtained at the Southern Railway bridge across the IHNC just south of the Seabrook Lock site showed chloride concentrations varying between approximate limits of 30 p.p.m. and 12,000 p.p.m. In such an environment, local corrosion cell action will proceed with great speed and severe damage to exposed non-protected steel structures can result. A system of cathodic protection for the Seabrook Lock gates and walls must be installed to supplement protective surface coatings applied thereto.

62. All steel surfaces of the sector gates and the sheet pile lock walls will be sandblasted to a near-white finish and painted with a 20-mil coal tar epoxy coating. In addition, because of their permanent inaccessibility below the water surface, the lock wall sheet piles will receive a zinc-rich primer.

63. The system of cathodic protection for the lock proposed by the Mobile District is shown on plates 4 and 5. To provide for future increases in the amount of exposed steel, due to the inherent likelihood of paint deterioration or damage from vessel impact, and to provide for adjustment of protective current as polarization and the deposition of calcareous deposits are accomplished, an impressed current system was selected. As planning for the system is well advanced, and details worked out, a relatively complete description thereof is provided (below) for review by higher authority at this time, so as to simplify later planning effort.

a. Lock gates. Protection of the interior and exterior faces of the sector gate skin plate will be provided by means of a system of suspended strings of cable-supported Duriron "sausage-type" anodes, supported from insulated clevises and protected from physical damage by an enclosing raceway. The raceway will be constructed of 3 inch plastic pipe encased in 3-1/2 inch steel pipe. Cutouts (or windows) will be provided in the raceway at each anode location to permit current flow to the gate structure. Wood timbers will be provided on the skin plate to provide additional protection from damage. A system of free-hanging, cable-supported Duriron "sausage-type" anodes, suspended from insulated clevises attached to the upper gate frame will provide protective current to all gate frame members. Insulated guide brackets will be provided at the intermediate frame members, and an eye bolt will be installed at the lower frame with a stay-line from the bottom anode up to the clevis, to prevent movement of the anode string during turbulence of the water. This arrangement will allow removal and reinstallation of the anode strings for inspection or replacement. A similar

installation has given satisfactory performance on sector gates at Olga Lock, on the Okeechobee Waterway in the Jacksonville, Florida District and on miter gates at two installations under construction in the Mobile District. Details of the installation are shown on plate 5.

b. Lock walls. Sheet piles will be bonded together metallically after driving, by means of a continuous No. 6 plain steel reinforcing rod welded to the pile sheets at the top. Bonds will also be provided between the pile sheets, the horizontal wale channels, and the stay bolts, to provide electrical continuity. Protection for the outer faces of the walls, exposed to the waters of Lake Pontchartrain and to the water in the lock chamber, will be provided by means of anode strings suspended inside perforated plastic-pipe guides supported by steel brackets mounted within the physical limits of the sheet-pile walls, as shown on plate 4. The plastic pipe will be perforated to allow passage of the protective current. With this method of installation, anode strings may be removed for periodic inspection and/or repair. Being mounted within the configuration of the "Z" piles, the anode guides will be protected from damage by wave action or from tows. Protection for the inward faces of the sheet piling, the tie rod system, and the wales will be provided by a system of Duriron anodes installed in the undisturbed soil of the lake bottom between the pile sheets. Leads from the individual anodes will be encased in plastic pipe for protection from damage by the shell ballast, and brought to the top of the lock wall to a header cable. All connections will be made in the dry in plastic conduit fittings at the top of the lock wall. In this way, any single anode which fails may be disconnected, allowing the remainder of the system to operate. Current limiting resistors may be installed if found to be necessary.

c. Rectifiers. Four dual type rectifiers, each having two separately and independently adjustable d.c. outputs will be provided. Each rectifier will supply protective current for one gate leaf from one d.c. output; and for one-half of the double lock wall, on one side of the lock, from the other d.c. output. Rectifiers will be sized on the basis of supplying 2 milliamperes per square foot of surface exposed to the water. Sufficient capacity, in excess of the calculated requirements, will be provided to ultimately supply 4 milliamperes per square foot, as normal coating deterioration occurs.

d. Junction boxes. Junction boxes with terminal strips will be provided for connection of all anode leads, and for the insertion of current-limiting resistors in anode leads, as may be required, in balancing the protection system. Junction boxes and terminal strips for the gate system will be located at walkway level on the gate structure. Junction boxes for the lock wall system will be located adjacent to the rectifiers.

e. Adjustment of system. Prior to placing the cathodic protection system in operation, a complete pre-protection survey will be made of the lock gates and lock walls. Structure-to-reference cell potentials will be measured at selected locations on each gate and at intervals along the outside and inside of the lock walls. Perforated plastic drain-pipe test wells will be provided in the clamshell ballast to enable measurements to be made of the lock wall interior faces. Measurements of potential will be made using a copper-copper sulphate reference cell with a corrosion voltmeter having an internal resistance of at least 200,000 ohms per volt, or a potentiometer voltmeter. After the pre-protection survey has been completed, the entire system will be placed in operation and the system voltages adjusted to give a maximum structure-to-reference cell potential over the entire area of approximately -1.20 volts, with protective current "on". After the system has operated for a period of several weeks, to permit initial polarization of the structure, the installation will be resurveyed and measurements of potential taken with current "on" and "off". The system voltages will be adjusted to provide potential readings with current "off", 0.22 to 0.30 volts more negative than the pre-protection potentials. Periodic adjustive surveys will be made until a stable operating condition is obtained. Reports of the surveys will be forwarded, thru channels, to the Office, Chief of Engineers, in accordance with requirements of EM 1110-2-3701 dated 15 May 1962.

SOURCES OF CONSTRUCTION MATERIALS

64. An investigation of sources of construction materials has been completed and results thereof are presented in "Lake Pontchartrain and Vicinity, Louisiana, Design Memorandum No. 12, Sources of Construction Materials" dated June 1966.

COST ESTIMATES

65. Estimate of first costs. The estimated cost for construction of the Seabrook Lock unit in accordance with the project plan presented in this design memorandum is given in table 3, following. The estimate is based on July 1968 price levels. For division of the estimated costs between Federal and non-Federal interests see table 4 in paragraph 66.

TABLE 3
ESTIMATE OF FIRST COSTS

Item No.	Description	Quantity	Unit	Unit cost	Amount
				$	$
1.	Lands:				
	a. Unpaved	11,000	s.f.	1.25	13,750
	b. Paved	1,900	s.f.	2.25	4,275
2.	Excavation of lacustrine deposits	143,000	c.y.	1.20	171,600
3.	Shell fill	199,000	c.y.	3.30	656,700
4.	Cofferdams:				
	a. Steel sheet piling, S-28	260,900	s.f.	4.30	1,121,870
	b. Fabricated tee piling	13,100	s.f.	6.55	85,805
	c. Shell cell fill	60,400	c.y.	4.10	247,640
5.	Dewatering		job		500,000
6.	Structural excavation	14,000	c.y.	2.00	28,000
7.	Riprap (in the wet)	20,190	ton	10.00	201,900
8.	Derrick stone:				
	a. In the dry	13,805	ton	13.00	179,465
	b. In the wet	17,405	ton	10.00	174,050
9.	Rock spalls	9,100	ton	8.50	77,350
10.	Lock chamber walls:				
	a. Steel sheet piling, Z-27	181,550	s.f.	5.10	925,905
	b. Fabricated piling	900	s.f.	7.55	6,795
	c. Metal work	193,000	lb.	0.35	67,550
	d. Shell fill	57,700	c.y.	3.75	216,375
	e. Timber fenders	6,160	l.f.	9.50	58,520
11.	Guide and guard walls:				
	a. Treated timber "marine piling"	35,000	l.f.	3.00	105,000
	b. Treated timber framing and planking	58	Mfbm	800.00	46,400
	c. Timber fenders	4,000	l.f.	9.50	38,000
12.	Barrier wall:				
	a. Treated timber "marine piling"	9,200	l.f.	3.00	27,600
	b. Timber fenders	810	l.f.	9.50	7,695

TABLE 3 (Cont'd)

Item No.	Description	Quantity	Unit	Unit cost	Amount
				$	$
13.	Mooring dolphins				
	a. Steel sheet piling	48,000	s.f.	5.70	273,600
	b. Shell cell fill	9,500	c.y.	3.75	35,625
14.	Timber bearing piles (untreated)	34,800	l.f.	4.10	142,680
15.	Pile loading test	4	ea.	2,900.00	11,600
16.	Temporary struts and wales		job		155,000
17.	Concrete:				
	a. Gate bays	7,720	c.y.	52.00	401,440
	b. Stilling basins (1)	3,950	c.y.	55.00	217,250
	c. Retaining walls	70	c.y.	67.00	4,690
	d. Lock chamber slab	4,850	c.y.	41.00	198,850
18.	Portland cement	21,740	bbl.	5.50	119,570
19.	Steel reinforcement	2,031,000	lb.	0.16	324,960
20.	Steel sheet piling, MA-22	55,500	s.f.	4.50	249,750
21.	Sector gates (incl. painting)		job		575,000
22.	Flow structure bulkheads		job		12,000
23.	Needle beam support girders		job		21,000
24.	Miscellaneous metalwork		job		50,000
25.	Cathodic protection		job		100,000
26.	Sandblasting and coal-tar-epoxy painting of steel surfaces	745,000	s.f.	0.60	447,000
27.	Control shelters	2	ea.	3,500.00	7,000
28.	Operating machinery		job		195,000
29.	Engine-generator set		job		11,000
30.	Electrical work		job		250,000
31.	Water distribution and fire protection system		job		25,000
32.	Sewage disposal system		job		20,000
33.	Liquified petroleum fuel system		job		20,000
34.	Access bridges	2	ea.	5,250.00	10,500
35.	Main O and M building		job		30,000
36.	Paint building		job		1,500
	Subtotal				8,872,260
	Contingencies, 20%±				1,727,740
	Subtotal				10,600,000
	Engineering and design, 8%				850,000
	Supervision and administration, 8%				850,000
	Total first cost				12,300,000

(1) Includes all concrete for the supplemental flow structure.

66. Comparison of estimates. A comparison between the estimate of cost presented in this design memorandum and previous estimates for the Seabrook Lock unit is provided in table 4, following (price levels of the several estimates are shown in parenthesis). In each case, pursuant to the requirements of local cooperation, a non-Federal contribution is shown amounting to 30 percent of the costs apportioned to hurricane protection (half of the estimated construction costs). In the project document the applicability of the additional non-Federal contribution toward the Lake Pontchartrain Barrier Plan, in return for Federal maintenance of the Rigolets Lock, was not made clear with respect to the Seabrook Lock unit. In subsequent estimates it has been the practice to pro-rate a share of that additional contribution toward all separable units of the barrier plan including, as shown, the Seabrook Lock unit.

TABLE 4
COMPARISON OF ESTIMATES

Item	Project document estimate (1) (Dec. 1961)	Latest approved estimate (2) (July 1968)	Design memorandum estimate (July 1968)
	$	$	$
FEDERAL			
Locks	4,727,000	6,828,000	10,600,000
Engineering and design	265,000	528,000	850,000
Supervision and administration	388,000	494,000	850,000
Subtotal	5,380,000	7,850,000	12,300,000
Less non-Federal contribution	- 807,000	- 1,410,000	- 2,078,000
Net Federal cost	4,573,000	6,440,000	10,222,000
NON-FEDERAL (Cash contributions)			
For Seabrook lock hurricane protection purpose	807,000	1,177,000	1,845,000
Share of capitalized OM & R costs for Rigolet lock	-	233,000	233,000
Total non-Federal cost	807,000	1,410,000	2,078,000
TOTAL	5,380,000	7,850,000	12,300,000

(1) House Document No. 231, 89th Congress, 1st session.

(2) Project Cost Estimate (PB-3) dated 1 July 1968.

67. The total difference of + $2,470,000 between the project document estimate and the latest approved estimate is due primarily to price level increases, December 1961 to July 1968.

68. The total difference of + $4,450,000 between the latest approved estimate and the estimate presented in this design memorandum is due to the following:

Changes in lock foundation design: excavation of lacustrine deposits and replacement with shell fill (+$772,000); and addition of bearing piles for gate bay support (+$185,000).....+	$ 957,000
Changes in cofferdam design and other provisions for construction dewatering, including those due to deficiencies of the lacustrine foundation materials, enlargement of the area to be dewatered due to addition of supplemental flow structure, stilling basin and concrete lock floor features, and greater average depths of water in areas of enlargement.....+	1,110,000
Changes in lock design to permit its use as an outlet structure, including concrete floor and addition of stilling basin.....+	551,000
Addition of the supplemental flow structure, including the stilling basin and barrier wall therefor.....+	261,000
Net addition of 7 dolphins.....+	324,000
Addition of O and M facilities.....+	105,000
Change in type of lock wall.....-	540,000
Raising of lock walls, lowering of dam crest, and net of other changes in plan resulting from these and foregoing modifications, more detailed planning, and refinement of estimates.....+	1,016,000
Reanalysis of requirements for engineering and design (+$322,000) and supervision and administration (+$356,000).....+	678,000

69. Estimate of annual charges. The estimated total investment costs and annual costs for the Seabrook Lock unit are shown below. Investment costs include interest during construction at an interest rate of 3-1/8 percent for one-half of an assumed 3-year construction period. Annual charges are based on the same interest rate and an assumed 50-year project life. The estimated annual maintenance and operations cost is based on a current analysis of requirements for the lock structure and appurtenant facilities proposed herein. Like estimated first costs, it reflects July 1968 price levels.

Estimated total first costs	$12,300,000
Interest during construction	577,000
Total investment costs	12,877,000
Annual costs:	
Interest	$ 402,000
Amortization	110,000
Maintenance and operations	170,000
Total annual costs	682,000

PROJECT JUSTIFICATION

70. Completion of the Lake Pontchartrain Louisiana and Vicinity, project will return benefits of very considerable magnitude from reduction of hurricane-induced flood damages to existing and future developments. Estimates of these benefits easily exceed estimated project costs. The Seabrook Lock unit, as an integral feature of the Lake Pontchartrain barrier plan, is justified on the basis thereof, and also on the basis of its requirement for mitigation of adverse salt water intrusion to the lake, adverse flow conditions to riparian users, and increased current velocities in the IHNC that are detrimental to facilities therein, all attributable to the MR-GO navigation project.

COORDINATION WITH OTHER AGENCIES

71. General. As mentioned in paragraph 11, the State of Louisiana, Department of Public Works, was appointed project coordinator for the State by Governor McKeithen. This agency has functioned to coordinate the needs, desires, and interests of state agencies and the Corps of Engineers. The Orleans Levee District, which will provide the local cooperation for all features of the project other than those located in St. Bernard Parish, actively assisted in coordinating the project planning The project plan presented herein is acceptable to both of the above agencies.

72. U. S. Fish and Wildlife Service. Extensive coordination with the U. S. Department of the Interior Fish and Wildlife Service was accomplished relative to the Seabrook Lock feature of the "Lake Pontchartrain, La. and Vicinity," project. By letter dated 4 November 1966, the Regional Director, U. S. Fish and Wildlife Service, Atlanta, Georgia, was informed that detailed planning for Seabrook Lock was underway, provided a tentative operating plan for the lock, and requested to furnish views and comments thereon. Subsequent to a meeting held relative to the salinity control in Lake Pontchartrain and in response to LMNED-PP letter dated 18 January 1967, the Regional Director, in a letter dated 26 April 1967, stated "...it appears at this time that operation of the lock at full discharge capacity throughout the full tidal cycle can be tolerated insofar as fish and wildlife resources are concerned." In addition, by letter dated 17 April 1967, the Regional Director was informed that preparation of a general design memorandum for the Seabrook Lock was underway, apprised of significant design modifications in the authorized lock, and requested to furnish views and comments on the modified plan. In a letter dated 7 June 1967, the Regional Director stated "...lowering the controlling elevation of the rock dike to elevation 7.2 feet will have no effect on fish and wildlife resources. On the other hand, the auxiliary water control structure should provide a more flexible system for salinity control in Lake Pontchartrain." The Regional Director also suggested that "...a salinity surveillance system be located in Lake Pontchartrain after the Seabrook structure is in place." Relative to the Regional Director's suggestion, upon completion of the lock, an adequate evaluation of the effects of lock operation on the salinity regimen and a determination as to the extent that the lock operation is producing the salinity regimen indicated by model data will be provided. Copies of the above correspondence are contained in Appendix C.

73. Federal Water Pollution Control Administration. By letter dated 19 April 1967, the Regional Director, Federal Water Pollution Control Administration of the U. S. Department of the Interior, was informed that preparation of a general design memorandum for the Seabrook Lock was underway, apprised of the departures from the project document plan, and requested to furnish views and comments on the modified plan. The Regional Director requested, in his letter of response dated 23 June 1967, that consideration be given to the following:

a. Minimizing water quality degradation during construction.

b. Constructing and operating the control structures so as to insure that ecological conditions remain unchanged.

c. Precluding mosquito breeding problems caused by increasing the Lake Pontchartrain water level, as a result of the hurricane protection project, thus flooding the lowlands bordering the lake.

d. Minimizing the accidental spillage of petroleum products or other harmful materials and maintenance of sanitary facilities to adequately treat domestic wastes.

Provisions relative to water quality degradation during construction, control of accidental spillages, and maintenance of adequate sanitary facilities by construction contractors will be incorporated into the construction plans and specifications. The Seabrook Lock will be operated to provide a desirable salinity regimen in Lake Pontchartrain to the end that deleterious alterations in lake ecology will be avoided. The Regional Director has been advised of the action to be taken in connection with his comments. Copies of correspondence with the Regional Director are included in Appendix C. With respect to the concern relative to mosquito breeding problems, in the event that the average level of Lake Pontchartrain is raised, it is noted that the Lake Pontchartrain Barrier Plan will not result in any material increase in the average lake level, but will serve only to prevent uncontrolled increases in lake levels during hurricanes.

74. Louisiana Wild Life and Fisheries Commission. By letter dated 17 April 1967, the Director, Louisiana Wild Life and Fisheries Commission, was informed that preparation of a general design memorandum for the Seabrook Lock was underway, apprised of significant design modifications in the authorized lock, and requested to furnish views and comments on the modified plan. In a letter dated 2 May 1967, the Director recommended that provisions be installed in the Seabrook Lock to allow salinities in Lake Pontchartrain to be adjusted as may be necessary for the maintenance of fish and wildlife resources. Relative to the above recommendation, upon completion of the lock, an adequate evaluation of the effects of lock operation on the salinity regimen and a determination as to the extent that the lock operation is producing the salinity regimen indicated by the model data will be provided. Copies of the above correspondence are contained in Appendix C.

76. New Orleans Public Service Inc. Subsequent to project authorization, extensive coordination covering operation of the Seabrook Lock for riparian needs was accomplished. NOPSI (New Orleans Public Service, Inc.), the electric utility for the city of New Orleans, operates steam electric generating stations on the IHNC and the MR-GO and is the controlling riparian use; therefore, its satisfaction will insure that all riparian needs are adequately provided for. Based on careful engineering studies relative to adverse effects of the Seabrook Lock on NOPSI cooling water requirements, Mr. L. J. Cucullu, Vice-President and Chief Engineer of New Orleans Public Service, Inc., in a letter dated 10 February 1967 stated that his agency is in agreement with the proposal presented in LMNED-PP letter dated 1 February 1967 to operate Seabrook Lock at full discharge capacity on a continuous basis. Copies of the above correspondence are contained in Appendix C.

SCHEDULE FOR DESIGN AND CONSTRUCTION

76. It is planned that the entire Seabrook Lock unit be accomplished under a single contract. The proposed schedule for completion of design and construction is as follows:

Submission of Design Memorandum No. 2, Detailed Design	June 1969
Submission of plans and specifications	July 1970
Advertise for bids	December 1970
Award contract	January 1971
Start construction	February 1971
Complete construction	July 1973

The time scheduled for construction is based on assumed use and re-use of one cofferdam for construction of the two gate bays. This would be modified, if, in detailed design studies, an alternative gate bay construction method is found to be more economical.

77. As presently proposed the construction sequence will consist of four separate phases, as follows:

Phase I. Predredge all lacustrine deposits and place shell fill to form base for cofferdams, gate bays and dam. Construct and unwater cellular cofferdam at lakeward gate bay site.

Phase II. Construct lakeward gate bay and stilling basin in the dry. Construct lock chamber walls in the wet. Remove lakeward cofferdam.

Phase III. Divert navigation to the west of lock site and construct landward cofferdam, connecting it to lock chamber walls and to easterly shore. Unwater cofferdam and construct landward gate bay, supplemental flow structure, and easterly portion of dam, all in the dry. Construct lakeward dolphins, guide and guard walls. Remove landward cofferdam.

Phase IV. Route navigation thru the completed lock. Construct landward guide walls and westerly portion of dam.

78. To maintain the design and construction, the following allocation of funds, by fiscal year, will be required:

Thru FY 1968	$ 231,000
FY 1969	340,000
FY 1970	340,000
FY 1971	1,159,000
FY 1972	5,715,000
FY 1973	4,515,000

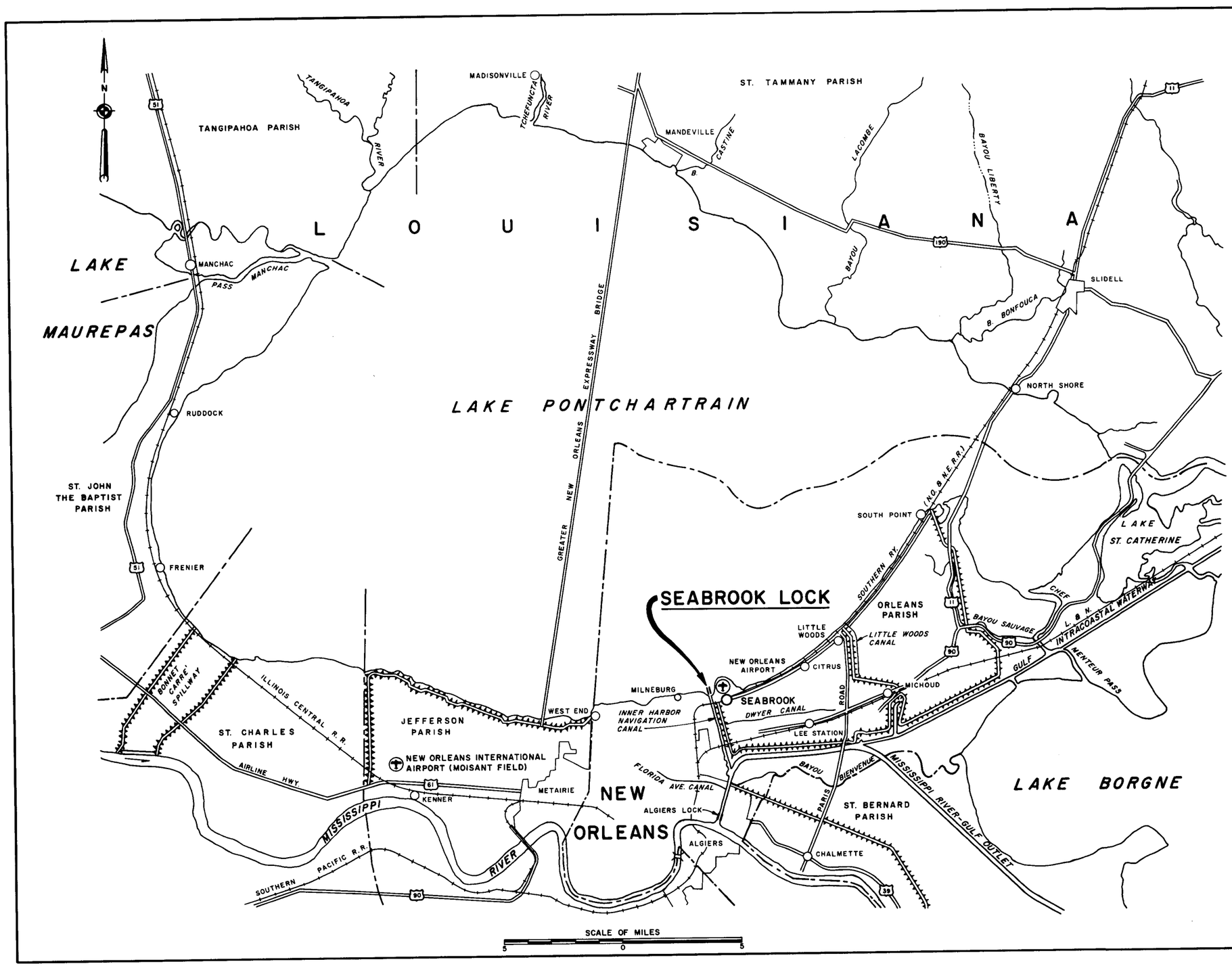
OPERATION AND MAINTENANCE

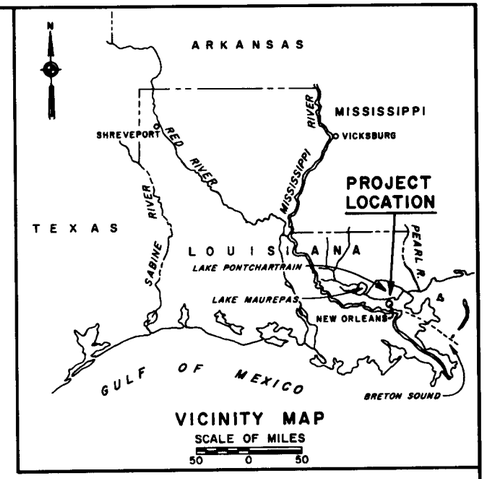
79. Maintenance will consist generally of repairs to lock components and maintenance of cover stone layers on the dam. Operation of the lock will be in accordance with standard operating procedures modified as described in Appendix D because of the dual operational function peculiar to this lock. Operation and maintenance will be under the supervision of the Operations Division, New Orleans District, Corps of Engineers. The lock will be staffed and operational on a 24-hour year round basis. The force required to operate and maintain the lock is estimated as follows:

No.	Position	Grade
1	Lockmaster	S-8
1	Lockmaster	S-6
5	Lock operators	W-8
5	Lock operators	W-7
2	Lock equipment repairers	W-8
1	Clerk	GS-3

RECOMMENDATION

80. It is recommended that the project plan for Seabrook Lock presented in this design memorandum be approved, and that further detailed design related to this unit of the Lake Pontchartrain, Louisiana and Vicinity hurricane protection project proceed on the basis thereof.





LAKE PONTCHARTRAIN, LOUISIANA AND VICINITY
AND MISSISSIPPI RIVER - GULF OUTLET, LOUISIANA

SEABROOK LOCK

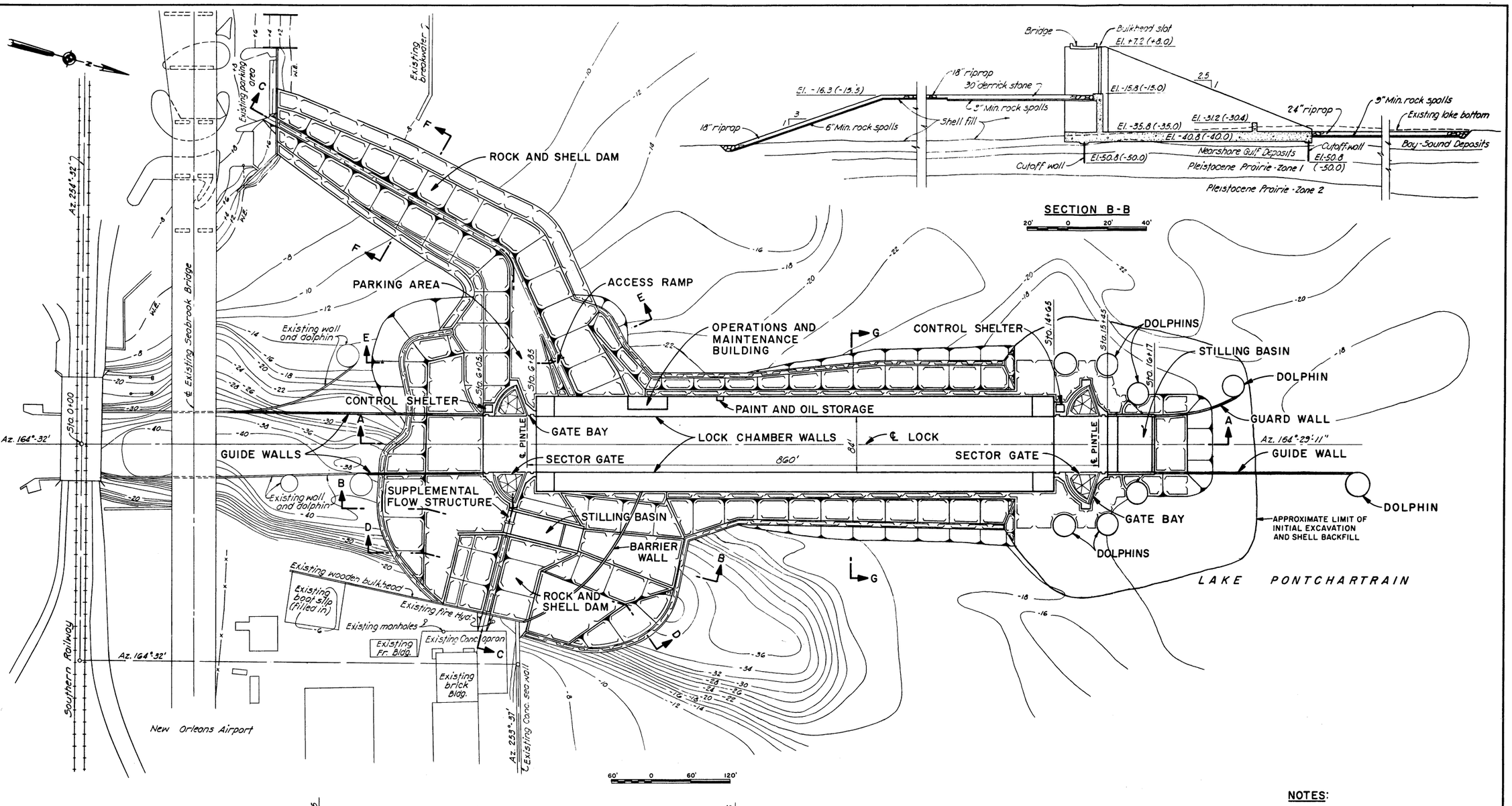
DESIGN MEMORANDUM NO. 1, GENERAL

LOCATION PLAN AND VICINITY MAP

SCALES AS SHOWN

U.S. ARMY ENGINEER DISTRICT, BUFFALO CORPS OF ENGINEERS, U.S. ARMY BUFFALO, N.Y.	U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS, U.S. ARMY NEW ORLEANS, LA.
DATE: JAN. 1969	FILE NO. H-2-23683

PLATE 1



NOTES:

For sections C-C, D-D, E-E, F-F and G-G, see Plate 3

Elevations are in feet, Mean Sea Level except those in parentheses which are in feet, Mean Low Gulf

LAKE PONTCHARTRAIN, LOUISIANA AND VICINITY
AND MISSISSIPPI RIVER - GULF OUTLET, LOUISIANA

SEABROOK LOCK

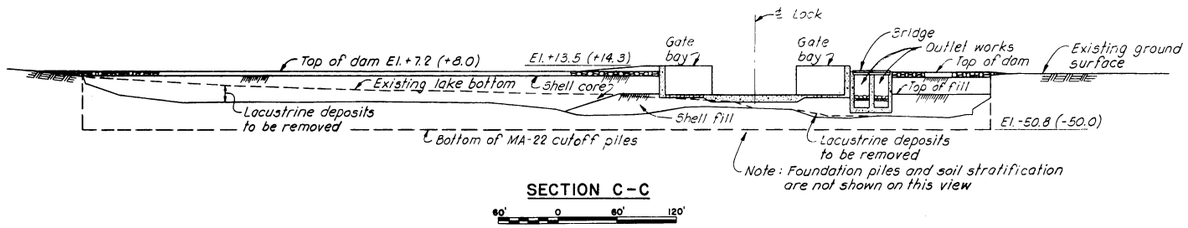
DESIGN MEMORANDUM NO. 1, GENERAL

PLAN OF LOCK

SCALES AS SHOWN

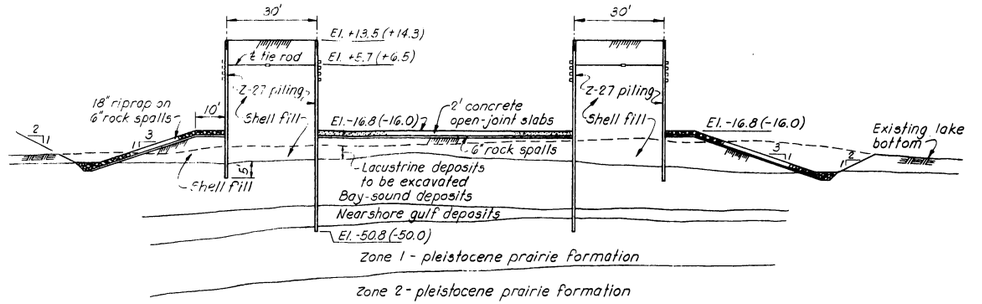
U.S. ARMY ENGINEER DISTRICT, BUFFALO CORPS OF ENGINEERS, U.S. ARMY BUFFALO, N.Y.	U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS, U.S. ARMY NEW ORLEANS, LA.
DATE: JAN. 1969	FILE NO. H-2-23683

PLATE 2



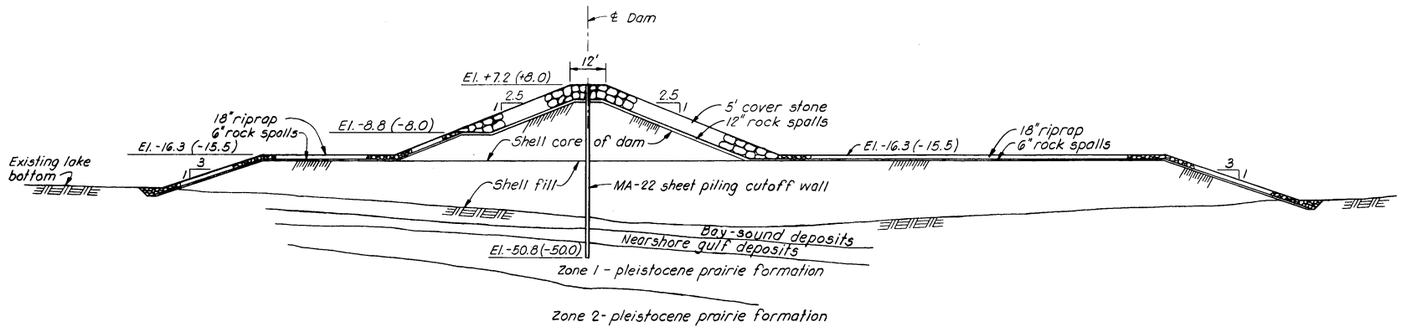
SECTION C-C

80' 0 80' 120'



SECTION G-G

20' 0 20' 40'



SECTION D-D

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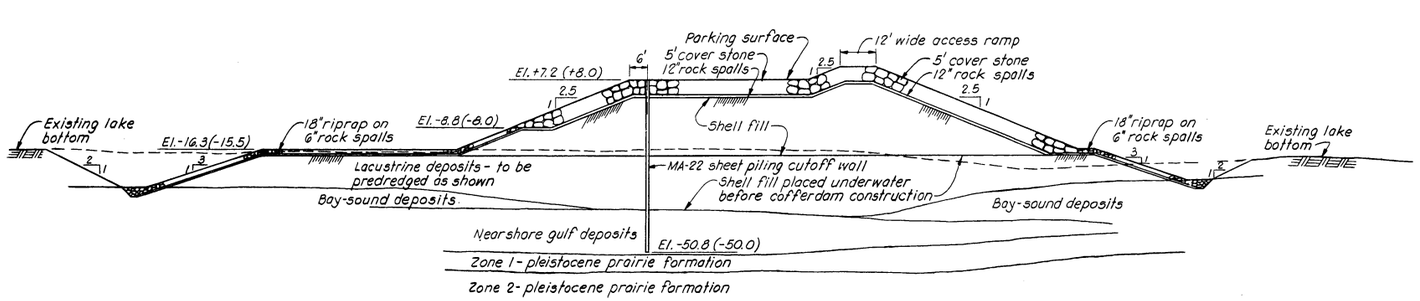

SECTION E-E

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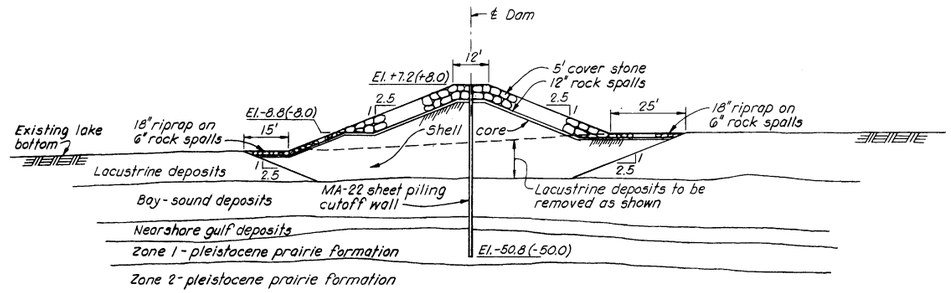

SECTION F-F

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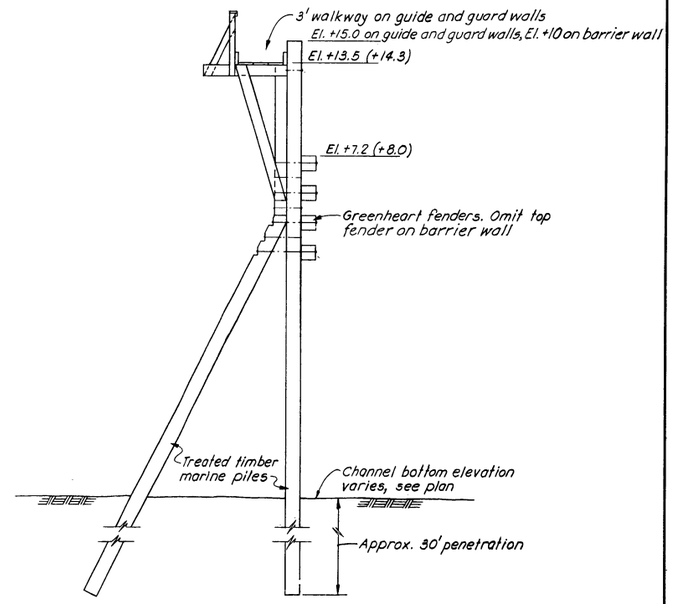


TYPICAL SECTION
THRU GUIDE WALL AND BARRIER WALL

4' 0 4' 8'

NOTE:

Elevations are in feet, Mean Sea Level except those shown in parentheses which are in feet, Mean Low Gulf.

LAKE PONTCHARTRAIN, LOUISIANA AND VICINITY
AND MISSISSIPPI RIVER - GULF OUTLET, LOUISIANA

SEABROOK LOCK

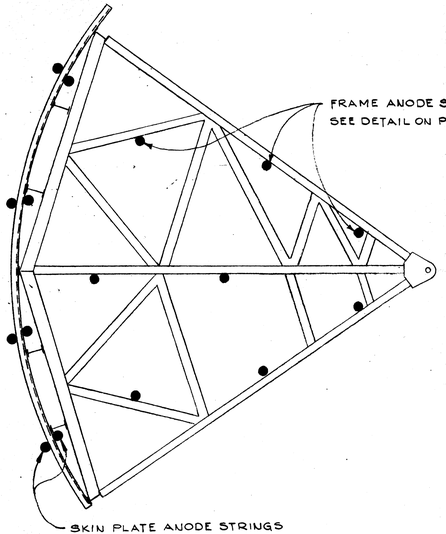
DESIGN MEMORANDUM NO. I, GENERAL

SECTIONS

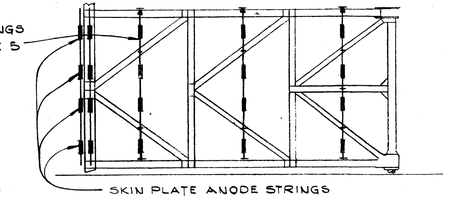
SCALES AS SHOWN

U.S. ARMY ENGINEER DISTRICT, BUFFALO CORPS OF ENGINEERS, U.S. ARMY BUFFALO, N.Y.	U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS, U.S. ARMY NEW ORLEANS, LA.
DATE: JAN. 1969	FILE NO. H-2-23683

PLATE 3



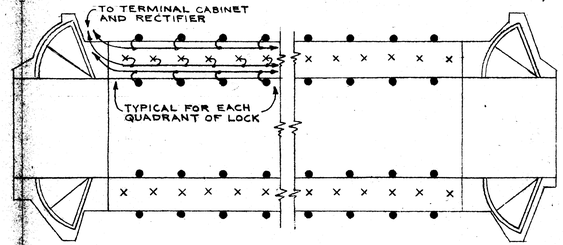
PLAN



SECTIONAL ELEVATION

TYPICAL SECTOR GATE

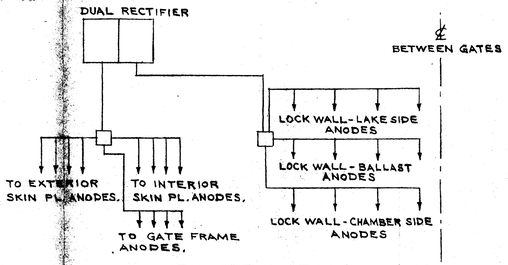
NO SCALE



X ANODES INSTALLED IN UNDISTURBED SOIL BETWEEN PILE WALLS.
● ANODES IN PERFORATED PLASTIC PIPE GUIDES ON PILE WALLS.

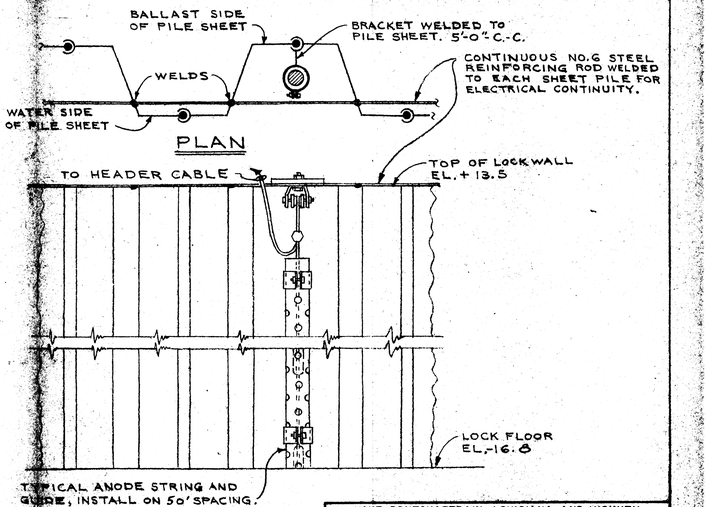
LOCK PLAN

NO SCALE



WIRING DIAGRAM

NO SCALE



ELEVATION

TYPICAL ANODE INSTALLATION ON LOCK WALL

NO SCALE

NOTE:
Elevations are in feet Mean Sea Level.

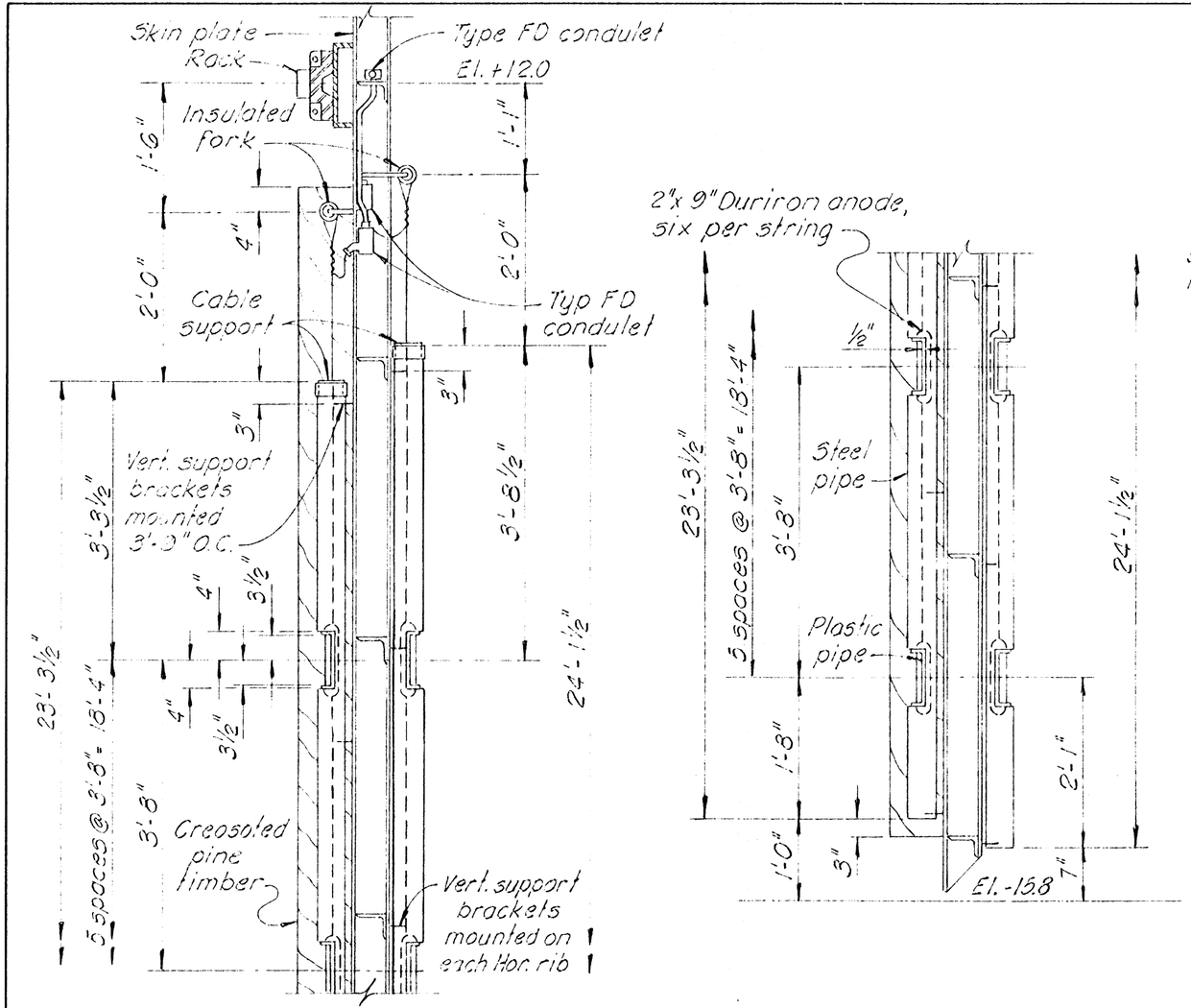
LAKE PONTCHARTRAIN, LOUISIANA AND VICINITY
AND MISSISSIPPI RIVER - GULF OUTLET, LOUISIANA

SEABROOK LOCK
DESIGN MEMORANDUM NO. 1, GENERAL

CATHODIC PROTECTION

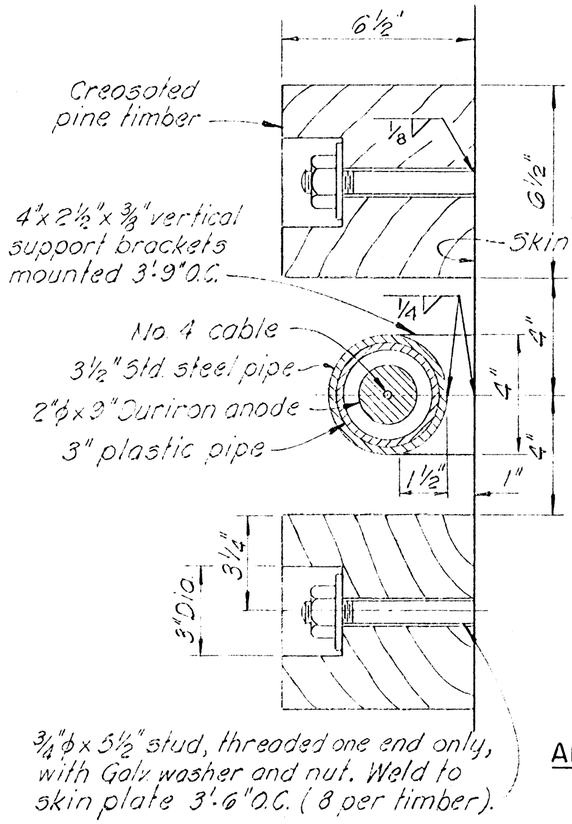
U.S. ARMY ENG. DIST. MOBILE, ALA.	U.S. ARMY ENG. DIST. NEW ORLEANS, LA.
DATE: JAN. 1963	FILE NO. H-2-23683

PLATE 4



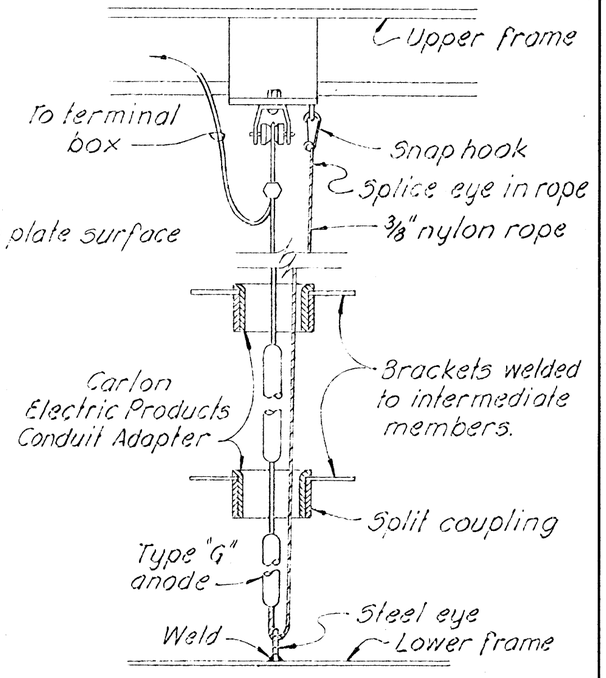
MOUNTING FOR SKIN PLATE ANODE STRINGS

SCALE $\frac{3}{4}$" = 1'-0"



SKIN PLATE MOUNTING DETAIL

SCALE 3" = 1'-0"



CABLE SUSPENSION AND STAY LINE ANCHORAGES FOR FRAME ANODE STRINGS

NOT TO SCALE

Note: Elevations are in Feet Mean Sea Level

LAKE PONTCHARTRAIN, LOUISIANA AND VICINITY
AND MISSISSIPPI RIVER - GULF OUTLET, LOUISIANA

SEABROOK LOCK
DESIGN MEMORANDUM NO. 1, GENERAL

CATHODIC PROTECTION DETAILS

U.S. ARMY ENG. DISTRICT MOBILE, ALA.	U.S. ARMY ENG. DISTRICT NEW ORLEANS, LA.
DATE: JAN. 1969	FILE NO. H-2-23683

LAKE PONTCHARTRAIN, LOUISIANA AND VICINITY
AND
MISSISSIPPI RIVER - GULF OUTLET, LOUISIANA

SEABROOK LOCK
DESIGN MEMORANDUM NO. 1, GENERAL

APPENDIX A
CONTROLLING ELEVATION OF SEABROOK LOCK

New Orleans District letter report, LMNED-PP, 19 October 1966, subject: Lake Pontchartrain, La. and Vicinity - Report on Controlling Elevation of Seabrook Lock / LMVD 1st Ind. dated 9 November 1966 / OCE 2d Ind. dated 12 January 1967 / LMVD 3d Ind. dated 18 January 1967

LMVED-TD (NOD 19 Oct 66) 3d Ind
SUBJECT: Lake Pontchartrain, La. and Vicinity - Report on Controlling Elevation of Seabrook Lock

DA, Lower Miss. Valley Div, CE, Vicksburg, Miss. 39180 18 Jan 67

TO: District Engineer, New Orleans District, ATTN: LMNED-PP

Referred to note approval of controlling elevation of 7.2 feet msl for Seabrook, unless modified by studies now underway.

FOR THE DIVISION ENGINEER:

A. J. DAVIS
Chief, Engineering Division

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P. O. BOX 60267
NEW ORLEANS, LOUISIANA 70160

IN REPLY REFER TO
LMNED-PP

19 October 1966

SUBJECT: Lake Pontchartrain, La. and Vicinity - Report on Controlling Elevation of Seabrook Lock

TO: Acting Division Engineer, Lower Mississippi Valley
ATTN: LMVED-TD

1. Authority and scope. This report is prepared in accordance with instructions contained in LMVED-TD 1st Indorsement dated 8 December 1965 to LMNED-PP letter dated 5 November 1965, subject "Revised Outline of Planning Procedure for 'Lake Pontchartrain, La. & Vicinity,' project," and in paragraph 9.b. of EM 1110-2-1150 dated 1 July 1966, for the purpose of establishing the bases for changing the controlling elevation of the authorized Seabrook Lock from that specified in the project document.

2. Project authorization. The "Lake Pontchartrain, La. and Vicinity," project was authorized by the Flood Control Act of 1965 (Public Law 89-298, approved 27 October 1965), substantially in accordance with the recommendations of the Chief of Engineers in his report printed as House Document No. 231, 89th Congress.

3. Project description. The project consists of two independent features: the Lake Pontchartrain Barrier Plan and the Chalmette Area Plan. Only the former is pertinent to this report. The Lake Pontchartrain Barrier Plan will serve to protect areas contiguous to the shores of Lake Pontchartrain from flooding by hurricane surges. The keystone around which the plan is built is the Lake Pontchartrain barrier--a system of levees and control structures, the purpose of which is to limit uncontrolled entry of hurricane tides into Lake Pontchartrain, while preserving navigation access. The barrier would comprise enlarged embankments along the existing seaward levee system, new embankment extending to high ground on the north side of the Rigolets with regulating tidal and navigation structures in the Rigolets and Chef Menteur Pass, and a dual-purpose navigation lock in the Inner Harbor Navigation Canal (IHNC) at Seabrook. In addition to the barrier, additional protective works consisting of new lakeshore levees in St. Charles Parish and the Citrus and New Orleans East areas of Orleans Parish, and enlargement or strengthening of existing protective works in Jefferson and Orleans Parishes and at Mandeville will be provided (see incl 1).

4. Need for Seabrook Lock. Prior to construction of the Mississippi River-Gulf Outlet (MR-GO), the salinity regimen in Lake Pontchartrain was largely controlled by the interaction between surface runoff entering it, and tidal inflows from Lake Borgne via the Rigolets and Chef Menteur Pass. The 30-foot deep IHNC channel (see incl 2) was connected to Lake Borgne by the Gulf Intracoastal Waterway (GIWW) through the Rigolets and Chef Menteur Pass (see incl 1), but, because of the relatively small, shallow cross section (12' by 125') of the Waterway, this connection exerted little influence on salinities in Lake Pontchartrain. Construction of the MR-GO established a large, deep (36' by 500') direct connection with the highly saline waters of Breton Sound. Tidal flow in the MR-GO reaches Lake Pontchartrain via the IHNC, and salinities in the lake and in the marsh adjacent to the MR-GO have increased significantly since its completion. Unless means are provided to restore a favorable salinity regimen, major damage to marine life in the lake and in the marsh traversed by the MR-GO may be anticipated.

5. A related problem deriving from the construction of the MR-GO is the generation of excessive tidal currents in the IHNC. These increased currents produce navigation difficulties and aggravate scour problems at bridges and along harbor developments.

6. The problems described above relate to normal tidal conditions, and even in the absence of hurricane effects, control works in mitigation are warranted.

7. As alluded to previously, the Lake Pontchartrain Barrier Plan is based upon limiting the entry of hurricane-driven waters into Lake Pontchartrain. In order that this may be accomplished, the MR-GO - IHNC link must be controlled. Further, some means for controlling flow from Lake Pontchartrain into the IHNC during hurricanes which produce conditions critical to the south shore of Lake Pontchartrain is essential.

8. Study of various alternatives leads to the conclusion that control of salinity in Lake Pontchartrain, management of excessive currents in the IHNC, and control of flow from the canal to Lake Pontchartrain and vice versa during hurricane periods can be best achieved by a control structure at Seabrook. Inasmuch as navigation between Lake Pontchartrain and the IHNC must be preserved, a lock is essential.

9. Description of Seabrook Lock (as authorized). The lock as authorized would have a concrete chamber 800 feet long and 84 feet wide with sill elevation at -15.8 feet m.s.l. Gates would be of the 60° radial type. The landward gate bay structure would be connected to shore by a rockfill embankment. The top elevations of the rockfill embankment and the landward gate bay and radial gates would be 13.2 feet m.s.l.

10. Considerations involved in selecting the controlling elevation of Seabrook Lock. The term "controlling elevation" as used herein refers to the elevation at which uncontrolled overflow of the Seabrook structure will commence. The structure may be thought of as having two distinct parts--the lock structure proper, consisting of the gate bays, gates and lock chamber, and the rock dike. In considering uncontrolled overflow of the structure, only the rock dike should be considered inasmuch as the required elevations of the chamber walls, gates, and gate bays must be based on considerations relating to the safe and efficient operation of the lock under various conditions, whereas the elevation of the rock dike may be determined on the basis of how well it will serve hurricane flood control objectives. As will be shown later herein, factors relating to the safe and efficient operation of the lock will require top elevations for the walls, gates, and gate bay which are essentially confining insofar as design hurricane surges are concerned. Thus uncontrolled overflow will involve the rock dike only and, as a practical matter, the controlling elevation of the structure will be equal to the crest elevation of the rock dike. This report will be limited in scope to fixing the crest elevation of the rock dike; elevations relating to the lock proper and the bases therefor will be established in the general design memorandum for the lock.

11. In the studies which led to authorization of the Seabrook Lock, it was considered that, irrespective of any requirements imposed by considerations of hurricane control, the lock, in order to be operable for navigation on a full-time basis (exclusive of major storms and hurricanes), would require a controlling elevation of 8.0 feet m.l.g. (7.2 feet m.s.l.). This elevation was based on the assumption that the lock should be usable for any combination of tides up to three feet and winds up to 25 m.p.h. Based on the conclusion that any interchange of flow between Lake Pontchartrain and the IHNC during a hurricane should be prevented, the controlling elevation was set at 13.2 feet m.s.l.--the elevation required to prevent overtopping of the rock dike and lock by a tidal surge resulting from passage of the standard project hurricane (SPH) critical to the IHNC; i.e., overtopping from the Canal side. The probable crest elevation on the Lake Pontchartrain side, resulting from passage of the SPH on a track critical to the south shore, including wind setup and wave runup, would be some two feet lower.

12. The passage of hurricane "Betsy" in September 1965 demonstrated that, under certain conditions, permitting flow to enter Lake Pontchartrain from the IHNC is advantageous. "Betsy's" surge crested at approximately 11 feet m.s.l. at the junction of the Canal and the MR-GO, while at Seabrook the crest stage was about 6 feet m.s.l.

13. Flow computations in the IHNC for passage of the SPH (using latest U. S. Weather Bureau hurricane parameters) on a path critical to the IHNC, assuming that the Seabrook structure is built so that the rock dike overtops at elevation 7.2 feet m.s.l., indicate that a discharge of 27,000 c.f.s. would flow from the IHNC into Lake Pontchartrain at the crest of the hurricane surge. The water surface elevations at the MR-GO junction and at Seabrook (canal end of the lock) would be 14.0 feet m.s.l. and 11.5 feet m.s.l., respectively. The profiles of the water surface between these two points for both a confining structure at Seabrook and one which would overtop at elevation 7.2 feet m.s.l. are shown on incl 3. In addition to reducing the required levee grades on the IHNC, the overtopping structure would reduce flood damages to industrial plants along the Canal which are located outside the levee system.

14. With a controlling elevation of 7.2 feet m.s.l. for the Seabrook structure, water will flow from the IHNC into the lake for a period of about 15 hours during the passage of the SPH as described in paragraph 13 above. This inflow would raise the average lake level by about 0.05 foot. The increase would have no significant effect on grade requirements for the lakefront levee systems.

15. Storm paths other than that critical to the IHNC can produce higher stages in the lake than in the canal. With the barrier in place, however, the peak stillwater elevation lakeward of Seabrook for the SPH critical to the south shore of Lake Pontchartrain would be about 7 feet m.s.l. Thus overtopping from the lake into the canal would be limited to wave action only. Inasmuch as this overtopping would occur at a time when the winds would be tending to reduce stages in the canal, it would be of little significance.

16. Lowering the controlling elevation below 7.2 feet m.s.l. would further reduce the stage in the canal at Seabrook. The point of diminishing returns in this regard is largely reached, however, at the crest elevation of 7.2 feet m.s.l., since, to achieve significant lowerings in the water surface at the lakeward end of the canal, a substantial additional lowering of the dike would be required. On the other hand, any substantial reduction in the crest of the rock dike below elevation 7.2 feet m.s.l. would be undesirable for a number of

reasons. First, it would result in a measurable increase in the design levels of Lake Pontchartrain with a corresponding increase in the grades for the lakefront levee systems. Because of the length of levees involved in these systems, the costs for effecting even a small increase in grade would be excessive when compared to the benefits which would result in the IHNC. Second, it would place the crown of the rock dike below the maximum stillwater level in Lake Pontchartrain for major hurricanes on tracks critical to the south shore of the lake and permit direct overflow of the dike to the detriment of conditions in the IHNC. Third, it would subject the dike to overtopping by waves for a number of combinations of non-hurricane winds and tides. Normal access to the lock for operating personnel will be along the crown of the dike and such overtopping would be most undesirable. Finally, the dike would have little or no freeboard over tidal elevations which are experienced outside of the hurricane season every year: sustained east and southeast winds of moderate velocity may be expected to generate tidal stages between 4 and 5 feet m.s.l. at least once each year.

17. Inasmuch as the above considerations rule out a controlling elevation lower than 7.2 feet m.s.l. and since a higher controlling elevation would result in higher stages on the IHNC lakeward of the MR-GO without offering advantages elsewhere, a controlling elevation of 7.2 feet m.s.l. is optimum insofar as limitation of hurricane-generated flows in the IHNC is concerned.

18. Insofar as the requirements of navigation are concerned, consideration must be given to needs arising out of lock operation under normal or average conditions as well as those from combinations of abnormal winds and/or tides. The top of the lockwalls and gates should be at least 10 feet above the normal high tides to facilitate mooring of light-loaded barges in day-to-day operations. Further, the lockwalls should be high enough to permit personnel to work thereon under the most extreme conditions of wind and tide for which the lock is likely to be used; similarly, the gates should be high enough to permit use of the gate walkways under such conditions. The above considerations require that the tops of the lockwalls and gates be well above 7.2 feet m.s.l. They relate to the lock structure only, however, and impose no limitation on the elevation of the rock dike. Overtopping of the rock dike with crest at elevation 7.2 feet m.s.l. would occur infrequently, and would not seriously impede navigation when it does occur.

19. With the crown of the rock dike at elevation 7.2 feet m.s.l. maximum velocities in the IHNC for passage of the SPH on the track critical to the Canal would range from about 1.5 f.p.s. in the Canal proper to 5 f.p.s. at the bridges. Considering the short interval of time during which these velocities would obtain, major scour problems are not anticipated.

20. Implications to local cooperation involved in lowering the controlling elevation of Seabrook Lock. In the survey report on which project authorization is based, the provision of a navigation lock at Seabrook for mitigation of undesirable effects resulting from the construction of the MR-GO was recognized to be a Federal responsibility, and a cost estimate for a lock with a controlling elevation of 7.2 feet m.s.l. (which elevation was considered adequate to meet the needs of navigation) was prepared to establish the basic Federal responsibility under the navigation function. A second cost estimate for a lock with a controlling elevation of 13.2 feet m.s.l. (which elevation was considered necessary to meet the needs of hurricane flood control) also was prepared. The difference between these two estimated costs was then taken to be the added cost for hurricane flood control. The survey report recommended construction of the Lake Pontchartrain Barrier Plan subject to the condition, inter alia, that local interests contribute not less than 30% of the first cost of the project including the hurricane flood control increment of the cost of the Seabrook Lock as computed above. The local interest share of the increment, based on survey report estimates, was $120,000.

21. The recommendations relative to Seabrook Lock contained in the survey report were approved by the Division Engineer, Lower Mississippi Valley, the Board of Engineers for Rivers and Harbors, and the Chief of Engineers. The Bureau of the Budget, however, questioned the allocated cost, noted that standard methods of cost allocation appeared to be inapplicable, and recommended that the cost be allocated equally between the navigation and hurricane flood control functions. Under these cost-sharing arrangements, local interests are required to contribute 30% of half of the total construction cost for the lock with controlling elevation of 13.2 feet m.s.l., rather than 30% of the added cost for such a lock over a similar lock with controlling elevation 6 feet lower. Based on survey report estimates, this results in additional costs to local interests of $687,000. In transmitting the report of the Chief of Engineers to Congress, the Secretary of the Army concurred in the view of the Bureau of the Budget with "...the understanding that this apportionment of costs would not unduly delay construction...." Authorization of the project by Public Law 89-298 specified that the recommendations of the Secretary of the Army with respect to Seabrook Lock would apply.

22. Views of local interests. By letter dated 13 April 1966, the State of Louisiana, Department of Public Works, the agency appointed by the Governor of Louisiana to coordinate the local cooperation on the project, informed the District Engineer, U. S. Army Engineer District, New Orleans, that local interests favored a reduction in the controlling elevation of the Seabrook Lock, and were opposed to the local cooperation requirements for the lock as authorized. A copy of the letter is inclosed (see incl 4). Despite this opposition, the Orleans Levee District, the agency appointed by the Governor of Louisiana to furnish the local cooperation required for the project, on 28 July 1966 adopted an acceptable act of assurance covering the local cooperation for the entire Lake Pontchartrain Barrier Plan. The act of assurance was accepted by and for the United States on 10 October 1966.

23. Discussion. The approaches of the reporting officers and the Bureau of the Budget in determining the local cooperation for the Seabrook Lock were radically different. The reporting officers hold, in effect, that the needs for mitigation of MR-GO effects, which are assignable to the navigation function, are prior to those of hurricane flood control and should be assumed to have been met before hurricane flood control requirements are considered. This is essentially equivalent to assuming that a lock capable of meeting the needs for mitigation is in place before hurricane flood control requirements are considered and that the cost for meeting these requirements is limited to the cost of any modifications to the basic lock which are necessary to provide for the hurricane flood control requirements (except, of course, that the cost advantage of concurrent construction is enjoyed). The Bureau of the Budget takes a contrary view, concluding that the lock is needed as much for one function as the other and rejecting the reporting officers' incremental approach to providing for hurricane flood control requirements.

24. In transmitting the survey report to Congress, the Secretary of the Army concurred in the views of the Bureau of the Budget in regard to the requirements of local cooperation for Seabrook Lock with the proviso that "...this apportionment of costs would not unduly delay construction,...." Accordingly, it would appear that an opportunity for modifying the authorized requirements of local cooperation for the lock, without further Congressional action, would arise only in the event that local interests refused to provide the required assurances of local cooperation for the project and cited as the reason therefor their dissatisfaction with the cost-sharing arrangements for Seabrook Lock. Inasmuch as local interests have provided the requisite assurances of local cooperation for the entire barrier plan, the requirements authorized for the Seabrook Lock will have to remain in force unless and until they are modified by the Congress.

25. The question has been raised as to whether lowering the controlling elevation of the Seabrook Lock involves a modification of the authorized local cooperation which is beyond the discretionary authority of the Chief of Engineers (see LMVED-TD letter to OCE dated 8 December 1965 subject "Lake Pontchartrain and Vicinity, Louisiana," copy of which is inclosed, incl 5). This concern would appear to be without foundation. In effect, the authorizing law directs that a lock capable of serving both the needs of hurricane flood control and mitigation of MR-GO effects be designed and constructed and that the costs for the lock be shared equally by the navigation and hurricane flood control functions. Thus, the requirements of local cooperation for the lock are clearly independent of its physical configuration and controlling elevation.

26. Inasmuch as the requirements of local cooperation for the Seabrook Lock as authorized are independent of the controlling elevation of the lock, selection of the controlling elevation may be based on purely technical considerations. A departure from the project document plan based on such considerations is clearly within the discretionary authority of the Chief of Engineers.

27. Conclusions. Based on the material presented herein, it is concluded that:

a. A change in the controlling elevation of Seabrook Lock from the authorized elevation of 13.2 feet m.s.l. to elevation 7.2 feet m.s.l. is both feasible and desirable. The reduction in controlling elevation will lower the required levee grades on the IHNC north of its junction with the MR-GO and reduce flood damages to industries located outside the levee system on the banks of the canal for hurricanes on tracks critical to the canal. It will not result in any significant increase in average lake levels during hurricanes, and thus will have no practical effect on levee grade requirements for the lakefront levee systems.

b. A controlling elevation of 7.2 feet m.s.l. is optimum. A higher controlling elevation would increase the levee grade requirements on the IHNC and damage riparian industries outside the levee system without producing any compensating advantage. A materially lower controlling elevation would be clearly undesirable. It would significantly raise average lake levels during hurricanes and thus require upward revision of the grades of all the lakefront protective systems, while producing little additional reduction of stages in the IHNC.

LMNED-PP 19 October 1966

SUBJECT: Lake Pontchartrain, La. and Vicinity - Report on Controlling Elevation of Seabrook Lock

c. The requirements of local cooperation for the Seabrook Lock as contained in the authorizing law are fixed and can only be changed by further action on the part of the Congress.

d. The authorized requirements of local cooperation for the Seabrook Lock are independent of the controlling elevation of the lock.

e. The selection of a controlling elevation for the Seabrook Lock involves technical considerations only, and a change in controlling elevation from that contained in the survey report on which authorization is based may be treated as a departure from the project document plan within the discretionary authority of the Chief of Engineers.

28. Recommendations. It is recommended that the Seabrook Lock be designed with a controlling elevation of 7.2 feet m.s.l.; that the change in controlling elevation be covered as a departure from the project document plan in the general design memoranda for the Lake Pontchartrain Barrier Plan and the Seabrook Lock; and that this report be included as an appendix to both memoranda.

5 Incl (quint)
1. General map, file No. H-2-24040/plate 1
2. Map IHNC, file No.H-2-24040/plate 2
3. Profile, IHNC, file No. H-2-24040/plate 3
4. DPW ltr dtd 13 Apr 66
5. LMVED-TD ltr dtd 8 Dec 66

THOMAS J. BOWEN
Colonel, CE
District Engineer

① Engrg
② Real Estate

LMVED-TD (NOD 19 Oct 66) 1st Ind
SUBJECT: Lake Pontchartrain, La. and Vicinity - Report on Controlling Elevation of Seabrook Lock

DA, Lower Miss. Valley Div, CE, Vicksburg, Miss. 39180 9 Nov 66

TO: Chief of Engineers, ATTN: ENGCW-V/ENGCW-EH/ENGCW-EZ/ENGRE-AP

1. Subject report is forwarded for review and approval pursuant to para 9, ER 1110-2-1150. The recommendations of the District Engineer in para 28 are concurred in.

2. The location of Seabrook Lock with adjoining rock dike is shown on Plate 4 of Interim Survey Report dated 21 Nov 62 and forwarded by our 1st Ind, LMVGN, dated 18 Jan 63. The Survey Report was printed as HD No. 231, 89th Congress, 1st Session. Plate 4 was not included in the printed document.

3. The correspondence referred to in para 1, basic communication, instructed the District to make a study to determine the controlling elevation for Seabrook Lock and to prepare a letter report, discussing their findings, for submission to your office.

FOR THE ACTING DIVISION ENGINEER:

A. J. DAVIS
Chief, Engineering Division

5 Incl (quad)
wd 1 cy ea

Copy furnished:
New Orleans District
ATTN: LMNED-PP

ENGCW-EZ (19 Oct 66) 2nd Ind
SUBJECT: Lake Pontchartrain, La. and Vicinity - Report on Controlling Elevation of Seabrook Lock

DA, CofEngrs, Washington, D. C., 20315, 12 January 1967

TO: Division Engineer, Lower Mississippi Valley Division

The controlling elevation of 7.2 feet m.s.l. for the proposed Seabrook Lock appears reasonable and is approved, subject to consideration of such modifications as may be indicated by the results of surge studies now under way on the effects of the Mississippi River - Gulf Outlet and surge studies for south shore Lake Pontchartrain. These studies are referred to in paragraph 8d(7) of Design Memorandum No. 1, Hydrology and Hydraulic Analysis, Part I, Chalmette and paragraph 13 of Design Memorandum No. 3, Chalmette Area Plan, General Design.

FOR THE CHIEF OF ENGINEERS:

Herman B. Willis

wd Incl

WENDELL E. JOHNSON
for Chief, Engineering Division
Civil Works

PROTECTIVE WORKS

	EXISTING	IMPROVEMENTS AUTHORIZED
Embankments	▬▬▬▬	▬▬ Barrier – low level plan
Lock	▷	➤
HURRICANE BARRIER STRUCTURE:		
Rigolets		ⓘ
Chef Menteur		Ⓗ
Drainage Structure High level or barrier		H

L A K E P O N T C H A R T R A I N

Mandeville

GREATER NEW ORLEANS BRIDGE

Seabrook Lock

Seawall

Inner Harbor Navigation Canal

ST CHARLES PARISH

JEFFERSON PARISH

NEW ORLEANS

CITRUS

NEW ORLEANS EAST

South Point

PARIS ROAD

Michoud

CHALMETTE

Violet

B. Dupre

BONNET CARRÉ SPILLWAY

MISSISSIPPI RIVER

GULF INTRACOASTAL WATERWAY

MISSISSIPPI RIVER – GULF OUTLET

LOWER B.

B. Bienvenue

CHEF MENTEUR PASS

RIGOLETS

L A K E B O R G N E

90

11

N

SCALE OF MILES

5 0 5

ARKANSAS

SHREVEPORT

RED RIVER

MISSISSIPPI RIVER

Vicksburg

MISSISSIPPI

LOCATION

TEXAS

LOUISIANA

SABINE RIVER

PEARL R.

MISSISSIPPI R.-GULF OUTLET

NEW ORLEANS

BRETON SOUND

GULF OF MEXICO

VICINITY MAP

50 0 50Mi.

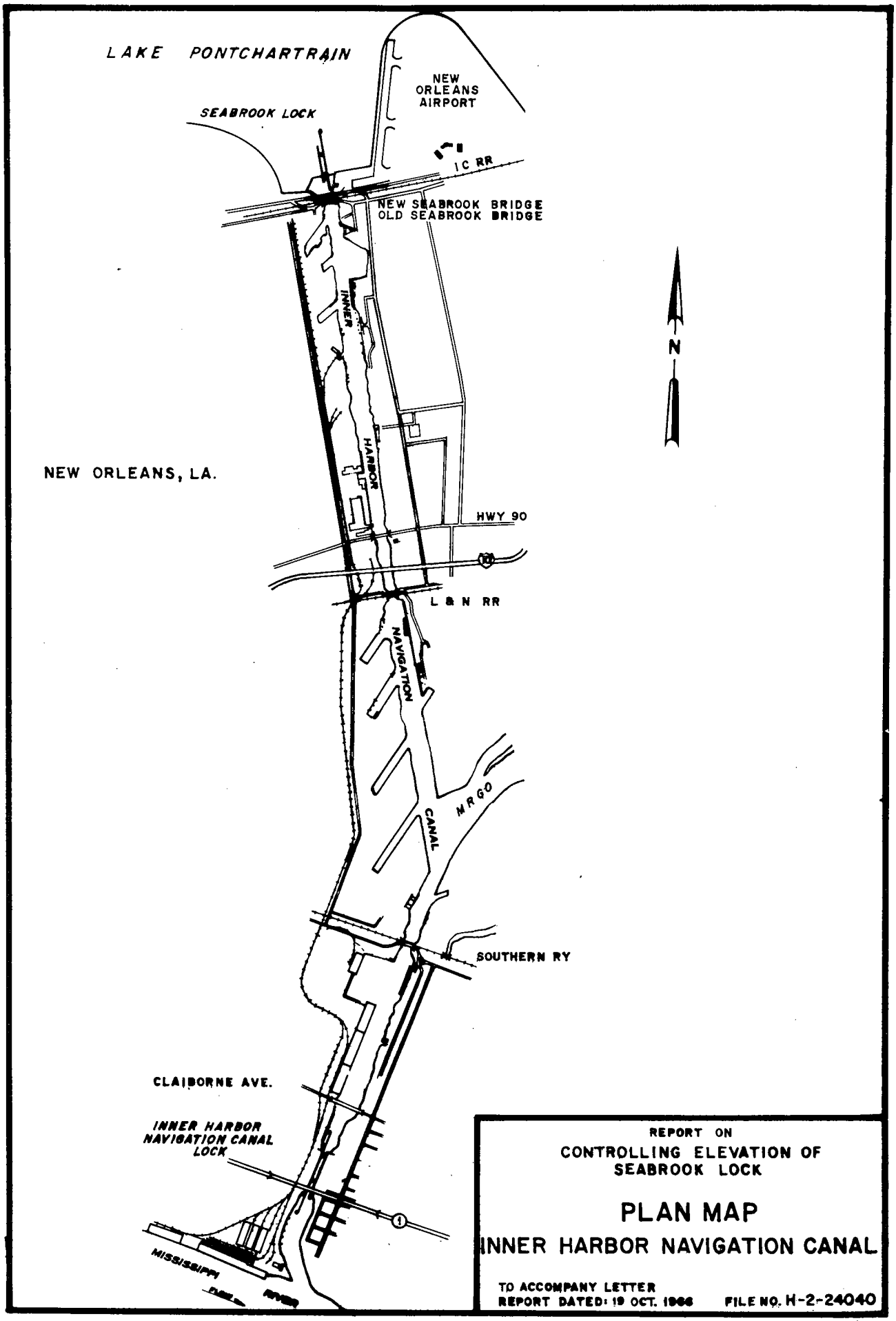
REPORT ON

CONTROLLING ELEVATION OF SEABROOK LOCK

GENERAL MAP

TO ACCOMPANY LETTER REPORT DATED: 19 OCT. 1966 FILE NO. H-2-24040

PLATE 1

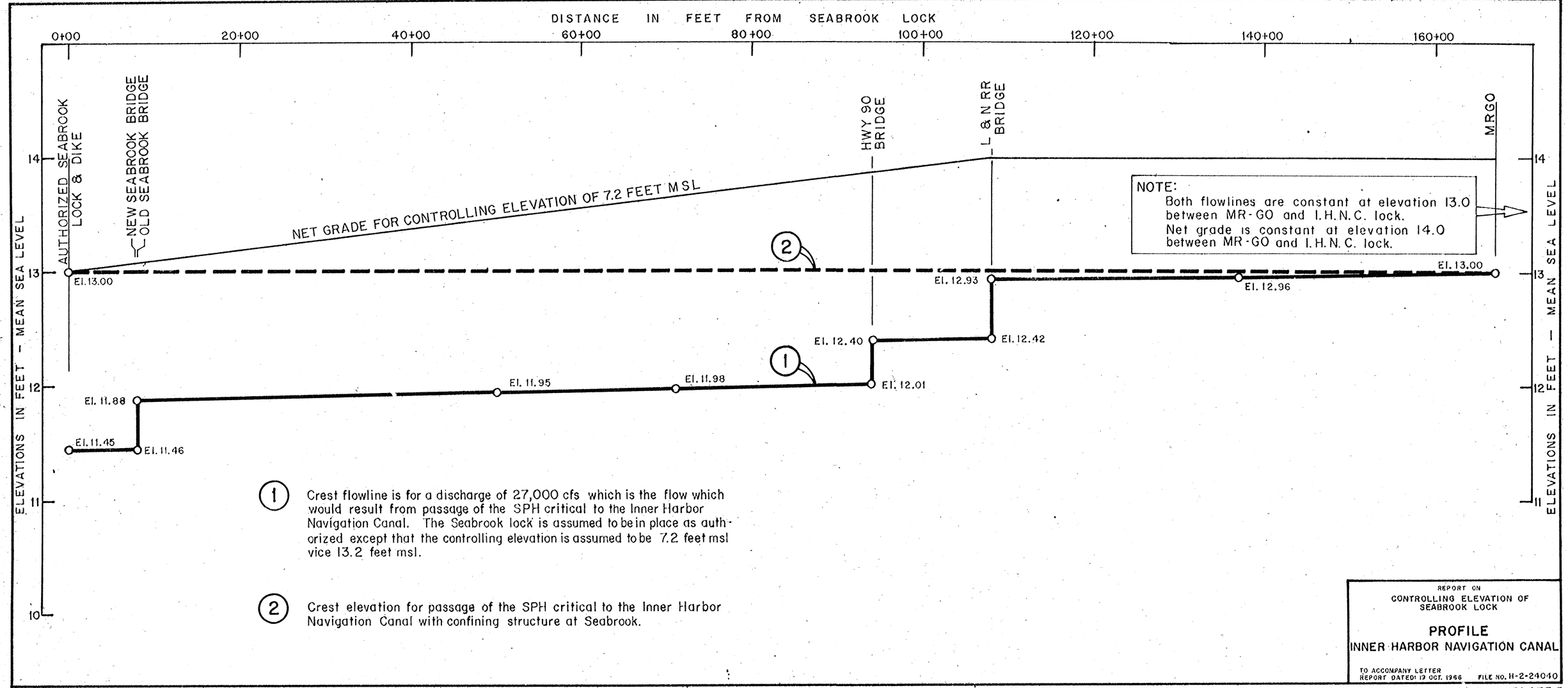


REPORT ON
CONTROLLING ELEVATION OF
SEABROOK LOCK

PLAN MAP
INNER HARBOR NAVIGATION CANAL

TO ACCOMPANY LETTER
REPORT DATED: 19 OCT. 1966 FILE NO. H-2-24040

PLATE 2



(1) Crest flowline is for a discharge of 27,000 cfs which is the flow which would result from passage of the SPH critical to the Inner Harbor Navigation Canal. The Seabrook lock is assumed to be in place as authorized except that the controlling elevation is assumed to be 7.2 feet msl vice 13.2 feet msl.

(2) Crest elevation for passage of the SPH critical to the Inner Harbor Navigation Canal with confining structure at Seabrook.

REPORT ON
CONTROLLING ELEVATION OF SEABROOK LOCK

PROFILE
INNER HARBOR NAVIGATION CANAL

TO ACCOMPANY LETTER REPORT DATED: 19 OCT. 1966 FILE NO. H-2-24040

PLATE 3

STATE OF LOUISIANA
DEPARTMENT OF PUBLIC WORKS
BATON ROUGE

April 13, 1966

ON GARY
DIRECTOR

Colonel Thomas J. Bowen
District Engineer
New Orleans District
Corps of Engineers, U.S. Army
P. O. Box 60267
New Orleans, Louisiana 70160

Dear Colonel Bowen:

As you know, the interim survey report for Lake Pontchartrain, Louisiana and Vicinity, recommended construction of a lock in Lake Pontchartrain near the terminus of the Inner Harbor Navigation Canal (Seabrook). The purposes of this lock are to alleviate undesirable current conditions in the canal generated by the Mississippi River-Gulf Outlet; provide for the preservation of a favorable salinity regimen in Lake Pontchartrain by permitting control of a tendency for the Mississippi River-Gulf Outlet to produce higher salinities in the lake; and for control of hurricane inflow. The interim survey report called for a lock with a controlling elevation of 13.2 feet above mean sea level, which elevation would not be exceeded by the stages expected to result from the passage of the design hurricane. The report further recommended that the costs of this feature chargeable to the hurricane project be limited to the differential in cost between the recommended lock and one with a controlling elevation based on Mississippi River-Gulf Outlet requirements alone (then estimated to be 7.2 above mean sea level). On the above basis, the costs chargeable to the hurricane protection project would have been $400,000 and the local cooperation would have amounted to $120,000.

In reviewing the interim survey report, the Bureau of the Budget recommended a change in the cost sharing specified in the report to provide for allocation of the costs equally between the navigation and hurricane protection functions. The Secretary of the Army agreed to the change with "... the understanding that this apportionment of costs would not unduly delay construction ..." The project, "Lake Pontchartrain, Louisiana and Vicinity," was ultimately authorized in accordance with this recommendation of the Secretary of the Army, resulting in an estimated additional cost to local interests of $687,000.

We understand that consideration is now being given, on technical grounds, to a reduction in the controlling elevation of the Seabrook Lock. We are of the opinion that such reduction is desirable. Hurricane "Betsy" demonstrated the advantages of having some outflow

Incl 4

from the canal under certain conditions, in that stages at the lake end of the canal were some 3 to 4 feet lower than those at the Inner Harbor Navigation Canal Lock as a result of outflow from the canal.

We are opposed to the local cooperation requirements for the Seabrook Lock as recommended by the Bureau of the Budget. We are of the opinion that the construction of a lock adequate to serve adequately the needs of navigation, lake ecology, and current regulation will also provide the degree of control of hurricane inflow required. The Mississippi River-Gulf Outlet project preceded the hurricane protection project. The need for current and salinity control was generated by the Mississippi River-Gulf Outlet, not by the hurricane protection project. It is only proper, therefore, that these needs be satisfied entirely under the Mississippi River-Gulf Outlet project, and that the question of assignment of some costs to the hurricane protection project be considered only if the facilities required to fulfill such needs fail to meet the requirements of the hurricane protection project. In the event that the latter should prove to be the case, we consider that the cost sharing should be along the lines specified in the interim survey report rather than those recommended by the Bureau of the Budget.

In view of the above, we consider that the cost sharing on the Seabrook feature as recommended by the Bureau of the Budget is improper, and we recommend that consideration be given to deleting or modifying, as appropriate, the present requirement for a local contribution toward the cost of construction of this feature.

Sincerely yours,

Calvin T. Watts

CALVIN T. WATTS
Assistant Director

/an

LMVED-TD 8 December 1965

SUBJECT: Lake Pontchartrain and Vicinity, Louisiana

TO: Chief of Engineers
ATTN: ENGCW-V/ENGCW-EH/ENGCW-EZ

1. The project for Lake Pontchartrain and Vicinity, Louisiana (hurricane protection) was authorized by the Flood Control Act of 1965 (PL 89-298) at an estimated Federal cost of $56,235,000 substantially in accordance with the recommendation of the Chief of Engineers in House Document 231, 89th Congress, except that the recommendation of the Secretary of the Army in that document shall apply with respect to the Seabrook Lock feature of the project. The Secretary of the Army recommended that the cost of the Seabrook Lock feature be allocated equally between navigation and hurricane protection purposes. The basis for this allocation of cost was that the lock would serve a dual purpose - mitigating anticipated adverse effects of the Mississippi River-Gulf Outlet navigation project, and serving as an element in the hurricane surge control project.

2. In view of Hurricane Betsy's experience, the District Engineer recognized the possibility that some benefits might be derived along the Inner Harbor Navigation Canal connecting the Mississippi River-Gulf Outlet and Lake Pontchartrain by reducing the controlling elevation of Seabrook Lock. By letter dated 19 October 1965, the District Engineer proposed to reduce the controlling elevation of Seabrook Lock from elevation 13.2 feet msl to 7.2 feet msl. His proposal was approved by our 1st indorsement dated 17 November 1965. Copies of basic letter and 1st indorsement are inclosed herewith for ready reference, copies having been previously furnished OCE to the attention of ENGCW-EH/ENGCW-EZ.

3. Construction of Seabrook Lock to elevation 7.2 feet msl would be a departure from the project document plan. Inasmuch as the lock would be a single-purpose structure for mitigation of effects caused by the Mississippi River-Gulf Outlet project its cost would be charged to that project and the allocation of costs recommended by the Secretary of the Army would be modified. This has raised the question as to whether

Incl 5 NOD, ATTN: LMNED-PP

LMVED-TD 8 December 1965
SUBJECT: Lake Pontchartrain and Vicinity, Louisiana

authority exists for modifying the project to the extent proposed in inclosed NOD letter of 19 October 1965 in light of the language contained in the Flood Control Act of 1965. In view of this uncertainty, and in the absence of more concrete support for the proposed modification, the District Engineer is being instructed to prepare a letter report taking into consideration all factors involving the modification, including technical data, the views of local interests, and the apportionment of costs between Federal and non-Federal interests. In compliance with paragraph 10, EM 1110-2-1150, the letter report will be forwarded to you with our recommendations for review and approval.

FOR THE DIVISION ENGINEER:

GEORGE B. DAVIS
Acting Chief, Engineering Division

1 Incl (dupe)
Cy ltr, LMNED-PP, NOD,
19 Oct 65 w/1st Ind,
LMVED-PH/LMVED-TD, LMVD,
17 Nov 65

Copy furnished:
NOD, ATTN: LMNED-PP

LAKE PONTCHARTRAIN, LOUISIANA AND VICINITY
AND
MISSISSIPPI RIVER - GULF OUTLET, LOUISIANA

SEABROOK LOCK
DESIGN MEMORANDUM NO. 1, GENERAL

APPENDIX B
DETERMINATION OF SUPPLEMENTAL FLOW AREA REQUIRED AT SEABROOK LOCK

APPENDIX B
DETERMINATION OF SUPPLEMENTAL FLOW AREA REQUIRED AT SEABROOK LOCK

1. General. The authorizing document provides for construction of a sector gated navigation lock at the Lake Pontchartrain terminus of the Inner Harbor Navigation Canal (IHNC) to provide a means for controlling tidal flow in the canal for the purposes of maintaining a satisfactory salinity regimen in Lake Pontchartrain and limiting flow velocities in the IHNC to safe values, while insuring sufficient tidal flow to meet riparian needs. The authorized dimensions of the lock are 84 feet wide by 800 feet long, with a depth over the sill of 15 feet measured from mean low gulf datum. Extensive model investigations were conducted in connection with preauthorization studies to ascertain the salinity regimen expected to obtain with the overall project in place. Subsequent to project authorization, extensive additional coordination concerning operation of the Seabrook Lock for salinity control and canal flow for riparian needs was accomplished. The Federal and state fish and wildlife agencies have approved the salinity regimen developed in the model studies for operation of the authorized Seabrook Lock with all gates fully open on a continuous basis. The New Orleans Public Service, Inc. (NOPSI), the electric utility for the city of New Orleans, which operates steam electric generating stations on the IHNC and Mississippi River-Gulf Outlet (MR-GO), and whose needs for cooling water dwarf all other riparian needs, has agreed to the flow regimen corresponding to the above operation of the authorized lock (see paragraph 75 "Coordination with Other Agencies"). A discharge-duration diagram depicting the flow regimen for the typical tidal cycle with the lock operated as described above is included herein as plate 1.

2. IHNC traffic. Traffic entering and leaving the IHNC at Seabrook includes barge tows carrying mainly clamshells, work boats, pleasure craft, and other miscellaneous craft. The Board of Commissioners of the Port of New Orleans (Dock Board) has, since 1946, maintained records of openings of the old Seabrook Bridge, and the number of bottoms passed. For the years 1946-1961, annual totals only are available; subsequent to this date, monthly records are available. Bridge openings and bottoms passed are, for all practical purposes, a direct measure of the traffic which would traverse the lock, since the restricted vertical clearance of the bridge (2 feet above mean high tide) precludes the passage, with the bridge closed, of all traffic except very small craft such as skiffs and outboard hulls.

3. Opening data for the 21-year period, 1946-1966, are shown in table 1. The number of openings per year varied from a minimum of 4,497 in 1947 to 12,602 in 1957. The average number of openings per year is indicated to be 7,991. For the period 1962-1966, for which monthly totals are available, openings per month vary from a minimum of 422 in January 1966 to a maximum of 1,147 in May 1966. The above data, plotted by years, are shown on plate 2.

4. Table 1, in addition to presenting data on bridge openings, also shows the bottoms passed. For the period 1946-1966, the bottoms passed per year varied from a minimum of 8,177 in 1947 to a maximum of 29,449 in 1954. The average number of bottoms passed per year for the above period is indicated to be 19,157. For the period 1961-1966, the monthly totals varied from a minimum of 1,056 in December 1962 to a maximum of 3,075 in July 1966. Data indicating the number of independent bottoms passed are not available; however, most openings appear to be for a single powered vessel towing one or more barges.

5. Study of existing records and analyses of the various factors relating to traffic indicate little likelihood for radical changes in traffic at the Seabrook site.

6. Flow requirements. As previously stated, the respective interests have agreed that the needs for salinity control and riparian use will be adequately met by maintaining the flow regimen shown on plate 1. The needs for salinity control and riparian use tend to be in conflict: satisfying the former requires a sharp reduction in existing Canal flows while any reduction is undesirable from the standpoint of riparian use. As has been previously indicated, the NOPSI need for flow for cooling water is the controlling riparian use and its satisfaction will insure that all riparian needs are adequately provided for. NOPSI would prefer a minimum average flow of about 7,000 c.f.s. A flow of this magnitude would, however, produce excessive salinities, and as previously indicated, NOPSI has agreed to a flow regimen producing a substantially smaller average flow. Requirements for cooling water are highest in the month of August, when both power demand and water temperature in the Canal are at their maximum values.

7. Reduction in flow due to traffic. The theoretical capacity of the authorized lock for passing flow is subject to reduction by interruptions occasioned by use of the lock to pass navigation traffic. The magnitude of the reduction would be a function of the number of lockages required and the average lockage time.

8. The maximum number of potential lockages for the month of August, based on the bridge opening data for the five-year period for which monthly information is available, is indicated to be 1,110 (August 1965, see table 1). The average number of potential lockages per day, based on the above, is approximately 36.

9. Experience at the Calcasieu and Vermilion Locks on the Gulf Intracoastal Waterway has demonstrated that normal barge traffic may safely transit an open lock provided the average velocity of flow in the lock is not in excess of about three feet per second. Based on the flow regimen shown on plate 1 and the average lock area of approximately 1,430 square feet, the average velocity would exceed three feet per second 29% of the time. The average number of lockages per day for the month in question would therefore be about 11.

10. The maximum number of bottoms passed in the month of August during the five-year period for which monthly information is available was 3,017 (August 1966, see table 1). The number of bridge openings in the same month was 1,072. The approximate number of bottoms per opening was, accordingly, three. As previously stated, the information to determine the independent number of bottoms per opening is not available. In the absence of such information, average lockage time has been estimated as the time required to lock through a tug with two barges. The average lockage will be accomplished against a small head, inasmuch as the head producing three feet per second in the lock is 0.4 foot and a head of three feet will almost never be exceeded. The estimated average lockage time is developed in the following table:

Operation	Time required--mins.
Close far gate	3
Tow enters lock	5
Close near gate	3
Moor tow	3
Open far gate	3
Tow leaves lock	3
Total	20

11. Based on 36 passages per day and an average lockage time of 20 minutes, the potential total time for lockages is 12 hours per day, or 50% of the total time. Assuming that the passages are uniformly distributed throughout the day, the flow lost by interruptions due to lockages is, therefore, represented by 50% of the area under the discharge-duration diagram for the period when the velocity through the lock is in excess of 3 feet per second (see plate 3). This area amounts to approximately 72,000,000 cubic feet, or 23.2% of the total flow through the lock in an average day. A reduction of this magnitude in the theoretical flow approved by NOPSI is clearly unacceptable.

12. Auxiliary structure. The availability of sufficient flow to meet the regimen agreed to by fish and wildlife interests and NOPSI can be insured by the addition to the authorized Seabrook complex of one or more auxiliary structures. Studies indicate that a single sector-gated structure of the

same width and depth as the authorized lock would pass approximately 27% more flow than the lock under any given head. The additional area required in an auxiliary gated structure to compensate for the lockage loss would be $1,438 \times \frac{23.2}{127}$ or approximately 260 square feet.

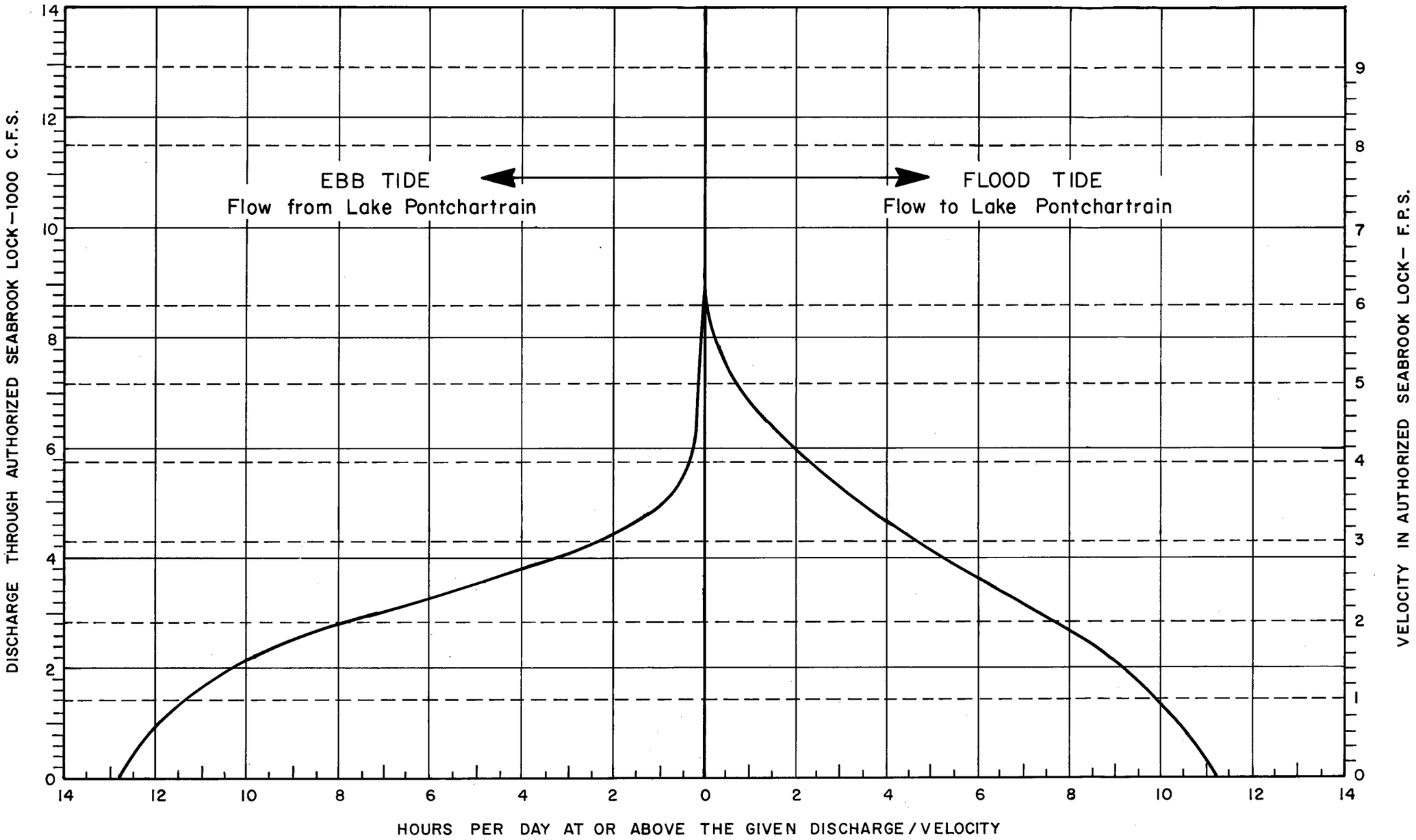
13. In view of the inherent imprecision of the above determination, and subsequent extra cost should the structure installed prove inadequate; and considering the desirability of providing some flexibility, it is considered that provision of twice the above cross section or 520 square feet to supplement the diversion capacity of the authorized lock is warranted. Installation in two independent structures will virtually assure that a means for providing for some flow in the Canal at all times will be available.

TABLE 1
TABULATION OF SEABROOK BRIDGE OPENINGS AND NUMBER OF VESSELS PASSED FROM 1946 TO 1966

Year	Month	Vessels passed	Openings
1966	Jan	1,722	422
	Feb	2,078	474
	Mar	2,725	552
	Apr	2,436	531
	May	2,428	529
	Jun	2,766	694
	Jul	3,075	1,106
	Aug	3,017	1,072
	Sep	2,397	907
	Oct	2,288	754
	Nov	2,147	727
	Dec	2,024	990
	Total	29,103	8,758
1965	Jan	2,022	791
	Feb	1,762	701
	Mar	2,002	801
	Apr	2,710	929
	May	2,981	1,147
	Jun	2,687	1,051
	Jul	2,523	1,054
	Aug	2,715	1,110
	Sep	1,466	522
	Oct	2,206	491
	Nov	2,298	502
	Dec	1,760	438
	Total	27,132	9,537
1964	Jan	1,352	601
	Feb	1,489	679
	Mar	2,236	981
	Apr	2,231	991
	May	2,279	949
	Jun	2,705	1,013
	Jul	2,870	1,073
	Aug	2,666	1,074
	Sep	2,747	1,074
	Oct	2,429	896
	Nov	2,641	1,026
	Dec	2,341	935
	Total	27,986	11,292

TABLE 1 (cont'd)

Year	Month	Vessels passed	Openings
1963	Jan	1,263	575
	Feb	1,256	530
	Mar	1,953	747
	Apr	2,043	847
	May	2,054	879
	Jun	2,078	956
	Jul	1,798	863
	Aug	2,105	908
	Sep	1,711	817
	Oct	1,866	839
	Nov	1,390	659
	Dec	1,129	558
	Total	20,646	9,178
1962	Jan	1,371	594
	Feb	1,506	732
	Mar	2,021	875
	Apr	2,078	868
	May	2,217	973
	Jun	2,096	903
	Jul	2,012	895
	Aug	1,899	815
	Sep	1,711	741
	Oct	1,579	655
	Nov	1,440	600
	Dec	1,056	503
	Total	20,986	9,154
1961		20,631	9,514
1960		26,818	11,151
1959		23,833	8,738
1958		27,128	9,660
1957		29,449	12,602
1956		25,210	10,221
1955		18,979	7,222
1954		13,754	6,068
1953		12,896	5,567
1952		14,410	6,026
1951		14,387	6,152
1950		10,222	5,441
1949		10,776	5,509
1948		10,270	5,276
1947		8,177	4,497
1946		9,508	6,244



NOTE:

Velocity in lock based on average cross sectional area of 1428 square feet.

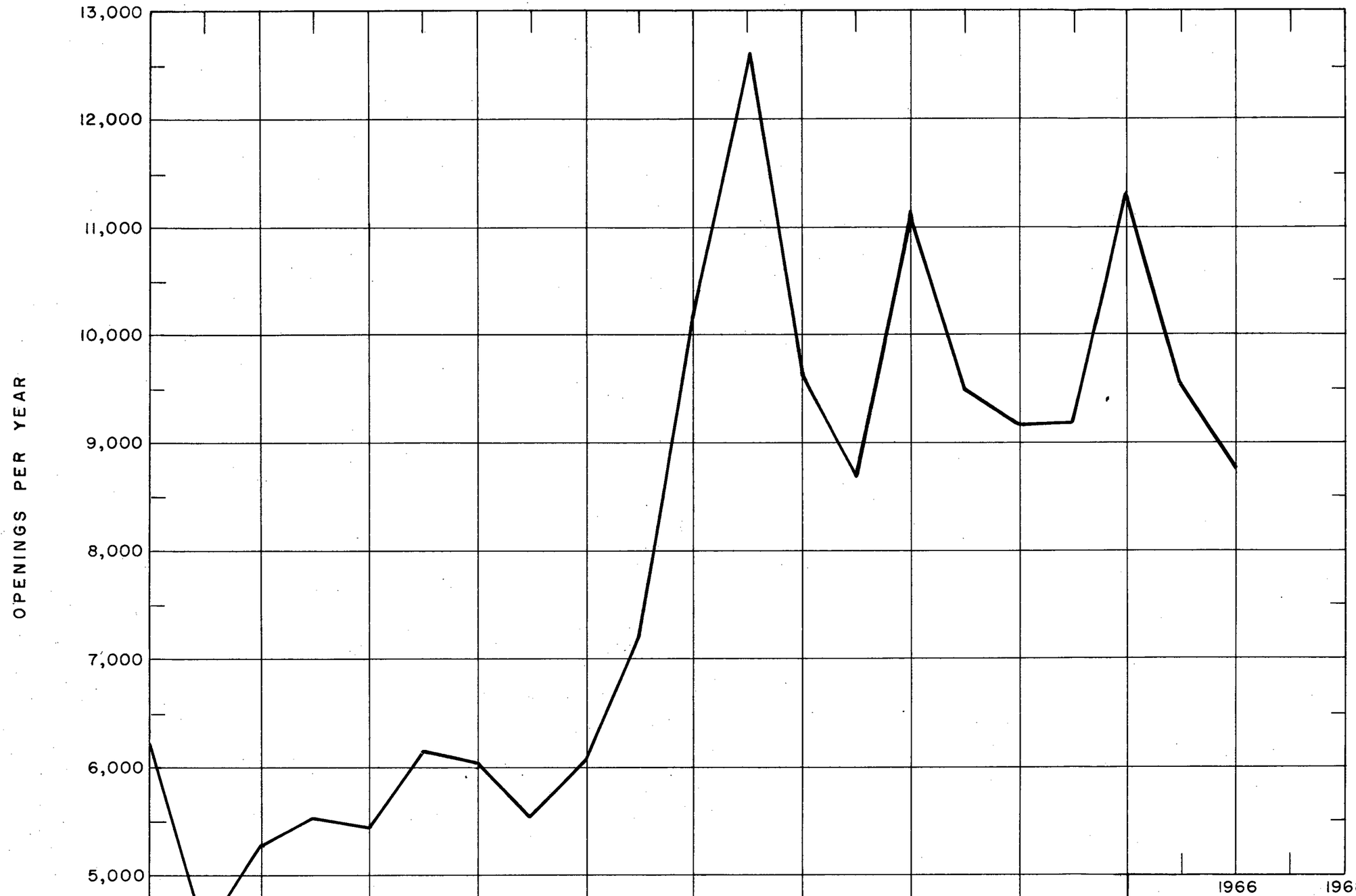
LAKE PONTCHARTRAIN, LA AND VICINITY
AND MISSISSIPPI RIVER – GULF OUTLET, LA.
DESIGN MEMORANDUM NO. 1
GENERAL DESIGN, SEABROOK LOCK

DISCHARGE – DURATION DIAGRAM

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

JUNE 1967 FILE NO. H-2-23683

APPENDIX B PLATE 1

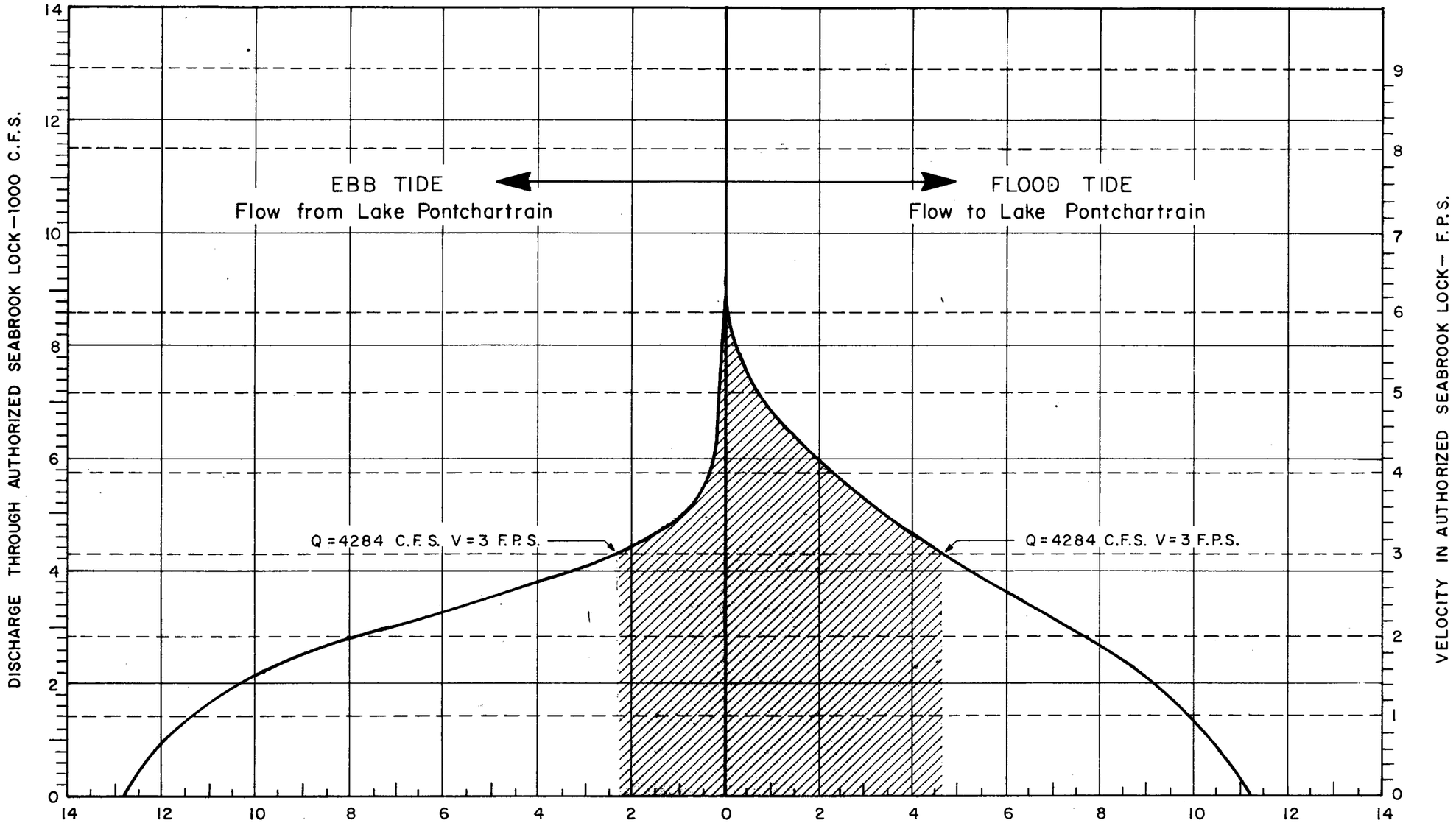


LAKE PONTCHARTRAIN, LA AND VICINITY
AND MISSISSIPPI RIVER – GULF OUTLET, LA.
DESIGN MEMORANDUM NO. 1
GENERAL DESIGN, SEABROOK LOCK

SEABROOK BRIDGE OPENING 1946 — 1966

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

JUNE 1967 FILE NO. H-2-23683



LEGEND

Represents total of volume of flow (144,000,000 cubic feet) which could be passed by lock when average velocity in lock is above 3 F.P.S., assuming no interruptions for lockages. Traffic studies indicate that, on the average, flow will be interrupted for 30 minutes of each hour for lockages whenever the velocity in the lock exceeds 3 feet per second. The volume of flow lost due to lockage will therefore be 144,000,000 X 0.5 or 72,000,000 cubic feet per day.

NOTE:

Velocity in lock based on average cross sectional area of 1428 square feet.

LAKE PONTCHARTRAIN, LA AND VICINITY
AND MISSISSIPPI RIVER – GULF OUTLET, LA
DESIGN MEMORANDUM NO. 1
GENERAL DESIGN, SEABROOK LOCK

FLOW LOST DUE TO LOCKAGES

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

JUNE 1967 FILE NO. H-2-23683

APPENDIX B PLATE 3

LAKE PONTCHARTRAIN, LOUISIANA AND VICINITY
AND
MISSISSIPPI RIVER - GULF OUTLET, LOUISIANA

SEABROOK LOCK
DESIGN MEMORANDUM NO. 1, GENERAL

APPENDIX C
CORRESPONDENCE RELATIVE TO COORDINATION WITH OTHER AGENCIES

Letters to U.S. Fish and Wildlife Service, Atlanta, Georgia, dated 4 November 1966, 18 January 1967, 17 April 1967 and 19 April 1967; and replies of 26 April 1967 and 7 June 1967.

Letter to Federal Water Pollution Control Administration, Dallas, Texas, dated 19 April 1967, reply dated 23 June 1967; and acknowledgement dated 25 July 1967

Letter to Louisiana Wild Life and Fisheries Commission, New Orleans, Louisiana, dated 17 April 1967; reply dated 2 May 1967; and acknowledgment dated 8 May 1967.

Letter to New Orleans Public Service, Inc., New Orleans, Louisiana, dated 1 February 1967 and reply dated 10 February 1967

LMNED-PP 4 November 1966

Mr. Walter A. Gresh, Regional Director
U. S. Department of the Interior
Fish and Wildlife Service
Bureau of Sport Fisheries and Wildlife
Peachtree-Seventh Building
Atlanta, Georgia 30323

Dear Mr. Gresh:

As you know, this office is now engaged in detailed planning for the "Lake Pontchartrain, La. and Vicinity," hurricane protection project. One feature of the project is the Seabrook Lock--a multipurpose structure at the lakeward end of the Inner Harbor Navigation Canal (IHNC) for control of hurricane inflow, and for mitigating undesirable alterations in the salinity regimen in Lake Pontchartrain and the marshes adjacent to Lake Borgne and excessive currents in the IHNC, both of which have developed as a result of the construction of the Mississippi River-Gulf Outlet (MR-GO). Based on studies made in connection with detailed planning, a tentative operating plan for the lock has been developed which we are presenting herein for your consideration and comment.

It should be borne in mind that any operating plan must provide some flow for riparian uses. Consideration of data developed in the model studies made prior to authorization of the project indicates that the requirements for salinity control are in conflict with those for riparian use. Generally speaking, the requirements for salinity control would dictate use of the lock to drastically reduce interchange of flow between Lake Pontchartrain and the MR-GO, while those for riparian use would dictate minimum interference by the lock to such interchange, consistent with adequate control of currents in the IHNC. A summary of salinity data for the high and low inflow years used in the model studies is inclosed. These data show that if all interchange between the IHNC and Lake Pontchartrain were eliminated, salinity conditions would approximate those which obtained prior to construction of the MR-GO, while, if the lock were allowed to remain open on a continuous basis, average salinities in Lake Pontchartrain would be from two to three times higher. In deriving a plan of operation, therefore, a compromise between the conflicting requirements must be reached.

1507-03 (Lake Pontchartrain)

LMNED-PP 4 November 1966 4 Nov 66
Mr. Walter A. Gresh Gatry/kn/239

Model data are not available for operation of the lock for discharge settings other than full diversion capacity. However, such data may be obtained by interpolation between model data for the lock closed and fully open. Salinity data obtained in this manner for operation at one-third of full capacity are shown on the inclosure. It will be noted that this operation would result in salinities in the marsh adjacent to the MR-GO which are generally little different than those obtaining prior to construction of the MR-GO. Salinities in Lake Pontchartrain would, however, be substantially higher, particularly in high inflow years.

Specific model data concerning operation of the lock to provide a diversion rate on the flooding period of the tidal cycle different than that on the ebb are not available. However, it seems evident that, if the discharge for ebb flow (flow from Lake Pontchartrain into the IHNC) were increased without changing the discharge for flood flow, little change would result in the salinities shown for the one-third capacity operation on the inclosed summary, and that any change which might result would tend to be in the direction of lower, rather than higher, salinities. Such an operation would better serve the needs for riparian water use, inasmuch as it would roughly double the average flow in the IHNC and MR-GO.

The matter of operation of Seabrook Lock and the requirements for salinity control were discussed at some length during a meeting held in this office on 11 May 1966, at which representatives of your Service and the Louisiana Wild Life and Fisheries Commission were present. As we understand it, your office considers that some increase in salinities over those representative of pre-MR-GO conditions would probably be desirable, but that radical increases should be avoided. We propose to operate the lock so as to utilize its full discharge capacity during periods when the flow is moving from Lake Pontchartrain into the IHNC, and to reduce the diversion to one-third of full capacity during periods of opposite flow. We consider that the data shown on the survey for the one-third capacity operation are representative of what salinity conditions would be under the operation proposed.

Your comments regarding the proposed operating procedure are requested. Inasmuch as further planning is dependent upon resolution of this matter, your cooperation in furnishing comments at the earliest practicable date will be very much appreciated. We shall be pleased to meet with you in this office, at your convenience, to discuss the proposed procedure if you feel that such discussions would be of value.

Sincerely yours,

THOMAS J. BOWEN
Colonel, CE
District Engineer

Incl
Salinity summary

Copies furnished: w/incl
U.S.Fish & Wildlife Svc, Vicksburg
La. Wild Life & Fish. Comm.

Ch, Hydraulics Br.

Note: Interruptions for lockages have been neglected. Such interruptions would not significantly alter the data shown.

4 Nov 66

LAKE PONTCHARTRAIN, LA. & VICINITY
SEABROOK LOCK

Salinity Summary

Source: Technical Report No. 2-636 dtd Nov 1963
U. S. Army Engineers Waterways Experiment Station, Vicksburg, Mississippi

	Average salinity (PPM) Lake Pontchartrain			Lake Borgne (marsh adjacent to MR-GO)		
	Min.	Max.	Avg.	Min.	Max.	Avg.
HIGH INFLOW YEAR						
High inflow year base test (Before MR-GO)	650	1850	1056	850	6750	2564
Seabrook Lock in place and:						
1. Operated at full disch. capacity	1950	3800	2622	2600	6250	3707
2. Operated at 1/3 disch. capacity*	1117	2533	1593	1367	6283	2856
3. Closed continuously	700	1900	1079	750	6300	2430
LOW INFLOW YEAR						
Low inflow year base test (Before MR-GO)	1675	3550	2278	3275	10125	6463
Seabrook Lock in place and:						
1. Operated at full disch. capacity*	3433	5508	4129	3850	10400	6830
2. Operated at 1/3 disch. capacity*	2261	4203	2895	3467	10217	6585
3. Closed continuously*	1675	3550	2278	3275	10125	6463

*Interpolated from available model study data.

LMMED-PP 18 January 1967

Mr. Walter A. Gresh, Regional Director
U. S. Department of the Interior
Fish and Wildlife Service
Peachtree-Seventh Building
Atlanta, Georgia 30323

Dear Mr. Gresh:

Please refer to our letter dated 4 November 1966 which forwarded a tentative operating procedure for the Seabrook Lock which was authorized for construction under the "Lake Pontchartrain, La. and Vicinity," project.

A meeting to discuss the tentative procedure was held in this office on 17 January 1967. Your office was represented by Messrs. Smith and Chamberlain, representatives of the Bureau of Sports Fisheries and Wildlife in Vicksburg, Mississippi, the Bureau of Commercial Fisheries in Galveston, Texas, and the Louisiana Wild Life and Fisheries Commission also participated in the meeting. The U. S. Army Corps of Engineers was represented by Mr. J. C. Baehr and other personnel of this office, and Mr. Henry Simmons of the U. S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

Available data regarding effects of the "Mississippi River-Gulf Outlet, La.," and "Lake Pontchartrain, La. and Vicinity," projects on salinities in Lake Pontchartrain and the marshes adjacent to the Mississippi River-Gulf Outlet are contained in Technical Report No. 2-636, dated November 1963, which was published by the Waterways Experiment Station and contains the results of extensive model investigations undertaken by them in connection with the preauthorization planning for the "Lake Pontchartrain, La. and Vicinity," project. In a base test reflecting conditions prior to construction of the Mississippi River-Gulf Outlet, maximum, minimum, and average salinities in Lake Pontchartrain and in the marshes adjacent to the Mississippi River-Gulf Outlet were determined for both a high inflow and a low inflow year. Additional tests were run to determine salinities with the Mississippi River-Gulf Outlet in place, both with and without control works at Seabrook. A gated control structure was used in the model tests and salinities determined for the full discharge capacity of the structure, and for

one-third and two-thirds reductions in the discharge capacity of the structure. The results for the base test (before Mississippi River-Gulf Outlet) and the controlled case with Mississippi River-Gulf Outlet in place and structure capacity reduced by two-thirds are summarized below:

Average Salinity (PPM)

	Lake Pontchartrain			Marsh adjacent to MR-GO		
	Min.	Max.	Avg.	Min.	Max.	Avg.
High Inflow Year						
Base test	650	1,350	1,056	850	6,750	2,564
Controlled case-- two-thirds reduction in structure capacity	1,950	3,800	2,620	2,600	6,250	3,707
Low Inflow Year*						
Base test	1,675	3,550	2,278	3,275	10,125	6,463
*Controlled case-- two-thirds reduction in structure capacity	3,433	5,508	4,129	3,850	10,400	6,830

*Interpolated from model data.

It will be noted that the above values for the controlled case are the same as those previously furnished for the controlled case with the authorized Seabrook Lock operated at full discharge capacity, it having been determined by the Waterways Experiment Station that the lock operated at full discharge capacity is equivalent to the control structure used in the model test operated with two-thirds reduction in discharge capacity.

Based on our discussions at the meeting, we understand that the salinity conditions represented by the data for the controlled case as given above are considered by you to be acceptable insofar as the preservation and/or enhancement of fish and wildlife values is concerned. We further understand that you consider the details of the control works necessary to produce, in the prototype, the salinity conditions corresponding to the model data shown, to be a matter for engineering determination by the Corps of Engineers.

18 Jan 67
Chatry/kn/239

LMNED-PP
Mr. Walter A. Gresh

16 January 1967

It is recognized that there is some element of uncertainty in regard to how closely actual conditions subsequent to construction will follow the results indicated by the model tests. It is, accordingly, agreed that corrective action would have to be taken in the event that postconstruction experience should indicate conditions markedly different from those indicated by the model data.

We are presenting flow data based on the above considerations to the New Orleans Public Service, Inc., and upon receipt of their concurrence, shall resume detailed planning for the Seabrook Lock. We shall be pleased to keep you informed as the design progresses.

Your cooperation in resolving this matter is appreciated.

Sincerely yours,

THOMAS J. ROWER
Colonel, CE
District Engineer

Mask
Becnel
Hudson
Exe Ofc

Copies furnished:
U.S.Fish & Wildlife Service, Vicksburg, Miss.
La. Wild Life & Fisheries Comm, New Orleans, La.

WES, ATTN: Mr. Henry Simmons

Ch, Hydraulics Br., Engrg. Div.

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
PEACHTREE-SEVENTH BUILDING
ATLANTA, GEORGIA 30323

April 26, 1967

District Engineer
U. S. Army, Corps of Engineers
P. O. Box 60267
New Orleans, Louisiana 70160

Dear Sir:

Reference is made to your letter of January 18, 1967, regarding tentative operating procedures for Seabrook Lock, a feature of the Lake Pontchartrain, Louisiana, and Vicinity project. Based on applicable model studies and our discussions in your office on January 17, it appears at this time that operation of the lock at full discharge capacity throughout the full tidal cycle can be tolerated insofar as fish and wildlife resources are concerned.

The Louisiana Wild Life and Fisheries Commission, in its letter of April 13 commenting on your letter of January 18, points out, however, that the 5.5 p.p.t. salinity indicated for Lake Pontchartrain in a low inflow year approaches the upper tolerance limit for the extremely valuable Rangia clam resource. In view of this, and since, as you point out, there is some uncertainty as to how closely post-construction conditions will follow the results indicated by the model, we strongly feel that operations must be modified if necessary to insure continued desirable salinity levels.

We suggest, therefore, that conditions in Lake Pontchartrain be monitored periodically after construction, and request that the need for corrective action be determined jointly by this Bureau, the Bureau of Commercial Fisheries, and the Louisiana Wild Life and Fisheries Commission. In this regard, we again call to your attention the need for maintaining full flexibility of operations to meet the requirements both of riparian use and of salinity control.

Your letter of April 17 regarding alterations in lock design has been received and is now being reviewed. Personnel of our Vicksburg, Mississippi, field office will be contacting your staff to obtain additional information as necessary. We will provide our comments as soon as we possibly can.

Sincerely yours,

Walter A. Gresh
Regional Director

1507-03 (Lake Pontchartrain)

17 Apr 67
Chatry/kn/239

LMNED-PP

17 April 1967

Mr. Walter A. Gresh, Regional Director
U. S. Department of the Interior
Fish and Wildlife Service
Bureau of Sport Fisheries and Wildlife
Peachtree-Seventh Building
Atlanta, Georgia 30323

Dear Mr. Gresh:

This office is presently engaged in preparing a general design memorandum for the Seabrook Lock, construction of which was authorized by the Flood Control Act of 1965 (Public Law 89-298, approved 27 October 1965).

The lock is to serve the multiple purposes of hurricane flood control, salinity control, and current control. The general layout of the lock is shown on inclosure 1, and additional descriptive material is contained in House Document 231, 89th Congress, 1st Session. The following significant alterations in the authorized lock will be incorporated into the design:

a. The Chief of Engineers has approved a change in the controlling elevation of the lock from 13.2 feet mean sea level to 7.2 feet mean sea level. This change will be effected by lowering the crown of the rock dike which will tie the lock to the levee system.

b. An auxiliary structure will be provided to permit diversions for salinity control and riparian use during periods when the lock is passing traffic. Your attention is invited to our meetings and correspondence relative to the matter of salinity control, and in particular to our letter of 18 January 1967 which sets forth the salinity regimen that the Seabrook works will be operated to maintain.

Because of the urgent nature of the work covered by the design memorandum, we are operating on a much compressed planning schedule. It will, accordingly, be very much appreciated if your comments are provided not later than 14 July 1967.

Sincerely yours,

THOMAS J. BOWEN
Colonel, CE
District Engineer

1 Incl
Dwg - Seabrook Lock
(file H-2-22077, plate 9)

Copies furnished: w/o incl
U.S.Fish & Wildlife
Service.
Vicksburg, Miss.
La. Wild Life & Fish.
N.O.,La.
Exe Off
Mask,
Hudson

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
PEACHTREE-SEVENTH BUILDING
ATLANTA, GEORGIA 30323

June 7, 1967

District Engineer
U. S. Army, Corps of Engineers
P. O. Box 60267
New Orleans, Louisiana 70160

Dear Sir:

This letter has been prepared in response to your request of April 17, 1967, for Bureau comments on design alterations in Seabrook Lock, a feature of the authorized Lake Pontchartrain, Louisiana, and Vicinity project. These are submitted in accord with the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.).

According to your letter, the following changes have been made in the design of the structure:

a. The crown of the rock dike tying the lock to the Lake Pontchartrain levee system has been lowered from a controlling elevation of 13.2 feet m.s.l. to 7.2 feet m.s.l.

b. An auxiliary water-control structure will be located in the rock dike. This structure will permit flow diversions for riparian use when the lock is passing traffic and also provide salinity control.

Review of these modifications indicates that lowering the controlling elevation of the rock dike to elevation 7.2 feet will have no effect on fish and wildlife resources. On the other hand, the auxiliary water-control structure should provide a more flexible system for salinity control in Lake Pontchartrain.

Your letter to us of January 18, 1967, set forth maximum facilities predicted by model tests with the Seabrook structure in place. The salinity ranges as predicted appear to be acceptable for the preservation of fish and wildlife resources. To assure that proper salinity ranges are maintained, we wish to take this opportunity to suggest a salinity surveillance system be located in Lake Pontchartrain after the Seabrook structure is in place. The monitoring of this system would provide a basis for maintaining lake salinities through operation of the Seabrook Lock.

It is suggested that your agency, the Louisiana Wild Life and Fisheries Commission, and this Bureau jointly develop a plan for the establishment of a salinity surveillance system.

We appreciate this opportunity to comment on your general design memorandum. A copy of this letter is being sent to the Louisiana Wild Life and Fisheries Commission.

Sincerely yours,

Walter A. Gresh
Regional Director

1507-03 (Lake Pontchartrain)

19 June 1967
Mr.Hardy/jlf/239

LMNED-PP

19 June 1967

Mr. Walter A. Gresh
Regional Director
U. S. Department of the Interior
Fish and Wildlife Service
Bureau of Sport Fisheries and Wildlife
Peachtree-Seventh Building
Atlanta, Georgia 30323

Dear Mr. Gresh:

Thank you for your letter dated 7 June 1967 relative to alterations in the authorized Seabrook Lock feature of the "Lake Pontchartrain, La. and Vicinity," project.

Our current data collection program includes extensive coverage of Lake Pontchartrain salinities. Upon completion of the lock, we shall expand this program, if necessary, to present an adequate evaluation of the effects of lock operation on the salinity regimen, and a determination as to the extent that the lock operation is producing the salinity regimen indicated by the model data previously furnished you. We are pleased with your suggestion that your agency and the Louisiana Wild Life and Fisheries Commission participate in the development of a salinity surveillance system and shall contact you further in this regard at an appropriate time.

Again, your cooperation in providing comments on the Seabrook Lock is very much appreciated.

Sincerely yours,

GEORGE H. HUDSON
Acting District Engineer

Chatry
Mask
Hudson

1507-03 (Lake Pontchartrain)

19 Apr 67
Hardy:Chatry/kr/239

LMNED-PP 19 April 1967

Mr. Jerome H. Svore, Regional Director
U. S. Department of the Interior
Federal Water Pollution Control Administration
1114 Commerce Street
Dallas, Texas 75202

Dear Mr. Svore:

This office is presently engaged in preparing a general design memorandum for the Seabrook Lock, construction of which was authorized by the Flood Control Act of 1965 (Public Law 89-298, approved 27 October 1965).

The lock is to serve the multiple purposes of hurricane flood control, salinity control, and current control. The general layout of the lock is shown on inclosure 1, and additional descriptive material is contained in House Document 231, 89th Congress, 1st Session. The following significant alterations in the authorized lock will be incorporated into the design:

a. The Chief of Engineers has approved a change in the controlling elevation of the lock from 13.2 feet mean sea level to 7.2 feet mean sea level. This change will be effected by lowering the crown of the rock dike which will tie the lock to the levee system.

b. An auxiliary structure will be provided to permit diversion for salinity control and riparian use during periods when the lock is passing traffic. In connection with the operation of Seabrook Lock, your attention is invited to our letter of 18 January 1967 (inclosure 2) to the U. S. Fish and Wildlife Service, Atlanta, Georgia, indicating the salinity regimen that the lock will be operated to maintain.

Because of the urgent nature of the work covered by the design memorandum, we are operating on a much compressed planning schedule. It will, accordingly, be very much appreciated if your comments are provided not later than 14 July 1967.

Mask

Hudson

Exe Ofc

Sincerely yours,

THOMAS J. BOWEN
Colonel, CE
District Engineer

2 Incl
Dwg - Seabrook Lock
(file H-2-22077, plate 9)
Cy ltr 18 Jan 67

UNITED STATES
DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
South Central Region
1114 Commerce Street
Dallas, Texas 75202

June 23, 1967

Re: LMNED-PP

District Engineer
U. S. Army Engineer District, New Orleans
P. O. Box 60267
New Orleans, Louisiana 70160

Dear Sir:

Reference is made to your letters of April 19 and April 21, 1967 initiating coordination of the general design memorandum for the Seabrook Lock and the Lake Pontchartrain Barrier Plan.

We have had an opportunity to review the information submitted in accordance with Executive Order 11288, Section 1, paragraph (7) and Section 6 and find as follows:

Every attempt should be made to minimize water quality degradation during actual construction and to control spoils that would cause highly turbid waters.

It is desirable that the water quality control structures be constructed and operated so as to prevent changes in present water quality and to insure that ecological conditions remain unchanged.

The Louisiana State Board of Health commented on the lack of information regarding insect control. If the water level in Lake Pontchartrain is raised so as to flood the lowlands bordering the lake, severe mosquito breeding problems may result.

All contractors should take precautions to prevent water pollution by accidental spillage of petroleum products or other harmful materials i.e. insecticides. Also, all contractors should provide and maintain sanitation facilities that will adequately treat domestic wastes to conform with Federal and local health regulations.

Please advise this office (Attention: Federal Activities Coordinator) of significant changes from the plan presented.

The comments of the State of Louisiana Stream Control Commission and the Louisiana State Board of Health have been incorporated in our review.

Your cooperation in carrying out the requirements of the Order is appreciated.

Sincerely yours,

John A. Strouse
for WILLIAM C. GALEGAR
Regional Director

cc: Louisiana State Board of Health
Louisiana Stream Control Commission

1507-03 (Lake Pontchartrain)

25 Jul 67
Broussard:Chatry/kn/239

LMNED-PP

25 July 1967

Mr. William C. Galegar, Regional Director
U. S. Department of the Interior
Federal Water Pollution Control Administration
1114 Commerce Street
Dallas, Texas 75202

Dear Mr. Galegar:

Thank you for your letter dated 23 June 1967 relative to the general design memorandum for the Lake Pontchartrain Barrier Plan and Seabrook Lock features of the "Lake Pontchartrain, La. and Vicinity," project.

Provisions to ensure that the objectives of your comments relative to water quality degradation during construction, control of accidental spillages, and maintenance of adequate sanitary facilities by construction contractors will be incorporated into our construction plans and specifications. With respect to the concern of the Louisiana State Board of Health relative to mosquito breeding problems in the event that the average level of Lake Pontchartrain is raised, we would observe that the plan will not result in any increase in the average lake level, but will serve only to lower lake stages during hurricanes.

The Seabrook Lock will be operated to provide a desirable salinity regimen in Lake Pontchartrain. The plan of operation will be developed with the advice of the state and Federal fish and wildlife agencies. We shall be pleased to seek the advice of your agency also when the plan is prepared.

Your cooperation in providing comments on the project is very much appreciated.

Sincerely yours,

Mask

Hudson

THOMAS J. BOWEN
Colonel, CE
District Engineer

Exe Ofc

#2210

1507-03 (Lake Pontchartrain)

17 Apr 67
Chatry/kn/239

LMED-PP 17 April 1967

Mr. Leslie L. Glasgow, Director
Louisiana Wild Life and Fisheries Commission
400 Royal Street
New Orleans, Louisiana 70130

Dear Mr. Glasgow:

This office is presently engaged in preparing a general design memorandum for the Seabrook Lock, construction of which was authorized by the Flood Control Act of 1965 (Public Law 89-298, approved 27 October 1965).

The lock is to serve the multiple purposes of hurricane flood control, salinity control, and current control. The general layout of the lock is shown on inclosure 1, and additional descriptive material is contained in House Document 231, 89th Congress, 1st Session. The following significant alterations in the authorized lock will be incorporated into the design:

a. The Chief of Engineers has approved a change in the controlling elevation of the lock from 13.2 feet mean sea level to 7.2 feet mean sea level. This change will be effected by lowering the crown of the rock dike which will tie the lock to the levee system.

b. An auxiliary structure will be provided to permit diversions for salinity control and riparian use during periods when the lock is passing traffic. Your attention is invited to our meetings relative to the matter of salinity control, and to our letter of 18 January 1967 to the U. S. Fish and Wildlife Service, Atlanta, Georgia, which sets forth the salinity regimen that the Seabrook works will be operated to maintain.

Because of the urgent nature of the work covered by the design memorandum, we are operating on a much compressed planning schedule. It will, accordingly, be very much appreciated if your comments are provided not later than 14 July 1967.

Mask

Sincerely yours,

Hudson

1 Incl
Dwg - Seabrook Lock
(file B-2-22077, plate 9)

THOMAS J. BOWEN
Colonel, CE
District Engineer

Exe/Ofc

Copy furnished: Louisiana Wild Life & Fisheries Commission
River Basin Section
Baton Rouge, La. 70804 w/o incl

U.S. Fish & Wildlife Service w/o incl
Atlanta, Ga., & Vicksburg, Miss.

LOUISIANA WILD LIFE AND FISHERIES COMMISSION

WILD LIFE AND FISHERIES BUILDING
400 ROYAL STREET
NEW ORLEANS, LOUISIANA 70130

May 2, 1967

District Engineer
U. S. Army Corps of Engineers
New Orleans District
P. O. Box 60267
New Orleans, Louisiana 70160

Dear Sir:

Reference is made to your letter of April 20, 1967, and your letter of January 18, 1967, concerning the Lake Pontchartrain Barrier Plan feature of the Lake Pontchartrain, Louisiana, and Vicinity Project and for the Seabrook Lock segment of this same project.

After reviewing the information contained in the barrier plan, we do not have any specific considerations or additional recommendations regarding this segment of this project. However, we are extremely concerned about the salinity level and the opportunity to provide for passage of water at the Seabrook Lock to control salinities and allow continued water exchange.

In your letter of January 18, 1967, the average salinities given for Lake Pontchartrain with the Seabrook Lock structure in place are within ranges considered necessary to maintain present fish and wildlife resources associated with this area. However, the 5.5 p.p.t. maximum salinity indicated for a low inflow year is approaching the upper tolerance level for the Rangia clam which is an extremely valuable resource associated with Lake Pontchartrain and the basis for a sizeable industry in Louisiana.

We are naturally concerned about the possible effect higher salinities will have on future clam production. It is known that the Rangia species are brackish water clams and can survive salinities approaching 8 p.p.t. However, we doubt seriously if they will continue to reproduce and survive in the higher salinity ranges. Therefore, we recommend that salinities for Lake

Pontchartrain be maintained as near as possible to conditions existing prior to the construction of the Mississippi River Gulf-Outlet Project and that the maximum salinity range not be allowed to exceed 8 p.p.t. for any extended period of time.

In the event the actual conditions of the Mississippi River Gulf-Outlet Project in place do not closely follow the model test results, we strongly recommend that provisions be installed in the Seabrook Lock to allow salinities in Lake Pontchartrain to be adjusted as may be necessary for the maintenance of fish and wildlife resources. We feel the inclusion of an auxiliary control structure in the lock design is necessary to provide for the passage of water for salinity control and other uses when the lock is handling traffic and cannot serve this important purpose.

We appreciate the opportunity to review and comment on these segments of the Lake Pontchartrain and Vicinity Project. In addition, we request to be kept informed on the progress of this work and in the event additional modifications are contemplated, we would like the opportunity to review and offer additional comments.

Sincerely yours,

Leslie L. Glasgow
Director

LLG:MWS/js

cc: U. S. Fish and Wildlife Service
Bureau of Sport Fisheries and Wildlife
Atlanta, Georgia

1507-03 (Lake Pontchartrain)

5 May 1967
Mr. Hardy/jlf/
1239

LMNED-PP

8 May 1967

Mr. Leslie L. Glasgow, Director
Louisiana Wild Life and Fisheries Commission
400 Royal Street
New Orleans, Louisiana 70130

Dear Mr. Glasgow:

Thank you for your letter dated 2 May 1967 relative to the Lake Pontchartrain Barrier Plan, and the Seabrook Lock features of the "Lake Pontchartrain, La. and Vicinity," project.

Our current data collection program includes extensive coverage of Lake Pontchartrain salinities. Upon completion of the lock, we shall expand this coverage, if necessary, to permit an adequate evaluation of the effects of lock operation on the salinity regimen, and a determination as to the extent that the lock operation is producing the salinity regimen indicated by the model data previously furnished you. We shall, of course, consult with your agency in making the above determination, and in the subsequent development of modifications as may be found necessary.

Sincerely yours,

THOMAS J. BOWEN
Colonel, CE
District Engineer

Chatry
Mask
Hudson
Exec Ofc

Copy furnished:
Louisiana Wild Life & Fisheries Commission
River Basin Section
Baton Rouge, Louisiana 70804

1516

1507-03 (Lake Pontchartrain)

20 Jan 67
Chatry/kn/239

LMNED-PP

1 February 1967

Mr. L. J. Cucullu, Vice-President
and Chief Engineer
New Orleans Public Service, Inc.
P. O. Box 60340
New Orleans, Louisiana 70160

Dear Mr. Cucullu:

Please refer to our letter dated 4 November 1966 relative to the Seabrook Lock feature of the "Lake Pontchartrain, La. and Vicinity," project which forwarded a tentative operating procedure for the lock. Please refer also to your reply to the above letter dated 21 November 1966.

Based on additional discussions with biologists of the U. S. Fish and Wildlife Service and the Louisiana Wild Life and Fisheries Commission, we have concluded that operation of the lock at full discharge capacity throughout the full tidal cycle can be tolerated. Such operation would result in trebling the flows for the flooding portion of the tidal cycle as compared with those under the tentative operating procedure described in our letter of 4 November. (See inclosure to above letter, file No. H-2-24053.) Flows on the ebbing portion of the cycle would remain the same as shown on the drawing.

As noted, the data on file No. H-2-24053 neglect interruptions due to lockages. Present and prospective traffic will be analyzed in connection with the detailed design studies for the lock, and the authorized lock structure modified, if required, to insure the flow regimen described.

We are hopeful that you will find the above proposed flow regimen acceptable and await your early reply.

Sincerely yours,

THOMAS J. BOWEN
Colonel, CE
District Engineer

Copy furnished:
Ch, Hydraulics Br.
U.S. Fish & Wildlife Service, Atlanta, Ga.
La. Wild Life & Fish. Comm, N.O.,La.

BECNEL
Mask
Hudson
Exe Ofc

1507-03 (Lake Pontchartrain)

NEW ORLEANS PUBLIC SERVICE INC.

POST OFFICE BOX 60340

NEW ORLEANS, LOUISIANA 70160

L. J. CUCULLU
VICE PRESIDENT & CHIEF ENGINEER

AREA CODE 504 529-4545
317 BARONNE STREET

February 10, 1967

Colonel Thomas J. Bowen, C. E.
District Engineer, New Orleans District
Corps of Engineers
Department of the Army
P. O. Box 60267
New Orleans, Louisiana 70160

PROPOSED CONTROL BARRIER AT
LAKE PONTCHARTRAIN AND SEABROOK
NEW ORLEANS, LOUISIANA

Dear Colonel Bowen:

Please refer to your letter of February 1, 1967 and to our previous correspondence concerning the effect at our generating stations of the proposed control barrier at Seabrook and Lake Pontchartrain.

Concerning your proposed operating procedure, we are in agreement that the lock should be operated at full discharge capacity on flood tide as well as ebb tide. The careful study by your engineers, which resulted in the conclusion that such operation is acceptable, is greatly appreciated.

It is apparent from the drawing, file No. H-2-24053, which you previously sent us, that the lock, when so operated, will reduce flow quantities from their present magnitudes to approximately those existing at Seabrook before the Mississippi River-Gulf Outlet was opened. It appears that inlet water temperatures to the generating stations will be increased over those now existing but we anticipate that the resultant temperatures probably will permit operation of the existing units within design limitations.

The State of Louisiana Stream Control Commission is presently developing criteria for thermal pollution in compliance with the U.S. Water Quality Act of 1965. We have confidence that present stream temperatures in the vicinity of our stations will comply with criteria to be adopted but also are concerned with the possibility that restriction of flow in the Industrial Canal and Mississippi River-Gulf Outlet could jeopardize our conformance to such criteria.

We do not know if the design of the lock is final or if any further increase in flow quantities can be tolerated. However, to the extent that such proposals can be considered at this stage, we recommend that the lock be of sufficient size to permit as large a volume of unobstructed flow of water as possible within the framework of other requirements which it must meet.

Colonel Thomas J. Bowen, C. E.
February 10, 1967

We appreciate the cooperation given to us by you and your engineers in the study of the installation of the proposed lock at Seabrook and, if desired, will be pleased to meet for further discussions at their convenience.

Very truly yours,

L. J. Cucullu

LJC.s
cc - Messrs. M. C. Abrahm
M. J. Cade
J. F. Vogt

LAKE PONTCHARTRAIN, LOUISIANA AND VICINITY
AND
MISSISSIPPI RIVER - GULF OUTLET, LOUISIANA

SEABROOK LOCK
DESIGN MEMORANDUM NO. 1, GENERAL

APPENDIX D
DETERMINATION OF SEABROOK COMPLEX OPERATING PROCEDURES
DURING HURRICANES

LAKE PONTCHARTRAIN BARRIER PLAN
SEABROOK LOCK AND SUPPLEMENTAL FLOW STRUCTURE
DESIGN MEMORANDUM NO. 1, GENERAL DESIGN

APPENDIX D

DETERMINATION OF SEABROOK COMPLEX[1] OPERATING PROCEDURES
DURING HURRICANES

1. Description of problem. The specific operating procedure for the structures described herein is dependent on many independent variables, two of which are the maximum wind speed and predicted path of the hurricane with respect to the project location. However, in every case the operating procedure should provide the best practical means of reducing the flood hazard to life and property.

All development located immediately outside the authorized plan of protection is subject to the hazards of flooding from hurricane generated surges producing lake levels as high as 13.0.[2] The present industrial development located along the IHNC (Inner Harbor Navigation Canal) is particularly subject to severe flooding hazards since this industry is located at approximate elevation 5.0 on the floodside of the existing and authorized protective works. Consequently, the Seabrook Complex feature of the Lake Pontchartrain Barrier Plan has inspired much inquiry by IHNC industries as to whether or not construction of the complex would increase the industries' susceptibility to flooding in the event of a hurricane. Investigations have revealed that for hurricanes on tracks critical to the IHNC, the stages in the IHNC north of the U. S. Highway 90 bridge would be increased by 1 to 3 feet, [with the Chef and Rigolets barriers structures in place and with the Seabrook Complex closed] depending on the magnitude of the hurricane. However, if the Seabrook Complex were open, for the same conditions, the stages in the IHNC north of U. S. Highway 90 bridge would be increased by less than 0.5 foot. For hurricanes on paths critical to the south shore of Lake Pontchartrain, the stages in Lake Pontchartrain and consequently the IHNC (with the Seabrook Complex open) would be lowered by some 2 to 3 feet as a result of the Barrier Plan (refer to D-1). It was therefore concluded that, on balance, the net hazard to the industries along the IHNC would not be significantly altered by construction of the complex. The maximum SPH (Standard Project

[1]Seabrook Complex as used herein refers to the Seabrook Lock, supplemental flow structure and rock dike.

[2]Elevations used herein are in feet referred to mean sea level.

Hurricane) flood stages which may occur along the IHNC under existing conditions and project conditions (barrier structures at Chef Menteur and Rigolets Passes in place and closed and with Seabrook Complex closed) are shown in profile on plate D-2.

2. Determination of flood stages. Extensive hydraulic studies were made in an effort to determine the maximum possible stage which can occur at any point along the IHNC with and without the Seabrook Complex in place. These studies involved the analysis of: (1) real time relationships between design hurricane stage-hydrographs in Lakes Borgne and Pontchartrain produced by hurricanes approaching on tracks considered to be critical to the project area (see tracks A and F, plate D-3); (2) the computation of backwater stages through the IHNC from the lower to the higher stage; and (3) the selection of the maximum computed stage at all points along the canal as the design profile. The synthetically computed stage-hydrographs at each terminus of the canal for each track considered are shown on plate D-4. The Lake Borgne stage-hydrograph represents stages in the IHNC at its junction with the MR-GO (Mississippi River-Gulf Outlet) and the Lake Pontchartrain (south shore) stage-hydrograph represents stages in the IHNC at its junction with the lake. These hydrographs show some lead or lag time in occurrence of peak stages at each terminus and demonstrate that peaks do not necessarily occur coincidentally even though this is possible. Therefore, in order to reflect maximum possible flood stages along the canal for each condition, it was assumed that the peaks will occur coincidentally, with the additional stipulation that, for the case with the Lake Pontchartrain Barrier in place, the lock and flow structure will be closed during the SPH. This established the maximum expected stages at any point for the tracks chosen and also the basis for comparison between stages with and without the lock and flow structure in place. Track F was found to produce higher stages than track A and, therefore, track F stages were used in the analysis of paragraph 3 below.

3. Feasibility determinations to relieve stages in IHNC. Studies were made to determine the most feasible method for reducing the consequences of the Seabrook Complex to an acceptable degree and, therefore, on balance, not significantly increase flooding along the IHNC. The method used must preserve in every case the rationale of the barrier plan, which is to limit the average stage in Lake Pontchartrain by closing the control structures at Chef Menteur and Rigolets Passes, and appropriately controlling the Seabrook Complex to limit inflow from Lake Borgne upon the approach of a hurricane. An investigation was made to determine whether or not stages could be lowered in the canal for some hurricanes if the lock and supplemental flow structure were opened. The same hurricane tracks and stage-hydrographs which were used to determine the maximum flood stages described in paragraph 2 above were used in this investigation. Backwater computations were made from a simultaneous stage in Lake Pontchartrain through the open lock and supplemental structure and upstream through the canal to its junction with the MR-GO, where the stage is equal to the Lake Borgne stage. The discharge through

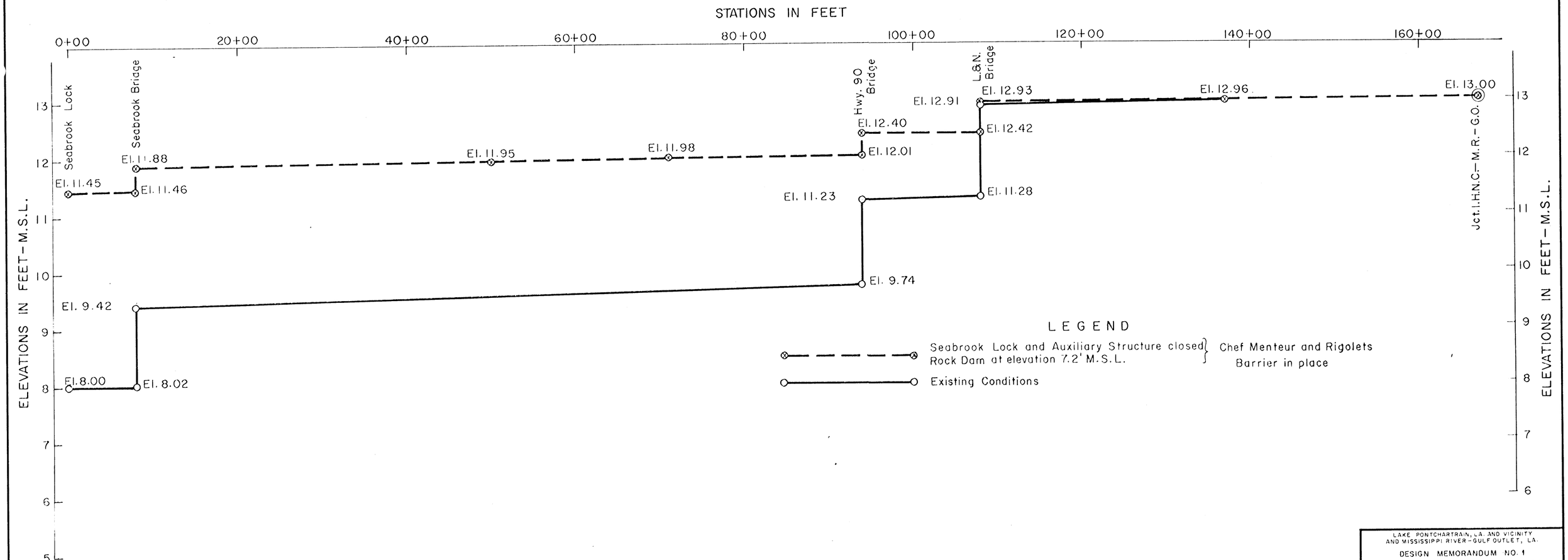
the lock and supplemental flow structure to Lake Pontchartrain for a relatively short period of time is insufficient to materially increase the average lake stage and therefore this method of operation will not violate the rationale behind the barrier plan. Hurricane stages along the IHNC can be made to approach stages which would prevail without the Seabrook Complex, as shown on plate D-5. The flow profile was derived by computing the stage at various points along the canal for each track with and without the Seabrook Complex open.

4. Determination of design differential heads. The studies performed to determine design heads were similar to those described in paragraph 2 above except in one respect: stage-hydrographs on Lake Pontchartrain were computed from synthetic hurricane tracks which gave offshore winds along the south shore of the lake. Offshore winds from a southeasterly direction can depress stages in Lake Pontchartrain and at the same time give Lake Borgne onshore winds which can create high stages (see plate D-6). The design hurricane track finally chosen, track C, to give the maximum head differentials, is reasonably possible and parallels many previous hurricane tracks through the area as shown on plate D-3. Because of the probability of an actual hurricane of SPH magnitude traversing the project area on precisely the track chosen to give coincidental minimum Lake Pontchartrain stages and reasonably high Lake Borgne stages is less than for an SPH on any track through the project area, a synthetic hurricane with a return frequency of once in 100 years and an intensity slightly less than the SPH windspeed was chosen to determine the design differential heads across the Seabrook unit. Two design conditions were determined from these studies: the first one was with the lock and supplemental flow structure closed with flow over the rock dike from the IHNC side to Lake Pontchartrain; the second was with flow through the lock and supplemental flow structure. Stage-hydrographs and flow profiles are shown on plates D-7 and D-8, respectively, for the design conditions. Flow profiles were determined as described in paragraphs 2 and 3 above, and 5 below.

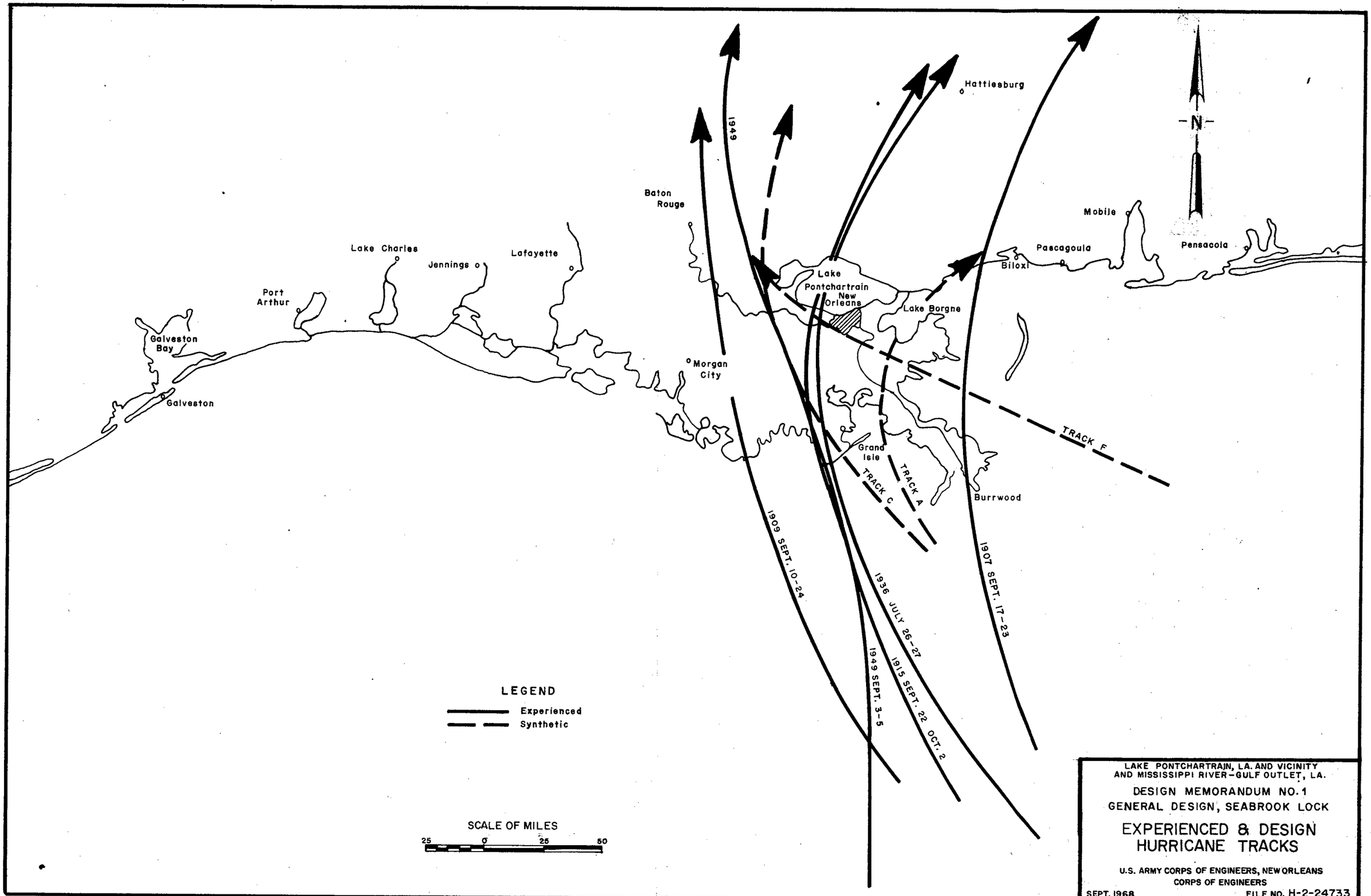
5. Flowline computations. The Manning formula was used in the determination of all friction losses. Values of "n" selected were 0.015 for the reinforced concrete lock and 0.035 for the channel of the IHNC. Entrance losses of 50 percent of the difference in velocity heads were used for the lock. For free discharge, flows through the supplemental flow structure were determined with the use of the weir equation $Q=3.32LH^{1.5}$, where L and H are the width of the weir crest and the head, respectively, expressed in feet. For submerged conditions, discharges were computed with the use of the curve based on the results of the work of Villemonte and Mavis on submerged weirs. This curve is shown on figure 5-5 of the fifth edition of Handbook of Hydraulics by Horace Williams King and Ernest F. Brater. Flows in the IHNC will be restricted

by the bridges for U. S. Highway 90 and for the Southern Railway and the Louisville and Nashville Railroad. Low steel on the railroad bridges are at an elevation of 5 feet and these bridges will be overtopped by tides from critical hurricanes. Flows through the submerged bridge openings were computed with the use of the formula $Q=0.70A(gH)^{1/2}$, where A is the area of the submerged opening in square feet and g is the acceleration due to gravity. Flows over the bridges were computed by means of the weir formula $Q=2.9LH^{1.5}$.

6. Design operation plan. In view of the conclusions drawn from studies described in paragraphs 2 and 3 above, a plan of operation to reduce flood stages in the IHNC by opening the lock and supplemental flow structure for a relatively short period of time has been determined to be practicable for the three hurricane tracks considered. Further studies have indicated the need for the addition of stilling basins on the Lake Pontchartrain side of the structures because velocities through the structures will be excessive during the time that differential heads are a maximum. The operating procedure for maximum stage relief in the IHNC provides for the bulkheads in the supplementary flow structure to be removed and for the lock to be opened when a stage of 3.5 is exceeded on the IHNC side of the lock.



LAKE PONTCHARTRAIN, LA. AND VICINITY
AND MISSISSIPPI RIVER–GULF OUTLET, LA.
DESIGN MEMORANDUM NO. 1
GENERAL DESIGN, SEABROOK LOCK
W.S. PROFILES – I.H.N.C.
MAXIMUM FLOOD STAGES
SPH
U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS
CORPS OF ENGINEERS
SEPT. 1968
FILE NO. H-2-24733



LAKE PONTCHARTRAIN, LA. AND VICINITY
AND MISSISSIPPI RIVER-GULF OUTLET, LA.

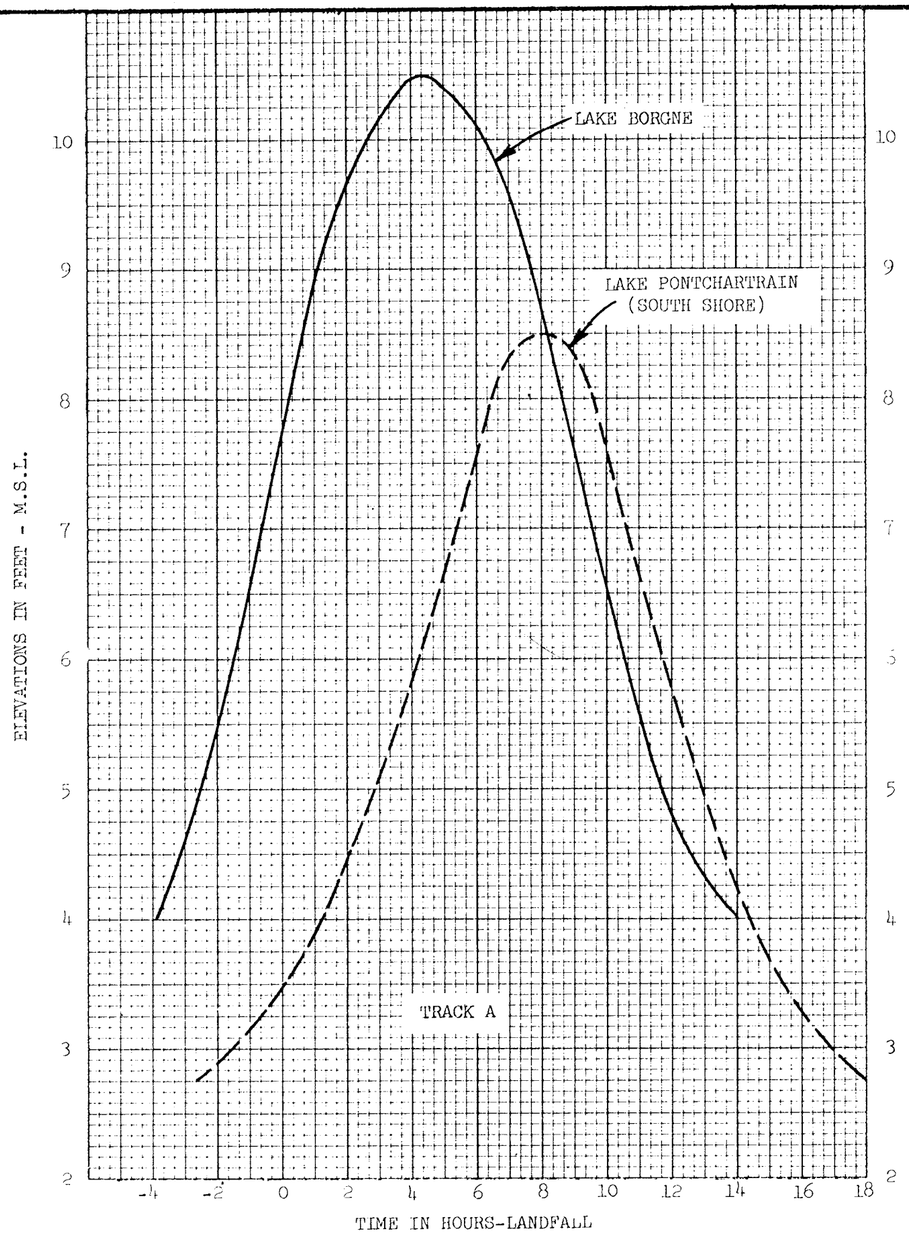
DESIGN MEMORANDUM NO. 1

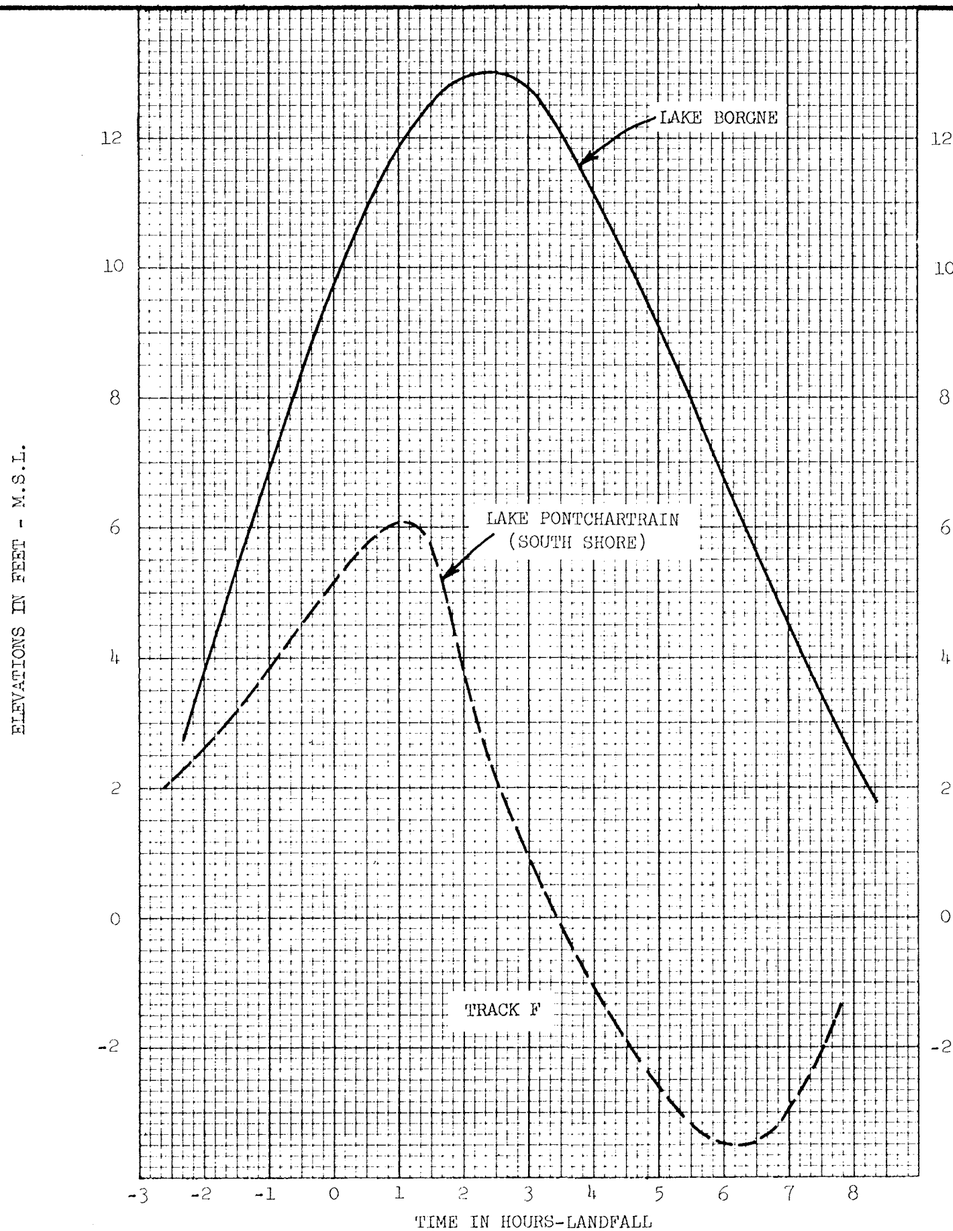
GENERAL DESIGN, SEABROOK LOCK

EXPERIENCED & DESIGN HURRICANE TRACKS

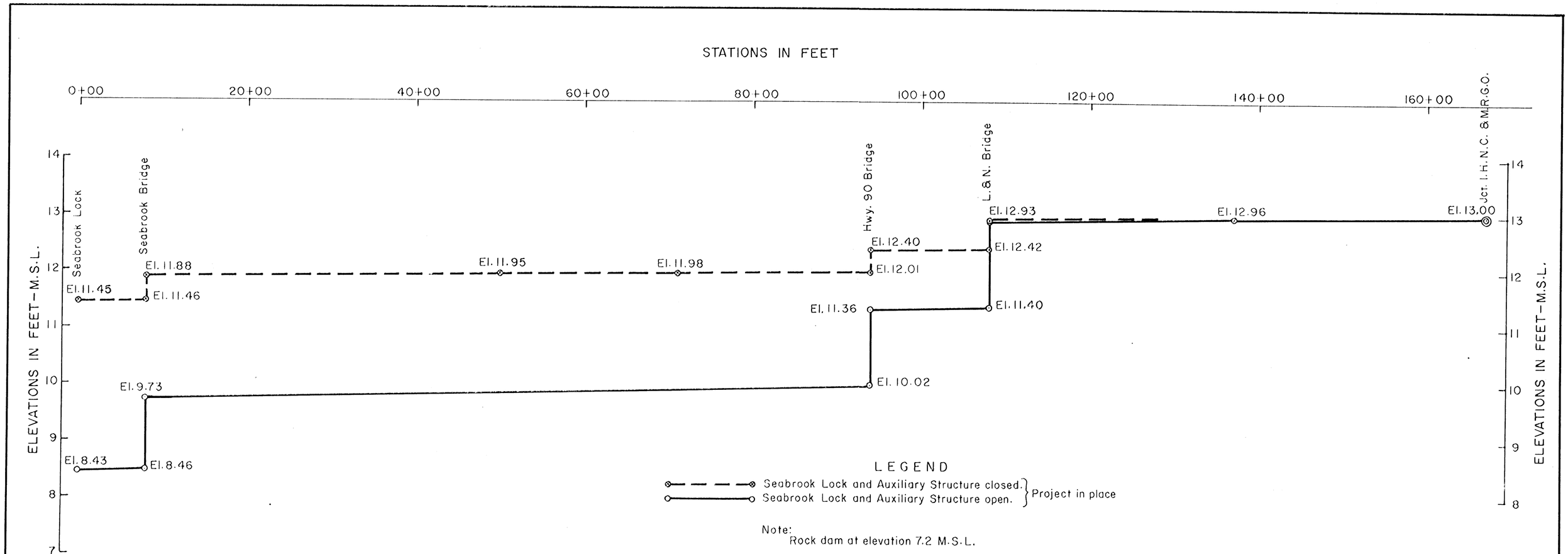
U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS
CORPS OF ENGINEERS

SEPT. 1968 FILE NO. H-2-24733





LAKE PONTCHARTRAIN, LA. AND VICINITY
AND MISSISSIPPI RIVER-GULF OUTLET, LA.
DESIGN MEMORANDUM NO. 1
GENERAL DESIGN, SEABROOK LOCK
SYNTHETIC STAGE HYDROGRAPHS
LAKES BORGNE & PONTCHARTRAIN
TRACKS A AND F SPH
U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS
CORPS OF ENGINEERS
SEPT. 1968 FILE NO. H-2-24733



LAKE PONTCHARTRAIN, LA. AND VICINITY
AND MISSISSIPPI RIVER - GULF OUTLET, LA.

DESIGN MEMORANDUM NO. 1

GENERAL DESIGN, SEABROOK LOCK

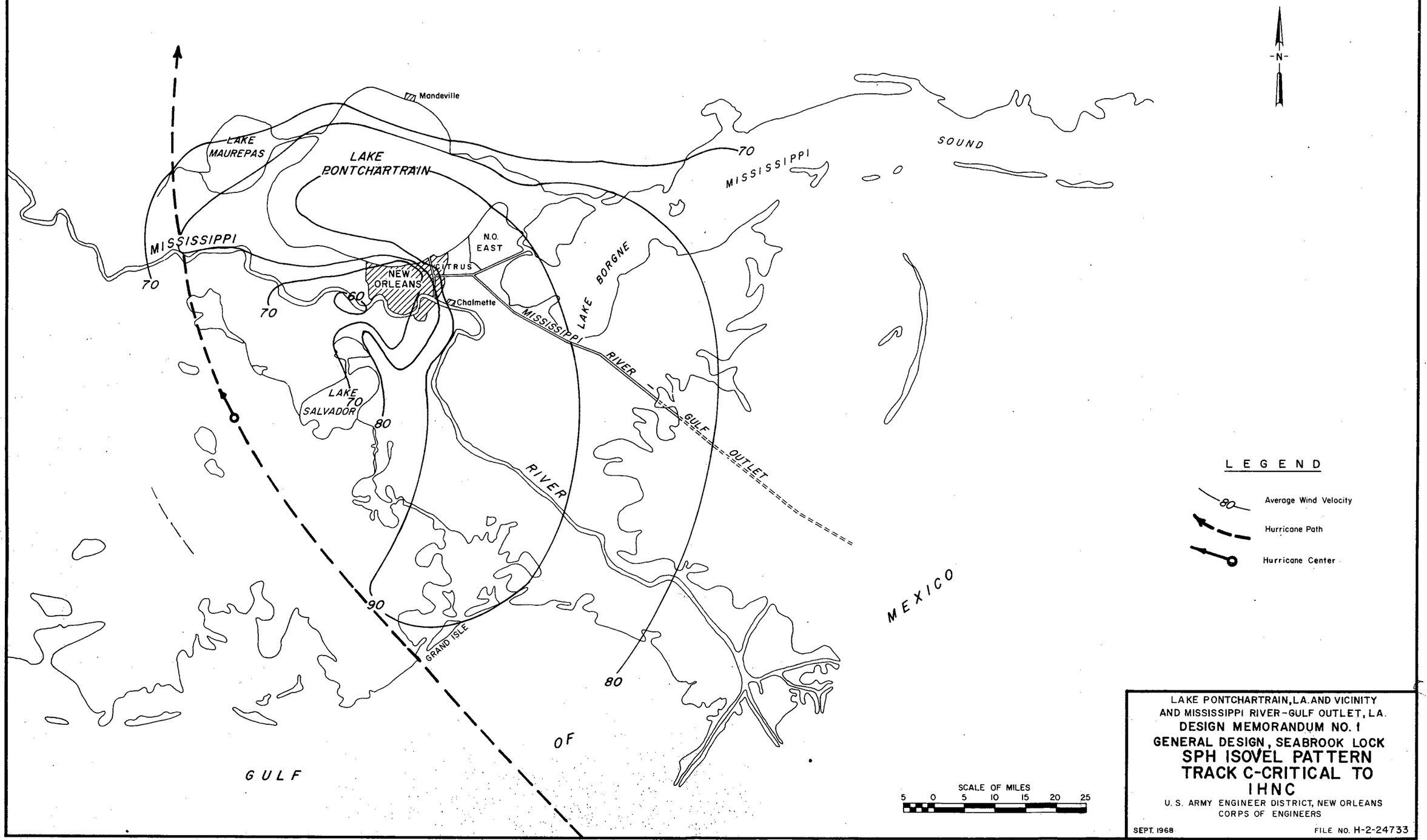
W.S. PROFILES - I.H.N.C.

RELIEF IN MAXIMUM FLOOD STAGES

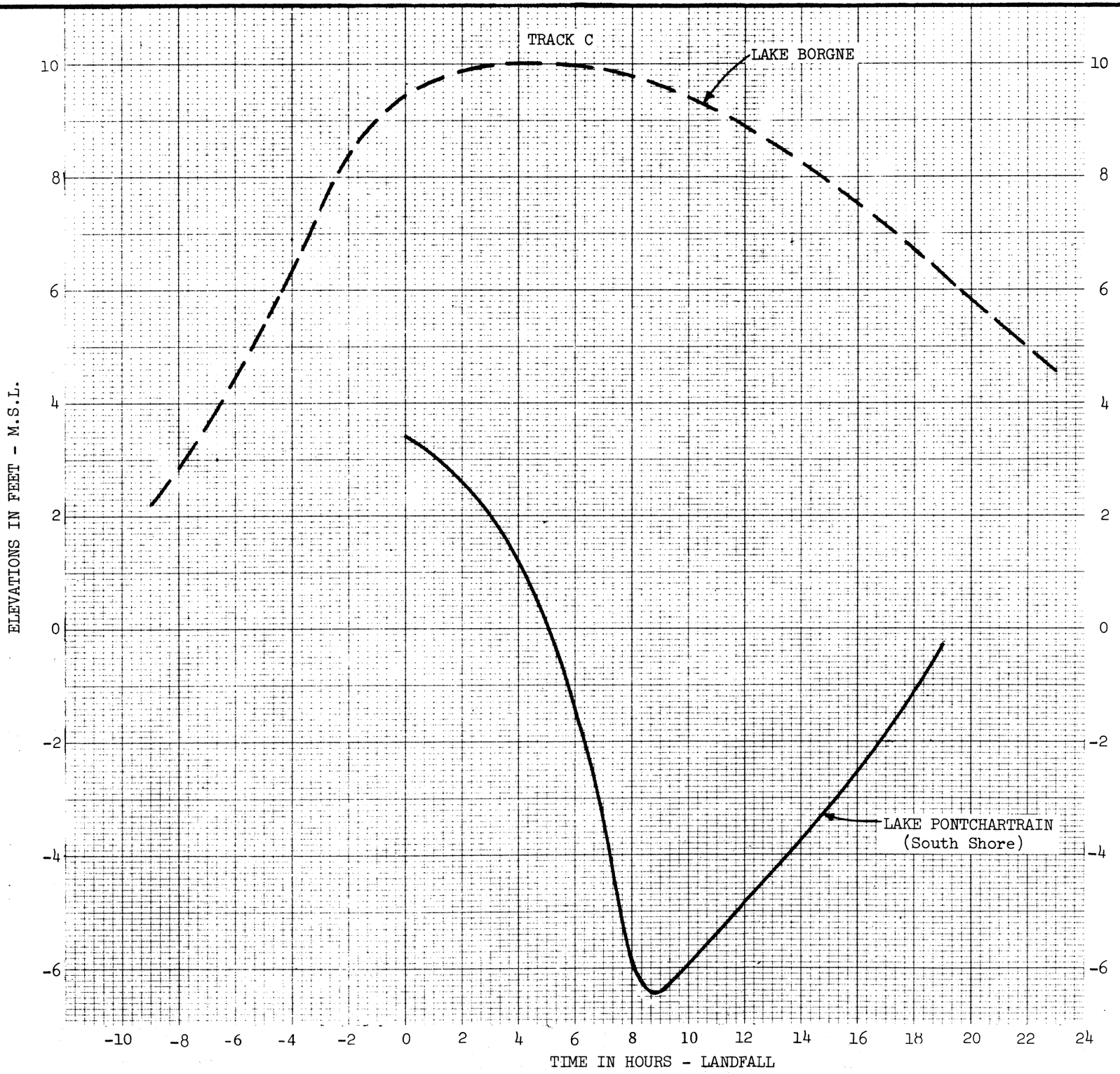
SPH

U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS
CORPS OF ENGINEERS

SEPT. 1968 FILE NO. H-2-24733

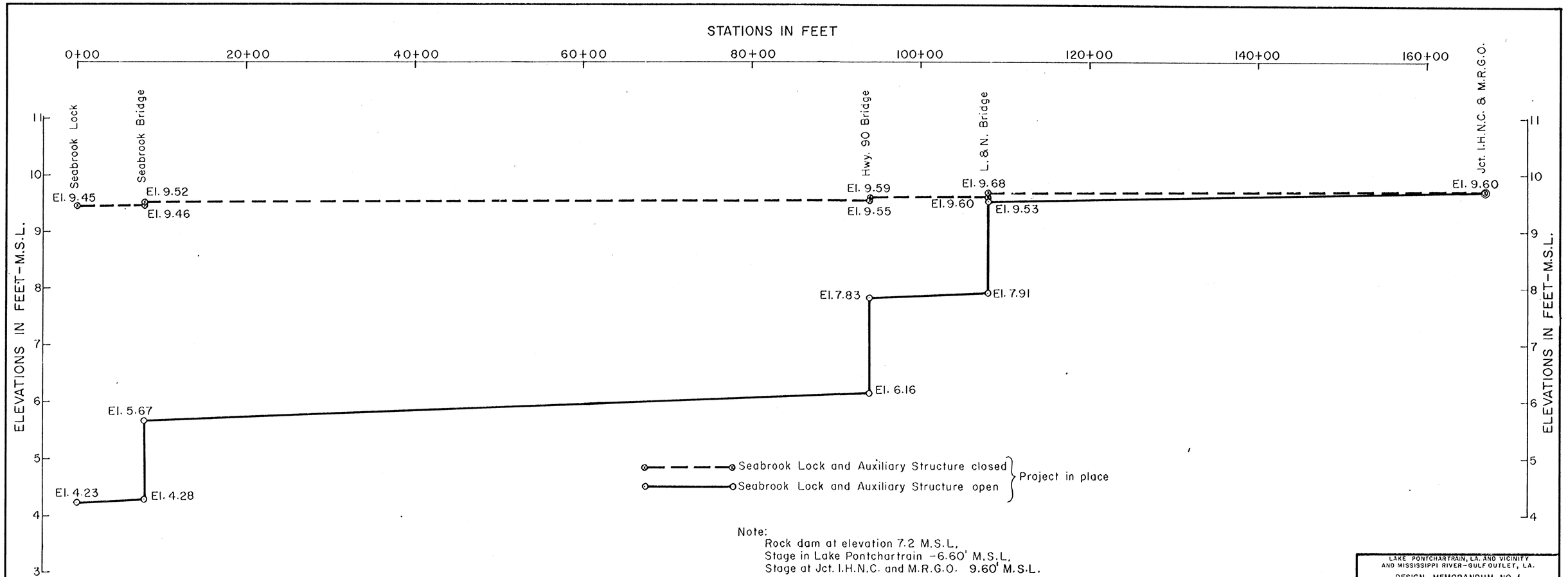


LAKE PONTCHARTRAIN, LA. AND VICINITY
AND MISSISSIPPI RIVER-GULF OUTLET, LA.
DESIGN MEMORANDUM NO. 1
GENERAL DESIGN, SEABROOK LOCK
SPH ISOVEL PATTERN
TRACK C-CRITICAL TO IHNC
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
SEPT. 1968 FILE NO. H-2-24733



LAKE PONTCHARTRAIN, LA. AND VICINITY
AND MISSISSIPPI RIVER-GULF OUTLET, LA.
DESIGN MEMORANDUM NO.1
GENERAL DESIGN, SEABROOK LOCK
SYNTHETIC STAGE HYDROGRAPHS
LAKES BORGNE AND PONTCHARTRAIN
DESIGN DIFFERENTIAL HEADS
TRACK C (100 YR. FREQ.)
U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS
CORPS OF ENGINEERS
SEPT. 1968 FILE NO. H-2-24733

APPENDIX D PLATE D-7



Note:
Rock dam at elevation 7.2 M.S.L.
Stage in Lake Pontchartrain -6.60' M.S.L.
Stage at Jct. I.H.N.C. and M.R.G.O. 9.60' M.S.L.

LAKE PONTCHARTRAIN, LA. AND VICINITY
AND MISSISSIPPI RIVER-GULF OUTLET, LA.
DESIGN MEMORANDUM NO. 1
GENERAL DESIGN, SEABROOK LOCK

W.S. PROFILES - I.H.N.C. FLOW LINE (100 YEAR-STORM)

U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS
CORPS OF ENGINEERS
SEPT. 1968 FILE NO. H-2-24733

LAKE PONTCHARTRAIN, LOUISIANA AND VICINITY
AND
MISSISSIPPI RIVER - GULF OUTLET, LOUISIANA

SEABROOK LOCK
DESIGN MEMORANDUM NO. 1, GENERAL

APPENDIX E
INVESTIGATION OF ALTERNATIVE TYPES OF LOCK CHAMBER WALLS AND ALTERNATIVE TYPES OF FOUNDATION PILES

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1. Alternative types of lock chamber walls. Four types of lock chamber walls have been selected for preliminary designs and estimates. Each is considered to be a technically feasible construction alternative that can be constructed in the wet (a necessary capability because of the considerably higher cost that a cofferdam would entail) and can be designed to withstand forces resulting from the loading cases to be used. The following criteria were applied as basic requirements:

a. Each type of wall must include a cutoff extending to elevation -50. This requirement, stipulated by Waterways Experiment Station and based on the foundation exploration by that office, will guarantee a continuous cutoff extending down to the clayey and relatively impervious layer of Nearshore Gulf Deposits.

b. All steel piling that is to become a permanent part of the wall will be sand blasted to near-white-metal, primed with a zinc-rich primer to provide a degree of autogenous cathodic protection supplemental to the impressed system, coated with a 20-mil coal tar epoxy system, and protected in the zone from mud line to water line with an impressed current system of cathodic protection. This extensive amount of corrosion protection is considered necessary because of the corrosive environment and the fact that repair of paint coatings cannot be accomplished except in areas above the water line.

2. The four types of wall considered are:

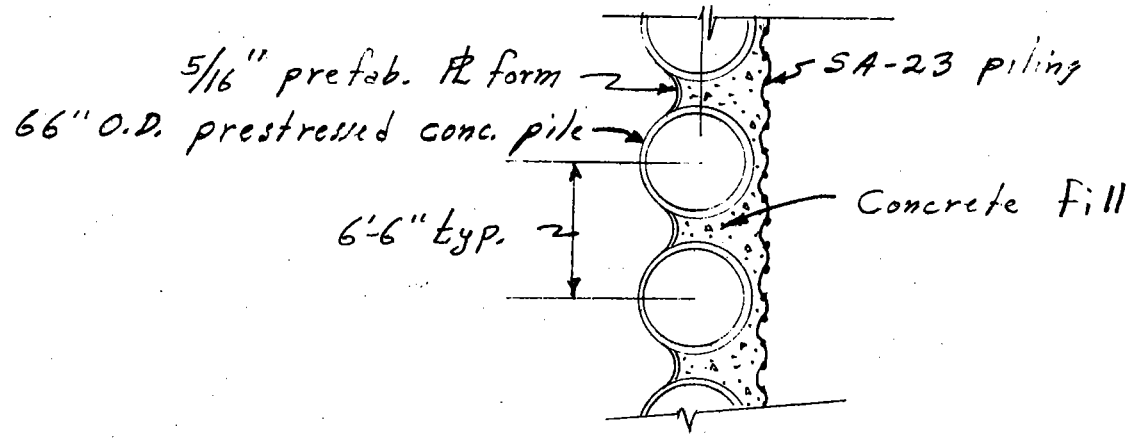
a. A cantilever type wall comprised of a single row of closely spaced prestressed concrete piles very similar to the plan used in the survey report. Because the design head differential now being used is much higher than was assumed in the survey report, it has been found necessary to place a considerable quantity of fill behind the wall to partially offset the maximum hydrostatic force and reduce the bending to a value compatible with the prestressed pile's bending resistance. The pile section was checked for bending and the required penetration was determined by conventional methods. The relatively deep penetration is needed because of low strengths in the soil layers encountered.

b. A cantilever type wall similar to the one described above but with a reinforced concrete superstructure replacing the top portion of pile.

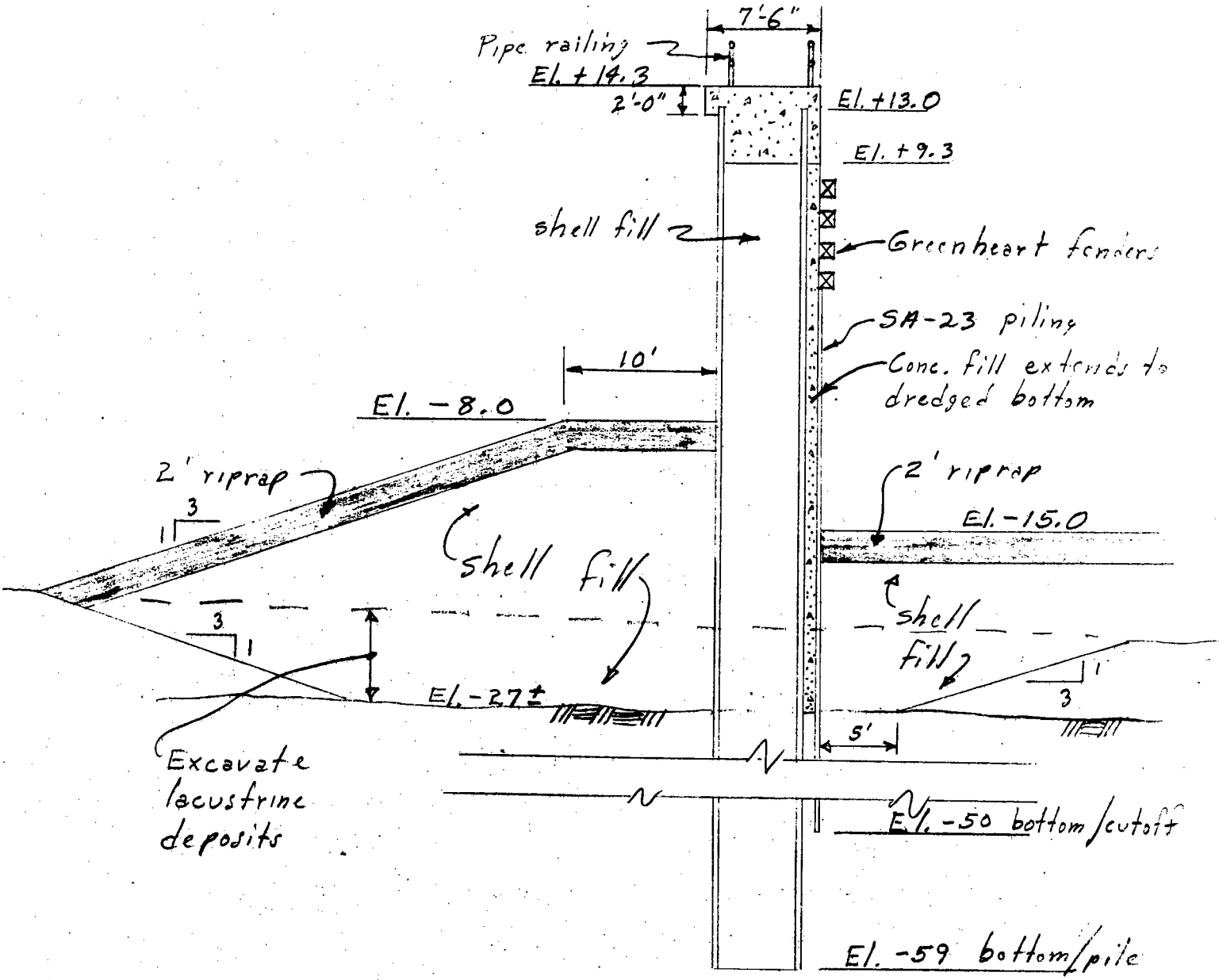
c. A steel sheet pile cellular wall analyzed in accordance with Cummings' method of calculating tilting resistance. This is a relatively simple gravity type wall but requires a great amount of piling.

d. A steel sheet pile parallel wall structure with a tie rod and wale system. This wall, also analyzed by Cummings' method, requires less piling but more fill and considerable miscellaneous metal in the way of tie rods, bolts and wales.

3. Sketches of the four types of wall considered, and the comparative estimate of cost, are shown on the following pages. The parallel wall structure described in subparagraph 2.d. above is the least costly by a substantial margin. Because there is no reliable way of estimating damage frequency (the prestressed pile types would be much more susceptible to boat impact damage) a meaningful estimate of annual cost for each type of wall cannot be made and the estimated first costs are considered to be reliable indicators of relative economy. It may be noted, in this regard, that the annual maintenance and operations cost for the cathodic protection required for steel in the chamber walls and gate structures as proposed in this design memorandum is estimated as less than $1,000 per year.

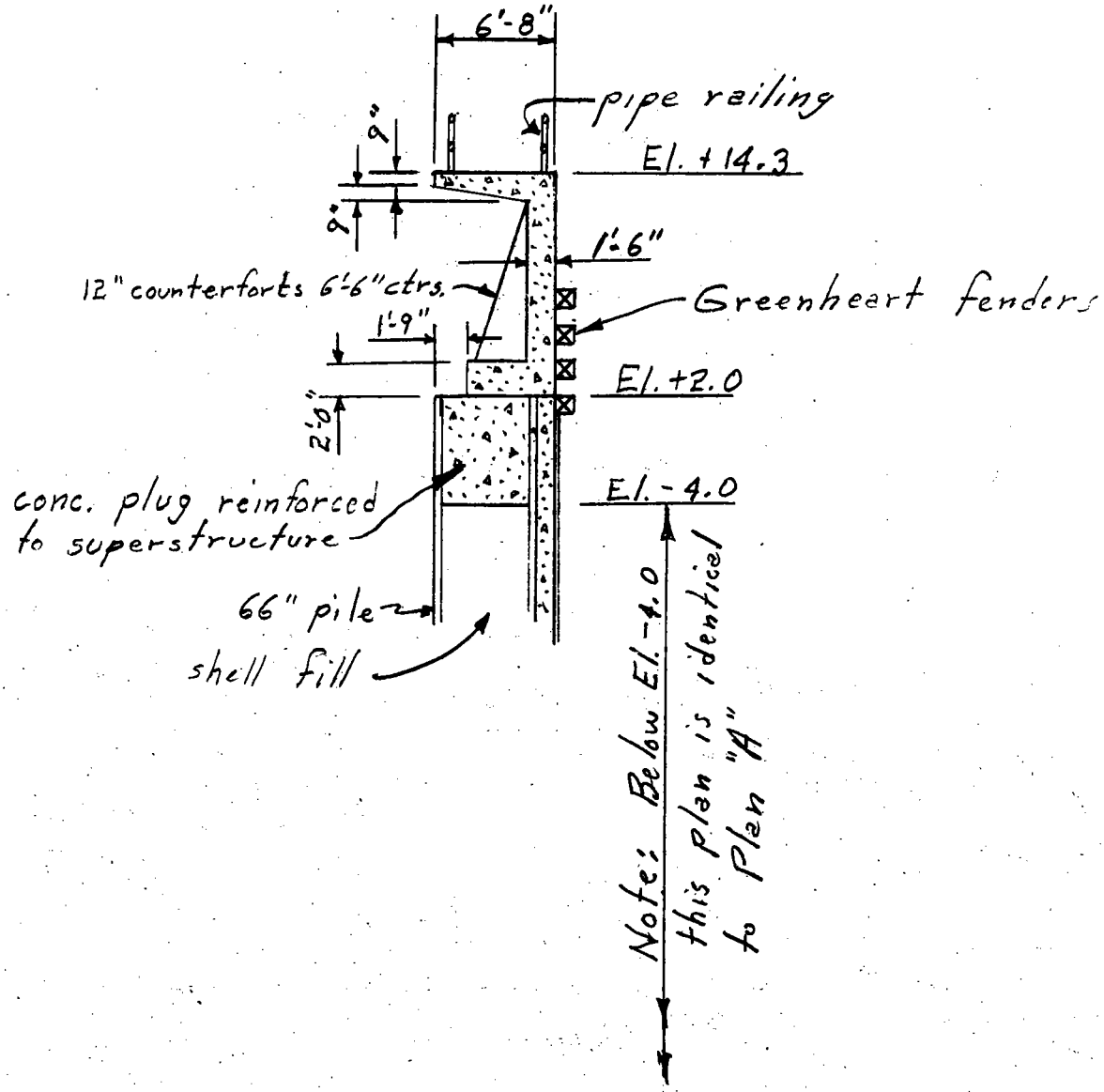


TYP. HORIZ. SECTION



PRESTRESSED CONCRETE PILE CANTILEVER WALL

PLAN "A"



PRESTRESSED CONCRETE PILE CANTILEVER WALL

WITH POURED CONCRETE SUPERSTRUCTURE

PLAN "B"

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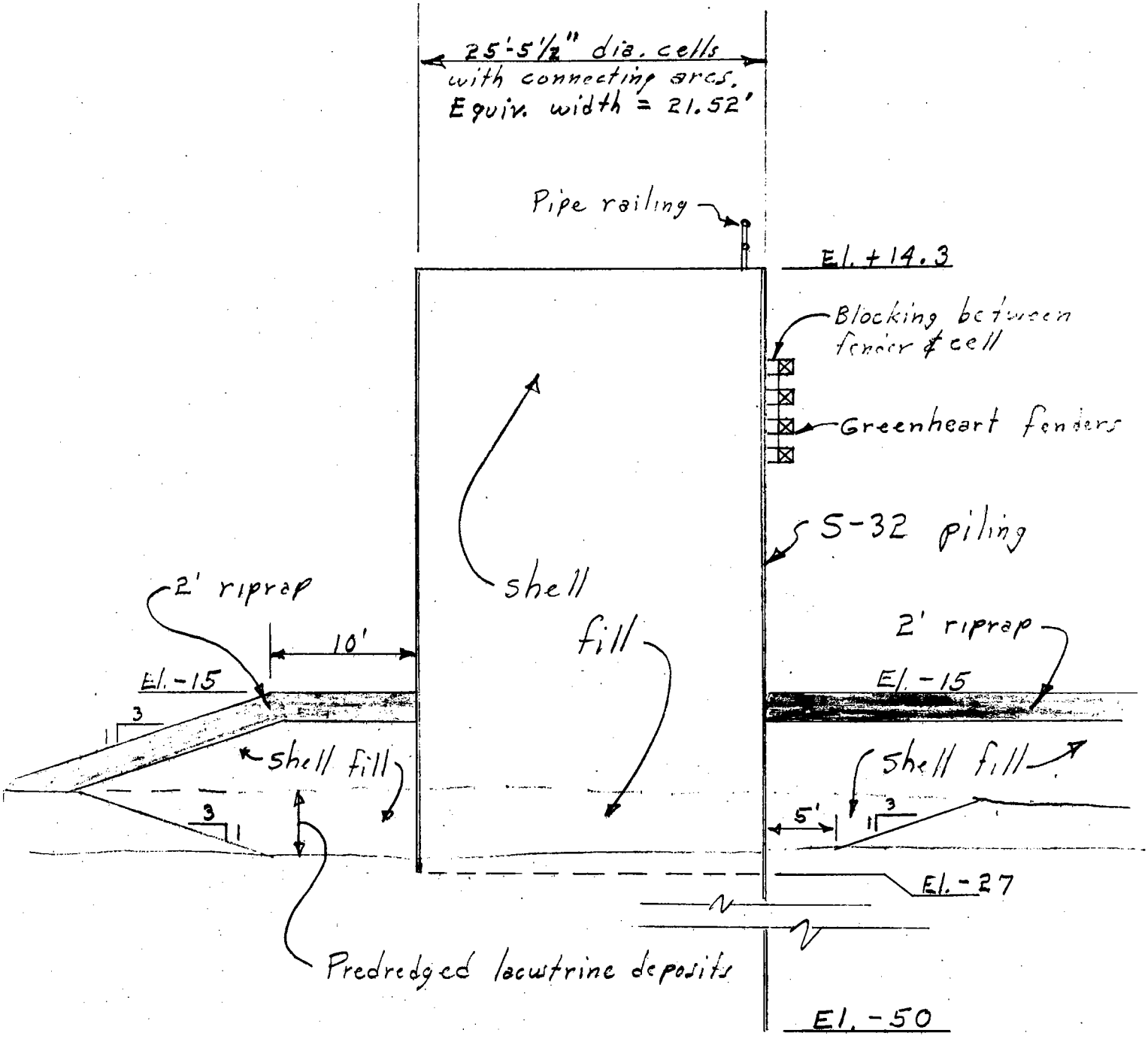
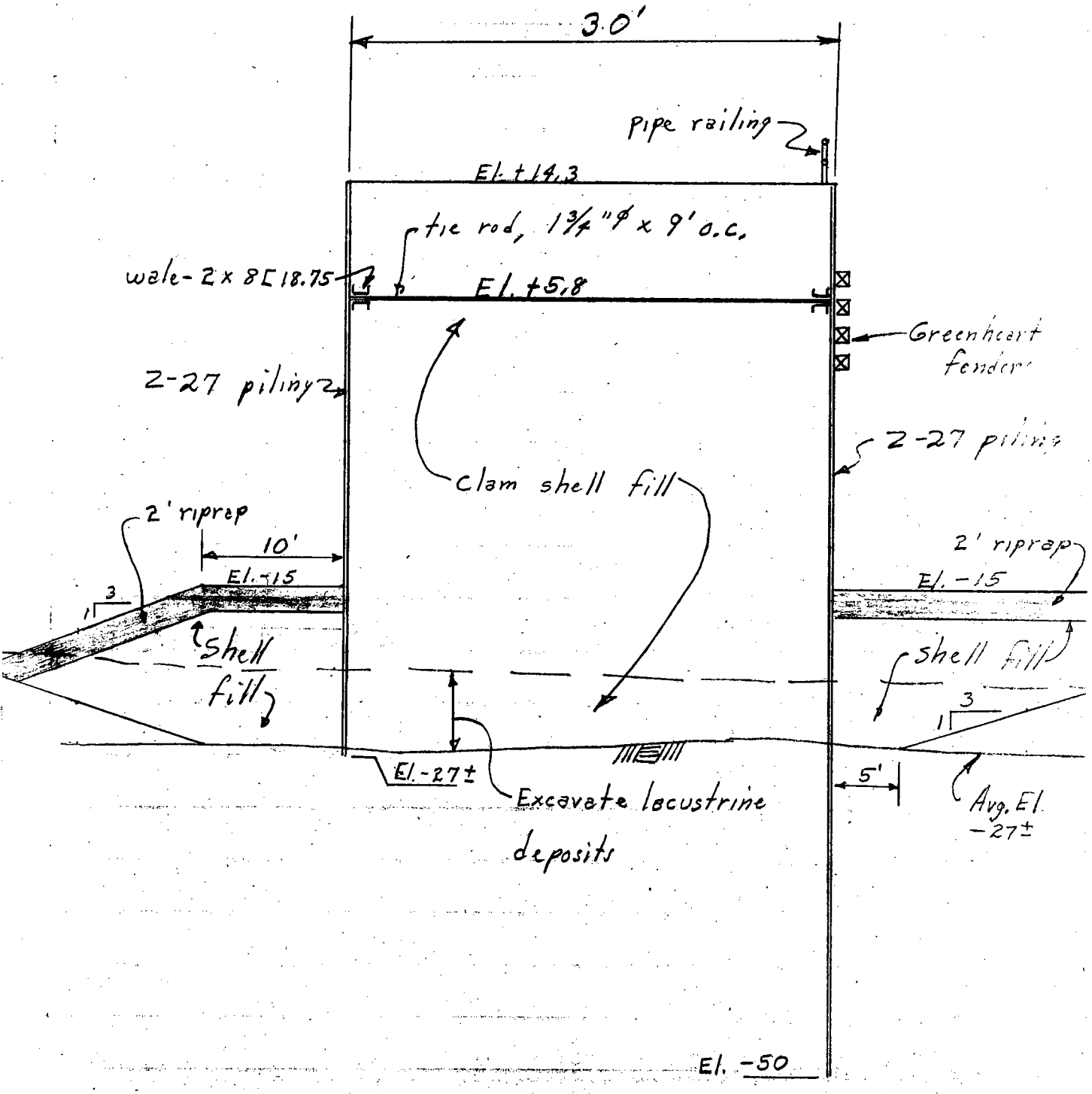


TYPICAL SECTION THRU CELLULAR LOCK WALL

PLAN "C"

Note: Required width of wall is greater than in Plan "C" because there is no interlock friction to resist tilting (Analysis is by Cummings method)



TYPICAL SECTION THRU PARALLEL TIE-BACK WALL

PLAN "D"

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TABLE 1
PRELIMINARY ESTIMATES OF COST
ALTERNATIVE TYPES OF LOCK CHAMBER WALLS

Item No.	Description	Quantity	Unit	Unit cost	Amount
				$	$
PLAN A - Cantilever concrete piles					
1	Excavation	9,400	c.y.	4.00	37,600
2	Concrete piles	17,280	l.f.	53.00	915,840
3	Steel sheet piling, SA-23	59,600	l.f.	5.00	298,000
4	Concrete, elev. -27 to +1	3,345	c.y.	60.00	200,700
5	Concrete, elev. +1 to +12.3	1,740	c.y.	60.00	104,400
6	Concrete cap	870	c.y.	60.00	52,200
7	Shell fill	48,400	c.y.	3.25	157,300
8	Riprap	17,500	ton	8.00	140,000
9	Timber fender	91	Mfbm	700.00	63,700
10	Pipe railing	3,120	l.f.	12.00	37,440
	Total				2,007,180
PLAN B - Cantilever concrete piles/poured concrete superstructure					
1	Excavation	9,400	c.y.	4.00	37,600
2	Concrete piles	14,640	l.f.	53.00	775,920
3	Steel sheet piling, SA-23	59,600	l.f.	5.00	298,000
4	Concrete, elev. -27 to +2	4,250	c.y.	60.00	255,000
5	Structural concrete	1,890	c.y.	150.00	283,500
6	Steel reinforcement	190,000	lb.	0.18	34,200
7	Shell fill	45,200	c.y.	3.25	146,900
8	Riprap	17,500	ton	8.00	140,000
9	Timber fender	91	Mfbm	700.00	63,700
10	Pipe railing	3,120	l.f.	12.00	37,440
	Total				2,072,260
PLAN C - Cellular steel sheet piling					
1	Excavation	15,600	c.y.	4.00	62,400
2	Steel sheet piling, S-32	200,000	l.f.	5.50	1,100,000
3	Tee piling	11,400	l.f.	15.50	176,700
4	Shell fill	81,000	c.y.	3.25	263,250
5	Riprap	13,500	ton	8.00	108,000
6	Timber fender	91	Mfbm	700.00	63,700
7	Pipe railing	1,560	l.f.	12.00	18,720
8	Paint piling		l.s.		340,000
9	Cathodic system		l.s.		50,000
	Total				2,182,770

TABLE 1 (Cont'd)

Item No.	Description	Quantity	Unit	Unit cost	Amount
				$	$
PLAN D - Parallel, tie-back, steel sheet piling					
1	Excavation	16,000	c.y.	4.00	64,000
2	Steel sheet piling, Z-27	110,000	l.f.	5.50	605,000
3	Tie rods, bolts, and wales	200,000	lb.	0.40	80,000
4	Shell fill	98,000	c.y.	3.25	518,500
5	Riprap	13,500	ton	8.00	108,000
6	Timber fender	91	Mfbm	700.00	63,700
7	Pipe railing	1,560	l.f.	12.00	18,720
8	Paint piling		l.s.		260,000
9	Cathodic system		l.s.		40,000
	Total				1,557,920

4. Alternative types of foundation piles. Closely underlying the Seabrook Lock gate bay sites are two clayey layers (Nearshore Gulf Deposits and zone 1 of the Pleistocene Prairie Formation). Application of significant permanent loading to these strata is very likely to cause soil consolidation and result in gate bay settlement. Consequently it is considered advisable to drive bearing piles completely through these strata and transfer all pile loads to Zone 2 of the Pleistocene Prairie Formation (a fairly strong, sandy stratum). Following this procedure will mean that every pile will have a majority of its length acting as a column but not transferring load to the surrounding soil. Only the relatively short length embedded in Zone 2 will be considered as transferring load to the soil. It appears possible, therefore, that by using a few very high capacity piles the proportion of piling actively transferring load to the soil will increase, the proportion of piling simply acting as a column will decrease, and the total pile cost may decrease also. Because of this possibility it was decided to make comparative estimates for several different types of piles.

5. The types of piles studied and their characteristics are as follows:

a. Timber pile (assumed treated). Capacity per pile taken as 30 tons. Nine inch tip diameter. Required penetration in sand is 28' per pile. Length of each pile is 58'. Number of piles required is 702.

b. Precast concrete pile assumed to be 14½ inches square. Allowable stress is 900 p.s.i. which gives a pile capacity of 94.6 tons. Required penetration in sand is 44' and length of pile is 74'. Number required is 214.

c. Precast prestressed hollow pipe piles assumed to be 54 inches O.D. with 4 inch walls. Allowable stress is 1,350 p.s.i. and pile capacity is 212 tons. Required penetration in sand is 34' and length of pile is 64'. Number required is 94.

6. Regardless of pile type used, actual length needed will be goverened by load tests at time of construction. Required penetrations cited above are based on 900 lbs. per sq. ft. assumed skin friction. The number and lengths cited are expected to provide equivalent foundation support and, thus, are directly comparable. Related estimates of costs are given below.

TABLE 2
PRELIMINARY ESTIMATES OF COST
ALTERNATIVE TYPES OF FOUNDATION PILES

Description	Quantity	Unit	Unit cost	Amount
			$	$
Timber piles, treated				
702 @ 58'	40,716	1.f.	3.50	142,506
Precast concrete piles				
214 @ 74'	15,836	1.f.	9.15	144,899
Prestressed concrete piles				
94 @ 64'	6,016	1.f.	45.00	270,720

7. It is concluded that treated timber piles are the least costly of the three types studied. Subsequent investigations have revealed that, since the timber piles would be permanently embedded in soil or shell fill, treatment would not be required and, consequently, a timber pile foundation would be even less costly than estimated. Based on this conclusion design will proceed using untreated timber piles.