

A0006810

MODEL STUDY RESULTS
REQUIRED FOR STRUCTURAL DESIGN
OF
LAKE PONTCHARTRAIN
BUTTERFLY CONTROL VALVE

The model study results should contain the magnitude, frequency, location and direction of the average and maximum hydraulic forces on the gate. This includes the horizontal and vertical reactions at each of the pin ends and, for the completely closed configuration, the reactions on the walls and sills. Also, the torque on each pin end during the opening and closing process as well as any torque during the operation of the structure should be provided. The results should also contain the water surface profile along both gate faces. The above should be provided for all hydraulic loading conditions.

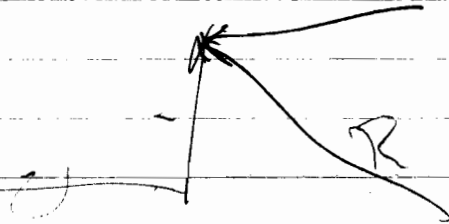
LPHP-BCV

12 Jun 85

model can only do this now:
Opd of gate mount + torque only at top of pin

2000 cfs ^{flow} - all gates open
Upper limit
Spring on tail of gate
16 ^{1-K} ± on spring gage

45° + 30° position or say every 15° get torque or force and moment arm from opening to closing



1 foot w/ flow coming out no more than ΔH of 3 feet open against inflow

1/2 ft increments up to 2' then 1' increments to 5'

^{flow}
11.5 ⁷ / ~~11~~ 8/9/9.5/10/10.5/11

information will arrive in 6 weeks

200 cfs will close the gate (w/ no friction)

500, 1000, 1500 cfs determine resist motion
test low water +1.5 or 2
and gate +7 or 8
~~submerged~~

BURK AND ASSOCIATES, INC
Engineers, Planners,
Environmental Scientists

4176 Canal Street
New Orleans, La. 70119
Tel. (504) 486-5901

**MEETING
REPORT**

PROJECT
London Ave. Canal Floodwalls

NO.
8407

PARTICIPANTS See attached list
B&A: **OTHER:**

SUMMARY

The meeting was held at the Corps of Engineers to discuss alternatives for flood protection along the outfall canal of London Ave. between the Broad Street Pump Station and Lake Pontchartrain. Dan Judlin began by giving a summary of how this project was developed from its' original concept. Originally the lake front protection was to consist of raised barriers maintaining a low water level elevation in Lake Pontchartrain as well as in the outfall canals from the pump stations into Lake Pontchartrain. After Hurricane Betsy the Corps of Engineers did a revised survey and revised the datum plane for the lake front of New Orleans. Also at this same time, the National Weather Service developed a revised storm projection for the project hurricane. With these two combinations, it was determined that some added protection was necessary to the lake front levee system as well as the three outfall canals in Orleans Parish. During the early 1970's the Corps of Engineers began studding lake front protection. They looked at three alternates. One was a parallel floodwall structure from the lake front to the pump stations. Another alternate was gate closure structures at the lake front end of each of these canals. And the third alternative was to build new drainage pump stations at the lake front end of each of these canals and abandon the parallel protection along each canal.

Sewerage and Water Board was against the concept of the closure gates. They wanted the Corps of Engineers to construct new drainage pump stations at the lake front on each of these three canals. The Corps began considering closure

Written by: Michael G. Jackson **Date:** February 13, 1985 **Page 1 of 5**
Copies to: Earl Magner
Walter Baudier
Dan Judlin

gates with a smaller lower-lift pumping station in conjunction with the closure gates at each of three lake front locations. In the early 70's the Corps looked at parallel floodwalls as a method of flood protection. Their preliminary look indicated that this would result in a very high project cost and would not be economically feasible. At about this time, the Corps of Engineers changed from the Raised Barriers Plan to the High Level Plan which would not construct flood gates at the Riggolets and Chef Pass, instead lake level would be allowed to rise during a project hurricane which meant even more flood protection requirements would be necessary at the three outfall canals due to high water surface elevations in Lake Pontchartrain. Also around this time, Sewerage and Water Board began looking at improvements necessary in the 17th Street Canal. S&WB improvements consisted of dredging and some raising of the flood walls to maintain adequate outfall capacity from the pump stations to the lake front. S&WB was looking to the Corps for assistance since raising of the flood walls could be considered Corps flood protection. Around this time the Corps developed a concept of a butterfly type closure gate for the lake front. This concept is still under development and is currently being model studied at the Waterways Experiment Station at Vicksburg. The concept of a butterfly closure gate will be based on preventing storm surge from backflowing into the canals, but will allow the pumping station flow outward. As long as interior canal levels are higher than the lake level the butterfly gates will automatically open and allow the discharge water to pass into the lake. Hydraulically the Corps of Engineers criteria is to minimize the hydraulic head loss through the structure by providing enough gate bays to maintain a negligible head loss under normal flow conditions. The Corps is still interested in alternative plans, particularly a parallel flood wall flood protection system, if these alternative plans are found to be economically feasible.

The Corps of Engineers has not addressed the problem of the needs to raise interior flood walls under the lake front closure plan. If the lake front closure structures are constructed, the interior flood walls will still have to be raised to be able to maintain a pool of water from the pump station to the lake front closure at a level higher than Lake Pontchartrain. The Corps attitude is that the lake front closure system will meet their criteria for storm protection to the city and any interior requirements from raising flood walls is a local drainage problem and must be addressed by S&WB and the Orleans Levee Board. The Levee Board must still address this problem if these walls are not raised theoretically the pump stations could fill this reservoir and overtop the flood walls causing flooding to the City of New Orleans.

However, the criteria for raising these interior flood walls may not be as severe with the gate closure at Lake Pontchartrain since wave action will not be allowed within the interior canal with the lake front closure. However some additional improvements will still be necessary to this flood wall system under the lake front closure concept.

Parallel protection system is still the preferred method if everything else was equal according to Dan Judlin. Modjeski and Masters is under contract with the New Orleans Sewerage and Water Board and has done most of the work to date on studying the parallel structures on the 17th Street Canal. On Orleans Ave. Canal and London Ave. Canal very little knowledge is available other than a very preliminary study the Corps did in the early 1970's on these canals. Modjeski and Masters is developing an interim high level plan for the 17th Street Canal. This plan will consist of steel sheet piles with no concrete cap for most of the canal protection. Portions of this flood wall will still require an inverted T flood wall type of structure for flood protection.

In the early 1970's the Corps of Engineers study found that utility relocations and real estate requirements were the major costs adding to the parallel protection flood system. Also, numerous roadway crossings along London Ave. Canal add additional cost to this flood protection system. The limited right-of-way along London Ave. Canal will reduce the possibilities of a combination of earthen levee and sheet pile type of flood protection. This means that an inverted T flood wall may be required over a greater portion of this reach of the project due to narrow right-of-way. The Corps of Engineers stated that the additional soil boring and field survey data, which they had on the 17th Street Canal, was extremely helpful in preparing detailed stability analysis and in choosing alternates for the 17th Street Canal. They strongly recommend that the Orleans Levee Board take this action on Orleans and London Ave. Canal as well.

The sill elevation for the lake front closure structures has been set at -10.0 Mean Sea Level (MSL) by the Corps of Engineers. The Corps is using a -5.0 MSL as design low water level in Lake Pontchartrain. Elevation +11.5 MSL is design still water level in Lake Pontchartrain at these closure structures. Along the 17th Street Canal the Corps of Engineers determined that the failure plane of any flood wall protection system was into the protected side and not into the canal along this entire reach of the project. As far as establishing maximum heights of parallel structures a hydraulic back water curve needs to be determined to establish these design water surface elevations along London Ave. Canal. Beginning at +11.5 MSL in Lake Pontchartrain and

whatever hydraulic gradient is necessary along the canal to determine top of the wall elevation.

The Orleans Levee Board bond issues specifically stated that money was funding an interim protection plan to provide flood protection for the City of New Orleans. The intention of this is to put up an interim protection system which eventually can be incorporated into the Corps of Engineers high level plan and thereby the Levee Board can get credit for their local match in funds for the Corps of Engineers High Level Plan. In the original budget for the Corps High Level Plan, the Corps included approximately \$40 million for flood protection cost on London Ave. Canal. The original concept was for parallel structures. Under the present concept of butterfly Valve structures, the Corps is intending to reduce its cost to approximately \$16 million for the structure at London Ave. Canal. And no money is being proposed to be spent on raising interior levees behind this closure structure. Present Orleans Levee Board budgets for interim protection are \$18.5 million for construction, total project cost of approximately \$21 million for London Ave. Canal. If this budget will develop parallel structures which will meet the final high level protection the Corps of Engineers is willing to adopt the parallel structure plan rather than use the lake front closure gates.

Dan Judlin reasserted the fact that the major cost on parallel structures will be if the T wall flood wall is required. The T wall structure adds considerably to the project cost and it will be very difficult to keep the parallel structures within the \$20 million budget.

The Orleans Levee Board feels that interior flood walls must be raised above elevation +11.5 plus freeboard based on the backwater hydraulic gradient from the S&WB if the Corps builds a lake front closure structure. Since the Corps of Engineers does not accept any responsibility for participation of these interior flood walls under the lake front closure concept, the Orleans Levee Board will be at liberty to establish their own design criteria for water surface elevations as well as factors of safety they are willing to accept on design on these interior protection walls. If the Orleans Levee Board's interim protection can be incorporated into the Corps high level plan, then full credit can be given to the Orleans Levee Board by the Corps of Engineers.

The Corps of Engineers will provide a package of design criteria for use by Burk and Associates in preparing the design memorandum on London Ave. Canal. Some of this criteria are: low water level at Lake Pontchartrain -5.0 MSL, high water level at Lake Pontchartrain +11.5 MSL, the slope

stability and structural design methodology will also be spelled out in this design criteria package. Three copies of this submittal will be available. One for the Orleans Levee Board, one for Burk and Associates and one for Walter Baudier. Jorge Romero from the Corps of Engineers will be putting together this package of design criteria. Jorge will also act as coordinator for the Corps of Engineers on this flood wall protection project.

MGJ/pw
Attachment

13 FEB 85
MEETING @ OUTFALL CANALS

| <u>NAME</u> | <u>ORGANIZATION</u> |
|-------------------|----------------------------|
| JORGE A. ROMERO | CORPS OF ENGRS |
| EARL MAGNER | OLB |
| Walter Baudier | DEF. |
| Jay Combe | C/Coastal Engr & Sec |
| Janis Hoke | Coastal Engr & Sec |
| Jim Richardson | Corps of Engr, F&M Br |
| Walter D. Judlin | Corps of Engr, Des. Branch |
| Frank Vojkovich | Corps of Engr, F&M Br |
| PHILIP NAPOLITANO | CORPS OF ENGRS, F&M Br |
| MICHAEL G. VANCE | BUER & ASSOC. |
| THOMAS L. JACKSON | BUER & ASSOC. |
| Gerard Girard | Corps of Engrs, Des Br |

13 Feb 85

MEMORANDUM FOR RECORD

SUBJECT: Lake Pontchartrain and Vicinity, Hurricane Protection Project Meeting on Outfall Canals.

1. A meeting was held on 13 Feb 85 in the New Orleans District office to discuss the Orleans^{Ave.} London Ave and Metairie Relief Outfall Canals. A list of attendees is enclosed. A brief summary of the meeting follows.

2. Mr. Judlin opened the meeting with a brief history of the subject project^{as follows}. Under the original barrier plan and after Hurricane Camille, the SPH was revised such that the design lake level went up. At the same time, benchmark data for the city was revised such that the elevation of the ^{existing} levees went down. When this occurred, we began looking at the ^{junction of the ~~present~~} hurricane protection ^{at the lake and} ~~at the junction of the outfall canals and the lake~~. Alternatives investigated were (1) raising of the existing levees from the lake to the ^{existing} pumping stations (parallel protection), (2) construction of a new pumping station at the lake and (3) constructing a structure and a smaller pumping station. During this investigation of the parallel protection, it was determined that this ~~costly~~ alternative would be so costly that this investigation was abandoned. When the S&WB began planning for the enlargement of conveyance capacity of the 17th Street Canal by deepening the channel and raising the height of the levees, the question as to whether this would part of the high level plan was raised.

3. The concept of the ^{present} control valve structures was investigated and was for the valve to be in the open position during routine

operation of the canals by the S&WB (see encl for ~~non~~description of nomenclature). When a hurricane approaches, the valve is set in the trimmed position which would allow the S&WB to continue pumping until the direction of flow reversed whereby the valve would close, i.e., the S&WB could not overcome or pump against the differential head. This concept is presently being model tested at WES. In addition, a wooden model was constructed by NOD.

4. Minimal head loss through the valve structure is a priority of the model studies because NOD is aware that the low head pumps of the S&WB are very sensitive to this head loss.

Raising of the parallel protection may be needed anyway for the S&WB ^{under higher lake elevations} to pump, and this ^{would} ~~may~~ be a part of the OLB ^{responsibility} ~~protection~~ but not part of the ^{Lake Poyichor train} ~~Government's protection~~ project.

5. Modjeski & Masters (AE for S&WB) is looking at raising the parallel protection along the 17th Street Canal to the HLP height and will furnish NOD with an "interim" HLP. The high cost of the HLP parallel protection was due to the crossings and parallel relocations involved. More data (borings, surveys, i.e. X sections especially on the protected side) is available for the 17th Street Canal which allows particular problem solving. An example of this was the installation of piezometers at one location to determine uplift and seepage. The governing stability for the 17th Street Canal will not be a failure into the canal.

6. The present design of the valve structures is to use a minimum lake elevation of -5.0 with the structure sill to be at El. -10 or -11. Not knowing the exact status of the valve structures, Mr. Magner stated that the OLB must proceed with interim protection.

7. Mr. Judlin continued with the fact the present HLP flood protection includes the outfall canals. The preliminary,

cost for parallel protection at London Ave. Canal is about \$40 million. The valve structures are estimated to cost between \$16 and \$20 million per canal. Mr. Magner stated that the estimated cost for the interim parallel protection is about \$18 million. Mr. Judlin responded by stating that if the final parallel protection can cost between \$20 and \$21 million per canal, the COE would abandon the valve concept and adopt the parallel protection scheme.

8. Mr. Baudier stated that the Orleans Ave Canal can have one side of the parallel protection consisting of I-wall and levee. London Ave. Canal, however, is different. If the S&WB can pump against the lake at E1. 11.5, the OLB will have to raise the levees anyway. Analyses of the following costs are of interest to the OLB. There is concern about the COE's contribution of the work behind the structure whereupon Mr. Judlin stated that the COE would have no contribution. Another concern was about the design criteria with the valve structure. The factor of safety for design ^{of parallel protection} could be something less than the COE's if the valve structure is the ^{main} flood protection. The final cost concern was about the alternative plan, i.e., parallel protection.

9. Mr. Judlin then relayed the following. The 17th Street Canal cost for parallel protection may be about the same as the valve structure concept and is dependant on the stability on the protected side. If stability precludes the use of an I-wall and an inverted T-wall must be used, the cost will probably increase, that it is more costly for the parallel protection.

10. Mr. T. Jackson was concerned about the specifics of the design study. Mr. Romero responded by stating that the COE would furnish a packet providing technical data including design criteria, structural methods, design examples, etc. the

analysis should be performed using low water El. 5.0 and high water El. 11.5 at the lake. Mr. Judlin stated that the good engineering judgement should be used in applying the I-wall deflection criteria that will be provided.

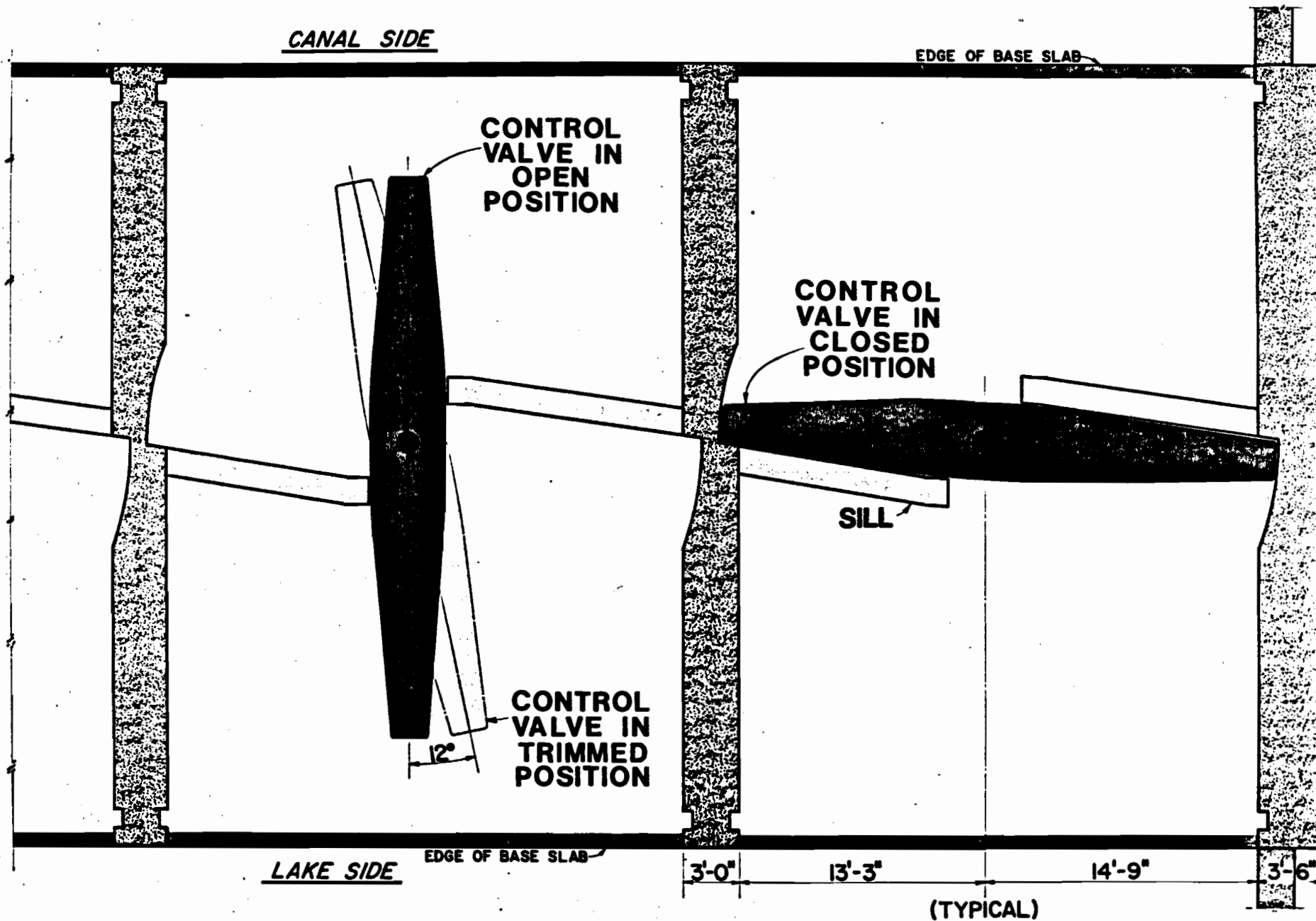
11. It was stated that Mr. Romero is the COE coordinator and Mr. Baudier was the OLB Hurricane Protection Project coordinator. The COE will furnish 3 sets of correspondence for the subject projects as requested by the OLB.

12. This concluded the meeting.

GIRDIR

13 FEB 85
MEETING @ OUTFALL CANALS

| <u>NAME</u> | <u>ORGANIZATION</u> |
|--------------------|----------------------------|
| JORGE A. ROMERO | CORPS OF ENGRS |
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| JIM RICHARDSON | Corps of Engr, F&M Br |
| WALTER D. JUDLIN | Corps of Engr, Des. Branch |
| FRANK VOJKOVICH | Corps of Engr, F&M Br |
| PHILIP NAPOLITANO | CORPS OF ENGRS, F&M BR |
| MICHAEL G. JACKSON | ENGR & ASSOCIATES |
| THOMAS L. JACKSON | BUER & ASSOC. |
| GERARD GIRAIR | Corps of Engrs, Des Br |



**PARTIAL PLAN
CONTROL VALVES
ORLEANS PARISH OUTFALL CANALS**

13 Feb 85

Judlin

Romero

Napolitano

Vokjovich

Jim Richardson

Jamice

Jay Conbe

Magner

Tom Jackson Burk & Assoc.

Walter + other

Judlin Briefing on history - barrier plan original

revised design hurricane \Rightarrow water level up

" benchmarks \Rightarrow levees went down

looked at junction of protection at Lake Pontchar.

raising levees (paralleling protection) to pumping station

move pumping station

costs for paralleling protection - so costly stop preliminary investigation

~~and~~ enlarge consequence of 17th st canal. by deepening channel and raise height of levees. maybe hi level plan.

trimmed position when hurricane coming allows valve to close when flow reverses (sfwb can't pump out)

bay model tested at WES

Hgner # of valves will make minimal head loss or ΔH

Judlin very sensitive to head loss which affects low head pumps

raising height may be needed for s_fw_B to pump anyway
and may be part of Levee Board Hur. Prot

Modj & Masters (working for s_fw_B) at 17th St. look at raising parallel prot.
to h₁ level pb.

Modj & Masters will ~~provide~~ ^{furnish} interim h₁ level plan

Crossings and parallels (relocations)

17th has better data - more borings, better X sections espec. ~~at~~ on
prot side

- allowed particular problem solving - installed piez - determined
uplift & seepage.

Design min. El is -5.0 → struct will be at -10 or -11

Failure ~~into~~ 17th St canal will not govern stability

~~Existing conditions~~ ^{improved} need flow line

existing sections - existing pump capacity - determine head loss

not knowing @ valve structure status - Levee Board must proceed w/ interim prot.

Flood protection @ ^{outfall} canals are included in h₁ level plan

Cost @ London Ave \$40 million very preliminary - valve is \$16-\$20 million

interim is \$18 million - Levee Board

if final can be \$20-\$21 for parallel prot. we'll adopt it
and abandon valves.

Walter

orleans can have one side all T wall + levee

London is diff

if S¹WB can pump to 11.5 levees will have to be raised
any way.

3 analysis on costs - ① corp contribution behind structure
- local interest - corp no contribution
② ~~corp structure~~ design something less w/our structure
there own FS.

③ parallel levees

Judith

17th

cost of struct vs parallel @ same

stability on prot. state not stable \Rightarrow T-wall cost \uparrow

Burk

specific format for study. - provide packages

Jorge - will provide technical data, package on design criteria - structural methods
analyzed low water - 5.0

hi water 11.5 at lake

Judini - criteria for T-wall deflection - good engr. judgement

Jorge is coordinator

Walter is his prot proj coord.

3 sets for all canals



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

REPLY TO
ATTENTION OF: February 8, 1985
Engineering Division
Structural Design Section

Mr. Earl J. Wagner, Chief Engineer
Board of Levee Commissioners
of the Orleans Levee District
Suite 202 - Administration Building
New Orleans Lakefront Airport
New Orleans, Louisiana 70126

Dear Mr. Wagner:

Reference is made to your letter of January 14, 1985, in which you informed us that the Orleans Levee Board has contracted the services of Burk and Associates, Inc., to develop interim flood protection along the London Avenue Canal. In your letter, you requested we provide Burk and Associates with our data for this work.

As you are aware, we are presently modeling the Butterfly Control Valves proposed to provide flood protection at the lakefront end of the canal. Early results from the model indicate that the control valves plan is a workable solution, therefore, our design efforts will be concentrated on this alternative. However, the parallel protection alternative will also have to be studied to help select the most economic, workable solution.

In view of the foregoing, we suggest an early meeting to coordinate our design efforts. Please let me know when it would be your earliest convenient time for us to meet and discuss this work.

Sincerely,

Frederic M. Chatry
Chief, Engineering Division

The Board of Levee Commissioners

OF THE

Orleans Levee District

SUITE 202 — ADMINISTRATION BUILDING
NEW ORLEANS LAKEFRONT AIRPORT

New Orleans, La.

70126

PROTECTING YOU
AND YOUR FAMILY

January 14, 1985



Mr. Frederic Chatry
Chief, Engineering Division
Department of the Army
New Orleans District
Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160

Re: Lake Pontchartrain and Vicinity
Hurricane Protection Project
London Avenue Canal Levees and Floodwalls

Dear Mr. Chatry:

The Orleans Levee Board has engaged the services of Burk and Associates, Inc., to develop a plan for interim protection along the east and west banks of the London Avenue Canal levee protection system.

It is requested that you furnish them with data that has already been formulated so that the work can be accomplished in a manner satisfactory to you and us, thereby providing us with the ability to receive credit for "work in kind".

Thank you for your cooperation in this matter.

Yours very truly,


Earl J. Wagner, Jr.
Chief Engineer

EJM:gmb

xc: Mr. H. B. Lansden
Mr. Ed Bailey
Design Engineering, Inc.
Burk and Associates, Inc.