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

REPLY TO
ATTENTION OF:

LMNED-HC

1 October 1983

SUBJECT: Lake Pontchartrain, Louisiana and Vicinity Hurricane Protection Project - Model Study, Request for Authorization

Commander, Lower Mississippi Valley Division
ATTN: LMVED-WH

1. Purpose. The purpose of this letter is to inform higher authority of the status of engineering studies associated with the Orleans Parish Outfall Canals as they relate to the authorized Lake Pontchartrain, Louisiana and Vicinity Hurricane Protection project and to request authority to conduct a model study of one of the proposed remedial measures for this project feature. It is our intent herein to establish the basis for this recommendation and briefly describe the various other possible remedial measures to be considered in an alternative plans study section that will be detailed in the General Design Memorandum for this project feature.

2. Background. The need for project work at the three drainage Outfall Canals in Orleans Parish was identified subsequent to project authorization. The adoption of more severe hurricane parameters by the U.S. Weather Bureau necessitated upward revisions to the hurricane levee grades under the Lake Pontchartrain project. Inclosure 1 shows the location of each of the three Outfall Canals. The canals provide the main pumped drainage outfalls for the City of New Orleans. As can be seen on inclosure 1, the pumping stations located on each of these canals are situated interior to the city some 2.5 to 3.1 miles from the shoreline of the lake. Protection from tidal inundation via the lake-canal connection is presently achieved by locally constructed lateral parallel levees along each side of the canals. The existing lateral levees along each of the outfall canals do not meet the design height or design sectional stability required for the Lake Pontchartrain project under either the authorized Barrier Plan or the proposed High Level Plan. Much of the New Orleans Area served by the Outfall Canals is well below sea level. Average topographic elevations in the drainage area are -6.0 ft. NGVD with some areas as low as -10.0 ft. NGVD.

3. Hydrologic and Physical Data for Outfall Canals. Although each canal is similar in appearance, hydrologic requirements for conveyance are quite different. Table 1 gives pertinent physical dimensions and hydraulic requirements for each of the canals.

Table 1
Hydrologic and Physical Characteristics of the
Orleans Parish Outfall Canals

Canal Name	Length (MI)	Top Width (FT)	Invert Elevation (FT-NGVD)	Pumping Station Capacity (CFS)
Metairie Relief (17th St Canal)	2.5	200	-18.4	10,400 *
Orleans Avenue Canal	2.6	160	-10.0	4,000
London Avenue Canal	3.1	230	-10.0	8,050

* Projected capacity presently under construction.

4. Plans Under Consideration. In general five basic plans will be studied and presented in the GDM. The plans include the following:

a. Plan 1. Lateral parallel protection - optimum combination of levee, I-wall, and T-wall.

b. Plan 2. Concrete Box - culverted canals with positive cutoff at the existing pumping stations.

c. Plan 3. Flood gates at the lake end of the canals.

d. Plan 4. Flood gates at the lake end of the canals with an auxiliary low-head pumping station.

e. Plan 5. Replacement of the existing stations with new stations at the lake end of the canals and appropriate modifications of the existing canals and removal of existing stations.

5. Summary of First Cost. Inclosure 2 shows survey scope estimates of first cost for these basic plans. Plans 3a and 3b are presented so that a comparison of cost between a conventionally gated structure and the "butterfly control valve" structure can be made. The GDM for this project feature will investigate the feasibility of various other gate types that might be used to insure that the most cost effective and constructible plan is recommended.

6. Finding a solution has been made difficult because, on the one hand, raising and strengthening the levees would be extremely expensive and disruptive of existing developments along the canals, while on the other hand, solutions which would eliminate the need to raise the levees are acceptable to the Sewerage and Water Board of New Orleans (SWBNO) only if they preserve the ability of the Board to pump into the canals under all conditions. With the exception of the vertically pinned butterfly control valves, all plans proved either excessive in cost, unacceptable to the Board, and/or presented apparently intractable operational problems. For instance, operationally Plan 3a which employs vertical lift gates, would require the gates to be closed during a hurricane at a predetermined time/stage and all pumping to cease. If pumping were not stopped, available canal storage would be used up in less than 20 minutes and overtopping of the lateral levees would occur. In the case of the butterfly control valves, this deficiency is avoided by virtue of its ability to automatically close in response to a higher lake stage than canal stage and, just as important, to reopen automatically when the lake level recedes and pumping can continue.

7. Last fall efforts were directed to a search for a solution which would operate to simultaneously provide, at reasonable cost, a means for keeping hurricane surges out of the canals while preserving for the SWBNO the option to pump at all times. Consequently we developed a concept for an automatic control valve (vertically pinned butterfly control valves) which would respond to very small changes in differential head. We believe this scheme may be the means by which we can cut the Gordian knot that has stymied our efforts thus far. The control valves as presently conceived are shown on inclosure 3. Under this solution, the control valves would ordinarily be stored in the open position, allowing unrestricted outflow. Should a hurricane impend, the valves would be "trimmed" well in advance of predicted landfall so that they would promptly swing closed in the event that lake stages were to exceed those in the canal. In effect, the control valves would never close as long as the SWBNO continued to pump, but would close promptly when lake waters start to flow into the canal. We have sought the views of the SWBNO, the Orleans Levee District (OLD), and Jefferson Parish, and find them, in general, favorably disposed toward the concept, pending further engineering studies and analyses. The favorable reaction from the SWBNO insofar as the 17th Street Canal is concerned is tempered, however, by the fact that they are rather far

advanced with plans to increase the capacity of the 17th Street Canal and the pumping station which discharges into it, and these plans involve raising the lateral levees. They believe that this can be done for about the same cost as we currently estimate for the control valves. Since the SWBNO would, of course, be desirous of having the work credited to the OLD under the project, we are following their studies with interest, but on the basis of our previous work, we believe that hurricane project standards will be difficult to achieve at that cost. Accordingly, we propose to continue with efforts to develop the control valve concept.

8. There are numerous questions concerning the control valve design which can best be addressed through model studies. The placement of the valve trunnions and the need for measures to deal with surges and waves are obviously crucial to the success of the concept. We have asked WES to prepare cost estimates for two model studies. The first would involve the construction, at a scale of 1 to 20, of a section of Lake Pontchartrain and an outfall canal sufficient in detail to determine flow conditions, forces on the gate, and the effects of shoaling, refraction and diffraction of waves as they progress up the outfall canal from the lake to the gate, and proper trunnion placement. This model will cost $241,000 to design and build, $84,000 to operate for 4 months, and $15,000 for a final report, for an estimated total cost of $340,000. Design guidance will be available in about 7 months. The second model would be used only if some essential forces determined in the comprehensive model are too small to allow adequate measurement for design details. This sectional model would be built to a scale of 1 to 10 and would simulate one complete gate, its piers, a portion of the gate on either side of the tested gate, and about 300 feet of the approach and 300 feet of the exit canal area. Design and construction of this model will take about 4 months and cost $144,000. Operation will cost $63,000 for 3 months and final test results would be combined into the report for the comprehensive model test. The total time required to conduct the model studies and to complete the report is estimated to be approximately 1 $\frac{1}{2}$ years. Please refer to LMNED-H 25 May 1983 letter to WES and WESHS 24 Jun 1983 1st Ind on the subject of Time and Cost Estimate for Hydraulic Model Tests of the Proposed Butterfly Valve Gated Structure, New Orleans Outfall Canals Hurricane Protection (copies at inclosure 4) for details of the model tests.

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9. For additional details of the model, Mr. Soileau can be contacted on 687-2420 or Mr. Combe on 687-2480.

FOR THE COMMANDER:

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FREDERIC M. CHATRY
Chief, Engineering Division