LAKE PONTCHARTRAIN, LOUISIANA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

CLL

CITRUS LAKEFRONT LEVEE
IHNC TO PARIS ROAD

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

36

MAY 1976

32603368

TC202
N462306
no.2
suppl.5A
1976

LMVED-TD (NOD 26 May 76) 5th Ind
SUBJECT: Lake Pontchartrain, Louisiana, and Vicinity, Lake Pontchartrain Barrier Plan, General Design Memorandum No. 2, Supplement No. 5A, Citrus Lakefront Levee, IHNC to Paris Road

DA, Lower Mississippi Valley Division, Corps of Engineers, Vicksburg, Miss. 39180 13 Jan 77

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

The actions taken to resolve the comments in the 3d Ind are satisfactory.

FOR THE DIVISION ENGINEER:

wd incl

R. H. RESTA
Chief, Engineering Division

CF:
DAEN-CWE-B (13 cy)
w 13 cy 4th Ind and Incl 4

LMNED-MP (26 May 76) 4th Ind
SUBJECT: Lake Pontchartrain, Louisiana, and Vicinity, Lake Pontchartrain Barrier Plan, General Design Memorandum No. 2, Supplement No. 5A, Citrus Lakefront Levee, IHNC to Paris Road

DA, New Orleans District, Corps of Engineers, PO Box 60267, New Orleans, LA 70160 1 Dec 76

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

1. Disposition of the comments contained in the 3d Ind is as follows:

a. Para a. Concur. Inclosure 4 is a revised stone gradation curve reflecting this change.

b. Para b. Comment is noted and the files will be documented as requested.

c. Para c. None of the comments and/or recommendations made in the four referenced letters pertained specifically to the Citrus Lakefront levee, IHNC to Paris Road reach of the project. Therefore, copies of these letters were not included in the subject report.

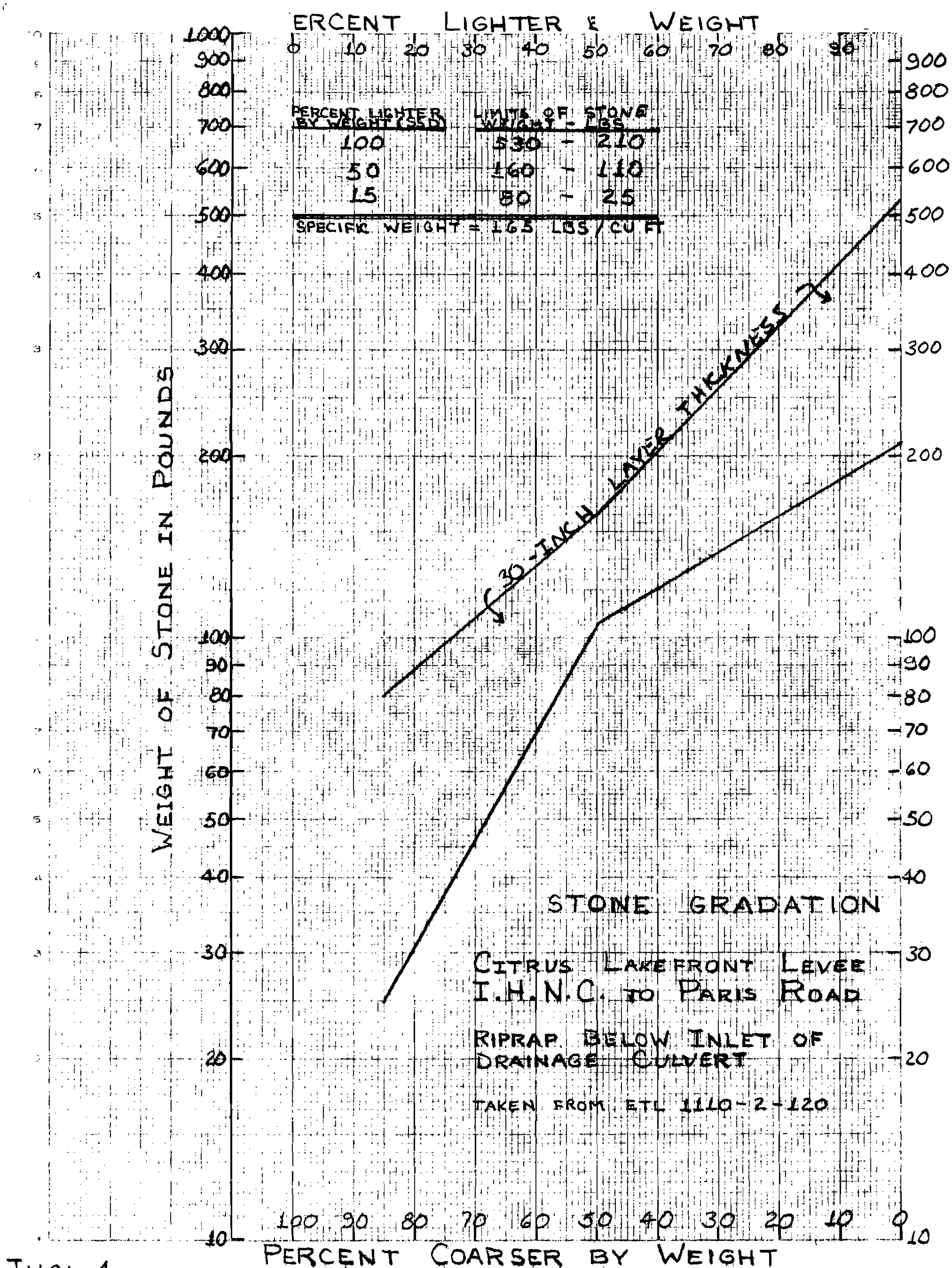
2. Only one comment contained in the four letters pertains to the entire project. That one was offered by the Louisiana Wildlife and Fisheries Commission in their statement for the 22 February 1975 public meeting, which was discussed in paragraph f. of the 2d Ind to this chain of correspondence. The remaining recommendations pertain to other specific features of the project. Copies of the letters and/or statement and our responses pertaining to the specific reaches will be included in future design memorandums for the respective reaches.

3. Copies of the letters from the US Fish and Wildlife Service (17 March 1975) and the National Marine Fisheries Service (21 March 1975) and the Louisiana Wildlife and Fisheries Commission statement at the 22 February 1975 public meeting can be found in the Record of Public Meeting for the subject meeting dated June 1975. The 1 October 1975 EPA letter and our response are included in the chain of correspondence dealing with the Statement of Findings for the above meeting dated 22 August 1975. Responses to the other three letters/statement are included in the Statement of Findings.

FOR THE DISTRICT ENGINEER:

1 Incl
Added incl 4
4. as

FREDERIC M. CHATRY
Chief, Engineering Division


ERCENT LIGHTER BY WEIGHT
PERCENT LIGHTER BY WEIGHT (SSD) | LIMITS OF STONE WEIGHT - LBS
100 | 530 - 210
50 | 160 - 110
15 | 80 - 25
SPECIFIC WEIGHT = 165 LBS/CU FT
30-INCH LAYER THICKNESS
WEIGHT OF STONE IN POUNDS
STONE GRADATION
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD
RIPRAP BELOW INLET OF
DRAINAGE CULVERT
TAKEN FROM ETL 1110-2-120
PERCENT COARSER BY WEIGHT

INCL 4

LMVED-TD (NOD 26 May 76) 3d Ind
SUBJECT: Lake Pontchartrain, Louisiana, and Vicinity, Lake Pontchartrain Barrier Plan, General Design Memorandum No. 2, Supplement No. 5A, Citrus Lakefront Levee, IHNC to Paris Road

DA, Lower Mississippi Valley Division, Corps of Engineers, Vicksburg, Miss. 39180 12 Nov 76

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

The information furnished and actions taken in response to comments in the 1st Ind are satisfactory subject to satisfactory resolution of OCE comments in para 5a of letter dated 25 Aug 76, subject as above, as discussed in our 3d Ind, dated 9 Nov 76, and to the following:

a. Para 1.aa and Inclosure 2. The lower limit of the D_{15} stone size for the 30-inch riprap is too small and could result in an excess of fines. This limit should be changed to approximately 25 pounds.

b. Paragraph 1b. The statements therein contained are correct. Although the 1966 assurance is binding, the project should not proceed in the absence of an agreement complying with PL 91-646 as to the Barrier Plan; however, since paragraph 1i states there are no relocations pursuant to Public Law 91-646 involved in this reach, you should so document your files. With this documentation, this item of work can proceed. This is an exception in this case only and does not constitute total endorsement of such procedure.

c. Para 1f. It is stated that the draft EIS was distributed in April 1972, that agencies were sent a copy of the final EIS in August 1974, and that coordination subsequent to 1968 was too extensive to include in this report. The stated dates are incorrect. The draft and final EIS were distributed in May 1972, and September 1974, respectively. Copies of letters from the U. S. Fish and Wildlife Service (17 Mar 75), the National Marine Fisheries Service (21 Mar 75), the Louisiana Wildlife and Fisheries Commission (22 Feb 75), and the EPA (1 Oct 75), should appear in Appendix A. District's responses to comments contained in this more recent coordination should be included in the report.

FOR THE DIVISION ENGINEER:

wd all incl

R. H. RESTA
Chief, Engineering Division

CF w 13 cy 2d Ind & Incl 2&3:
DAEN-CWE-B (13 cy)

LMNED-MP (NOD 26 May 1976) 2d Ind
SUBJECT: Lake Pontchartrain, Louisiana, and Vicinity, Lake Pontchartrain Barrier Plan, General Design Memorandum No. 2, Supplement No. 5A, Citrus Lakefront Levee, IHNC to Paris Road

DA, New Orleans District, Corps of Engineers, PO Box 60267, New Orleans, LA 70160 6 Oct 76

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

1. The disposition of comments contained in the 1st Ind is as follows:

a. Para 1a. We concur. Para 3, page 2 of the GDM should be changed by adding the following paragraph:

"c. Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, (Public Law 91-646). The local interests are required to comply with the applicable provisions of this act."

b. Para 1b. New assurance agreements embodying the deferred payment plan have been received from Orleans Levee District and are complete as to supporting documents. Instructions from LMVRE-A were that separate assurances would not be forwarded for acceptance, but rather that all assurances be forwarded in one assembly.

We do have an acceptable assurance supplementing the 1966 assurance covering Public Law 91-646, but for the Chalmette Area Plan only. Nonetheless, the 1966 assurance is, although not supplemented to include Public Law 91-646 for the Barrier Plan, binding under contract law for all other requirements contained therein, and shall remain binding until acceptable separate assurances are received from other agencies covering the entire project.

c. Para 1c. The 54-inch diameter sluice gate will remain open at all times except when a hurricane strikes. It will then be closed to prevent water from flowing to the protected side. This gate will be closed well in advance of a hurricane. The operation of this gate is the responsibility of the Orleans Levee District.

d. Para 1d. EPA's comments and applicable letters thereon regarding maintaining water quality are responded to in the GDM in para 64b, page 35. We stated that measures incorporated to reduce the impact of this work on the water quality will be added to the project during preparation of the plans and specifications for this reach. It is beyond the scope of a GDM to specify these measures.

e. Para le. There has been more extensive coordination with the Southern Railroad that was not shown in the GDM and/or has occurred subsequent to the 2 Sep 75 letter. In fact, this GDM could have been submitted months earlier if we did not have the trouble of obtaining the Southern Railroad's approval of our plan. They have been very adamant on every point.

Furthermore, the Orleans Levee District is very interested in getting this reach of the project built as soon as possible because this area is the weak spot in the existing hurricane protection system for New Orleans.

Therefore, since we expect stiff opposition from the Southern Railroad about this matter and in the interest of expediting the remaining planning work for and the eventual construction of this reach, we recommend the additional cost (approximately $25,000) to provide the 600-foot spacing be considered a project cost. The Orleans Levee District agrees with this approach.

f. Para lf (1) The draft environmental statement for the entire Lake Pontchartrain, Louisiana, and Vicinity hurricane protection project was distributed for review and comment in April 1972. No significant modifications have been made to the project plan including this reach presented therein. Copies were sent to the US Department of the Interior who responded by letter dated 8 November 1972, the US Department of Commerce who responded by letter dated 26 June 1972, the Environmental Protection Agency who responded by letter dated 7 June 1972, and the Louisiana Wildlife and Fisheries Commission who responded by letter dated 24 July 1972. Each of these agencies were sent a copy of the final environmental statement in August 1974.

Environmental agencies were provided an additional opportunity to evaluate the effects of the project on the areas of their expertise on the occasion of the 22 February 1975 public meeting. The Regional Director of the US Fish and Wildlife Service by letter dated 17 March 1975 made six recommendations concerning the construction of the project. All but one of these recommendations will definitely be implemented. The remaining recommendation is still being studied. The Regional Director of the National Marine Fisheries Service by letter dated 21 March 1975 endorsed, in essence, the recommendations of the US Fish and Wildlife Service. The Director of the Louisiana Wildlife and Fisheries Commission in a statement for the 22 February 1975 public meeting requested that the design of the ponding areas for the Chef Menteur Complex be coordinated with that agency. He also recommended a periodic review and evaluation regarding the project effects on fish and wildlife. Both will be done.

On 22 August 1975, copies of the record of the 22 February 1975 public meeting and the statement of findings on same were forwarded for review and for approval of the dredged material disposal plan. By letter dated 1 October 1975, the Regional Administrator of the US Environmental Protection Agency approved the dredged material disposal plan and made two other recommendations, one of which is being implemented and one of which is still being studied.

This extensive coordination subsequent to 1968 is considered to be sufficient. The coordination was too extensive to include in this report.

g. Para 1f (2). The alinement along the lakeshore would have directly affected campsites and disrupted the esthetic natural state along the lake in this area. The alinement between the Southern Railway embankment and the Hayne Blvd. right-of-way would preserve the lakeshore campsites and the natural setting of the shoreline of Lake Pontchartrain in this reach.

The final EIS has been reviewed and adequately covers the impacts of the project. The results of the environmental studies and assessments noted on page 4, paragraph 5h of the GDM, are included in the final EIS.

The Citrus area consisting of 14,800 acres is presently leveed. Of this total, 13,750 acres are residential, commercial, and/or nonswamp wooded lands, and 1,230 acres are leveed swamp. The impact of the additional protection on the existing wildlife habitat will be minimal since the non-developed areas are nonwetlands and are covered mostly with marsh elder, eastern baccharis and willow which are marginal for food value to wildlife species. All three species provide excellent cover but are generally considered marginal as wildlife habitat.

h. Para 1g (1). The real estate costs were verified by the values determined in a gross appraisal report made in December 1975. However, under Table 5 - Lands and Damages, 01 Lands, construction easements should show 2.514 acres instead of 3.034 acres.

i. Para 1g (2). There are no relocations pursuant to Public Law 91-646 involved in this reach. This item should appear between "Contingencies and Real estate hired labor" under Table 5 - Lands and Damages, page 43, and it should show zero cost.

j. Para 1g (3). The acreage figures shown on the pertinent data sheet should be changed from "54 to 2.5" to "11.26 to 2.94", respectively.

k. Para 1h. Annotations marked in red on pages 22 and 38 and plates 3, 15 and 18 were noted.

l. Para 2a. We concur. The fourth sentence should be changed to read, "A 12-inch diameter corrugated metal drain pipe, sloped approximately 1 on 60 will extend from the catch basin under the railroad embankment into a narrow drain outlet in the wave wash protection from B/L station 64+00 to B/L station 331+50."

m. Para 2b. Slope sloughing of the landside levee slope due to prolonged hurricane rainfall was analyzed using the method of planes analysis and is shown on plates 50, 51 and 52. These analyses were performed using one-half of the friction angle in sand to simulate steady seepage conditions.

n. Para 2c. Predrilling is not necessarily required for installing the service piles. However, past experiences have shown difficulty in driving concrete piles to the desired grade through sands and silty sand materials. Also, driving resistances as shown on the capacity curves of the test piles may indicate the necessity for predrilling. The P&S will be written to allow the contractor to drive the piles without predrilling. But, if he has difficulty, the contractor will be required to predrill.

o. Para 2d (1). Concrete sheet piling is required in the railroad embankment in lieu of steel sheet piling in order to avoid corrosion problems. The air pockets which are present in the ballast would enhance the occurrence of corrosion if steel piling were used.

p. Para 2d (2). Since the railroad embankment consists of ballast and other pervious materials, sheetpiling is needed to prevent the occurrence of piping.

q. Para 2e (1). Concur. The contract specifications will require the contractor to keep the pipes clear throughout the term of the contract. If erosion is still occurring at the conclusion of the contract, the Corps will request the Orleans Levee District to keep the lines clear until the erosion ceases. Any costs incurred by the levee district in this regard would be creditable toward their required 30 percent contribution.

r. Para 2e (2). Concur. The contract plans will be so noted.

s. Para 2e (3). The installation of the sluice gate in the 54-inch diameter culvert will be included into phase three.

t. Para 2f. Ramps were used where possible when enough space was available. Ramps are cheaper than floodgates, require no closure prior to a hurricane and are a more efficient closure because of no leakage. The ramps also provide access to and from the protected side for a longer period of time during the approach of a hurricane.

u. Para 2g. The Jahncke Pumping Station will not require further modification. Local interests will be given credit towards their 30 percent share of the cost for the installation of the sluice gates at the Jahncke Pumping Station. Therefore, the items are listed in the cost estimate as a project cost even though the modification is complete.

v. Para 2h (1). The sluice gate structure is a relocation item and will be constructed by local interests. The proposed connecting conduit is not a part of the project and, as a result, we have impressed upon local interests the wisdom of constructing the conduit with the sluice gate structure and local interests are presently considering this alternative.

w. Para 2h (2). The 50-inch pipe is the discharge line from the existing pumping station. The pipe passes over the top of the enlarged levee and is equipped with a vacuum breaker; therefore, no positive closure is required.

x. Para 2h (3). Plate 15 clearly shows a dashed line with arrows projecting from each side which designate who will construct what at this location. Others will construct everything to the right of the dashed line and the government will construct everything to the left of the dashed line. The Citrus Canal closure will be constructed prior to our levee work.

y. Para 2i (1). The 2-foot thickness of riprap on the lakeside of the levee is needed for interim wavewash protection because this closure will be built prior to the wavewash protection for the entire project. This 2-foot thickness of riprap should replace the extra 2 feet of clay cover requested. Furthermore, we have already approved

LMNED-MP (NOD 26 May 1976) 2d Ind 6 Oct 76
SUBJECT: Lake Pontchartrain, Louisiana, and Vicinity, Lake Pontchartrain Barrier Plan, General Design Memorandum No. 2, Supplement No. 5A, Citrus Lakefront Levee, IHNC to Paris Road

these plans for local interests, who will construct this closure. It would be difficult to request local interests to change their plans at this late date. Also the stability of the closure was checked during our review and an adequate factor of safety was calculated using the section as it is shown in the GDM.

z. Para 2i (2). On the contract plans the lake end of the pipe will be located flush with the surrounding riprap; therefore, support will not be required.

aa. Para 2j (1). Based on possible storm surges and wave action, 30-inches of riprap underlain by 6-inches of gravel on a plastic filter cloth having the stone size presented on incl 2 should be used as minimum layer thickness for riprap below the invert of the drainage culverts. We are also furnishing the stone gradation (incl 3) for the 12-inches of riprap underlain by 4-inches of shell around the catch basins. Note, these layer thicknesses and stone sizes also apply to plate 33.

bb. Para 2j (2). Concur

cc. Para 2k (1) & (2). Concur. The contract plans will be appropriately noted.

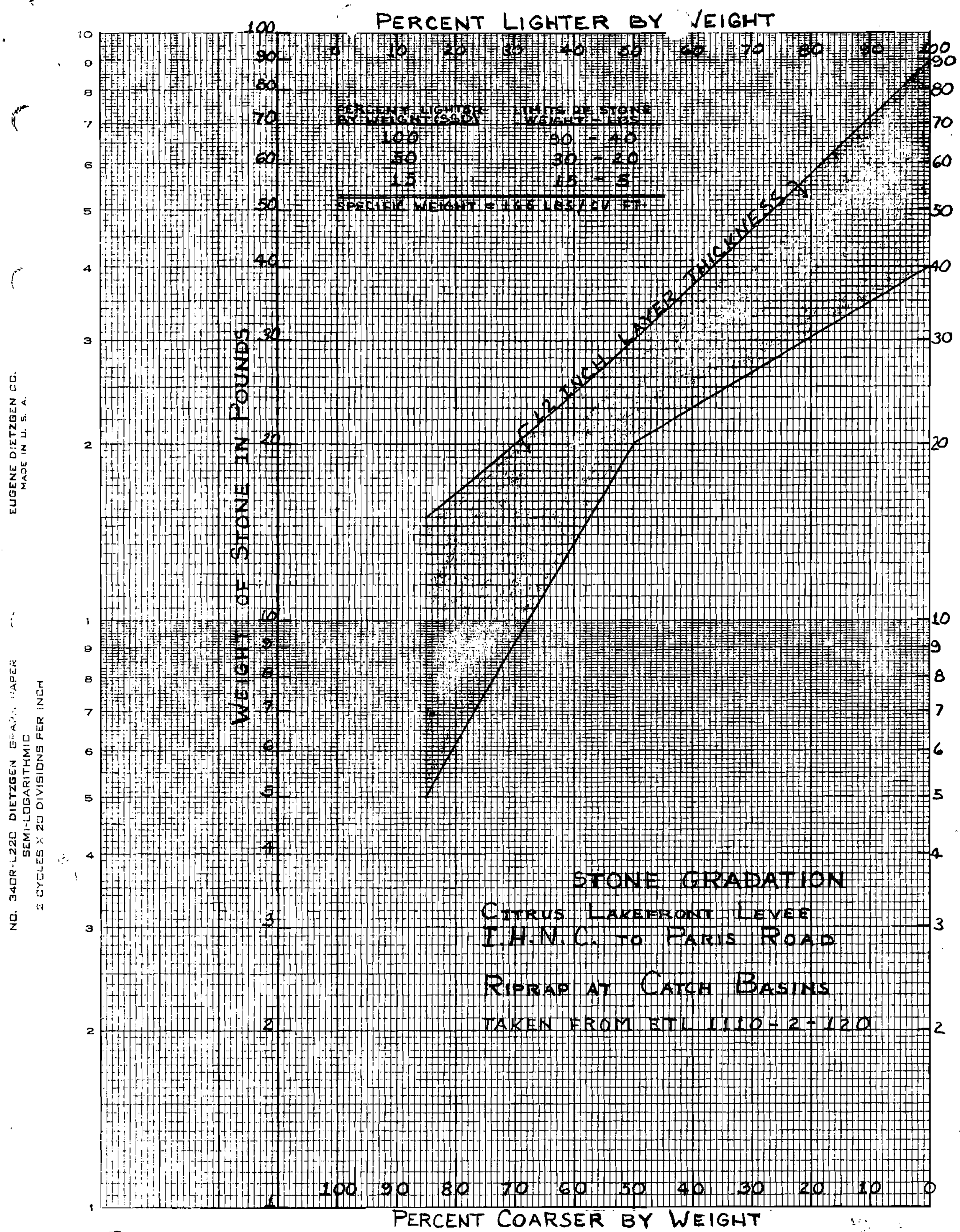
dd. Para 2l. Concur. The wood mat was developed for the purpose of obtaining the railroad company's concurrence in allowing materials to be cast over the tracks. The railroad company will not allow substitution unless they approve the substitute plan. The plans and specifications will allow the contractor to propose a substitute plan.

FOR THE DISTRICT ENGINEER:

for William B. Searle
FREDERIC M. CHATRY
Chief, Engineering Division

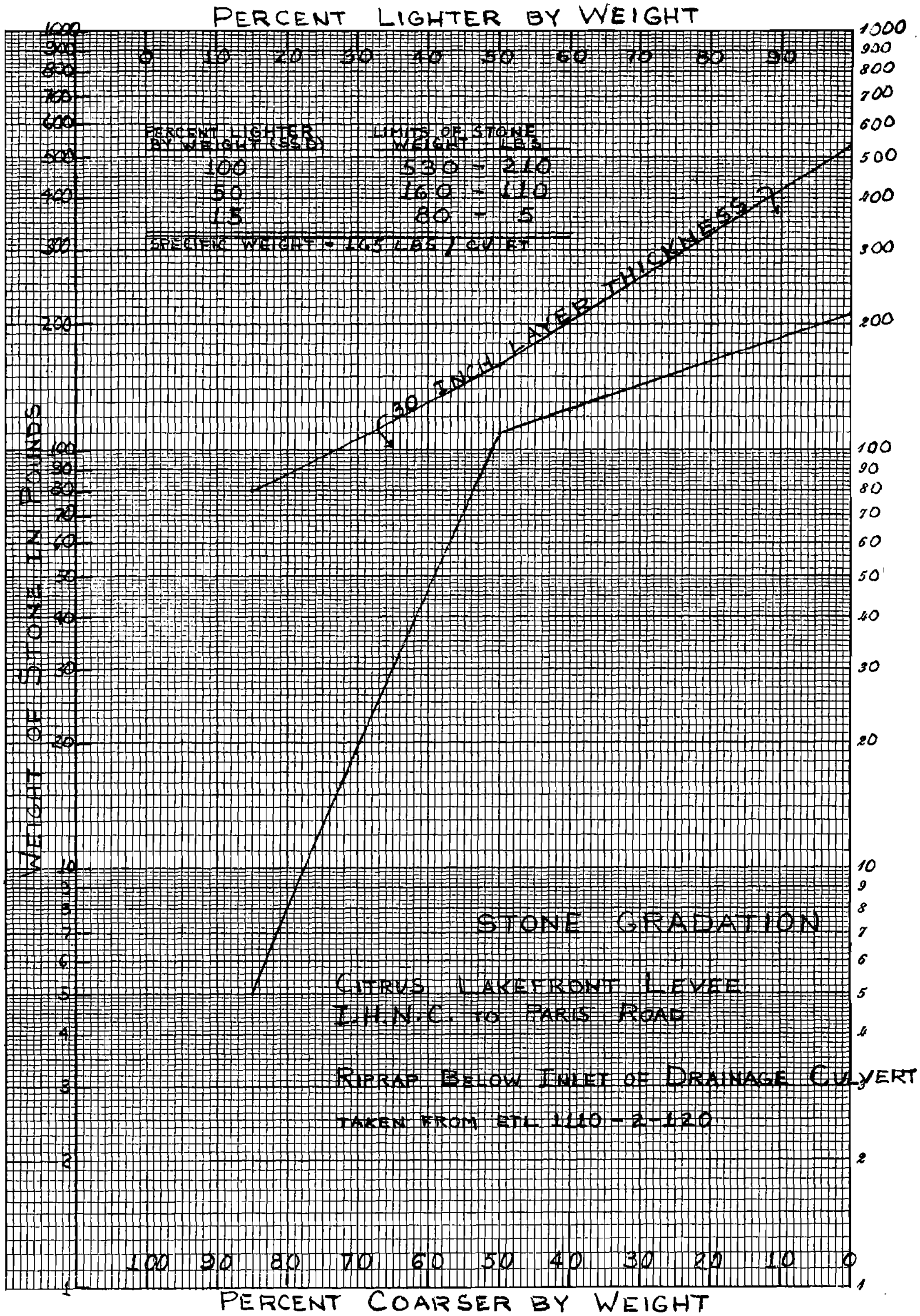
2 Incl
wd Incl 1
Added 2 incl
as

CF: w/incl
HQDA (DAEN-CWE-B)



PERCENT LIGHTER BY WEIGHT
PERCENT LIGHTER BY WEIGHT (SSD)
LIMITS OF STONE WEIGHT - LBS
100 | 90 - 40
50 | 30 - 20
15 | 15 - 5
SPECIFIC WEIGHT = 165 LBS/CU FT
12 INCH LAYER THICKNESS
WEIGHT OF STONE IN POUNDS
STONE GRADATION
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD
RIPRAP AT CATCH BASINS
TAKEN FROM ETL 1110-2-120
PERCENT COARSER BY WEIGHT
NO. 340R-L22D DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
2 CYCLES X 20 DIVISIONS PER INCH
EUGENE DIETZGEN CO.
MADE IN U. S. A.

INCL 2


PERCENT LIGHTER BY WEIGHT
PERCENT LIGHTER BY WEIGHT (SSD)
100
50
15
LIMITS OF STONE WEIGHT - LBS
530 - 210
160 - 110
80 - 5
SPECIFIC WEIGHT = 165 LBS / CU FT
30 INCH LAYER THICKNESS
WEIGHT OF STONE IN POUNDS
STONE GRADATION
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD
RIPRAP BELOW INLET OF DRAINAGE CULVERT
TAKEN FROM ETL 1110-2-120
PERCENT COARSER BY WEIGHT

INCL 3

LMVED-TD (NOD 26 May 76) 1st Ind
SUBJECT: Lake Pontchartrain, Louisiana, and Vicinity, Lake Pontchartrain Barrier Plan, General Design Memorandum No. 2, Supplement No. 5A, Citrus Lakefront Levee, IHNC to Paris Road

DA, Lower Mississippi Valley Division, Corps of Engineers, Vicksburg, Miss. 39180 12 Jul 76

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

1. Approved subject to the following comments:

a. Page 2, Para 3. An additional item of local cooperation is compliance with the provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646. This is treated under Paragraph 55; however, it should be set forth as an item of local cooperation.

b. Page 6, Para 8d. We concur in the last sentence of this paragraph; however, the new assurance agreements embodying the deferred payment plan require approval of the Office, Chief of Engineers. The 1966 assurances, of course, do not cover the requirements imposed by Public Law 91-646. The supplemental assurances (paragraph 8b) were not in acceptable form. Thus, we have no agreement which meets the requirements of law. The agreement referred to in paragraph 8d should be finalized and approval of OCE secured prior to initiation of construction.

c. Page 25, Para 40c(2). Operating criteria should be developed for the 54-inch diameter sluice gate.

d. Page 35, Para 64. EPA (then FWPCA) comments and applicable letters thereon regarding maintaining water quality are not responded to in this document. Response should include measures incorporated to reduce impact of construction on water quality, any silt detention devices at construction sites, any measures to confine turbidity at borrow areas.

e. Page 36, Para 65b(4), Appendix C, Page C-5, Para 6. As stated in these two paragraphs, the spacing between catch basins could be at 900-foot intervals and still provide adequate drainage for the area during the design storm. Therefore, if the Southern Railway dictates the interval to be 600 ft (Appendix A, letter of 2 Sep 75) then they (the railroad) should be required to pay the additional cost to provide this betterment.

f. Page 35, Para 63 and Page 37, Para 66. (1) Para 66a states that extensive coordination has been accomplished with appropriate agencies relative to fish and wildlife and water quality. Information elsewhere in the report (Appendix A) indicates that the most recent direct coordination with USFW and FWPCA (now EPA) was in May 1968.

Subsequent to 1968, there have been several changes in project design, including alignment. Environmental interests have become more acute. The 1968 coordination predates the 1969 National Environmental Policy Act and many current policies on interagency coordination. In view of these changes, you should consider the need for additional coordination with environmental agencies.

(2) Para 66 should contain an assessment of the changes in impacts created by the changed alignments. A statement should also be made indicating that the existing EIS has been reviewed and adequately covers the impacts of the project or that the existing statement will be supplemented if the assessment reveals this is necessary. The results of the environmental studies and assessments referred to on page 4, para 5h, could have been included as a basis of establishing the adequacy of the current EIS. The impact of the additional protection on the existing wildlife habitat is not adequately covered.

g. Table 5, Estimate of First Cost. (1) Real Estate costs should be verified.

(2) Table 5 (cont'd), page 43, includes no item for Public Law 91-646. The only improvement listed is chain link fence. In view of paragraph 55, at some place in the report it should be shown whether there are relocations pursuant to Public Law 91-646 involved.

(3) The total acreage shown in Table 5, page 43, does not agree with the pertinent data tabulation inserted behind the table of contents. This discrepancy should be reconciled.

h. Annotations in red on pages 22 & 38, and Plates 3, 15, & 18.

2. The following comments may be resolved concurrent with preparation of plans and specifications:

a. Page 14, Para 29a(2). In the fourth sentence the slope of the 12-inch diameter CMPs is stated as varying. This does not agree with 1V on 60H slope as indicated on Plate 34, para 40a, or para 6 in Appendix C. Para 29a(2) should be corrected to agree with the other portions of the DM.

b. Page 15, Para 30b. The last sentence states that analyses were made to investigate sloughing of the landside levee slope due to prolonged hurricane rainfall. For record purposes the procedures used in these analyses should be described.

c. Page 21, Para 33c(2). This paragraph mentions predrilling as a means for installing the service piles. There are no apparent reasons why the concrete piles cannot be driven to the desired grade.

LMVED-TD (NOD 26 May 76) 1st Ind 12 Jul 76
SUBJECT: Lake Pontchartrain, Louisiana, and Vicinity, Lake Pontchartrain Barrier Plan, General Design Memorandum No. 2, Supplement No. 5A, Citrus Lakefront Levee, IHNC to Paris Road

d. Page 21, Para 34a(2). (1) The reason for using concrete sheet piling instead of steel sheet piling beneath the railroad embankment is not apparent and should be explained since use of concrete sheet piling could require the Contractor to have additional equipment on the job.

(2) Since this railroad embankment ties into earthen levee on either side, the need for sheet piling should be explained.

e. Page 22, Para 37b(1). (1) In following the construction sequence outlined in this paragraph, the District should insure that the 12-inch drain pipes do not become clogged with material removed by rainfall runoff from the newly constructed and/or enlarged levee. To prevent this from occurring, each pipe should be inspected after a significant rainfall and cleaned out if needed. This procedure should be repeated until a good sod cover is established.

(2) Immediately after placement of the drain pipes, the sequence could include the placement of riprap protection ~~protected~~ at the outlet end of each pipe. This will prevent scour holes developing at each outlet.

(3) This paragraph should be expanded to specify the phase that will include the installation of sluice gate in the 54-inch diameter culvert.

f. Page 24, Para 39c. The first sentence states, "In lieu of gates, roadways will be ramped over the flood protection in two locations." The reasons for providing ramps instead of floodgates should be explained.

g. Page 24, Para 40c(1). The fourth sentence states that the Jahncke Pumping Station will not require modification. Item 02 of the cost estimate, page 43 shows, however, a list of items to be constructed at the Jahncke Pumping Station. This apparent discrepancy should be resolved.

h. Plate 15. (1) A note on the Citrus Canal Crossing section states that the temporary walls of the sluice gate structure will be removed at a later time and replaced by conduit. Since this procedure would no doubt require the excavation of a large portion of the closure section to be built under this contract, consideration should be given to placing this conduit before constructing the closure section.

(2) The Citrus Canal Crossing plan shows a 50-inch steel pipe to be constructed by others. The need for this item should be discussed in the text along with the method for providing closure.

LMVED-TD (NOD 26 May 76) 1st Ind 12 Jul 76
SUBJECT: Lake Pontchartrain, Louisiana, and Vicinity, Lake Pontchartrain Barrier Plan, General Design Memorandum No. 2, Supplement No. 5A, Citrus Lakefront Levee, IHNC to Paris Road

(3) This plate shows that a sluice gate structure with a sheet pile cutoff will be constructed at the Citrus Canal Crossing. Para 29c, however, states that these items will be constructed by others. The questions of who will construct these items and at what point in the sequence of construction should be clearly explained.

i. Plate 16. Wavewash Protection for Citrus Canal Shell Closure. (1) The section shows a 2-ft thickness of semicompacted clay covered by riprap on the lakeside of the levee. The 2-ft thickness is considered to be too thin and should be increased to 4 ft. It also appears that the 2-ft thickness of riprap on the lakeside of the levee could be deleted since protection is being provided by the wavewash protection located lakeward.

(2) The lake end of the pipe should be supported.

j. Plate 34. (1) To insure that adequate riprap protection is provided at the outlet end of each pipe, a minimum blanket thickness should be specified.

(2) The section at drain pipe shows an existing catch basin and pipe to be plugged and a new catch basin and drain pipe to be constructed at the same location. In order to prevent possible leakage through the old drain pipe, suggest the new catch basins be constructed at different locations from the existing catch basins.

k. Plate 36. (1) Minimum width of rung should be 1'4".

(2) Grabbars should comply with OSHA 1910.27(d)(4).

l. Plate 42. Suggest that in lieu of explicitly stating that the wood mats illustrated on this plate be the one and only way to protect the rails paralleling this item, the Contractor should assume the responsibility for the protection of the rails as well as the safety of passing trains. The mats illustrated on this plate could be advanced as one acceptable method for rail protection.

FOR THE DIVISION ENGINEER:

for Robert J Kaufman
R. H. RESTA
Chief, Engineering Division

1 Incl
Mkd cy Incl 1

CF:
DAEN-CWE-B (~~14~~ 13 cy)
w/Mkd cy Incl 1

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

59-6

IN REPLY REFER TO
LMNED-MP

26 May 1976

SUBJECT: Lake Pontchartrain, Louisiana, and Vicinity, Lake Pontchartrain Barrier Plan, General Design Memorandum No. 2, Supplement No. 5A, Citrus Lakefront Levee, IHNC to Paris Road

Division Engineer, Lower Mississippi Valley
ATTN: LMVED-TD

1. The subject supplement is submitted herewith for review and approval, and has been prepared generally in accordance with the provisions of ER 1110-2-1150 exclusive of the Phase I-Phase II planning procedure.

2. Approval of this supplement is recommended.

1 Incl (16 cy)
GDM No. 2,
Suppl. No. 5A fwd sep

for EARLY J. RUSH III
Colonel, CE
District Engineer
LTC, CE

LAKE PONTCHARTRAIN, LOUISIANA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN

STATUS OF DESIGN MEMORANDUMS

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	Approved 6 Mar 69
	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	Approved 10 Nov 70
2	Lake Pontchartrain Barrier Plan, GDM Supplement No. 2, Lake Pontchartrain Barrier, Rigolets Lock and Adjoining Levees	Approved 19 Oct 71
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 3, Lake Pontchartrain Barrier, Chef Menteur Pass Complex	Approved 19 Sep 69
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 4, New Orleans East Back Levees	Approved 18 Aug 71
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 5, Orleans Parish Lakefront Levees - West of IHNC	Scheduled May 77
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 5A, Citrus Lakefront Levees - IHNC to Paris Road	Submitted May 76

STATUS OF DESIGN MEMORANDUMS (Cont'd)

Design Memo No.	Title	Status
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 5B, New Orleans East Lakefront Levee - Paris Road to South Point	Approved 5 Dec 72
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 5C, Orleans Parish Outfall Canals - West of the IHNC	Scheduled Feb 78
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 6, St. Charles Parish Lakefront Levees	Approved 4 Nov 70
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 7, St. Tammany Parish, Mandeville Seawall	Indefinite
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 GIWW	Approved 1 May 73
3	Chalmette Area Plan, GDM	Approved 31 Jan 67
3	Chalmette Area Plan, GDM, Supplement No. 1, Chalmette Extension	Approved 12 Aug 69
4	Lake Pontchartrain Barrier Plan, and Chalmette Area Plan, GDM, Florida Avenue Complex, IHNC	Scheduled Nov 76
5	Chalmette Area Plan, DDM Bayous Bienvenue and Dupre Control Structures	Approved 29 Oct 68
6	Lake Pontchartrain Barrier Plan, DDM, Rigolets Control Structure and Closure	Scheduled Nov 77

STATUS OF DESIGN MEMORANDUMS (Cont'd)

Design Memo No.	Title	Status
7	Lake Pontchartrain Barrier Plan, DDM, Chef Menteur Control Structure and Closure	Scheduled Mar 78
8	Lake Pontchartrain Barrier Plan, DDM, Rigolets Lock	Approved 20 Dec 73
9	Lake Pontchartrain Barrier Plan, DDM, Chef Menteur Navigation Structure	Scheduled Sep 78
10	Lake Pontchartrain Barrier Plan, Corrosion Protection	Approved 21 May 69
12	Sources of Construction Materials	Approved 30 Aug 66
1	Lake Pontchartrain, Louisiana, and Vicinity, and Mississippi River-Gulf Outlet, Louisiana, GDM, Seabrook Lock	Approved 4 Nov 70
2	Lake Pontchartrain, Louisiana and Vicinity, and Mississippi River-Gulf Outlet, Louisiana, DDM, Seabrook Lock	Scheduled Feb 77
Report	Lake Pontchartrain Barrier Plan, Seabrook Lock Breakwater	Scheduled Mar 78

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. DEC. 1970

LAKE PONTCHARTRAIN, LOUISIANA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A
CITRUS LAKEFRONT LEVEE
IHNC TO PARIS ROAD

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont'd)

TABLE OF CONTENTS (Cont'd)

TABLE OF CONTENTS (Cont'd)

TABLE OF CONTENTS (Cont'd)

TABLE OF CONTENTS (Cont'd)

TABLES

PLATES

TABLE OF CONTENTS (Cont'd)

TABLE OF CONTENTS (Cont'd)

TABLE OF CONTENTS (Cont'd)

APPENDIXES

PERTINENT DATA

Location of project	Southeastern Louisiana in Orleans Parish
Hydrologic data	
Temperature: Maximum monthly	89.8° Fahrenheit
Minimum monthly	46.3° Fahrenheit
Average annual	69.3° Fahrenheit
Annual precipitation: Maximum	85.73 inches
Minimum	31.07 inches
Average	60.07 inches
Hydraulic design criteria--tidal	
Design hurricane--Standard Project Hurricane (SPH) Frequency	1 in 300 yrs
Central Pressure Index (CPI)	27.5 inches of mercury
Maximum 5-min. average wind	100 m.p.h.
Levee	
Method of construction	Hauled, semi-compacted clay fill
Levee length	5.5 miles
Elevation, varies	10.5[1] to 13.5
Crown width	10 feet
Floodwall (I and T)	
Floodwall length	0.9 miles
Elevation, varies	10.5 to 14.0
Drainage structures	
Location: B/L Station 33+21	Sluice gate to be added to existing 54" culvert
B/L Station 31+00 to 64+00	Concrete catch basins on 600 foot centers with CMP collector pipe between levee and embankment
B/L Station 64+00	30" Ø CMP culvert with concrete catch basin
B/L Station 64+50 to B/L Station 331+50	Concrete catch basins with 12" Ø CMP culverts all on 600 foot centers
B/L Stations 74+00, 155+50 and 236+50	Sluice gate to be added to pumping stations' discharge facilities

---

[1] Elevations contained herein are in feet referred to mean sea level unless otherwise noted.

PERTINENT DATA (Cont'd)

Gates	
Location: W/L Station 3+90.29 and W/L Station 107+65.91	Steel overhead roller gate in a concrete monolith
W/L Stations 5+23.38, 9+90.70, and 29+11.89	Steel swing type in a concrete monolith
Rights-of-way	
Permanent rights-of-way	54 acres
Construction easements	2.5 acres
Estimated first cost	
Levees and floodwalls	$10,316,000
Engineering and design	1,322,000
Supervision and administration	979,000
Relocations	1,707,000
Lands and damages	876,000
TOTAL	$15,200,000

LAKE PONTCHARTRAIN, LOUISIANA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A
CITRUS LAKEFRONT LEVEE
IHNC TO PARIS ROAD

PROJECT AUTHORIZATION

1. Authority.

a. Public Law. Public Law 298, 89th Congress, 1st Session, approved 27 October 1965, authorized the "Lake Pontchartrain, Louisiana, and Vicinity," hurricane protection project, 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.

b. House Document. The report of the Chief of Engineers dated 4 March 1964 printed in House Document No. 231, 89th Congress, 1st Session, submitted for transmission to Congress the report of the Board of Engineers for Rivers and Harbors, accompanied by the reports of the District and Division Engineers and the concurring report of the Mississippi River Commission for those areas under its jurisdiction. The report of the Board of Engineers for Rivers and Harbors stated: "For protection from hurricane flood levels, the reporting officers find that the most suitable plan would consist of a barrier extending generally along US Highway 90 from the easternmost levee to high ground east of The Rigolets, together with floodgates and a navigation lock in The Rigolets, and flood and navigation gates in Chef Menteur Pass; construction of a new lakeside levee in St. Charles Parish extending from the Bonnet Carre' Spillway guide levee to and along the Jefferson Parish line; extension upward of the existing riprap slope protection along the Jefferson Parish levee; enlargement of the levee landward of the seawall along the 4.1 mile lakefront, and construction of a concrete-capped sheet-pile wall along the levee west of the Inner Harbor Canal in New Orleans; raising the rock dikes and landward gate bay of the planned Seabrook lock; construction of a new levee lakeward of the Southern Railway extending from the floodwall at New Orleans Airport to South Point; enlargement of the existing levee extending from US Highway 90 to the Gulf Intracoastal Waterway, thence westward along the waterway to the Inner Harbor Canal, together with riprap slopes along the canal; construction of a concrete capped sheet-pile wall along the east levee of the Inner Harbor Canal between the Gulf Intracoastal Waterway and the New Orleans Airport...."

c. BERH recommendation. The report of the Chief of Engineers stated: "...The Board (of Engineers of Rivers and Harbors) recommends authorization for construction essentially as planned by the reporting officers...I concur in the recommendation of the Board of Engineers for Rivers and Harbors."

2. Purpose and scope. This memorandum presents the essential data, assumptions, criteria, and computations for developing the plan, design, and cost for the project levee feature along the Citrus lakefront from the Inner Harbor Navigation Canal (IHNC) to Paris Road. Its purpose is to present sufficient detail to provide an adequate basis for preparing plans and specifications for the levee and appurtenant structure construction without additional design analysis, and is accordingly presented in feature design memorandum scope.

3. Local cooperation.

a. Flood Control Act of 1965 (Public Law 89-298). The conditions of local cooperation pertinent to this supplement and as specified in the report of the Board of Engineers for Rivers and Harbors and concurred in by the report of 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 works;

"(3) Hold and save the United States free from damages due 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...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...."

b. Water Resources Development Act of 1974 (Public Law 93-251). The local interest payment procedures outlined in the original conditions of local cooperation were modified in 1974 as follows: "The hurricane-flood protection project on Lake Pontchartrain, Louisiana, authorized by section 204 of the Flood Control Act of 1965 (Public Law 89-298) is hereby modified to provide that non-Federal public bodies may agree to pay the unpaid balance of the cash payment due, with interest, in yearly installments. The yearly installments will be initiated when the Secretary determines that the project is complete but in no case shall the initial installment be delayed more than ten years after the initiation of project construction. Each installment shall not be less than one twenty-fifth of the remaining unpaid balance plus interest on such balance, and the total of such installments shall be sufficient to achieve full payment, including interest, within twenty-five years of the initiation of project construction."

INVESTIGATIONS

4. Project document investigations. Studies and investigations made in connection with the report on which authorization is based (H.D. No. 231, 89th Congress, 1st Session) consisted of: research of information which was available from previous reports and existing projects in the area; extensive research in the history and records of hurricanes; damage and characteristics of hurricanes; extensive tidal hydraulics investigations involving both office and model studies relating to the ecological impact of the project on Lakes Pontchartrain and Borgne; an economic survey; and survey-scope design and cost studies. A public hearing was held in New Orleans on 13 March 1956 to determine the views of local interests.

5. Investigations made subsequent to project authorization. Surveys and studies made subsequent to project authorization for this reach of levee include:

a. Alternate plan studies to include alternative alinement studies and alternative construction method studies;

b. Aerial and topographic surveys;

c. Soils investigations including general and undisturbed type borings and associated laboratory evaluations;

d. Detailed design studies for levee, concrete floodwall, and gap closure construction including levee section stability determinations;

e. Tidal hydraulic studies required for establishing design grades for protective works based on revised hurricane parameters furnished subsequent to project authorization by the National Weather Service;

f. Real estate requirements and appraisals;

g. Cost estimates for the levee, concrete floodwalls and gap closures, drainage catch basins and culverts, railroad gap closure, pumping station discharge modifications, road ramps and utility relocations;

h. Environmental effects and evaluations;

i. Comprehensive public meeting held on 22 February 1975.

6. Planned future investigations. Upon completion of the entire reach, this feature will be turned over to local interests. Accordingly, any future investigations would be performed by local interests and no future investigations will be required by and/or for the Government.

LOCAL COOPERATION

7. Local cooperation requirements. The conditions of local cooperation as specified in the authorizing laws are quoted in paragraph 3.

8. Status of local cooperation.

a. Assurances from the Board of Levee Commissioners of the Orleans Levee District for the Barrier Plan portion of the project were originally accepted on 10 October 1966. Because of the rising non-Federal cost of participation and the widespread benefits to be derived by surrounding parishes, the Orleans Levee District requested assistance in carrying out the assurances. Accordingly, the Governor of the State of Louisiana by Executive Order Number 80, dated 5 March 1971, designated the Louisiana Department of Public Works as the agency to coordinate the efforts of the Orleans Levee District, the Pontchartrain Levee District and the St. Tammany Parish Police Jury in carrying out assurances of local cooperation for the portions of subject project within their respective jurisdictions. The designation was under the authority of Section 81, Title 38, Louisiana Revised Statutes of 1950.

b. Acceptable assurances, pursuant to the distribution of the non-Federal responsibilities through the Louisiana Department of Public Works, were received from the Board of Levee Commissioners of the Orleans Levee District and the Board of Commissioners of the Pontchartrain Levee District on 16 September 1971 and 7 October 1971, respectively. Supplemental assurances covering Public Law 91-646 (the "Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970") were received from the Orleans Levee District and the Pontchartrain Levee District on 21 October 1973 and 15 October 1973, respectively. However, the Pontchartrain Levee District has refused to furnish the required attorney's opinion for the latter assurance. This situation has arisen out of the District's concern over the status of the St. Charles Parish Lakefront levee.

c. The St. Tammany Parish Police Jury is reluctant to grant the assurances providing for its participation in the project. However, on 8 May 1972 Governor John J. McKeithen executed formal assurances on behalf of the Police Jury by virtue of his authority under Section 81 et. seq of Title 38 of Louisiana Revised Statutes of 1950, as amended. However, the State of Louisiana has failed to provide the necessary attorney's opinion and the Governor's assurances have not been approved on behalf of the United States.

d. Acceptance of all of the later assurances has been pending receipt of the necessary attorney's opinions. However, in view of the increasing burden of providing required matching local funds, legislation to defer required local payments over an extended period of time was enacted in February 1974, as Section 92 of the Water Resources Development Act of 1974. This act modified the authorizing law by providing that non-Federal public bodies may agree to pay the unpaid balance of their required cash payment due, with interest, in annual installments in accordance with a specified formula. New assurance agreements implementing this act have been forwarded to the Louisiana Department of Public Works for coordination. Through the process of accepting these new agreements with each of the local agencies, the existing difficulties will be resolved. In the interim, the original assurances of 1966 from the Orleans Levee District form the basis of the local cooperation for the project.

e. The principal officers currently responsible for the fulfillment of the conditions of local cooperation are as follows:

Mr. Roy Aguillard, Director
State of Louisiana
Department of Public Works
PO Box 44155, Capitol Station
Baton Rouge, Louisiana 70804

Mr. Guy F. LeMieux, President
Board of Levee Commissioners of the
Orleans Levee District
Room 200, Wildlife and Fisheries Building
418 Royal Street
New Orleans, Louisiana 70130

Mr. John L. Lauricella, Jr., President
Board of Commissioners of the
Pontchartrain Levee District
PO Box 426
Lutcher, Louisiana 70071

Mr. M. W. Hart, President
St. Tammany Parish Police Jury
PO Box 628
Covington, Louisiana 70433

f. Section 221 of the Flood Control Act of 1970 (Public Law 91-611) is not applicable to this project since construction of the Lake Pontchartrain, Louisiana, and Vicinity, project commenced prior to 1 January 1972 and since the proposed work described in this supplement is not a new increment to, but rather a dependent part of the overall plan of protection included in the report of the Chief of Engineers dated 4 March 1964.

9. Views of local interests. The Orleans Levee District is the agency responsible for providing local interest assurances for this feature of the project. The plan presented herein was coordinated in detail with the Orleans Levee District engineering staff and bears the approval of that agency. The intention and capability of this sponsor to provide the required non-Federal contribution for this feature have been amply demonstrated; in fact, considerable work on other completed features of the overall project has already been accomplished by this sponsor.

LOCATION OF PROJECT AND TRIBUTARY AREA

10. Project location. The IHNC to Paris Road levee segment of the Lake Pontchartrain, Louisiana and Vicinity hurricane protection project, as shown on plate 1, is located in southeastern Louisiana in the eastern portion of New Orleans in an area known as Citrus. The project area covered in this memorandum is located in Orleans Parish.

11. Tributary area. The tributary area of Lake Pontchartrain varies in character from flat tidal marsh at or near sea level to upland areas of significant relief with natural ground elevations as high as 250 feet above mean sea level (m.s.l.).[1] Runoff from within the project area drains into either Lake Borgne or Lake Pontchartrain, generally by pumping from within the protected areas, although some developed areas located on alluvial ridges in St. Charles, St. Bernard, and St. Tammany Parishes are drained by gravity. In addition to runoff from the project area, Lake Pontchartrain receives the runoff of 4,700 square miles located to the north and west of the lake. During major floods on the Mississippi River and its tributaries, floodflows may be diverted from the Mississippi River to Lake Pontchartrain through the Bonnet Carre' Spillway, a controlled overbank floodway constructed under the Flood Control, Mississippi River and Tributaries project.

---

[1] Elevations contained herein are in feet referred to mean sea level datum unless otherwise noted.

PROJECT PLAN

12. General. The project, as shown on the flyleaf map, consists of two separate and distinct major features--the Chalmette Area Plan and the Lake Pontchartrain Barrier Plan. This memorandum is concerned only with a segment of the latter, the Citrus Lakefront levee from the IHNC to Paris Road. The overall Lake Pontchartrain Barrier Plan is described in GDM No. 2, Citrus Back Levee, approved 29 December 1967.

13. Citrus Lakefront levee, IHNC to Paris Road. This levee is located in eastern New Orleans along the Citrus lakefront of Lake Pontchartrain and extends from a tie-in with the existing IHNC floodwall along Jourdan Road on the west end to a tie-in with the New Orleans East Lakefront levee, Paris Road to South Point, at the intersection of Hayne Boulevard and Paris Road on the east end. The project plan presented herein provides for enlargement of the existing levee with hauled clay material. This clay will be obtained from a borrow pit on the bottom of Lake Pontchartrain in the vicinity of Howze Beach on the north shore of the lake. Drainage for the area on the protected side of the levee will be provided by existing drainage facilities. These facilities include a 54-inch diameter culvert at baseline (B/L) station 33+21, and three pumping stations, namely St. Charles, Citrus, and Jahncke. Modifications to these structures will be required to be incorporated into the protection system. The modifications are detailed in a subsequent paragraph. The levee from B/L station 28+31 to Paris Road is located just landward of the Southern Railway System railroad embankment and is laterally contiguous with that embankment for the majority of the reach. This plan has the approval of the Southern Railway System. Drainage will be provided for the collector ditch between the railroad embankment and the levee by means of a system of culverts and catch basins spaced at 600-foot intervals for most of the reach. Floodwalls will replace the levee from the tie-in to the floodwall along Jourdan Road to B/L station 28+31 and in the vicinity of Lincoln Beach. Within the floodwall reaches two steel overhead roller gates and three steel swing gates will be constructed. The overhead roller gates will be located across Hayne Blvd. at Jourdan Road and across the entrance to Lincoln Beach. The swing gates will be located across the Southern railroad track near the IHNC, across the New Orleans Lakefront Airport service road near Seabrook bridge and across an entrance to the New Orleans Lakefront Airport. The project plan also provides for riprapping of the lakeward face of the railroad embankment. The function of the riprap blanket is twofold: 1) to serve as a wave berm allowing a reduction in levee height; and 2) to protect the levee indirectly by protecting the railroad embankment from daily wave erosion, thus insuring levee integrity when a hurricane strikes. Many relocations including two road ramps will be needed which are discussed in subsequent paragraphs.

14. Departures from project document plan. The project document plan contemplated construction of a levee lakeside of the Southern Railway embankment in the shallow waters of Lake Pontchartrain. At that time, the levee was to have a crest of elevation 11.0, a 20-foot crown width and riprap slope protection below elevation 6.5. The most significant departure from the project document has been to change the alinement of the levee from lakeside of the railroad embankment to the landside. Several reasons governed this modification; namely, a reduction in the first cost of construction, a shorter construction period, the preservation of campsites protruding into the lake, and environmental considerations of disruption of the natural state during construction. These and other pertinent considerations are discussed in detail later in this memorandum. The second departure from the project document arises from the alinement change described above. The net levee grade was revised upward from elevation 11.0 to 13.5 and the crown width was decreased from 20 feet to 10 feet. These revisions evolved from the results of tidal hydraulic studies utilizing more severe hurricane parameters developed by the National Weather Service subsequent to project authorization; and by more detailed design. The levee grades presented in Design Memorandum No. 1, Hydrology and Hydraulic Analysis, Part III--Lakeshore, approved 25 February 1969 do not reflect the change in levee alinement and such information, therefore, cannot be directly related to this feature. Rather, the levee grade was established by recent and detailed tidal hydraulic study to reflect the new alinement and riprap configurations. The reduction in the levee crown width is dictated by the requirement to fit the levee between the Southern Railway embankment on the north and the Hayne Blvd. right-of-way on the south. The 10-foot crown width dimension results from consultations with representatives of the Southern Railway System with regard to railroad right-of-way requirements in order to insure the stability of the railroad ballast.

HYDROLOGY AND HYDRAULICS

15. General. The Hydrology and Hydraulic Analysis design memorandum for the Lake Pontchartrain Barrier Plan was presented in a series of three separate reports entitled Design Memorandum No. 1 and subtitled Part 1 - Chalmette, Part II - Barrier, and Part III - Lakeshore. Part I - Chalmette was approved on 27 October 1966; Part II - Barrier was approved on 18 October 1967; and Part III - Lakeshore was approved on 6 March 1969. These documents present detailed descriptions and analyses of the tidal hydraulic methods and procedures used in the tidal hydraulic design of the features for the plan and include the essential data, assumptions, and criteria used and results of studies which provide the bases for determining surges, routing, wind tides, runup, overtopping, and frequencies. The criteria applicable to this levee feature and the hydraulic design of the drainage facilities in this levee reach are presented in Appendix C to this memorandum.

GEOLOGY

16. Physiography. The project area is located within the central gulf coastal plain on the northeastern flank of the Mississippi River delta plain. The primary physiographic features of the study area include Lake Pontchartrain to the north, the Inner Harbor Navigation Canal, and ponds, lagoons, bayous, canals, abandoned distributaries and small natural levees to the south and east. Relief in the area is very slight with elevations ranging from about 5 feet below mean sea level landward of the project alinement to about mean sea level along the lakefront.

17. General geology. Only the geologic history since the end of the Pleistocene epoch is relevant to this project. At that time with sea level about 400-450 feet below its present level, the Mississippi River began to aggrade the final entrenchment which it had cut to the west of the project area during the last glacial period. About 5,000 years ago, as sea level approached its present stand, the Mississippi River began to migrate laterally back and forth across the alluvial valley region. Delta lobes of the Mississippi River system began a series of progradations to the south of the project area about 4,700 years ago with the initiation of the St. Bernard delta complex. As the river continued to shift to steeper gradient courses, the Bayou Sauvage delta was initiated about 1900 years ago and subsequently became the primary source of sediments in the project area. Deposition at first was concentrated in a depression between the older St. Bernard delta lobes to the south and Pine Island, a relict beach trend, to the north. Pine Island was gradually buried by deltaic deposits of Bayou Sauvage and its distributaries which extended to the south and east of the project area. Deposition from this source continued at a decreasing rate until about 700 years ago when the major stream course shifted south and west to the Plaquemine-Modern and Lafourche delta complexes and only occasional seasonal flooding brought new sediments into the project areas. Finally the levee systems constructed along the Mississippi River eliminated seasonal flooding of lands adjacent to the river, and consequently the annual sediment supply formerly introduced into the project area was halted. As a result, the land masses formed from sediments transported to the area by the shifting network of distributaries are presently in a state of deterioration and retreat.

18. Subsidence and erosion. The project area lies in a region of active subsidence and downwarping which have been occurring since the end of the Pleistocene epoch. The Pleistocene surface has been downwarped toward the south and west from zero at the Pleistocene outcropping on the north shore of Lake Pontchartrain to about 500 feet near the edge of the continental shelf, about 80 miles south of New Orleans. The over-all rate of regional

subsidence has been about 0.39 foot per century. Local subsidence within the project area has been accelerated in recent years as land reclamation projects have extended eastward from New Orleans. Erosion of the Lake Pontchartrain shoreline in the project area has been at the rate of about 2 feet per year over an 18 year period.

19. Investigations performed. General type and 5-inch undisturbed borings to a maximum depth of about 85 feet were made for this project. In addition, the logs of borings made in conjunction with other projects as well as geologic information were available for the interpretation of the subsurface and foundation conditions of the area.

20. Foundation conditions. The subsurface along the project alinement is represented by the soil and geologic profiles on Plates 54 through 57. The legend on Plate 54 describes the various geologic environments of deposition and the general nature of the soils contained within each environment. Generally, the area consists of Holocene deposits varying in thickness from about 50 to 60 feet throughout the project area. The only exceptions to this depositional sequence are the three estuaries which were cut into the Pleistocene surface and subsequently filled with Holocene deposits. The approximate locations of the estuaries which are estimated to be less than 1,000 feet wide and at least 30 feet deep are as follows: B/L stations 73+00, 225+00, and 289+00. The entire sequence of Holocene deposits is underlain throughout the project area by older, more durable sediments of the Pleistocene epoch. These materials, although deposited under deltaic conditions similar to the younger overlying Holocene sediments, are generally much firmer and more resistant as a result of considerable weathering and oxidation, and consequently, provide the best load bearing formation in the area.

21. Mineral resources. Oil and gas production, common to other areas around New Orleans, is not presently found in the immediate vicinity of the project area. However, any future exploration or production of these natural resources will not be adversely affected by the project, nor will the project be adversely affected by oil and gas operations.

22. Sources of construction materials. Design Memorandum No. 12, Lake Pontchartrain, Louisiana and Vicinity, Sources of Construction Materials, approved 30 August 1966, documents available sources of sand, gravel, shell, and stone. Suitable borrow materials for levee construction are available from the Howze Beach area borrow pit in Lake Pontchartrain near the north shoreline. The soil borings in this proposed borrow area are shown on Plate 58.

23. Conclusions. The subsurface investigations and analyses of all existing and new data indicate that geologic conditions for construction of the proposed earthen levee and concrete floodwalls along the established alinement are generally favorable. The undesirable near surface organic materials normally found in this area have been previously removed and replaced with more stable granular materials (silt, silty sand, and sand).

FOUNDATIONS INVESTIGATION AND DESIGN

24. General. This section covers the soil and foundation investigations and design for enlarging the Citrus Lakefront-IHNC to Paris Road - levee and constructing gates and floodwalls. See Plate 14 for existing and recommended levee sections. As shown on Plate 1, the project extends from the existing I-wall on the eastern side of the IHNC near Seabrook Bridge to Paris Road where the project ties into the Paris Road to South Point levee (GDM No. 2 Supp. No. 5B). Excluding road ramps and gates, the protection from the IHNC floodwall to approximately midway of the New Orleans Airport will be I-type floodwall. From this point to the end of the airport, the protection will be a new earthen levee. Except at Lincoln Beach, where I-type floodwall will be used, the remaining protection will be enlargement of the existing levee.

25. Field exploration. Undisturbed 5-inch diameter borings were made at 16 locations (borings 2AU, 5AU, 6AU, 9AU, 10AU, and 1-ULC thru 11-ULC) along the levee alinement. The boring logs and laboratory test data are shown on Plates 59 through 100. General type core borings 1-7/8 inch I.D. were made at 41 locations (borings 1A, 3A, 4A, 7A, 8A, 1-C thru 31-C, and 1-CT thru 5-CT) along the levee alinement and at 5 locations (borings 1L thru 5L) 140 feet to 550 feet lakeside of the baseline. The soil borings for the general type borings and the undisturbed borings are shown plotted as general-type logs on Plates 59 through 84. The borings are shown in plan on Plates 2 thru 4. See Table No. 1 for soil boring schedules.

26. Laboratory tests. Visual classifications were made for all samples obtained from the borings. Water content determinations were made on all cohesive soil samples. Unconfined compression (UC), unconsolidated-undrained (Q), consolidated-undrained (R), and consolidated-drained (S) shear tests, and consolidation (C) tests were performed on representative soil samples from the undisturbed borings. Liquid and plastic limits were obtained on the undisturbed test specimens. The undisturbed test data are shown on Plates 69 through 84. The detail shear strength data are shown on Plates 85 through 100.

TABLE 1
SOIL BORING TABLE

BORING NUMBER	LOCATION BASELINE STATION	LOCATION DISTANCE FROM BASELINE	BORING NUMBER	LOCATION BASELINE STATION	LOCATION DISTANCE FROM BASELINE
1-A	8+96	330' Landside	3-L	138+00	140' Lakeside
2-AU		75' Landside	3-CT		30' Landside
1-C	8+85	57' Landside	10-ULC	157+25	100' Landside
3-A	12+00	200' Lakeside	14-C	160+70	53' Landside
2-C	16+85	60' Landside	15-C	170+84	53' Landside
4-A	18+00	200' Lakeside	16-C	183+26	55' Landside
5-AU	25+00	140' Lakeside	17-C	192+97	53' Landside
3-C	25+57	72' Landside	18-C	203+00	54' Landside
4-C	34+96	62' Landside	19-C	213+60	54' Landside
5-C	43+87	67' Landside	4-L		550' Lakeside
6-C	52+94	62' Landside	4-CT		30' Landside
7-C	64+25	45' Landside	7-ULC	Sec."C" 217+69	50' Landside
7-A	65+00	15' Landside	8-ULC		100' Landside
6-AU		43' Landside	9-ULC		300' Landside
8-C	73+21	45' Landside	20-C	222+06	54' Landside
1-CT		30' Landside	21-C	232+15	54' Landside
1-ULC	Sec."A"	57' Landside	22-C	243+83	54' Landside
2-ULC	83+60	114' Landside	9-AU	246+00	52' Landside
3-ULC		315' Landside	23-C	252+81	55' Landside
1-L	84+60	140' Lakeside	24-C	264+39	56' Landside
9-C	93+87	53' Landside	25-C	272+23	56' Landside
10-C	103+84	53' Landside	26-C	282+65	54' Landside
2-L		140' Lakeside	5-L	285+00	500' Lakeside
2-CT		30' Landside	5-CT		28' Landside
4-ULC	Sec. "B"	53' Landside	27-C	289+42	53' Landside
8-A	115+65	91' Landside	11-ULC	295+00	65' Landside
5-ULC		108' Landside	28-C	304+41	53' Landside
6-ULC		303' Landside	29-C	314+48	55' Landside
11-C	117+98	52' Landside	30-C	324+04	53' Landside
12-C	127+98	55' Landside	31-C	330+72	53' Landside
13-C	137+82	55' Landside	10-AU	331+00	52' Landside

27. Foundation conditions. The soil types and stratifications along the project alinement are shown on the soil and geologic profiles on Plates 54 through 57. In general the subsurface along this project can be divided into two reaches. From B/L station 0+00 to B/L station 64+00 deposits of clays, silts and sands, exist down to approximate elevations -12.0 to -17.0 underlain by a sand deposit to elevation -40.0. From B/L station 64+00 to B/L station 331+50 the soils consist of 15 to 20 feet of artificial levee fill as shown on the stability sections. The levee is underlain by recent deposits of clays, silts, and sands overlying the Pleistocene surface at approximate elevation -40.0.

28. Design and construction problems. The following were the principle design and construction problems on this project:

a. Types and location of flood protection

b. Types and locations of drainage facilities

c. Erosion protection

d. Sources of fill material

e. Method of construction

29. Drainage facilities.

a. Catch basins.

(1) Existing. Before the levee is enlarged, 138 existing catch basins will be removed and the drain pipes plugged and sealed off. The catch basins are located at varying spacings between the levee and railroad from B/L station 64+00 to B/L station 331+50. The recommended method of removal and sealing is shown on Plate 34 and is discussed in paragraph 37.

(2) Recommended. Catch basins will be installed on 600-foot centers from B/L station 28+31 to B/L station 331+50. These will collect and dispose of surface runoff from the lakeside levee slope. The catch basin will vary in size and be made of reinforced concrete. A 12-inch diameter corrugated metal drain pipe, slope varies will extend from the catch basin under the railroad embankment into a narrow drain outlet in the wave wash protection from B/L Station 64+00 to B/L Station 331+50. From B/L Station 31+00 to B/L Station 64+00 a corrugated metal collector pipe will be installed between the levee and the embankment. Semi-compacted clay will be used as backfill around the pipe. Plastic filter cloth will be required at the joints. The catch basins and drain pipes will be installed prior to placement of the semicompacted clay fill. The clay around each catch basin will be compacted with power tampers. A 12-inch layer of riprap

on 4 inches of shell will surround each catch basin to prevent scour of the clay cover. The recommended method of construction and details of the drainage facilities are shown on Plates 33 and 34.

b. Modification of existing culvert. The existing 54-inch culvert through the railroad embankment at B/L station 33+21 will be modified by installing a sluice gate on the flood side to provide positive closure to flow through the culvert.

c. Pumping stations. There are three existing pumping stations along the levee alinement: St. Charles located at B/L station 74+00, Citrus located at B/L station 155+50, and Jahncke located at B/L station 236+60. When St. Charles and Jahncke pumping stations were built, PDA 27 sheet piling was driven to a depth at elevation -50.0± for 60± feet on each side of the centerline of the discharge conduit in the existing levee and capped with concrete. Therefore, the levee enlargement of semicompacted clay can tie into the existing discharge conduits with no additional protective works required (see plate 15). The discharge canal at the abandoned Citrus station will be filled in as part of the levee enlargement. The canal will be filled with shell, and the shell core covered by semicompacted clay (see Plate 53). In addition a sluice gate and a sheet pile cutoff are to be constructed by others across the Citrus canal closure.

30. Levee.

a. General. A conventional earthen levee enlargement will be the main protective feature for the project from B/L stations 64+00 to 331+50. The levee will be constructed by enlarging the existing levee which was built by the Orleans Levee District after Hurricane Betsy in 1965. The levee enlargement will be constructed by placing semicompacted clay fill on the existing levee to the design grades and sections as shown on Plate 14. Between B/L stations 28+31 and 64+00 a new earthen levee will be constructed of semicompacted fill as shown on Plate 14. Table No. 2 contains pertinent levee data along the alinement.

b. Shear stability. Using cross sections representative of existing conditions along the levee, the stability of the levee was investigated by the method of planes using the design (Q) shear strength trends assigned to the various levee sections and applying a minimum factor of safety with respect to shear strengths of approximately 1.3. The results of the stability analyses for the recommended levee enlargement are shown on Plates 48 through 53. Analyses made to investigate sloughing of the landside levee slope due to prolonged hurricane rainfall are shown on the stability plates.

c. Settlement. Settlement analyses indicate that the gross grade levee crown will settle approximately 0.5 foot after construction except for the reach between B/L stations 28+31

TABLE 2
LEVEE DATA

STATIONING ALONG BASELINE	ELEVATIONS M.S.L. NET LEVEE GRADE	GROSS LEVEE GRADE	WIND TIDE LEVEL	DESIGN WATER TABLE	DISTANCE FROM SOUTH RAIL (FT) LEVEE CENTER-LINE	EROSION PROT. C/L	SHEAR STABILITY F.O.S. (S) CASE SLOPE SLOUGH	(Q) CASE LAKE SIDE	LAND SIDE	GDM PLATE NUMBER
ROAD RAMP 5+97.38 W/L	13.0	14.0	N.A.	5.0	N.A.	N.A.	N.A.	-	2.60	48
ROAD RAMP 32+71.96 W/L	10.5	11.5	8.5	2.0	N.A.	N.A.	N.A.	-	2.41	"
32+96.46 TO 34+29 W/L	10.5	11.5	8.5	2.0	N.A.	N.A.	N.A.	-	2.16	"
28+31 TO 33+21	10.5	11.5	8.5	0.0	42'	N.A.	N.A.	-	2.25	"
CULVERT 33+21	10.5	11.5	8.5	0.0	42'	N.A.	N.A.	-	1.46	49
33+21 TO 63+00	10.5	11.5	8.5	0.0	42'	N.A.	N.A.	-	2.27	"
64+00 TO 73+00	13.5	14.0	8.5	0.0	varies	30'	N.A.	2.10	2.11	"
ST. CHARLES & JAHNCKE PUMP STAS 74+00 & 236+50	13.5	14.0	8.5	0.0	44'	30'	N.A.	2.85	2.75	"
75+00 TO 107+00	13.5	14.0	8.5	0.0	varies	30'	1.14	2.03	2.01	50
108+00 TO 120+00	13.5	14.0	8.5	0.0	"	30'	1.36	2.02	1.59	50
121+00 TO 154+83	13.5	14.0	8.5	0.0	"	30'	1.45	1.58	1.78	51
CITRUS CANAL CROSSING 155+50	13.5	14.0	8.5	0.0	37.5'	30'	N.A.	1.92	2.10	53
156+13 TO 235+40	13.5	14.0	8.5	0.0	varies	30'	1.46	1.74	1.62	52
237+60 TO 289+59	13.5	14.0	8.5	0.0	varies	30'	1.49	1.75	1.51	52
100+00 TO 101+20 W/L and 114+23.81 TO 115+43.81 W/L	8.0	8.0	8.5	0.0	30'	N.A.	N.A.	-	2.07	46
101+20 TO 106+88.91 W/L and 109+14.91 TO 114+23.81 W/L	5.0	5.0	8.5	0.0	30'	N.A.	N.A.	-	2.33	46
304+31.4 TO 331+50	13.5	14.0	8.5	0.0	varies	30'	1.49	1.75	1.51	52

NOTE: N.A. denotes not applicable. Slope sloughing stability analyzed for steady seepage conditions parallel to the landside slope caused by hurricane rainfall, F.O.S. = 1.0 acceptable for this analysis.

and 64+00 where the crown will settle approximately a foot. To compensate for this long-term settlement, the levee crown will be overbuilt or grossed as shown on the levee data Table No. 2 and as shown on Plates 14 and 48 through 53.

d. Underseepage. Calculations made to investigate the need for a landside seepage berm indicate an upward gradient of less than 0.3. No seepage berm is required for (i_v) values of less than 0.5. The values of the upward gradient (i_v) through the landside blanket at the levee toe are shown along the soil and geologic profiles on Plates 54 through 57.

31. Road ramps.

a. Shear stability. Using cross-sections representative of existing conditions at each road ramp, the road ramps were designed for the most critical conditions with the shear stability being determined by the method of planes and a minimum factor of safety of 1.3 being applied with respect to shear strength. See Plate 48 for presentation of ramp cross-sections and stability analyses.

b. Settlement. Settlement calculations indicate that the crowns of the road ramps will settle approximately 1.0 foot after construction. To compensate for this long-term settlement, the ramp crowns will be overbuilt or "grossed," as shown on the levee data Table No. 2 and as shown on Plate 48.

32. I-walls.

a. General. The protection from the floodwall on the east bank of IHNC, along the New Orleans airport (W/L stations 0+00 to 32+47.46), and landside of Lincoln Beach (W/L stations 100+00 to 115+43.81) will consist predominantly of a cantilever I-type floodwall of sheet piling driven through existing levees, and/or fill, and capped with a concrete wall (see Plates 5 thru 13). See Table No. 3 for I-wall data along the alinement.

b. Cantilever I-wall (S) shear stability. The stability and required penetration of the steel sheet pile below the earth's surface were determined by the method of planes using the (S) shear strengths shown on the stability plates. Sufficient (Q) stability analyses were performed to confirm that the (S) case governed for design. A factor of safety of 1.5 was applied to the design shear strengths as follows: (c=0), ϕ developed = $\tan^{-1}$ (tan ϕ available) / (factor of safety). Using the resulting shear strengths, net lateral water and earth pressure diagrams were determined for movement toward each side of the sheet pile. Using these distributions of pressure, the summation of horizontal

TABLE 3
I-WALL DATA

STATIONING ALONG WALL LINE	ELEVATIONS M.S.L. TOP OF WALL NET	GROSS	WATER STAGE W.T.L.	DESIGN	STEEL SHEET PILE PENETRATION (S)STAB. FOS=1.5 LENGTH FEET	TIP EL. M.S.L.	BY CREEP WCR=7 TIP EL.	RECOMMENDED SHEET PILING LENGTH FEET	TIP EL. M.S.L.	GDM PLATE NUMBER
0+00 to 1+11	13.0	14.0	12.0	13.5	11.0	-1.0	-7.0	19.0	-9.0	43
1+11 to 2+15.79	"	"	"	"	20.5	-12.5	-15.5	varies	-12.5	"
5+43.38 to 5+79.38	"	"	"	"	24.0	-16.0	-16.0	21.4	-16.0	"
6+15.38 to 7+65.38	"	"	"	"	27.0	-19.5	-18.0	27.0	-19.5	"
7+65.38 to 9+71.20	"	13.5	"	13.0	24.5	-17.0	-16.5	24.5	-17.0	"
10+13.20 to 17+40	10.5	11.0	8.5	10.5	23.0	-17.0	-13.9	23.5	-17.0	"
17+40 to 18+40	"	"	"	"	14.8	-7.3	-12.4	20.0	-12.5	"
18+40 to 22+20	"	"	"	"	12.2	-4.2	-11.9	20.0	-12.0	"
22+20 to 24+00	"	"	"	"	14.7	-7.2	-12.4	20.0	-12.5	44
24+00 to 26+00	"	"	"	"	17.5	-10.5	-12.9	20.0	-13.0	"
26+00 to 27+00	"	"	"	"	20.0	-13.5	-13.4	20.0	-13.5	"
27+00 to 28+95.27	"	"	"	"	23.1	-17.1	-13.9	23.5	-17.5	"
29+26.27 to 31+06.27	"	"	"	"	23.1	-17.1	-13.9	23.5	-17.5	"
31+06.27 to 32+47.46	10.5	11.0	"	10.5	18.7	-12.7	-13.9	20.0	-14.0	"
100+00 to 101+20	13.5	14.0	"	13.5	17.0	-8.0	-11.0	19.0	-10.0	"
114+23.81 to 115+43.81	"	"	"	"	"	"	"	"	"	"
101+20 to 106+88.91	10.5	11.0	"	10.5	18.5	-12.5	-14.0	19.0	-13.0	"
109+14.91 to 114+23.81	"	"	8.5	"	"	"	"	"	"	"

NOTE: WCR is Lane's Weighted Creep Ratio.
WCR = (Σ V + 1/3 Σ H) ÷ Net Head . (Value $\approx$ 7.0 0 K)

forces was equated to zero for various tip penetrations. At these penetrations summations of overturning moments about the tip of the sheet pile were determined. The required depths of penetrations to satisfy the stability criteria were determined as those where the summation of moments were equal to zero. The results of the shear stability analyses for the cantilever sheet pile floodwalls are shown on Plates 43 and 44. The sheet pile penetration required to satisfy a Lane's weighted creep ratio of 7 was determined for various I-wall sections. The deeper penetration of the two analyses (shear stability or creep ratio) was selected as the recommended tip elevation of the sheet pile floodwall except where the soil boring data indicated that a slightly deeper penetration would be preferable, as shown on Table No. 3.

c. (Q) shear stabilities. The stability of the levees with I-walls was determined by the method of planes using the design (Q) shear strengths shown on the stability plates and applying a minimum factor of safety of approximately 1.3. Between W/L stations 0+00 and 2+15.79, hydrostatic uplift was applied on the base of the clay, from the top of the sands to the piezometric head determined by relief well analysis, and dissipating to the ground water surface of the landside along the passive earth wedge. The shear stability analyses are shown on Plates 45 and 46.

33. T-walls and gates.

a. General. T-type floodwalls supported by bearing piles will provide the protection adjacent to the inverted T-type gates supported by bearing piles at the railroad and street crossings. See Table No. 4 for gates and T-wall seepage cutoff data.

b. Steel sheet pile cutoff. A steel sheet pile cutoff will be used beneath the gates and T-walls to provide protection against hazardous seepage during a hurricane. The sheet pile penetration required to satisfy Lane's weighted creep ratio (WCR) of 3 was determined for the gates and various T-wall sections. The structures are supported on bearing piles and piping is not a threat to their integrity, therefore a WCR of approximately 3 can be tolerated. The recommended tip elevation of the sheet pile cutoff wall was selected as that required to cutoff a pervious stratum near the surface or that required to satisfy a WCR of 3 as shown in the Seepage Cutoff Data Table No. 4. Unbalanced hurricane water load analyses were performed on the sheet pile cutoff wall for the gates and various T-wall sections. The results of the two most critical analyses are presented on Plate 47. The net pressure diagrams indicated that the total available horizontal resistance is in excess of the total horizontal water load. Therefore, the bearing piles are not required to carry any additional lateral load resulting from water pressure acting on the sheet pile cutoff wall.

TABLE 4
SEEPAGE CUTOFF DATA TABLE
T-WALLS, GATES, RAMPS, LEVEE, AND CANAL CROSSING

STATIONING ALONG WALL LINE	ELEVATIONS M.S.L. DESIGN WATER FLOOD FEET	ELEVATIONS M.S.L. DESIGN WATER PROT. SIDE	ELEVATIONS M.S.L. PROT. GRADE NET	ELEVATIONS M.S.L. PROT. GRADE GROSS	PENETRATION FOR WCR=3 LENGTH FEET	PENETRATION FOR WCR=3 TIP EL. M.S.L.	TYPE OF PROTECTIVE FEATURE	RECOMMENDED SHEET PILING LENGTH FEET	RECOMMENDED SHEET PILING TIP EL. M.S.L.	GDM PLATE NUMBER
2+15.79 to 2+65.79	12.5	3.0	13.0	13.0	11.5	-10.0	T-wall	9.75	-11.5	47
2+65.79 to 3+15.79	"	2.5	"	"	12.0	-11.0	"	10.25	-12.0	"
3+15.79 to 3+67.79	"	1.5	"	"	13.0	-13.5	"	11.75	-13.5	"
3+67.79 to 4+45.79	"	0.0	"	"	15.5	-17.5	Road Gate	15.0	-17.0	"
4+45.79 to 5+03.38	"	"	"	"	19.5	-17.5	T-wall	Varies	-17.0	"
5+03.38 to 5+43.38	"	5.0	"	"	10.0	-5.0	R.R. Gate	21.44	-16.0	"
5+79.38 to 6+15.38	"	6.5	13.0	14.0	-	-	Road Ramp	8.5	CORE 3.5	"
9+71.20 to 10+13.20	"	"	"	13.0	4.0	-1.0	Road Gate	13.25	-10.0	"
28+95.27 to 29+26.27	9.5	5.0	10.5	10.5	4.0	-1.0	Road Gate	13.25	-10.0	"
32+47.46 to 32+96.46	"	2.5	"	11.5	-	-	Road Ramp	11.0	CORE -1.0	48
32+96.46 to 34+16	"	"	"	"	-	2.0	Levee	CORE TRENCH 3.5	-1.0	"
34+16 to 34+86	"	2.0	"	"	-	2.0	Sh. Pile in RR Embk	18.5	-10.0	"
ST. CHARLES PUMP STA. 73+40 to 74+60 B/L	8.5	1.0	13.5	14.0	-	-	P. Sta. Conduit	(Existing)	-47.43	49
CITRUS CANAL X'ING 154+90 to 156+10 B/L	"	2.0	13.5	14.0	-	-	Canal Crossing	(By others)	-44.93	53
JAHNCKE PUMP. STA. 235+90 to 237+10 B/L	"	1.0	13.5	14.0	-	-	P. Sta. Conduit	(Existing)	-50.4	49
LINCOLN BEACH 106+88.91 to 109+14.91 W/L	10.0	0.0	10.5	10.5	11.0	-13.5	Gate & T-wall	12.0	-13.5	47

NOTE: The structures are supported on bearing piles and piping is not a threat to their integrity, therefore, a W.C.R. = 3 can be tolerated.

c. Bearing pile foundations.

(1) Ultimate compression and tension pile capacities versus tip elevations were developed for 12-inch square concrete piles. In determining the normal pressure on the pile surface for the (S) case, conjugate stress ratios (K_o) of 1.0 and 0.70 were used in compression and tension, respectively. The results of pile design loads versus tip elevations analysis are shown on Plate 101. The recommended tip elevations for cost estimating purposes are based on applying factors of safety of 1.75 and 2.0 in compression and tension, respectively.

(2) During construction, 12-inch square prestressed concrete test piles will be driven and tested at two sites (in vicinity of Gates 1 and 5) along the project alinement. The test piles will be driven to the depths indicated on Plate 101. The results of the pile tests will be used to determine the length of the service piles. The capacity data include curves beginning at various predrilled depths in the foundation sands. These data are provided for estimating pile capacities if the driving resistances for the test piles indicates that predrilling is prudent.

d. Soil moduli. Bearing pile subgrade moduli curves for estimating lateral restraint of the soil beneath the gates and T-walls are shown on Plate 47. The procedures used in the development of these data are as stated in the notations on the design plate.

34. Seepage control.

a. Sheet pile cutoffs.

(1) Steel. Steel sheet pile cutoff will be used beneath the gates and T-walls to provide protection against hazardous seepage. The existing steel sheet piling at the discharge conduits of the St. Charles and Jahncke pumping stations will be left in place and will be used to provide protection against seepage.

(2) Concrete. Concrete sheet piling extending to elevation -10 feet will be used to provide protection against seepage beneath the railroad embankment where the levee ties in to it at B/L station 28+31.49 (see Plate 10).

b. Clay plug cutoffs. Clay plugs will be used to provide protection against piping and seepage at several locations along the levee alinement (see Plates 20, 33, and 49).

c. Seepage control during construction. Conventional sumps and pumps will be utilized to collect and dispose of seepage and surface water during normal water stages in the IHNC and in Lake Pontchartrain. For other than normal conditions, the construction specifications will require the contractor to maintain adequate interception of seepage and pressure relief as an end result type of performance.

35. Erosion protection. Thirty-six inches of derrick stone on a 12-inch riprap blanket will cover the lakeside slope of the existing railroad embankment as shown on Plate 16. This riprap serves as a wave berm for the enlarged levee section, and also protects the railroad embankment and thus the levee from wave and backwash erosion.

36. Sources of borrow material. The levee will be constructed of semicompacted clay fill which will be obtained from a borrow area of Pleistocene clays in the bottom of Lake Pontchartrain along the north shore. The material will be transported to the project on barges, stockpiled, hauled, and placed in the levee. See Plate 58 for the location and soil boring sections of the borrow area in the lake.

37. Sequence of construction.

a. General. Three separate contracts will be utilized for the construction of the project as described in paragraph 71.

b. Levee. The levee will be constructed in three phases as described below:

(1) Phase one. Drive and/or drill drain pipe beneath R.R. embankment, and install catch basin. Place semicompacted clay fill around catch basins. Place 12-inch layer of riprap on a 4-inch shell blanket in a 15-foot square around the catch basins.

(2) Phase two. Pump water out of existing basins, plug and seal drain pipes, backfill and compact clay in the bottom halves of the catch basins, remove the top halves of the catch basins and backfill and compact clay as basins are removed. See Plate 33.

(3) Phase three. Construct enlargement of existing and new levee with semicompacted fill as shown on the design sections on Plate 14 and to the gross grades shown in the Levee Data Table No. 2.

DESCRIPTION OF PROPOSED STRUCTURES AND IMPROVEMENTS

38. Levees. The project levee will consist of an enlargement of the existing levee and construction of a new levee with hauled clay material. The new levee will extend from just east of Downman Road (B/L station 28+31) to the eastern edge of the New Orleans Lakefront Airport (B/L station 64+00). The levee enlargement will extend from B/L station 64+00 to the western edge of Lincoln Beach (B/L station 289+58.59) and continue again from the eastern edge of Lincoln Beach (B/L station 304+31.58) to the intersection with the New Orleans East Lakefront levee, Paris Road to South Point, (B/L station 331+50) at the intersection of Paris Road and Hayne Boulevard. The centerline of the proposed levee will be located a varying distance south of the southernmost rail of the Southern Railway System's mainline tracks (see Plate 14 for offset distances). The net grade of the levee is 10.5 from B/L stations 28+31 to 64+00 and 13.5 for the remaining levee reaches. The general location and alinement of the proposed levee are shown on Plate 1. The detailed alinement and profile of the levee and features contiguous thereto are shown on Plates 2 thru 4. Typical levee design sections are shown on Plate 14.

39. Floodwalls, gates, and ramps.

a. Floodwalls. I-type and T-type floodwalls will be provided in lieu of levees from the intersection with the existing IHNC floodwall along Jourdan Road (W/L station 0+00) to the intersection with the new levee at B/L station 28+31 (W/L station 34+64) and again from the western edge of Lincoln Beach (W/L station 100+00) to the eastern edge of Lincoln Beach (W/L station 115+43.81). The elevation of the top of the floodwall varies as shown on Plates 5 thru 13. The general location and alinement of the proposed floodwall are shown on Plate 1. The detailed alinement and profile of the floodwall and features contiguous thereto are shown on Plates 5 thru 13. Typical design sections are shown on Plates 17 thru 19.

b. Gates.

(1) Overhead roller gates. At two locations within the floodwall reaches, steel overhead roller gates supported from reinforced overhead concrete beams will be constructed for access reasons. One of these gates will be located across Hayne Blvd. near Jourdan Road (centerline at W/L station 3+90.29) and the other will be constructed across the existing entrance to Lincoln Beach (centerline at W/L station 107+65.91). Vertical clearances will be 22 feet and 13 feet 8 inches for the Hayne Blvd. and Lincoln Beach locations, respectively. Horizontal clearances are 30 and 32 feet, respectively. Details of these gates are shown on Plates 24 and 28.

(2) Swing gates. Three steel swing gates will be included in the floodwall reaches. The locations are across the Southern Railway tracks near Jourdan Road (centerline at W/L station 5+23.38), across an entrance to the Orleans Levee Board facilities near Seabrook Bridge (centerline at W/L station 9+90.70) and across another airport service entrance nearer the terminal building (centerline at W/L station 29+10.77). Horizontal clearances are 32 feet, 26 feet, and 22 feet, respectively. Details of these gates are shown on Plates 25, 26, and 27.

c. Ramps. In lieu of gates, roadways will be ramped over the flood protection in two locations. The access road parallel and between the Seabrook Bridge and Southern Railway tracks near the IHNC (centerline at W/L station 5+97.38) will be ramped to elevation 14.0. Lakeshore Drive in front of the airport (centerline at W/L station 32+71.96) will be ramped to elevation 11.5. These ramps will include clay cores. For details of these ramps refer to Plate 20.

40. Drainage facilities.

a. Catch basins and drainage culverts. Catch basins and drainage culverts will be installed on 600-foot centers from B/L station 64+00 to B/L station 331+50, with the first one at B/L station 67+00 and the last one at B/L station 329+00, excluding the reach at Lincoln Beach, for the purpose of draining the area between the railroad embankment and the project levee. One corrugated metal collector pipe (24" Ø or 30" Ø) will be installed, with catch basins on 600 foot centers, between the levee and the railroad embankment from B/L Station 31+00 to B/L Station 64+00. The catch basins will be made of concrete and covered with steel gratings. The dimensions vary as shown in the table on Plate 33 and 34. The drainage culverts will consist of 12-inch diameter corrugated metal pipes, sloped approximately 1 on 60 under the railroad embankment. A 12-inch layer of riprap on a 4-inch shell bedding will surround each catch basin to prevent localized scour. Details of these drainage structures are shown on Plate 33 and 34.

b. Drainage ditch. The ditch formed between the railroad embankment and the new levee will be used to convey the runoff from the lakeside levee slope and railroad embankment to the catch basins. The bottom width of the ditch will vary and it will slope 1 foot from the midpoint between the catch basins to the catch basins.

c. Modifications to existing drainage facilities.

(1) Pumping stations. The St. Charles pumping station will be modified by adding a sluice gate structure to the discharge

pipe within the new levee section similar to the existing sluice gate structure at the Jahncke pumping station. Refer to Plate 15 for details. A shell closure, a sluice gate structure and a sheet pile cutoff wall will be added to the Citrus pumping station, details of which are shown on Plate 15. The Jahncke pumping station will not require any modification. The sluice gate structures are a requisite for positive closure during hurricane conditions.

(2) Drainage culvert. The 54-inch diameter culvert through the railroad embankment at B/L station 33+21 in the vicinity of the New Orleans Lakefront Airport will be modified by the installation of a sluice gate on the floodside to provide positive closure. The hand-powered hoist on the sluice gate will be provided with load brakes designed to be self holding for safety reasons. Details are shown on Plates 35 and 36.

(3) Lincoln Beach. The drainage facilities for Lincoln Beach area were modified by installation of catch basins, knife valves and new drain lines as shown on Plate 12. A portion of an existing drain line will also be removed as shown on Plate 12. The knife valves are required for positive closure during hurricane conditions.

METHOD OF CONSTRUCTION

41. Recommended levee construction plan. The recommended plan of construction consists of building a new levee near the New Orleans Lakefront Airport and enlarging the existing levee that extends eastward from the airport with semicompacted clay barged from Howze Beach in Lake Pontchartrain. The barges will be unloaded into trucks at a barge unloading site which will be located at the midpoint of the work. The clay will then be trucked across the existing railroad tracks and via the levee crown as required for placement. In a separate contract, the wave wash protection will be constructed of riprap and derrick stone, and these materials will be barged and trucked in the same manner as the clay, to the point of placement. A dragline working on the levee will hoist all the riprap and derrick stone across the railroad tracks to build the wave wash protection along the lakeside toe of the existing railroad embankment. No wave wash protection will be constructed in the vicinity of the New Orleans Lakefront Airport or Lincoln Beach.

42. Alternate levee construction plans.

a. Flotation channel plan. Approximately 120 campsites along the lakefront would be displaced if a flotation channel were constructed parallel to the existing railroad embankment. This channel would allow lakeside placement of riprap and derrick stone by barge-mounted draglines, for construction of wave wash protection along the lakeside toe of the railroad embankment. In a separate contract, clay barged from Howze Beach would be used for the levee enlargement - in the form of a semicompacted clay blanket. It would be hauled by truck from the barge, via the levee, to the point of placement. The estimated value of the existing campsites is $825,000. The tabulation below shows this plan not to be economical.

b. <u>IHNC barge unloading site plan</u>. All material for the construction of the levee and wave wash protection would be barged in and unloaded at the Morrison Yard (New Orleans Dock Board facilities) in the IHNC. It would then be hauled by truck via Hayne Boulevard to the Citrus Lakefront levee and unloaded at the point of placement. A dragline located on the levee would place all rock for the wave wash protection on the lakeside toe of the existing railroad embankment. In a separate contract, the clay for levee enlargement would also be truck hauled from the barge to the levee, and placed on the levee as required. Because of the fees charged by the New Orleans Dock Board to use their barge unloading facilities, and the increased haul distance as compared to the recommended plan, the following tabulation shows this plan not to be economical.

Alternate	Total Cost
Flotation channel plan	$11,417,000
IHNC barge unloading site plan	$10,577,000
Recommended plan	$9,478,000

OTHER PLANS CONSIDERED

43. <u>Alternate plan--floodwall in lieu of levee enlargement</u>. During the design of the recommended plan, an alternate plan of providing a floodwall instead of the levee enlargement was considered. The floodwall would be I-type and would consist of sheet piling driven into the existing levee and the upper portion of the sheet piling would be capped with concrete. The elevation of the top of the floodwall would be 15.5. Steps over the floodwall for access to camps would be provided. Riprap on the lakeside of the railroad would be needed. The total cost of this alternative is $16,750,000, excluding lands, damages, and relocations. This cost is $1,550,000 more than the recommended plan. Because of the high cost, aesthetic reasons, and limited accessibility to the campsites this alternative was not recommended.

44. <u>Alternate plan--levee alinement on lakeside of railroad embankment</u>. During project formulation and planning, consideration was given to constructing the levee along the alinement

presented in the project document, namely lakeside of the railroad embankment in the shallow waters of Lake Pontchartrain. This alternate included the additional works required such as riprap protection, pipeline relocations, a new drainage structure, and other associated items similar to the recommended plan. This alternate was rejected for the following reasons:

a. Excessive cost. The lakeside levee plan was estimated to cost in excess of $21 million excluding lands, damages, and relocations. This estimate represents an additional cost of about $6 million when comparing the same work items with the recommended plan. Studies also reveal that no inherent advantages were availed by this added expenditure and that the recommended project plan fulfills all requisites for the least costly plan for hurricane protection.

b. Campsite relocations. This alternate would have necessitated removal of about 120 shoreline campsites for levee construction. This relocation was considered a hardship which was avoidable by the recommended alinement. In the recommended plan, the walkways to these campsites will be removed for riprap placement and then replaced.

c. Ecological consideration. The lakeside levee alinement was considered to have permanent effects on the natural environment of the lake. This effect derives from the permanent loss of the lake bottomland and wildlife habitat beneath the embankment. Both this alternate and the recommended plan will cause temporary ecological disruptions due to turbidity in pumping borrow materials.

d. Construction problems. The alternate plan would create problems in construction; namely, involving pipeline relocations, campsite relocations, lift construction requiring a lengthy construction period, tie-ins with adjacent lines of protection, and interior drainage.

ACCESS ROADS

45. Access roads. Vehicular access to the project site is available via many roads. Hayne Boulevard (La. Hwy. 47) traverses parallel to the entire reach of the project except for the floodwall reach at the New Orleans Lakefront Airport. Other major thoroughfares which provide access to the project area are Lakeshore Drive, Downman Road, Paris Road, Read Boulevard, Jourdan Road, Crowder Road, and Bullard Road. Water access is available via Lake Pontchartrain. The Southern Railway System parallels the entire project reach.

STRUCTURAL DESIGN

46. Criteria for structural design. The structural designs presented herein comply with standard engineering practice and criteria set forth in Engineering Manuals for civil works construction published by the Office, Chief of Engineers, subject to modifications indicated by engineering judgment and experience to meet local conditions. The floodwall design is similar to the design presented in the South Point to GIWW GDM. (See Lake Pontchartrain, La., and Vicinity, Lake Pontchartrain Barrier Plan, DM No. 2 - General Design Supplement No. 9, New Orleans East Levee approved May 1973.)

47. Basic data. Basic data relevant to the design of the protective works are shown in the following table:

a. Water elevation.	Elevation (ft. m.s.l.)
Wind tide level (IHNC)	13.0
Wind tide level (Lake Pontchartrain)	8.5
Landside of floodwall	0.0

b. Floodwall gross grade. (stationing refers to W/L)	Elevation (ft. m.s.l.)
I-wall (sta. 0+00 to sta. 2+15.79)	14.0
T-wall and gates (sta. 2+15.79 to sta. 5+43.38)	13.0
I-wall (sta. 5+43.38 to sta. 7+65.38)	14.0
I-wall (sta. 7+65.38 to sta. 9+71.20)	13.5
Gate (sta. 9+71.20 to sta. 10+13.20)	13.0
I-wall (sta. 10+13.20 to sta. 28+95.27)	11.0
Gate (sta. 28+95.27 to sta. 29+26.27)	10.5
I-wall (sta. 29+26.27 to sta. 32+47.46)	11.0
I-wall (sta. 100+00 to sta. 101+20.00)	14.0
I-wall (sta. 101+20.00 to sta. 106+88.91)	11.0
T-wall and gate (sta. 106+88.91 to sta. 109+14.91)	10.5
I-wall (sta. 109+14.91 to sta. 114+23.81)	11.0
I-wall (sta. 114+23.81 to sta. 115+43.81)	14.0

c. Unit weights.	Lb. per cu. ft.
Water	62.5
Concrete	150
Steel	490
Earth	See Plates 48 thru 53.

d. Design loads.	
Earth pressures (lateral)	See Plates 43 and 44.
Wind loads	50 p.s.f.
Water loads	See Plates 43 and 44.

48. Allowable working stresses. The allowable working stresses for concrete and structural steel are in accordance with those recommended in "Working Stresses for Structural Design," EM 1110-1-2101 dated 1 November 1963 and amendment No. 1 dated 14 April 1965. The basic minimum 28-day compressive strength for concrete will be 3,000 p.s.i. except for prestressed concrete piling, where the minimum will be 5,000 p.s.i. Steel for steel piling will meet the requirements of ASTM A328-69, "Standard Specification for Steel Sheet Piling." For convenient reference, pertinent allowable stresses are tabulated below:

a. Reinforced concrete.

fc'	3,000 p.s.i.
fc	1,050 p.s.i.
vc (without web reinforcement)	60 p.s.i.
vc (with web reinforcement)	274 p.s.i.
fs	20,000 p.s.i.
Minimum area steel	0.0025bd
Shrinkage and temperature steel area	0.0020bt

b. Structural steel (ASTM A-36).

Basic working stress	18,000 p.s.i.

49. Location and alinement. The new floodwall will tie into an existing floodwall at W/L station 0+00 (B/L station 34+06 IHNC floodwall) along Jourdan Road, and continue north to cross Hayne Boulevard, the Southern Railroad embankment and the concrete roadway on the south side of Lakeshore Drive to W/L station 6+42.38. The floodwall turns westward at W/L station 6+42.38 parallel to Lakeshore Drive to W/L station 8+87.93 and turns north under the Seabrook Bridge approach to W/L station 10+10.20 at the New Orleans Lakefront Airport fence. The floodwall then continues easterly along the fence to W/L station 32+15.35 and turns directly south to tie into the Lakeshore Drive ramp at W/L station 32+47.46. A new levee will be constructed from W/L station 32+96.46, south of the Lakeshore Drive ramp, to tie into the Southern Railroad embankment. A sheet pile cutoff wall will be constructed through the existing railroad embankment to W/L station 34+86.00. The new levee will then continue eastward parallel to the existing railroad embankment to B/L station 289+58.59 at Lincoln Beach. Concrete I-wall, T-wall and a gate will be constructed from W/L station 100+00 to W/L station 115+43.81. The flood protection will consist of earth levee except for reaches of I-wall, T-wall, and gate monolith described above. See Plates 2 thru 5.

50. I-type floodwall.

a. General. The floodwall from W/L station 0+00 to W/L station 32+47.46 and from W/L station 100+00 to W/L station 115+43.81

will be concrete I-wall except for eight T-wall monoliths, five gate monoliths and two roadway ramps. The I-wall will consist of sheet piling driven into the existing ground and in some cases into a new embankment and the upper portion of the sheet piling will be capped with concrete. The sheet piling will be driven to the required depth with 1 foot of the sheet pile extending above the finished ground elevation. The concrete portion of the floodwall will extend from 2 feet below the finished ground elevation to the required protection height. See Plates 17, 18, and 19.

b. Loading cases. In the design of the I-wall, one loading case was considered.

Case I. Static water at 6 inches below top of wall, no wind, no dynamic wave force.

c. Joints. Expansion joints in the I-wall will be spaced 30 feet apart adjusted to fall at sheet pile interlocks. Where the I-wall joins the T-wall, the deflection of the I-wall will produce a lateral displacement. To take care of this displacement, a special seal located in a notch in the I-wall has been designed to prevent water from flowing through this joint. See Plates 22 and 23 for details.

51. T-type floodwall.

a. General. Four T-wall monoliths will be constructed along the east side of Jourdan Road adjacent to gate monoliths No. 1 and No. 2, and four other T-wall monoliths will be constructed adjacent to both sides of gate No. 5 at Lincoln Beach. See Plates 5 through 13 for the location and length of each T-wall monolith.

b. Loading cases. These walls were designed for the following load conditions.

Case I. Static water to top of wall, no wind, impervious sheet pile cutoff, no dynamic wave force.

Case II. Static water to top of wall, no wind, pervious sheet pile cutoff, no dynamic wave force.

Case III. No water, no wind.

Case IV. No water, wind (75 percent forces used).

c. Piling. Factors considered in the selection of the type of piling include availability, economy, resistance to decay, resistance to corrosive soil and water conditions, and fitness for driving. In general, the above considerations indicate that 12-inch square, precast, prestressed concrete piles are the most suitable. The prestressed concrete pile will meet the requirements of the joint AASHO and PCI committee standard specifications for "square concrete prestressed piles."

52. Gates and gate monoliths.

a. General. Five gate monoliths will be constructed for access roads, railroad crossings, and street crossings in lieu of I-walls. Each gate monolith will include a steel gate which will be closed by local interests when a hurricane approaches. See Plates 24 through 28 for locations, details of these gates and gate monoliths. The gate monoliths were designed for the following load conditions.

b. Overhead roller gates.

(1) Description. Two overhead roller gates will be constructed. Each structure will consist of a single leaf steel overhead roller gate, riding on an I-beam suspended from a reinforced concrete beam. The concrete beam will be supported by three concrete columns. One gate at Hayne Blvd. will have a vertical clearance of 22 feet and a horizontal clearance of 30 feet. The gate at Lincoln Beach will have a vertical clearance of 13 feet 8 inches and a horizontal clearance of 32 feet. Gate guides will be provided to restrain the gates against wind forces when the gates are being closed. Each sill across the gate opening will be sloped 1 inch to prevent the bottom seal of the gate from sliding along the full length of the opening while the gate is being closed. The bottom of the gate will be sloped 1 inch to match the sill slope. The sloping of the sill and gate is designed to eliminate previous gate closing difficulties associated with resistance to sliding the seal over the sill. Design computations for a typical overhead gate are shown in Appendix B. Typical plans, elevation, and details of the overhead roller gates are shown on Plates 24 and 28.

(2) Loading cases.

Case I. Water at top of wall, no wind, impervious sheet pile cutoff.

Case II. Water at top of wall, no wind, pervious sheet pile cutoff.

Case III. Water at el. 9.75 of wall, no wind, impervious sheet pile cutoff.

Case IV. Water at el. 9.75 of wall, no wind, pervious sheet pile cutoff.

Case V. No water, no wind, truck on edge of slab, flood side.

Case VI. No water, no wind, truck on edge of slab, protected side.

Case VII. No water, wind from flood side, truck on edge of slab, protected side, 33 1/3 percent increase in allowable stresses.

Case VIII. No water, wind from protected side, truck on edge of slab, flood side, 33 1/3 percent increase in allowable stresses.

c. Swing gate.

(1) Description. Three swing gates will be constructed in the vicinity of the New Orleans Lakefront Airport at the following locations, one at the Southern Railroad crossing, W/L station 5+23.38, one at the entrance to the Orleans Levee Board facilities, W/L station 9+90.70, and one at the entrance of the New Orleans Lakefront Airport, W/L station 29+10.77. To assure a proper seal, the gate is constructed so that it can be adjusted in either the horizontal or the vertical direction. The side and bottom seals can also be adjusted as alternate or supplemental means to assure that a proper seal is obtained. Plan elevation and details are shown on Plates 25 through 27.

(2) Loading cases.

Case I. Gate closed, water at top of wall, no wind.

Case II. Gate closed, water at top of wall, wind from flood side 33 1/3 percent increase in allowable stresses.

Case III. Gate opened (parallel to wall), no water, no wind.

Case IV. Gate opened (perpendicular to wall), no water, no wind.

53. Corrosion control. No specific measures other than painting the exposed ferrous metal components which are not galvanized or stainless steel with a five-coat vinyl paint system, are required for corrosion control.

SOURCES OF CONSTRUCTION MATERIALS

54. Sources of construction materials. In addition to the information presented in this memorandum relative to borrow area location and materials, information relating to material sources is also contained in Design Memorandum No. 12, "Sources of Construction Materials," approved 30 August 1966.

REAL ESTATE REQUIREMENTS

55. General. All rights-of-way and construction easements required for construction of this levee will be acquired by the Orleans Levee District and furnished without cost to the United States. There will be no acquisition by the United States. Rights-of-way and construction easement limits are shown on Plates 2 through 13. Local interests are required to assume the cost of relocation assistance to persons and businesses displaced by such acquisition pursuant to the requirements of Public Law 91-646.

RELOCATIONS

56. General. Under the authorizing law, local interests are responsible for the accomplishment of "...all necessary alterations and relocations to roads, railroads, pipelines, cables, wharves, drainage structures and other facilities made necessary by the construction work,...." Included in the required modifications are road ramps, utilities, and drainage rectification work.

57. Road ramps. Road ramps will be constructed in two locations. The first will be located at W/L station 5+97.38, where the concrete roadway on the south side of Lakeshore Drive intersects the I-type floodwall. The ramp will be constructed to elevation 14.0. The other ramp will be located at W/L station 32+71.46 on Lakeshore Drive. This ramp will be constructed to elevation 11.5. The locations of the ramps are shown on Plates 6 and 10. Details of the ramps are shown on Plate 20.

58. Utilities crossing I-wall. Details of pipeline crossings through the I-wall are shown on Plates 39 and 40. Each utility crossing will be so constructed that any anticipated settlement or deflection of the I-wall or any small movements of the pipe will not seriously affect either the wall or pipeline.

59. Campsite walkways. There are approximately 110 timber walkways that lead from the lakeside campsites to the existing railroad embankment. Approximately 40 feet of each timber walkway will be removed in the vicinity of the railroad embankment in order to facilitate the construction of the wave wash protection. After the completion of construction, all of the walkways will be replaced.

60. Campsite utility lines.

a. All known lines that cross over or through the existing levee are small diameter lines that consist of 1-inch pipes or less, and they convey water and electricity to the lakeside campsites from Hayne Blvd. All the utility lines crossing the levee will be removed or relocated as follows:

(1) All lines which are within 2 feet of the existing levee surface will be removed.

(2) All lines which are more than 2 feet below the existing levee surface will be cut off at the levee and railroad embankment toes and capped.

b. After the new levee is completed, any utilities that are reestablished may be buried in the new levee approximately 1 foot below the levee surface. This procedure is necessary because of the steeper than normal levee slope brought about by the limited right-of-way available between the railroad embankment and the road.

c. Approximately 110 water and electric lines pass under the existing railroad tracks in order to provide service to the existing lakeside camps. These lines are attached to the timber walkways discussed in paragraph 59 above. Approximately 40 feet of each line will be temporarily removed between the railroad embankment and the camps in order to construct the wave wash protection along the lake shore. The removed portion of each line will be replaced after construction is completed in a given area.

61. Concrete walkways. There are 64 concrete walkways that cross over the existing levee at various locations. These walkways must be removed to facilitate the levee enlargement and the placement of rock for wave wash protection. The walkways will be replaced by permit application by the owners after the levee is completed.

COORDINATION WITH OTHER AGENCIES

62. General. As previously mentioned, the State of Louisiana, Department of Public Works, was appointed project coordinator for the State by the Governor of Louisiana. This agency has functioned to coordinate the needs, desires, and interests of state agencies and the Corps of Engineers. The Orleans Levee District will provide the local cooperation for this feature of the hurricane protection project. The project plan presented herein is acceptable to both of the above agencies. The entire Lake Pontchartrain hurricane protection project, including this project feature, has been discussed at numerous public and private meetings since its authorization. Such meetings have been held before regional, state, local, community, social, and educational organizations and have served generally to inform the public of the proposed works, to explain project functions, and to solicit the public viewpoint. The latest public meeting was held in New Orleans on 22 February 1975. It was a combined public information meeting and a meeting to discuss the plan for disposal of dredged material as per Section 404 of the Federal Water Pollution Control Act of 1972. A statement of findings has been prepared and approved by the Environmental Protection Agency. The project has also been described and discussed in press and by communications media, as well as by organizational and individual correspondence.

63. U.S. Department of the Interior, Fish and Wildlife Service. Extensive coordination with the U.S. Fish and Wildlife Service was accomplished during preauthorization studies and subsequent to authorization of the project. By letter dated 2 April 1968, the Regional Director, U.S. Fish and Wildlife Service, Atlanta, Georgia, was informed of the current layout for the Lake Pontchartrain Barrier Plan feature of the Lake Pontchartrain, Louisiana and Vicinity, hurricane protection project and requested to furnish views and comments on the entire Lake Pontchartrain Barrier Plan. By letter dated 15 May 1968, the Acting Regional Director stated "...We are of the opinion that hurricane control structures in the Rigolets and Chef Menteur tidal passes have little appreciable effect on salinities in Lakes Maurepas, Pontchartrain, and Borgne. Therefore, no adverse effects on fish and wildlife resources in these areas are expected." Any significant modifications to the current plan will be forwarded to the Regional Director for further review and comment. Copies of the above letter and the responses of the Acting Regional Director are included in Appendix A.

64. U.S. Department of the Interior, Federal Water Pollution Control Administration (now Environmental Protection Agency).

a. Review and recommendations. By letter dated 8 April 1968, the Regional Director, Federal Water Pollution Control Administration, was informed of the current layout for the Lake Pontchartrain Barrier Plan feature of the Lake Pontchartrain, Louisiana and Vicinity, hurricane protection project and requested to furnish views and comments on the project. The Regional Director requested in his letter of response dated 15 May 1968 that consideration be given to the following:

(1) Minimizing water quality degradation during construction.

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

(3) Constructing and operating water quality control structures so as to insure that ecological conditions remain unchanged.

b. Project incorporation of recommendations. 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 the 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 A.

65. Southern Railway System.

a. Review and recommendations. Since the plan of protection for this reach parallels the Southern Railway System, extensive coordination with this agency, both written and oral, has occurred during the preparation of this report. Much of this coordination has been through the Orleans Levee District. The Railway System recommended specific criteria concerning the relationship between the protective works and their railroad system. The recommendations are as follows: 1) the top of the drainage culvert through the railroad embankment should be at least 5 feet, 6 inches below the bottom of the southernmost rail; 2) the centerline of the drainage ditch should be 15 feet from the southernmost rail; 3) elevation of the top of the catch basin should be no higher than 6.0; 4) the spacing between the catch basins should be no farther than 600 feet; 5) the horizontal clearance on each side of the tracks through the swing gate should be 18 feet for maintenance purposes; and 6) the swing gate across their tracks near the IHNC be designed so adjustments can be made for future track raisings.

b. Project incorporation of recommendations. Incorporation of the recommendations into the project plan has been accomplished to the following extent: (Copies of pertinent correspondence are included in Appendix A.)

(1) The difficulty in alining the levee in the narrow right-of-way between the railroad embankment and Hayne Blvd. precluded the use of the 5.5-foot clearance below the southernmost rail. It was agreed that the distance could be reduced to 5.0 feet.

(2) This recommendation was complied with. The size of the catch basins were varied from 2.5' to 4' clear opening to conform to this requirement.

(3) This recommendation was complied with.

(4) The spacing between catch basins was set at 600 feet as per the recommendation. It should be noted that the hydraulic analysis for this project determined that 900-foot spacings would be sufficient to handle the runoff from the area between the railroad embankment and new levee.

(5) The existing railroad bridge crossing the IHNC and the bridges east of South Point along the same system have

approximately 8.0 feet of horizontal clearance on each side of the track. The clearances shown on Plate 25 are 10 feet on each side. This complies with a more recent request. Therefore the request to provide 18 feet of clearance for maintenance purposes was not honored.

(6) An adjustable extender plate was added to the bottom of the gate so the gate may be raised for future track maintenance. The gate sill will also be raised by the Orleans Levee District. See Plate 25 for details.

ENVIRONMENTAL ANALYSIS

66. Environmental Quality.

a. General. The engineering treatment required for preserving and maintaining the environmental quality of the project has been considered during preparation of this memorandum. Extensive coordination has been accomplished with the appropriate agencies relative to effects of the project on fish and wildlife resources and water quality control during and subsequent to construction.

b. Enhancement. Construction of the project works in the Citrus area will alter the existing terrain only to the extent of development of a floodwall in an area which has previously been altered by man's activities. The Citrus area consists of 14,800 acres bounded by New Orleans East, the IHNC, the Mississippi River-Gulf Outlet, and Lake Pontchartrain. This area has been drained for about 40 years and is protected from normal flooding by levees on the west, south, and east, and by a railroad embankment and levee along Lake Pontchartrain on the north. Construction of this feature of the project would result in enhancement for long-term human occupation of this area.

67. Environmental statement. The final environmental statement for the entire Lake Pontchartrain, Louisiana and Vicinity, Hurricane Protection project was filed with the President's Council on Environmental Quality on 17 January 1975. This statement, in part, describes effects of the Citrus Lakefront levee from IHNC to Paris Road as follows:

a. In the Citrus area, construction features will extend a length of 6.4 miles, just south of the existing railroad embankment. Project features will require the commitment of about 30 acres of developed land.

b. Construction activities will result in the modification of the developed land to project features. This action will enhance long-term human expansion into the Citrus area. These modifications will involve the long-term change in land use and short-term annoyances such as increases of sound levels in the immediate area due to construction of the project features.

c. The overall action of construction of hurricane protection features in this area will enhance long-term human expansion into the area. The completion of this project feature will tend to accelerate urban development and will likely result in an increase in the rate at which the remaining natural production of the area is lost. The no-action alternative would retard the environmental changes, that would, under the proposed action, convert shrub and wooded areas to urbanization. It should be noted that almost all of the Citrus area is considered nonwetland and losses of natural habitat to encroaching development would not be as extreme if the area were a wetland.

d. Should the anticipated increase in development in the protected areas occur, an increase in the quantities of solid and liquid wastes cannot be avoided. Disposal of those wastes will be accompanied by corresponding environmental stresses.

68. Cultural resources. The entire project strip has been covered over by rocks, fill soil, shell fill, concrete, asphalt, railroad, riprap, and existing levee. Those clues by which sites are typically looked for are virtually useless in the case of this developed area.

a. A cultural resources survey was conducted along the rights-of-way for this project in March 1976. Only one site is specifically recorded in the project rights-of-way. The site has two locations, on the lakeshore at the intersection of Hayne Blvd. and Edward, and at the intersection at Hayne Blvd. and Benson. Artifacts were not found at either location.

b. There are no properties in the Citrus area which are included in the latest National Register of Historic Places published in Federal Register on 10 February 1976.

c. The project features will have no adverse effect on any known cultural resource, pre-historic or historic.

ESTIMATE OF COST

69. General. Based on October 1975 price levels, the estimated first cost of construction of the Citrus Lakefront levee and floodwall, Inner Harbor Navigation Canal to Paris Road, is $15,200,000. This estimate consists of $876,000 for lands and damages, $1,707,000 for relocations, $10,316,000 for levees and floodwalls, $1,322,000 for engineering and design, and $979,000 for supervision and administration. The detailed estimate of first cost is shown on Table 5.

TABLE 5

LAKE PONTCHARTRAIN BARRIER PLAN
CITRUS LAKEFRONT LEVEE

ESTIMATE OF FIRST COST
(October 1975 price levels)

Cost Acct. No.	Item	Estimated Quantity	Unit	Unit Price	Estimated Amount
				$	$
	I. Floodwall Reaches				
CONSTRUCTION					
11	Levees and floodwalls				
	Compression pile test	2	Ea.	8000.00	16,000
	Addition Comp. pile test	2	Ea.	2500.00	5,000
	Tension pile test	2	Ea.	5000.00	10,000
	Levee embankment	5,940	c.y.	6.50	38,610
	Steel sheet piling PZ-27	86,700	s.f.	8.00	693,600
	Steel sheet piling PMA-22	8,720	s.f.	7.00	61,040
	Steel sheet piling PSA-22	1,075	s.f.	8.00	8,600
	Prestressed conc. piling 12" x 12"	10,620	l.f.	14.00	148,680
	Concrete in stabilization slab	60	c.y.	70.00	4,200
	Concrete in T-wall base	665	c.y.	80.00	53,200
	Concrete in walls, columns, and beams	2,265	c.y.	120.00	271,800
	Portland cement	15,045	c.w.t.	3.00	45,140
	Steel reinforcement	316,220	lbs.	0.35	110,680
	Structural steel	53,500	lbs.	1.50	80,250
	Waterstops, L-Type	80	l.f.	15.00	1,200
	Waterstops, 3-Bulb type	1,190	l.f.	5.00	5,950
	Gate seals	225	l.f.	15.00	3,380
	Sack rubbed finish	50,600	s.f.	0.40	20,240
	Structure excavation	3,150	c.y.	5.00	15,750
	Structure backfill	2,100	c.y.	6.00	12,600
	Expansion joint filler	2,210	s.f.	1.25	2,760
	Concrete removal	460	c.y.	50.00	23,000
	Miscellaneous metal	1	job	L.S.	15,000
	Trolleys, overhead roller gates	1	job	L.S.	5,000
	Fertilizing & seeding	4	Acres	500.00	2,000
	Subtotal				$1,653,680
	Environmental protection (0.005)				8,270
	Subtotal				$1,661,950
	Contingencies 20%±				332,350
	Subtotal				$1,994,300

TABLE 5 (cont'd)

Cost acct. No.	Item	Estimated Quantity	Unit	Unit Price	Estimated Amount
				$	$
30	Engineering and design 12%± (based on estimate of actual E&D required)				239,800
31	Supervision and administration 10%± (based on estimate of the actual S&A on E&D required)				199,000
	TOTAL, CONSTRUCTION FOR FLOODWALL REACHES				$2,433,100
	LANDS AND DAMAGES (included in the estimate for Lands and Damages for Levee Enlargement)				
	RELOCATIONS				
02	Relocations				
	Pipelines and Powerlines				
	2"Ø pipe thru I-Wall	2	Ea.	750.00	1,500
	16"Ø C.I. water line thru I-wall	1	Ea.	3,500.00	3,500
	3" Ø Steel H.P. gas line thru I-Wall	2	Ea.	3,000.00	6,000
	8" Ø water line thru I-Wall	3	Ea.	1,500.00	4,500
	12" Ø Drain pipe thru I-Wall	1	Ea.	2,000.00	2,000
	8" Ø Water line thru levee	1	Ea.	1,500.00	1,500
	12" Ø Water line thru I-Wall	1	Ea.	2,000.00	2,000
	6" Ø Gasoline line thru I-Wall	1	Ea.	1,000.00	1,000
	12" Ø C.M.P. thru I-Wall	1	Ea.	1,500.00	1,500
	6" Ø Water line thru I-Wall	3	Ea.	1,000.00	3,000
	10" Ø Drain pipe thru I-Wall	2	Ea.	1,500.00	3,000
	8" Ø Drain pipe thru I-Wall	1	Ea.	1,500.00	1,500
	21" Ø Drain pipe thru levee	1	Ea.	2,500.00	2,500
	Powerline 2400/4160 volts thru I-Wall	2	Ea.	8,000.00	16,000
	1" Ø Electrical conduit thru I-Wall	1	Ea.	500.00	500
	Relocate 55 l.f. of 3" H.P. gas line	1	Ea.	500.00	500
	Relocate 65 l.f. of 8" Ø water line	1	Ea.	1,000.00	1,000
	Relocate 510 l.f. of 10" Ø drain pipe	1	Ea.	7,000.00	7,000
	Relocate 45 l.f. of 12" Ø drain pipe	1	Ea.	710.00	710
	Relocate 210 l.f. of 15" Ø drain pipe	1	Ea.	4,500.00	4,500
	Relocate 500 l.f. of 8" Ø water line and fire hydrant	1	Ea.	6,500.00	6,500
	Subtotal				$70,210

TABLE 5 (cont'd)

Cost acct. No.	Item	Estimated Quantity	Unit	Unit Price	Estimated Amount
				$	$
	Relocations (cont'd)				
	Modification to existing roadways				
	Ramp @ roadway near Seabrook Bridge	1	job	L.S.	56,000
	Ramp @ Lakeshore Drive	1	job	L.S.	68,500
	Subtotal				$124,500
	Drainage Structures				
	8" Knife gate valve & struc.	1	Ea.	5,000.00	5,000
	10" knife gate valve & struc.	2	Ea.	6,000.00	12,000
	12" knife gate valve & struc.	2	Ea.	7,000.00	14,000
	54" Sluice gate structure	1	Ea.	30,000.00	30,000
	21" Sluice gate structure	1	Ea.	15,000.00	15,000
	Relocate catch basins	3	Ea.	700.00	2,100
	Relocate sewer cleanout	1	job	2,000.00	2,000
	Installation of manhole struc.	8	Ea.	1,000.00	8,000
	Subtotal				$88,100
	Miscellaneous structures				
	Railroad falsework	1	job	L.S.	15,000
	Relocate transit shelters	1	job	L.S.	3,000
	Relocate street lighting	1	job	L.S.	2,500
	Subtotal				$20,500
	Subtotal, RELOCATIONS				$303,310
	Contingencies 20%±				61,090
	Subtotal				$364,400
30	Engineering and design 10%± (based on estimate of actual E&D required)				36,500
31	Supervision and administration 7%± (based on estimate of actual S&A on E&D required)				25,300
	TOTAL, RELOCATIONS FOR FLOODWALL REACHES				$426,200
I.	TOTAL, FLOODWALL REACHES				$2,859,300

TABLE 5 (cont'd)

Cost Acct. No.	Item	Estimated Quantity	Unit	Unit Price	Estimated Amount
				$	$
	II. Levee Enlargement				
CONSTRUCTION					
11	Levees and floodwalls				
	Embankment				
	Clearing and grubbing	1	job	L.S.	3,500
	Barge unloading facility	1	job	L.S.	300,000
	Railroad crossing	1	job	L.S.	3,500
	Clay embankment	215,000	c.y.	6.50	1,398,000
	Fertilizing and seeding	49	Acres	500.00	25,000
	Shell	500	c.y.	10.00	5,000
	Removal of 138 catch basins	1	job	L.S.	27,600
	Mobilization and demob	1	job	L.S.	30,000
	Subtotal				$1,792,600
	Drainage structures				
	Structure excavation	2250	c.y.	5.00	11,250
	Structure backfill	1650	c.y.	6.00	9,900
	Catch basins (5'x5'x4')	48	Ea.	500.00	24,000
	Installation of 12" Ø CMP thru railroad embankment	2,490	l.f.	50.00	124,500
	Riprap around catch basins	530	tons	30.00	15,900
	Shell bedding	120	c.y.	10.00	1,200
	Installation of 24" Ø CMP	2,390	l.f.	24.00	57,360
	Installation of 30" Ø CMP	900	l.f.	30.00	27,000
	Installation of 30" Ø CMP thru railroad embankment	64	l.f.	95.00	6,080
	Subtotal				$277,190
	Subtotal, CONSTRUCTION				$2,069,790
	Environmental protection (0.7%)				14,490
	Subtotal				$2,084,280
	Contingencies (20%)				416,420
	Subtotal				$2,501,700
30	Engineering and design 11%± (based on actual estimate of actual E&D required)				275,200
31	Supervision and administration 8%± (based on estimate of actual S&A on E&D required)				200,000
	TOTAL, CONSTRUCTION FOR LEVEE ENLARGEMENT				$2,976,900

TABLE 5 (cont'd)

Cost acct. No.	Item	Estimated Quantity	Unit	Unit Price	Estimated Amount
				$	$
LANDS AND DAMAGES					
01	Lands				
	Industrial park	3.48	Ac	93,500	325,380
	Residential lots	6	Ac	37,000	222,000
	Neighborhood business	1.781	Ac	50,000	89,050
	Construction easement	3.034	Ac	varies	37,430
	Drainage easement	0.62	Ac	18,500	11,740
	Improvements, chain link fence	3,075	l.f.	2.80	8,610
	Subtotal				$693,940
	Contingencies (25%±)				174,060
	Real estate hired labor (4 tracts)				3,200
	Acquisition by others (4 tracts)				4,800
	TOTAL, LANDS AND DAMAGES				$876,000
RELOCATIONS					
02	Relocations				
	Removal of concrete walkways over existing levee	64	Ea.	3,000	192,000
	Removal & replacement of water and electrical lines thru existing levee	110	Ea.	900	99,000
	Subtotal				$291,000
	Pumping stations				
	Positive cutoff at				
	Jahncke pumping sta.				
	Structure excavation	640	c.y.	5.00	3,200
	Structure backfill	200	c.y.	6.00	1,200
	Temporary cofferdam (PZ-27)	6,500	s.f.	7.00	45,000
	Steel sheet piling PDA-27	6,236	s.f.	8.00	50,000
	Class "B" timber piling	1,424	l.f.	3.00	4,300
	Concrege in stabilization slab	25	c.y.	70.00	1,750
	Concrete in T-wall base	52	c.y.	80.00	4,160
	Concrete in walls, columns, & beams	96	c.y.	120.00	11,520
	Portland cement	900	cwt	3.00	2,700
	Steel reinforcement	28,110	lbs.	0.35	9,840
	Structural steel	10,030	lbs.	1.50	15,050
	1" Ø Stainless steel bar	130	lbs.	2.00	260

TABLE 5 (cont'd)

Cost acct. No.	Item	Estimated Quantity	Unit	Unit Price	Estimated Amount
				$	$
02	Relocations (cont'd)				
	Sack rubbed finish	610	s.f.	0.40	250
	Miscellaneous metal	1	job	L.S.	20,000
	7'x12' Sluice gate (2 gates)	1	job	L.S.	63,000
	Subtotal				$232,230
	Some structure required at Citrus and St. Charles pumping stations	(2 x 232,230)			464,460
	Subtotal, RELOCATIONS				$987,690
	Contingencies 20%±				196,910
	Subtotal				$1,184,600
30	Engineering and design 10%± (based on estimate of actual E&D required)				118,500
31	Supervision and administration 7%± (based on estimate of actual S&A on E&D requied)				82,700
	TOTAL, RELOCATIONS FOR LEVEE ENLARGEMENT				$1,385,800
II.	TOTAL, LEVEE ENLARGEMENT				$5,238,700
III.	Wavewash protection				
CONSTRUCTION					
11	Levees and floodwalls				
	Clearing	1	job	L.S.	5,000
	Railroad crossing	1	job	L.S.	3,500
	Railroad guard mat	4	Ea.	3,000.00	12,000
	Shell (citrus x-ing)	1,500	c.y.	10.00	15,000
	Riprap	75,000	ton	18.00	1,350,000
	Derrick stone	167,000	ton	20.00	3,340,000
	Mobilization & demob	1	job	L.S.	90,000
	Subtotal				$4,815,500
	Environmental protection (0.7%)				34,000
	Subtotal				$4,850,000
	Contingencies 20%±				970,000
	Subtotal				$5,820,000

TABLE 5 (cont'd)

Cost acct. No.	Item	Estimated Quantity	Unit	Unit Price	Estimated Amount
				$	$
III.	Wavewash protection (cont'd)				
30	Engineering and design 11%± (based on estimate of actual E&D required)				636,000
31	Supervision and administration 8%± (based on estimate of actual S&A on E&D required)				461,000
	TOTAL, CONSTRUCTION OF WAVEWASH PROTECTION				$6,917,000
RELOCATIONS					
02	Relocations				
	Removal and replacement of approx. 40' of wooden walkways, water lines, electric lines, for each camp	110	Ea.	1,200.00	132,000
	Contingencies 20%±				26,000
	Subtotal				$158,000
30	Engineering and design 10%± (based on estimate of actual E&D required)				16,000
31	Supervision & administration 7%± (based on estimate of actual S&A on E&D required)				11,000
	TOTAL, RELOCATIONS FOR WAVEWASH PROTECTION				$185,000
III.	TOTAL, WAVEWASH PROTECTION				$7,102,000
I.	FLOODWALL REACHES				$2,859,300
II.	LEVEE ENLARGEMENT				$5,238,700
III.	WAVEWASH PROTECTION				$7,102,000
	TOTAL PROJECT COST				$15,200,000

70. Comparison of estimates.

a. GDM versus PB-3. The current estimate of $15,200,000 for the Citrus Lakefront levee and floodwall represents an increase of $2,108,000 when compared to the latest PB-3, effective 1 October 1975. The PB-3 estimate is based on the estimate included in Design Memorandum No. 2, Citrus Back Levee, approved 29 December 1967, and escalated to October 1975 price levels. Table 6 shows a comparison of the project document, PB-3, and general design memorandum estimates. Reasons for the difference between the general design memorandum and PB-3 estimates follow:

(1) Levees and floodwalls. There is a net increase of $471,000; however, since the levee has been relocated on the landside of the railroad embankment rather than on the lakeside in Lake Pontchartrain as originally contemplated by the project document plans, a direct comparison of specific construction items and analysis of price level fluctuations is not feasible. The savings realized from the landside alinement offsets most of the cost increase resulting from the addition of 3,250 feet of floodwall.

(2) Engineering and design. The net decrease of $182,000 results from recomputing the E&D cost based on an analysis of actual work required rather than using a fixed percentage of the construction cost.

(3) Supervision and administration. The net increase of $240,000 results from recomputing the S&A costs based on an analysis of actual work required rather than using a fixed percentage of the construction cost.

(4) Lands and damages. The net decrease of $24,000 is due to a more detailed determination of the acreages required for rights-of-way and construction easements and an update of the values of the lands involved.

(5) Relocations. The net increase of $1,603,000 is due to the need to modify the St. Charles and Jahncke pumping stations in addition to the Citrus pumping station, construct two road ramps, and modify campsite utilities to facilitate placement of wave wash protection. The net increase also reflects refinements in the cost estimate based on more detailed information available during preparation of the GDM.

b. GDM versus project document. The estimated cost of $15,200,000 for the Citrus Lakefront levee and floodwall represents a net increase of $11,541,000 over the project document estimate. Reasons for the difference between the design memorandum and project document estimates follow:

TABLE 6

COMPARISON OF ESTIMATES

Feature		Project Document (Dec 61 Prices)	PB-3 (eff. Oct 75)	GDM (Oct 75 prices)	Difference GDM - PB-3	Difference GDM - Proj. Document
		$	$	$	$	$
11	Levees and floodwalls	3,266,000	9,845,000	10,316,000	+ 471,000	+7,050,000
30	Engineering and design	122,000	1,504,000	1,322,000	- 182,000	+1,200,000
31	Supervision & administration	197,000	739,000	979,000	+ 240,000	+ 782,000
	Subtotal	3,585,000	12,088,000	12,617,000	+ 529,000	+9,032,000
01	Lands and damages	0	900,000	876,000	- 24,000	+ 876,000
02	Relocations	74,000	104,000	1,707,000	+1,603,000	+1,633,000
	Subtotal	74,000	1,004,000	2,583,000	+1,579,000	+2,509,000
	TOTAL PROJECT COST	3,659,000	13,092,000	15,200,000	+2,108,000	+11,541,000

(1) Levees and floodwalls. The net increase of $7,050,000 is comprised of a decrease due to the alinement change from lakeside to landside of the railroad tracks and an increase due to price level increases between December 1961 and July 1975. As described previously, the basic reason for cost estimate difference is the relocated levee alinement. This basic fact prohibits valid and meaningful cost comparisons between the GDM and project document.

(2) Engineering and design. The increase of $1,200,000 results from recomputing the E&D cost based on an analysis of actual work required rather than by using a fixed percentage of the construction cost.

(3) Supervision and administration. The increase of $782,000 is based on an analysis of actual work required rather than using a fixed percentage of the construction cost.

(4) Lands and damages. The increase of $876,000 results from locating the levee landside of the railroad embankment rather than in Lake Pontchartrain. The project document alinement did not require the purchase of rights-of-way or easements.

(5) Relocations. The net increase of $1,633,000 is due to reasons described in paragraph 70a(5) above.

SCHEDULE FOR DESIGN AND CONSTRUCTION

71. Schedule for design and construction. The sequence of contracts and schedules are as follows below:

Contracts	Plans & Specs		Construction			Est. Constr. costs include 20% cont., +6% for S&I
	Start	Complete	Advert.	Award	Complete	
Airport and Lincoln Beach area, flood-wall contract	Apr 75	Submit LMVD Nov 76	Jan 77	Feb 77	Dec 78	$2,114,000
Levee contract from sta. 28+31 to sta. 289+59, & from sta 304+31 to sta. 331+50	Apr 75	Submit LMVD May 77	Sep 77	Nov 77	Feb 79	$2,652,000
Rock placement (wave wash contract)	Jan 79	Submit LMVD Aug 79	Dec 78	Feb 79	Feb 81	$6,169,000

72. Funds required by fiscal year. To maintain the schedules for design and construction of the Citrus Lakefront levee, Federal funds will be required by fiscal year as follows:

Funds required by FY	76	$ 640,000[2]
	76T	190,000
	77	800,000
	78	3,000,000
	79	2,450,000
	80	2,450,000
	81	3,087,000
	TOTAL	$12,617,000

OPERATION AND MAINTENANCE

73. General. The Citrus Lakefront levee will be maintained and operated at the expense of local interests as a feature of local cooperation for the project. The estimates of the annual operation and maintenance costs for the different features of the project are as follows: (1) levee - $4,700; (2) catch basins and culverts $8,000; (3) wave wash protection - $1,600; and (4) overhead roller and swing gates - $500. It is estimated that replacement of the overhead roller gates ($35,900 each) and swing gates ($11,700 each) will be necessary at 30-year intervals. Sluice gates for drainage pipes ($7,500 each) and knife gate valves ($2,100 each) will be replaced at 10-year intervals. The sluice gates at the pumping stations ($30,000 each) will be required to be replaced at 20-year intervals. Partial replacement of the wave wash protection will be needed after 50 years. The annual charge for all of these replacements is $29,300.

ECONOMICS

74. Economic justification. The current economic analysis for the entire Lake Pontchartrain, Louisiana and Vicinity hurricane protection project, based on the October 1975 PB-3 costs, indicated a benefit-cost ratio of 13.3 to 1. An economic reanalysis of the entire Lake Pontchartrain, Louisiana and Vicinity hurricane protection project is presently being prepared and will be submitted at a later date. This reanalysis will include incremental justification for each portion of the entire project, including the Citrus Lakefront levee.

---

[2] Includes cost to date and cost for preparation of plans and specifications in the remainder of FY 76.

FEDERAL AND NON-FEDERAL COST BREAKDOWN

75. Federal and non-Federal cost breakdown. The breakdown of the construction cost into the Federal and non-Federal shares are shown on Table 7 below:

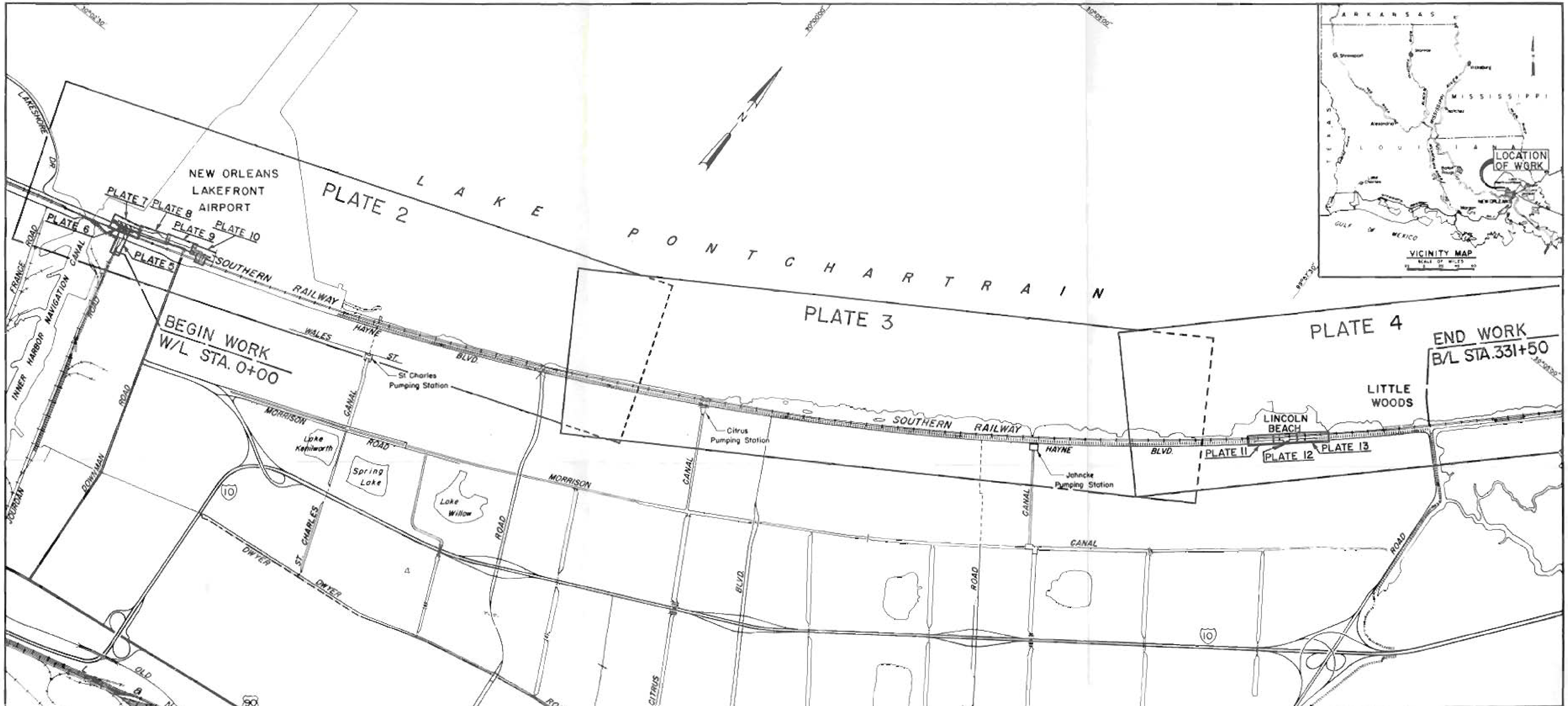
TABLE 7

FEDERAL AND NON-FEDERAL
COSTS BREAKDOWN

Item	Federal	Non-Federal	Total
Levees, floodwalls, and structures	10,600,000	2,017,000	12,617,000
Lands & damages	-	876,000	876,000
Relocations	-	1,707,000	1,707,000
TOTAL	$10,600,000	$4,600,000	$15,200,000

RECOMMENDATIONS

76. Recommendations. The plan of improvement presented herein consists of 5.5 miles of levee enlargement and new floodwall along the Citrus lakefront from IHNC to Paris Road. The plan includes suitable provision for modification of drainage facilities, erosion protection, and necessary relocations. This plan is considered to be the best means of accomplishing project objectives and is recommended for approval.



LAKE PONTCHARTRAIN, LA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO.2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

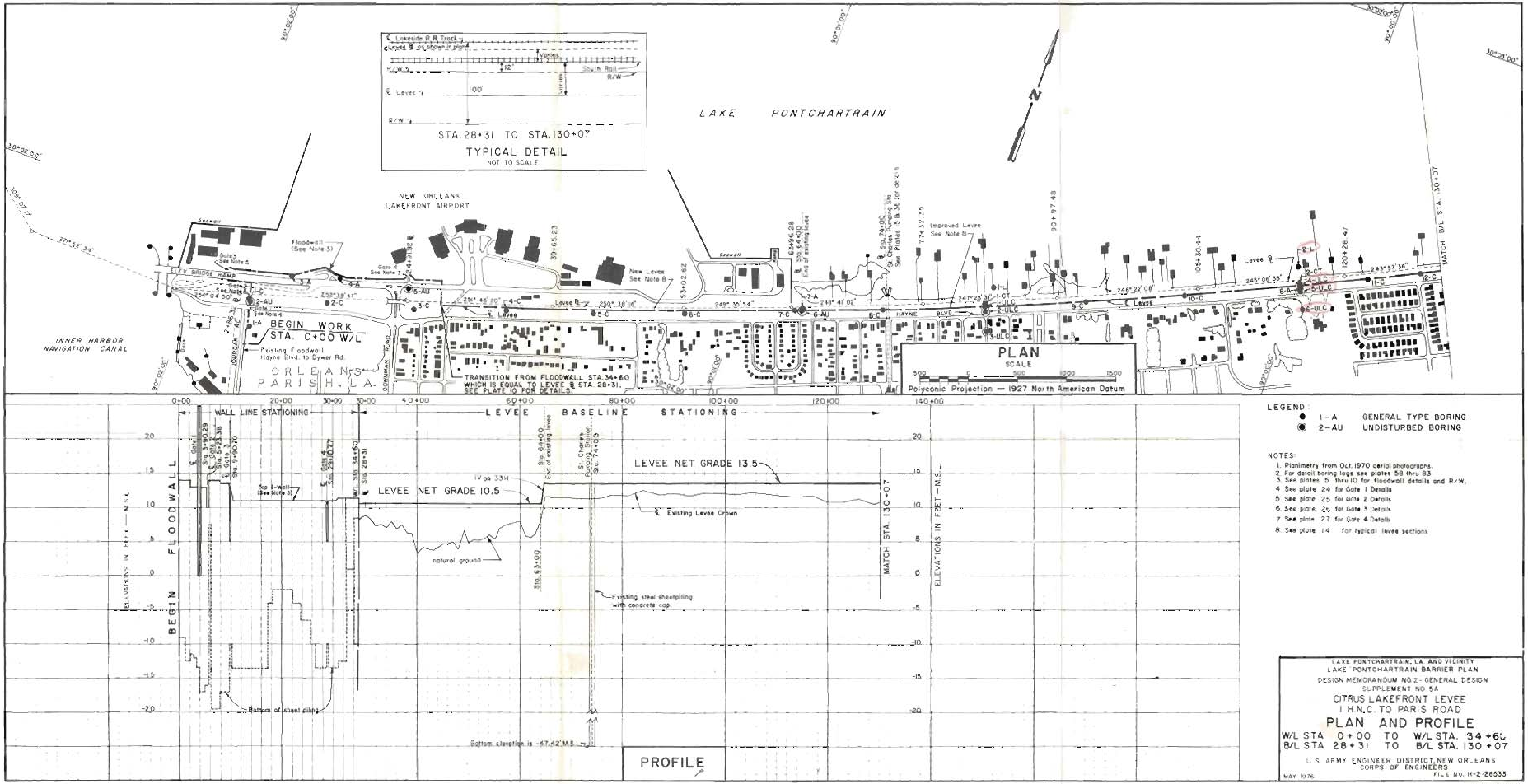
INDEX AND VICINITY MAP

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

MAY 1976

FILE NO. H-2-26533

PLATE 1



LEGEND:

- 1–A GENERAL TYPE BORING
- 2–AU UNDISTURBED BORING

NOTES:

1. Planimetry from Oct. 1970 aerial photographs.
2. For detail boring logs see plates 58 thru 83
3. See plates 5 thru 10 for floodwall details and R/W.
4. See plate 24 for Gate 1 Details
5. See plate 25 for Gate 2 Details
6. See plate 26 for Gate 3 Details
7. See plate 27 for Gate 4 Details
8. See plate 14 for typical levee sections

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO 5A
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD
PLAN AND PROFILE
W/L STA 0+00 TO W/L STA. 34+60
B/L STA 28+31 TO B/L STA. 130+07
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MAY 1976 FILE NO. H-2-26533

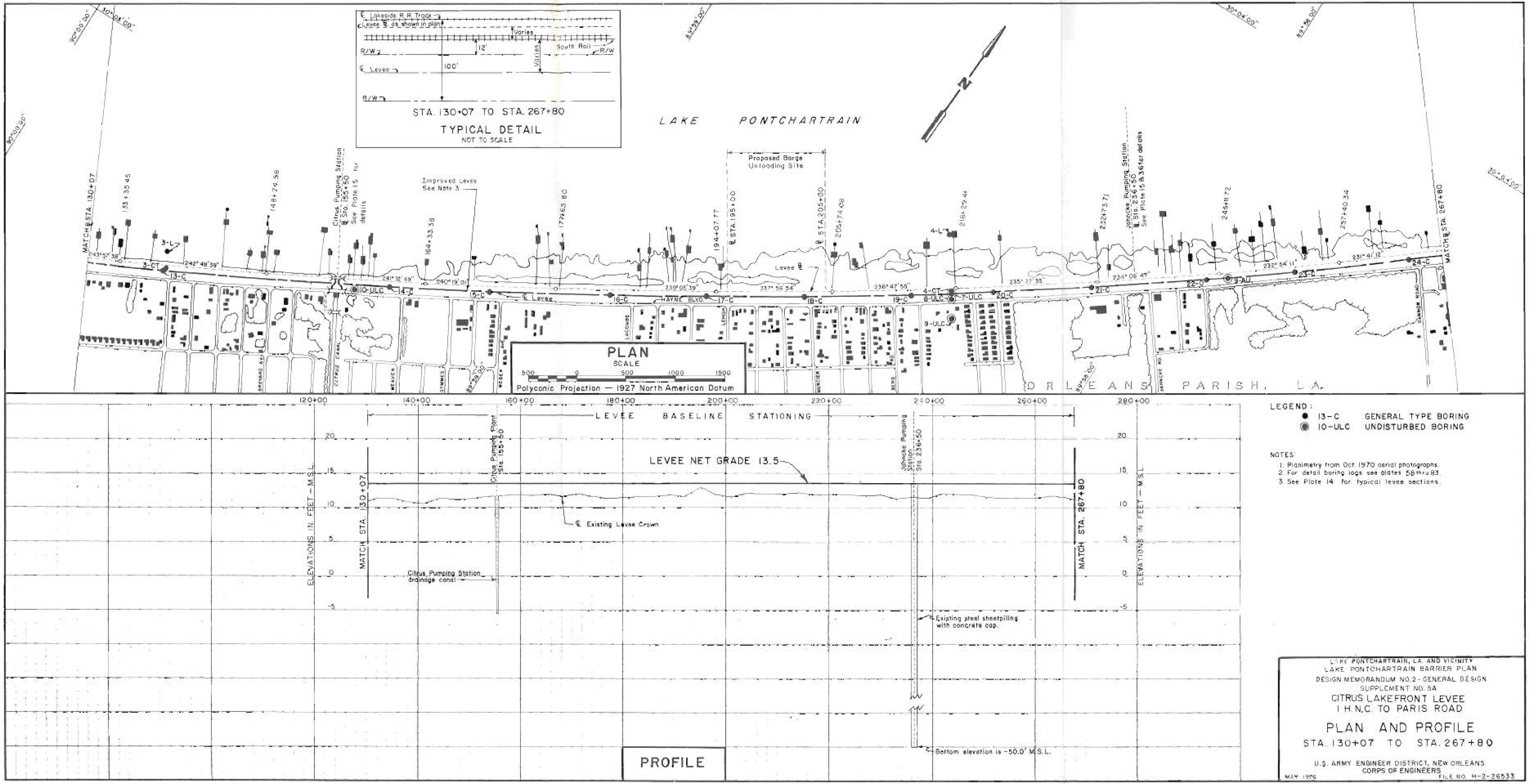
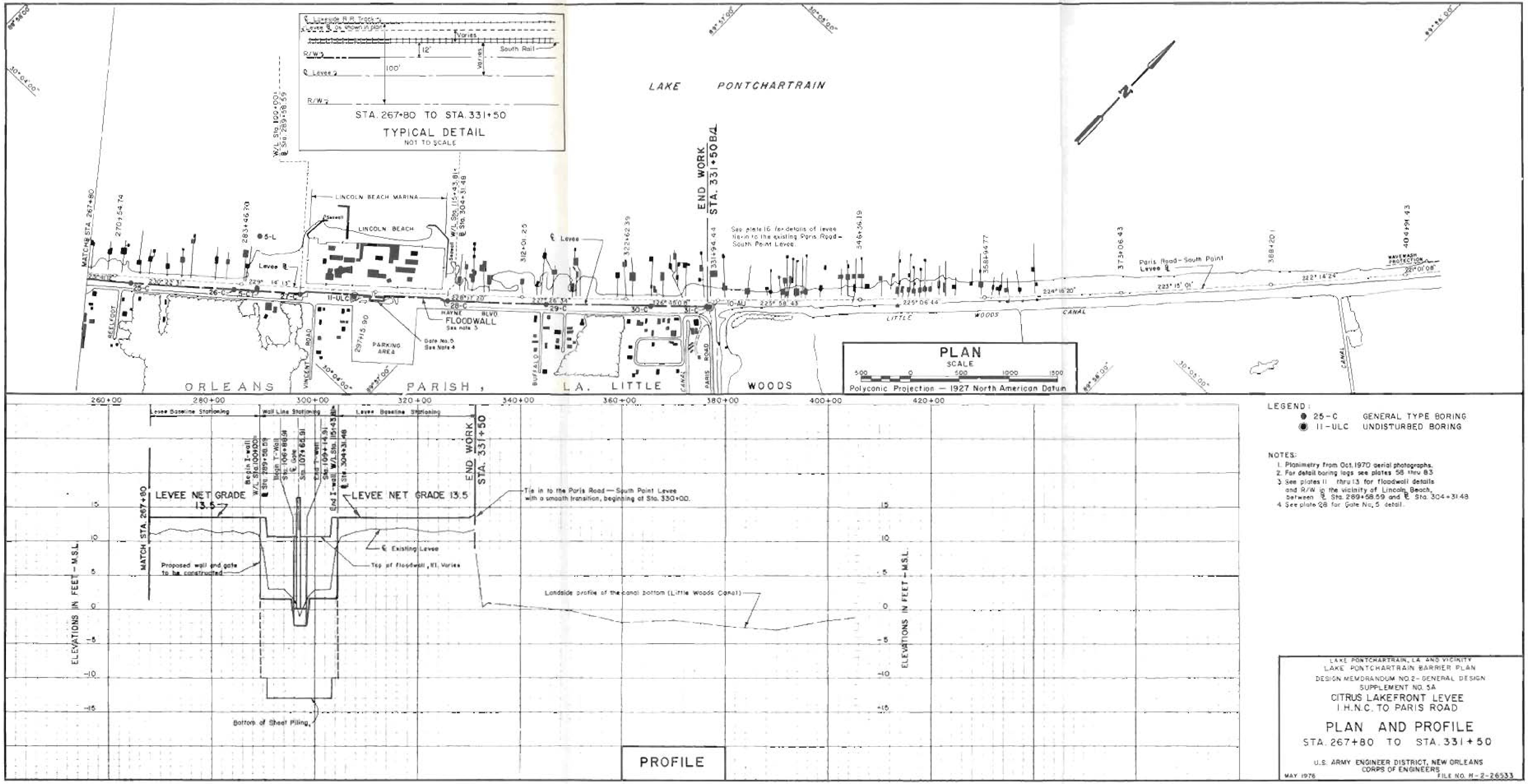
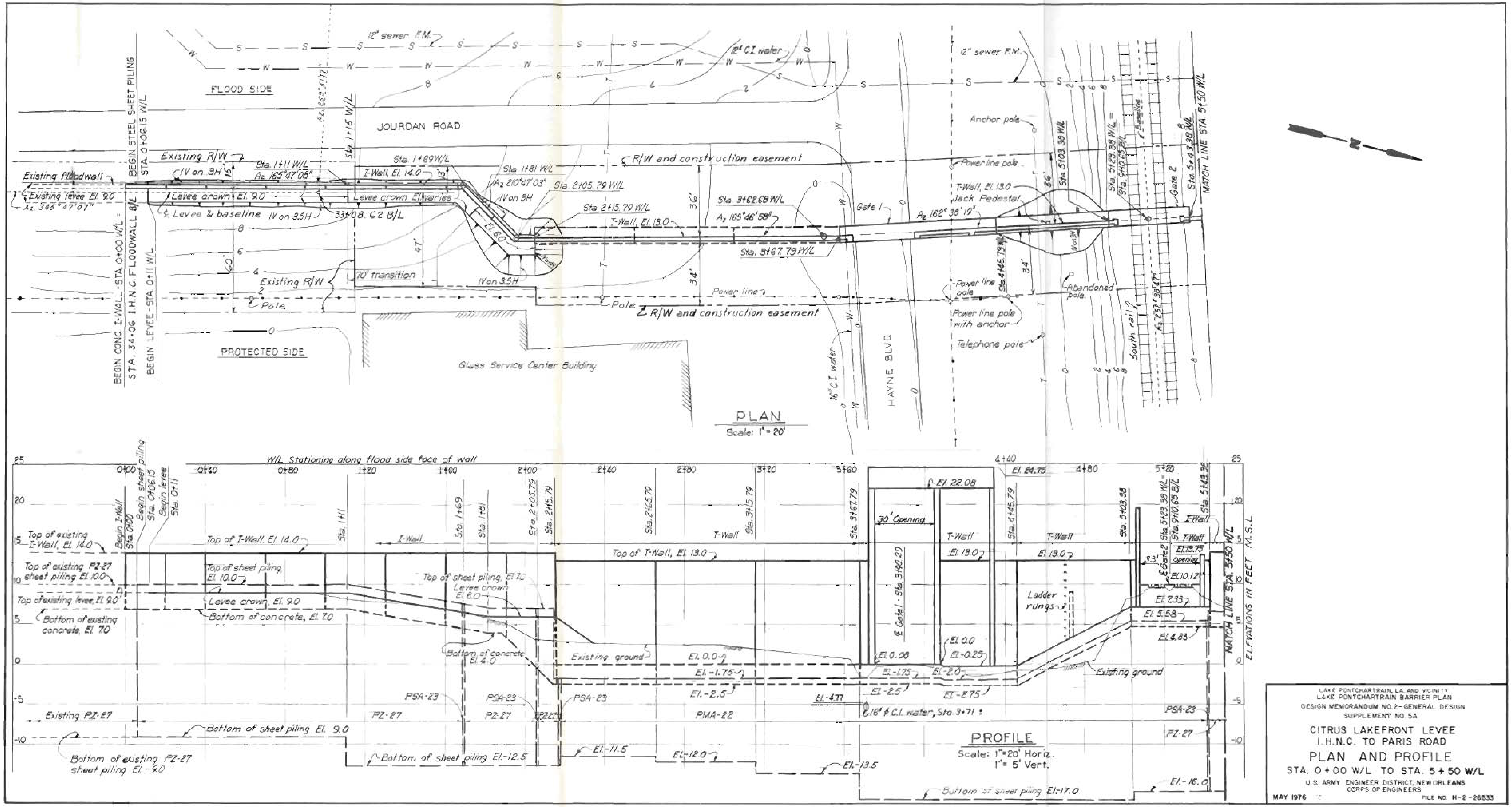

STA. 130+07 TO STA. 267+80
TYPICAL DETAIL
NOT TO SCALE
LAKE PONTCHARTRAIN
Proposed Barge Unloading Site
Improved Levee See Note 3
Citrus Pumping Station ℄ Sta. 155+50 See Plate 15 for details
Jahncke Pumping Station ℄ Sta. 236+50 See Plate 15 & 36 for details
MATCH STA. 130+07
MATCH STA. 267+80
HAYNE BLVD.
PLAN
SCALE
Polyconic Projection — 1927 North American Datum
ORLEANS PARISH, LA.
LEVEE BASELINE STATIONING
LEVEE NET GRADE 13.5
℄ Existing Levee Crown
Citrus Pumping Station drainage canal
Existing steel sheetpiling with concrete cap.
Bottom elevation is -50.0' M.S.L.
ELEVATIONS IN FEET - M.S.L.
PROFILE
LEGEND:
13-C GENERAL TYPE BORING
10-ULC UNDISTURBED BORING
NOTES:
1. Planimetry from Oct. 1970 aerial photographs.
2. For detail boring logs see plates 58 thru 83.
3. See Plate 14 for typical levee sections.
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD
PLAN AND PROFILE
STA. 130+07 TO STA. 267+80
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MAY 1976
FILE NO. H-2-26533

PLATE 3



LAKE PONTCHARTRAIN
STA. 267+80 TO STA. 331+50
TYPICAL DETAIL
NOT TO SCALE
LINCOLN BEACH MARINA
LINCOLN BEACH
END WORK
STA. 331+50B/L
FLOODWALL
PLAN
SCALE
Polyconic Projection — 1927 North American Datum
ORLEANS PARISH, LA.
LITTLE WOODS
LEVEE NET GRADE 13.5
MATCH STA. 267+80
END WORK STA. 331+50
Tie in to the Paris Road — South Point Levee with a smooth transition, beginning at Sta. 330+00.
Proposed wall and gate to be constructed
Top of floodwall, El. Varies
Landside profile of the canal bottom (Little Woods Canal)
Bottom of Sheet Piling
ELEVATIONS IN FEET – M.S.L.
PROFILE
LEGEND:
25-C GENERAL TYPE BORING
11-ULC UNDISTURBED BORING
NOTES:
1. Planimetry from Oct. 1970 aerial photographs.
2. For detail boring logs see plates 58 thru 83
3. See plates 11 thru 13 for floodwall details and R/W in the vicinity of Lincoln Beach, between ℄ Sta. 289+58.59 and ℄ Sta. 304+31.48
4. See plate 28 for Gate No. 5 detail.
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD
PLAN AND PROFILE
STA. 267+80 TO STA. 331+50
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MAY 1976
FILE NO. H-2-26533



LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

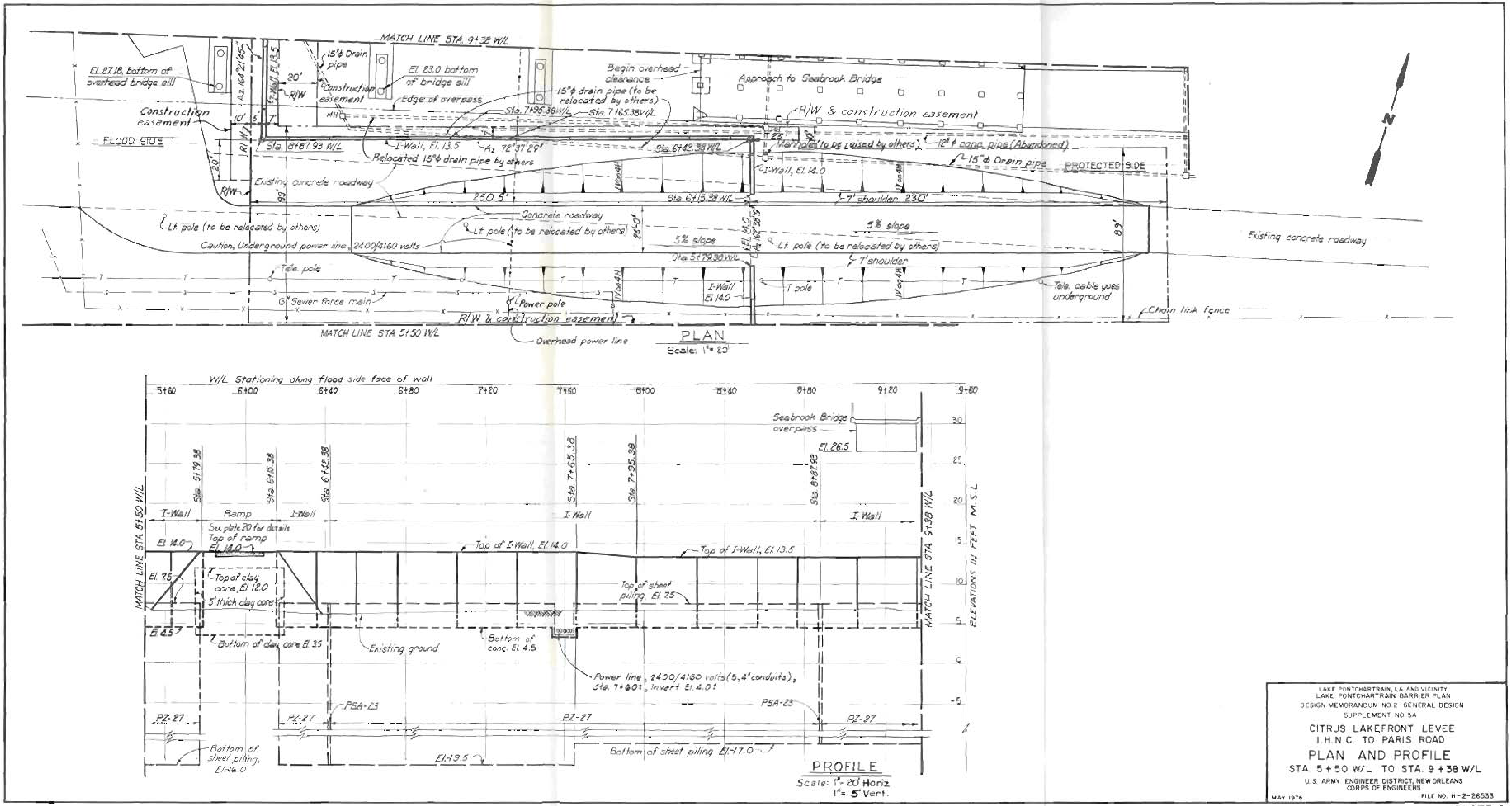
PLAN AND PROFILE
STA. 0+00 W/L TO STA. 5+50 W/L

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

MAY 1976

FILE NO. H-2-26533

PLATE 5



LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

PLAN AND PROFILE
STA. 5 + 50 W/L TO STA. 9 + 38 W/L

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

MAY 1976 FILE NO. H-2-26533

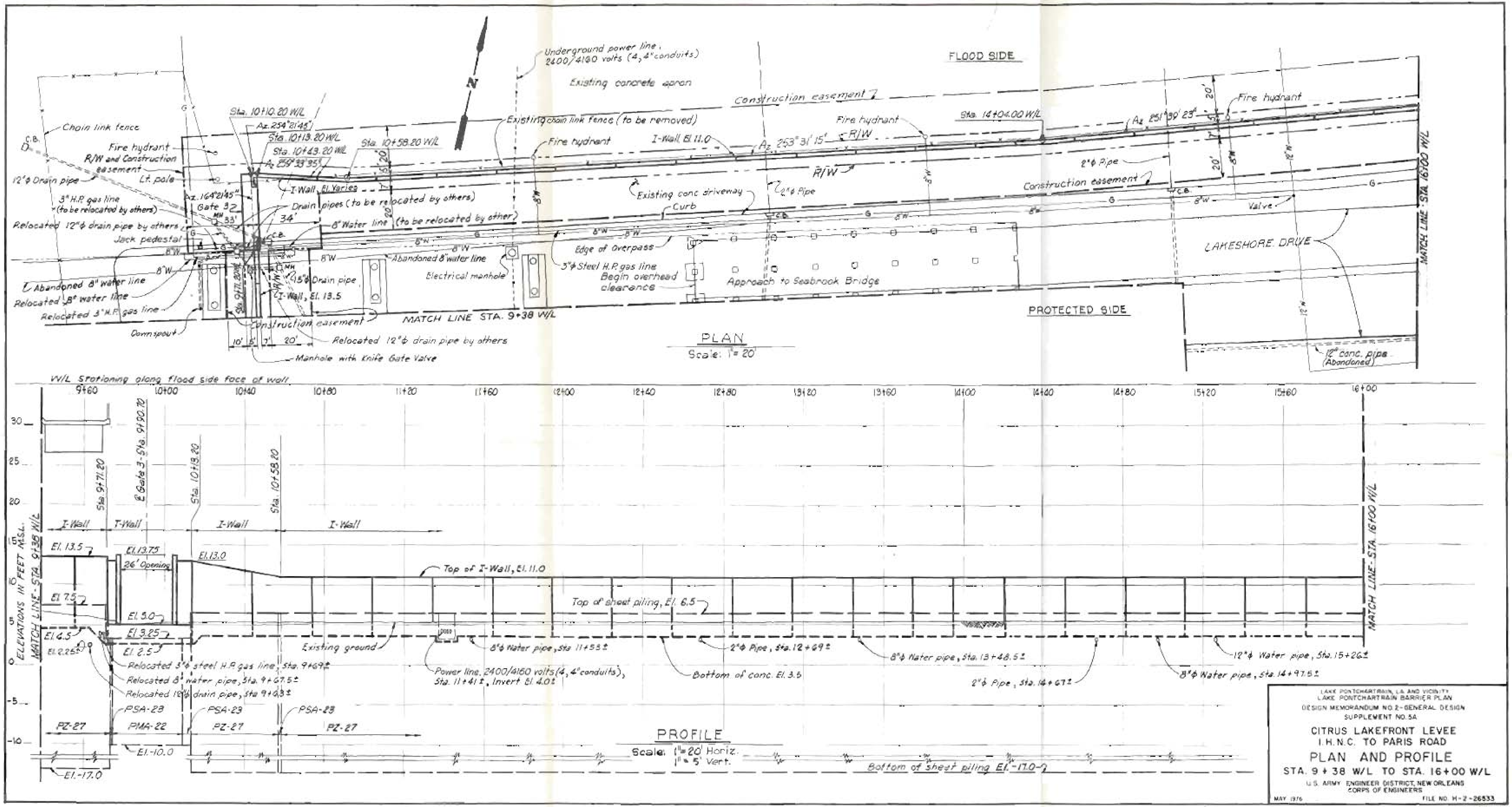
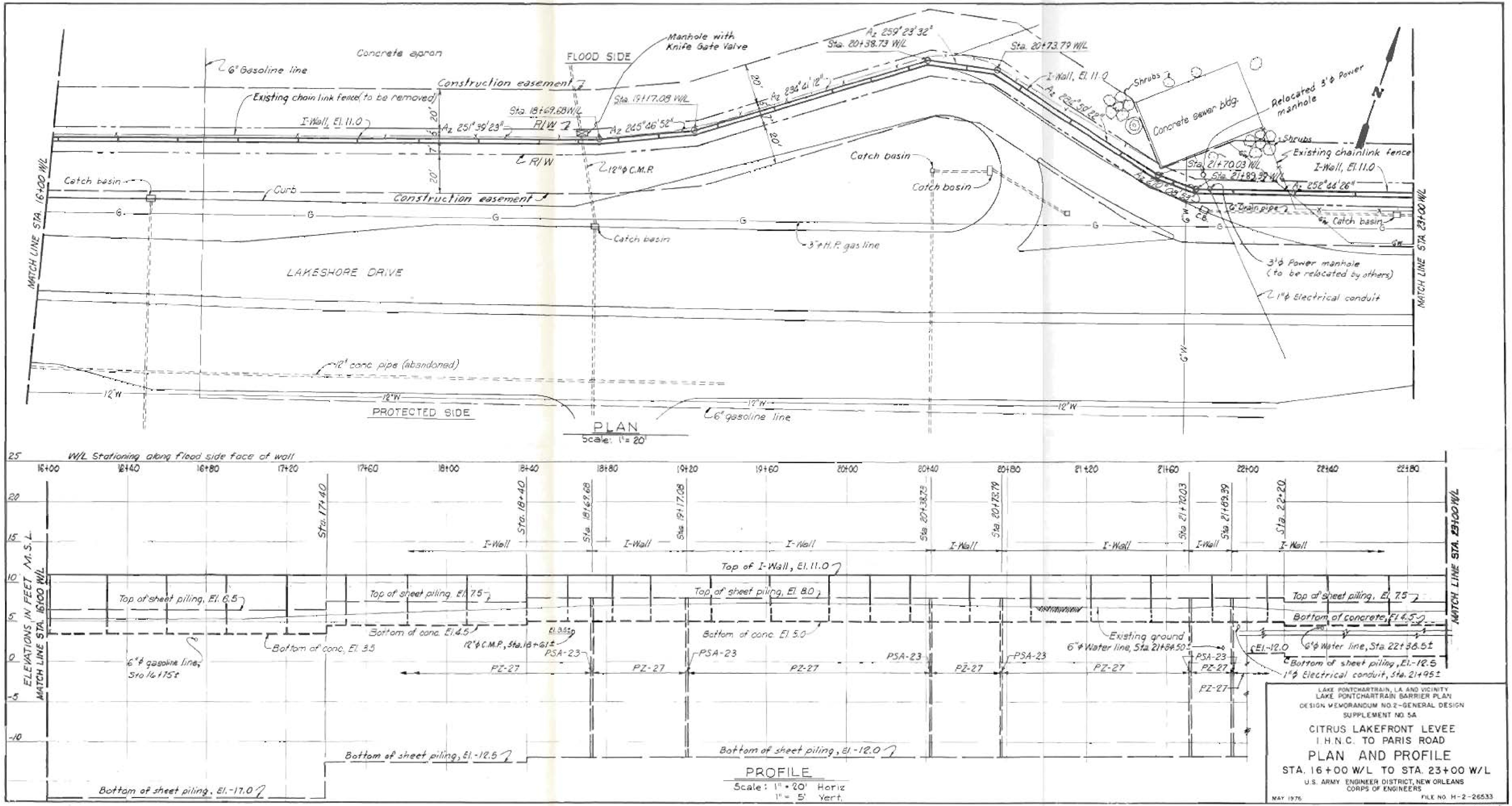

FLOOD SIDE
PROTECTED SIDE
Underground power line, 2400/4160 volts (4, 4" conduits)
Existing concrete apron
Construction easement
Existing chain link fence (to be removed)
Chain link fence
Fire hydrant
R/W and Construction easement
12"ϕ Drain pipe
Lt. pole
3" H.P. gas line (to be relocated by others)
Relocated 12"ϕ drain pipe by others
Jack pedestal
Abandoned 8" water line
Relocated 8" water line
Relocated 3" H.P. gas line
Downspout
Sta. 10+10.20 W/L
Az. 254°21'45"
Sta. 10+13.20 W/L
Sta. 10+43.20 W/L
Az. 259°33'35"
Sta. 10+58.20 W/L
Az. 164°21'45"
Gate 3
I-Wall, El. Varies
Drain pipes (to be relocated by others)
8" Water line (to be relocated by other)
Abandoned 8" water line
Electrical manhole
15"ϕ Drain pipe
I-Wall, El. 13.5
Construction easement
Relocated 12"ϕ drain pipe by others
Manhole with Knife Gate Valve
MATCH LINE STA. 9+38 W/L
I-Wall El. 11.0
Az. 253°31'15"
R/W
Existing conc driveway
Curb
2"ϕ Pipe
Edge of Overpass
3"ϕ Steel H.P. gas line
Begin overhead clearance
Approach to Seabrook Bridge
Sta. 14+04.00 W/L
Az. 251°39'23"
Construction easement
Valve
LAKESHORE DRIVE
12" conc. pipe (Abandoned)
MATCH LINE - STA. 16+00 W/L
PLAN
Scale: 1" = 20'
W/L Stationing along flood side face of wall
9+60
10+00
10+40
10+80
11+20
11+60
12+00
12+40
12+80
13+20
13+60
14+00
14+40
14+80
15+20
15+60
16+00
ELEVATIONS IN FEET M.S.L.
MATCH LINE - STA. 9+38 W/L
Sta. 9+71.20
℄ Gate 3 - Sta. 9+90.70
Sta. 10+13.20
Sta. 10+58.20
I-Wall
T-Wall
I-Wall
I-Wall
El. 13.5
El. 13.75
26' Opening
El. 13.0
Top of I-Wall, El. 11.0
El. 7.5
Top of sheet piling, El. 6.5
El. 5.0
El. 3.25
El. 6.5
El. 2.25
El. 2.5
Existing ground
8"ϕ Water pipe, Sta. 11+53±
2"ϕ Pipe, Sta. 12+69±
8"ϕ Water pipe, Sta. 13+48.5±
12"ϕ Water pipe, Sta. 15+26±
Relocated 3"ϕ steel H.P. gas line, Sta. 9+69±
Relocated 8" water pipe, Sta. 9+67.5±
Relocated 16"ϕ drain pipe, Sta. 9+63±
Power line, 2400/4160 volts (4, 4" conduits), Sta. 11+41±, Invert El. 4.0±
Bottom of conc. El. 3.5
2"ϕ Pipe, Sta. 14+67±
8"ϕ Water pipe, Sta. 14+97.5±
PSA-23
PSA-23
PSA-23
PZ-27
PMA-22
PZ-27
PZ-27
El. -10.0
El. -17.0
PROFILE
Scale: 1" = 20' Horiz.
1" = 5' Vert.
Bottom of sheet piling El. -17.0
30
25
20
15
10
5
0
-5
-10
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD
PLAN AND PROFILE
STA. 9 + 38 W/L TO STA. 16 + 00 W/L
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MAY 1976
FILE NO. H-2-26533

PLATE 7



LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 5A

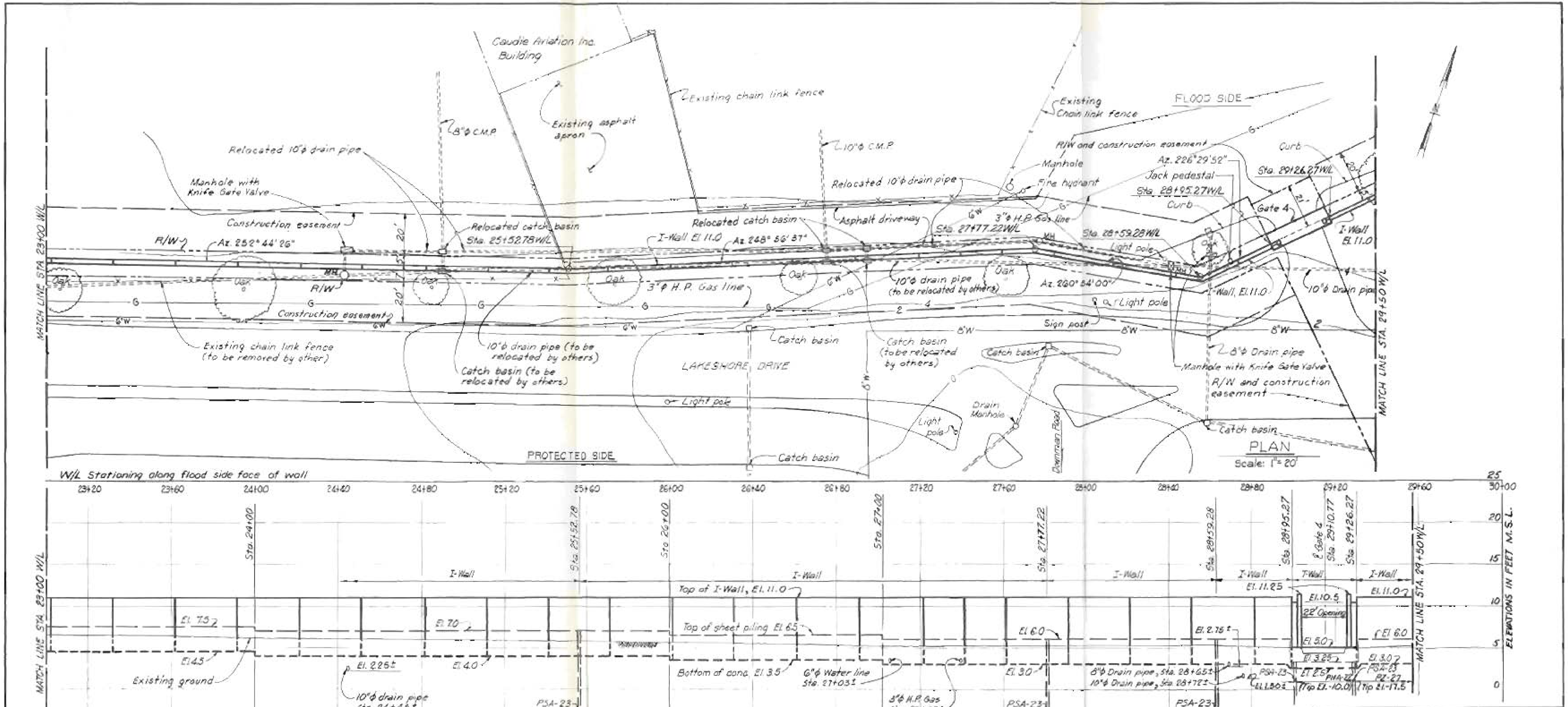
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

PLAN AND PROFILE
STA. 16+00 W/L TO STA. 23+00 W/L

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

MAY 1976 — FILE NO. H-2-26533

PLATE 8



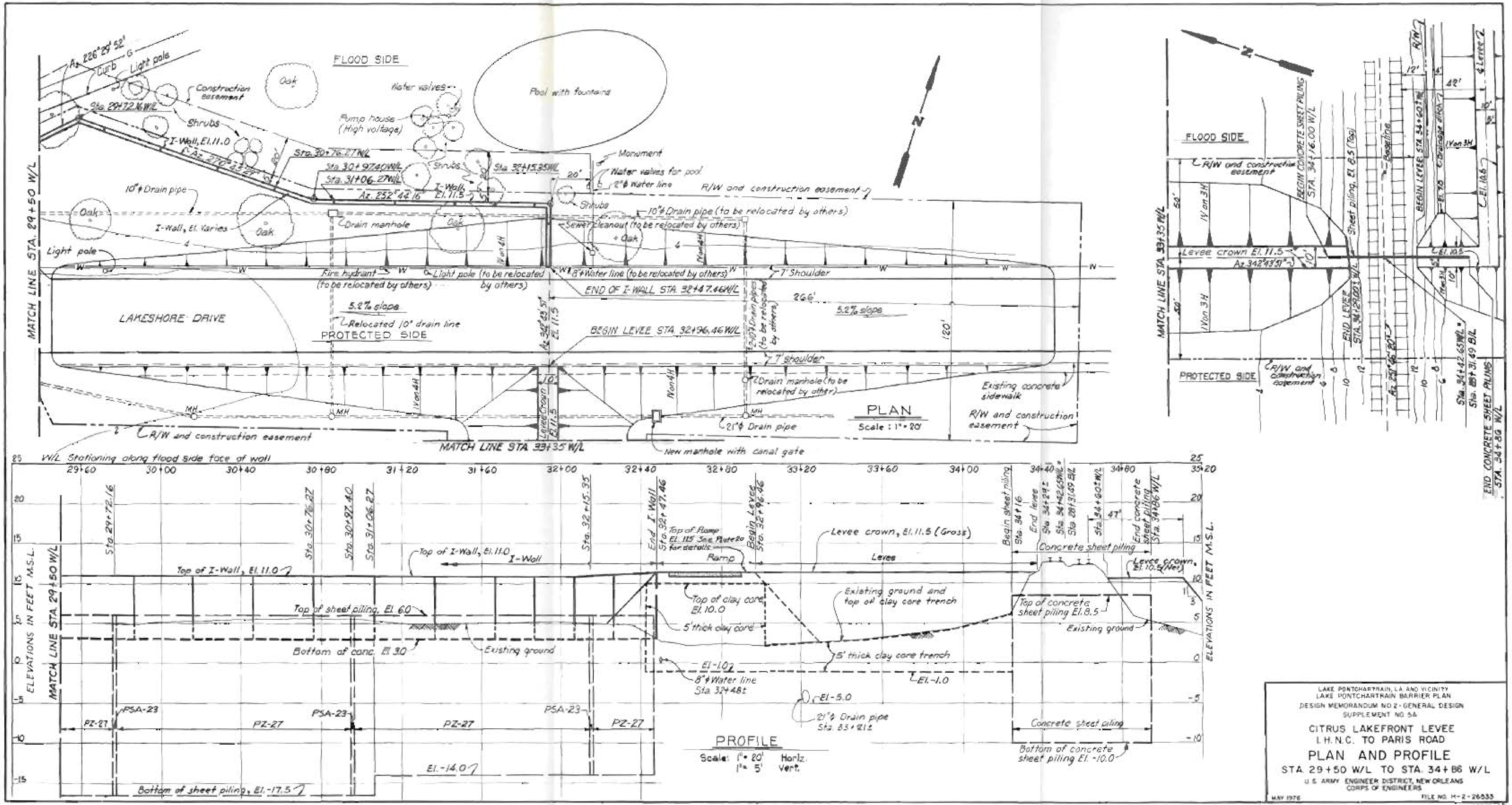
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

CITRUS LAKEFRONT LEVEE
I. H. N. C. TO PARIS ROAD
PLAN AND PROFILE
STA. 23+00 W/L TO STA. 29+50 W/L

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

MAY 1976 FILE NO. H-2-26533

PLATE 9



LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

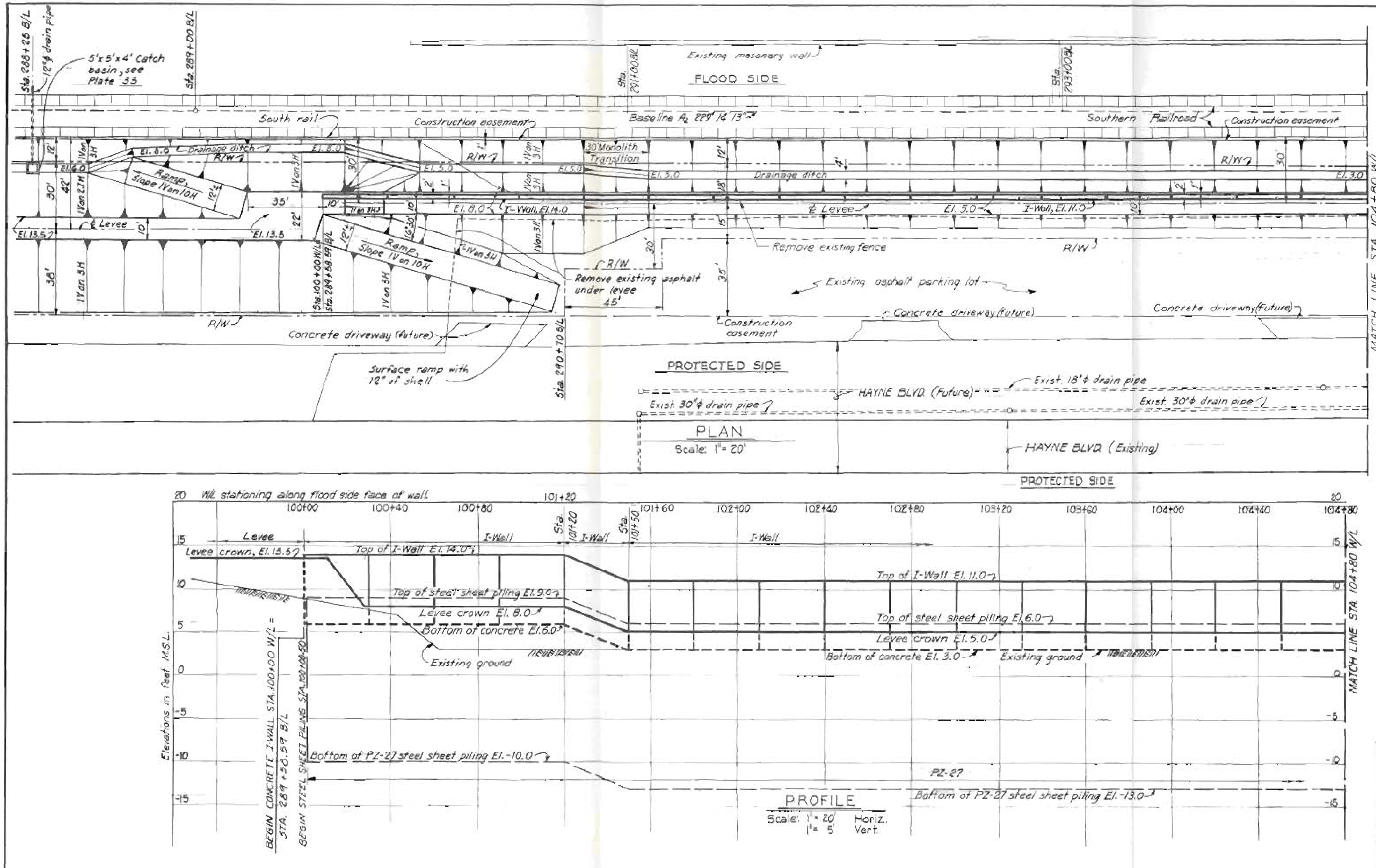
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

PLAN AND PROFILE
STA. 29+50 W/L TO STA. 34+86 W/L

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

MAY 1976 FILE NO. H-2-26533

PLATE 10



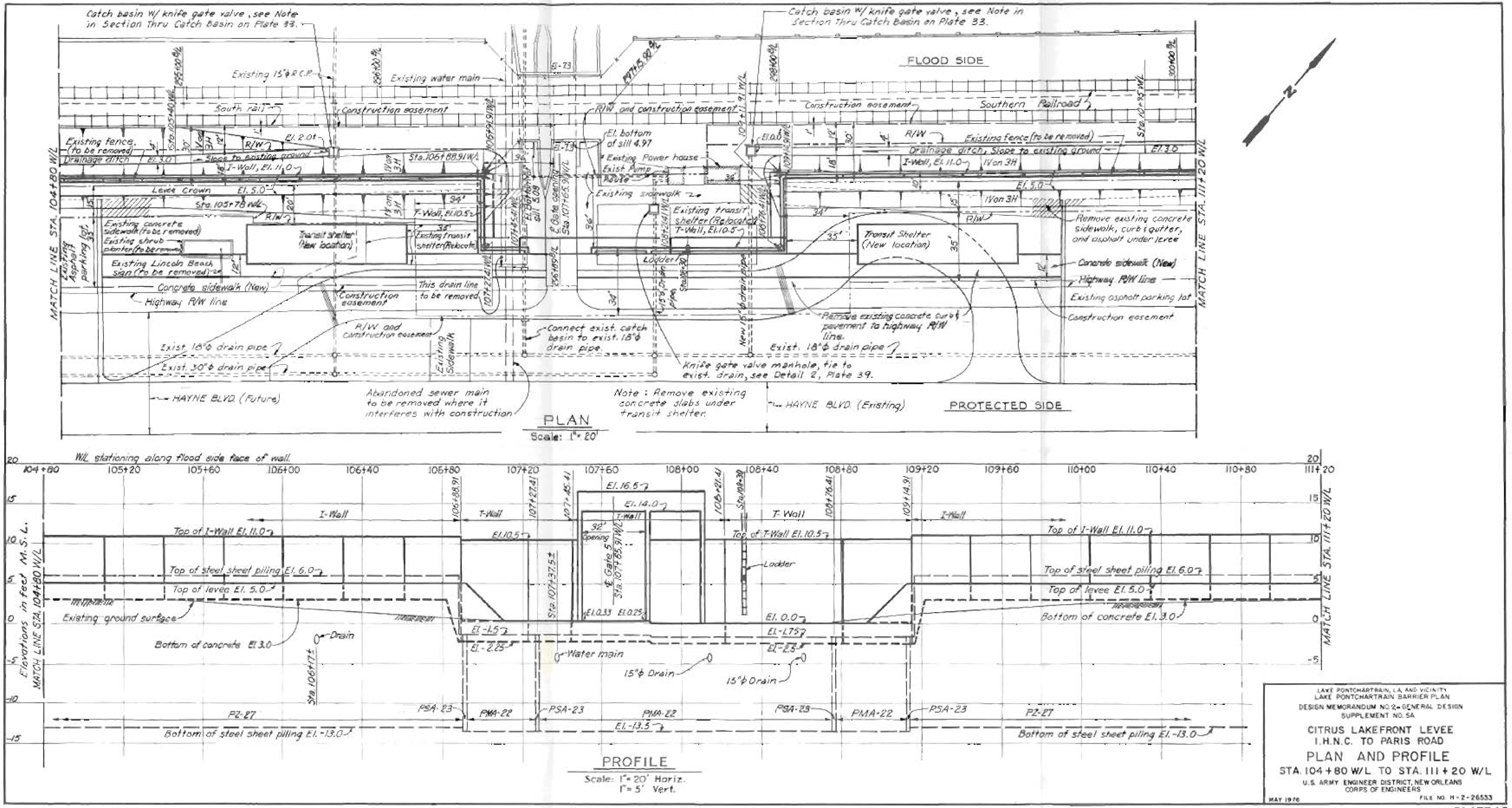
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

PLAN AND PROFILE
STA. 100+00 W/L TO STA. 104+80 W/L

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

MAY 1976 FILE NO. H-2-26533



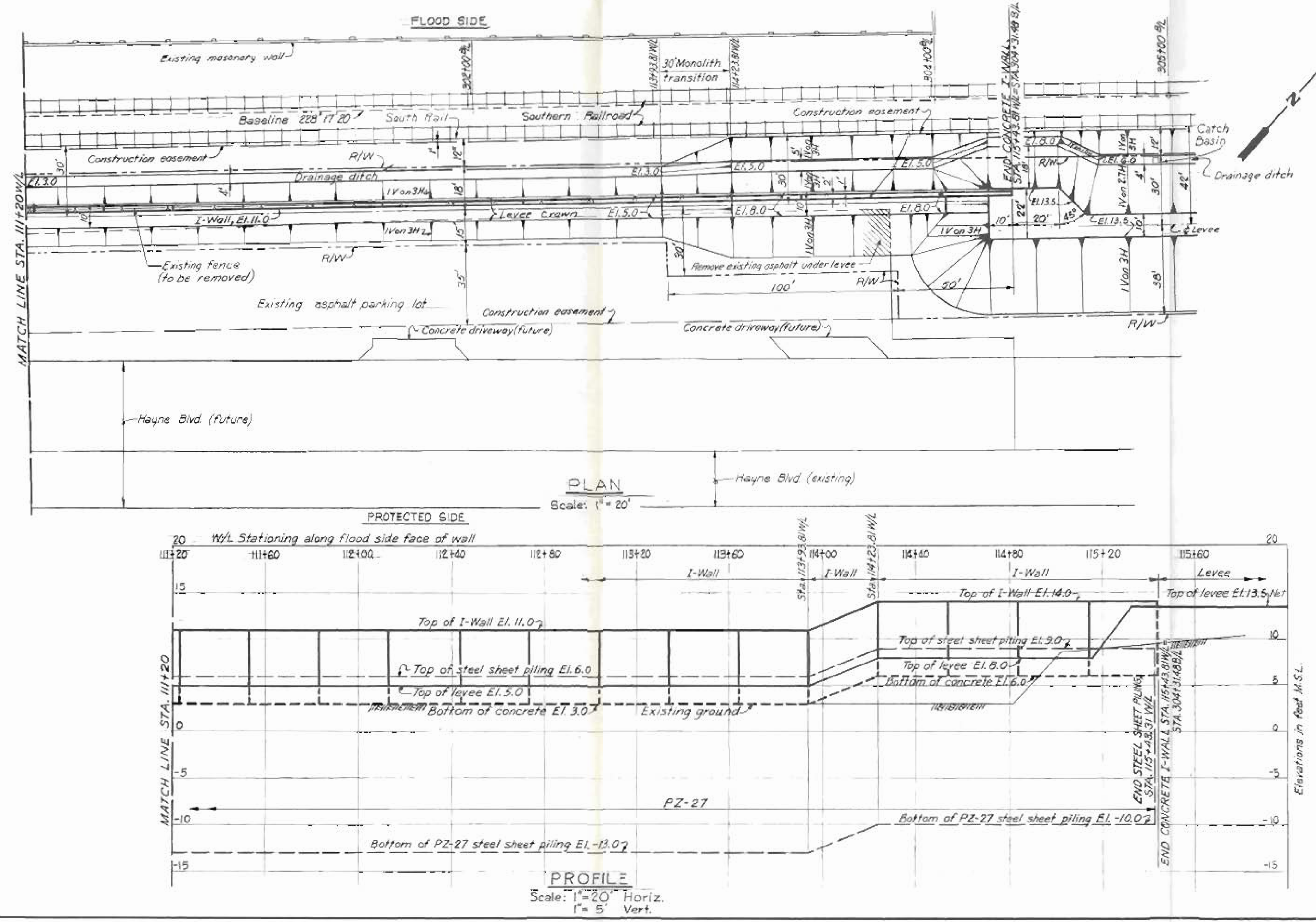
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD
PLAN AND PROFILE
STA. 104+80 W/L TO STA. 111+20 W/L

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

MAY 1976 FILE NO. H-2-26533

PLATE 12



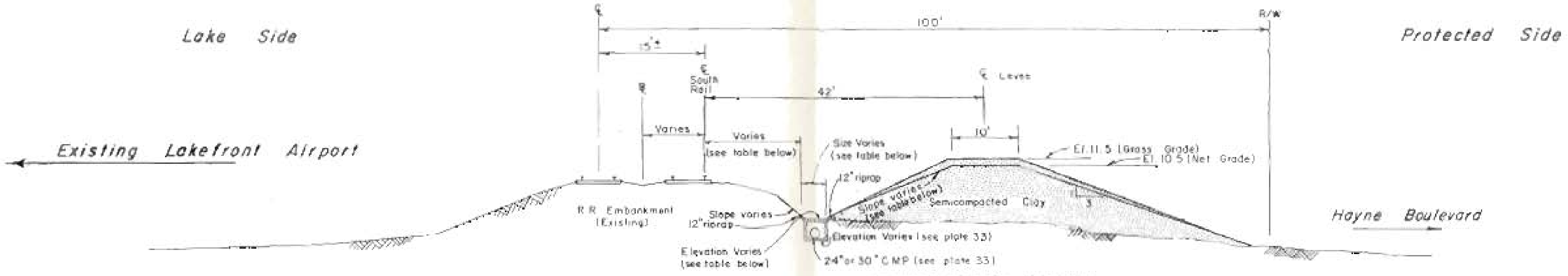
LAKE PONTCHARTRAIN, LA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO 2-GENERAL DESIGN
SUPPLEMENT NO 5A

CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD
PLAN AND PROFILE
STA. 111+20 W/L TO STA. 115+43.81 W/L

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

MAY 1976 FILE NO. H-2-26533

PLATE 13



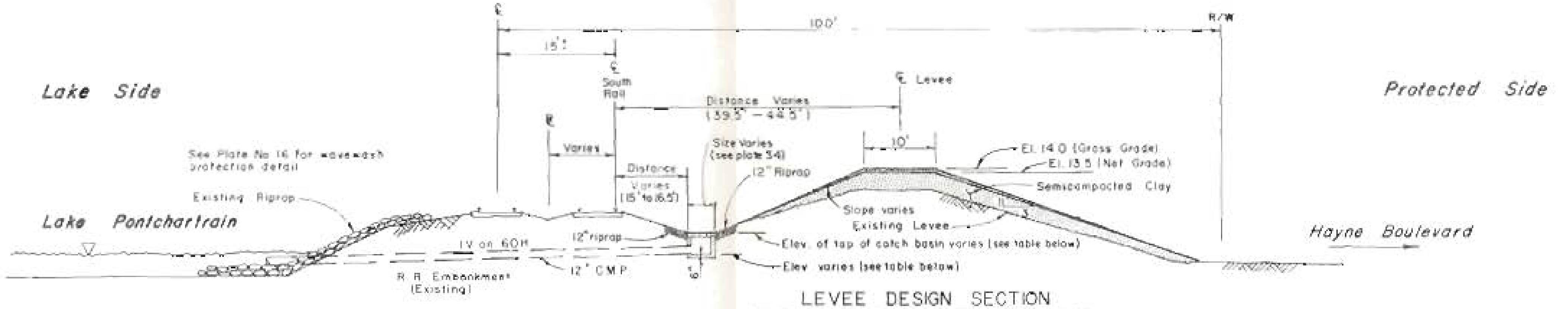
LEVEE DESIGN SECTION

STA 28+31 B/L TO STA 63+50 B/L

LEVEE BASELINE STATION	LEVEE FLOODSIDE SLOPE
28+31 TO 39+00	1V ON 3H
40+00 TO 53+00	1V ON 4H
54+00 TO 61+00	1V ON 3H
61+00 TO 63+00	1V ON 4H

CATCH BASIN STATION	ELEV. OF TOP OF CATCH BASIN (FEET MSL)	SOUTH RAIL TO EDGE OF CATCH BASIN FEET	WIDTH OF CATCH BASIN F.T.
31+00	6.0	18.0	5
37+00	6.0	18.5	5
43+00	5.0	13.0	3.5
49+00	5.0	15.5	5
55+00	5.0	16.5	5
64+00	6.0	17.0	5

NOTE: The catch basin at Sta. 64+00 will have a 30" CMP drilled through the railroad discharging into the lake. See plate 33 for details.



LEVEE DESIGN SECTION

STA 64+50 B/L TO STA 289+59 B/L
STA 304+31 B/L TO STA 331+50 B/L

LEVEE BASELINE STATION	LEVEE FLOODSIDE SLOPE	EL OF TOP OF CATCH BASINS WITHIN LEVEE REACHES (FEET MSL)	EL OF BOTTOM OF CATCH BASINS WITHIN LEVEE REACHES (FEET MSL)
64+50 TO 73+00 149+00 TO 154+83 156+13 TO 235+40 255+50 TO 282+50	1V ON 2.5H	6.0	2.5
75+00 TO 108+50 237+60 TO 264+50 283+50 TO 289+59 304+31 TO 331+50	1V ON 2.7H	6.0	2.5
109+50 TO 149+00	1V ON 2.5H	5.0	2.0

NOTES:

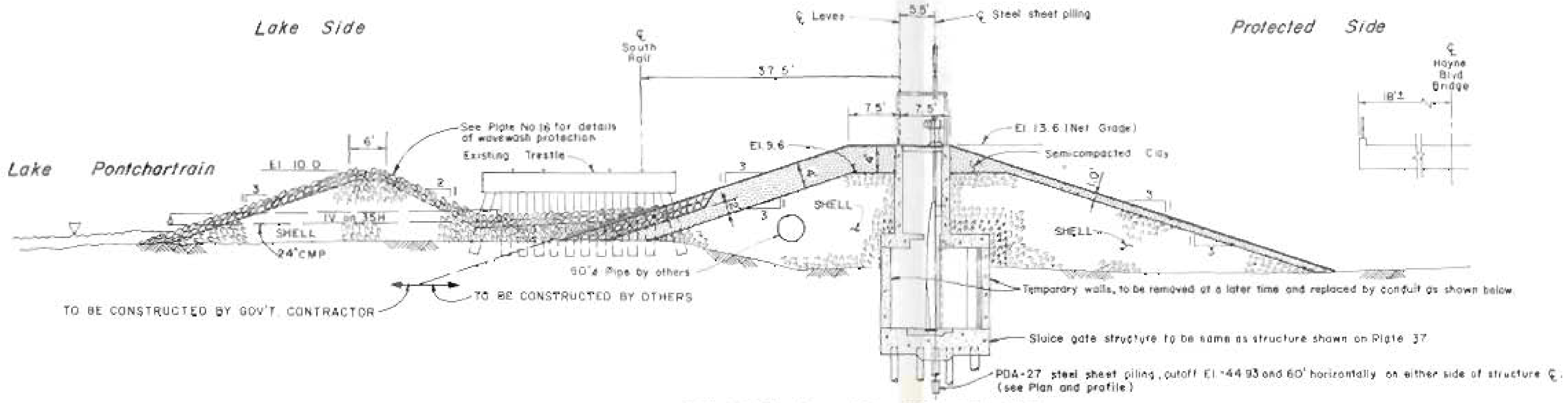
1. All stationing is levee baseline stationing
2. Elevations are expressed in feet, mean sea level
3. Sections drawn to scale 1" = 10' horizontal and vertical
4. A smooth transition shall be constructed between levee design sections
5. See Plate No 15 for design sections in the following reaches— Stations 73+40 to 74+60, 155+33 to 155+63, and 235+90 to 237+10
6. All levee side slopes shown on design sections and in tabulations are based on net grade of levee crown
7. Catch basins are located on 600' centers.

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD
TYPICAL LEVEE
DESIGN SECTIONS

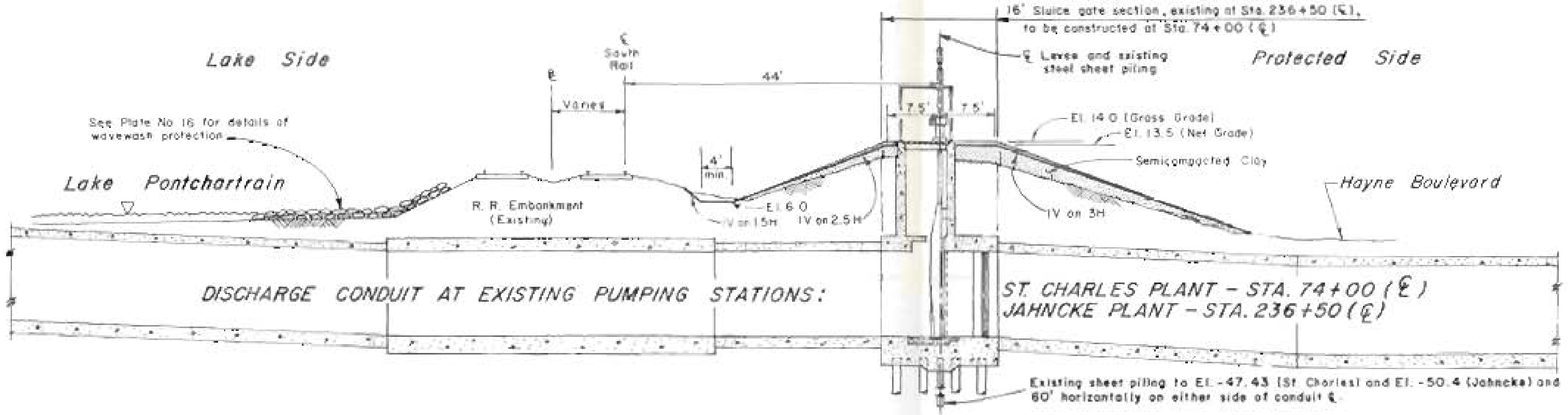
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

MAY 1976 — FILE NO. H-2-26533

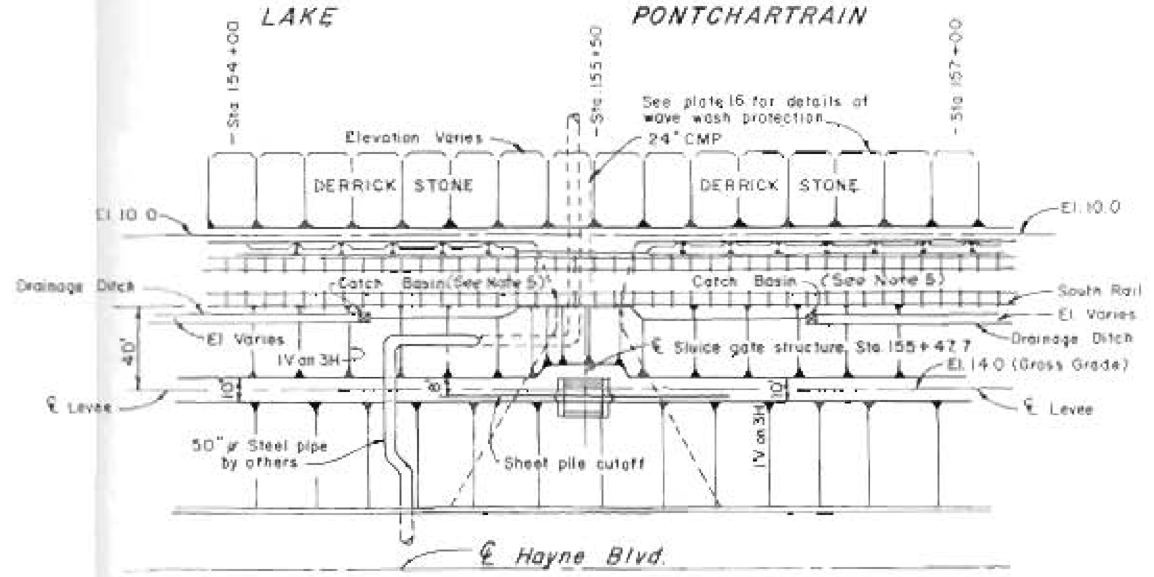


STA. 155+33 TO STA. 155+63

CITRUS CANAL CROSSING



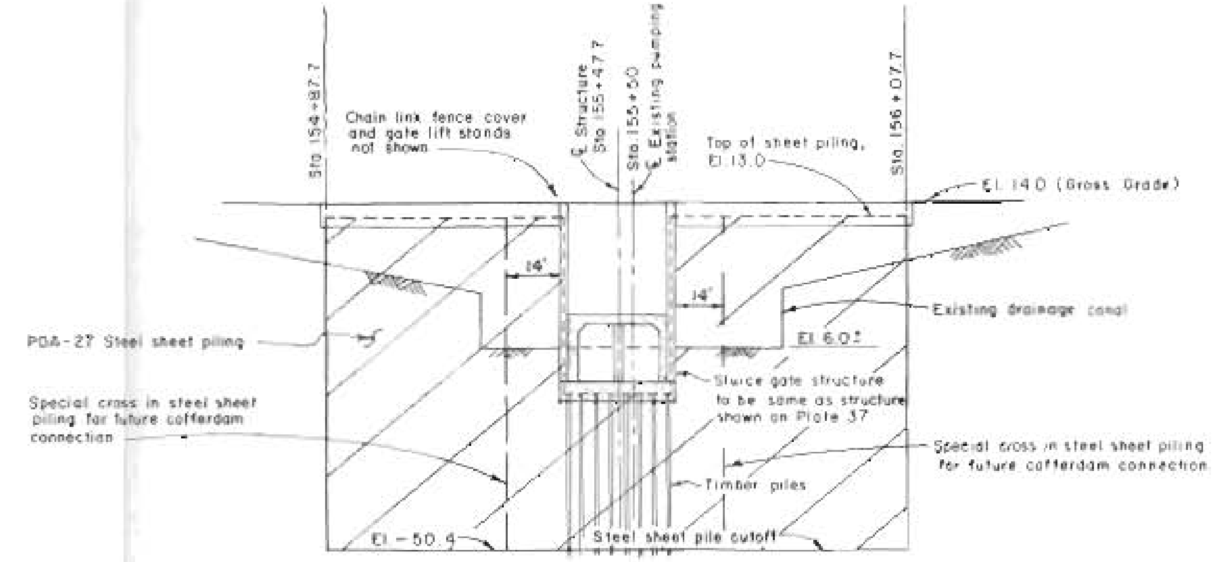
ST. CHARLES PUMPING STATION – STA. 73+40 TO STA. 74+60
JAHNCKE PUMPING STATION – STA. 235+90 TO STA. 237+10



PLAN

CITRUS CANAL CROSSING

SCALE 0 40 80



PROFILE

CITRUS CANAL CROSSING

SECTION ALONG CROWN OF ENLARGEMENT
NOT TO SCALE

NOTES:

1. All stationing shown is levee baseline stationing.
2. N.G. and G.G. refers to the "Net Grade" and "Gross Grade", respectively.
3. The elevations shown are expressed in feet (Mean Sea Level).
4. Sections drawn to scale 1" = 10', horizontally and vertically.
5. Exact location of catch basins dependent upon extent of closure embankment constructed by others.

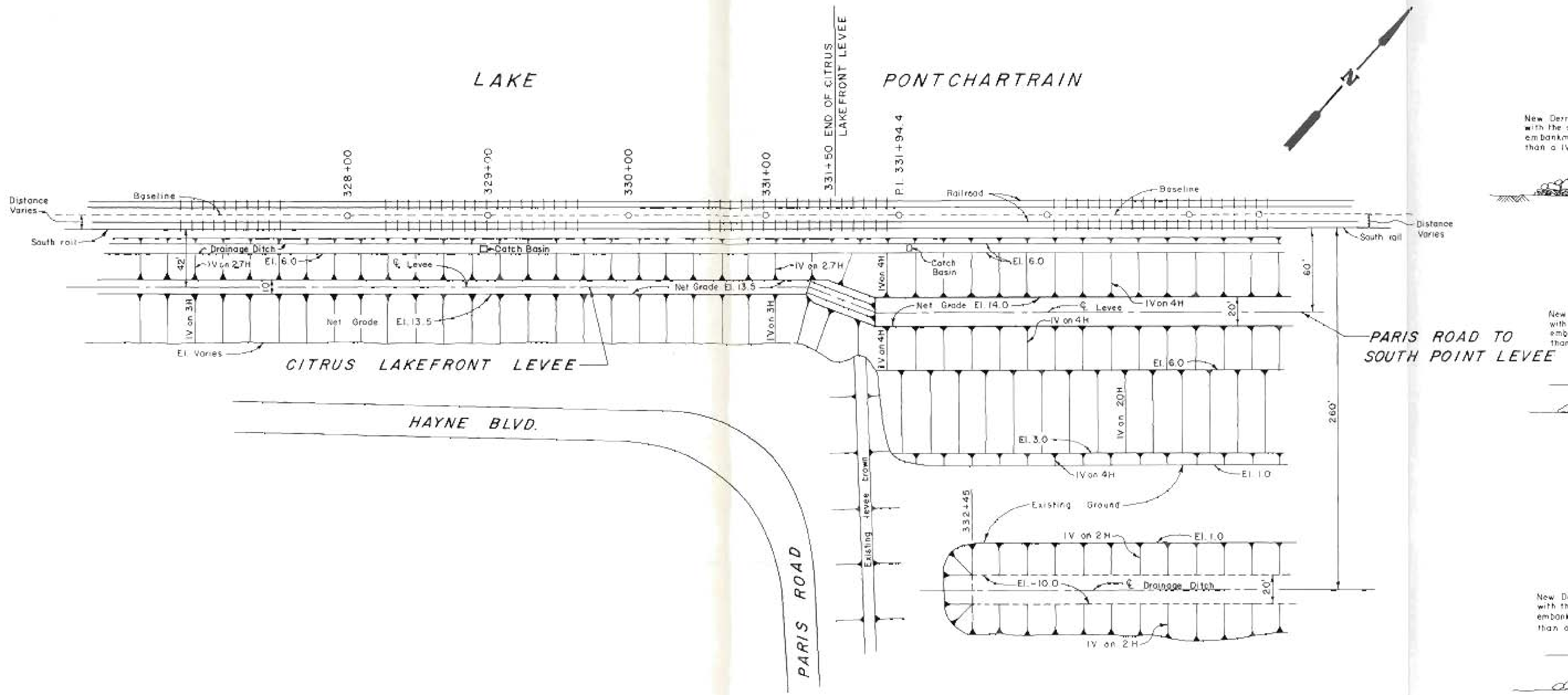
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

PUMPING STATION
DESIGN SECTIONS

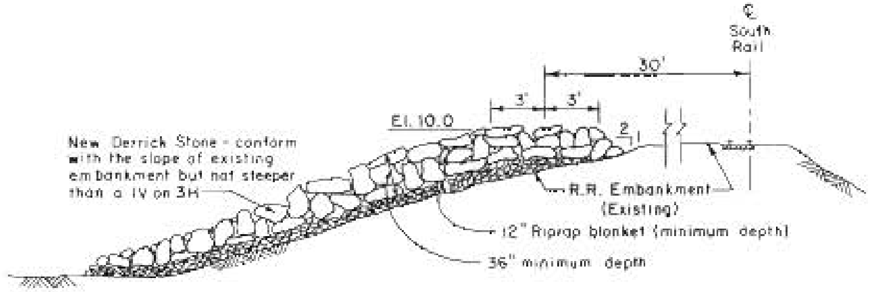
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

MAY 1976 FILE NO. H-2-26533



PLAN - LEVEE AND DRAINAGE DITCH

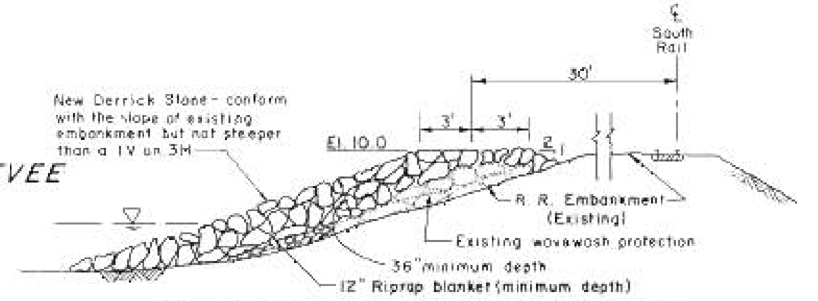
DISTANCE IN FEET
0 40 80



PROTECTION FOR DRY LAND REACHES

APPROX. STA. 165+00 TO APPROX. STA. 251+00

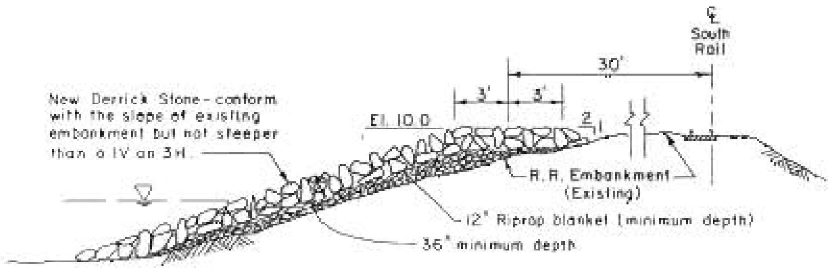
Not To Scale



ENLARGEMENT OF EXISTING PROTECTION

APPROX. STA. 74+00	TO	APPROX. STA. 155+33
APPROX. STA. 155+63	TO	APPROX. STA. 165+00
APPROX. STA. 251+00	TO	APPROX. STA. 290+00
APPROX. STA. 304+00	TO	APPROX. STA. 331+50

Not To Scale

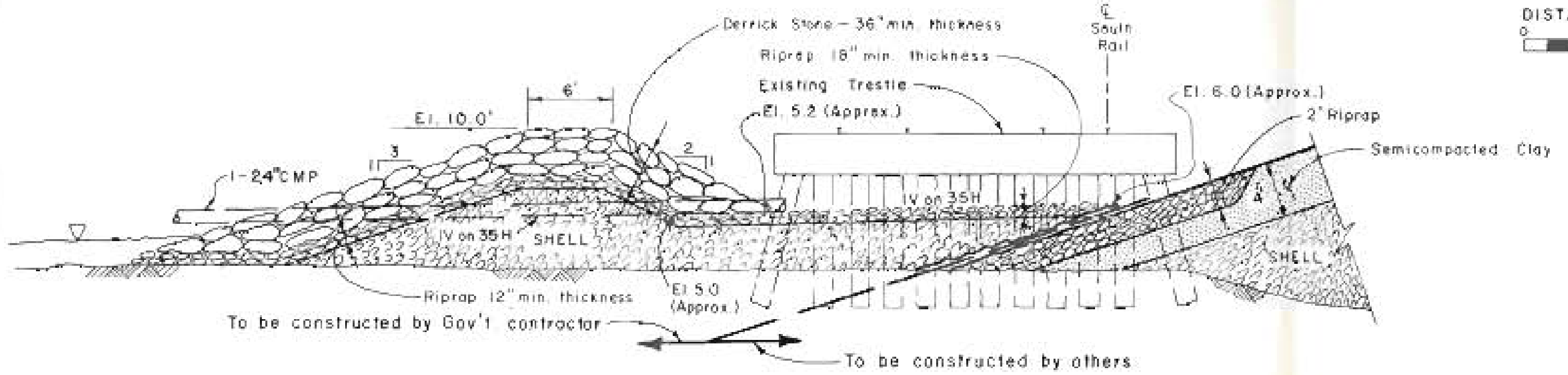


NEW CONSTRUCTION FOR WET SHORELINE

APPROX. STA. 64+50 TO APPROX. STA. 74+00

Not To Scale

WAVEWASH PROTECTION DETAILS



WAVEWASH PROTECTION FOR CITRUS CANAL SHELL CLOSURE

APPROX. STA. 155+33 TO APPROX. STA. 155+63

Not To Scale

NOTES:

1. Elevations are expressed in feet, Mean Sea Level.
2. All stationing shown is levee baseline stationing.

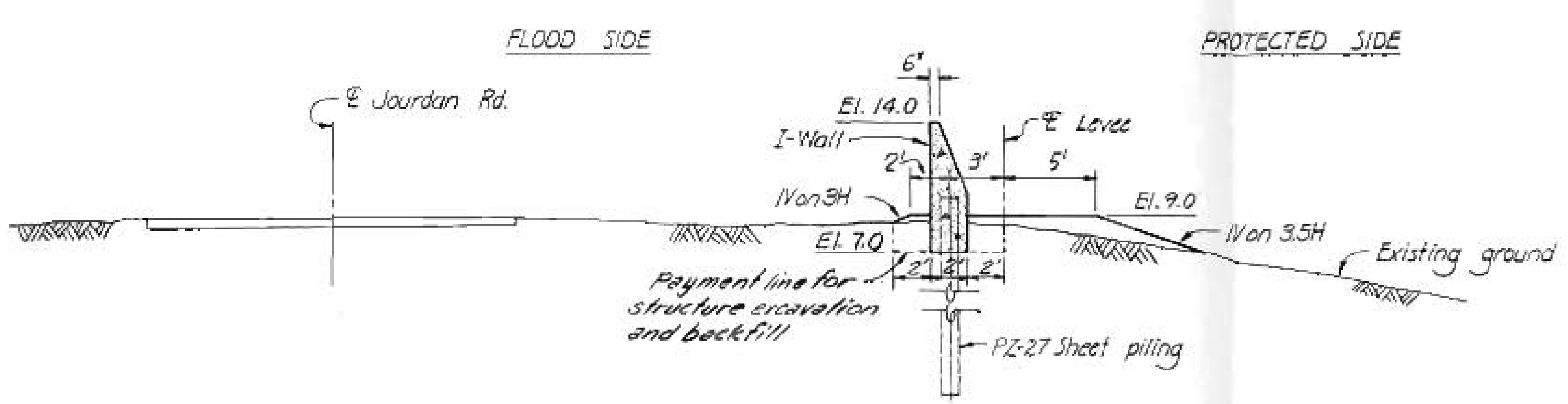
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

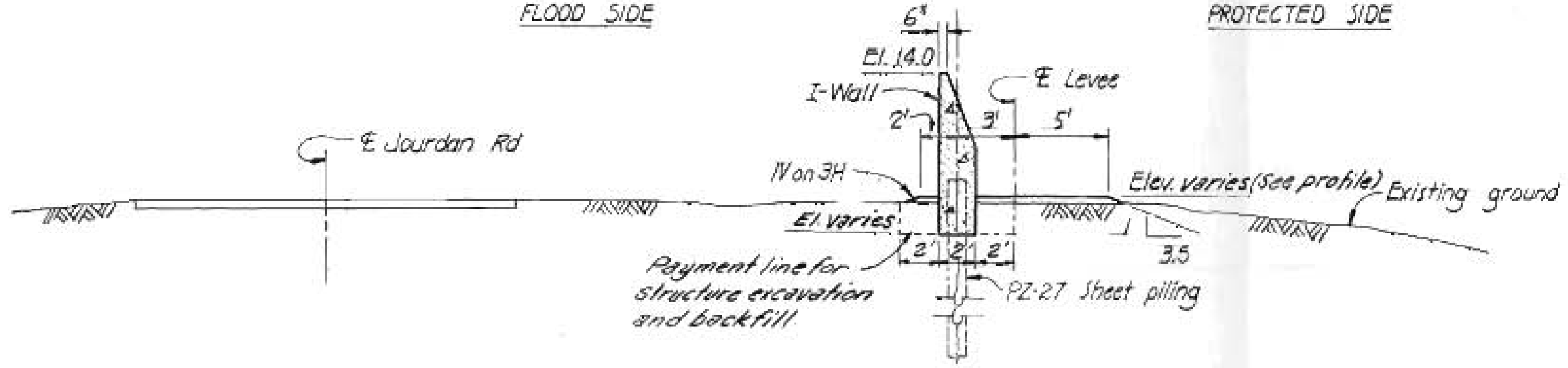
LEVEE TIE-IN AT PARIS ROAD AND WAVEWASH PROTECTION DETAILS

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

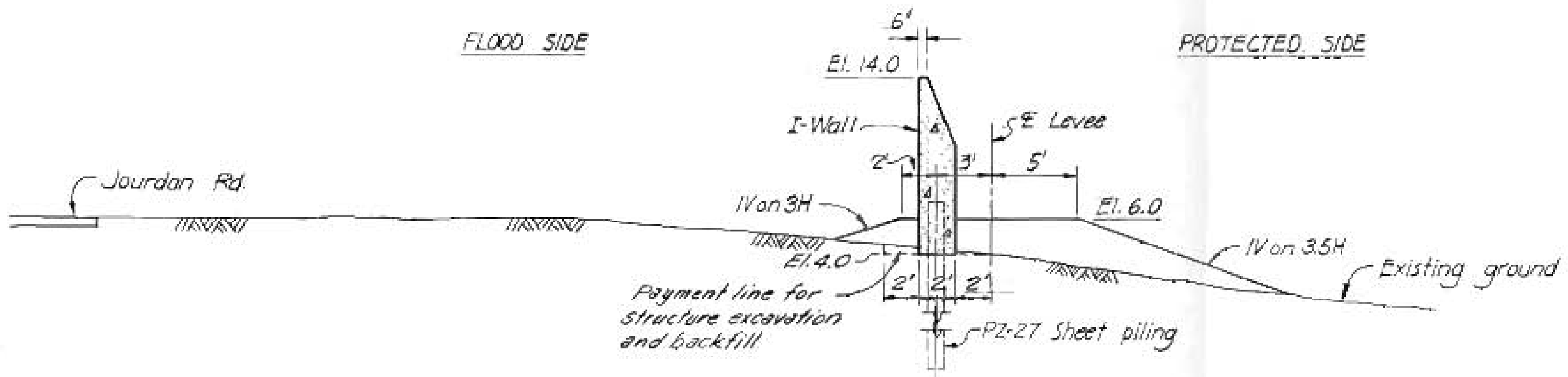
MAY 1975 FILE NO. H-2-26533



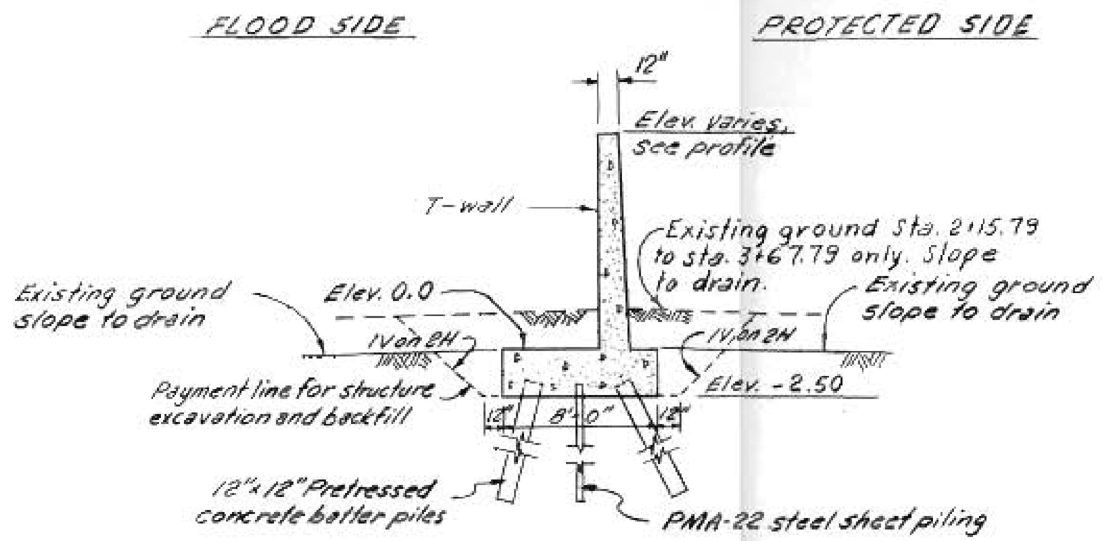
STA. 0+00 TO STA. 1+11



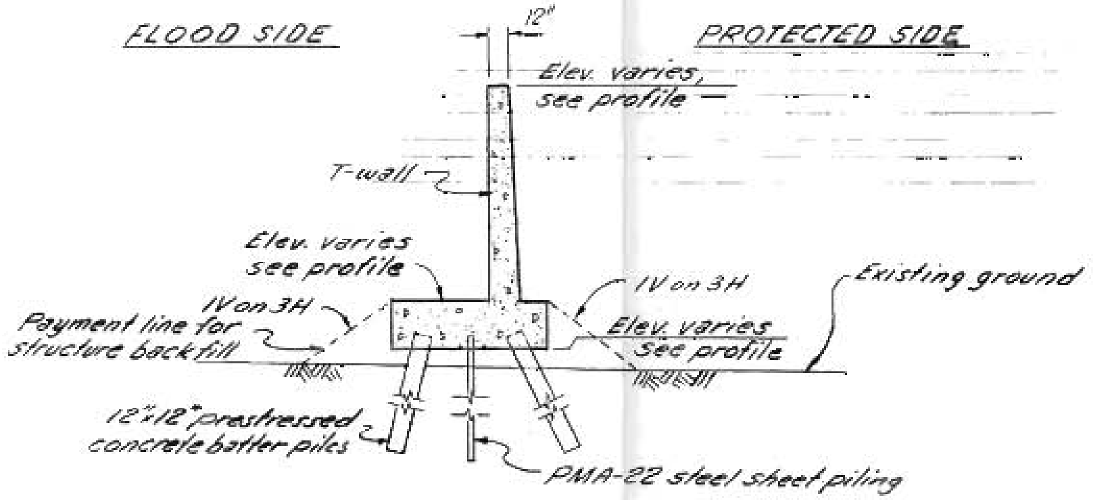
STA. 1+11 TO STA. 1+81



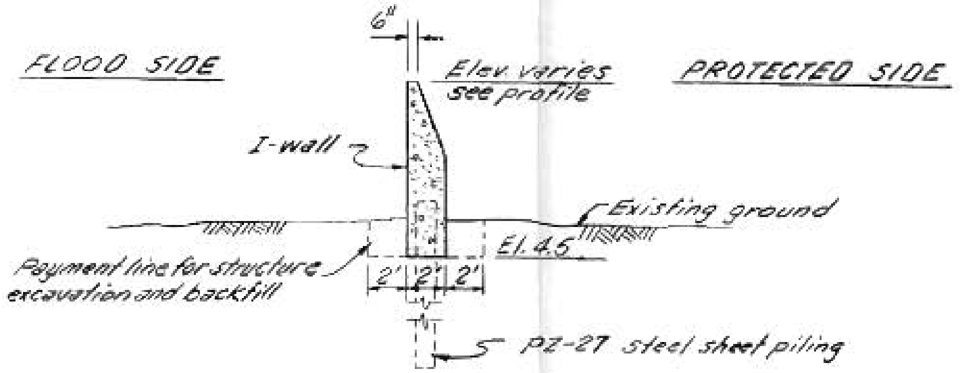
STA. 1+81 TO STA. 2+15.79



STA. 106+88.91 TO STA. 107+45.41
STA. 108+21.41 TO STA. 109+14.91
STA. 2+15.79 TO STA. 3+67.79



STA. 4+45.79 TO STA. 5+03.38



STA. 5+43.38 TO STA. 5+79.38
STA. 6+15.38 TO STA. 9+71.20

GATE MONOLITHS
STA. 3+67.79 TO STA. 4+45.79
STA. 5+03.38 TO STA. 5+43.38
STA. 9+71.20 TO STA. 10+13.20
STA. 28+95.27 TO STA. 29+26.27
STA. 107+45.41 TO STA. 108+21.41

RAMP CROSSINGS
STA. 5+79.38 TO STA. 6+15.38
STA. 32+47.46 TO STA. 32+96.46

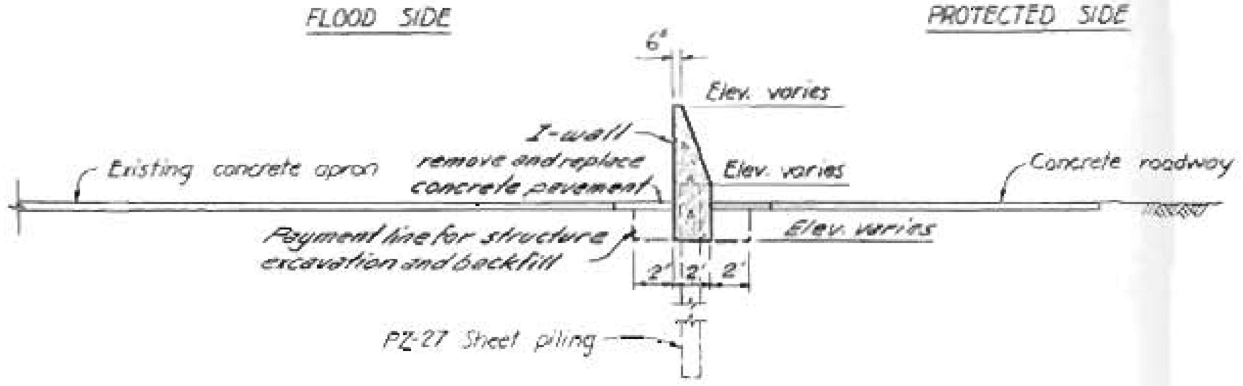
Note
All stations are W/L stations.
All sections drawn to a scale of 1" = 5'.

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

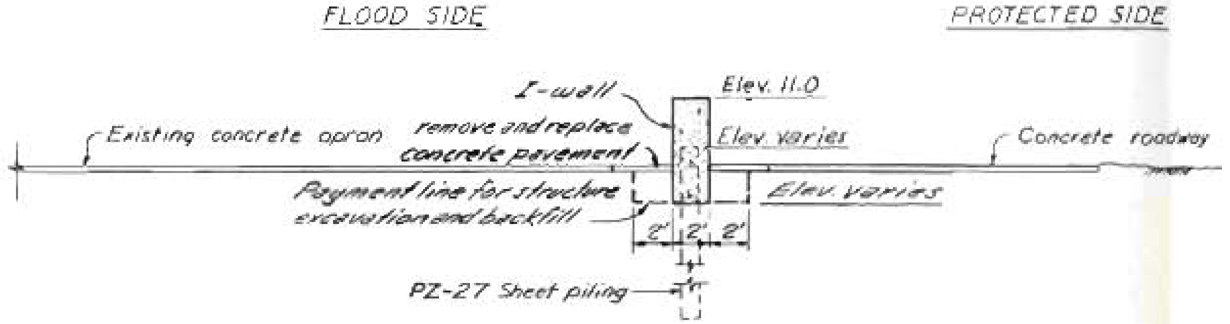
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD
FLOODWALL
DESIGN SECTIONS

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

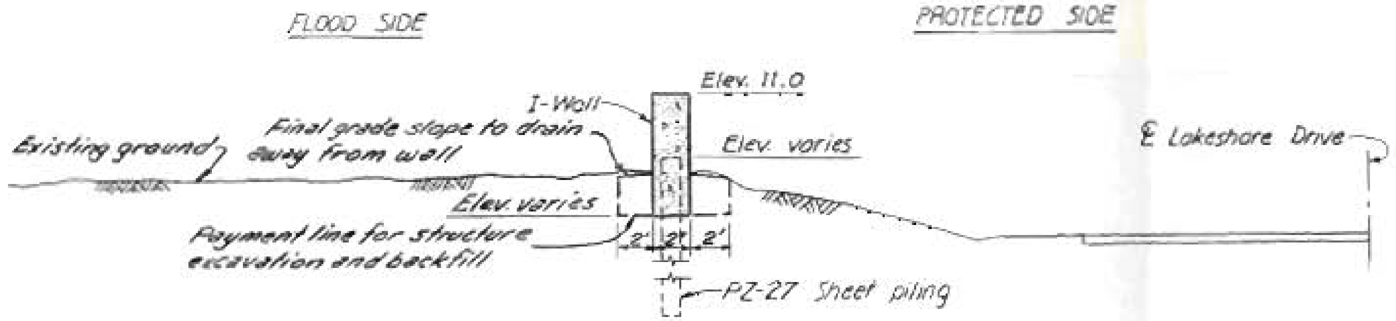
MAY 1976 FILE NO. H-2-26533



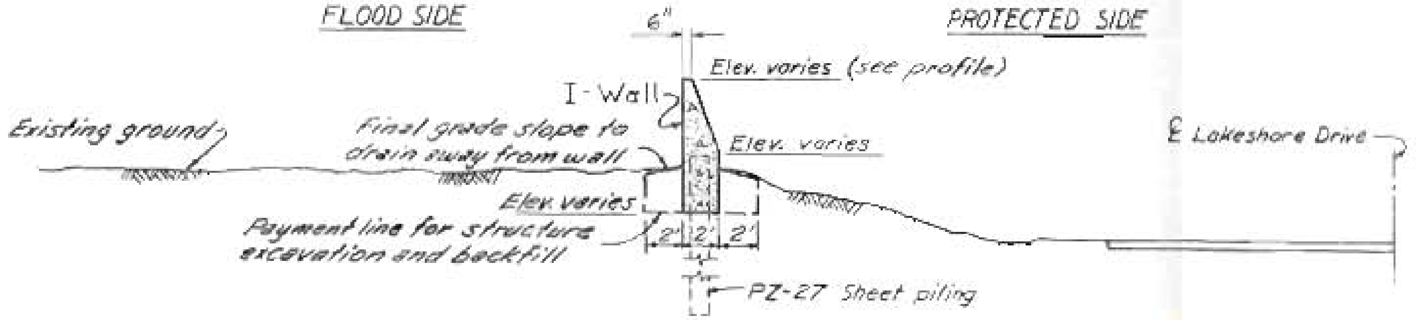
STA. 10+13.20 TO STA. 17+40.00



STA. 17+40 TO STA. 20+38.73

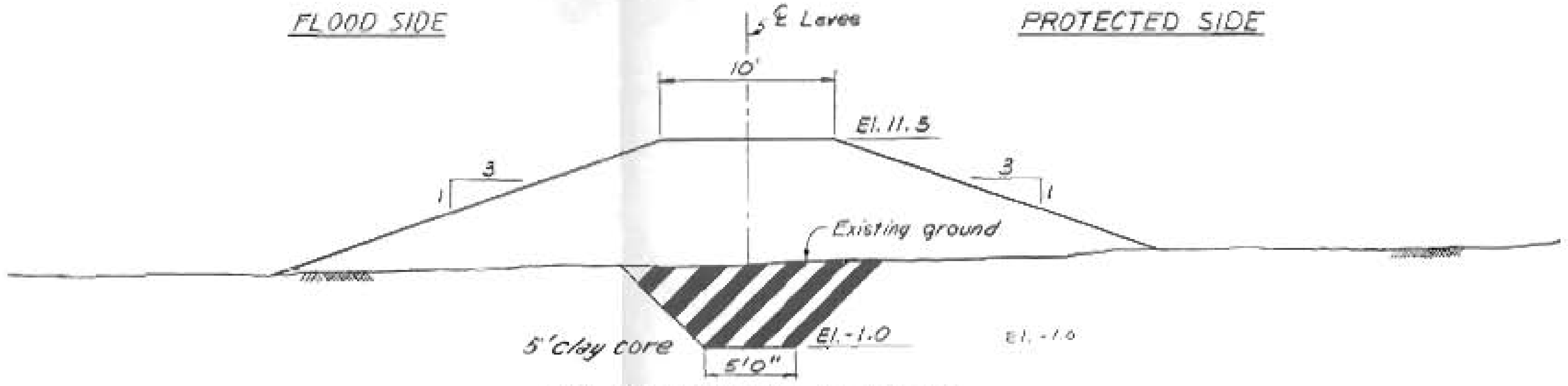


STA. 20+38.73 TO STA. 24+00

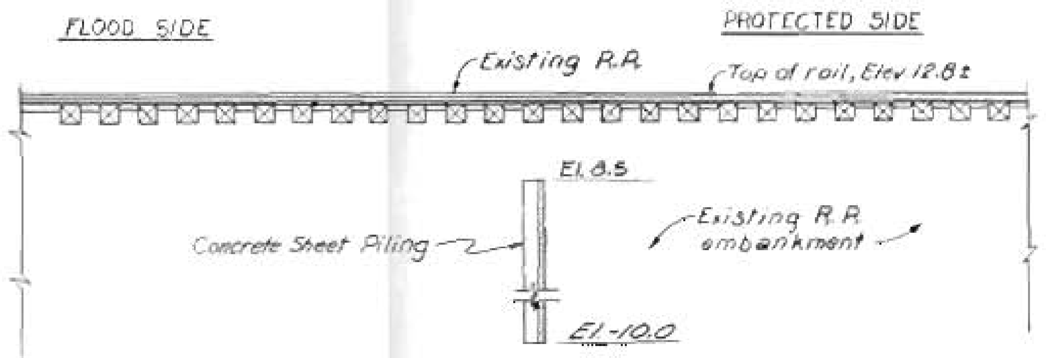


STA. 24+00 TO STA. 28+95.27

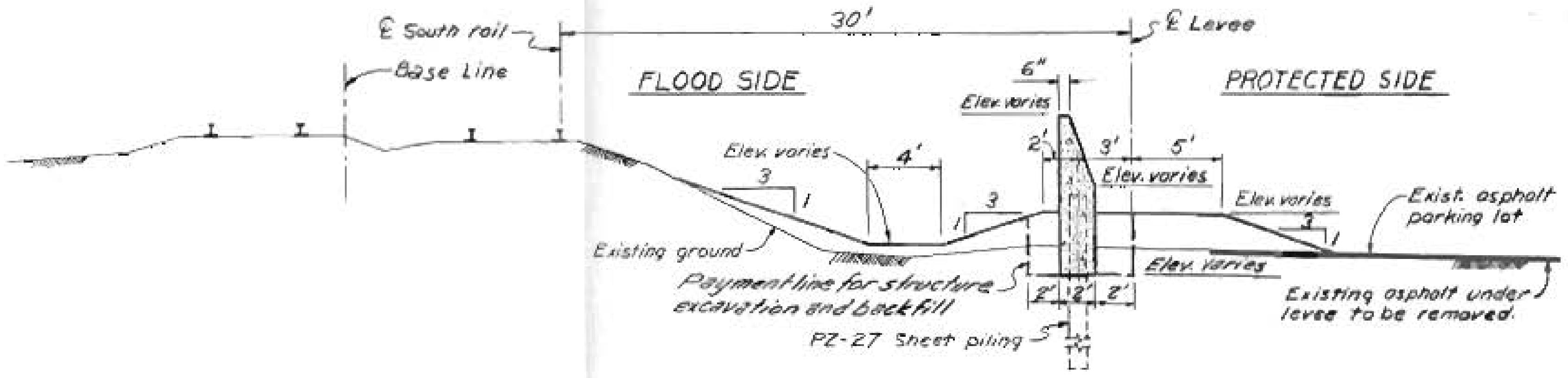
STA. 29+26.27 TO STA. 32+47.46



STA. 32+47.46 TO STA. 34+29



STA. 34+26 TO STA. 34+86



STA. 100+00 TO STA. 106+88.91

STA. 109+14.91 TO STA. 115+43.81

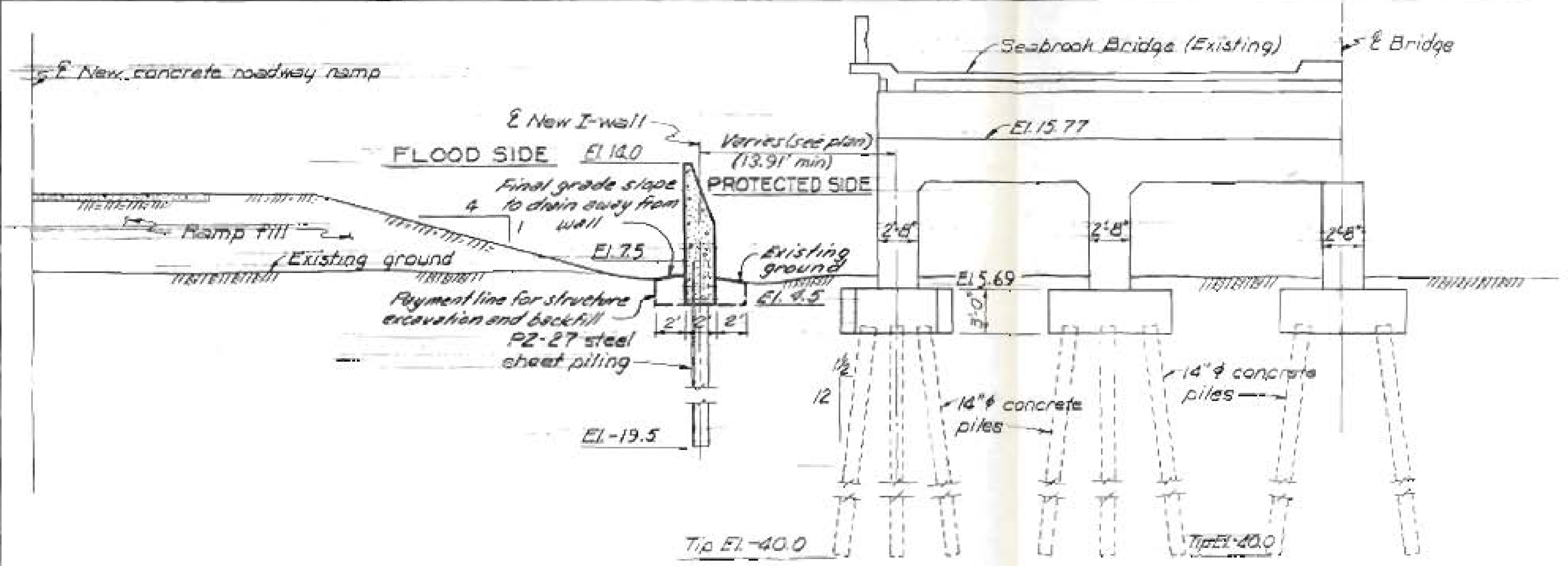
Note
All stations are W/L stations.
All sections drawn to a scale of 1" = 5'.

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD
FLOODWALL
DESIGN SECTIONS

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

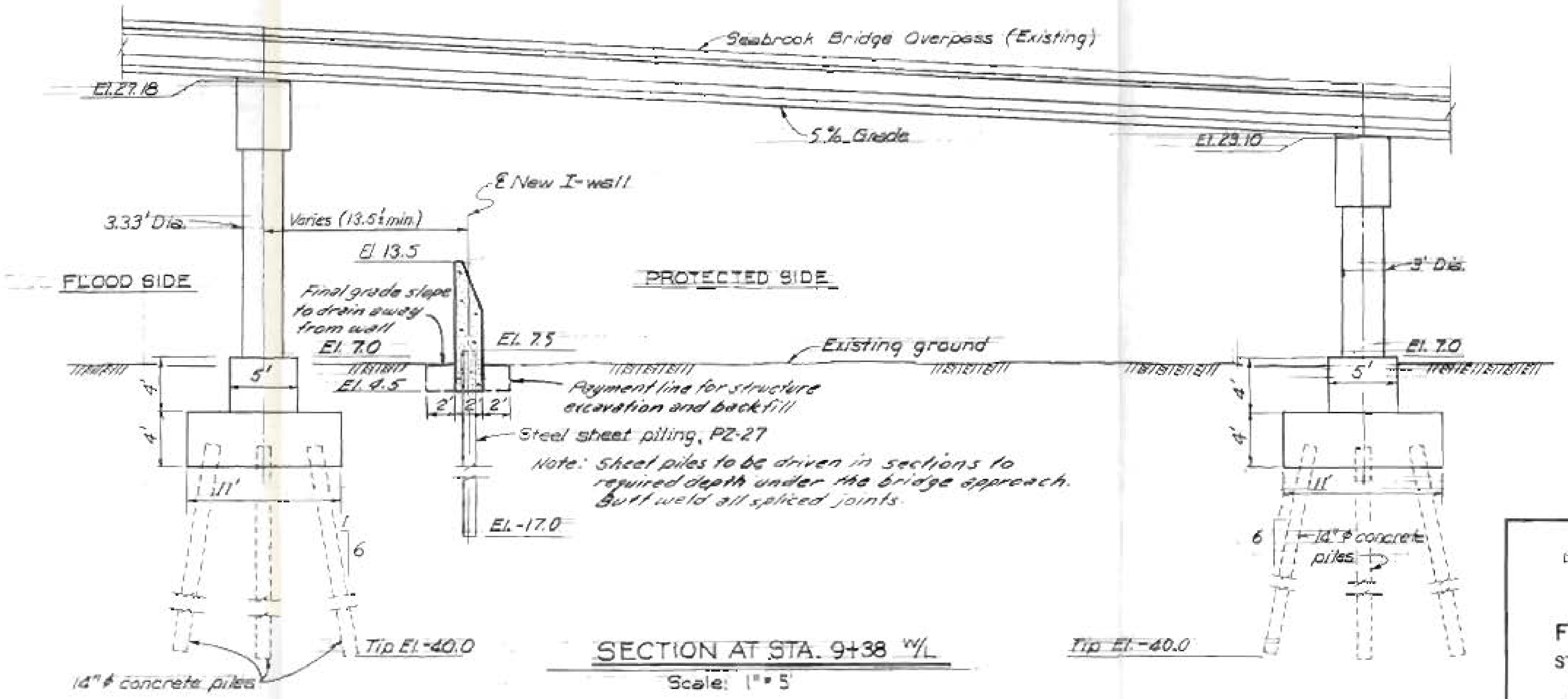
MAY 1976 FILE NO. H-2-26533



SECTION AT STA. 6+65 W/L

Scale: 1" = 5'

Note:
Investigation indicates no interference between PZ-27 steel sheet piling and existing concrete piles.



SECTION AT STA. 9+38 W/L

Scale: 1" = 5'

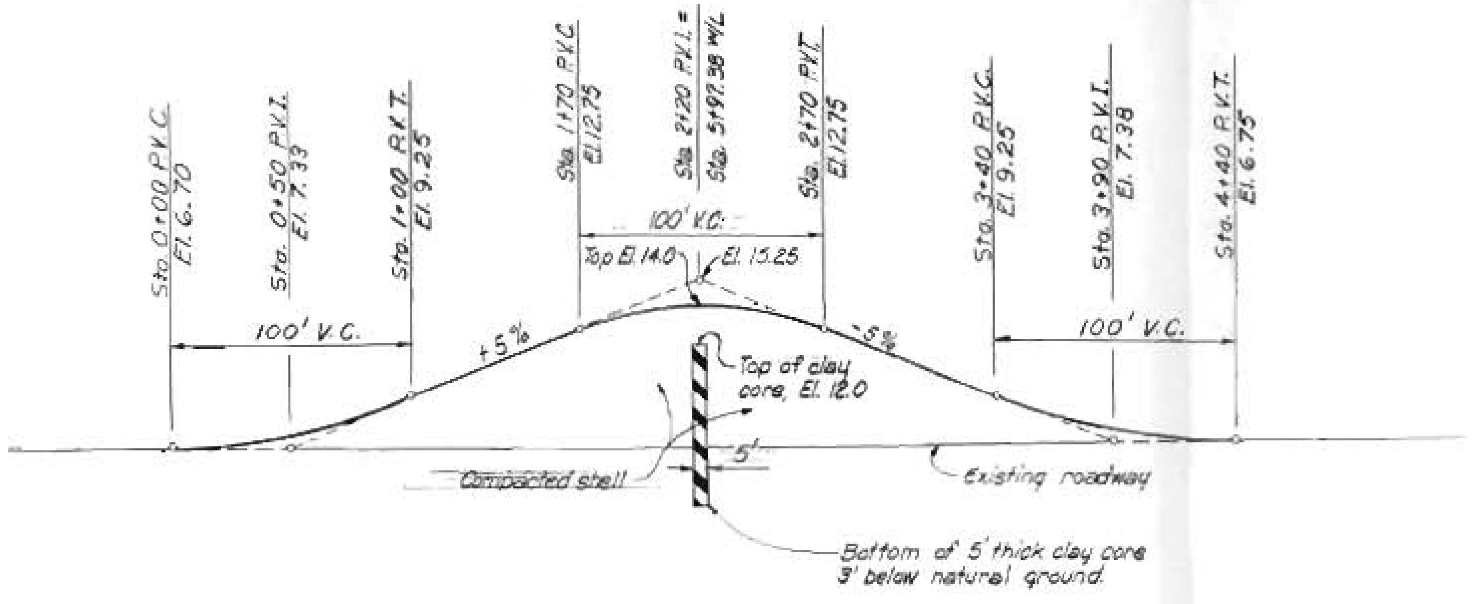
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

FLOODWALL SECTIONS

STA. 6+65 W/L AND STA. 9+38 W/L

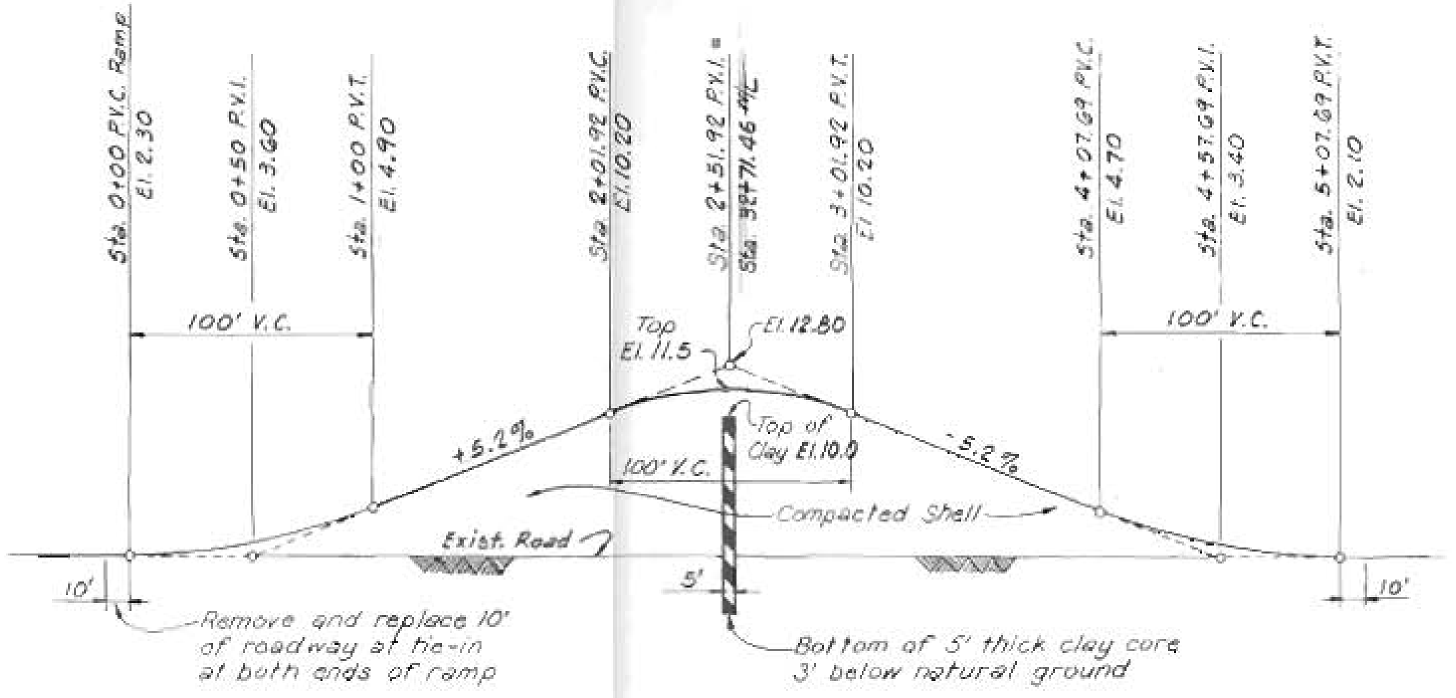
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

MAY 1976 FILE NO. H-2-26533



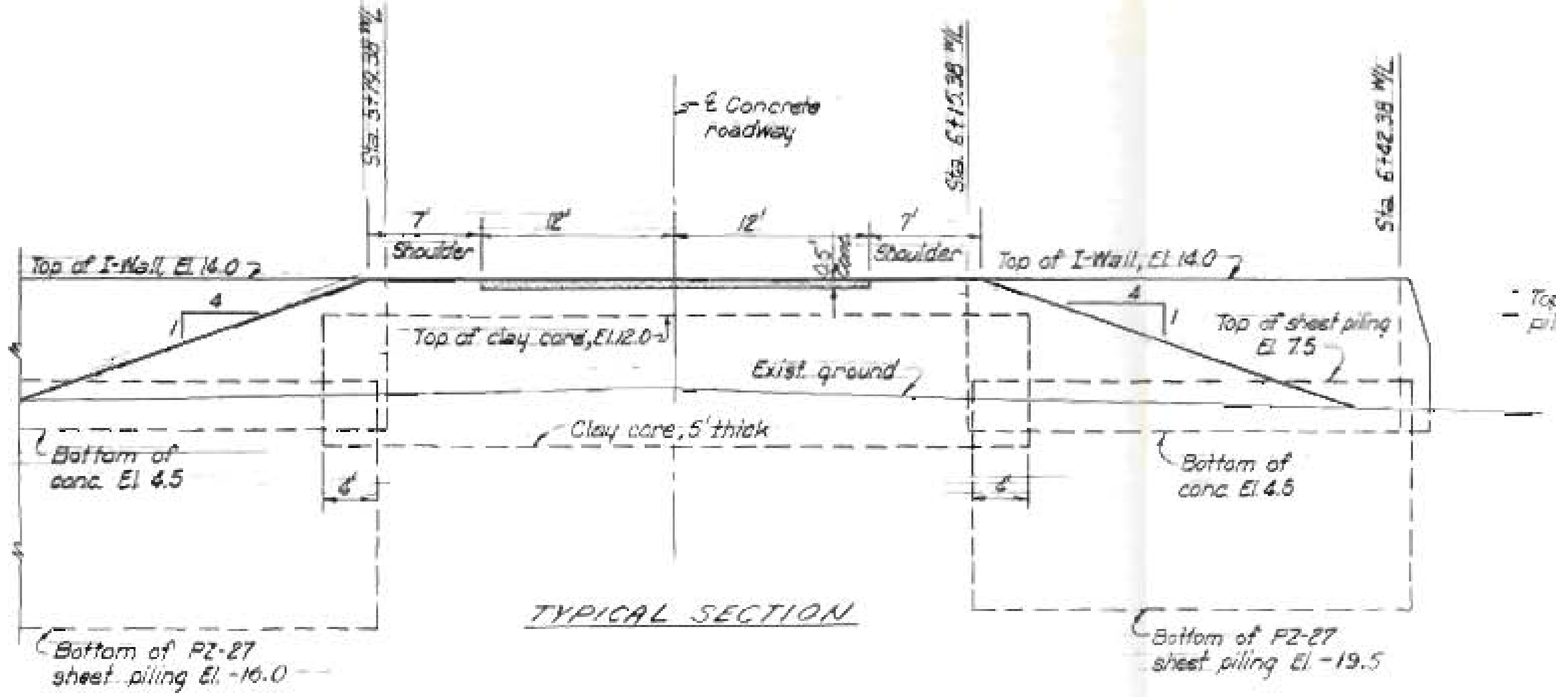
PROFILE AT CONCRETE ROADWAY RAMP

Scale: 1" = 40' Horiz. 1" = 5' Vert.



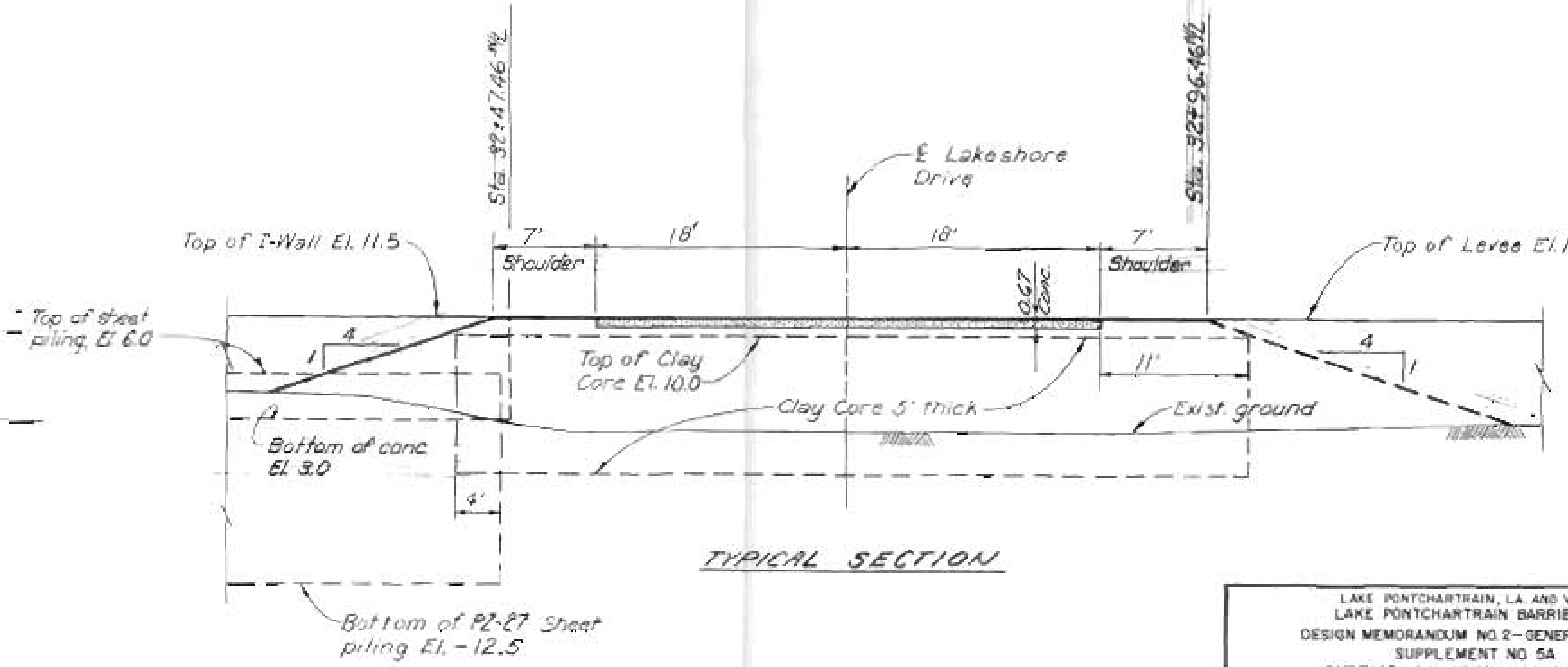
PROFILE AT LAKESHORE DRIVE RAMP

Scale: 1" = 40' Horiz. 1" = 5' Vert.



SECTION THRU CONCRETE ROADWAY RAMP

Scale: 1" = 6'



SECTION THRU LAKESHORE DRIVE RAMP

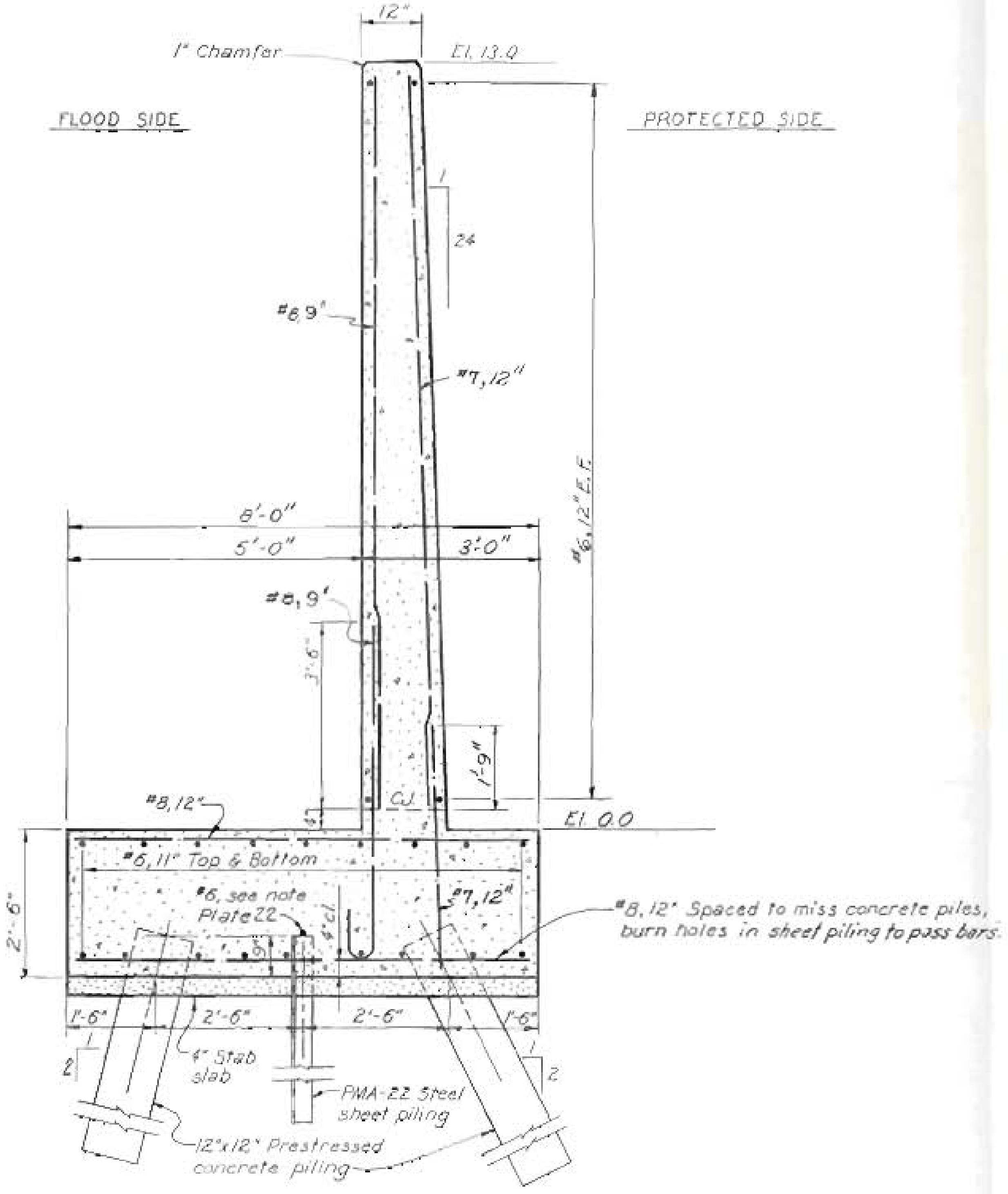
Scale: 1" = 6'

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2—GENERAL DESIGN
SUPPLEMENT NO. 5A
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

RAMP DETAILS

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MAY 1976
FILE NO. H-2-26533

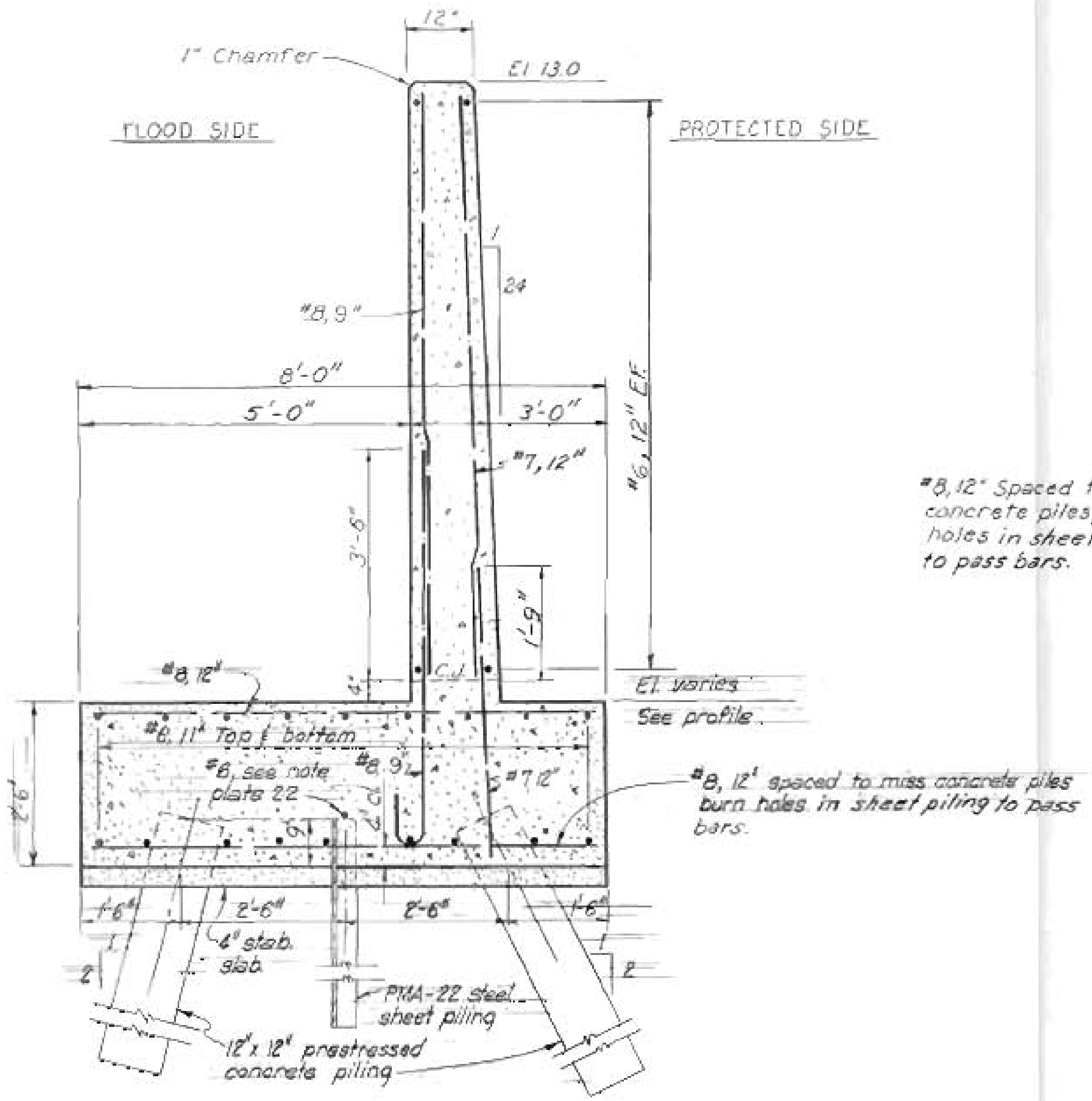
PLATE 20



STA. 2+15.79 to STA. 3+67.79

TYPICAL SECTION

Scale: 3/4" = 1'-0"

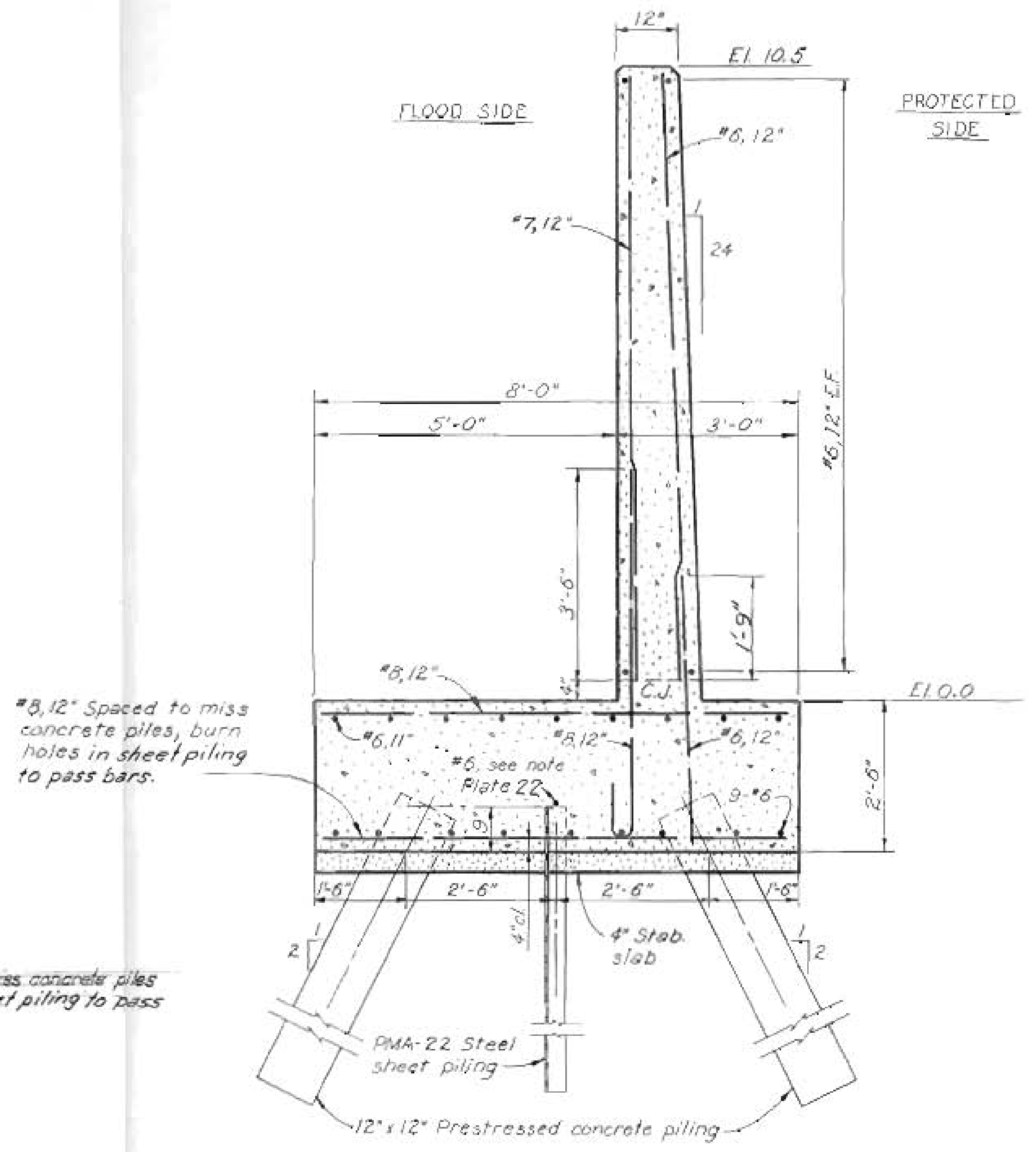


STA. 4+45.79 to STA. 5+03.38

TYPICAL SECTION

Scale: 3/4" = 1'-0"

NOTE: Holes cut in sheet piling shall not exceed 12"ϕ, and to miss interlocks.



STA. 106+88.91 to STA. 107+45.41 & STA. 108+21.41 to STA. 109+14.91

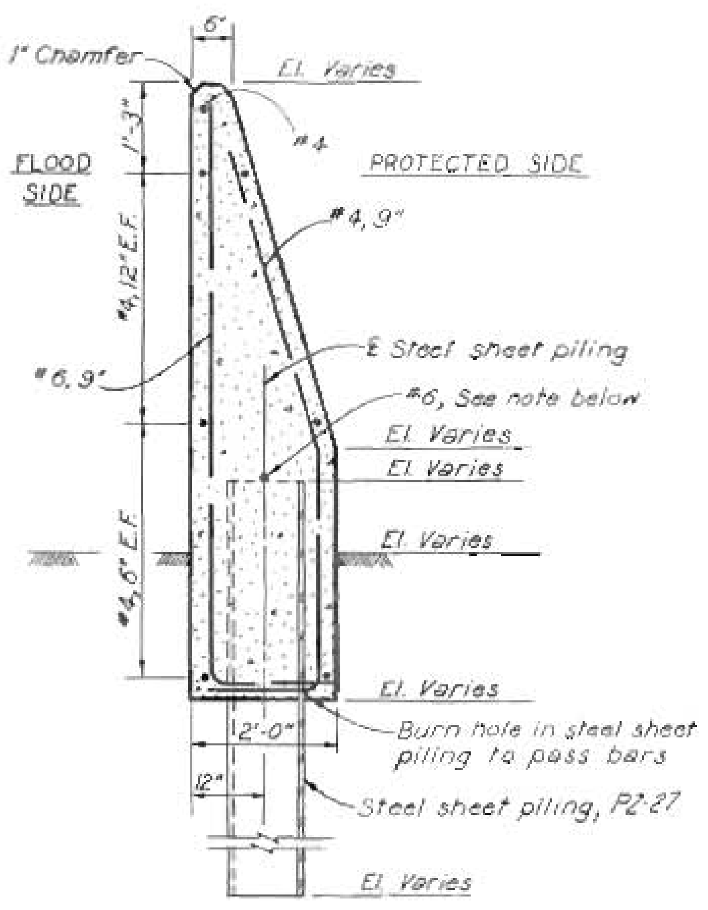
TYPICAL SECTION

Scale: 3/4" = 1'-0"

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 – GENERAL DESIGN
SUPPLEMENT NO. 5A
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD
DETAILS OF T-WALL
MONOLITHS

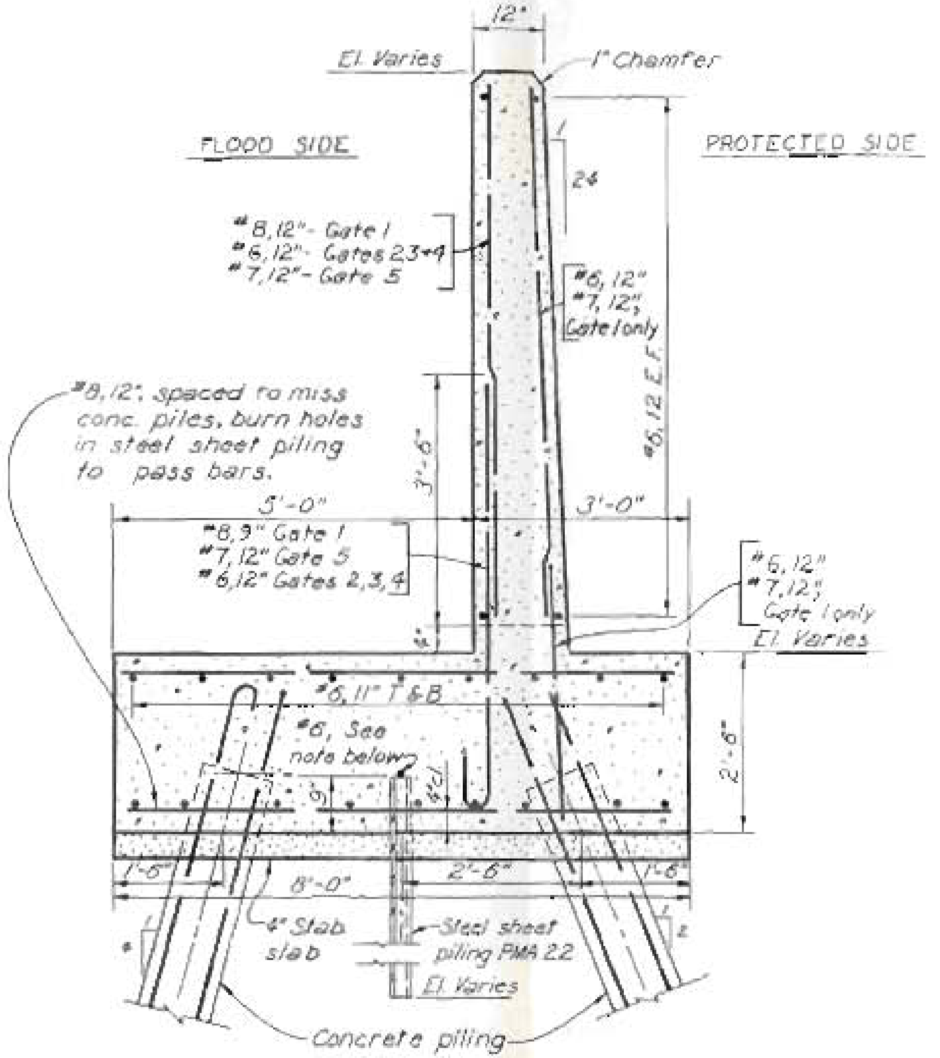
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MAY 1976
FILE NO. H-2-26533

PLATE 21



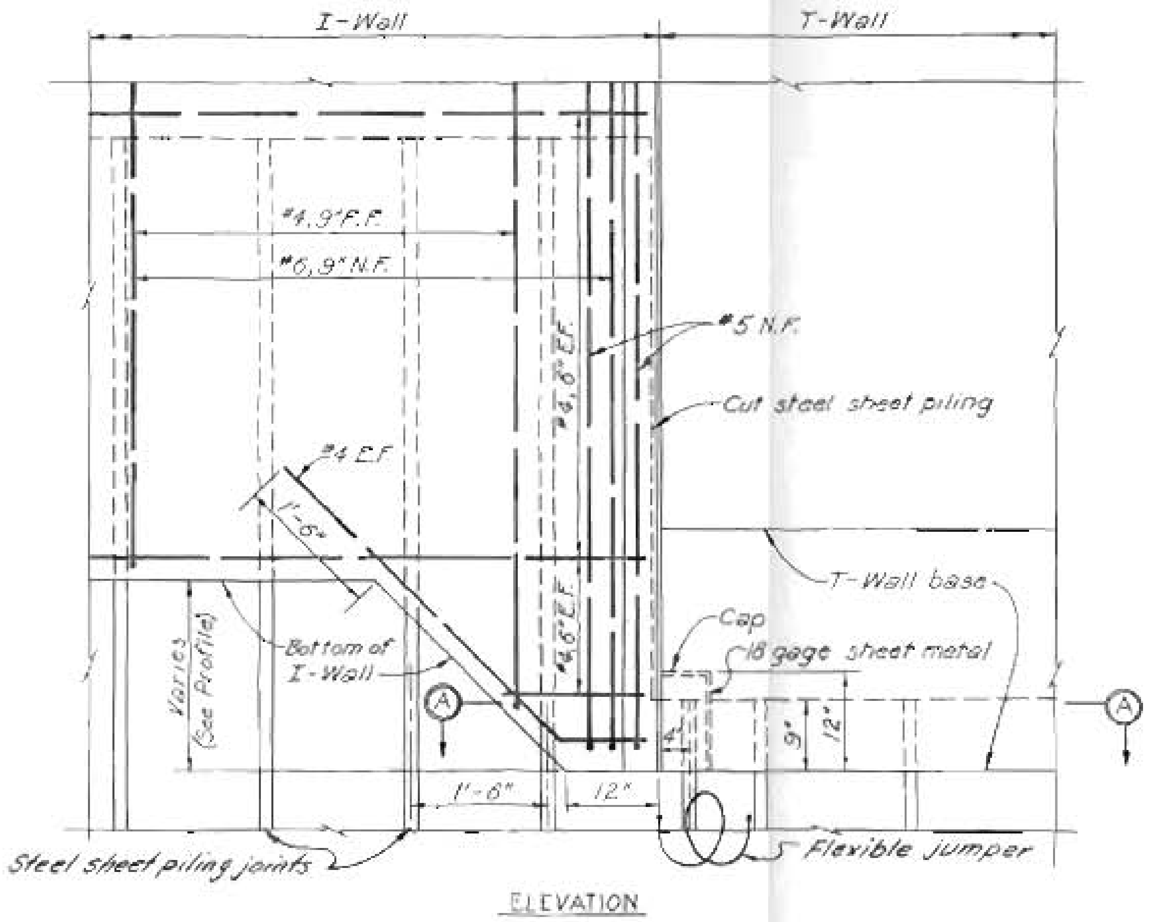
TYPICAL I-WALL SECTION

Scale: 3/4" = 1'-0"



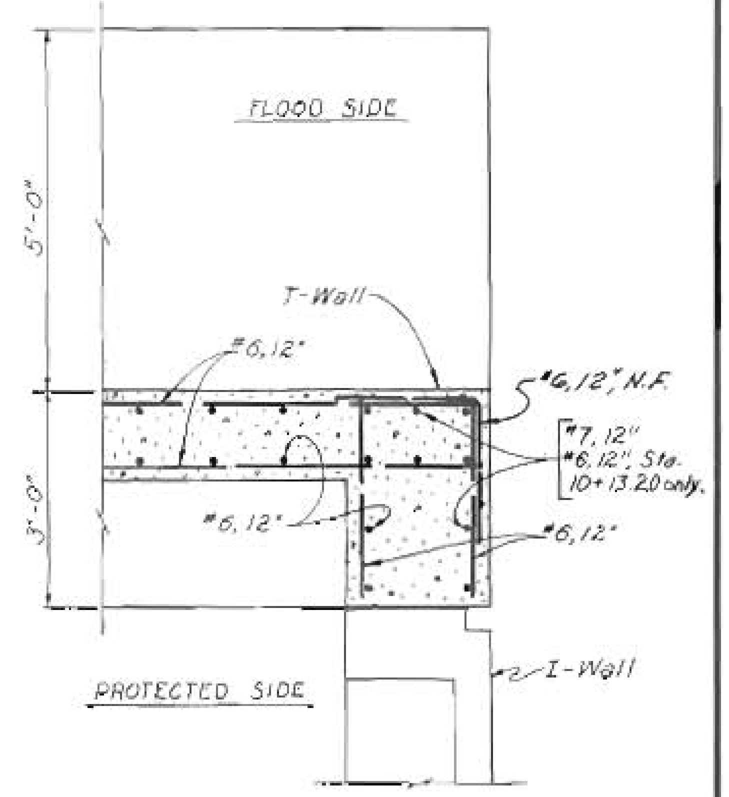
TYPICAL T-WALL SECTION FOR GATE MONOLITH

Scale: 3/4" = 1'-0"



TYPICAL DETAIL FOR I-WALL TO T-WALL AT BASE

Scale: 1" = 1'-0"

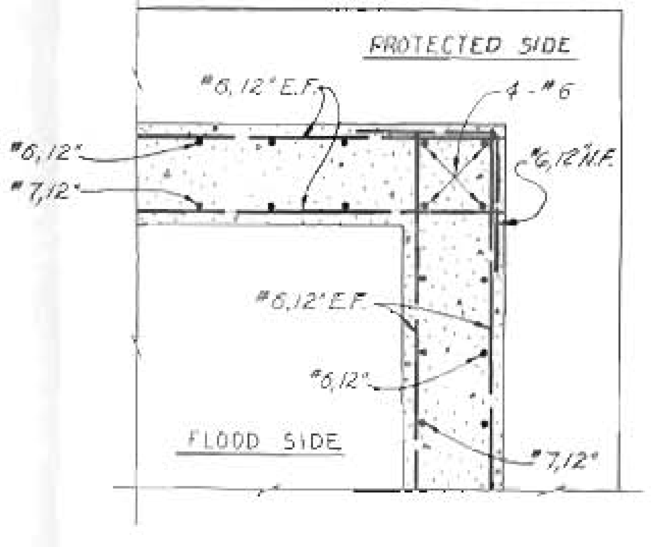


T-WALL CORNER DETAIL

AT STA. 10+13.20, STA. 106+88.91 & STA. 109+14.91

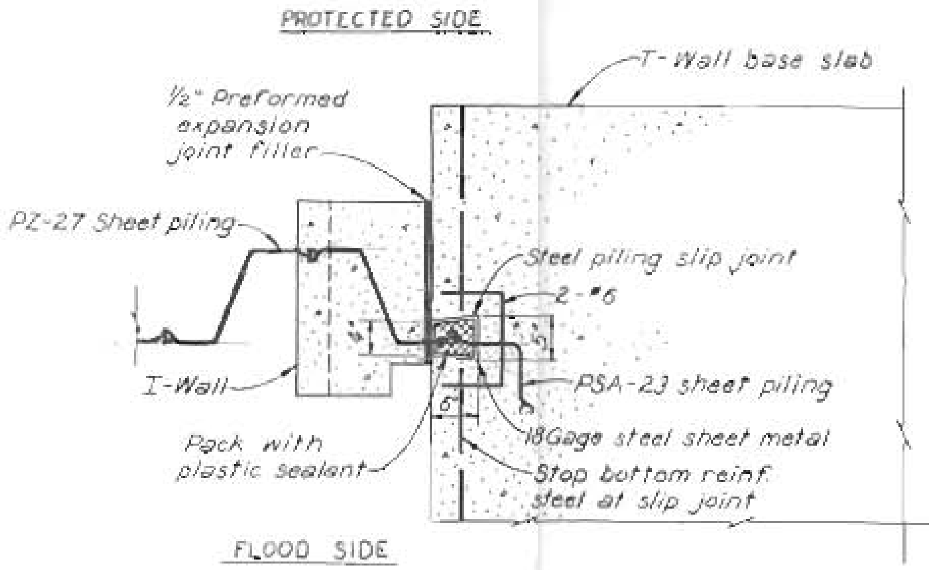
Scale: 3/4" = 1'-0"

NOTE:
1. Weld a No. 6 reinf. rod to top of each steel sheet pile. Install flexible jumper at all monolith joints. Jumpers shall be No. 1/0 AWG copper insulated with cross linked polyethylene in an 8" dia. loop. Jumper shall be welded to adjacent steel sheet piles 3 inches below bottom of concrete cap. Welded connections shall be coated with splicing epoxy to obtain a moisture proof connection.
2. Holes cut in sheet piling shall not exceed 1½"ϕ, and to miss interlocks.



TYPICAL T-WALL CORNER DETAIL

Scale: 3/4" = 1'-0"



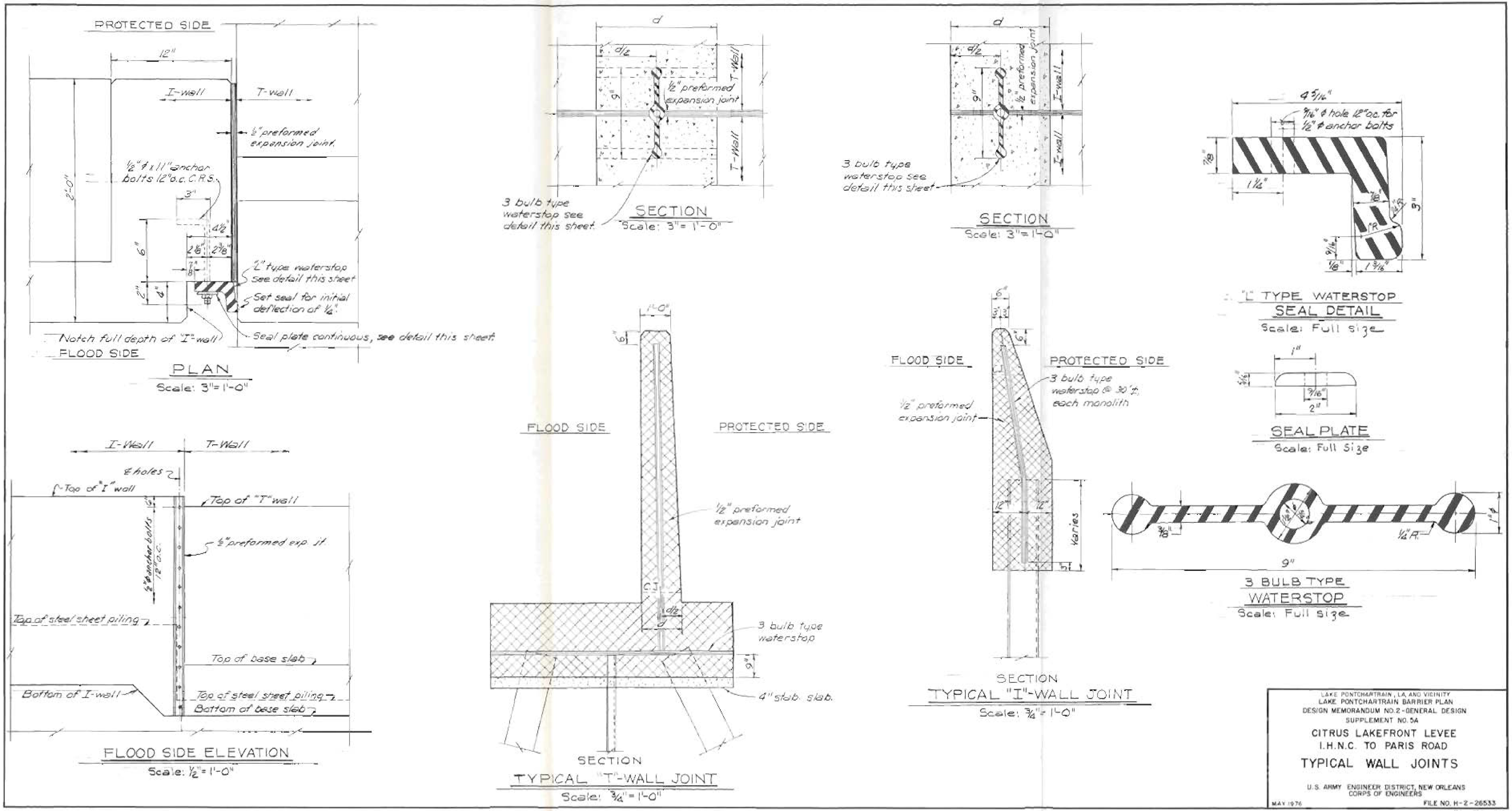
SECTION A~A

Scale: 1" = 1'-0"

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

TYPICAL WALL SECTIONS

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MAY 1976
FILE NO. H-2-26533



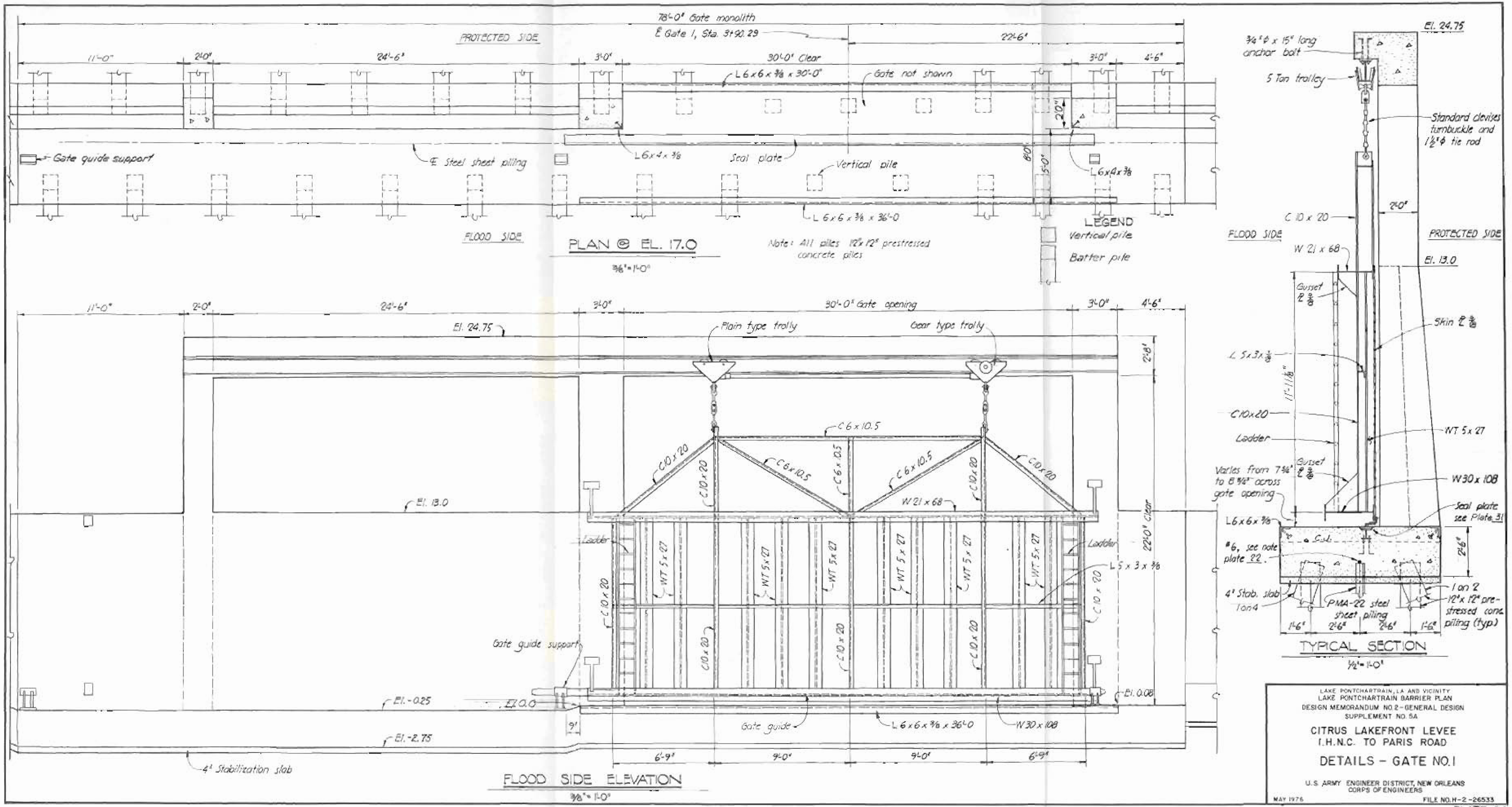
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 5A

CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

TYPICAL WALL JOINTS

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

MAY 1976 FILE NO. H-2-26533



LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

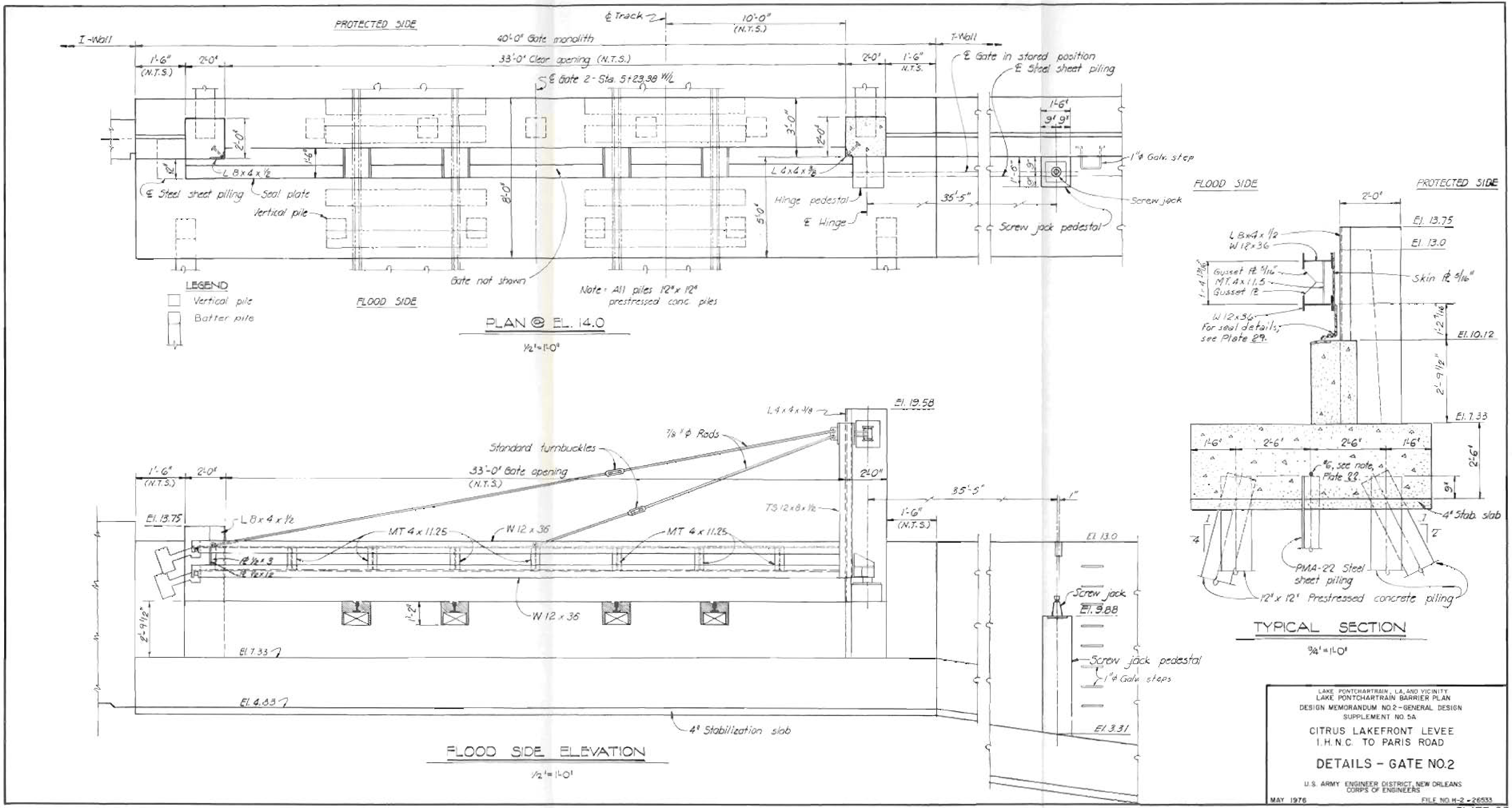
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

DETAILS - GATE NO. 1

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

MAY 1976 FILE NO. H-2-26533

PLATE 24



LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

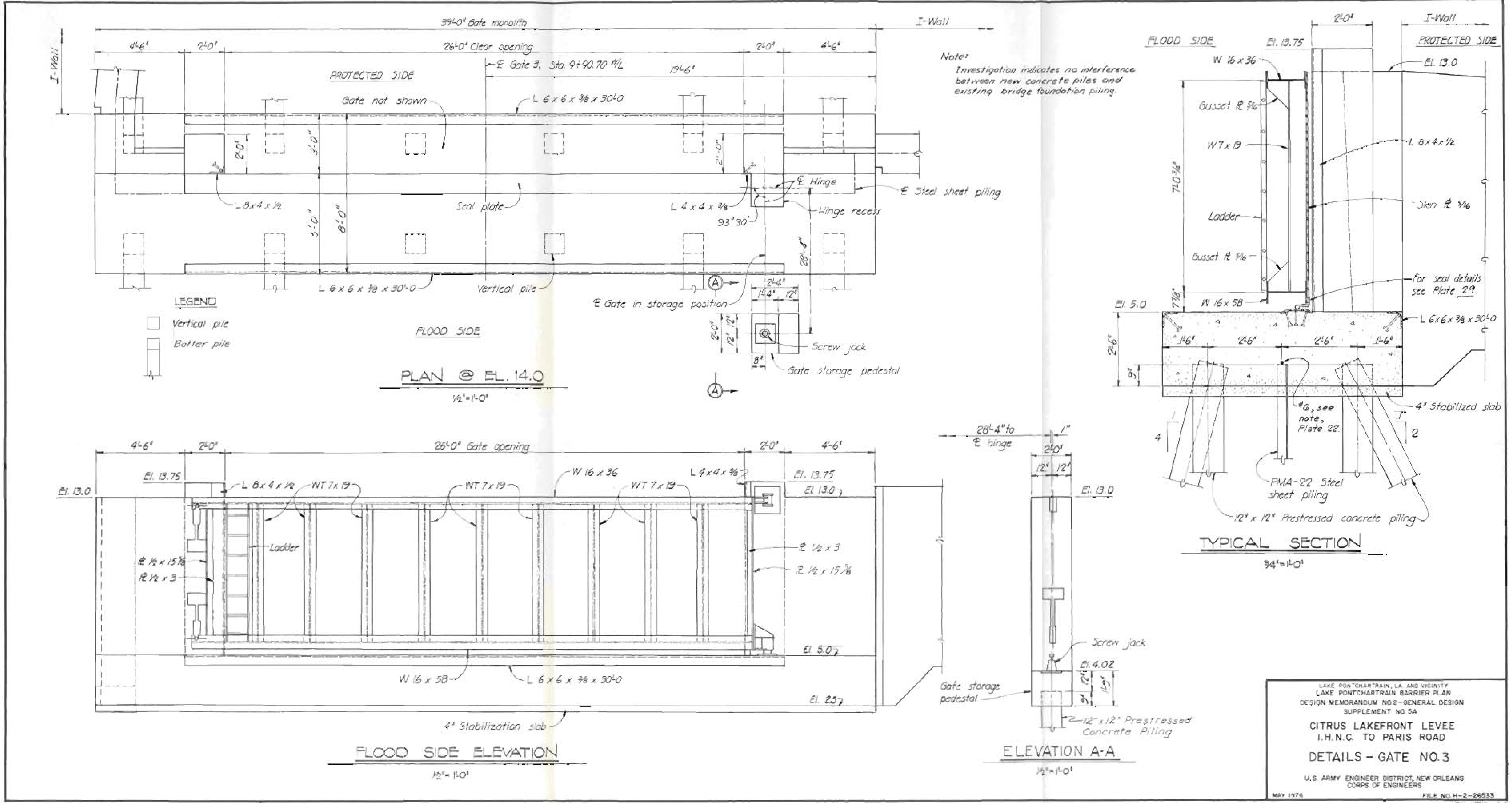
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

DETAILS - GATE NO. 2

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

MAY 1976 FILE NO. H-2-26533

PLATE 25



LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO 2-GENERAL DESIGN
SUPPLEMENT NO. 5A

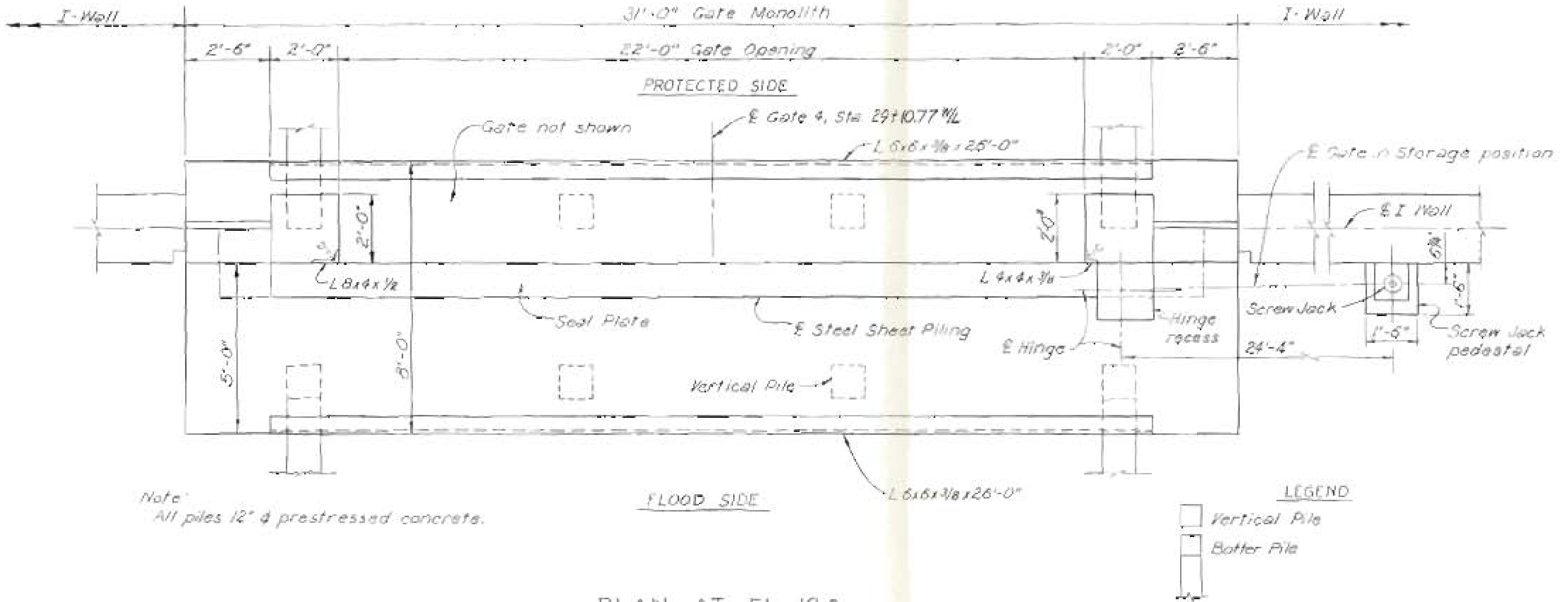
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

DETAILS - GATE NO. 3

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

MAY 1976

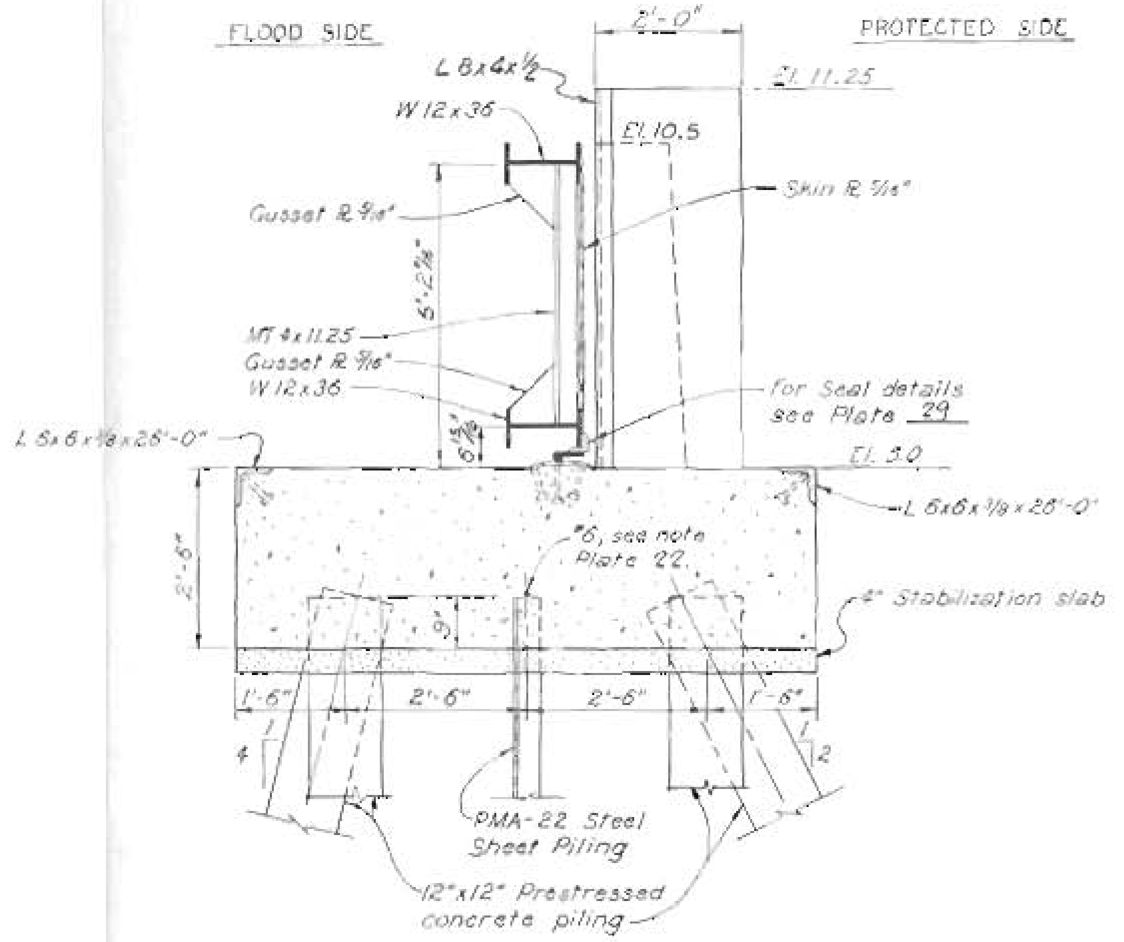
FILE NO. H-2-26533



Note:
All piles 12" ⌀ prestressed concrete.

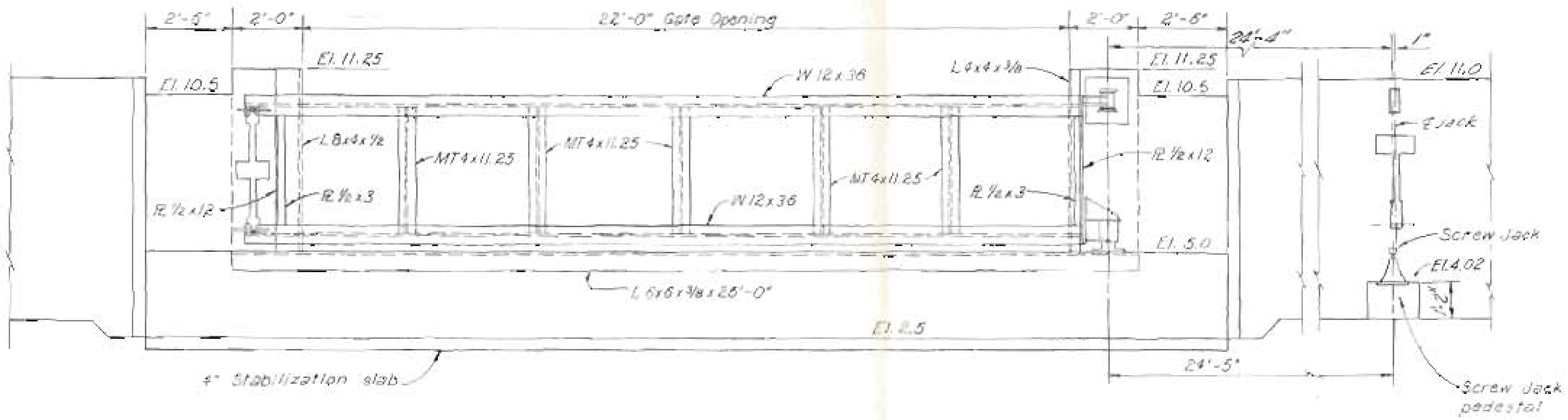
PLAN AT EL. 12.0

Scale: 1/2" = 1'-0"



TYPICAL SECTION

Scale: 3/4" = 1'-0"



FLOOD SIDE ELEVATION

Scale: 1/2" = 1'-0"

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

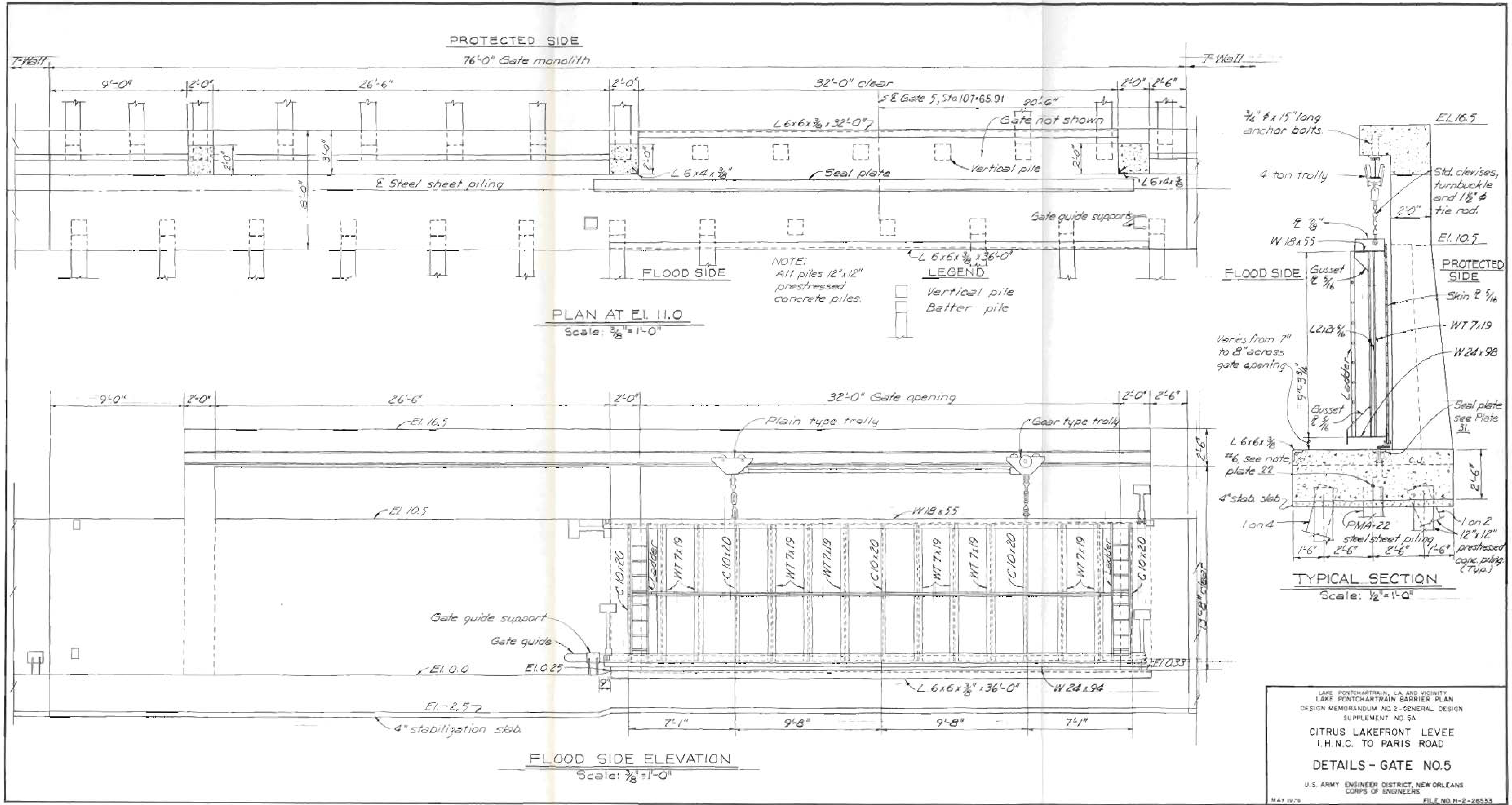
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

DETAILS - GATE NO. 4

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

MAY 1976 FILE NO. H-2-26533

PLATE 27



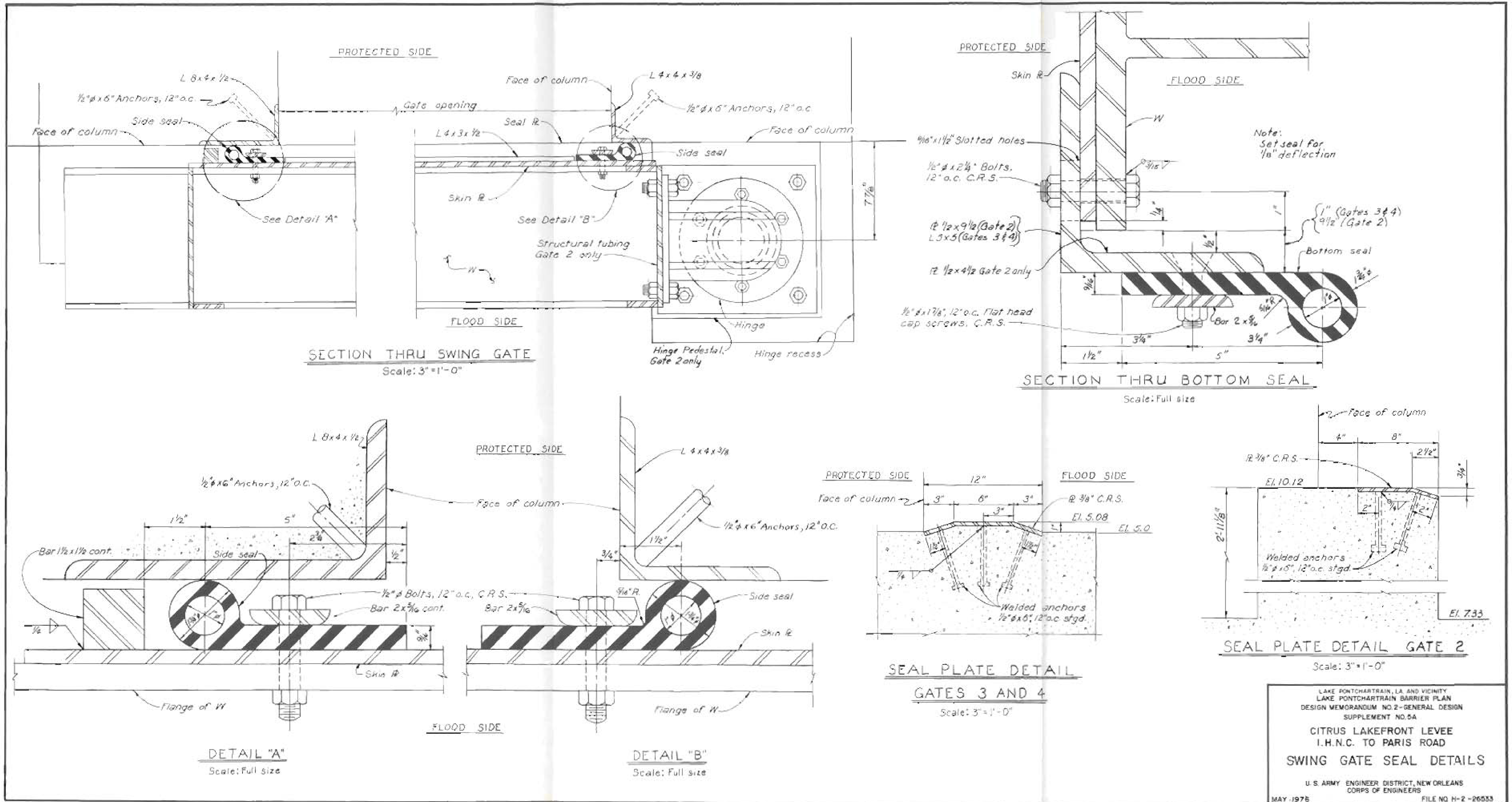
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

DETAILS - GATE NO.5

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

MAY 1979 FILE NO. H-2-26533



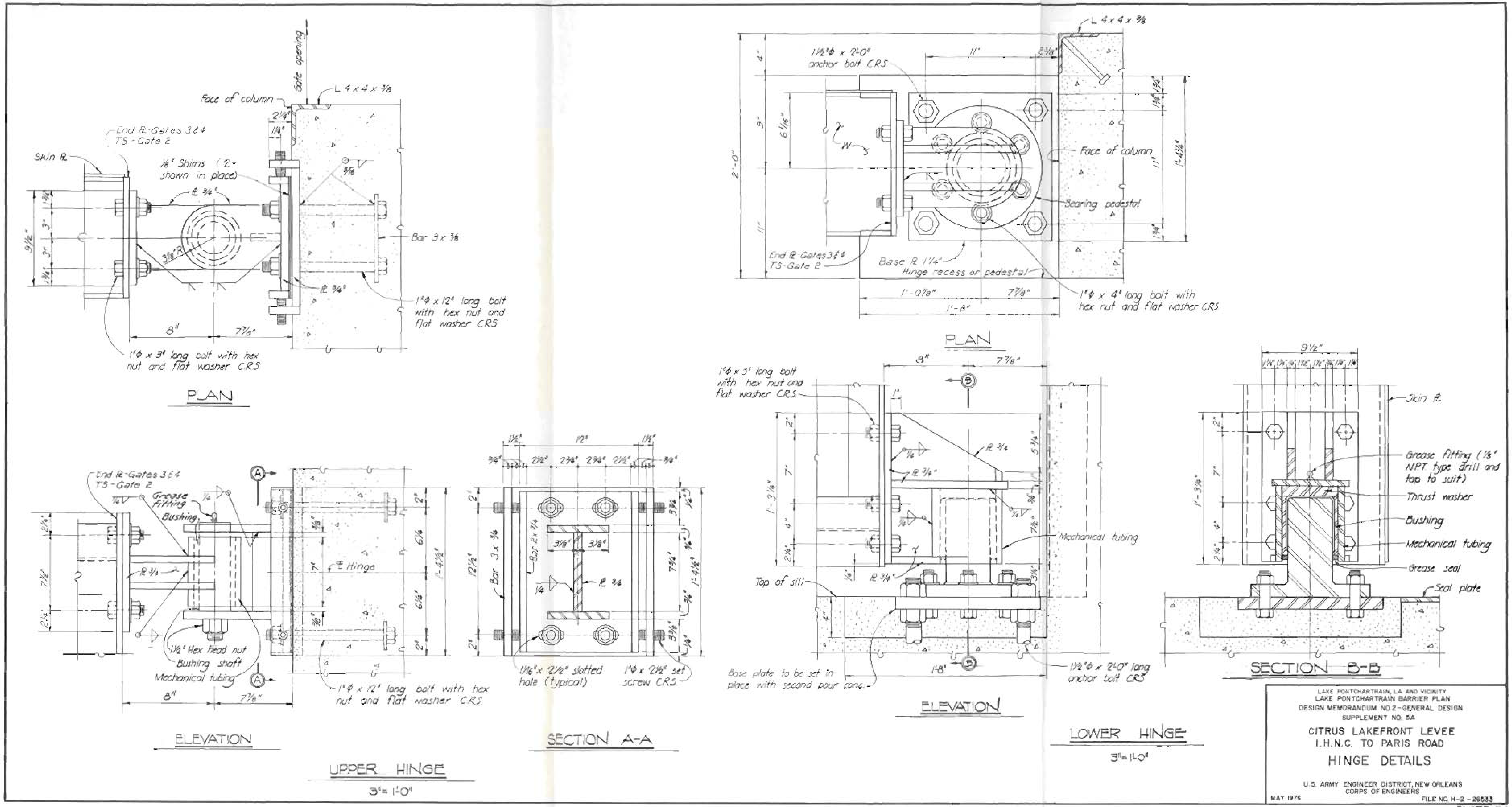
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

SWING GATE SEAL DETAILS

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

MAY 1976 FILE NO. H-2-26533



LAKE PONTCHARTRAIN, LA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

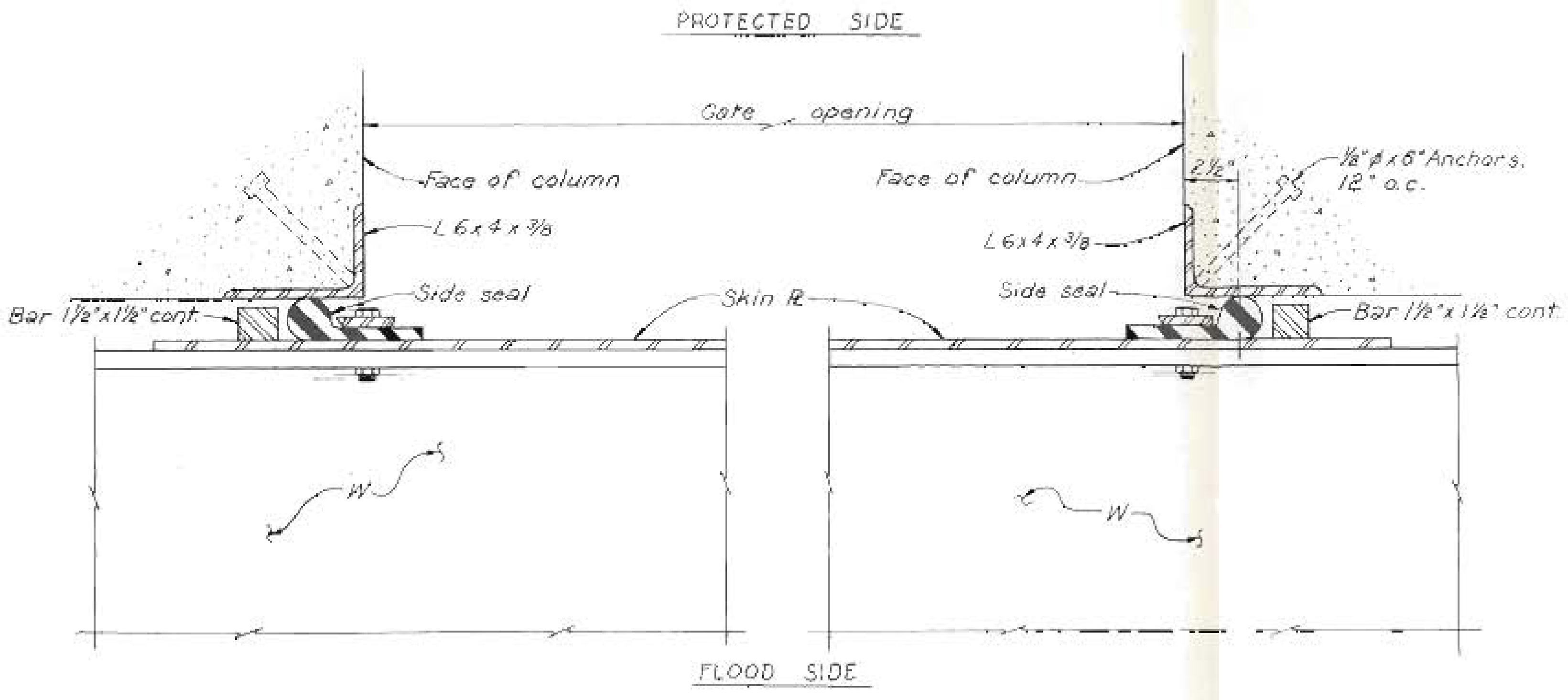
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

HINGE DETAILS

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

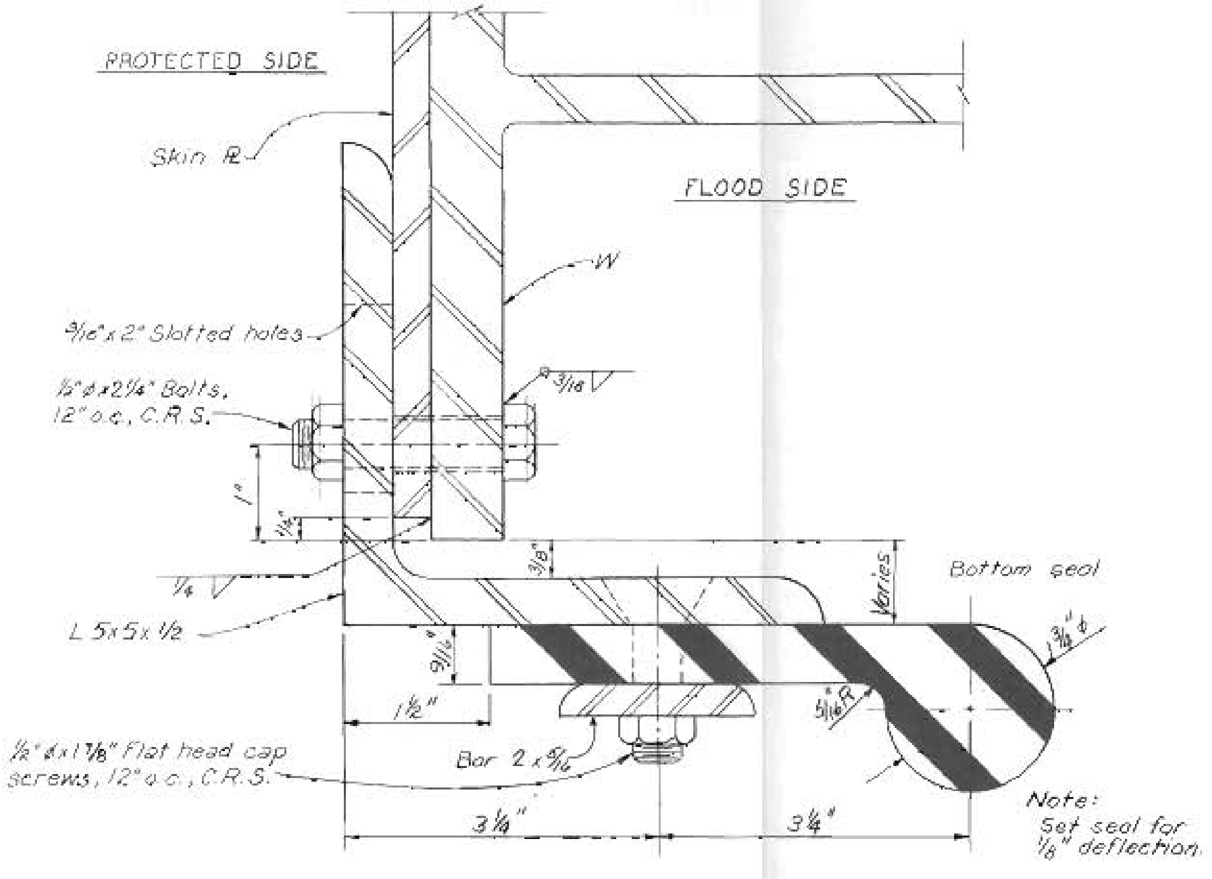
MAY 1976 FILE NO. H-2-26533

PLATE 30



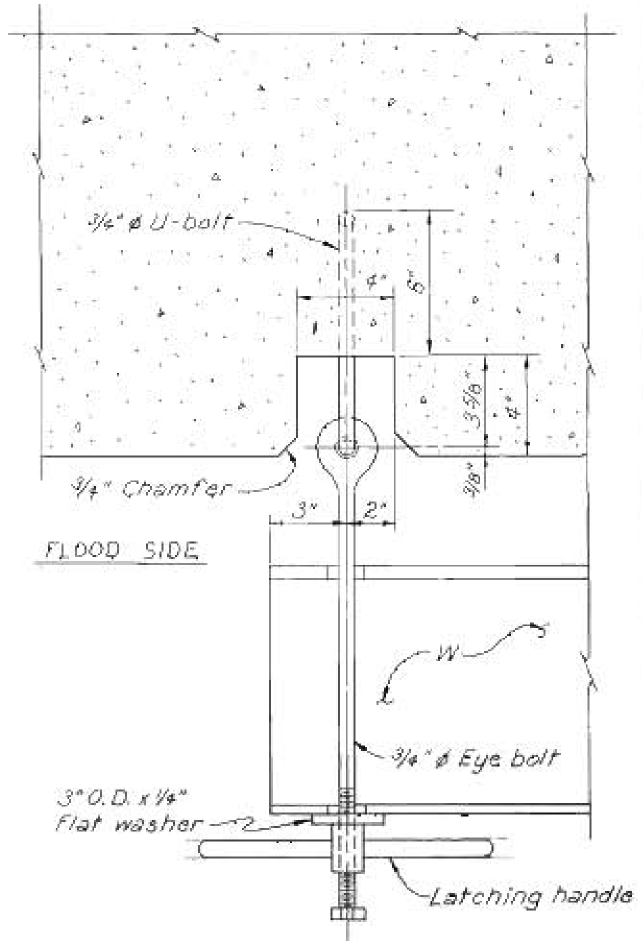
SECTION THRU OVERHEAD ROLLER GATE

Scale: 3"=1'-0"



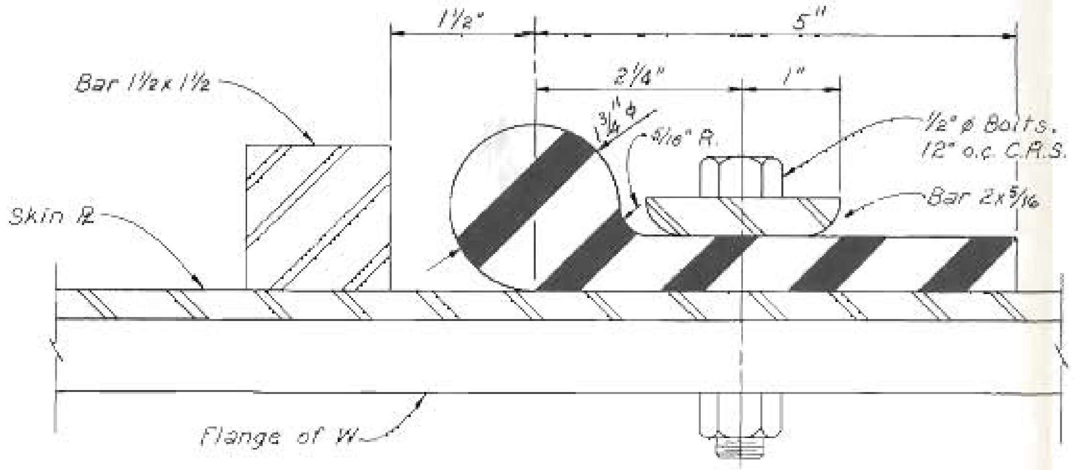
SECTION THRU BOTTOM SEAL

Scale: Full size



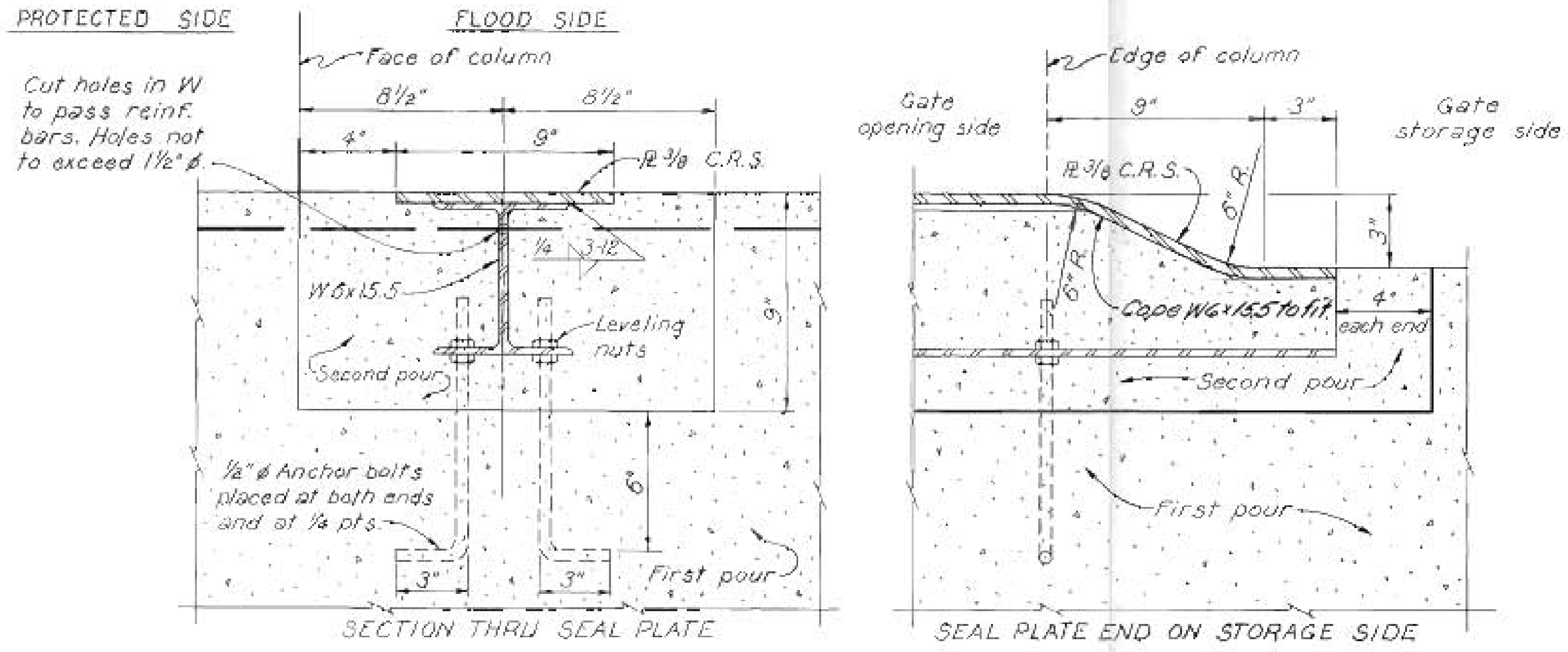
LATCHING ASSEMBLY

Scale: 3"=1'-0"



TYPICAL SIDE SEAL

Scale: Full size



TYPICAL SEAL PLATE FOR GATES

Scale: 3"=1'-0"

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

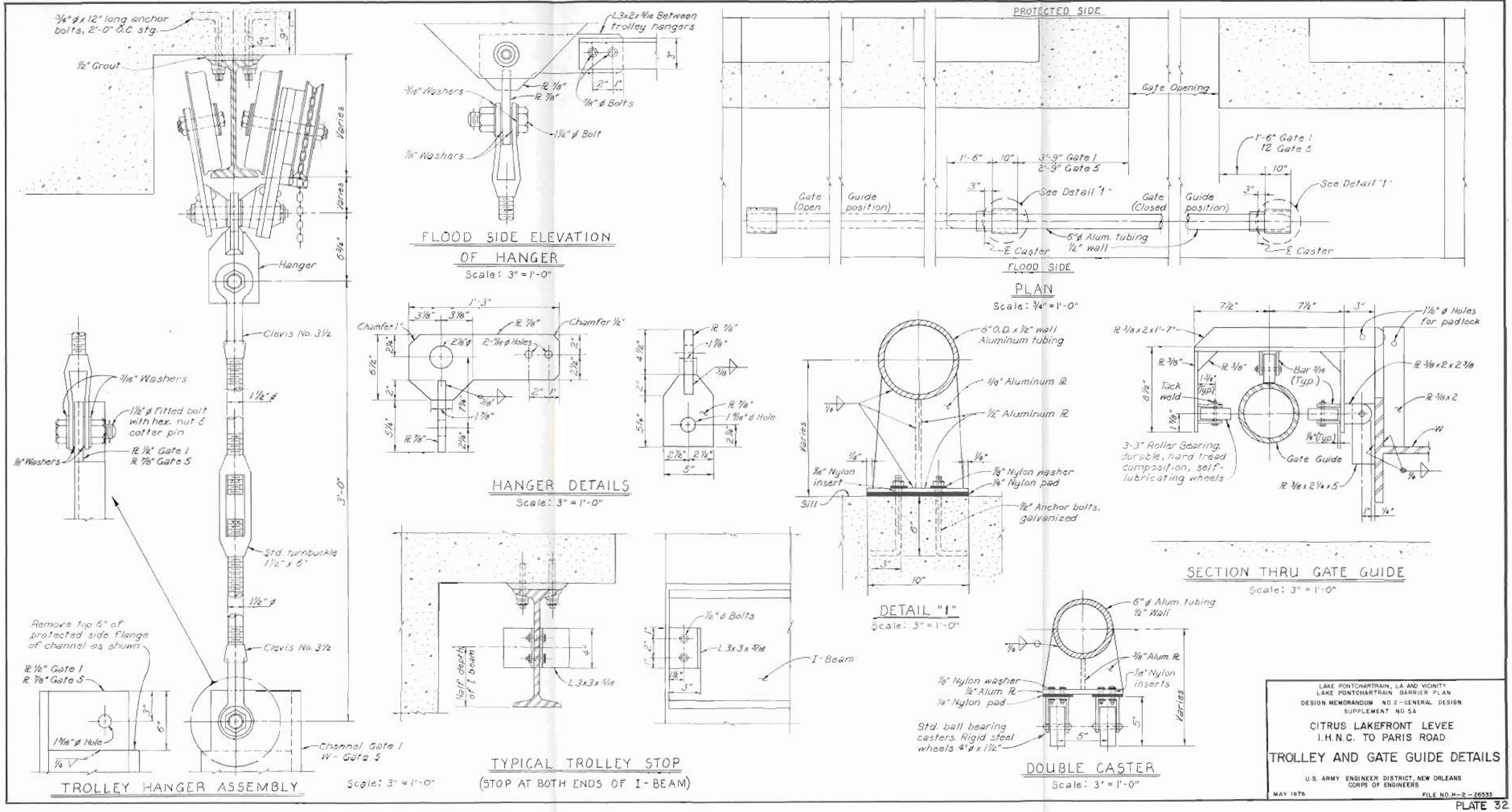
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

SEAL DETAILS AND LATCHING ASSEMBLY

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

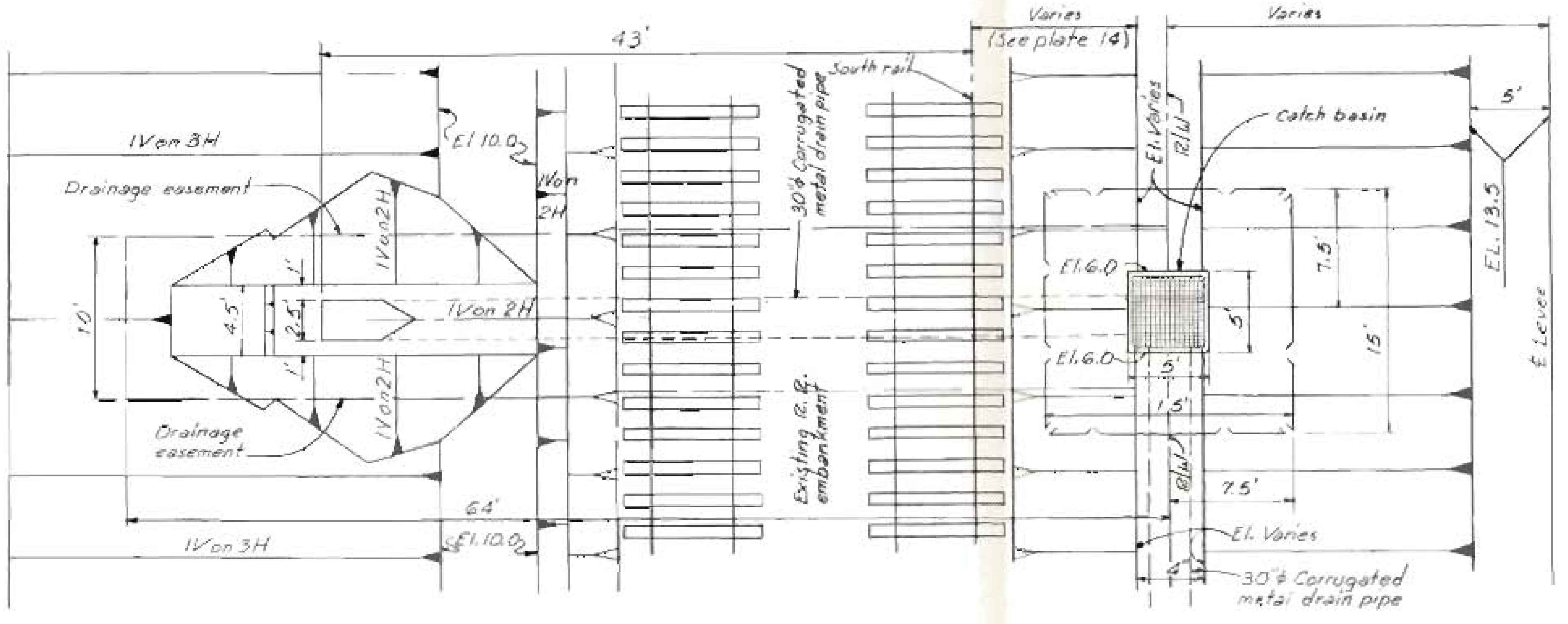
MAY 1976 FILE NO. H-2-26533

PLATE 31



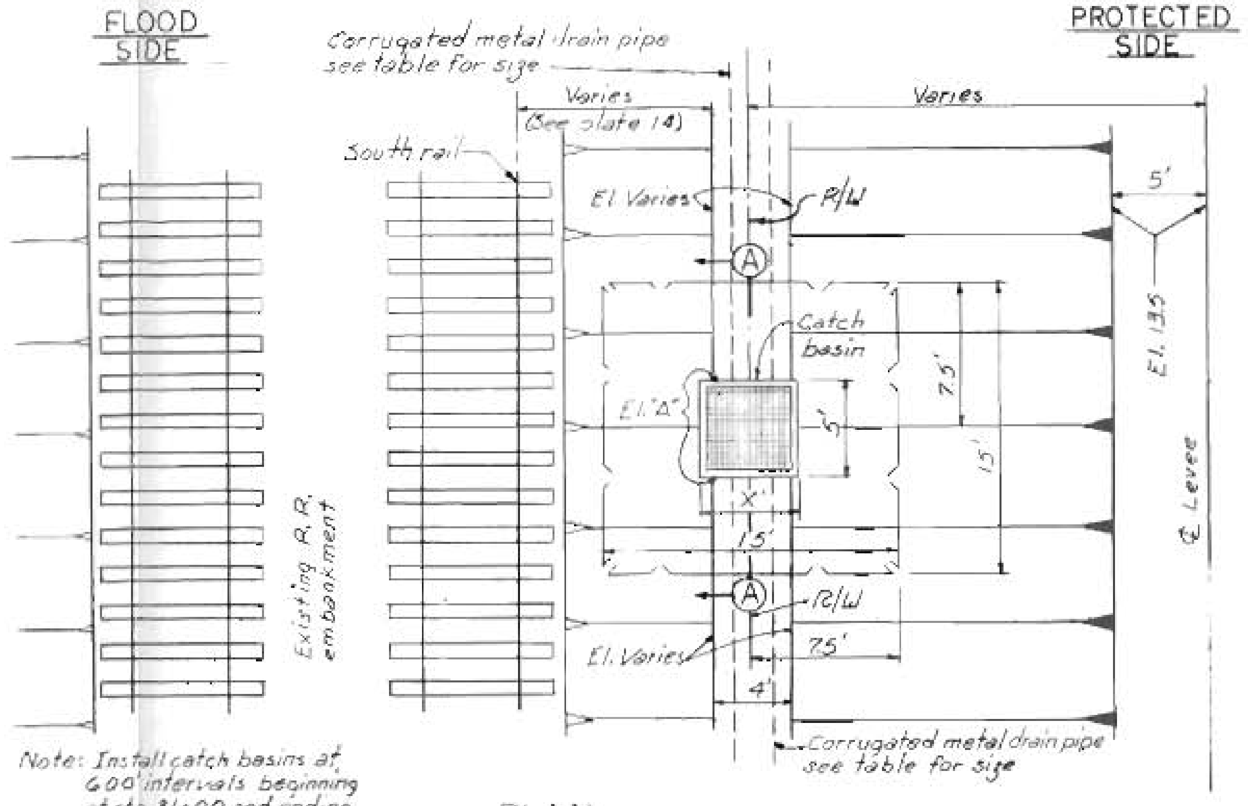
TROLLEY HANGER ASSEMBLY
Scale: 3" = 1'-0"
FLOOD SIDE ELEVATION OF HANGER
Scale: 3" = 1'-0"
HANGER DETAILS
Scale: 3" = 1'-0"
TYPICAL TROLLEY STOP
(STOP AT BOTH ENDS OF I-BEAM)
PROTECTED SIDE
Gate Opening
FLOOD SIDE
PLAN
Scale: 3/4" = 1'-0"
DETAIL "1"
Scale: 3" = 1'-0"
SECTION THRU GATE GUIDE
Scale: 3" = 1'-0"
DOUBLE CASTER
Scale: 3" = 1'-0"
3/4" ø x 12" long anchor bolts, 2'-0" O.C. stg.
1/2" Grout
Hanger
Clevis No. 3 1/2
Std. turnbuckle 1 1/2" x 6"
Remove top 6" of protected side flange of channel as shown
Channel Gate 1
W - Gate 5
L3x2x5/16 Between trolley hangers
1 1/2" ø Bolt
6" ø Alum. tubing 1/2" wall
6" O.D. x 1/2" wall Aluminum tubing
1/2" Anchor bolts, galvanized
3-3" Roller Gearing, durable, hard tread composition, self-lubricating wheels
Gate Guide
1 1/8" ø Holes for padlock
Std. ball bearing casters. Rigid steel wheels 4" ø x 1 1/2"
I-Beam
LAKE PONTCHARTRAIN, LA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO 2 - GENERAL DESIGN
SUPPLEMENT NO 5A
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD
TROLLEY AND GATE GUIDE DETAILS
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MAY 1976
FILE NO. H-2-26533

PLATE 32



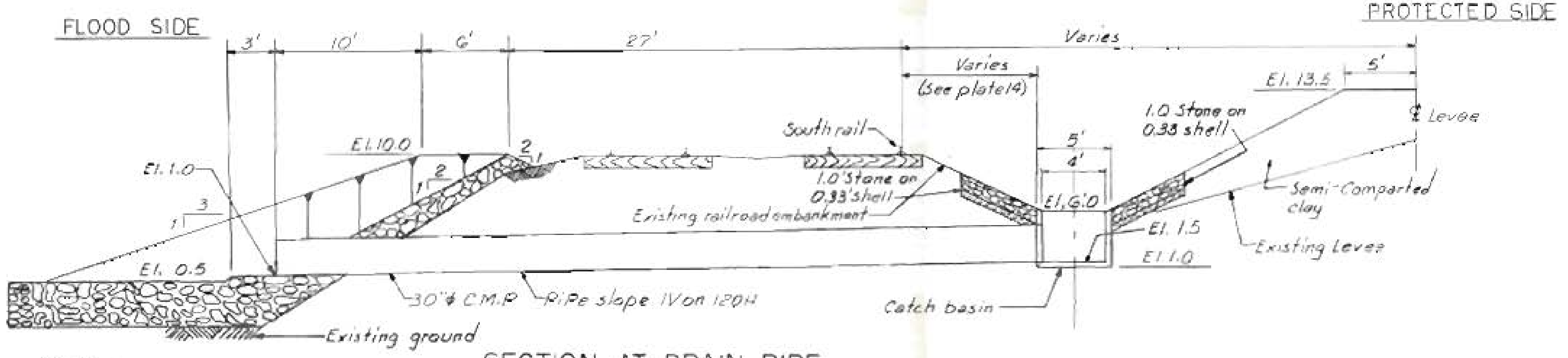
PLAN AT STA. 64+00

SCALE: 1"=5'



PLAN
TYPICAL AT 600 INTERVALS
BEGINNG AT STA. 31+00

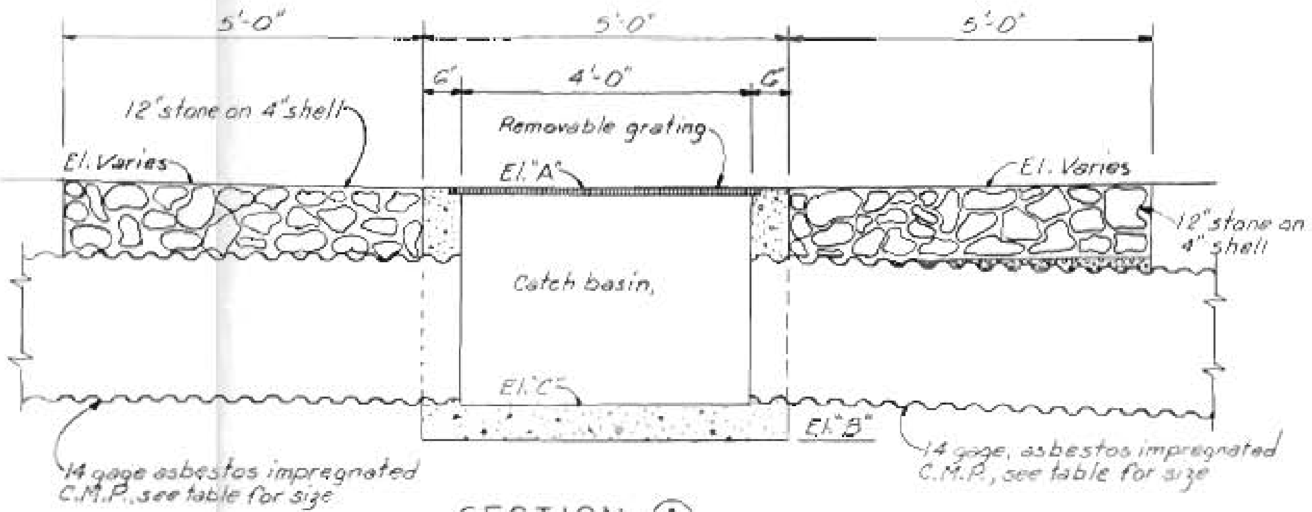
SCALE: 1"=5'



Note:
30" Drain pipe to be jacked thru existing railroad embankment.

SECTION AT DRAIN PIPE
STA. 64+00

SCALE: 1"=5'



SECTION A

SCALE: 3/4"=1'-0"

Note: Catch basin details similar to Catch basins shown on plate 34.

SIZE OF DRAIN PIPE		
FROM STA.	TO STA.	SIZE
31+00	37+00	24"
37+00	43+00	24"
43+00	49+00	24"
49+00	55+00	24"
55+00	64+00	30"

LOCATION AND SIZE OF CATCH BASINS					
STATION-B/L	"X"	"Y"	EL "A"	EL "B"	EL "C"
31+00	5'	4'	6.0	3.0	3.5
37+00	5'	4'	6.0	2.5	3.0
43+00	3.5'	2.5'	5.0	2.0	2.5
49+00	5'	4'	5.0	1.7	2.2
55+00	5'	4'	5.0	1.4	1.9
64+00	AS SHOWN				

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

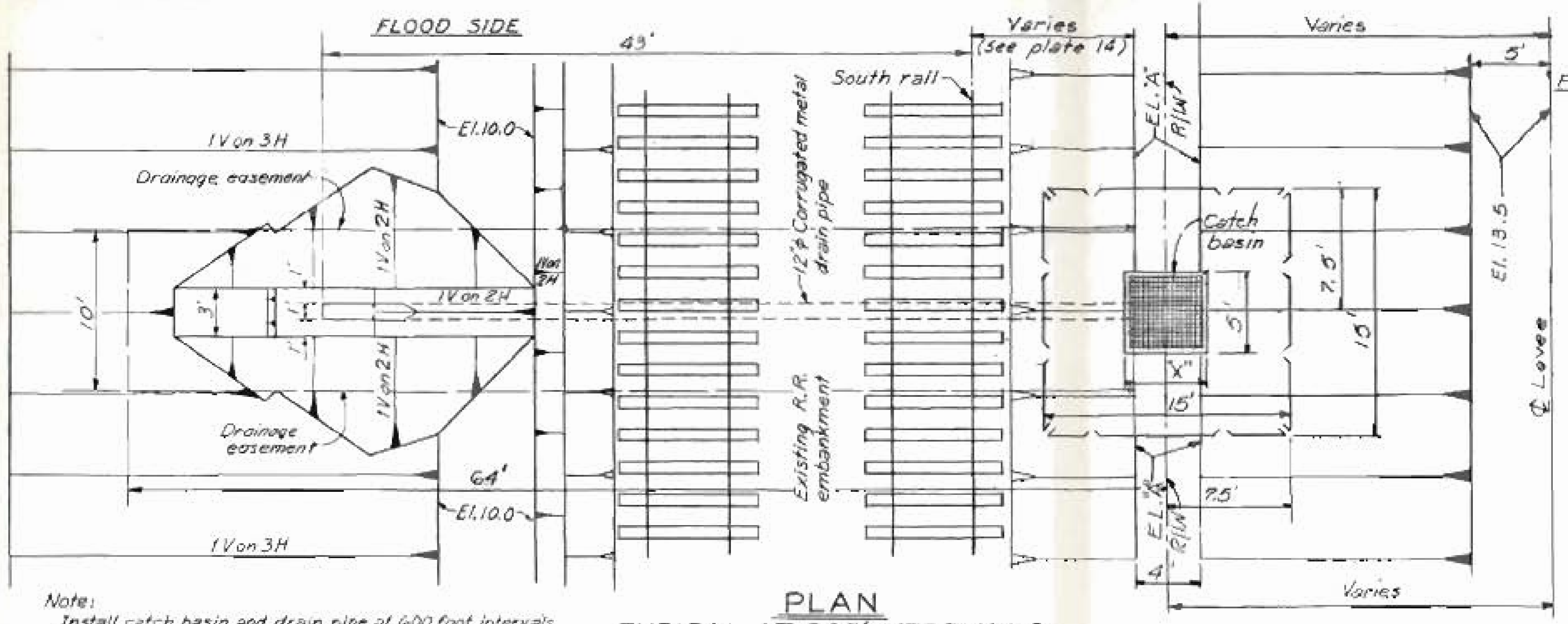
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

LEVEE DRAINAGE DETAILS
STA. 28+31 B/L TO STA. 64+00 B/L

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

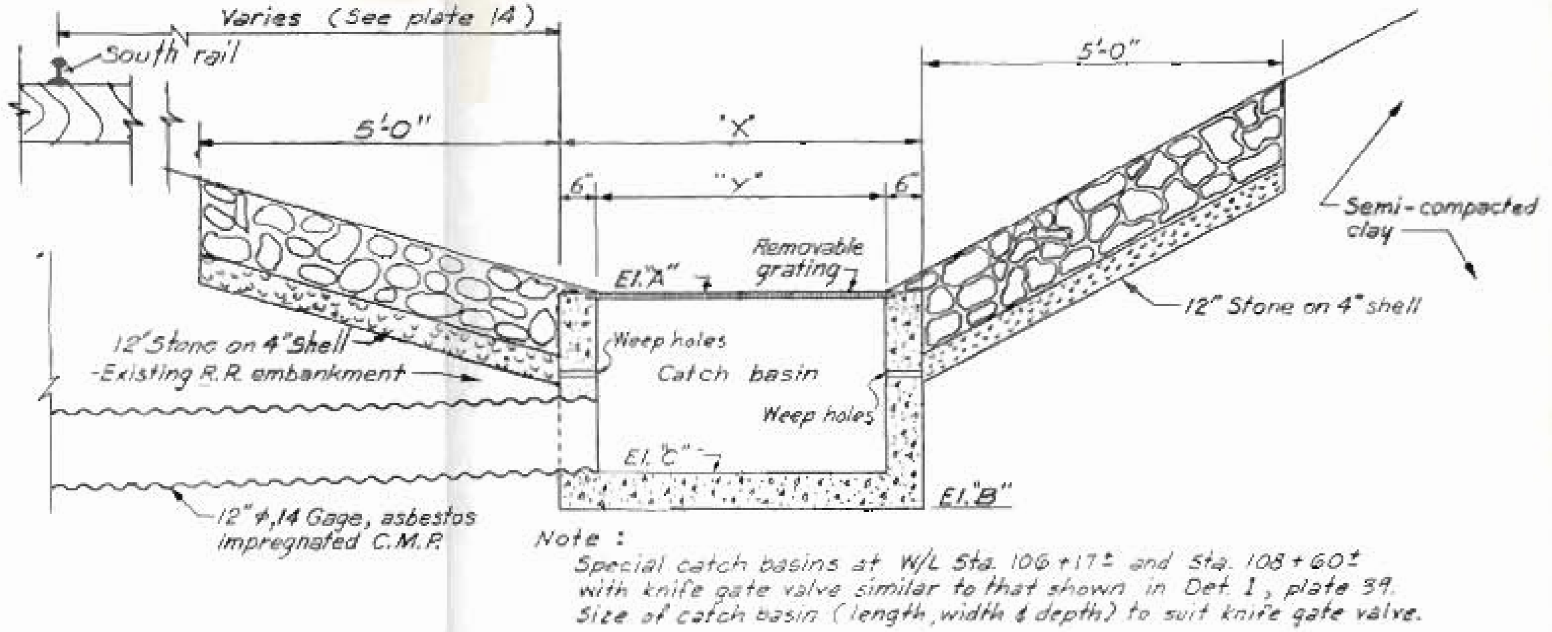
MAY 1976

FILE NO. H-2-26533



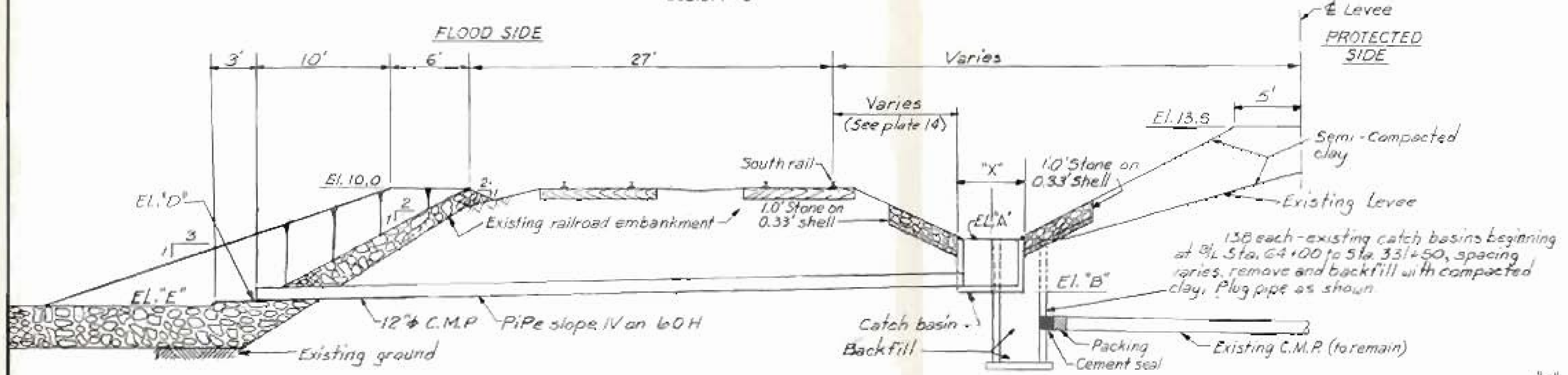
Note:
Install catch basin and drain pipe at 600 foot intervals beginning at Sta. 69+00 and ending at Sta. 329+00.

PLAN
TYPICAL AT 600' INTERVALS BEGINNING AT STA. 69+00
Scale: 1"=5'



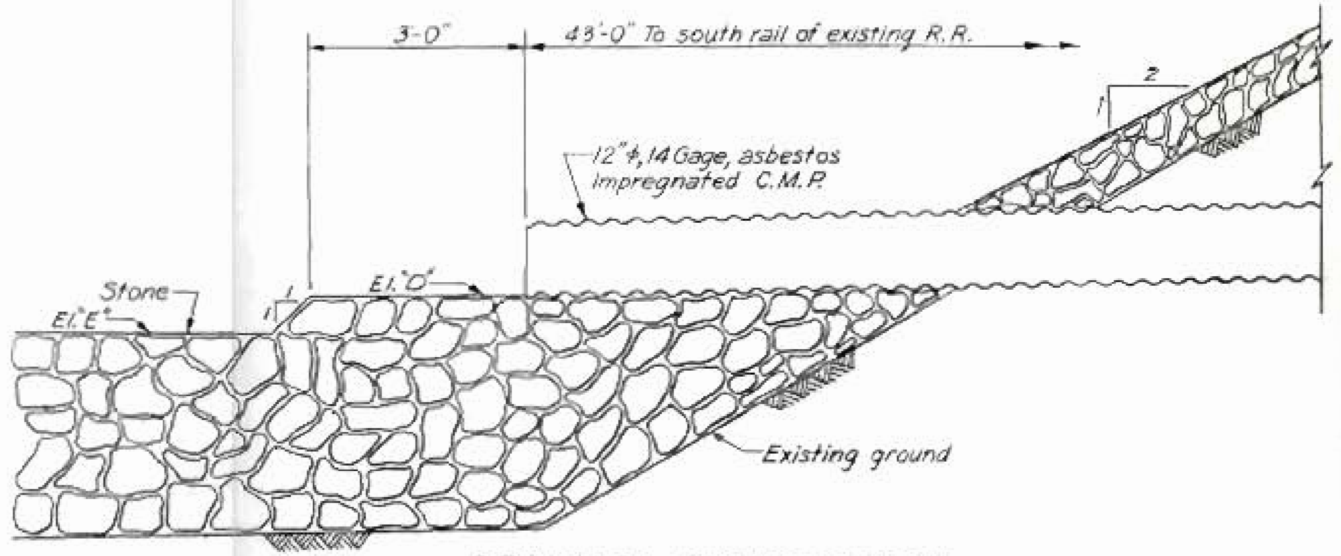
Note:
Special catch basins at W/L Sta. 106+17± and Sta. 108+60± with knife gate valve similar to that shown in Det. 1, plate 39. Size of catch basin (length, width & depth) to suit knife gate valve.

SECTION THRU CATCH BASIN
Scale: 3/4"=1'-0"



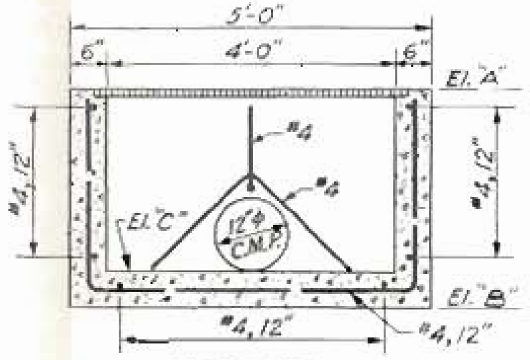
Note:
12" Drain pipe to be jacked thru existing railroad embankment.

SECTION AT DRAIN PIPE
Scale: 1"=5'

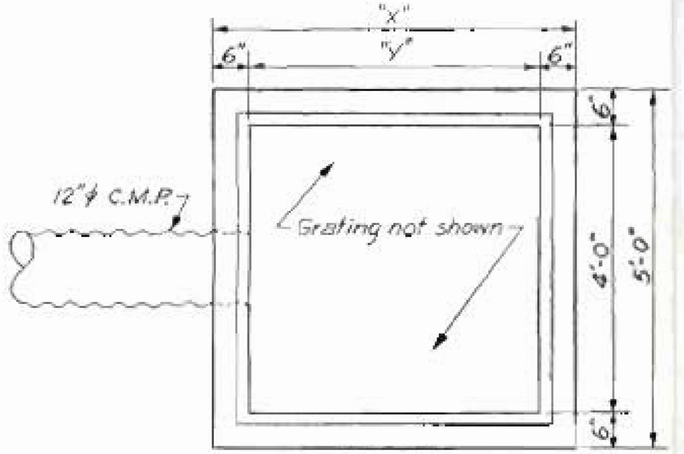


DRAINAGE OUTLET DETAIL
Scale: 3/4"=1'-0"

LOCATION AND SIZE CATCH BASINS								
Sta. at Catch Basin ℄	No. Req.	X	Y	EL."A"	EL."B"	EL."C"	EL."D"	EL."E"
69+00, 86+00, 92+00, 155+00, 156+00 172+00, 178+00, 184+00, 196+00 226+00, 238+00, 256+00 262+00 280+00, 305+00 TO 329+00	19	3.5'	2.5'	6	2.5	3.0	2.0	1.5
116+00 TO 128+00	3	3.5'	2.5'	5	2.0	2.5	1.5	1.0
74+00, 80+00 98+00 104+00 166+00, 190+00 202+00, TO 220+00 232+00, 244+00 250+00 268+00 274+00 288+25	16	5'	4.0'	6	2.5	3.0	2.0	1.5
110+00, 134+00, TO 146+00	4	5'	4.0'	5	2.0	2.5	1.5	1.0



SECTION



PLAN

CATCH BASIN
Scale: 3/4"=1'-0"

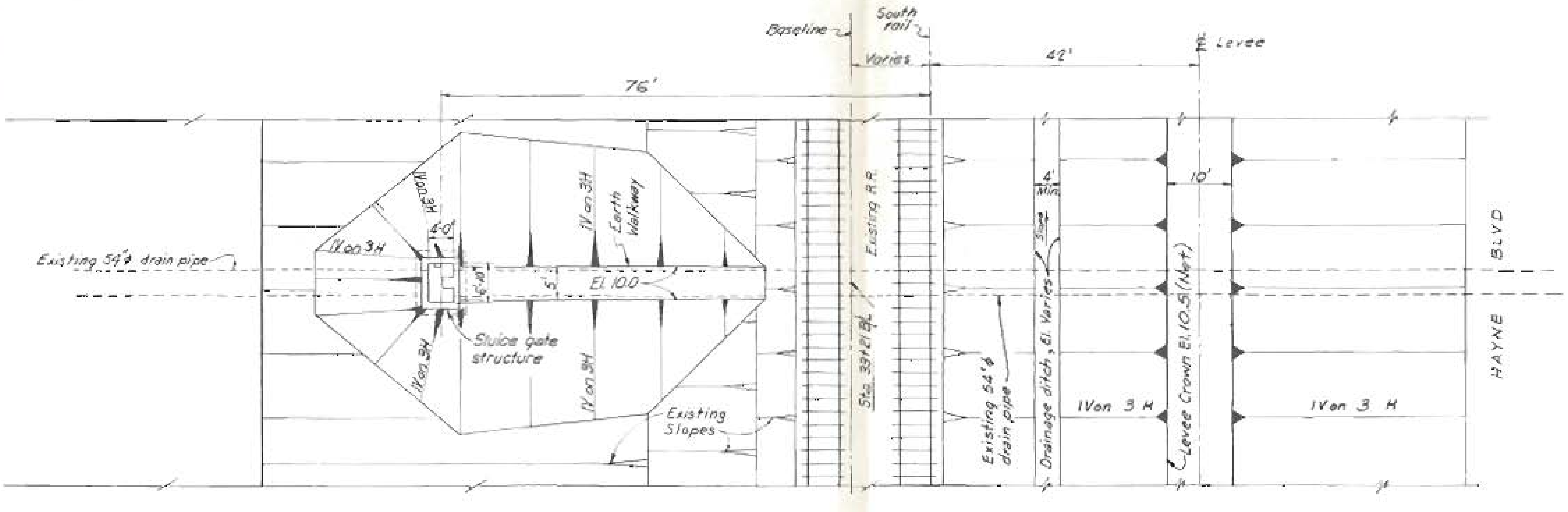
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 5A

CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

LEVEE DRAINAGE DETAILS
STA. 64+00 B/L TO STA. 331+50 B/L

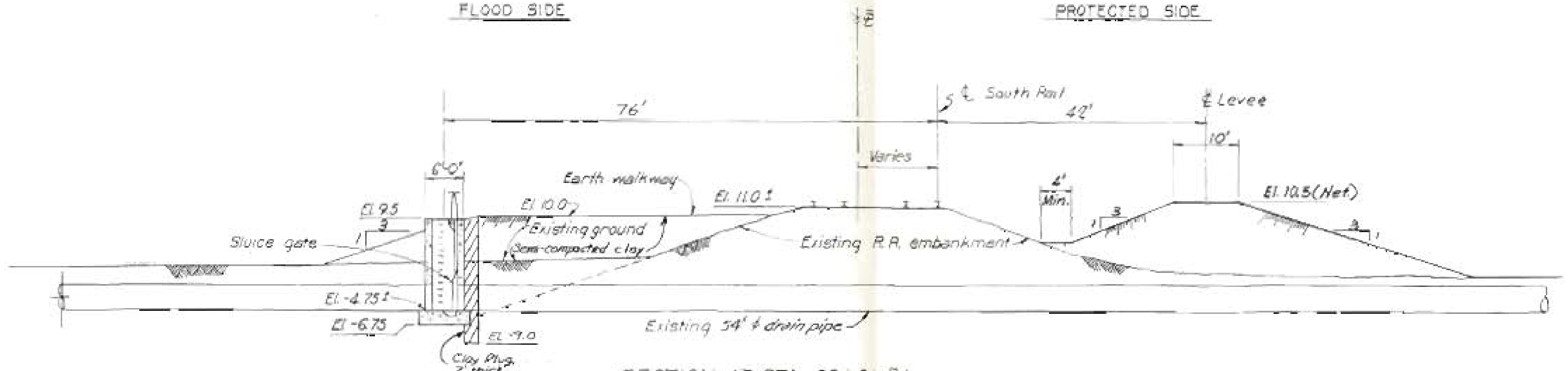
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

MAY 1976 FILE NO. H-2-26533



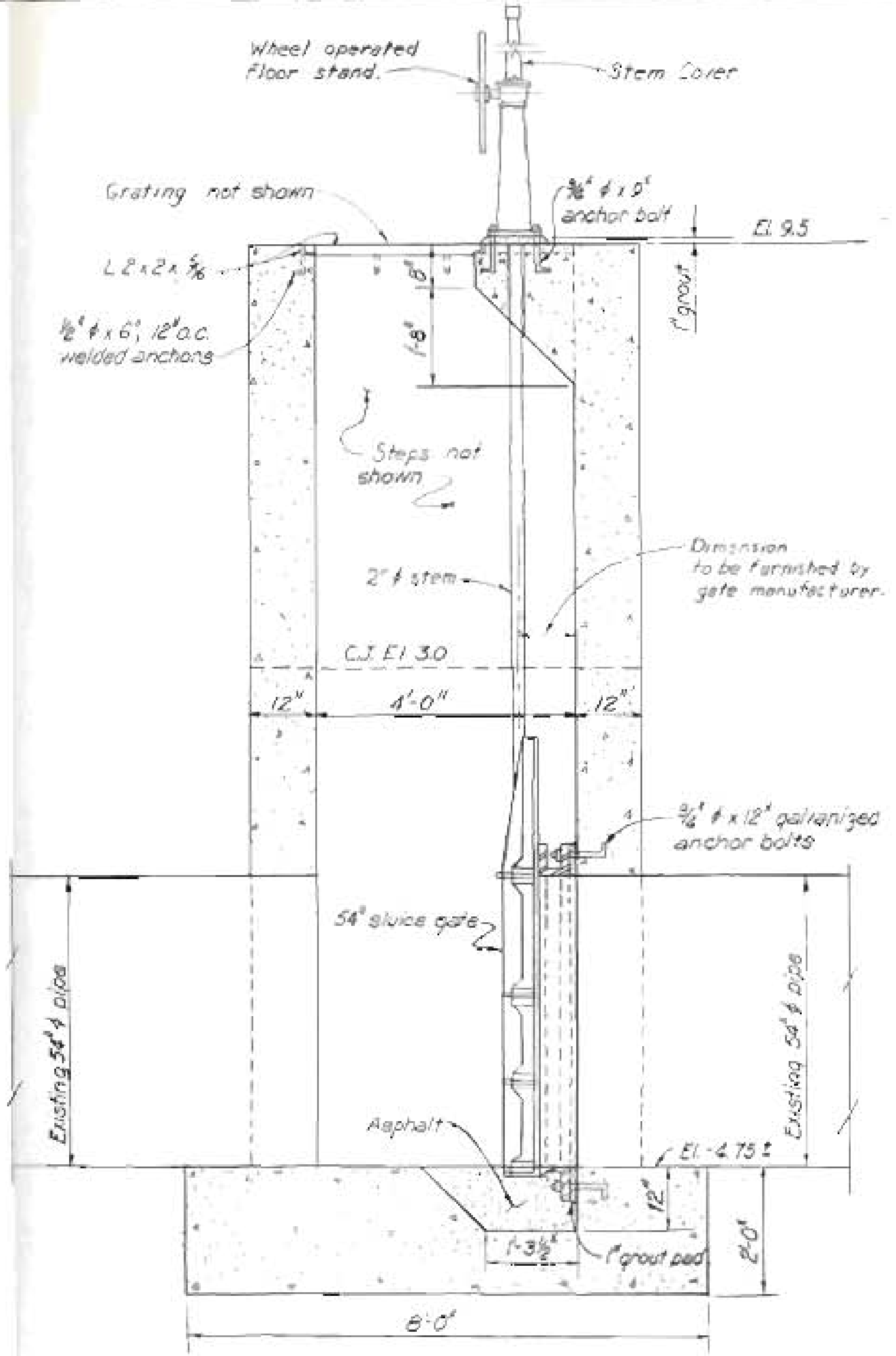
PLAN

Scale: 1" = 10'



SECTION AT STA. 33+21 B/L

Scale: 1" = 10'



SLUICE GATE DETAIL

Scale: 3/4" = 1'-0"

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

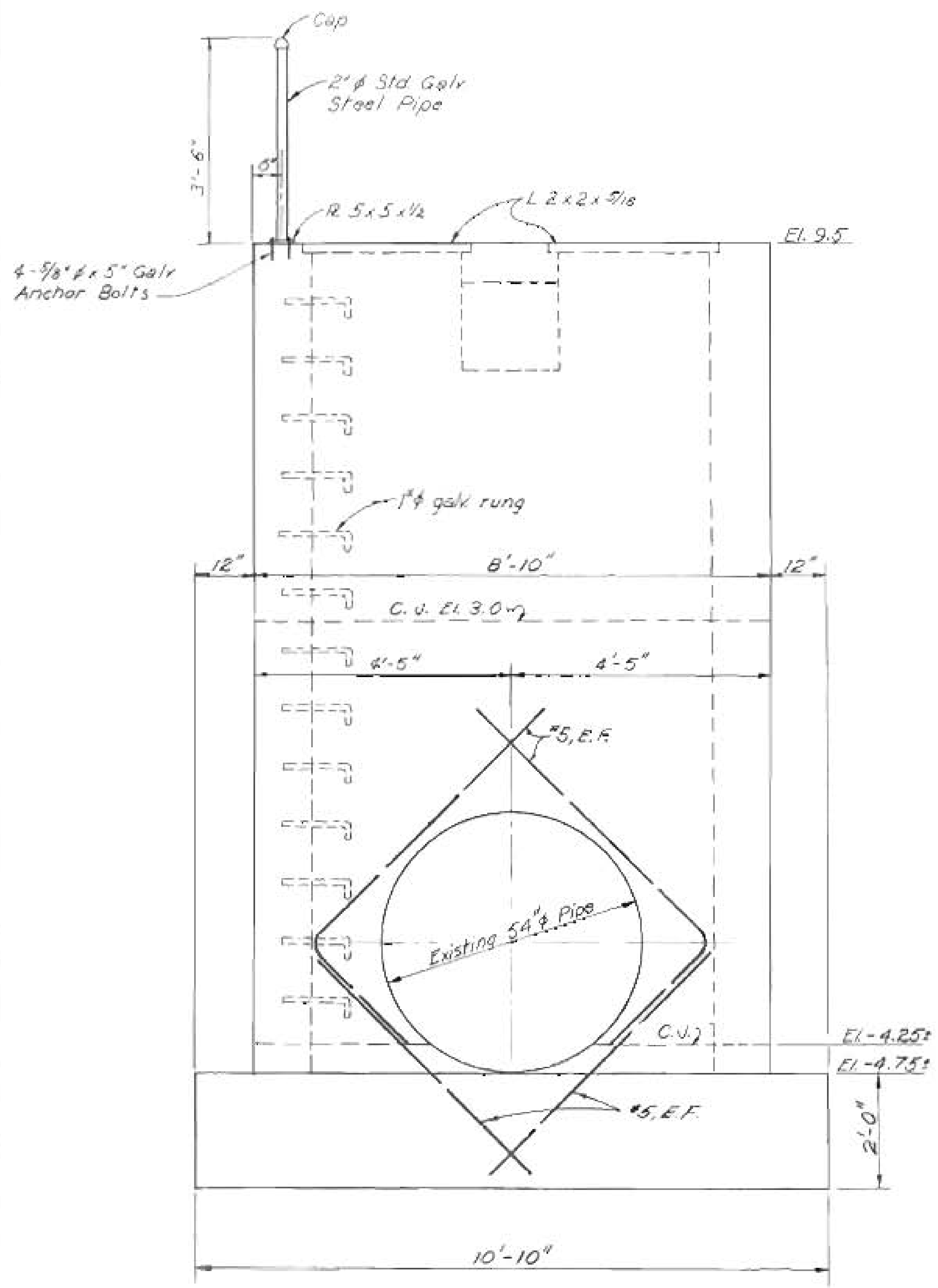
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

AIRPORT DRAINAGE
CONTROL STRUCTURE

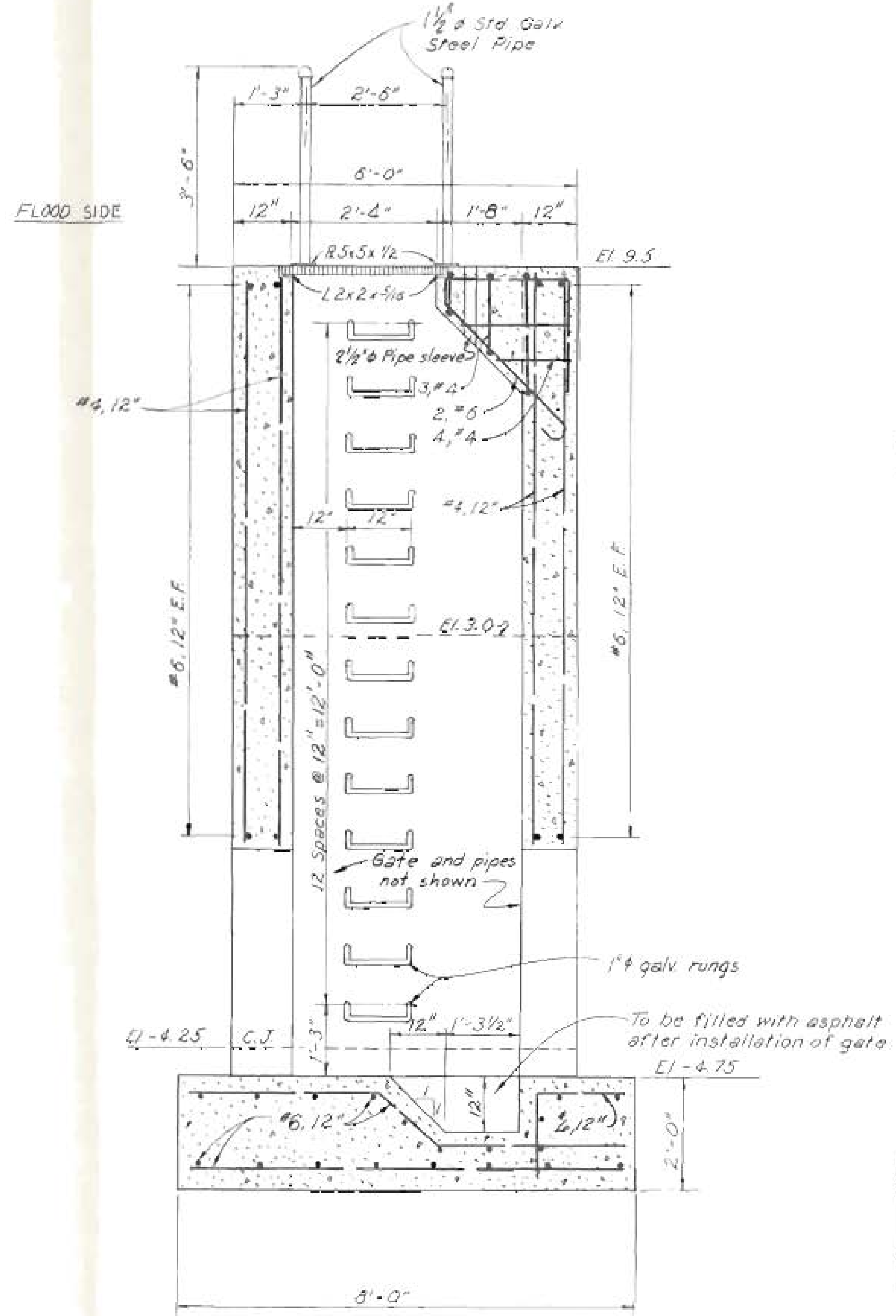
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

MAY 1976

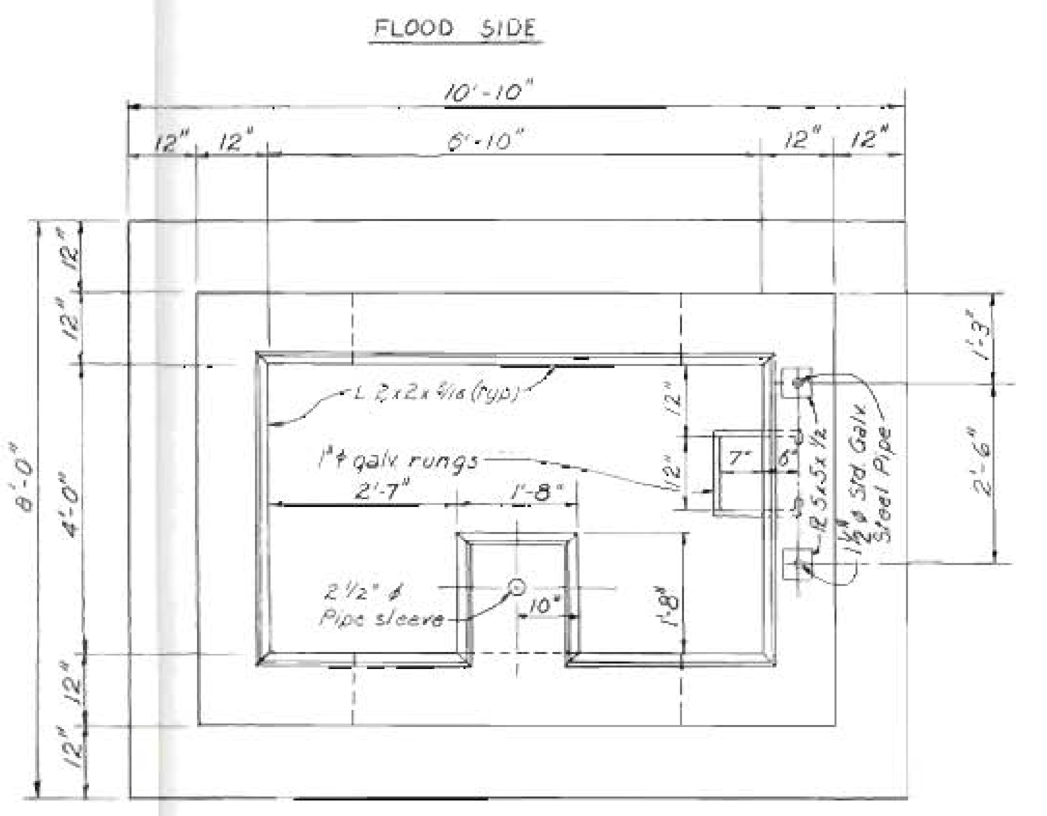
FILE NO. H-2-26633



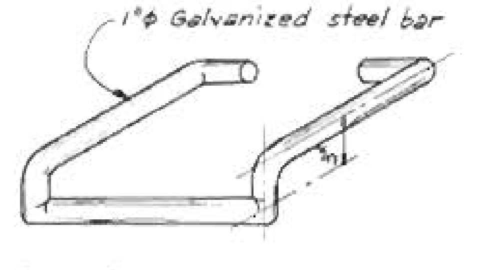
FLOOD SIDE ELEVATION
Scale: 3/4" = 1'-0"



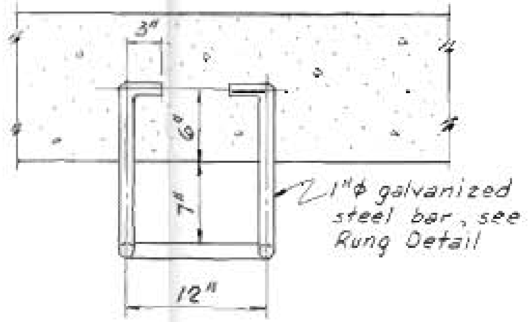
SECTION AT ℄ PIPE
Scale: 3/4" = 1'-0"



PLAN
Scale: 3/4" = 1'-0"



RUNG DETAIL
N.T.S.



PLAN
Scale: 1 1/2" = 1'-0"

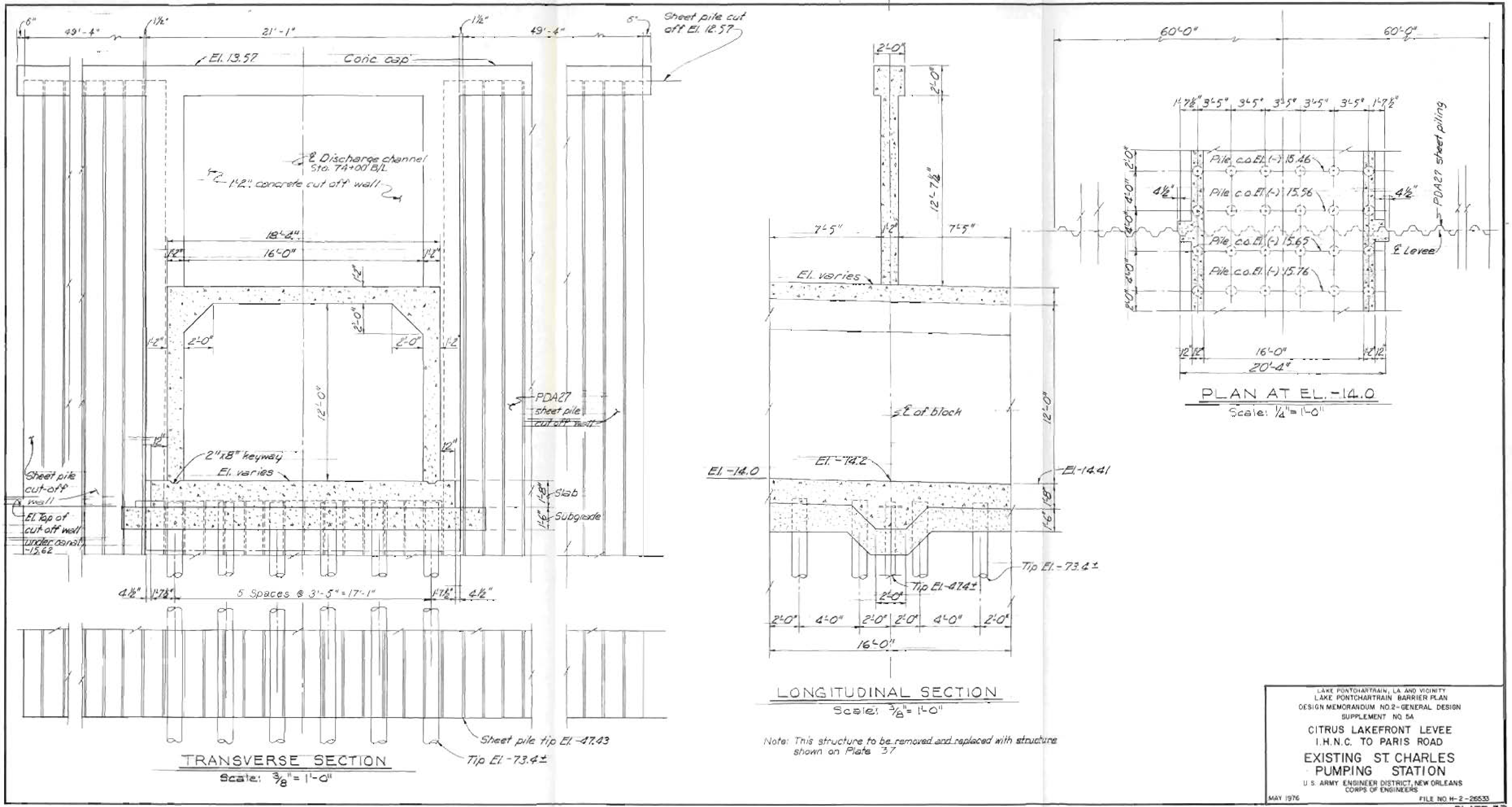
LAKE PONTCHARTRAIN, LA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO 2 - GENERAL DESIGN
SUPPLEMENT NO 5A

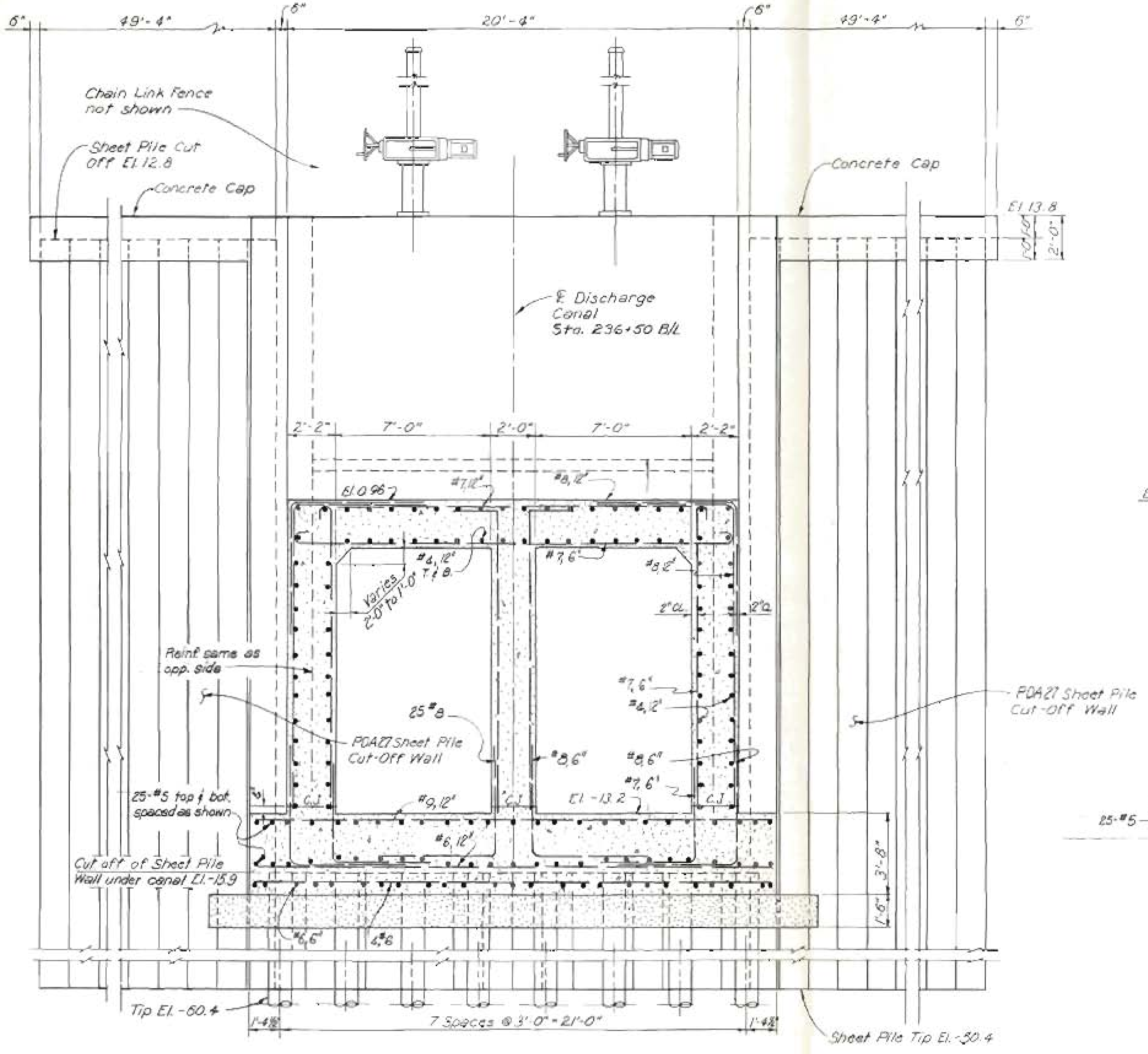
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD
AIRPORT DRAINAGE
CONTROL STRUCTURE

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

MAY 1976
FILE NO H-2-26533

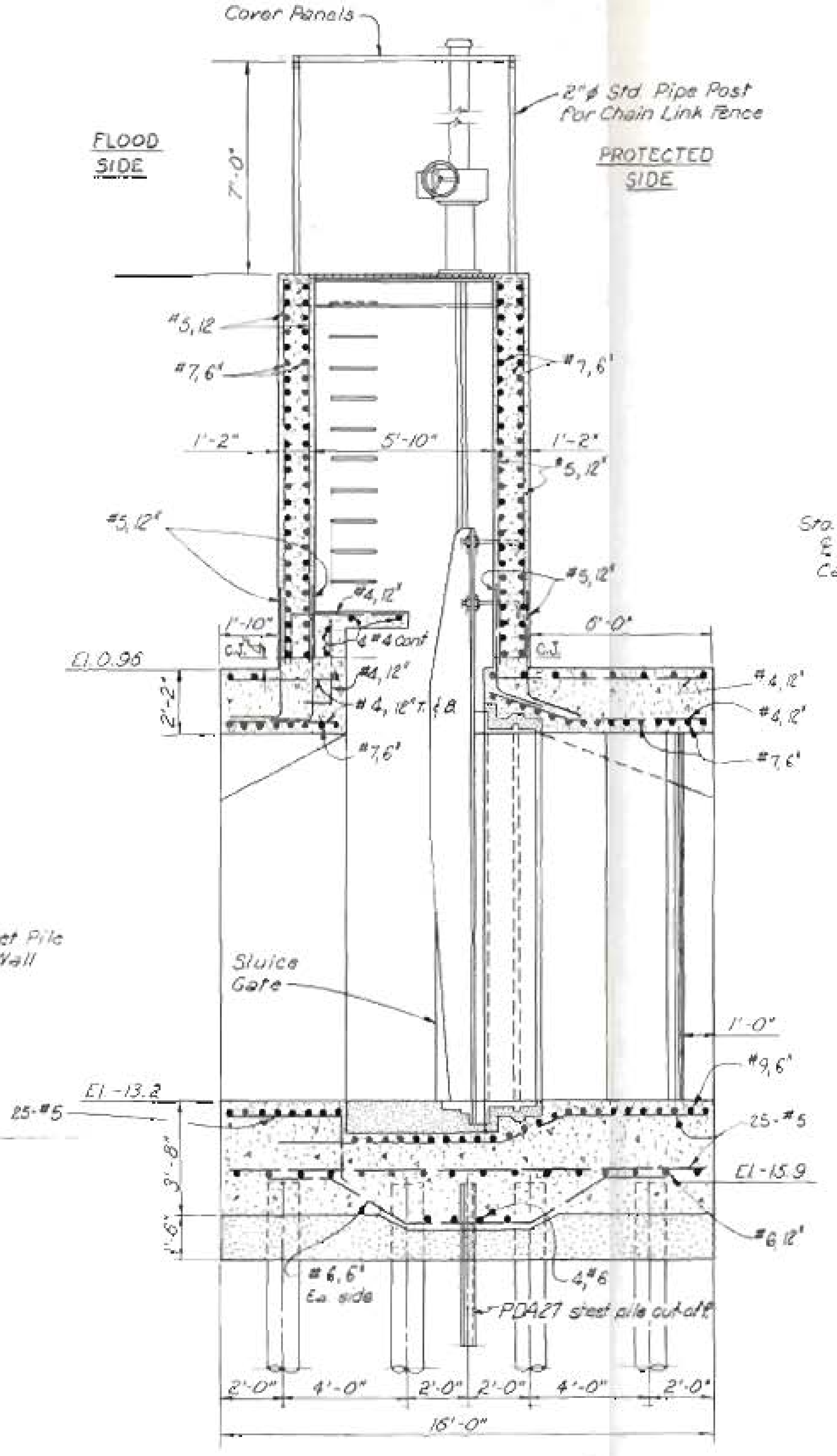
PLATE 36


Sheet pile cut off El. 12.57
El. 13.57
Conc cap
℄ Discharge channel Sta. 74+00 B/L
1'-2" concrete cut off wall
18'-4"
16'-0"
2'-0"
12'-0"
2"x8" keyway
El. varies
Sheet pile cut-off wall
El. Top of cut off wall under canal -15.62
PDA27 sheet pile cut off wall
Slab
Subgrade
5 Spaces @ 3'-5" = 17'-1"
Sheet pile tip El. -47.43
Tip El. -73.4±
TRANSVERSE SECTION
Scale: 3/8" = 1'-0"
7'-5"
El. varies
℄ of block
El. -14.0
El. -14.2
El. -14.41
Tip El. -73.4±
Tip El. -47.4±
16'-0"
LONGITUDINAL SECTION
Scale: 3/8" = 1'-0"
Note: This structure to be removed and replaced with structure shown on Plate 37
60'-0"
Pile c.o.El. (-) 15.46
Pile c.o.El. (-) 15.56
Pile c.o.El. (-) 15.65
Pile c.o.El. (-) 15.76
PDA27 sheet piling
℄ Levee
20'-4"
PLAN AT EL. -14.0
Scale: 1/4" = 1'-0"
LAKE PONTCHARTRAIN, LA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD
EXISTING ST. CHARLES PUMPING STATION
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MAY 1976
FILE NO. H-2-26533
PLATE 37



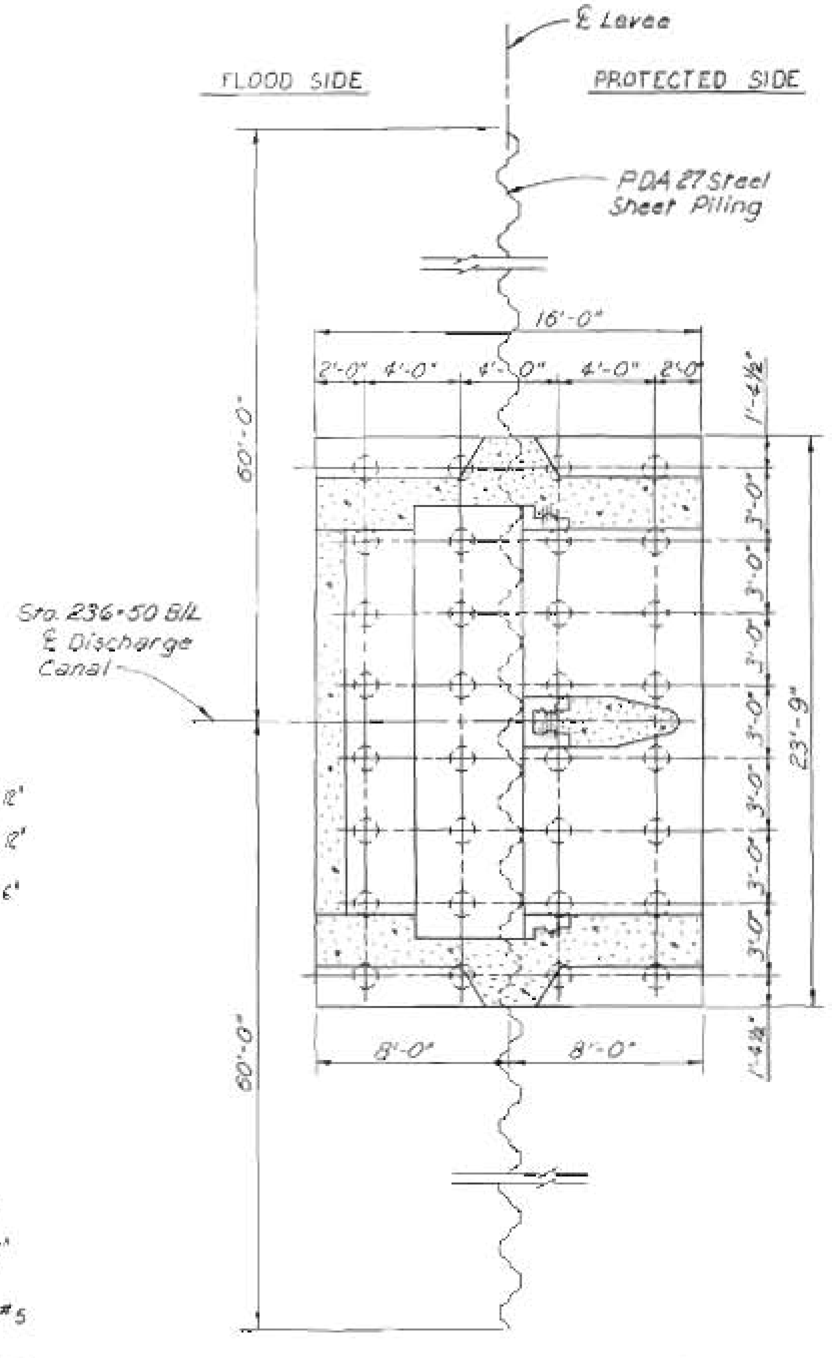
TRANSVERSE SECTION

Scale: 3/8" = 1'-0"



LONGITUDINAL SECTION

Scale: 3/8" = 1'-0"



PLAN AT EL. -13.0

Scale: 1/4" = 1'-0"

LAKE PONTCHARTRAIN, LA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

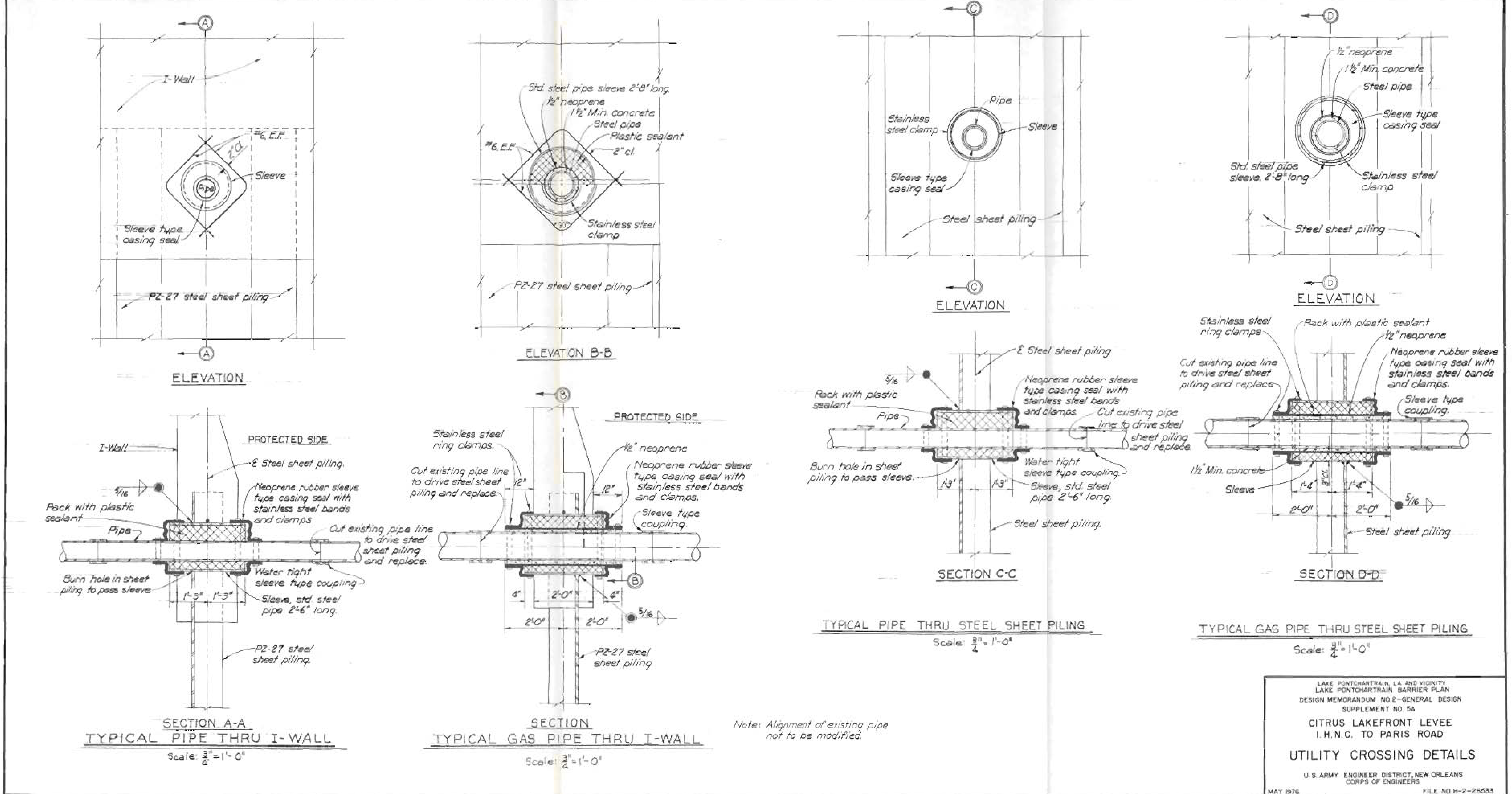
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

EXISTING JAHNCKE
PUMPING STATION

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

MAY 1976 FILE NO. H-2-26533

PLATE 38



LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 – GENERAL DESIGN
SUPPLEMENT NO. 5A

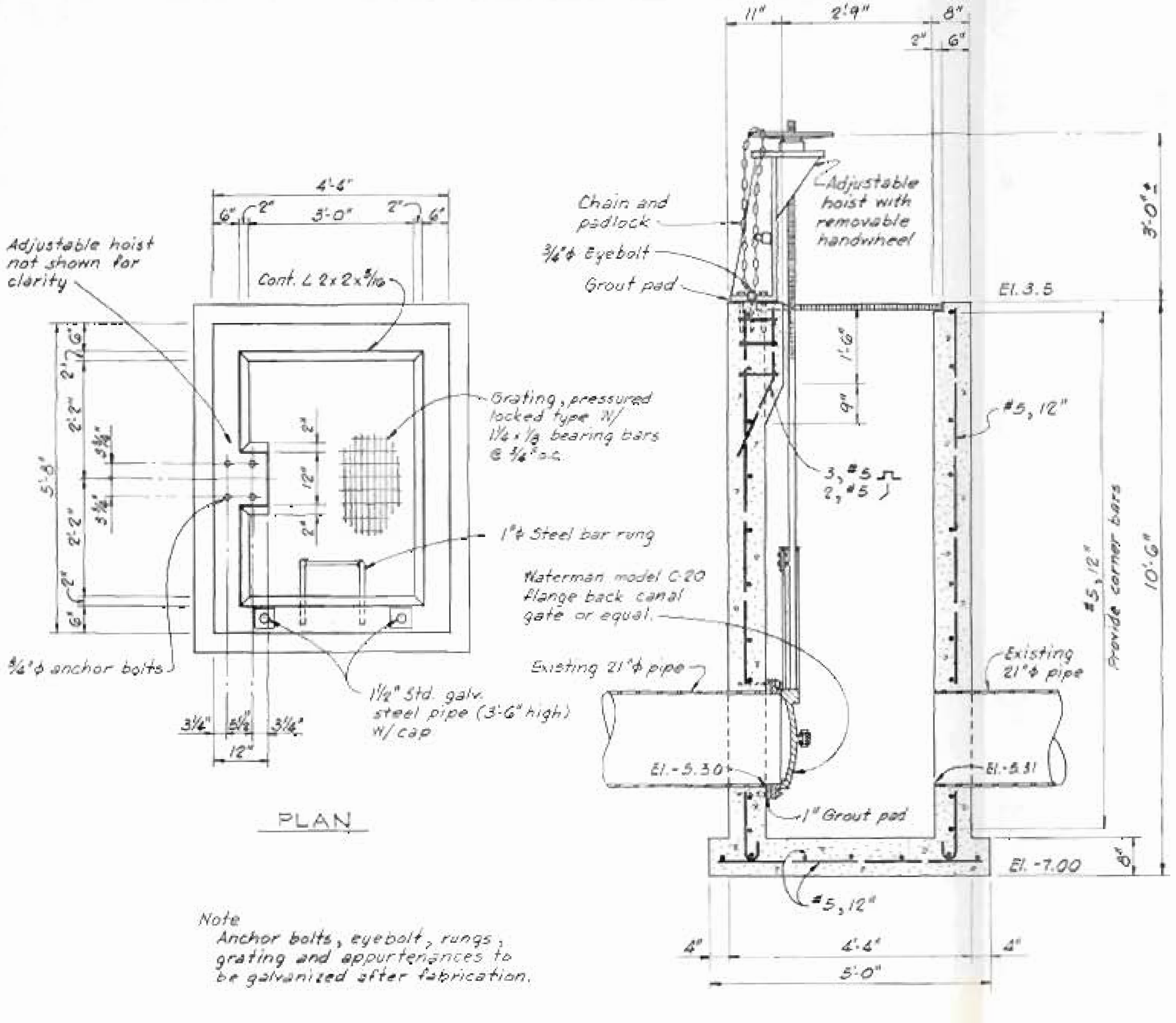
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

UTILITY CROSSING DETAILS

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

MAY 1976 FILE NO. H-2-26533

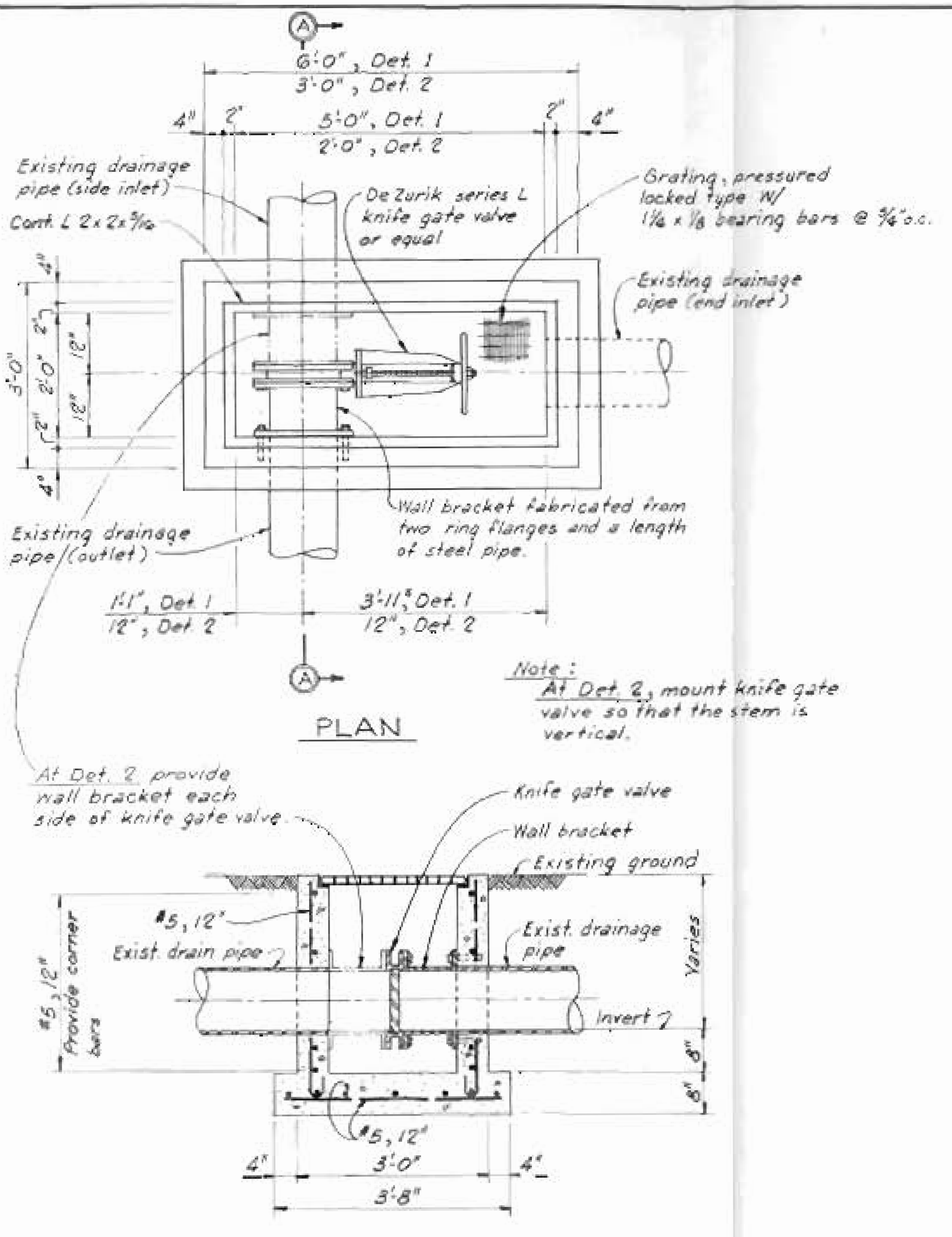
PLATE 39



Note
Anchor bolts, eyebolt, rungs, grating and appurtenances to be galvanized after fabrication.

CANAL GATE MANHOLE

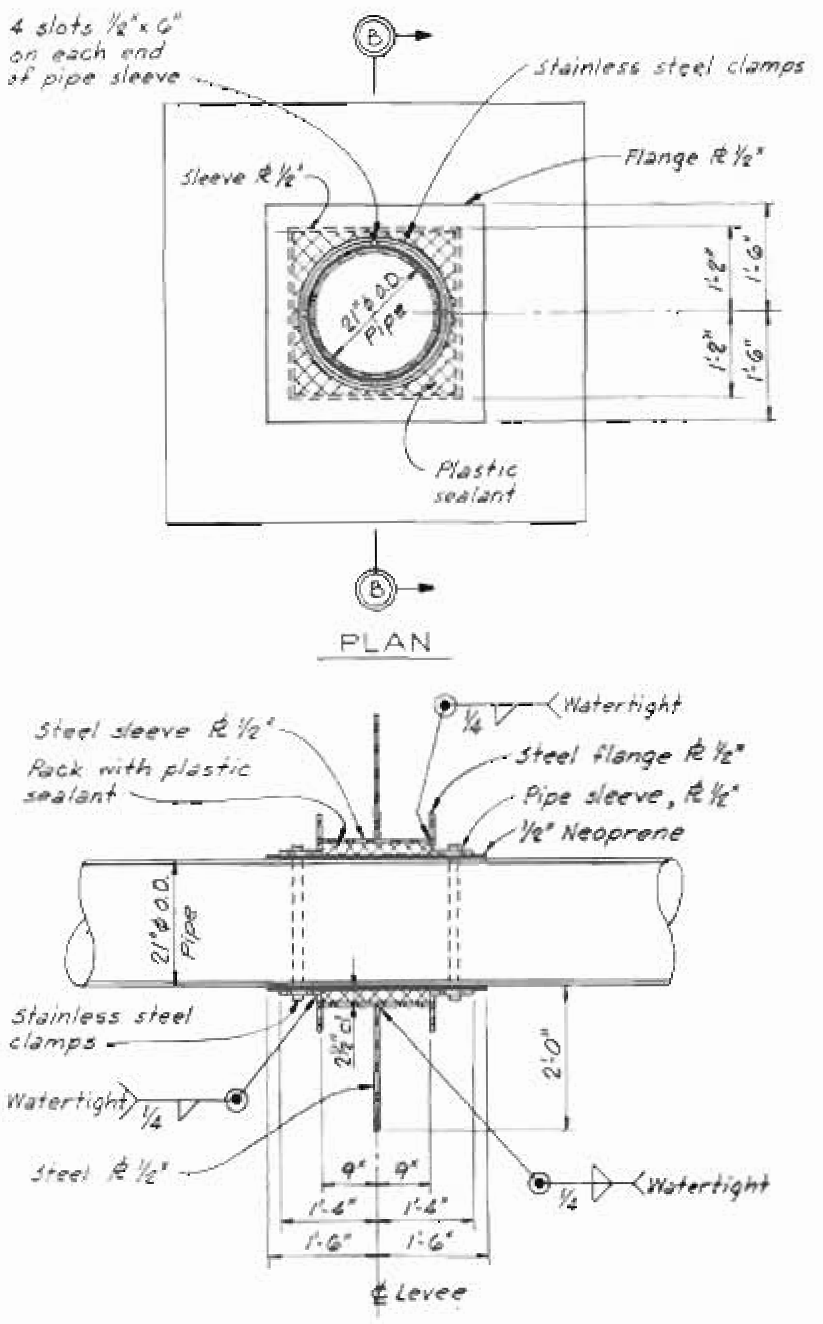
Scale : ¾" = 1'-0"



DETAILS 1 AND 2

KNIFE GATE VALVE MANHOLE

Scale : ¾" = 1'-0"



21"ϕ DRAIN PIPE THRU LEVEE

Scale : ¾" = 1'-0"

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 – GENERAL DESIGN
SUPPLEMENT NO. 5A

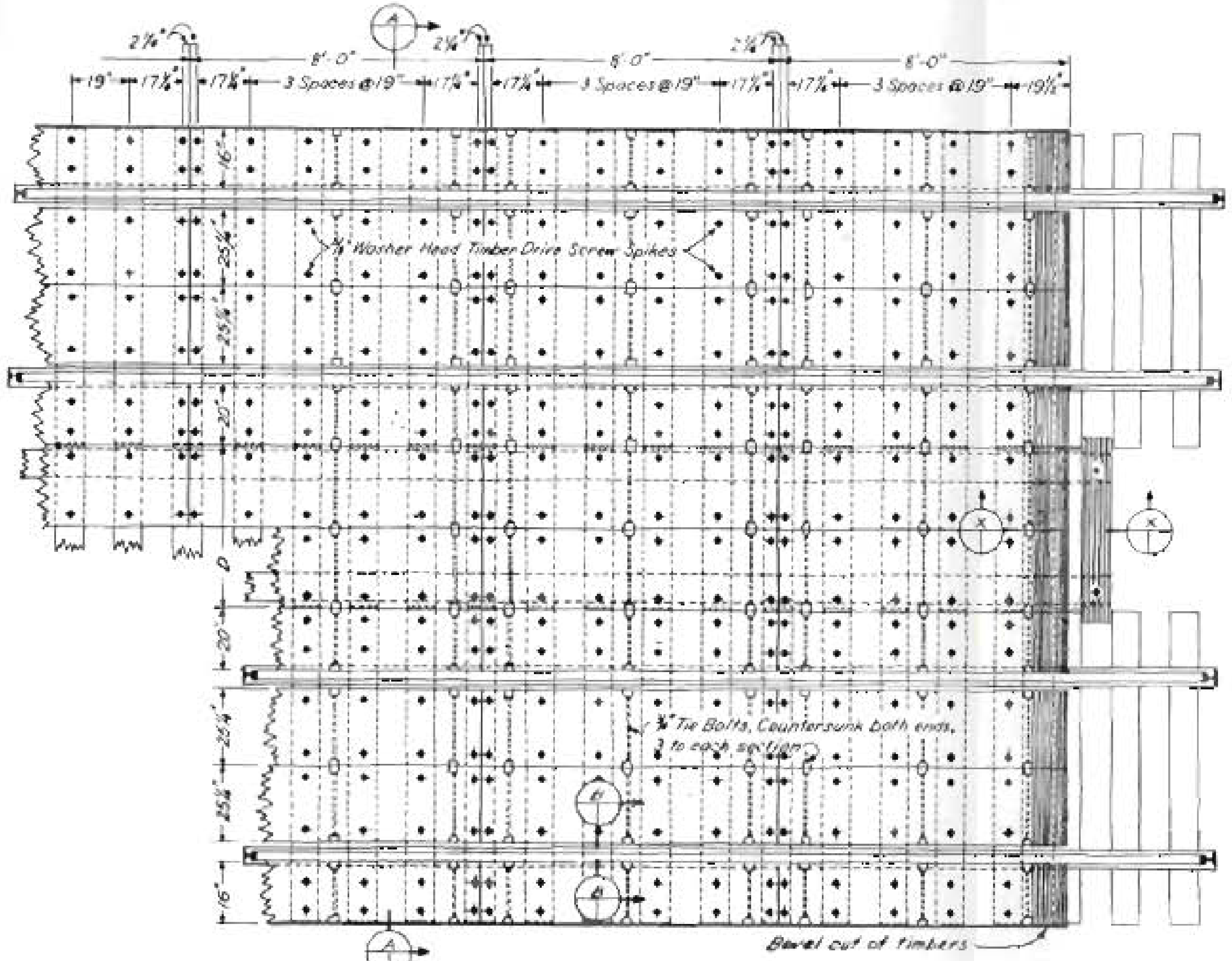
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD
UTILITY CROSSING
AND MANHOLE DETAILS

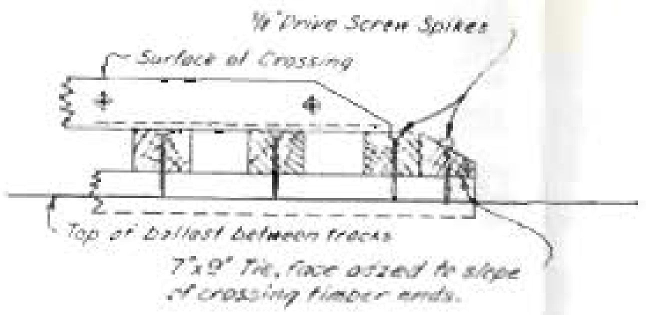
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

MAY 1976

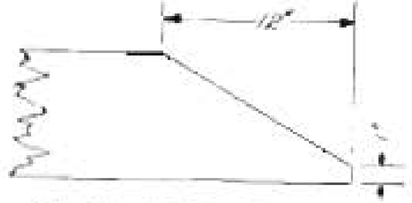
FILE NO. H-2-25533

PLATE 40

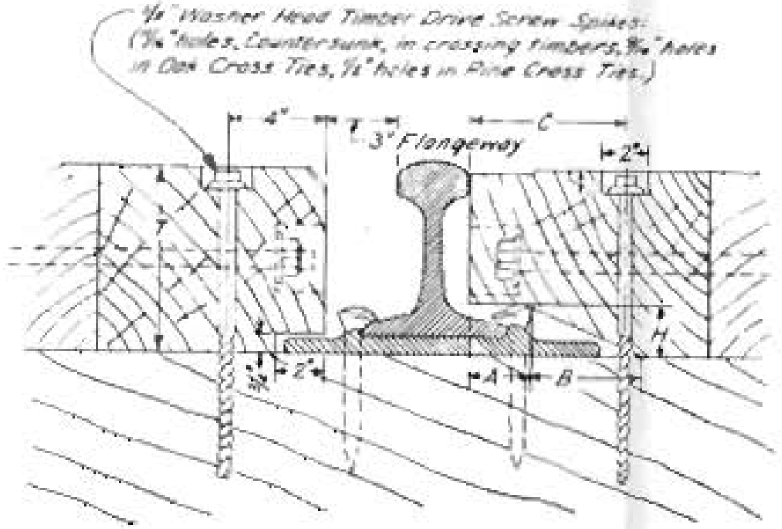




SECTION X

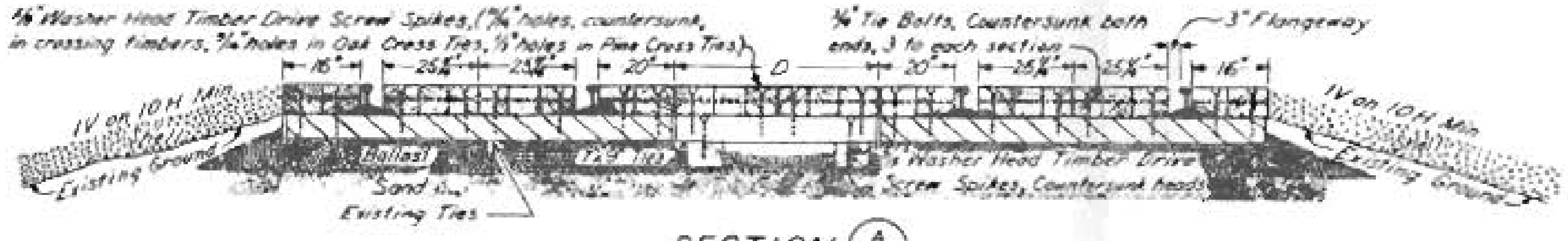


BEVEL CUT OF TIMBERS AT END OF CROSSING



SECTION B

Weight of Rail, Lbs. per yd	100#
Thickness of Timbers "T"	6½"
Dimension A, Section B	2⅜"
Dimension B, Section B	3⅝"
Dimension C, Section B	6"
Dimension H, Section B	1⅝"
Length of Spike Required	12"



SECTION A

TIMBER MAT FOR RIGHT ANGLE CROSSING
OVER EXISTING DOUBLE TRACKS

NOTES:

1. Timber to be gum, pine or oak sized on one face only, shaped and bored. Countersunk spike holes to be sealed with mastic after spikes are driven.
2. Timber mat and adjacent shell ramp to be constructed across existing ties and tracks, in the vicinity of stockpile area.
3. Crossing to be constructed at right angle to existing tracks.
4. Width of crossing is 32 feet, out to beveled end timbers.
5. The distance between track centers and the dimension "D," both to be determined in the field at the location of crossing.
6. Grade crossing to conform with 100 lb./yd. rail.
7. All drawings on this plate are drawn "not to scale".
8. B "B" Section identification letter.
   Number of plate from which section is taken.
   Number of plate on which section is drawn.

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

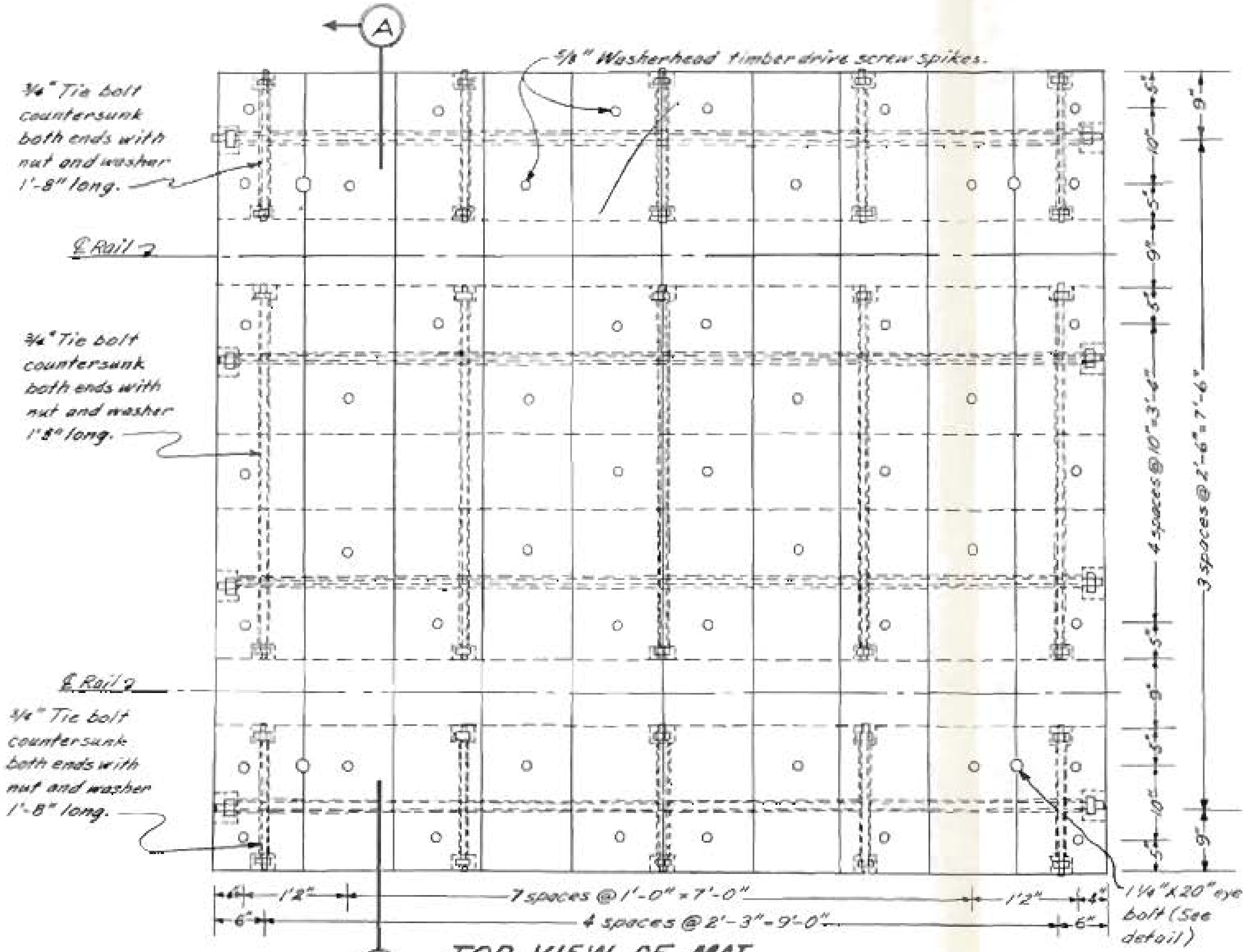
RAILROAD CROSSING
AT BARGE FACILITY

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

MAY 1976

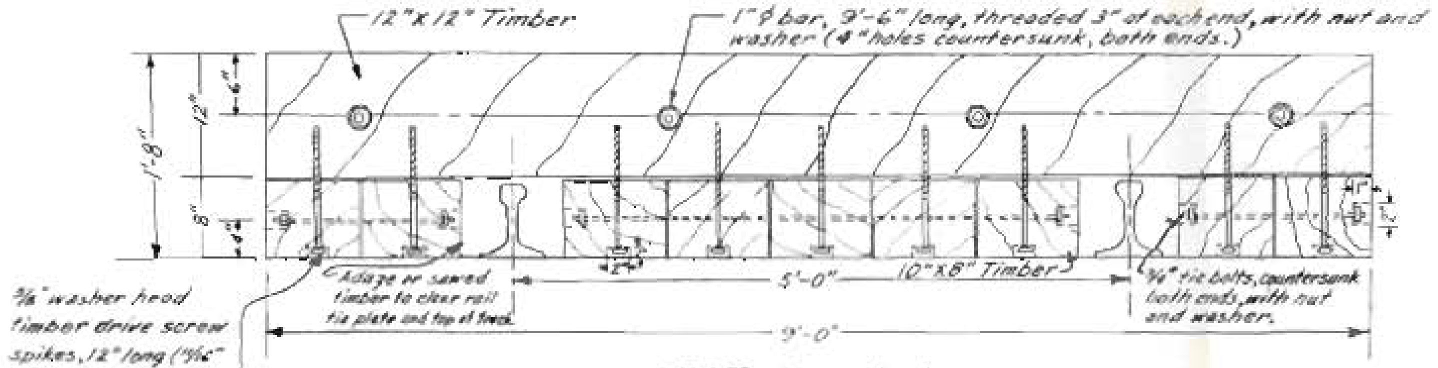
FILE NO. H-2-26533

PLATE 41



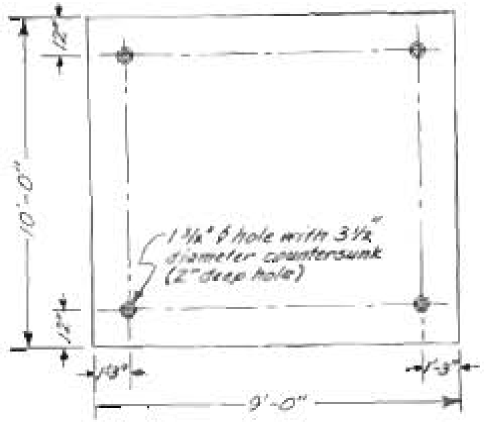
TOP VIEW OF MAT

Not To Scale



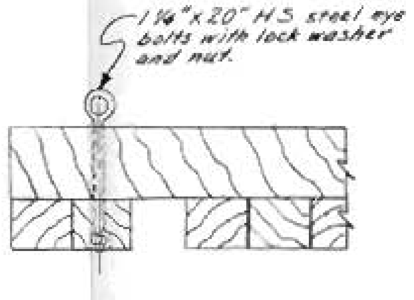
SECTION A-A

Not To Scale



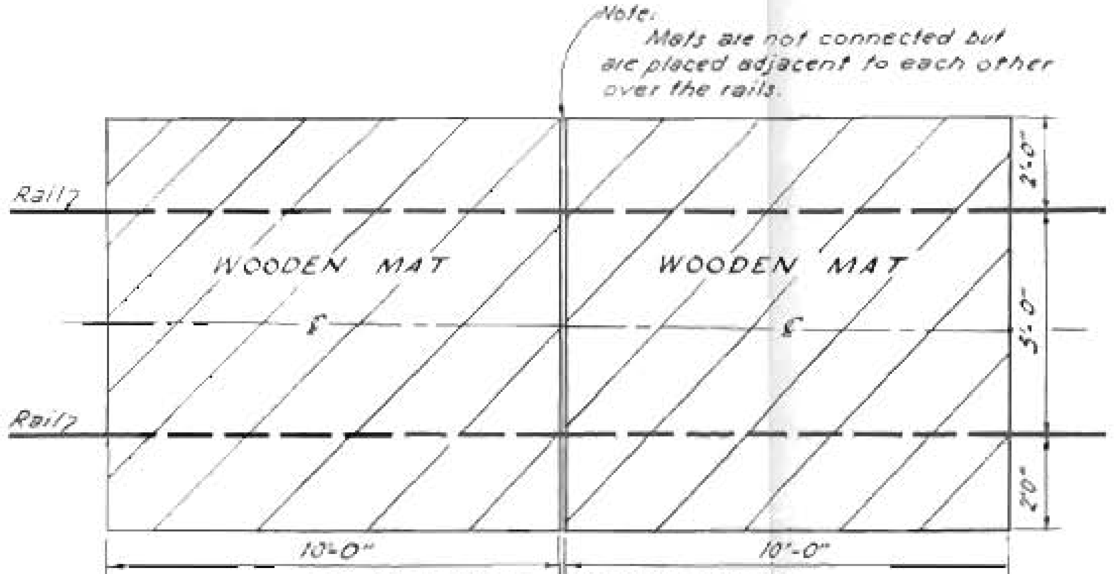
PLAN OF EYE-BOLT LOCATION

Not To Scale



ELEVATION

Not To Scale



PLAN OF MAT PROTECTION

Not To Scale

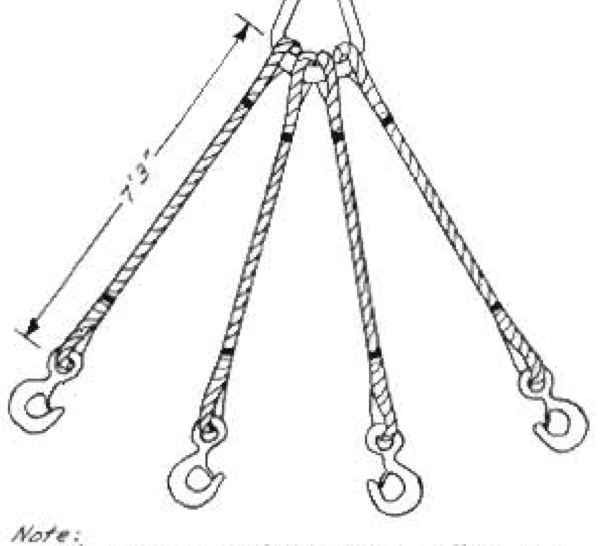
NOTES

1. Wooden mats are to be constructed of oak timber.

2. Track guard mats are to be placed over rails whenever any rock is aerially transported from the landside to the lakeside of railroad tracks during the construction of wave wash protection. Mats shall be placed in such a manner so that rails are not exposed to falling rock whenever machine bucket is swung over the tracks.

3. The use of the wooden mats, as related to safety and passing trains, shall be explicitly stated in the special provisions of the contract specifications.

4. Actual timber dimensions may be rough size or dressed size, except the 8" nominal dimension must be not less than 7 7/8" actual size.



Note:
It is recommended that the operating angle between leg and the vertical be kept below 60 degrees.

4 LEG SLING

Not To Scale

DATA FOR SLING

Diameter (in)	1/2
Cable Construction	7 x 7 x 7
Lope L (in)	4 x 8
Thimble Heavy T (in)	1/2 - 9/16
Hook Eye Hoist H No.	25
Shackle Screw Pin Anchor SPA Size	1/2
Slip Thru Thimble St. No.	3
Armored Loop Al No.	8
Str't. Side Link SSL Size	1 3/8

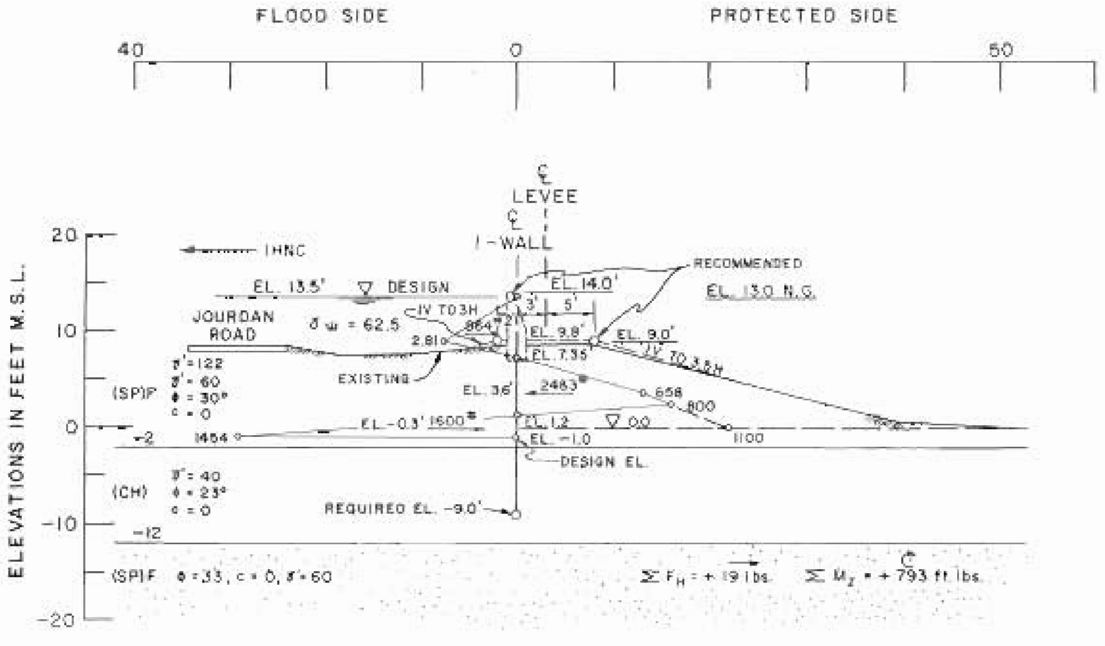
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

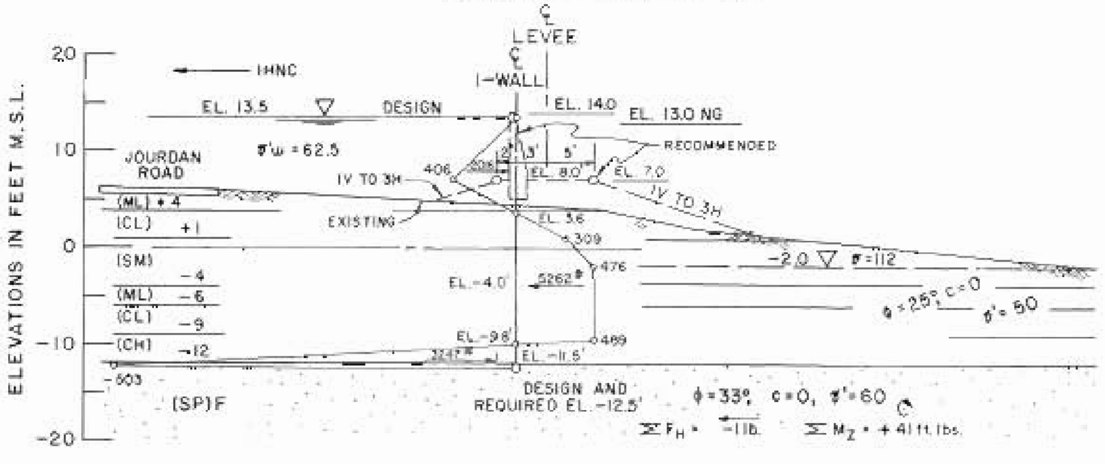
RAILROAD
TRACK GUARD MAT

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

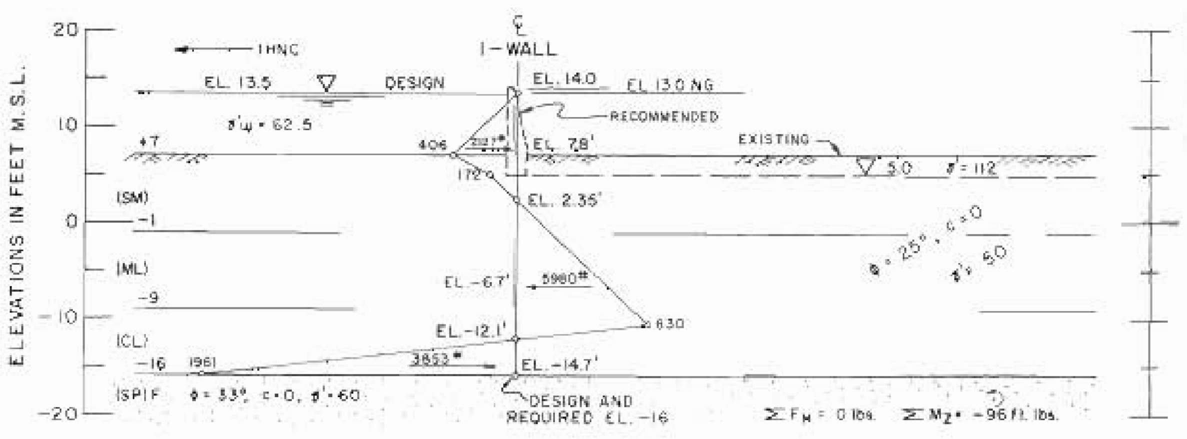
MAY 1976 FILE NO. H-2-26533



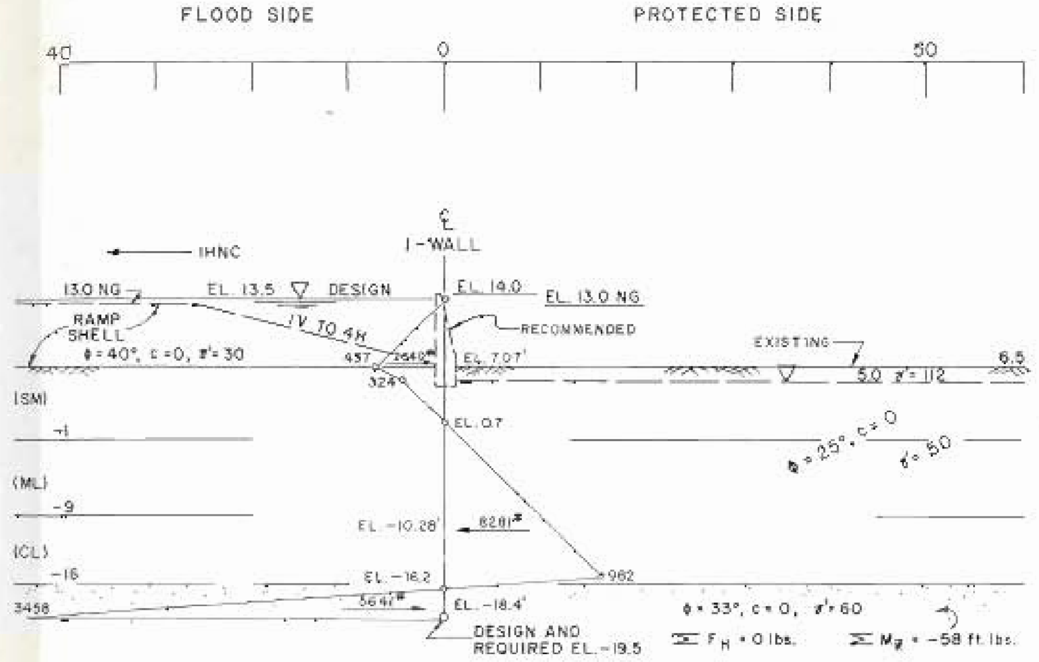
STA. 0+00 TO 1+11 W/L



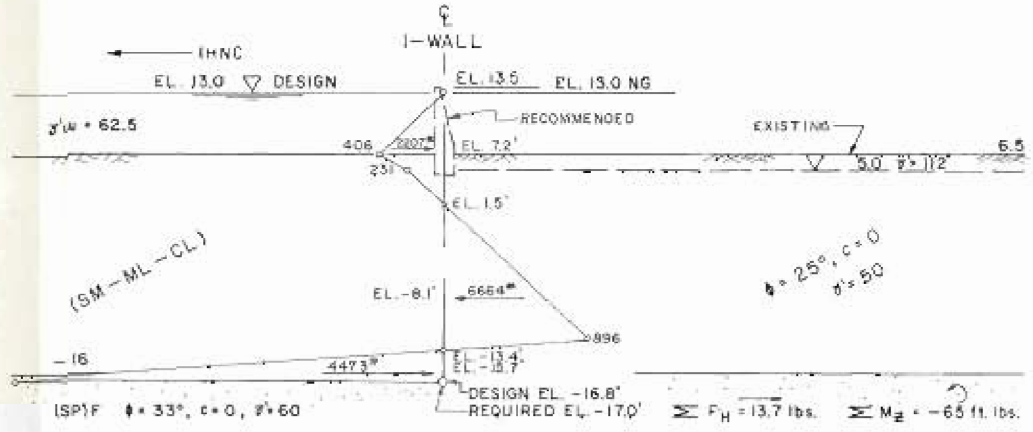
STA. 1+11 TO 2+15.79 W/L



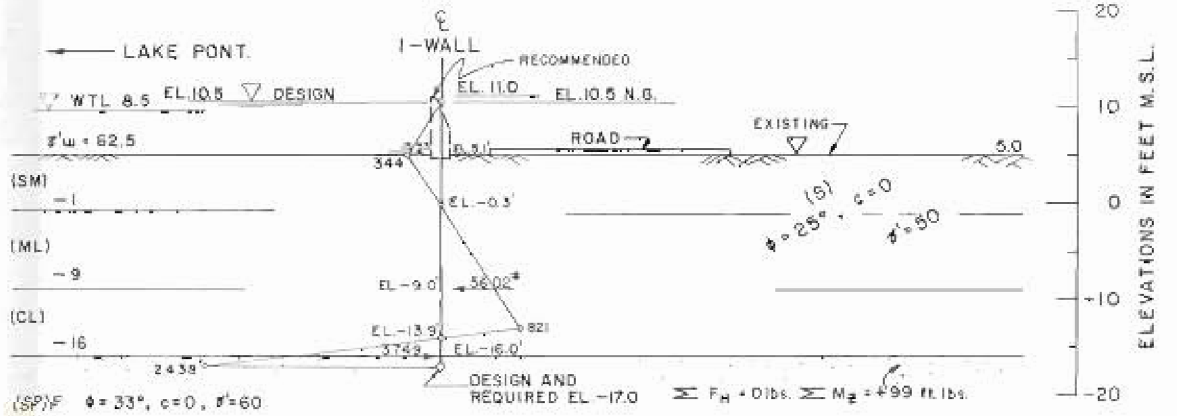
STA. 5+43.38 TO 5+79.38 W/L



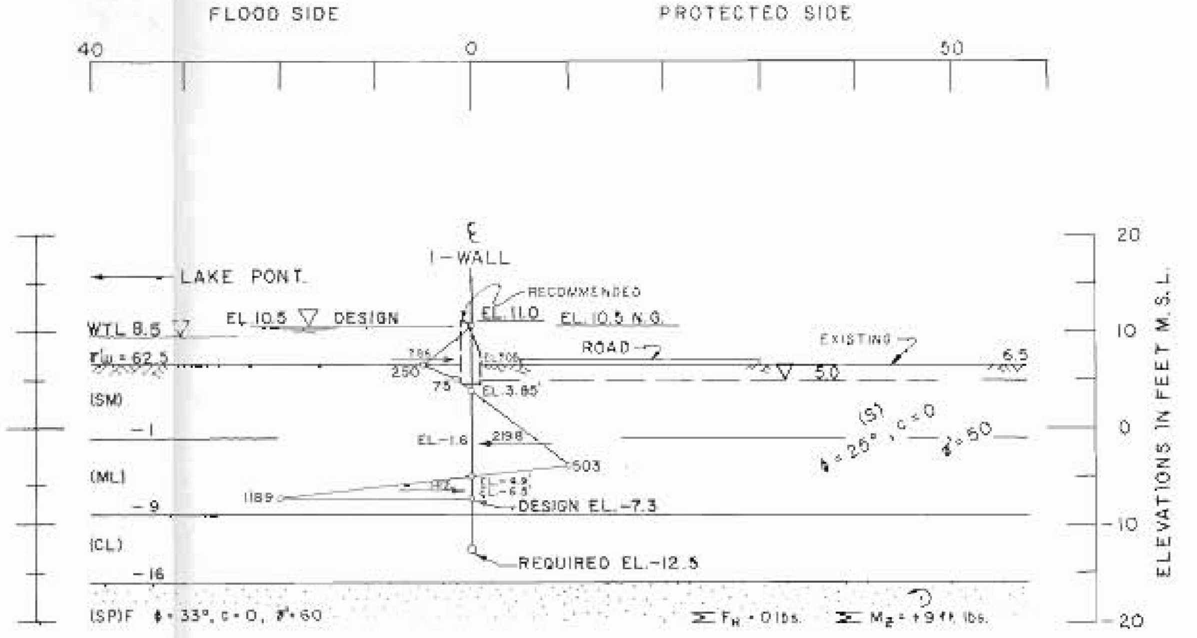
STA. 6+15.38 TO 7+65.38 W/L



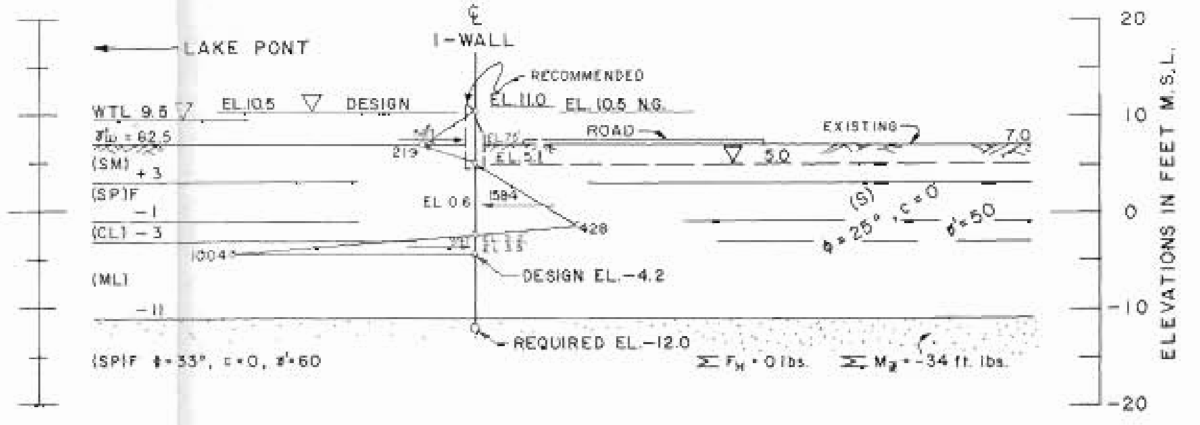
STA. 7+65.38 TO 9+71.20 W/L



STA. 10+13.20 TO 17+40 W/L



STA. 17+40 TO 18+40 W/L



STA. 18+40 TO 22+20 W/L

GENERAL NOTES

(S) CASE GOVERNED FOR SHEAR STABILITY DESIGN.

W/L = WALL STATIONING

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

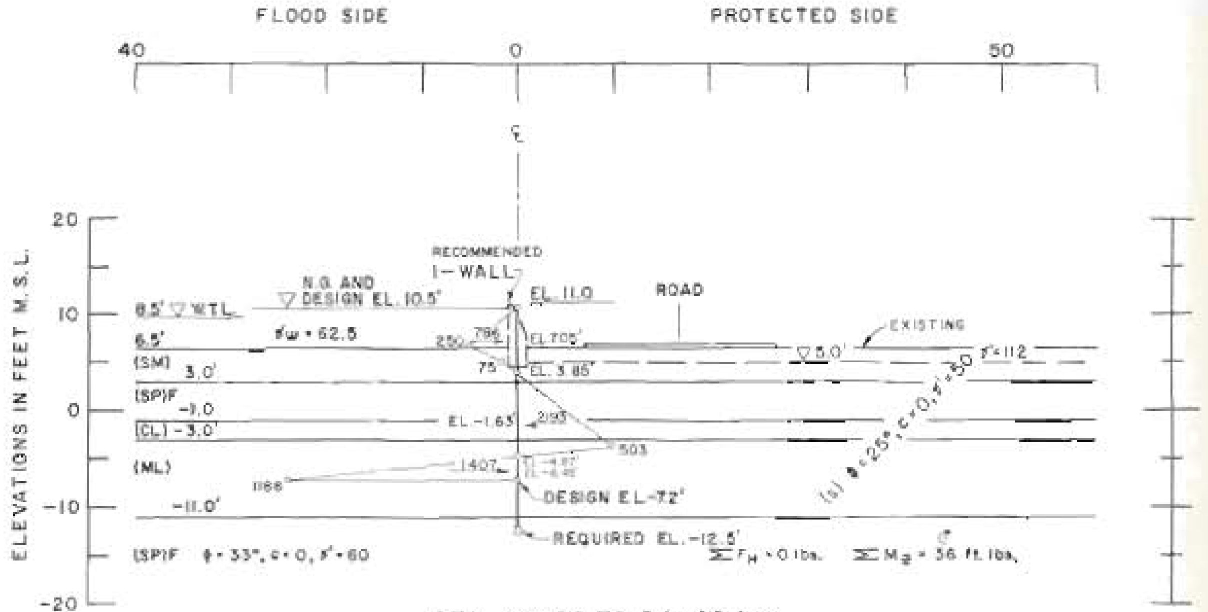
CITRUS LAKEFRONT LEVEE
I. H. N. C. TO PARIS ROAD

CANTILEVER I-WALL ANALYSIS (S-CASE)
STA. 0+00 W/L TO STA. 22+20 W/L

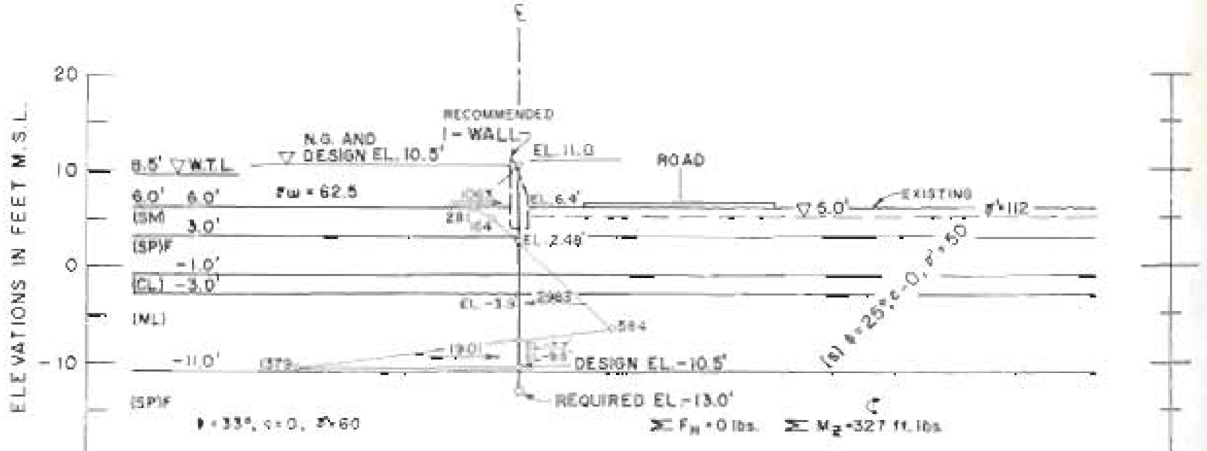
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

MAY 1976 FILE NO. H-2-26533

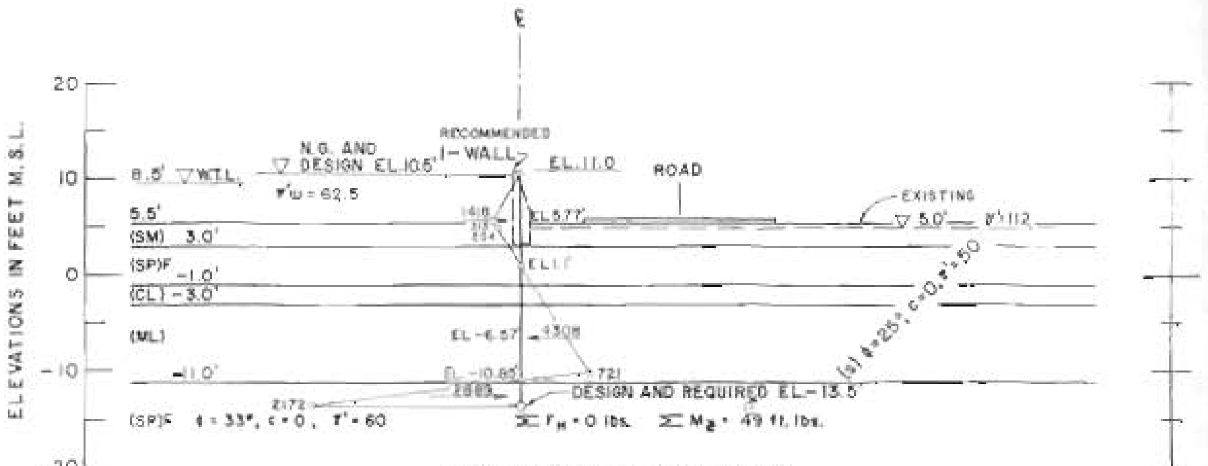
PLATE 43



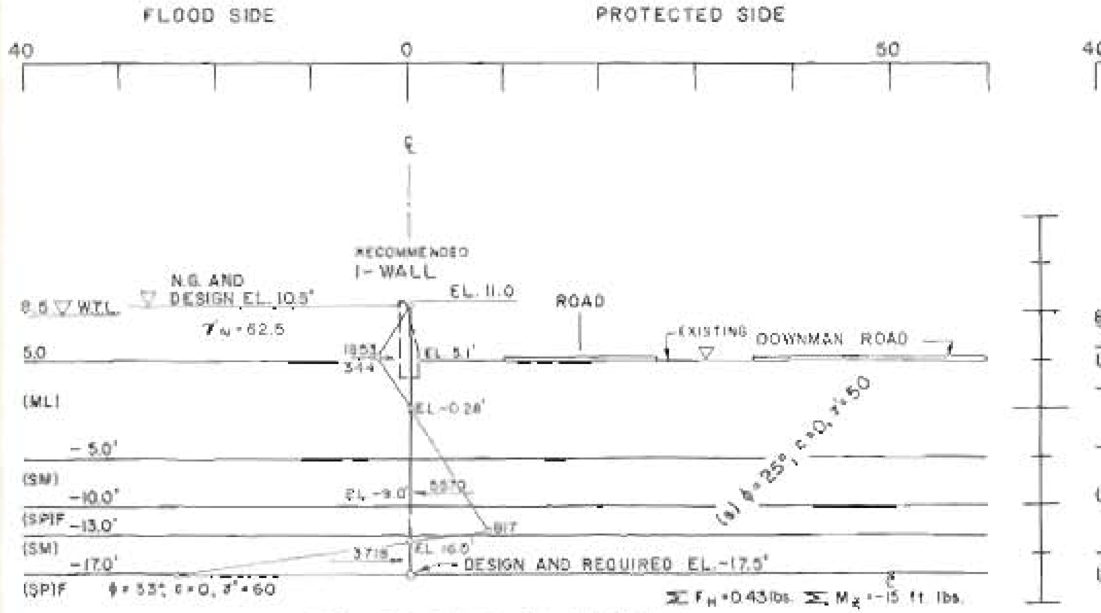
STA. 22+20 TO 24+00 W/L



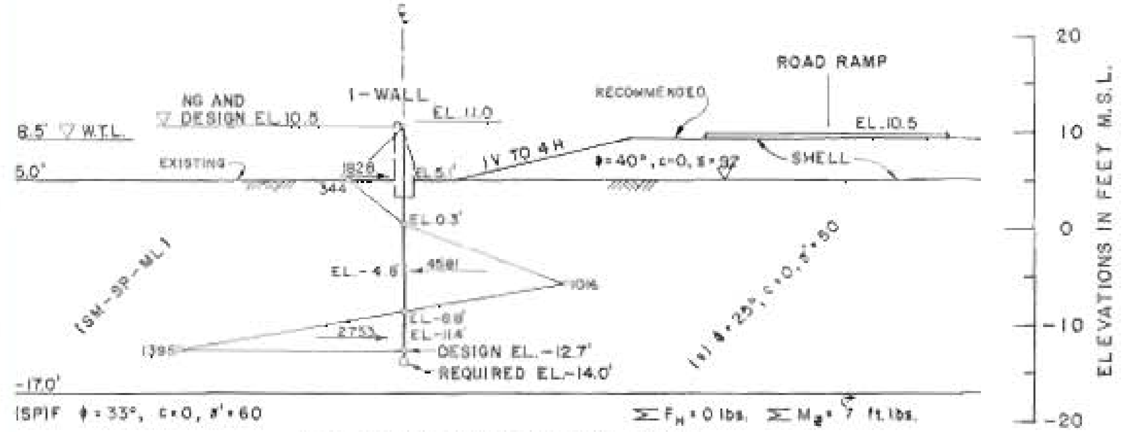
STA. 24+00 TO 26+00 W/L



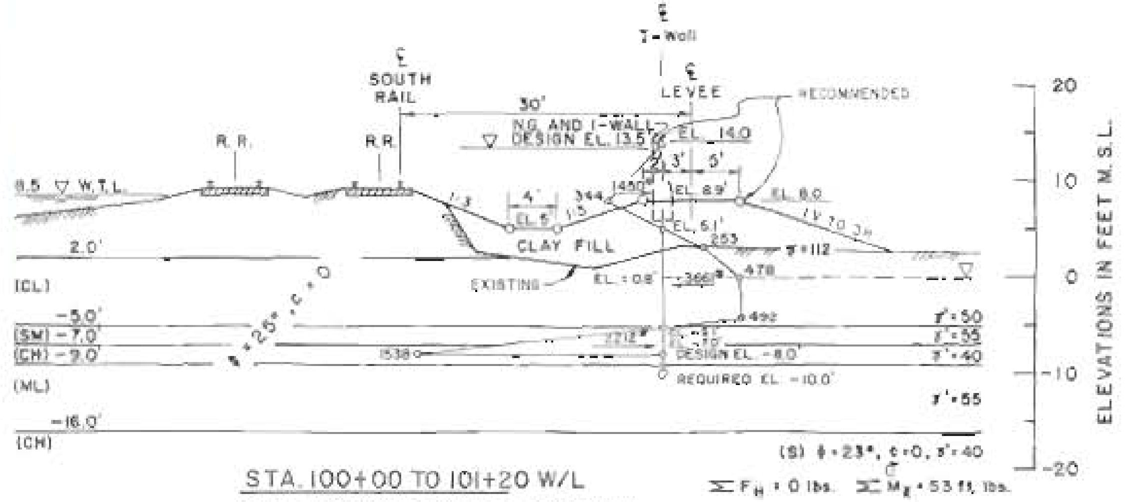
STA. 26+00 TO 27+00 W/L



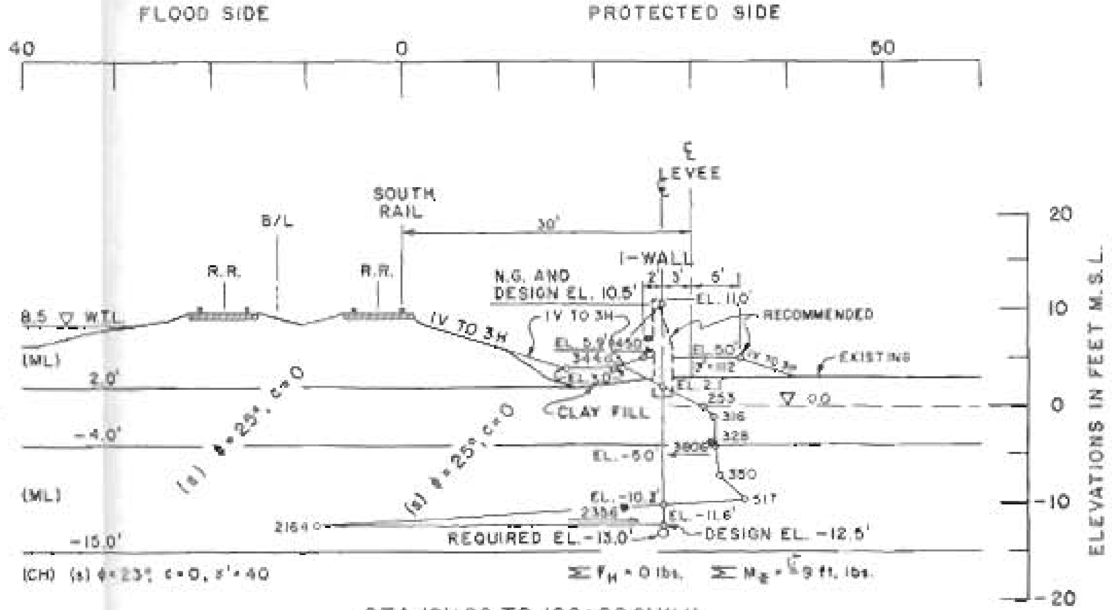
STA. 27+00 TO 28+95.27 W/L
STA. 29+26.27 TO 31+06.27 W/L



STA. 31+06.27 TO 32+47.46 W/L



STA. 100+00 TO 101+20 W/L
STA. 114+23.81 TO 115+43.81 W/L



STA. 101+20 TO 106+88.91 W/L
STA. 109+14.91 TO 114+23.81 W/L

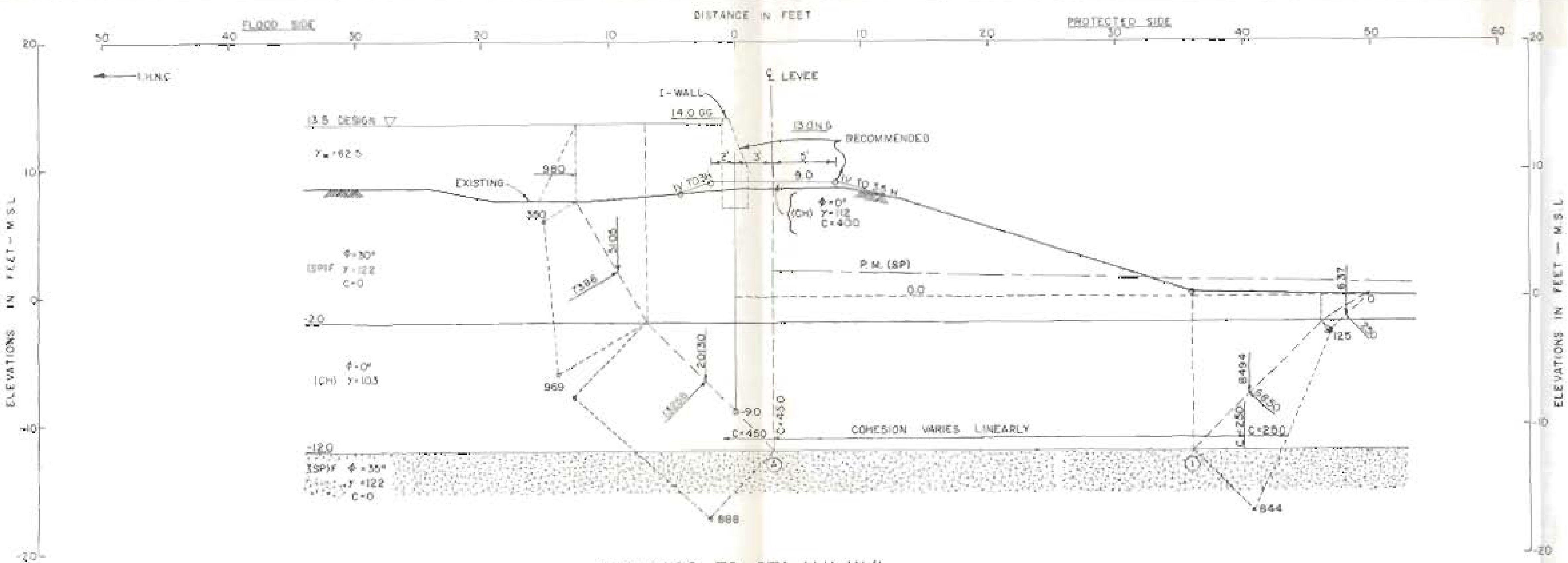
GENERAL NOTES

(S) CASE GOVERNED FOR SHEAR STABILITY DESIGN.
W/L = WALL STATIONING

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A
CITRUS LAKEFRONT LEVEE
I. H. N. C. TO PARIS ROAD
CANTILEVER I-WALL ANALYSIS (S-CASE)
STA. 22+20 W/L TO STA. 32+47.46 W/L AND
STA. 100+00 W/L TO STA. 115+43.81 W/L

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

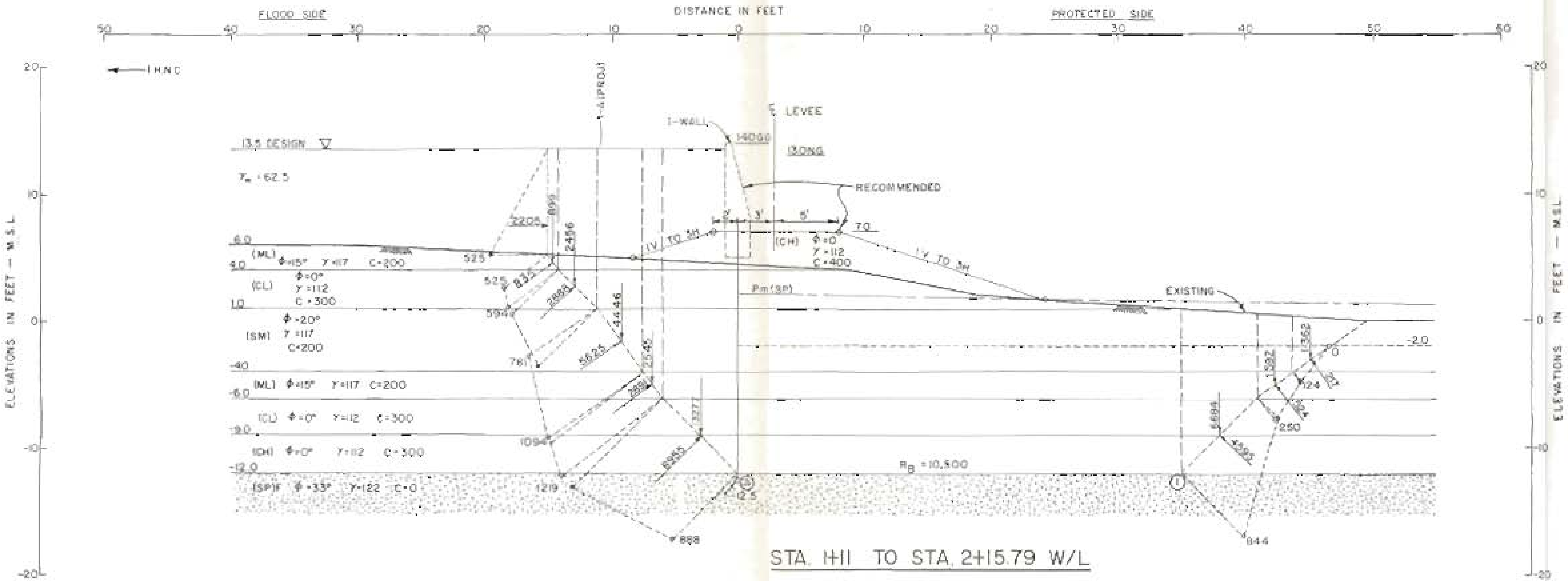
MAY 1976 FILE NO. H-2-26533



STA. 0+00 TO STA. 1+11 W/L

ASSUMED FAILURE SURFACE		DRIVING FORCES			RESISTING FORCES				FACTOR OF SAFETY
NO.	EL.	D_A	D_P	ΣD	R_A	R_B	R_P	ΣR	
Ⓐ-①	-12.0	29952	8861	21091	10629	12128	5728	28485	1.351

Pm (SP) HYDROSTATIC PRESSURE GRADIENT AT EL. -12.0, SOIL STRATIFICATION, AND SOIL PARAMETERS ARE SHOWN ON PLATE III-37 IN GDM NO 2 SUPP. NO 8 I.H.N.C. REMAINING LEVEES



STA. 1+11 TO STA. 2+15.79 W/L

ASSUMED FAILURE SURFACE		DRIVING FORCES			RESISTING FORCES				FACTOR OF SAFETY
NO	EL.	D_A	D_P	ΣD	R_A	R_B	R_P	ΣR	
Ⓐ-①	-12.0	28767	8858	19909	9268	10500	7977	27745	1.39

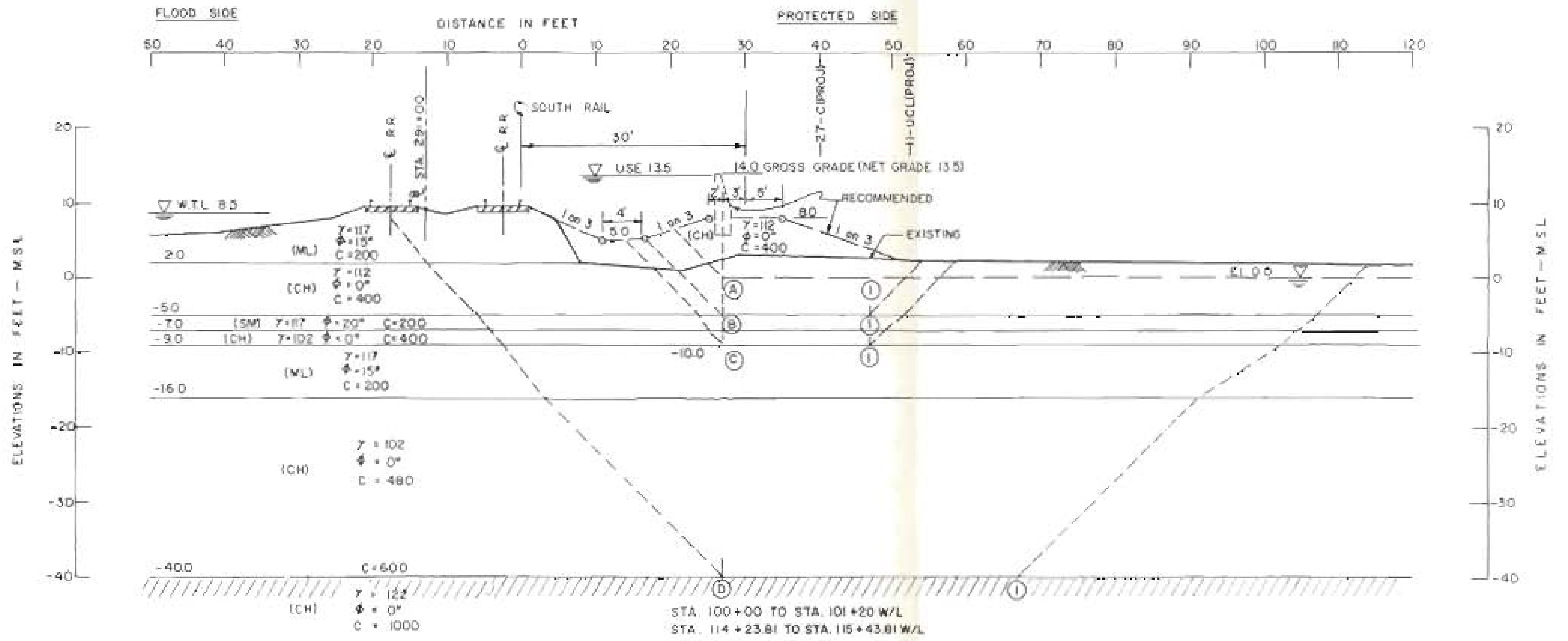
Pm (SP) HYDROSTATIC PRESSURE GRADIENT A EL -12.0 IS BASED ON DATA CONTAINED IN GDM NO 2 SUPP. NO 8 I.H.N.C. REMAINING LEVEES

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD
I-WALL IN LEVEE
(Q) SHEAR STABILITY

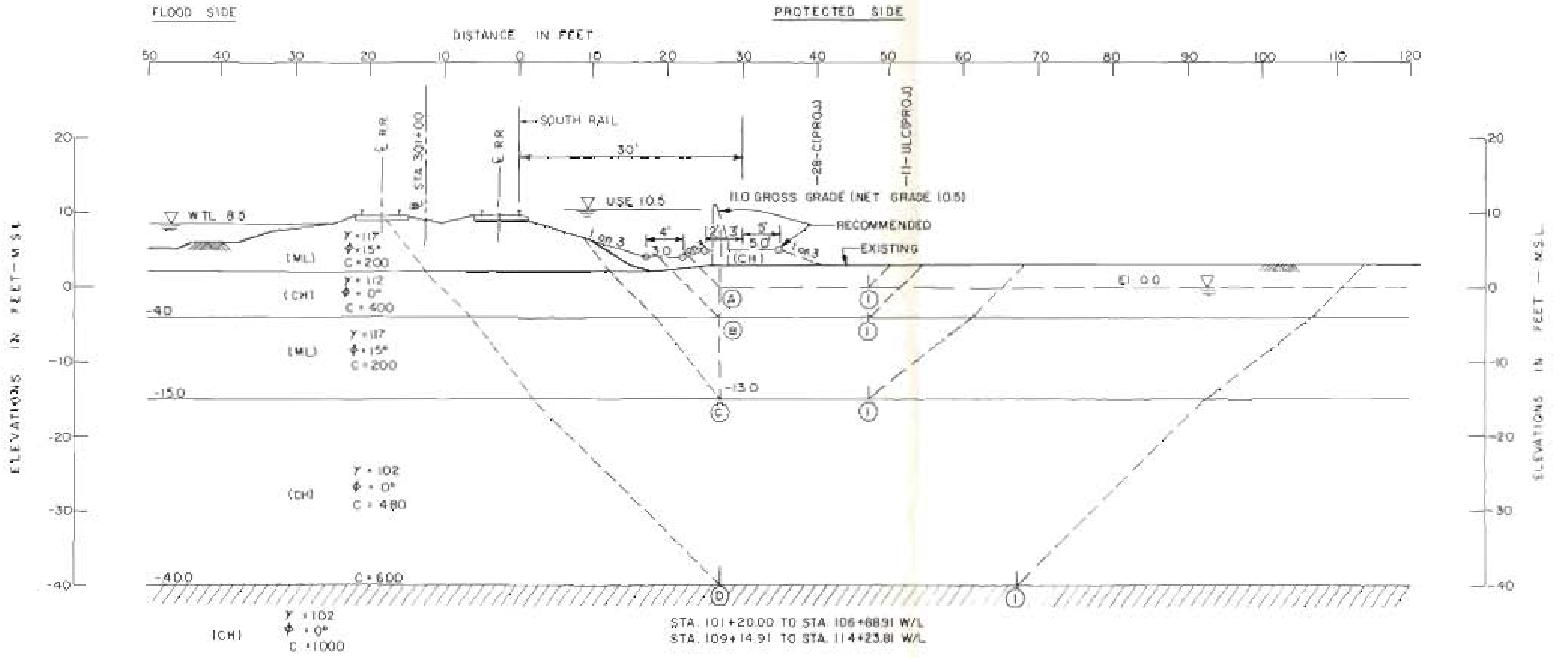
STA. 0+00 W/L TO STA. 2+15.79 W/L
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

MAY 1976 FILE NO. H-2-26533



ASSUMED FAILURE SURFACE		DRIVING FORCES			RESISTING FORCES				FACTOR OF SAFETY
NO.	ELEV	D_A	D_P	ΣD	R_A	R_B	R_P	ΣR	
A-I	0	7060	578	6482	5200	8000	2210	15410	2.377
B-I	-5.0	14135	3391	10744	8200	8000	6000	22200	2.066
C-I	-9.0	21738	7644	14094	12103	8000	10764	30867	2.190
D-I	-40.0	145105	99273	45832	47339	24000	45679	117018	2.553

NOTE: ASSUMING COOPER'S E-72 ENGINE LOADING FOR TRAINS ON BOTH TRACKS SIMULTANEOUSLY WEDGE(S) D — I HAVE A FACTOR OF SAFETY OF 1.9*.



ASSUMED FAILURE SURFACE		DRIVING FORCES			RESISTING FORCES				FACTOR OF SAFETY
NO.	ELEV.	D_A	D_P	ΣD	R_A	R_B	R_P	ΣR	
A-I	0	6262	503	5759	3400	8000	2400	13800	2.396
B-I	-4.0	11332	2742	8590	6400	8000	5600	20000	2.328
C-I	-15.0	35394	18442	16952	20662	12000	22299	54961	3.242
D-I	-40.0	145046	102398	42648	47629	24000	46299	117928	2.765

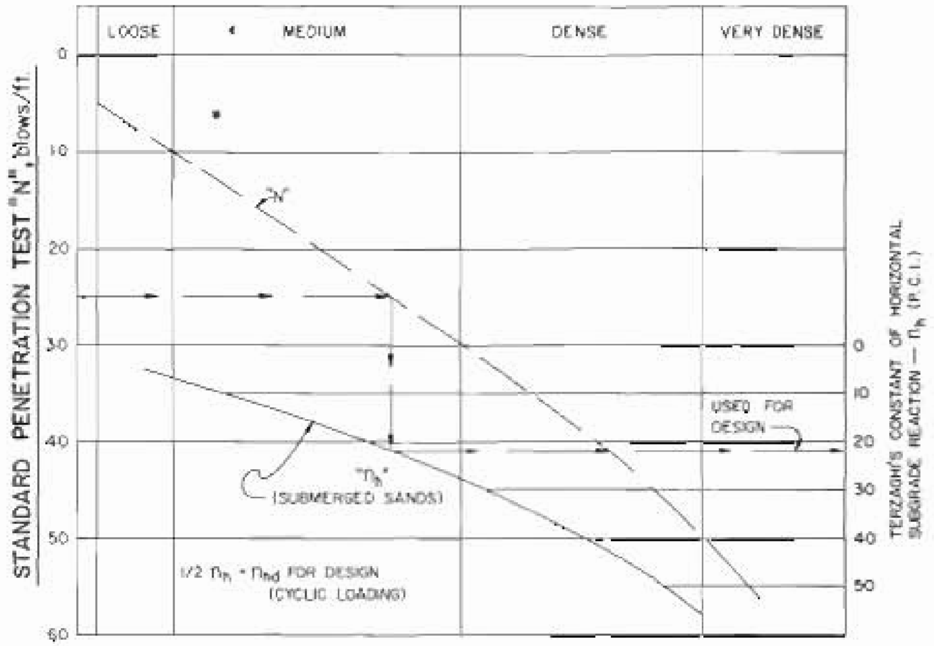
NOTE: W/L = WALL LINE

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

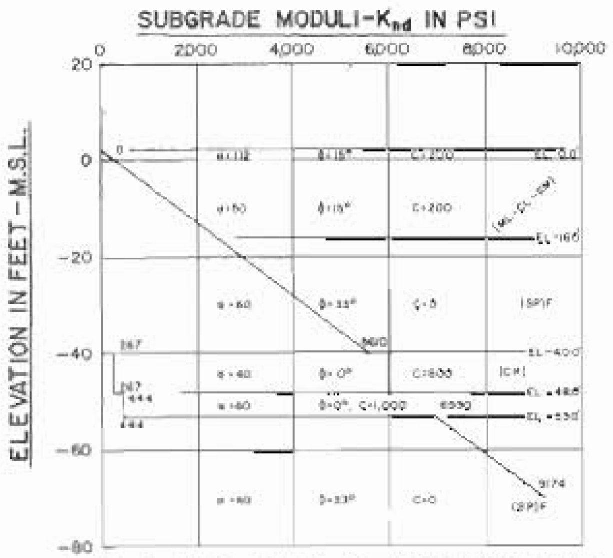
I-WALL IN LEVEE
(Q) SHEAR STABILITY

STA. 100+00 W/L TO STA. 106+88.91 W/L
AND STA. 109+14.91 W/L TO STA. 115+43.81 W/L
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

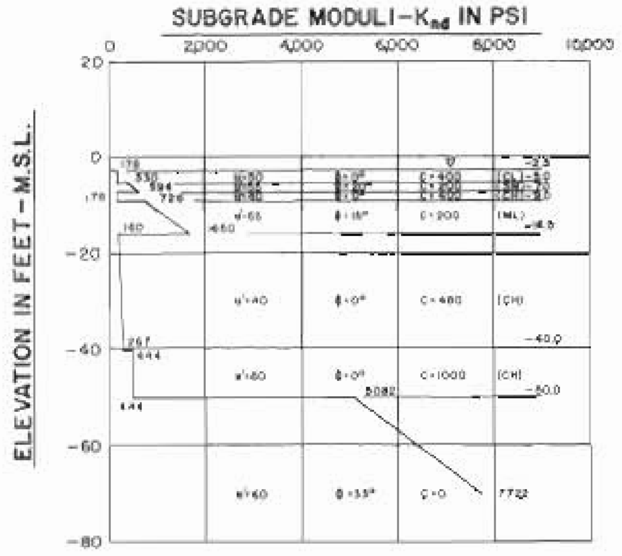
MAY 1976 FILE NO. H-2-26533



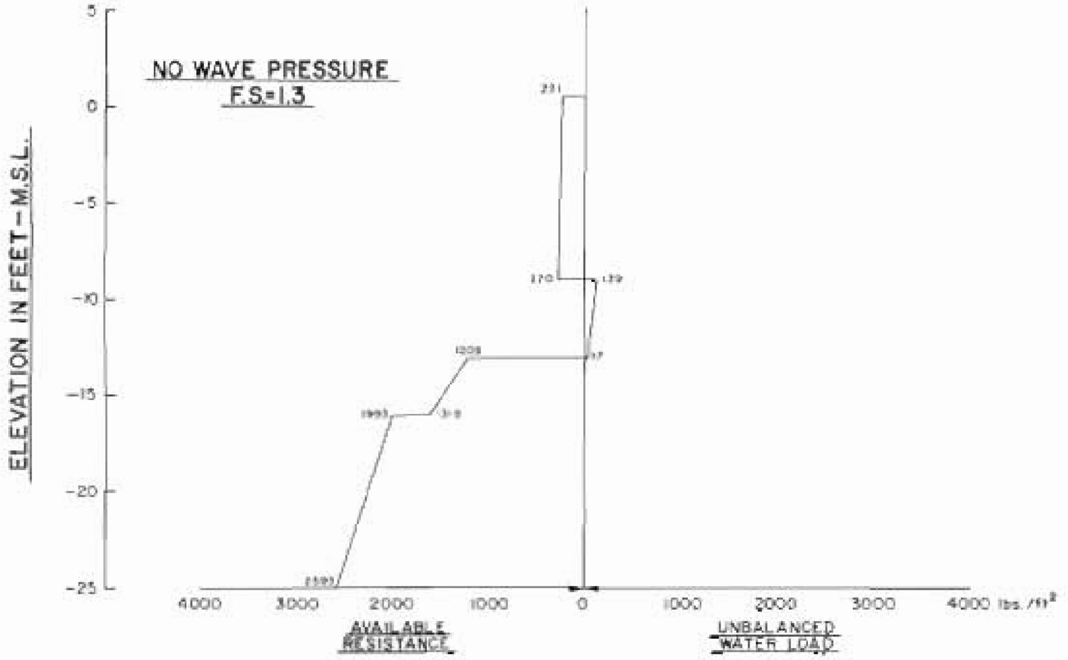
CORRELATION OF "N" AND "n_h"



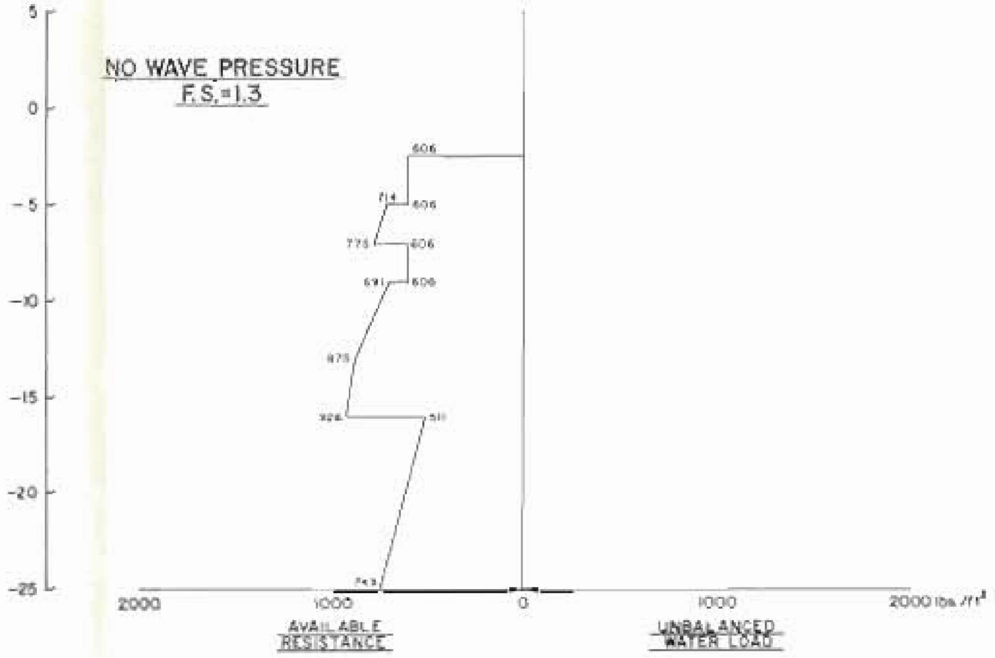
STA. 2+15.79 TO STA. 29+26.27 (WALL LINE)



STA. 106+88.91 TO STA. 109+14.91 (WALL LINE)



SHEET PILE CUTOFF ANALYSIS
STA. 2+15.79 TO STA. 29+26.27 (WALL LINE)



SHEET PILE CUTOFF ANALYSIS
STA. 106+88.91 TO STA. 109+14.91 (WALL LINE)

COHESIONLESS SANDS

K_{hd} = $(n_{hd})(X)(d/b)$, FOR DESIGN
K_h = SUBGRADE MODULUS (P.S.I.)
n_h = CONSTANT OF HORIZONTAL SUBGRADE REACTION FOR SUBMERGED (P.C.I.)
X = DEPTH BELOW TOP OF SAND (IN.)
d = PROJECTED DIAMETER OF PILE (IN.)
b = 12" = UNIT CONVERSION FACTOR (IN.)
SUB "d" DENOTES DESIGN

COHESIVE CLAYS

K_h = $80 \cdot Q_u$ (P.S.F.) = $0.5555 \cdot Q_u$ (P.S.I.)
K_{hd} = $0.4 \cdot K_h \cdot d/b = 0.2222 \cdot Q_u \cdot d/b$, DESIGN (P.S.I.)
Q_u = UNCONFINED COMPRESSION SHEAR STRENGTH

NOTE: NO UNBALANCED LATERAL WATER LOADS TRANSMITTED TO THE BEARING PILING.

GENERAL NOTES

K_h AND n_h VALUES ARE THOSE PROPOSED BY K. TERZAGHI IN EVALUATION OF COEFFICIENTS OF SUBGRADE REACTIONS, "GEOTECHNIQUE", LONDON, ENGLAND, VOL. V, 1955, pp. 297-326.

K_{hd} VALUES INCLUDE REDUCTION FACTORS FOR CYCLIC LOADING.

THE COHESIVE OVERBURDEN, ABOVE THE BURIED SAND WAS CONVERTED TO A "WEIGHTED" THICKNESS OF MATERIAL WITH A UNIT WEIGHT EQUAL TO THAT OF THE SUBMERGED SAND AND THIS THICKNESS WAS USED IN DETERMINING X IN THE COHESIONLESS SAND EXPRESSION FOR APPROXIMATING K_{hd}. DESIGN K_{hd} VALUES ARE ASSIGNED, FOR PURPOSES OF CONSERVATISM IN THE SANDS.

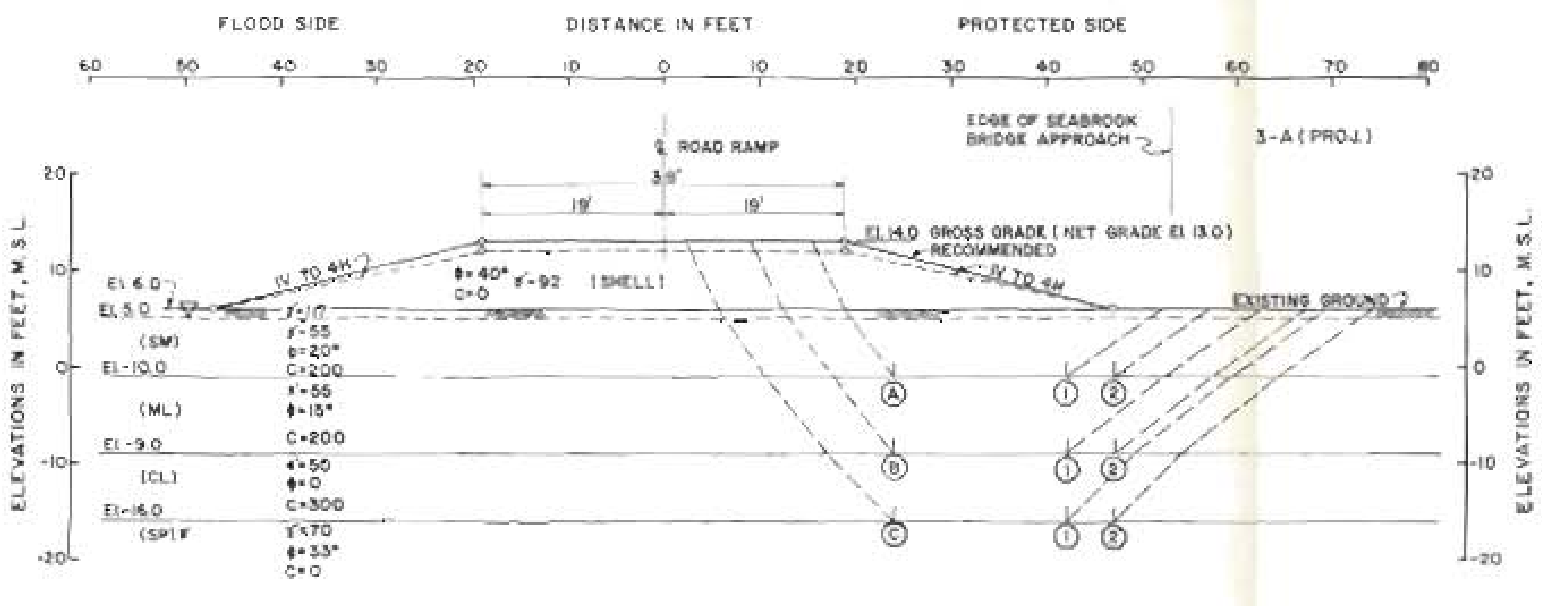
THE SHEET PILE CUTOFF ANALYSES ARE APPLICABLE TO GATES AND T-TYPE FLOOD WALLS LOCATED BETWEEN THE STATIONING INDICATED.

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

SUBGRADE MODULI AND SHEET PILE CUTOFF ANALYSIS
STA. 2+15.79 W/L TO STA. 29+26.27 W/L AND STA. 106+88.91 W/L TO STA. 109+14.91 W/L

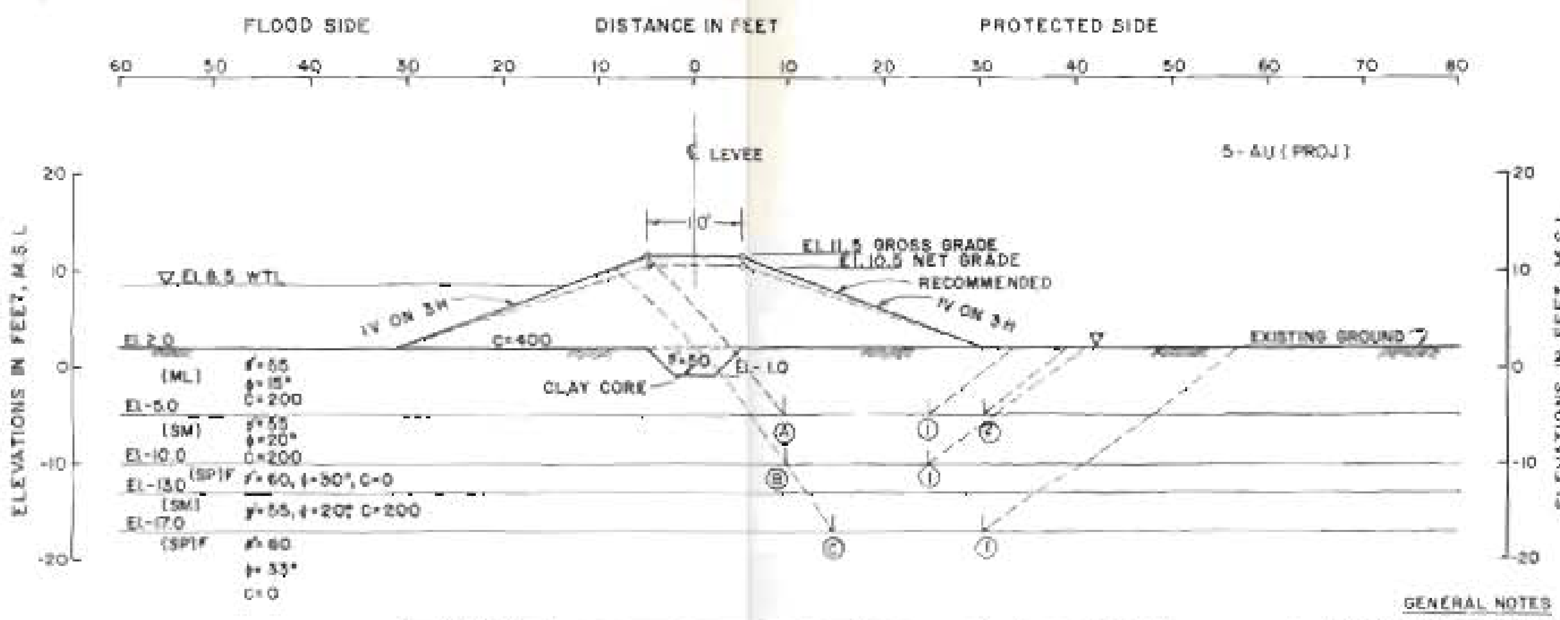
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

MAY 1976 FILE NO. H-2-26533



ASSUMED FAILURE SURFACE		DRIVING FORCES			RESISTING FORCES				FACTOR OF SAFETY
NO.	ELEV	D_A	D_P	ΣD	R_A	R_B	R_P	ΣR	
A-1	-1.0'	8108	1951	6157	6709	7309	6027	20045	3.256
A-2			1750	6358		8965	5618	21512	3.383
B-1	-9.0'	18633	7305	11328	13534	5400	13868	32802	2.896
B-2			7085	11548		6900	13714	34148	2.957
C-1	-16.0	30664	14805	15859	17888	5400	17914	41202	2.598
C-2			14518	16146		6900	17914	42707	2.645

STA. 5 + 97.38 W/L



ASSUMED FAILURE SURFACE		DRIVING FORCES			RESISTING FORCES				FACTOR OF SAFETY
NO.	ELEV	D_A	D_P	ΣD	R_A	R_B	R_P	ΣR	
A-1	-5.0	13174	1831	11343	13066	6778	4927	24741	2.181
A-2			1351	11823		8411	4592	26089	2.207
B-1	-10.0	20875	4400	16475	17707	9559	10620	37886	2.300
C-1	-17.0	32049	10012	22037	25335	10610	20899	56844	2.579

STA. 32 + 96.46 TO STA. 34 + 29 W/L

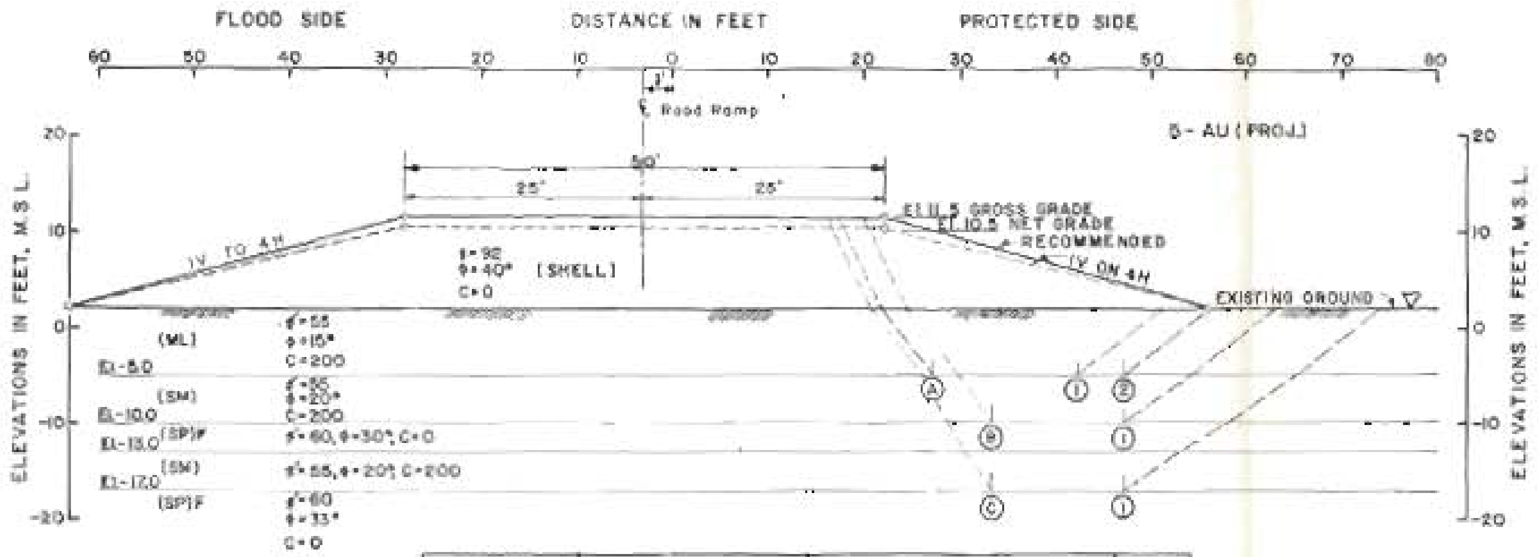
GENERAL NOTES

ϕ – ANGLE OF INTERNAL FRICTION, DEGREES.
C – UNIT COHESION, P.S.F.
▽ – STATIC WATER SURFACE.
D – HORIZONTAL DRIVING FORCE IN POUNDS.
R – HORIZONTAL RESISTING FORCE IN POUNDS.
A – AS A SUBSCRIPT, REFERS TO ACTIVE WEDGE.
B – AS A SUBSCRIPT, REFERS TO CENTRAL BLOCK.
P – AS A SUBSCRIPT, REFERS TO PASSIVE WEDGE.

$$\text{FACTOR OF SAFETY} = \frac{R_A + R_B + R_P}{D_A - D_P}$$

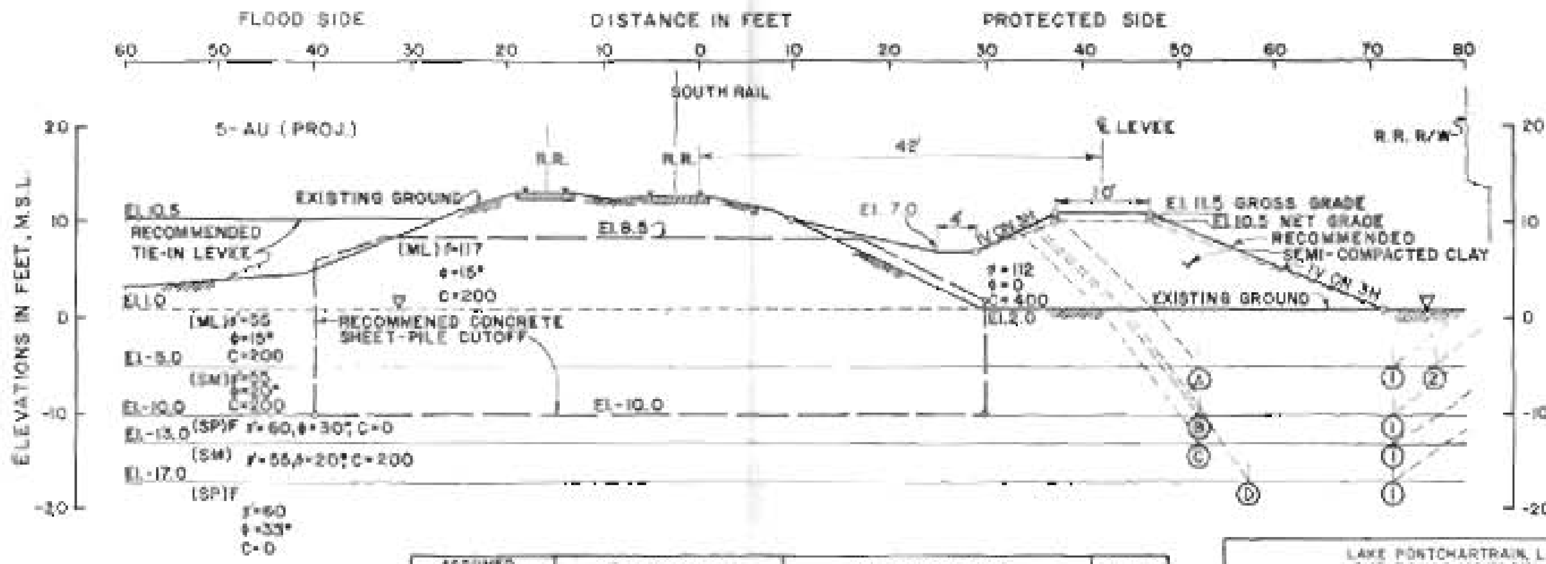
CLASSIFICATION, STRATIFICATION, SHEAR STRENGTHS, AND UNIT WEIGHTS OF THE SOIL WERE BASED ON THE RESULTS OF THE UNDISTURBED BORINGS.

W/L – WALL LINE
B/L – BASELINE



ASSUMED FAILURE SURFACE		DRIVING FORCES			RESISTING FORCES				FACTOR OF SAFETY
NO.	ELEV.	D_A	D_P	ΣD	R_A	R_B	R_P	ΣR	
A-1	-5.0	11016	2898	8118	8218	6665	5771	20654	2.544
A-2			1977	9039		8543	5030	21791	2.411
B-1	-10.0	16427	4535	11892	12372	8757	10758	31887	2.681
C-1	-17.0	28471	10575	17896	20271	10962	21523	52756	2.948

STA. 32 + 71.96



ASSUMED FAILURE SURFACE		DRIVING FORCES			RESISTING FORCES				FACTOR OF SAFETY
NO.	ELEV	D_A	D_P	ΣD	R_A	R_B	R_P	ΣR	
A 1	-5.0	12707	1347	11360	12764	8770	4068	25402	2.234
A 2			989	11718		10337	3819	26920	2.297
B 1	-10.0	20457	3653	16804	17306	12420	9444	39370	2.343
C 1	-13.0	25623	5680	19943	20668	13791	13812	48271	2.420
D 1	-17.0	31880	9317	22563	25271	11035	19619	55925	2.479

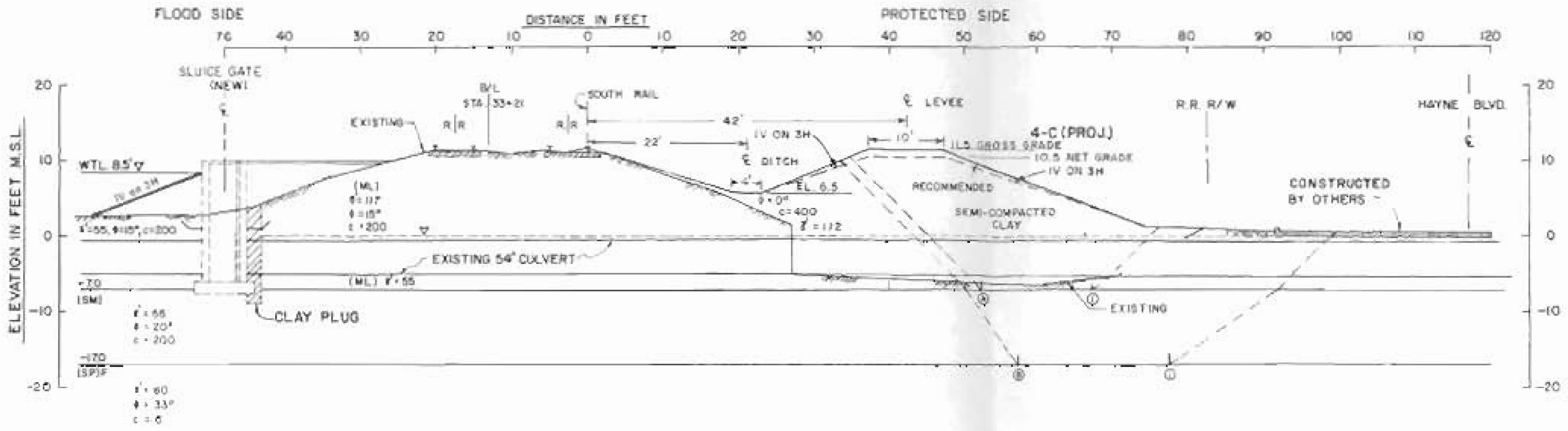
STA. 28 + 31 B/L TO STA. 33 + 21 B/L

LAKE PONTCHARTRAIN, LA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO 2 – GENERAL DESIGN
SUPPLEMENT NO 5A

CITRUS LAKEFRONT LEVEE
I H N C TO PARIS ROAD
DESIGN SECTION AND RAMP
STA. 5+97.38 W/L AND STA. 32+71.96 W/L
STA. 32+96.46 W/L TO STA. 34+29 W/L
STA. 28+31 B/L TO STA. 33+21 B/L

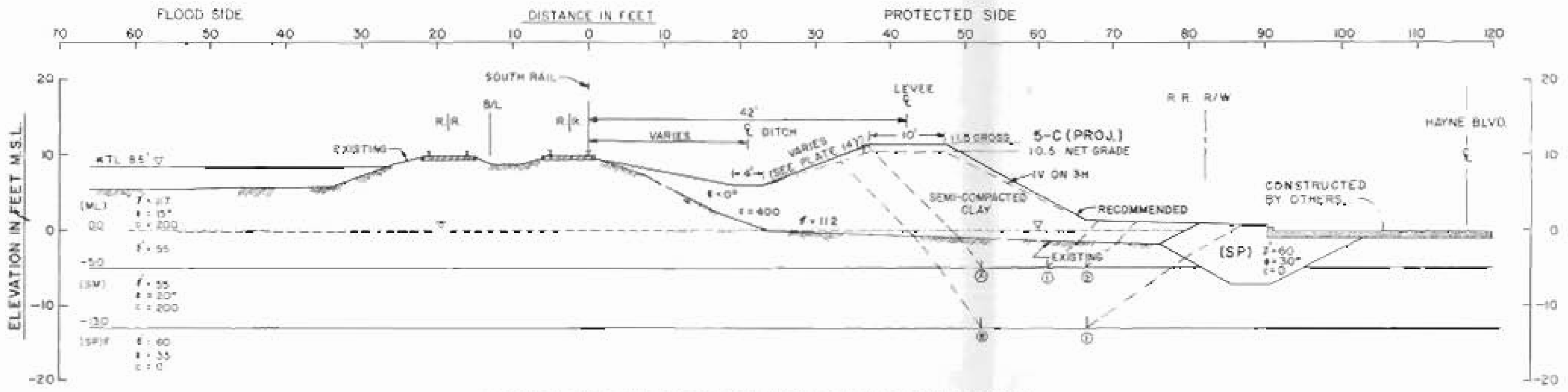
U S ARMY ENGINEER DISTRICT NEW ORLEANS
CORPS OF ENGINEERS

MAY 1975
FILE NO. H-2-26533



ASSUMED FAILURE SURFACE		DRIVING FORCES			RESISTING FORCES				FACTOR OF SAFETY
NO.	ELEV.	D_A	D_P	ΣD	R_A	R_B	R_P	ΣR	
WATER IN PIPE: A-1	-7.0	17056	2903	14153	10606	7550	2510	20666	1.46
B-1	-17.0	33966	9241	23725	21570	13796	14810	50176	1.95
SOIL IN PIPE: A-1	-7.0	16880	2727	14153	12384	7333	4273	23990	1.70
B-1	-17.0	33250	7526	25724	23072	13403	16011	52486	2.04

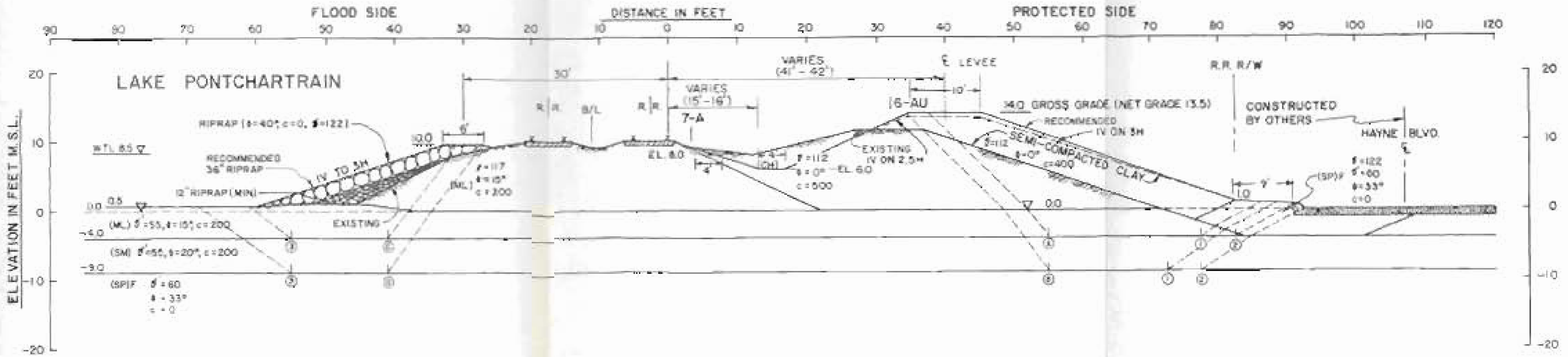
STA. 33+21 B/L



NOTE: SECTION SHOWN IS MOST CRITICAL WITHIN THIS RANGE. OTHER SECTIONS DIFFER IN REGARDS TO DITCH AND R/R TRACK ELEVATIONS.

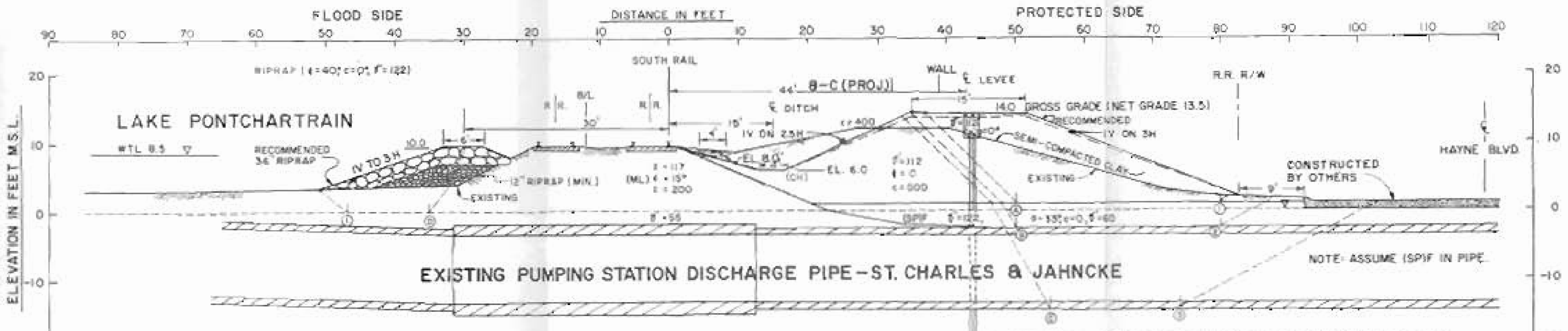
ASSUMED FAILURE SURFACE		DRIVING FORCES			RESISTING FORCES				FACTOR OF SAFETY
NO.	ELEV.	D_A	D_P	ΣD	R_A	R_B	R_P	ΣR	
A-1	-5.0	13855	2924	10931	13173	5395	6292	24860	2.27
A-2	-5.0		2486	11369		7146	5925	26244	2.31
B-1	-13	27351	8156	19195	21316	11033	14152	46501	2.42

STA. 33+21 TO 63+00 B/L



ASSUMED FAILURE SURFACE			DRIVING FORCES			RESISTING FORCES				FACTOR OF SAFETY
	NO.	ELEV.	D_A	D_P	ΣD	R_A	R_B	R_P	ΣR	
LEVEE	A-1	-4	15445	1300	14145	16589	10405	2784	29778	2.105
	A-2			1028	14417		12016	2450	31055	2.154
	B-1	-9	24720	4690	20030	22663	12096	9103	43862	2.190
	B-2			3798	20922		14773	8196	45632	2.181
WAVE WASH PROTECTION	C-3	-4	8872	1096	7576	7170	3111	5636	15917	2.101
	D-3	-9	15968	3140	128	12690	8053	8231	28974	2.259

STA. 64+00 TO 73+00 B/L



CUT OFF TO EL. -47.43' (ST CHARLES) AND EL. -50.4' (SAHCKE) - EXTENDS 60' EACH SIDE ℄ CONDUIT (EXISTING)

ASSUMED FAILURE SURFACE			DRIVING FORCES			RESISTING FORCES				FACTOR OF SAFETY
	NO.	ELE.	D_A	D_P	ΣD	R_A	R_B	R_P	ΣR	
LEVEE	A-1	10	8981	56	8925	12600	15000	1600	28600	3.204
	B-1	-2.5	12606	940	11666	15557	13575	2924	32056	2.748
	C-1	-4.5	36632	9395	27237	31790	20832	22474	75096	2.757
WAVE WASH PROTECTION	D-1	0.0	5056	1042	4014	3972	4917	2551	11440	2.850

STA. 74+00 & 236+50 B/L

SEE PLATE NO. 47 FOR GENERAL NOTES
B/L - BASELINE

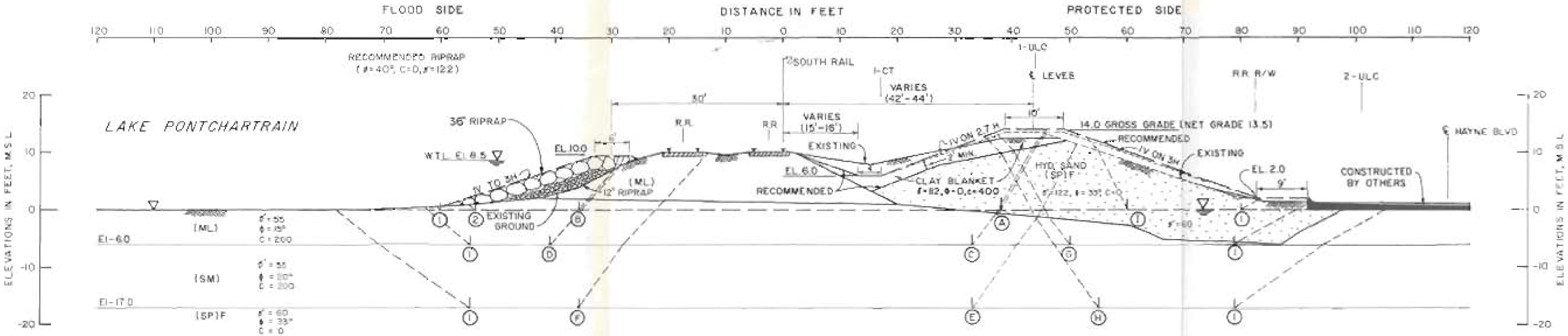
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

CITRUS LAKEFRONT LEVEE
I. H. N. C. TO PARIS ROAD
DESIGN SECTIONS AND
LEVEE (Q) SHEAR STABILITY
STA. 33+21 B/L TO STA. 74+00 B/L AND STA 236+50 B/L

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

MAY 1976 — FILE NO. H-2-26533

PLATE 49



WAVE WASH PROTECTION ANDLEVEE (FLOOD SIDE)

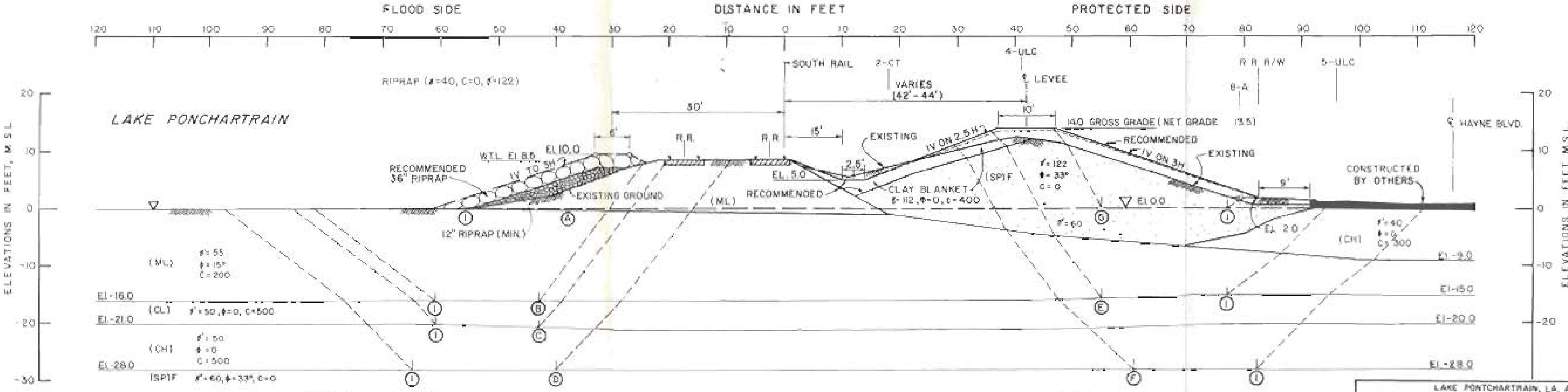
ASSUMED FAILURE SURFACE		DRIVING FORCES			RESISTING FORCES				FACTOR OF SAFETY
NO.	ELEV	D_A	D_P	ΣD	R_A	R_B	R_P	ΣR	
A-I	0	11998	15	11983	9897	49277	271	59445	4.961
B-2	0	5083	201	4882	4300	6963	689	11952	2.448
C-I	-6	21917	1757	20160	15803	48947	4616	69366	3.441
D-I	-6	11228	1757	9471	8516	6005	4615	19237	2.031
E-I	-17	47405	9322	38083	35509	77877	18901	132287	3.474
F-I	-17	32312	9322	22990	23181	14563	18901	56615	2.463

STA. 75+00 TO STA. 107+00 B/L

LEVEE (PROTECTED SIDE)

ASSUMED FAILURE SURFACE		DRIVING FORCES			RESISTING FORCES				FACTOR OF SAFETY
NO	ELEV	D_A	D_P	ΣD	R_A	R_B	R_P	ΣR	
G-I	-6	21910	2840	19070	17084	14659	6539	38282	2.007
H-I	-17	45059	12687	32372	32112	18801	22720	73633	2.275
I-I	0	6059	244	5815	2681	3774	193	6648	1.143 *

* SLOPE SLOUGHING ANALYZED FOR STEADY SEEPAGE CONDITIONS PARALLEL TO THE LANDSIDE SLOPE CAUSED BY HURRICANE RAINFALL



WAVE WASH PROTECTION

ASSUMED FAILURE SURFACE		DRIVING FORCES			RESISTING FORCES				FACTOR OF SAFETY
NO.	ELEV	D_A	D_P	ΣD	R_A	R_B	R_P	ΣR	
A-I	0	4585	127	4458	3805	6292	457	10554	2.368
B-I	-16	27113	7042	20071	18466	8831	13259	40556	2.021
C-I	-20	35177	10963	24214	23095	9000	17256	49349	2.038
D-I	-28	53899	21197	32702	30773	12500	25256	68529	2.096

STA. 108+00 TO STA. 120+00 B/L

LEVEE

ASSUMED FAILURE SURFACE		DRIVING FORCES			RESISTING FORCES				FACTOR OF SAFETY
NO	ELEV	D_A	D_P	ΣD	R_A	R_B	R_P	ΣR	
E-I	-15	40715	8610	32105	27969	13991	13138	55098	1.716
F-I	-28	74774	26175	48599	40140	11000	26242	77381	1.592
G-I	0	8939	330	8609	5697	5234	746	11677	1.356 *

NOTES:

SEE PLATE NO. 47 FOR GENERAL NOTES.

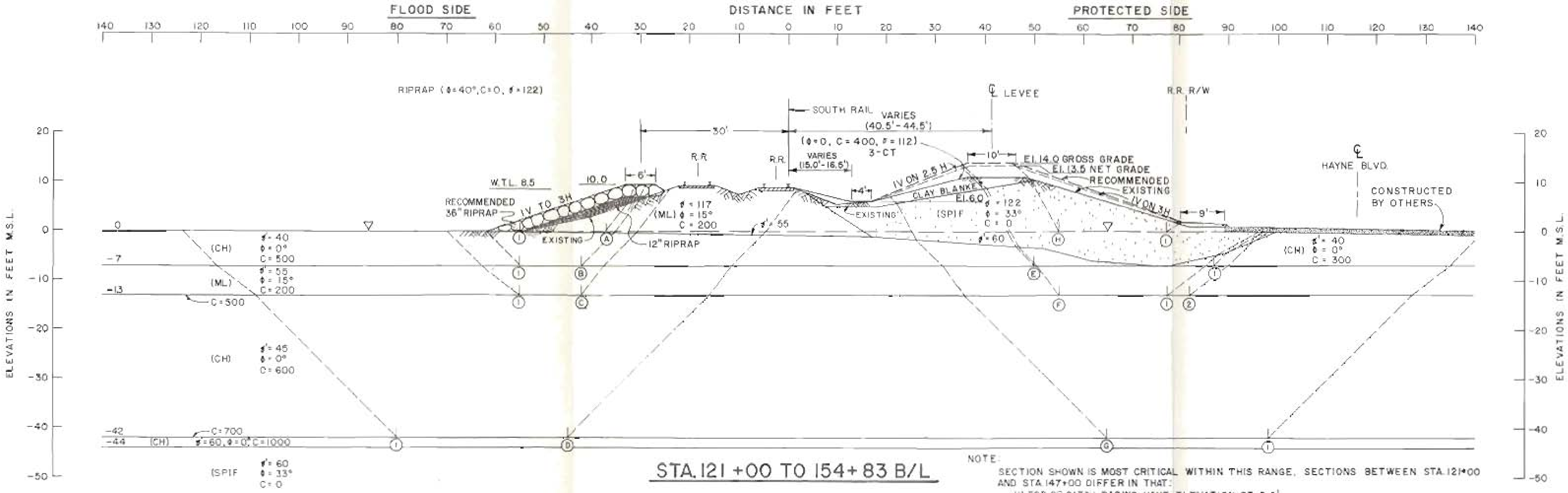
B/L - BASELINE

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

CITRUS LAKEFRONT LEVEE
I. H. N. C. TO PARIS ROAD
DESIGN SECTIONS AND
LEVEE (Q) SHEAR STABILITY
STA. 75+00 B/L TO STA. 120+00 B/L

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

MAY 1976 FILE NO. H-2-26533



STA. 121 +00 TO 154+83 B/L

NOTE:

SECTION SHOWN IS MOST CRITICAL WITHIN THIS RANGE. SECTIONS BETWEEN STA. 121+00 AND STA 147+00 DIFFER IN THAT:
(1) TOP OF CATCH BASINS HAVE ELEVATION OF 5.0'.
(2) WIDTH OF DITCH IS 2.5'.

WAVE WASH PROTECTION

ASSUMED FAILURE SURFACE		DRIVING FORCES			RESISTING FORCES				FACTOR OF SAFETY
NO.	ELEV.	D_A	D_P	ΣD	R_A	R_B	R_P	ΣR	
A-1	0	4899	178	4721	4076	5349	639	10064	2.132
B-1	-7	12449	1894	10555	8562	3900	4200	16662	1.579 ←
C-1	-13	21111	4350	16761	13965	6480	9682	30127	1.798
D-1	-42	86514	40258	46256	48526	24500	43992	117018	2.530

LEVEE

ASSUMED FAILURE SURFACE		DRIVING FORCES			RESISTING FORCES				FACTOR OF SAFETY
NO.	ELEV.	D_A	D_P	ΣD	R_A	R_B	R_P	ΣR	
E-1	-7	23895	2543	21352	18867	16731	4361	39959	1.871
F-1	-13	35118	7545	27573	25321	12615	11456	49392	1.791
F-2	-13	35118	6806	28312	25321	14954	10194	50469	1.783
G-1	-42	109148	42578	66570	54172	19800	44213	118185	1.775 ←
H-1	0	8906	336	8570	6756	5202	439	12397	1.446 *

NOTE:

SEE PLATE NO. 47 FOR GENERAL NOTES.
B/L- BASELINE

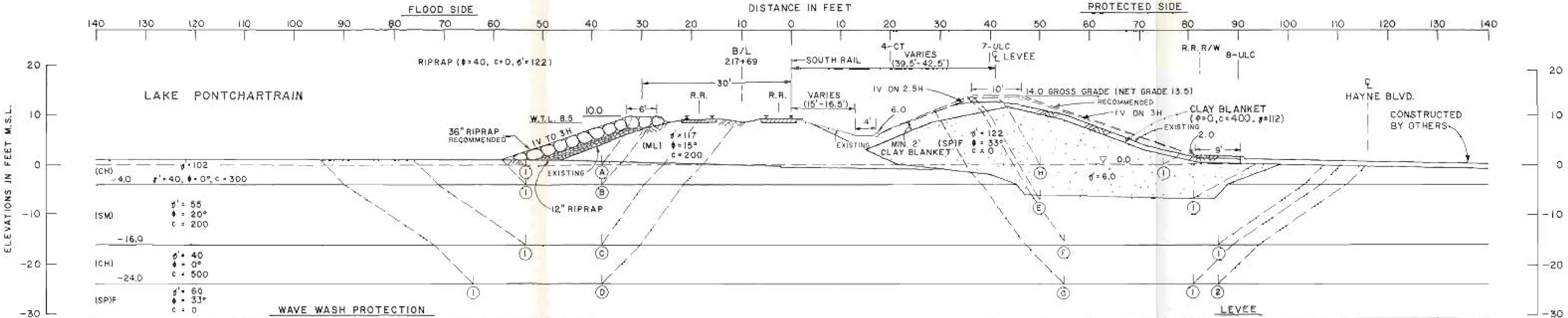
SEE PLATE NO. 49 FOR STEADY SEEPAGE NOTE

LAKE PONTCHARTRAIN, LA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD
DESIGN SECTION AND LEVEE
(Q) SHEER STABILITY
STA. 121+00 B/L TO STA. 154+83 B/L

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

MAY 1976 FILE NO. H-2-26533



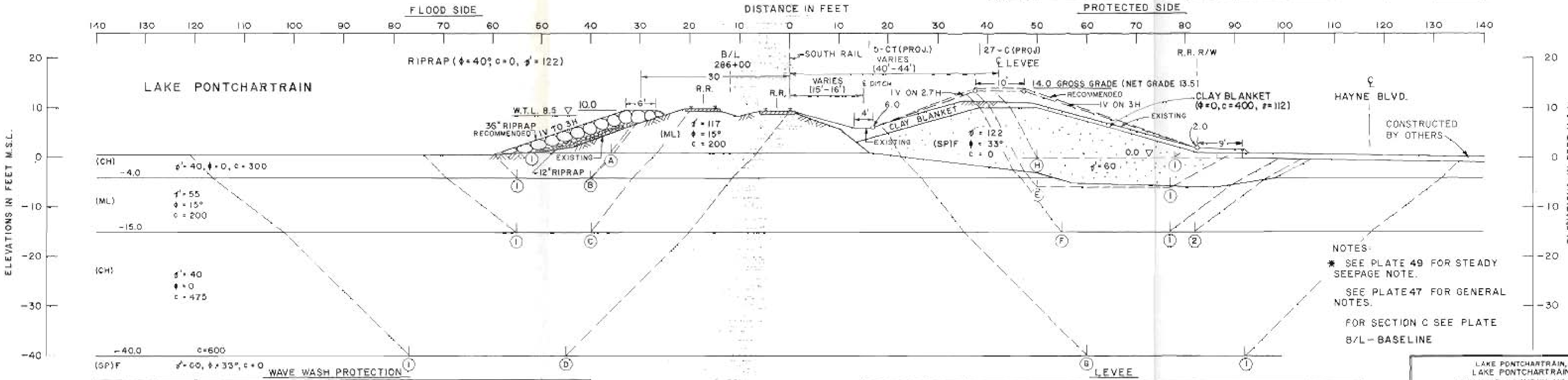
WAVE WASH PROTECTION

ASSUMED FAILURE SURFACE		DRIVING FORCES			RESISTING FORCES				FACTOR OF SAFETY
NO.	ELEV.	D_A	D_P	ΣD	R_A	R_B	R_P	ΣR	
A-1	0	4755	313	4442	4001	4650	842	9493	2.137
B-1	-4	9708	1319	8399	6967	4650	3000	14617	1.743 ←
C-1	-16	27929	8188	19741	19836	8000	17558	45394	2.299
D-1	-24	44200	16536	27664	27897	13000	25239	66136	2.391

STA. 156+13 TO 235+40 B/L

LEVEE

ASSUMED FAILURE SURFACE		DRIVING FORCES			RESISTING FORCES				FACTOR OF SAFETY
NO.	ELEV.	D_A	D_P	ΣD	R_A	R_B	R_P	ΣR	
E-1	-7	23977	2758	21219	18962	20327	7198	46487	2.191
F-1	-16	44231	8411	35820	32687	13661	17331	63679	1.778
G-1	-24	62437	18124	44313	36324	12000	23312	71636	1.617 ←
G-2	-24	62437	17119	45318	36324	14011	22856	73191	1.615 ←
H-1	0	10949	515	10434	6931	7133	1167	15231	1.460 *



NOTES:

* SEE PLATE 49 FOR STEADY SEEPAGE NOTE.

SEE PLATE 47 FOR GENERAL NOTES.

FOR SECTION C SEE PLATE

B/L – BASELINE

WAVE WASH PROTECTION

ASSUMED FAILURE SURFACE		DRIVING FORCES			RESISTING FORCES				FACTOR OF SAFETY
NO.	ELEV.	D_A	D_P	ΣD	R_A	R_B	R_P	ΣR	
A-1	1	4240	180	4060	3701	4439	623	8773	2.160
B-1	-4	8828	867	7961	6701	4500	2721	13922	1.749 ←
C-1	-15	24876	6068	18808	17054	8045	12390	37489	1.993
D-1	-40	78909	37833	41076	39472	18000	35890	93362	2.273

STA. 237+60 TO 289+59

STA. 304+31.4 TO 331.50

B/L

LEVEE

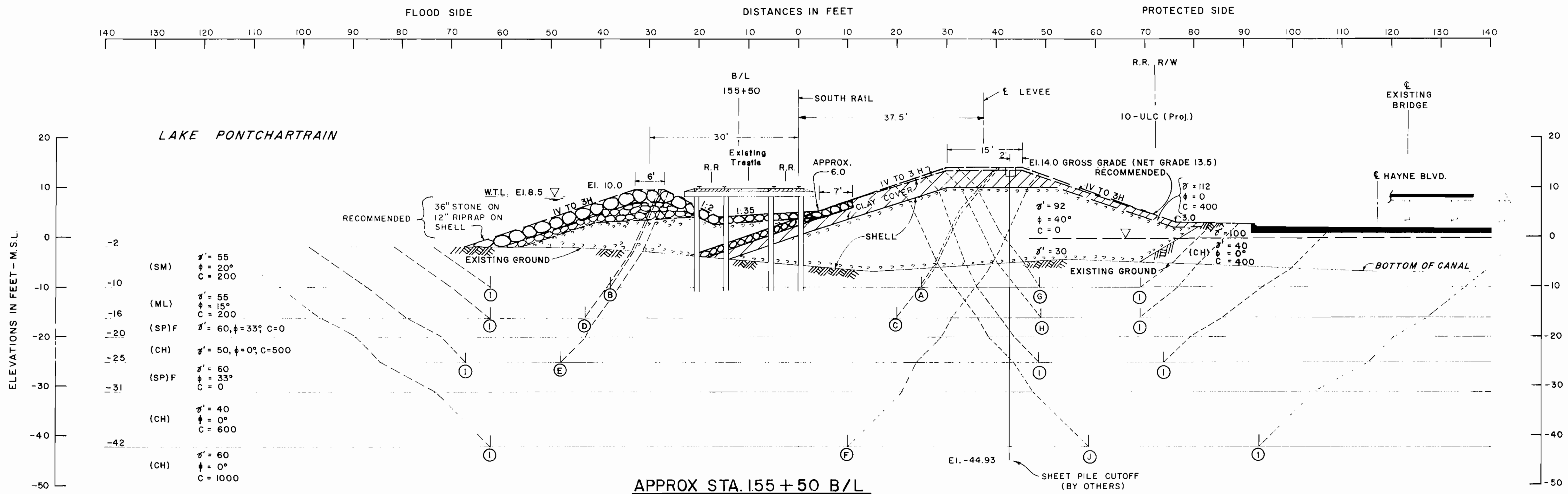
ASSUMED FAILURE SURFACE		DRIVING FORCES			RESISTING FORCES				FACTOR OF SAFETY
NO.	ELEV.	D_A	D_P	ΣD	R_A	R_B	R_P	ΣR	
E-1	-6	21866	2629	19237	16706	14369	6510	37585	1.954
F-1	-15	40207	9501	30706	26842	12896	14458	54196	1.765
F-2	-15	40207	8958	31249	26842	15385	13651	55878	1.788
G-1	-40	99184	36365	62819	39962	19200	35602	94764	1.509 ←
H-1	0	10830	263	10567	7594	7291	837	15722	1.488 *

* FOR STEADY SEEPAGE

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO.2 – GENERAL DESIGN
SUPPLEMENT NO.5A

CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD
DESIGN SECTIONS AND LEVEE
(Q) SHEAR STABILITY
STA. 156+13 B/L TO STA 289+59 B/L
STA. 304+31.4 B/L TO STA. 331+50 B/L
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

MAY 1976 FILE NO. H-2-26533



APPROX STA. 155+50 B/L

CITRUS CANAL CROSSING

(SECTION ADJACENT TO SLUICE GATE)

ASSUMED FAILURE SURFACE NO.		ASSUMED FAILURE SURFACE ELEV.	DRIVING FORCES D_A	D_P	ΣD	RESISTING FORCES R_A	R_B	R_P	ΣR	FACTOR OF SAFETY
A	I	-10	29023	2218	26805	23915	47707	6875	78497	2.928
B	I	-10	18827	2218	16609	14033	11670	6875	32578	1.961
C	I	-16	41183	5891	35292	30596	51503	12412	94511	2.678
D	I	-16	28023	5891	22132	19643	10462	12412	42517	1.921
E	I	-25	45694	14628	31066	30049	9500	25576	65125	2.096
F	I	-42	112123	44156	67967	64863	43200	59443	167506	2.464
G	I	-10	31406	9242	22164	23076	11000	12967	47043	2.12
H	I	-16	46054	19765	26289	22812	12752	19761	55325	2.10
I	I	-25	78396	42868	35528	31828	12500	35717	80045	2.25
J	I	-42	159854	112101	47753	53499	21000	73308	147807	3.10

NOTE:

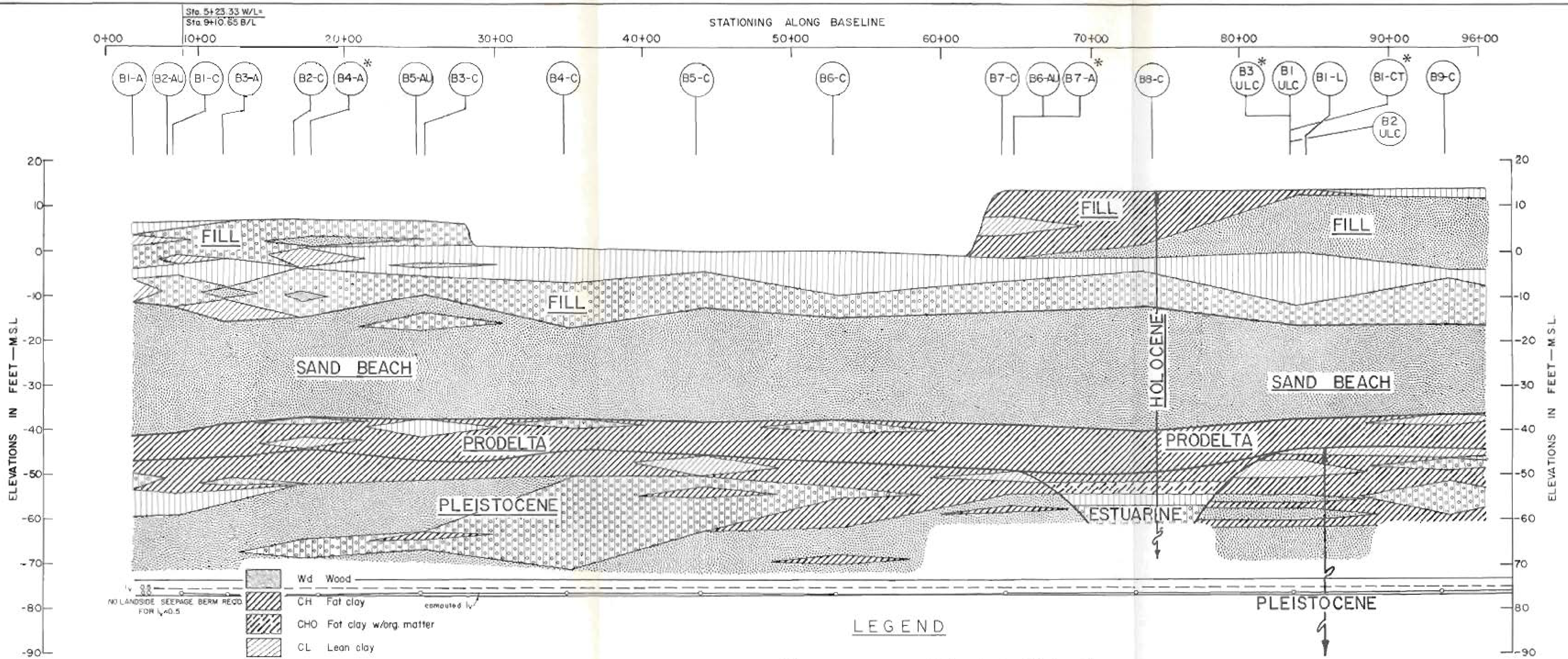
SEE PLATE NO. 47 FOR GENERAL NOTES.
B/L - BASELINE

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

CITRUS LAKEFRONT LEVEE
I. H. N. C TO PARIS ROAD
DESIGN SECTIONS AND
LEVEE (Q) SHEAR STABILITY
CITRUS CANAL CROSSING
STA. 155+50 B/L

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

MAY 1976 FILE NO. H-2-26533



Wd	Wood
CH	Fat clay
CHO	Fat clay w/org. matter
CL	Lean clay
CLO	Lean clay w/org matter
SI	Shells
ML	Silt
MLO	Silt w/org matter
SM	Silty sand
Sp	Fine sand

Boring omitted in developing profile stratification

B6-AU Soil Boring No. 6-AU

LEGEND

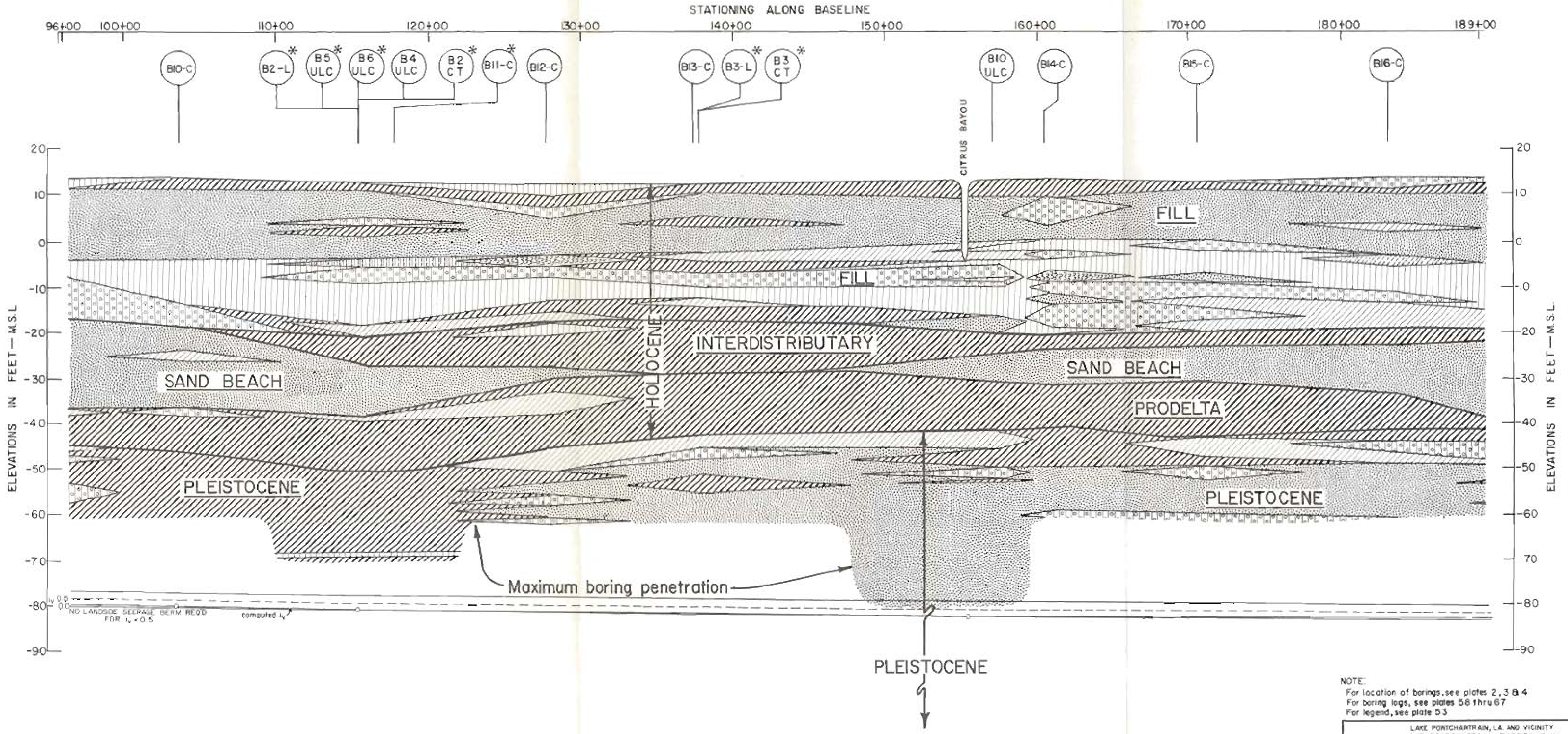
	FILL —	Medium to very stiff clays, silts, silty sands & sands
HOLOCENE	INTERDISTRIBUTARY —	soft to medium clays w/SIS, ss & slf
	SAND BEACH —	Fine to medium sand w/cs, sl, & slf
	PRODELTA —	Medium to stiff clays w/slf
	ESTUARINE —	Soft to medium clays, silts, silty sands & sands, w/wd & slf.
PLEISTOCENE		stiff to very stiff clays, silt & large layers of silty sand & sand

NOTE
For location of borings, see plates 2, 3 & 4
For boring logs, see plates 58 thru 67

LAKE PONTCHARTRAIN, LA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A
CITRUS LAKEFRONT LEVEE
IHNC TO PARIS ROAD

SOIL AND GEOLOGIC PROFILE
STA. 0+00 B/L TO STA. 96+00 B/L

US ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MAY 1976
FILE NO. H-2-26533



NOTE:
For location of borings, see plates 2, 3 & 4
For boring logs, see plates 58 thru 67
For legend, see plate 53

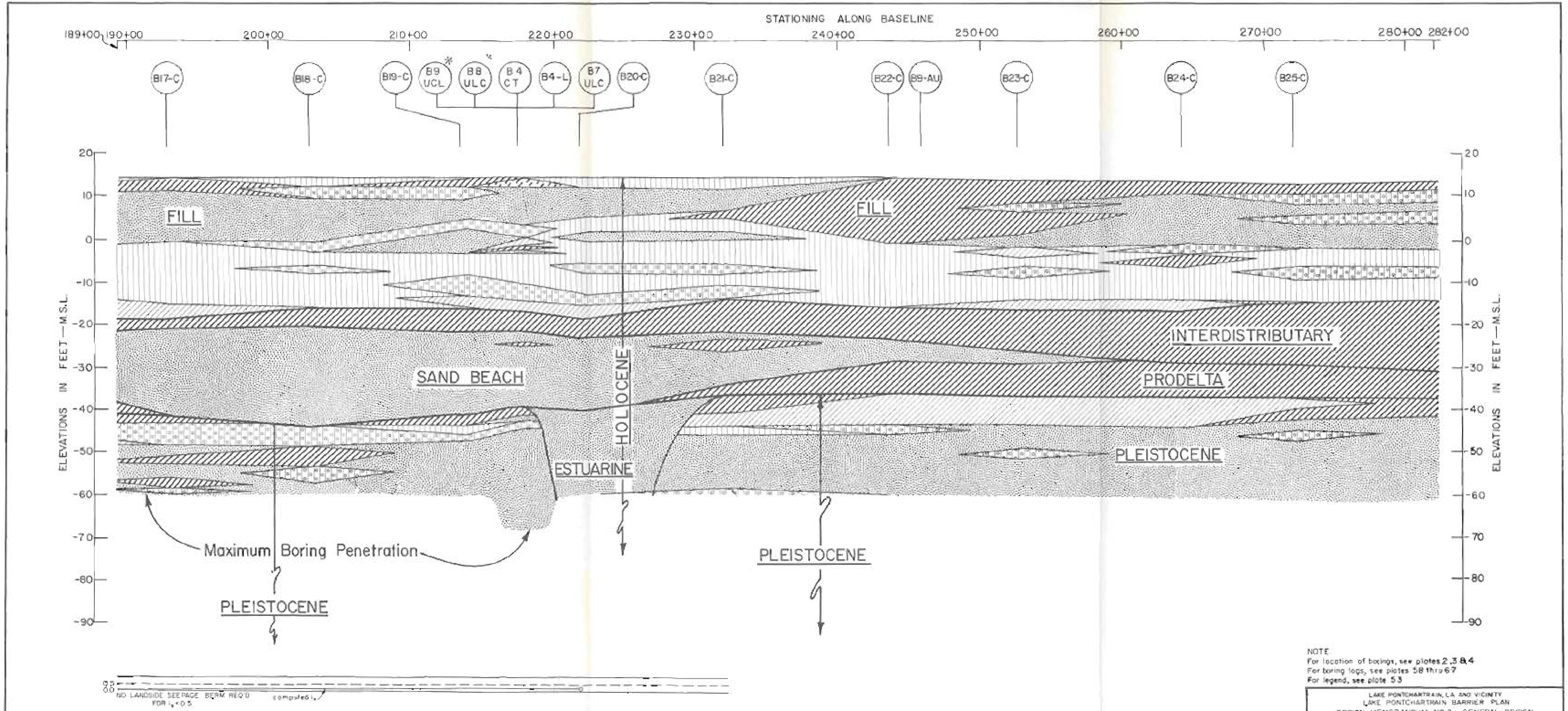
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO 2 — GENERAL DESIGN
SUPPLEMENT NO. 5A
CITRUS LAKEFRONT LEVEE
IHNC TO PARIS ROAD

SOIL AND GEOLOGIC PROFILE

STA. 96+00 B/L TO STA. 189+00 B/L

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

MAY 1976 FILE NO H-2-26533

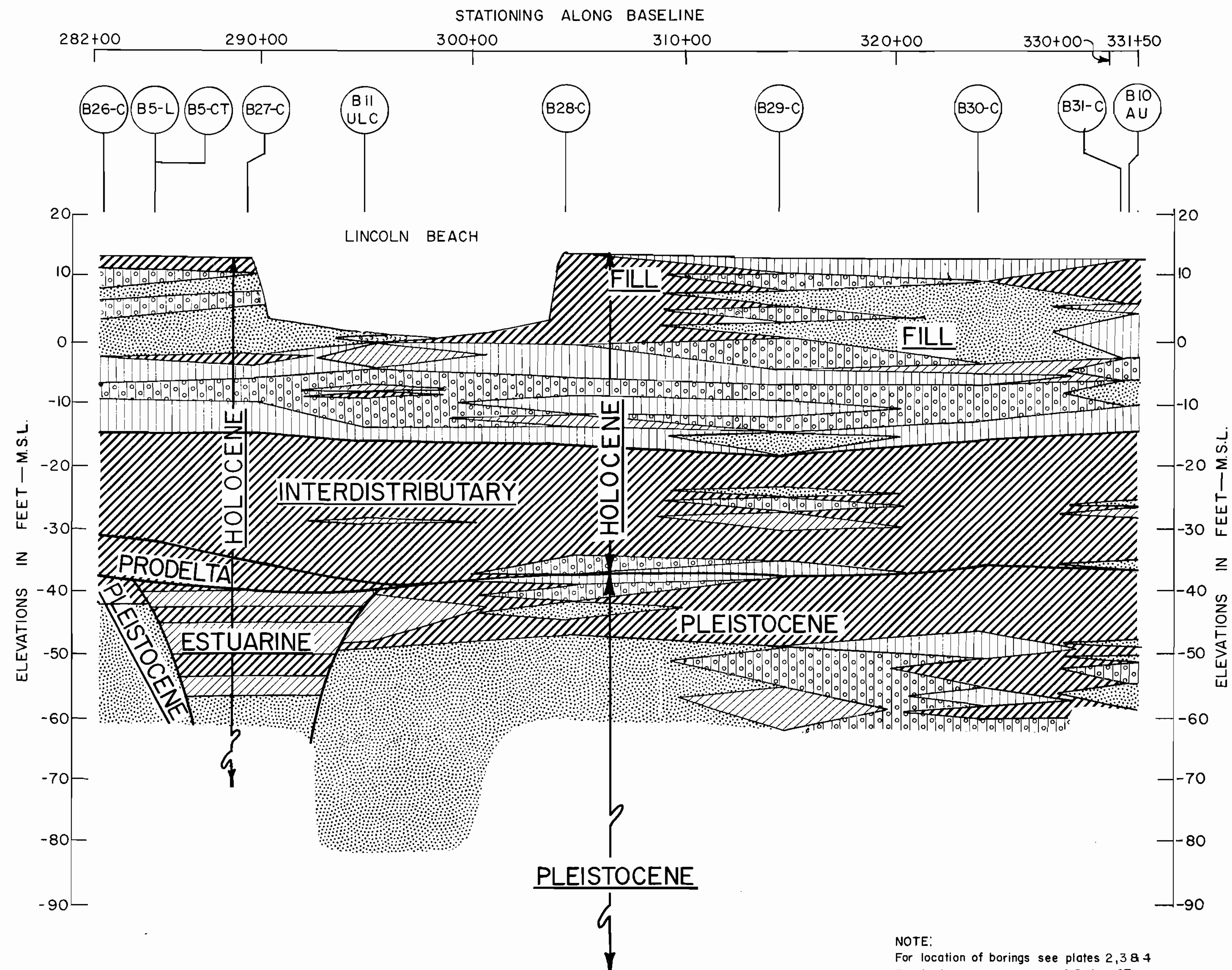


NOTE
For location of borings, see plates 2,3 & 4
For boring logs, see plates 58 thru 67
For legend, see plate 53

LAKE PONTCHARTRAIN, LA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO 2 – GENERAL DESIGN
SUPPLEMENT NO 5A
CITRUS LAKEFRONT LEVEE
IHNC TO PARIS ROAD

SOIL AND GEOLOGIC PROFILE

STA. 189 + 00 B/L TO STA. 282 + 00 B/L
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MAY 1976
FILE NO. H-2-26533



NOTE:
For location of borings see plates 2,3 & 4
For boring logs, see plates 58 thru 67
For legend, see plate 53

LAKE PONTCHARTRAIN, LA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 – GENERAL DESIGN
SUPPLEMENT NO. 5A
CITRUS LAKEFRONT LEVEE
IHNC TO PARIS ROAD

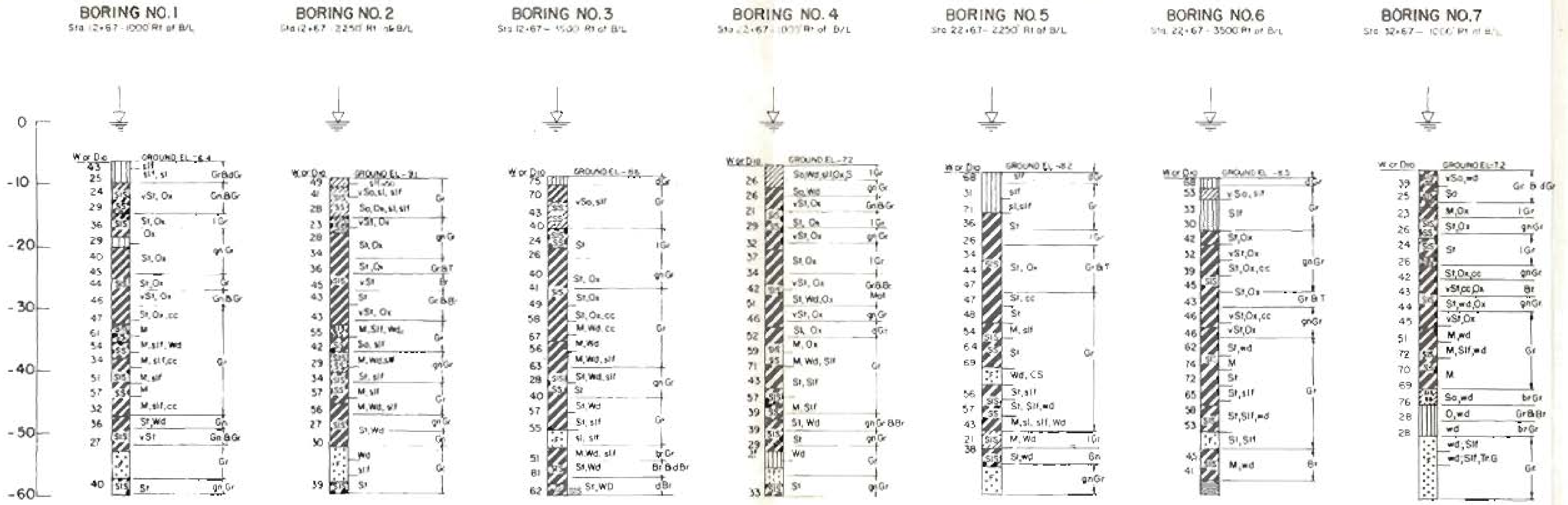
SOIL AND GEOLOGIC PROFILE

STA. 282 + 00 B/L TO STA. 331+50 B/L

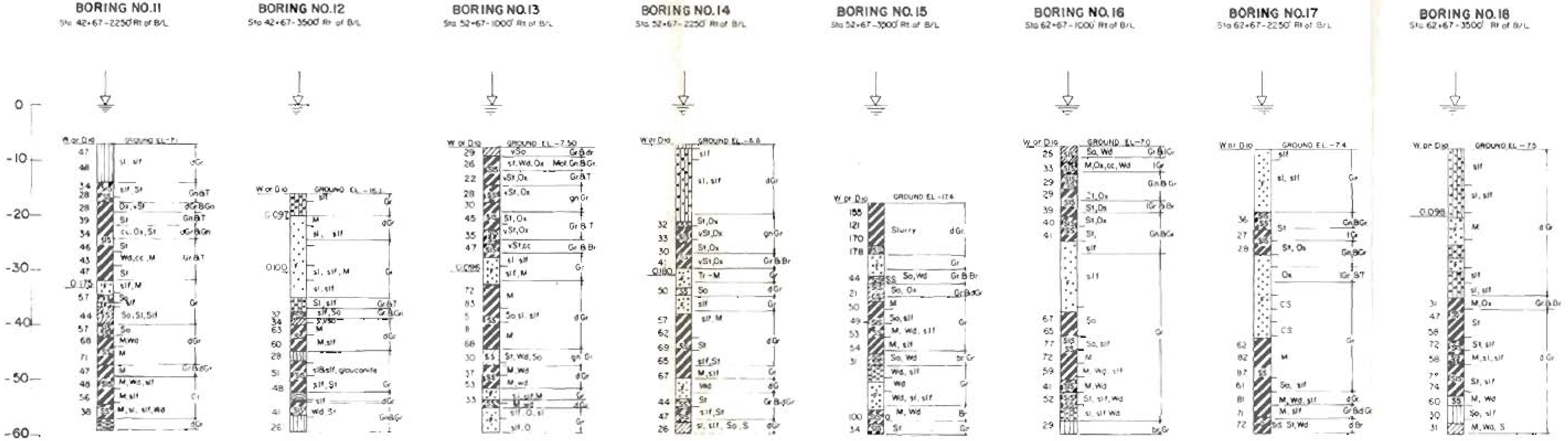
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

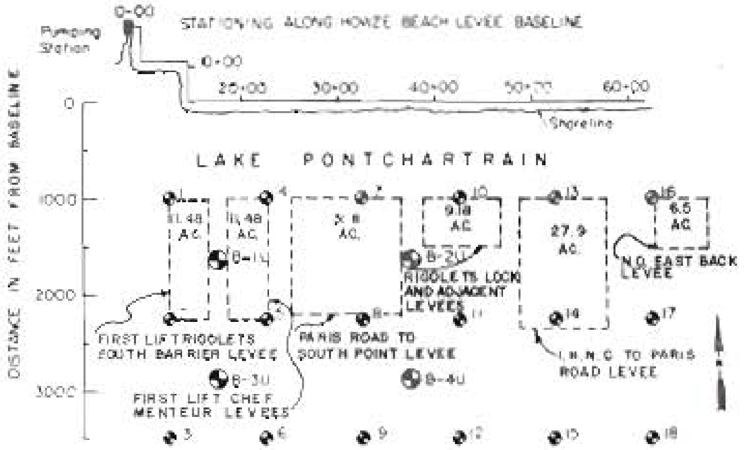
MAY 1976 FILE NO. H-2-26533

PLOT NO. 4



PLOT NO. 4





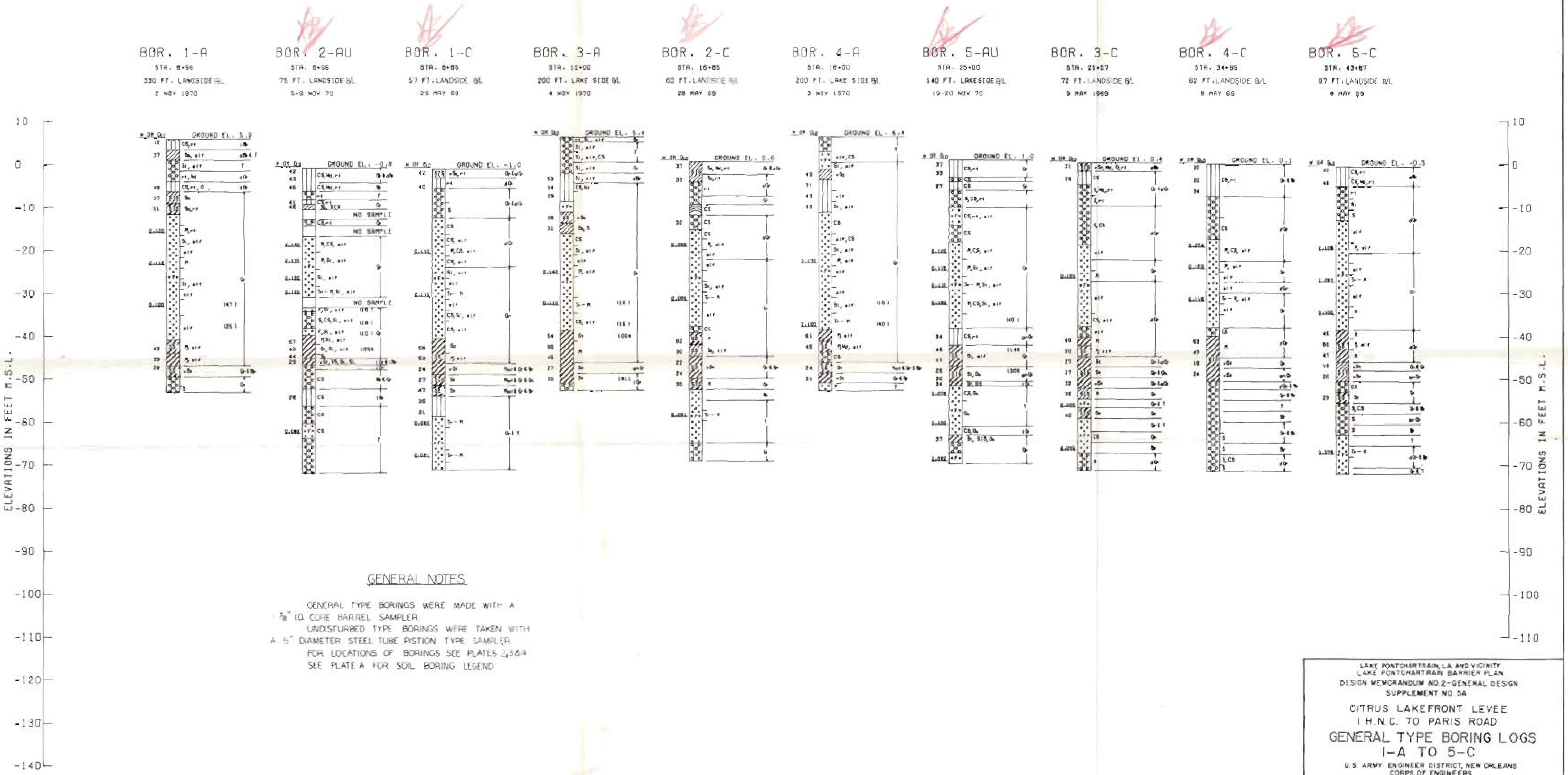
PROSPECTIVE BORROW AREAS
LAKE PONTCHARTRAIN ALONG NORTH SHORE
INDICATES BORING LOCATIONS

GENERAL NOTES:
FOR SOIL BORING LEGEND SEE PLATE 4
SOIL SAMPLES TAKEN WITH 1 5/8" Ø CORE BARREL SAMPLER

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD
BORROW DATA
PIT AREA IN LAKE PONTCHARTRAIN
ALONG NORTH SHORE

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

MAY 1976 FILE NO. H-2-26533



GENERAL NOTES

GENERAL TYPE BORINGS WERE MADE WITH A 1 7/8" I.D. CORE BARREL SAMPLER.

UNDISTURBED TYPE BORINGS WERE TAKEN WITH A 5" DIAMETER STEEL TUBE PISTION TYPE SAMPLER.

FOR LOCATIONS OF BORINGS SEE PLATES 2,3&4

SEE PLATE A FOR SOIL BORING LEGEND

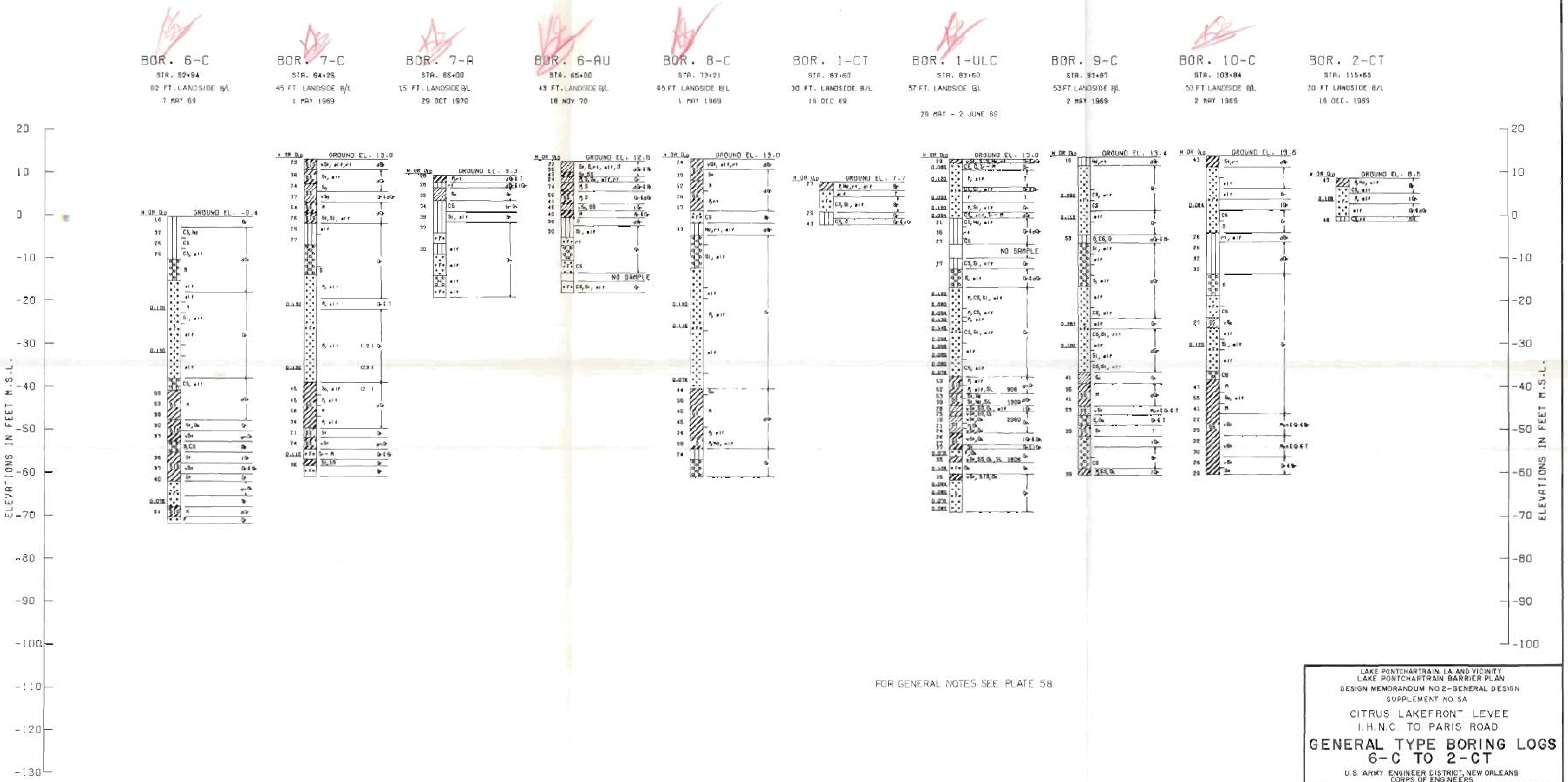
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

GENERAL TYPE BORING LOGS
I-A TO 5-C

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

MAY 1976 FILE NO. H-2-26533



FOR GENERAL NOTES SEE PLATE 58

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

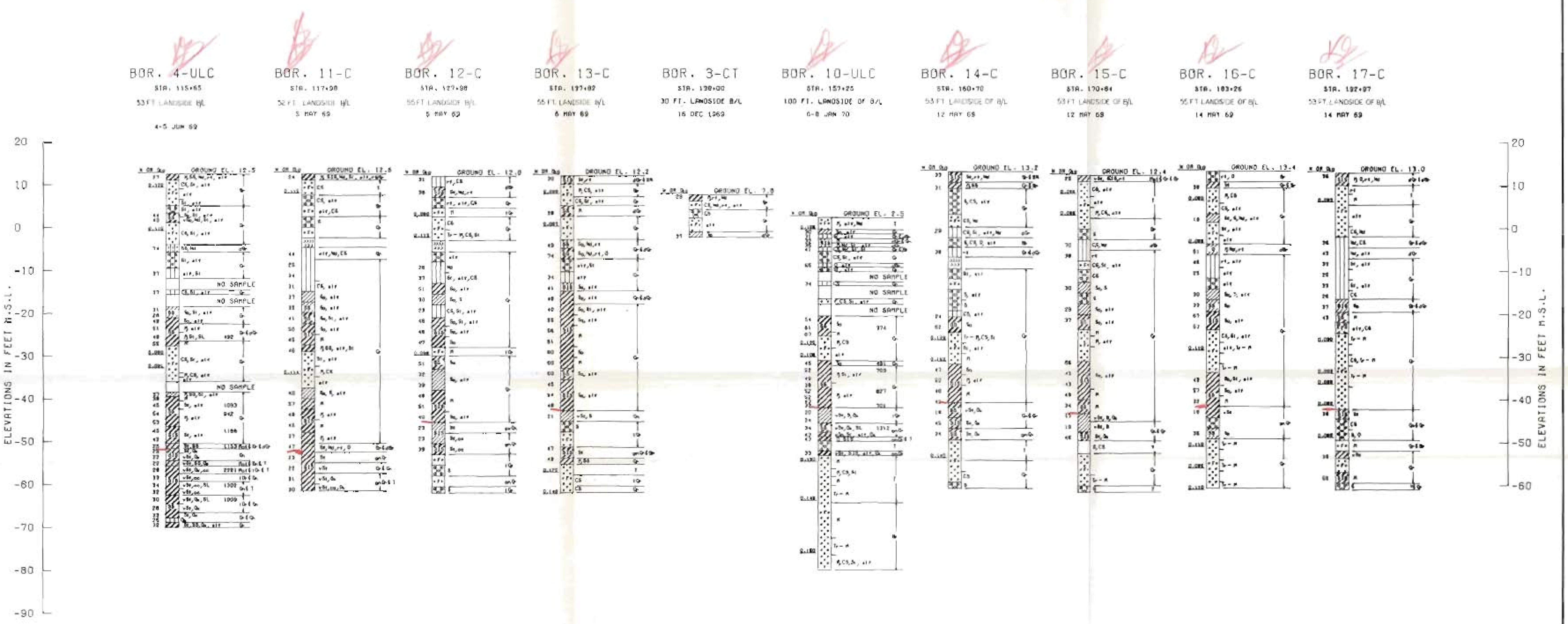
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

GENERAL TYPE BORING LOGS 6-C TO 2-CT

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

MAY 1976

FILE NO. H-2-26533



FOR GENERAL NOTES SEE PLATE 58

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

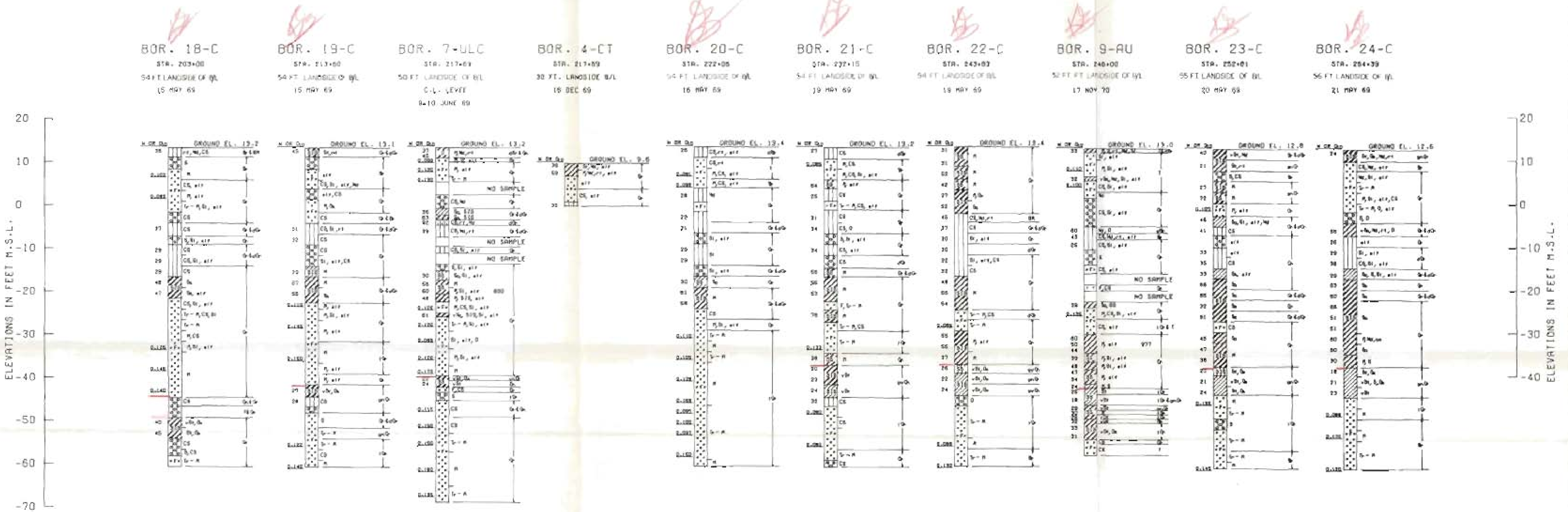
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

GENERAL TYPE BORING LOGS 4-ULC TO 17-C

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

MAY 1976 FILE NO. H-2-26533

PLATE 61



FOR GENERAL NOTES SEE PLATE 58

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

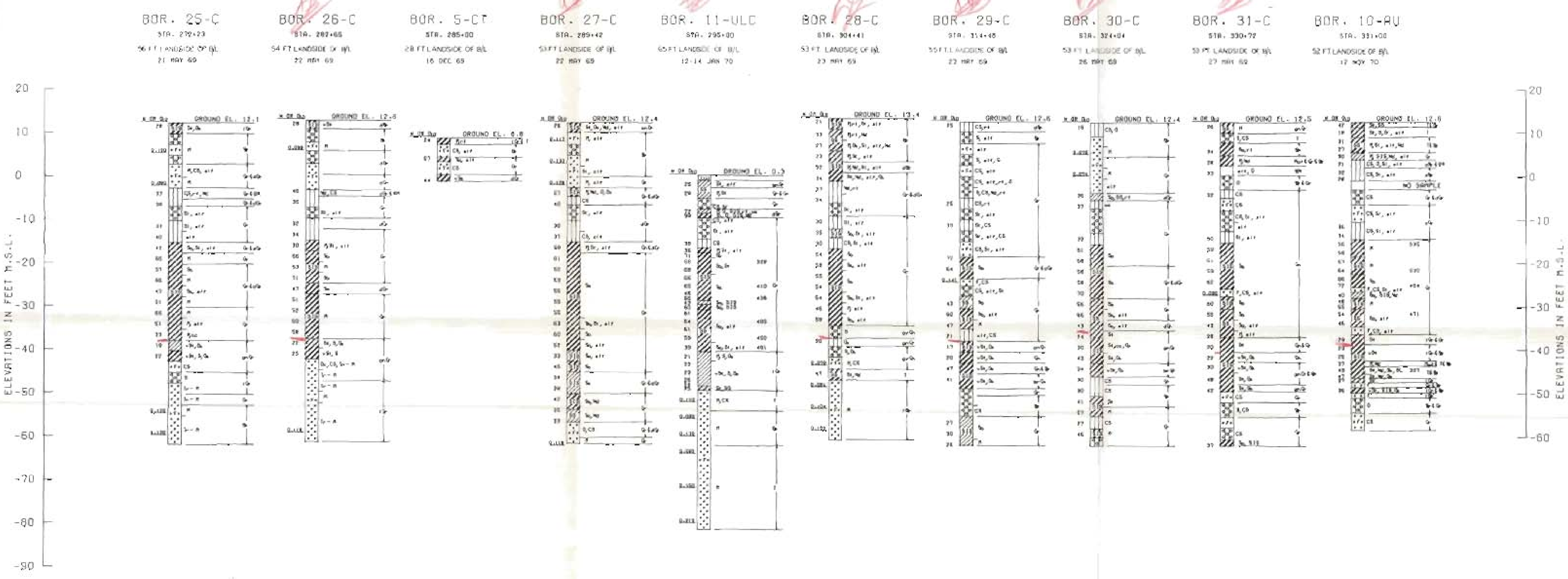
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

GENERAL TYPE BORING LOGS
18-C TO 24-C

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

MAY 1976 FILE NO. H-2-26533

PLATE 62



FOR GENERAL NOTES SEE PLATE 58

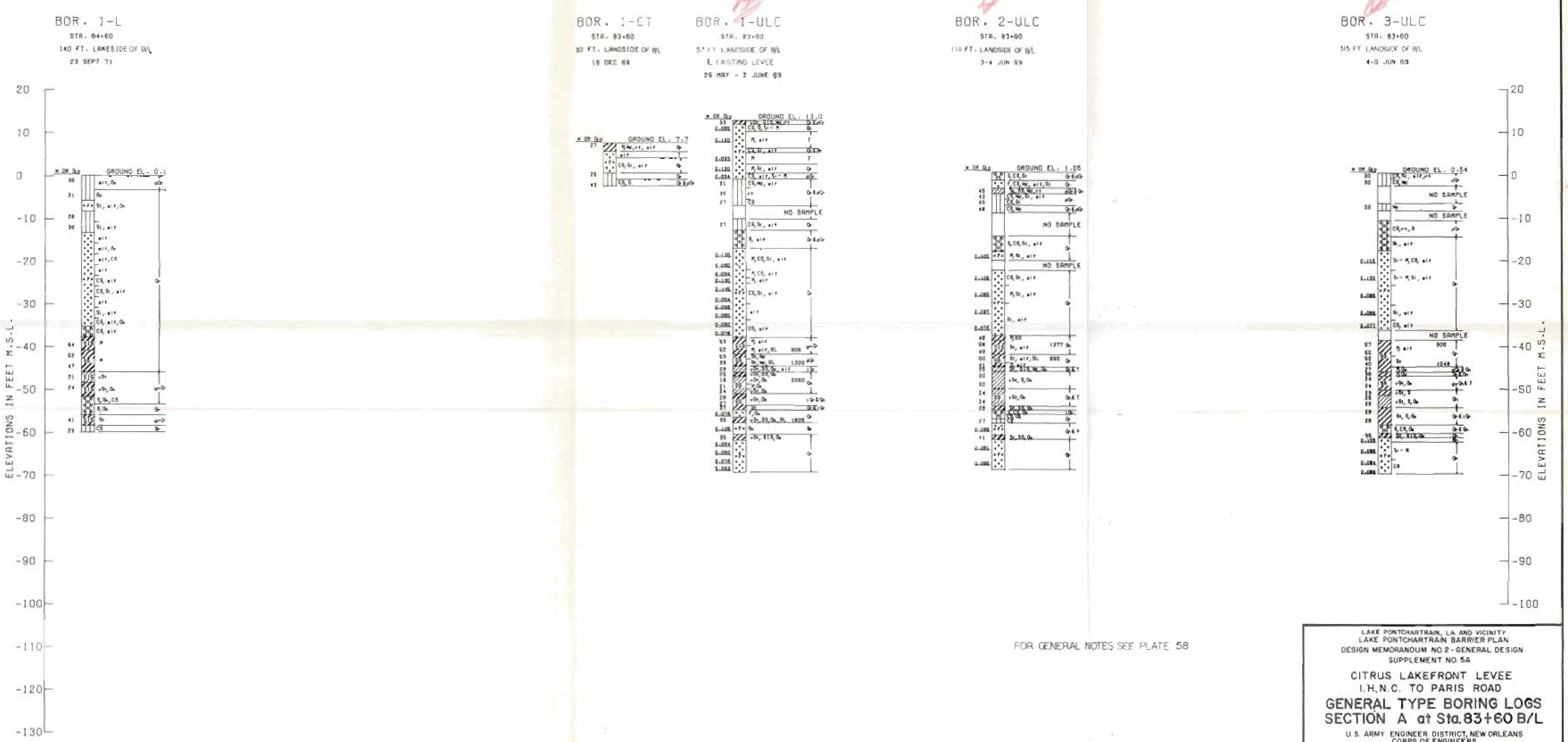
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

GENERAL TYPE BORING LOGS
25-C TO 10AU

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

MAY 1976 FILE NO. H-2-26533



FOR GENERAL NOTES SEE PLATE 58

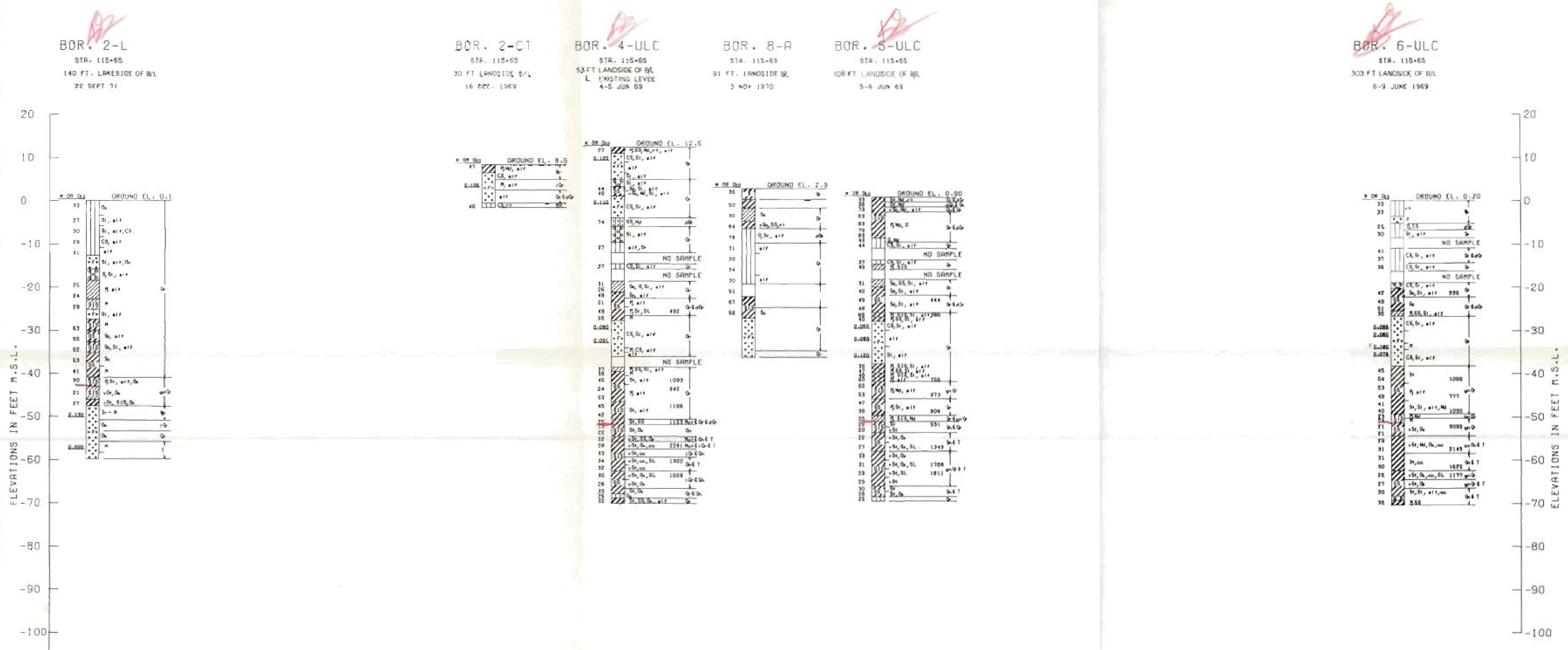
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

GENERAL TYPE BORING LOGS
SECTION A at Sta. 83+60 B/L

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

MAY 1976 FILE NO. H-2-26533



FOR GENERAL NOTES SEE PLATE 58.

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

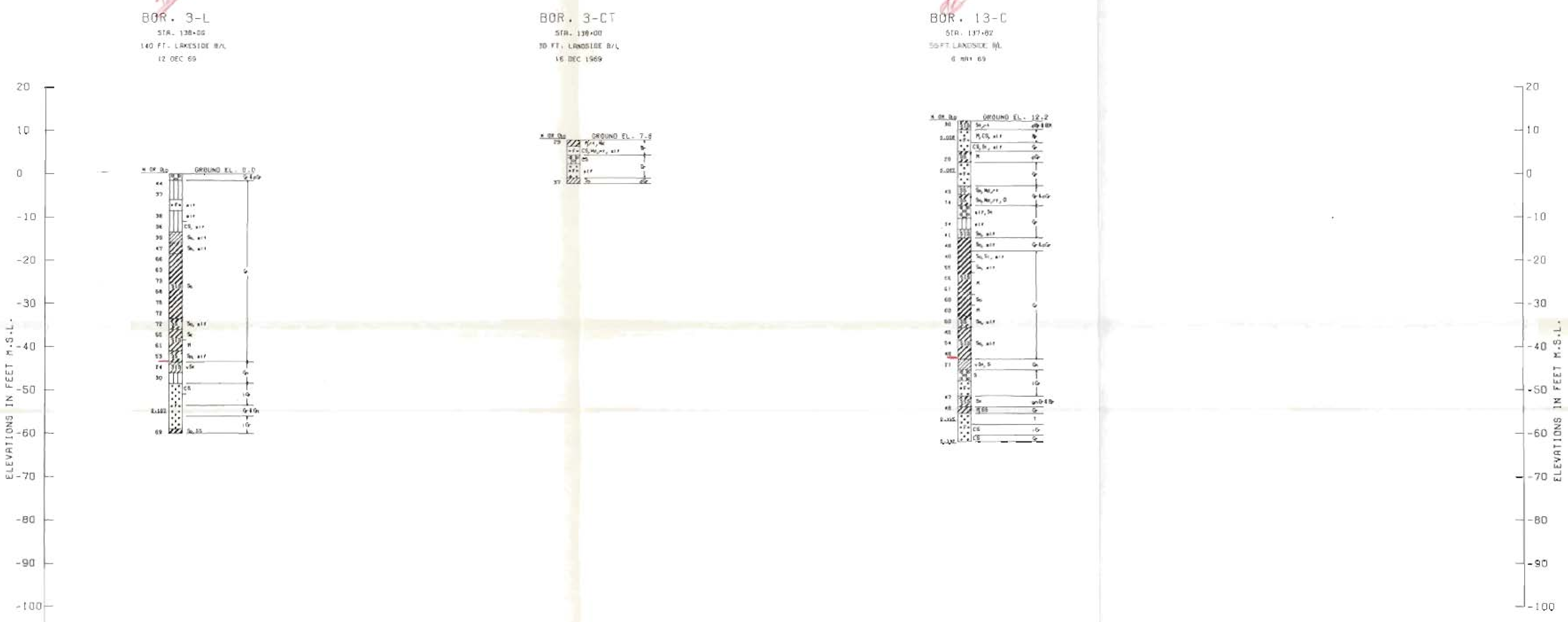
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

GENERAL TYPE BORING LOGS
SECTION "B" AT STA. 115+65 B/L

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

MAY 1976

FILE NO. H-2-26533



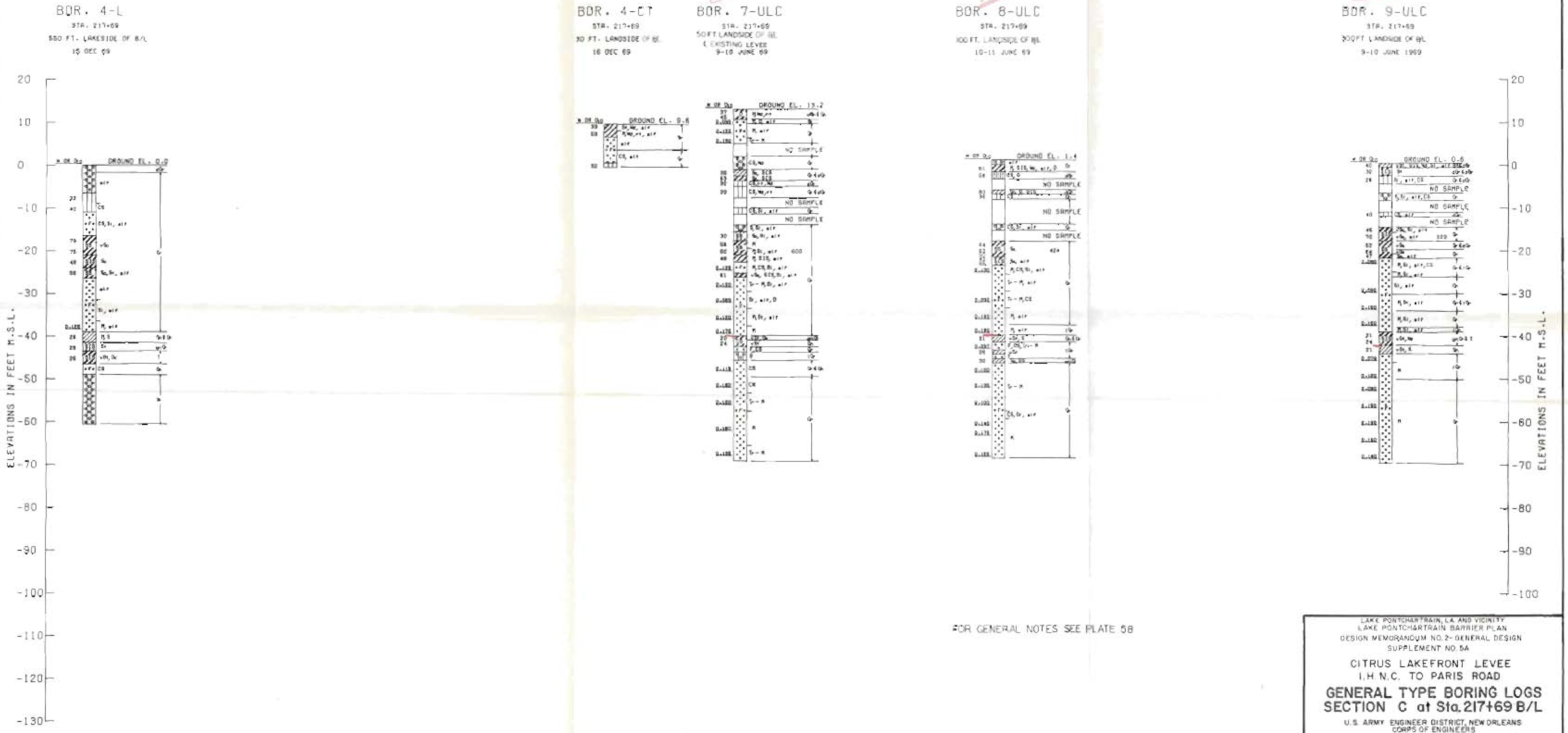
FOR GENERAL NOTES SEE PLATE 58

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO.2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD
GENERAL TYPE BORING LOGS
SECTION AT VICINITY OF
STA. 138+00 B/L

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

MAY 1976 FILE NO. H-2-26533



FOR GENERAL NOTES SEE PLATE 58

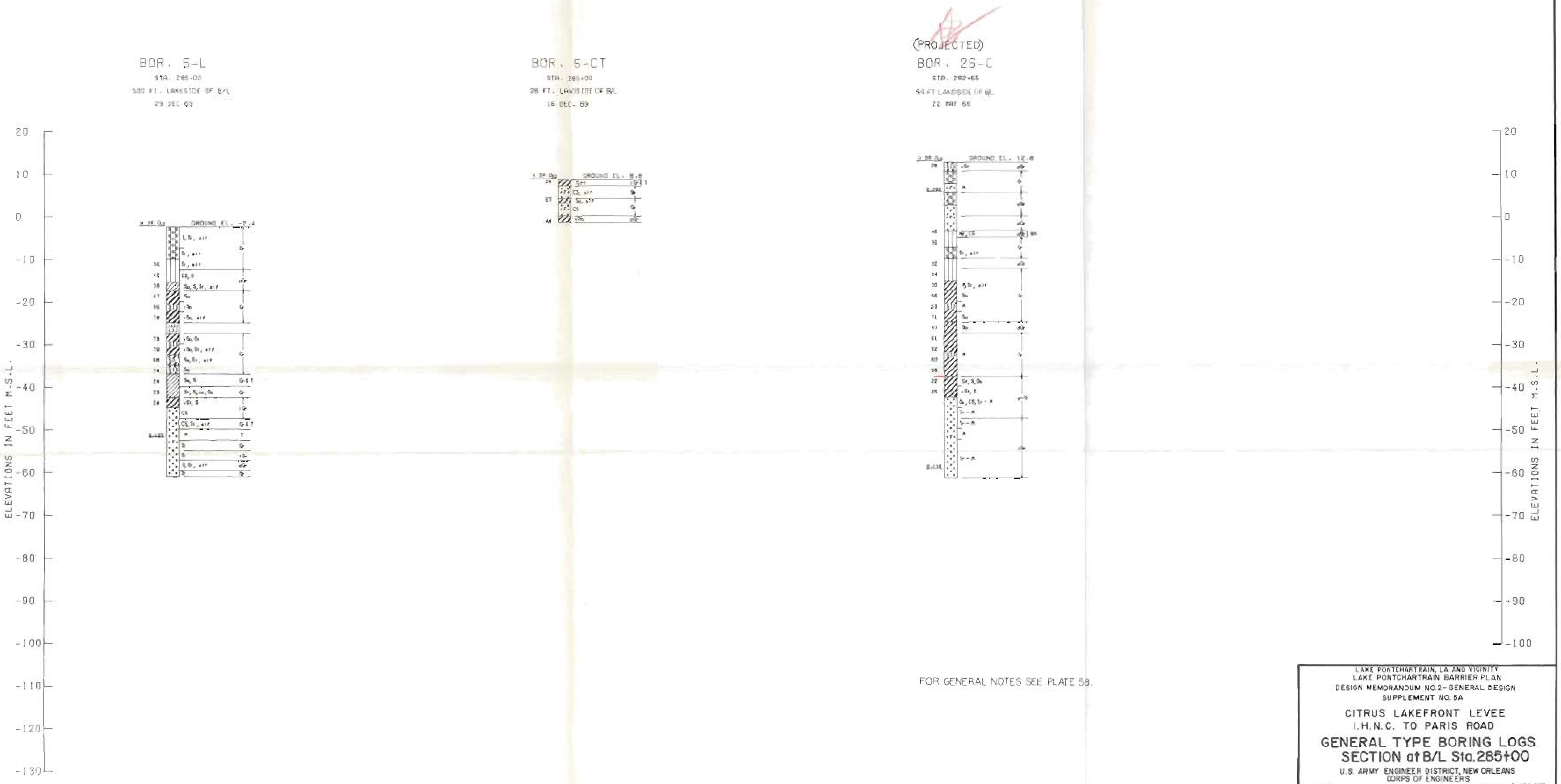
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2- GENERAL DESIGN
SUPPLEMENT NO. 5A

CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

GENERAL TYPE BORING LOGS
SECTION C at Sta. 217+69 B/L

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

MAY 1967 FILE NO. H-2-26533



FOR GENERAL NOTES SEE PLATE 58.

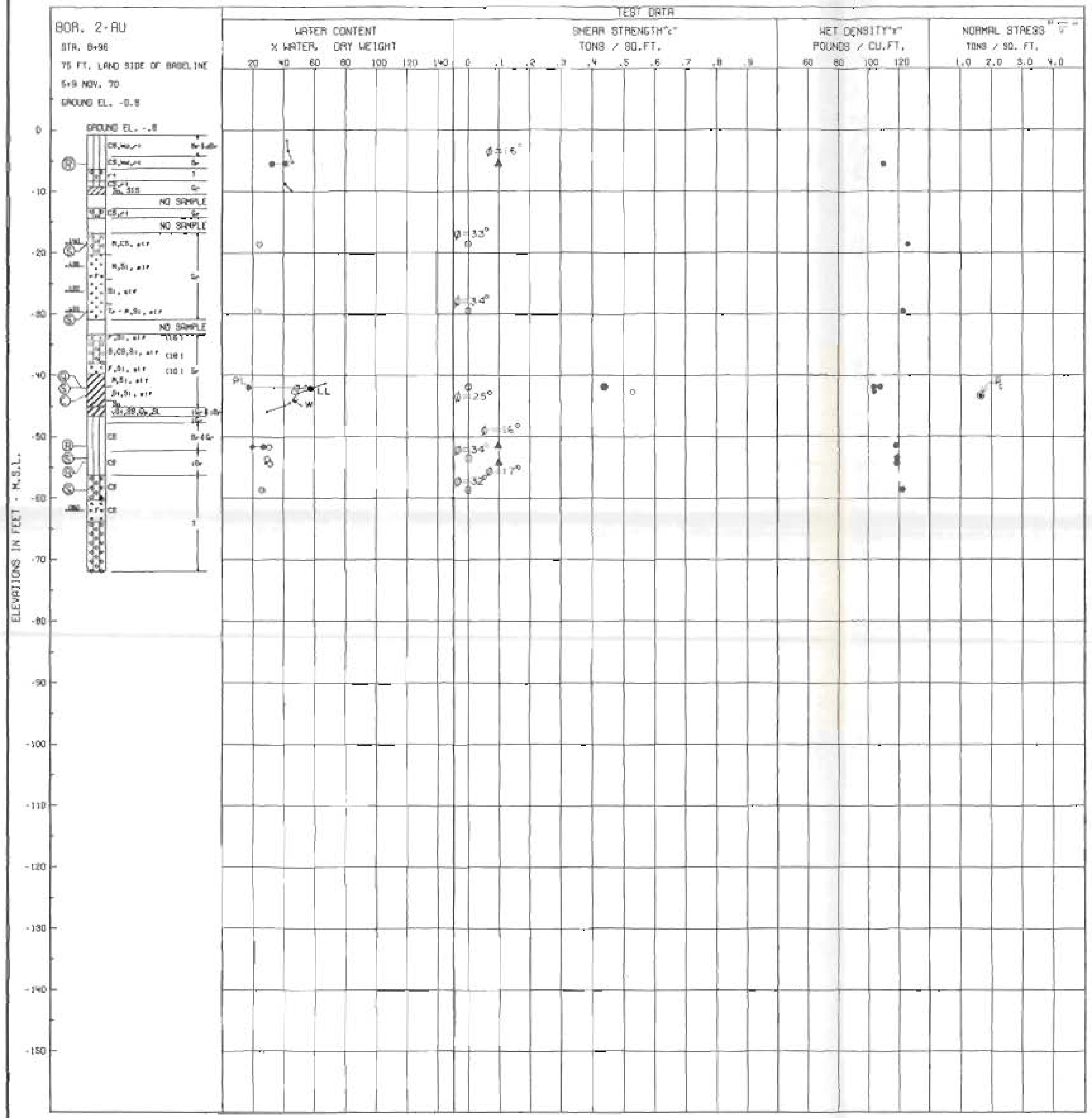
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

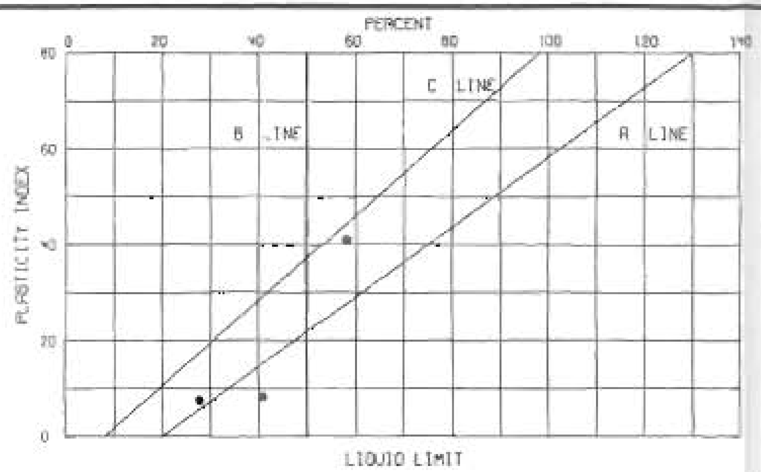
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

GENERAL TYPE BORING LOGS
SECTION at B/L Sta. 285+00

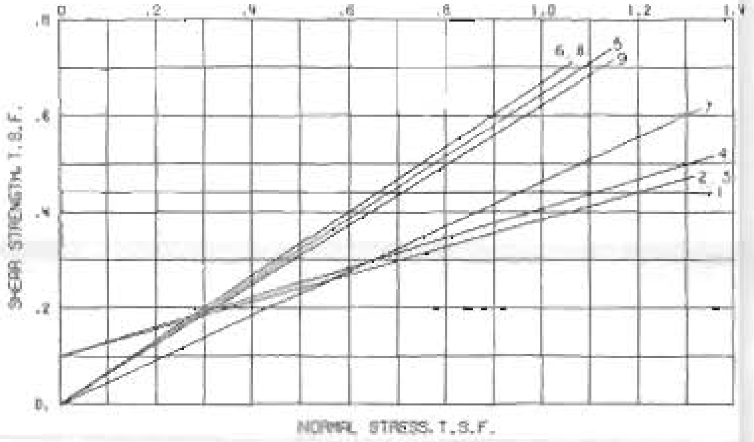
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

MAY 1976   FILE NO. H-2-26533





PLASTICITY CHART

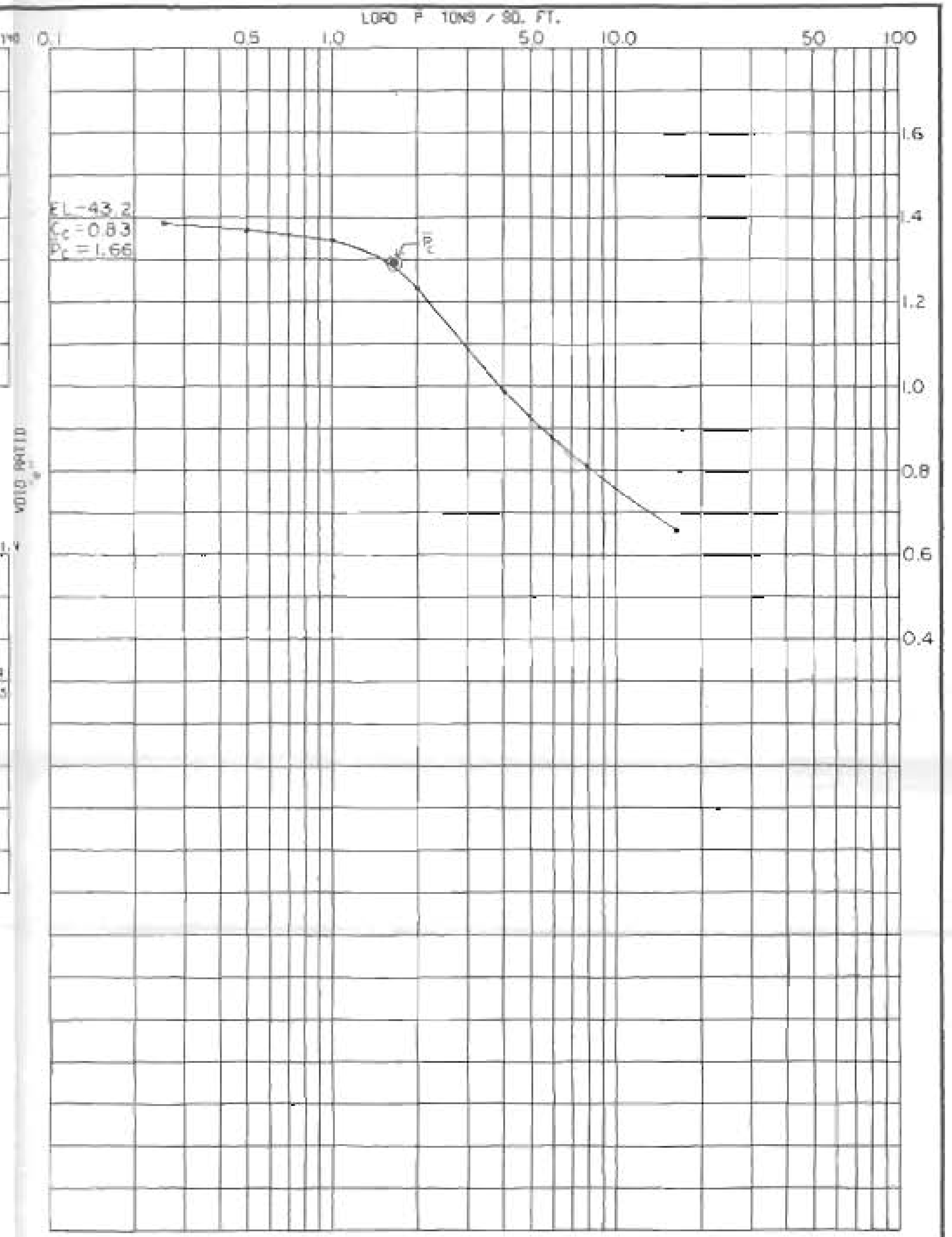


SHEAR STRENGTH DATA

BORING NO.	ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH $\Phi°$	STRENGTH C - TSF	CLASS
2-AU	1	-42.0	Q	0	0.44	CH
	2	- 5.6	R	*16	0.10	ML
	3	-51.5		*16	0.10	ML
	4	-54.5		*17	0.10	ML
	5	-18.6	S	33	0	SM
	6	-29.5		34	0	SP
	7	-42.0		25	0	CH
	8	-53.5		34	0	ML
	9	-58.5		32	0	SM

GENERAL NOTES

- ◎ — CONSOLIDATION TEST
- W — NATURAL WATER CONTENT
- LL — LIQUID LIMIT
- PL — PLASTIC LIMIT
- c — UNIT COHESION
- Φ — ANGLE OF FRICTION
- γ — UNIT WEIGHT OF SOIL
- p — NORMAL STRESS
- ◉ P_c — PRECONSOLIDATION PRESSURE
- e — VOID RATIO
- C_c — COMPRESSION INDEX
- OB — OVERBURDEN



CONSOLIDATION DATA

NOTES

- ○ - (UC) UNCONFINED COMPRESSION TEST
- ● - (Q) UNCONSOLIDATED - UNDRAINED SHEAR TEST
- ▲ - (R) CONSOLIDATED - UNDRAINED SHEAR TEST
- □ - (S) CONSOLIDATED - DRAINED SHEAR TEST

BORINGS WERE TAKEN WITH A 5 INCH DIAMETER STEEL TUBE PISTON TYPE SAMPLER

FOR SOIL BORING LEGEND SEE PLATE A

FOR LOCATION OF BORINGS SEE PLATES 2,3,&4.

FOR DETAIL SHEAR STRENGTH DATA SEE PLATE 84

* BASED ON DEVIATOR STRESS AT MAXIMUM POSITIVE PORE PRESSURE.

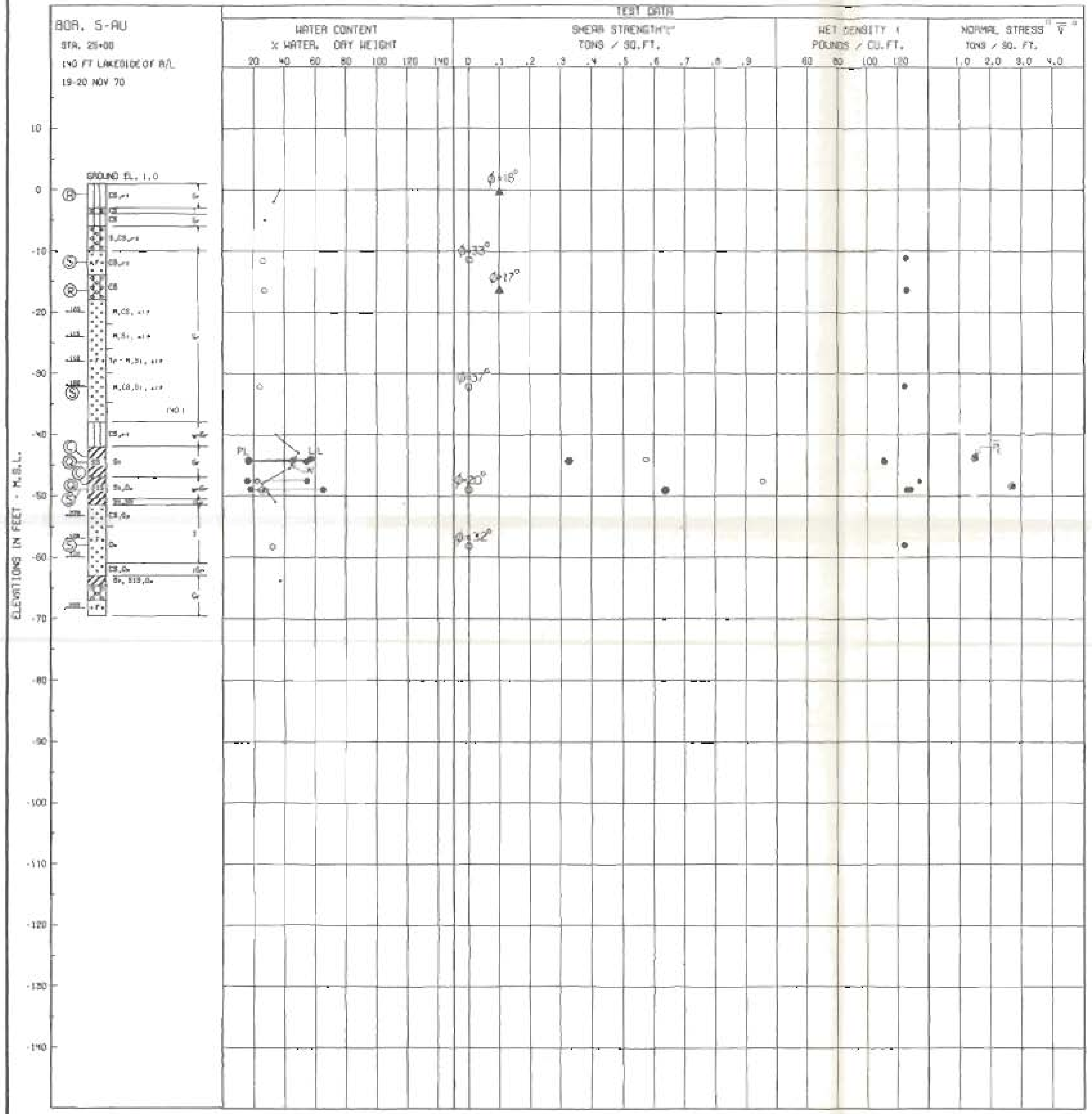
LAKE PONTCHARTRAIN, LA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO.2 - GENERAL DESIGN
SUPPLEMENT NO 5A

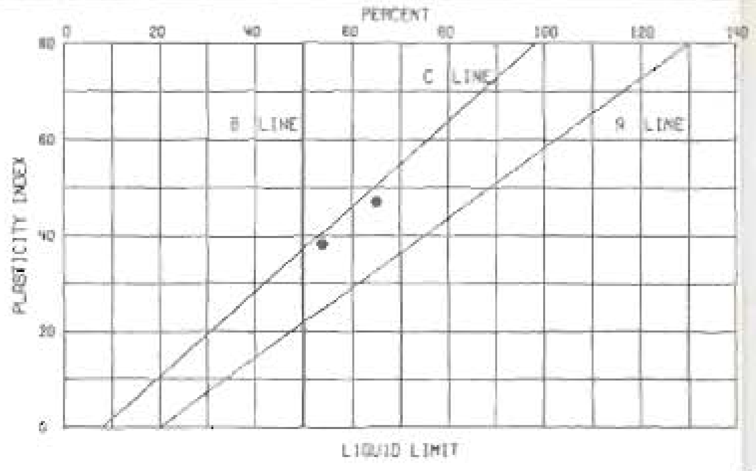
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

UNDISTURBED BORING 2-AU DATA

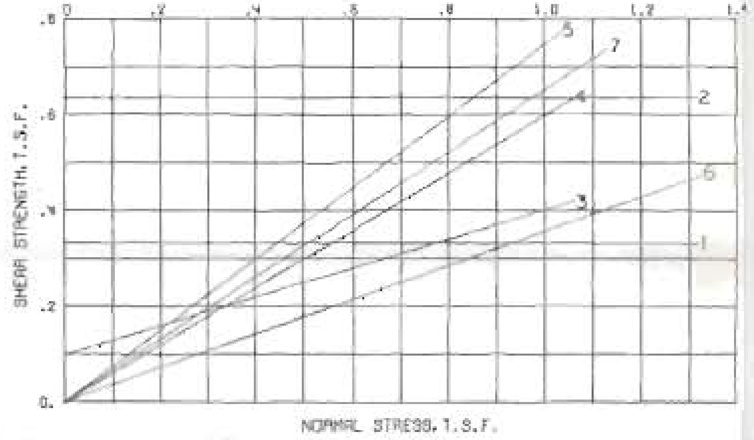
U.S. ARMY ENGINEER DISTRICT NEW ORLEANS
CORPS OF ENGINEERS

MAY 1976 — FILE NO H-2-26533





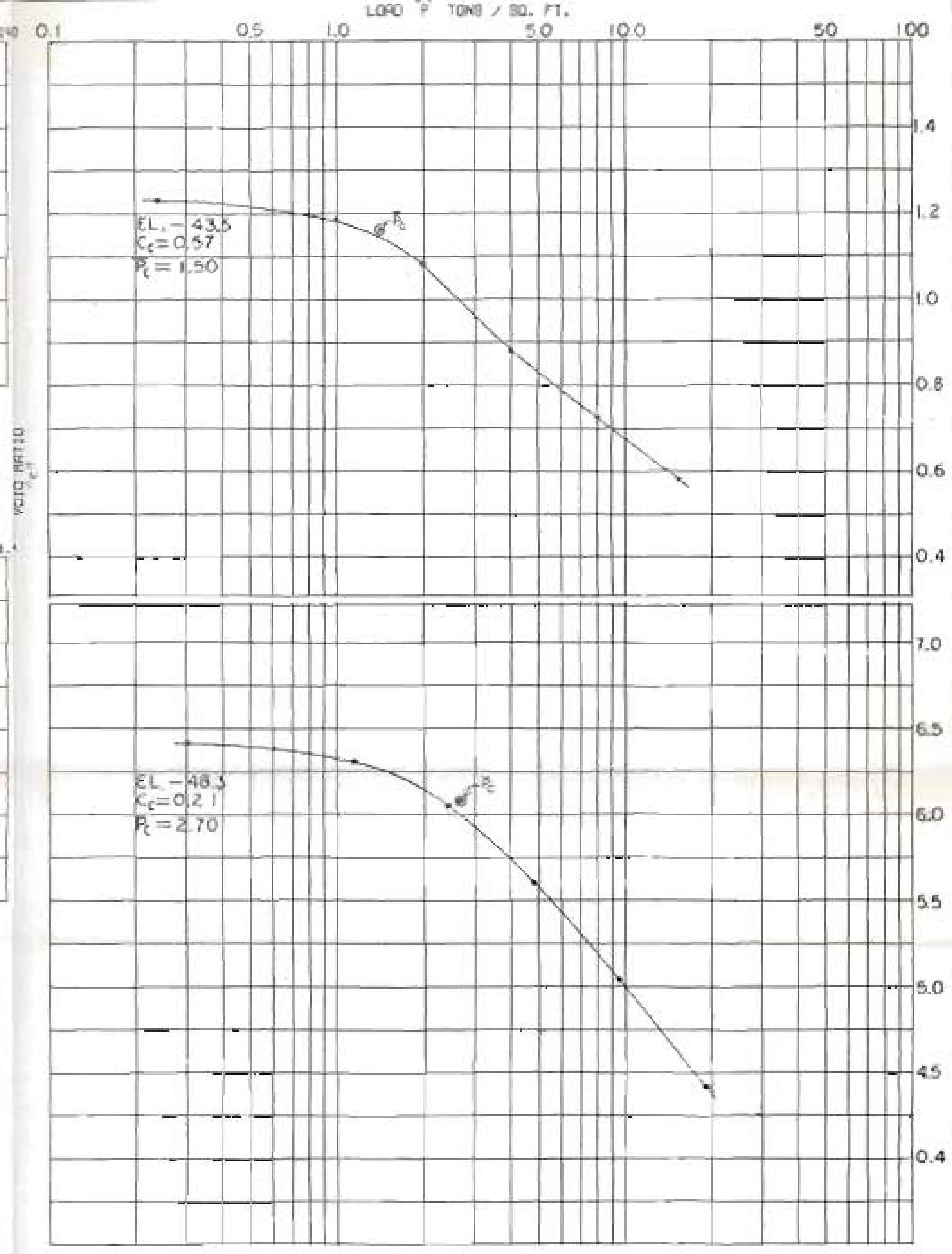
PLASTICITY CHART



SHEAR STRENGTH DATA

BORING NO.	ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH ϕ°	STRENGTH C - TSF	CLASS
5-AU	1	-44.5	Q	0	0.330	CH
	2	-49.0		0	0.636	CH
	3	-16.4	R	*17	0.100	SM
	4	-11.9	S	33	0	SP
	5	-32.2		37	0	SP
	6	-49.0		20	0	CH
	7	-57.8		32	0	SP
	8	-0.7	R	*18	0.100	ML

* BASED ON DEVIATOR STRESS AT MAXIMUM POSITIVE PORE PRESSURE.



CONSOLIDATION - DATA

○ - (UC) UNCONFINED COMPRESSION TEST
● - (Q) UNCONSOLIDATED - UNDRAINED SHEAR TEST
▲ - (R) CONSOLIDATED - UNDRAINED SHEAR TEST
□ - (S) CONSOLIDATED - DRAINED SHEAR TEST

BORINGS WERE TAKEN WITH A 5 INCH DIAMETER STEEL TUBE PISTON TYPE SAMPLER

FOR SOIL BORING LEGEND SEE PLATE A

FOR LOCATION OF BORINGS SEE PLATES 2, 3, & 4.

FOR DETAIL SHEAR STRENGTH DATA SEE PLATE 85

FOR GENERAL NOTES SEE PLATE 68.

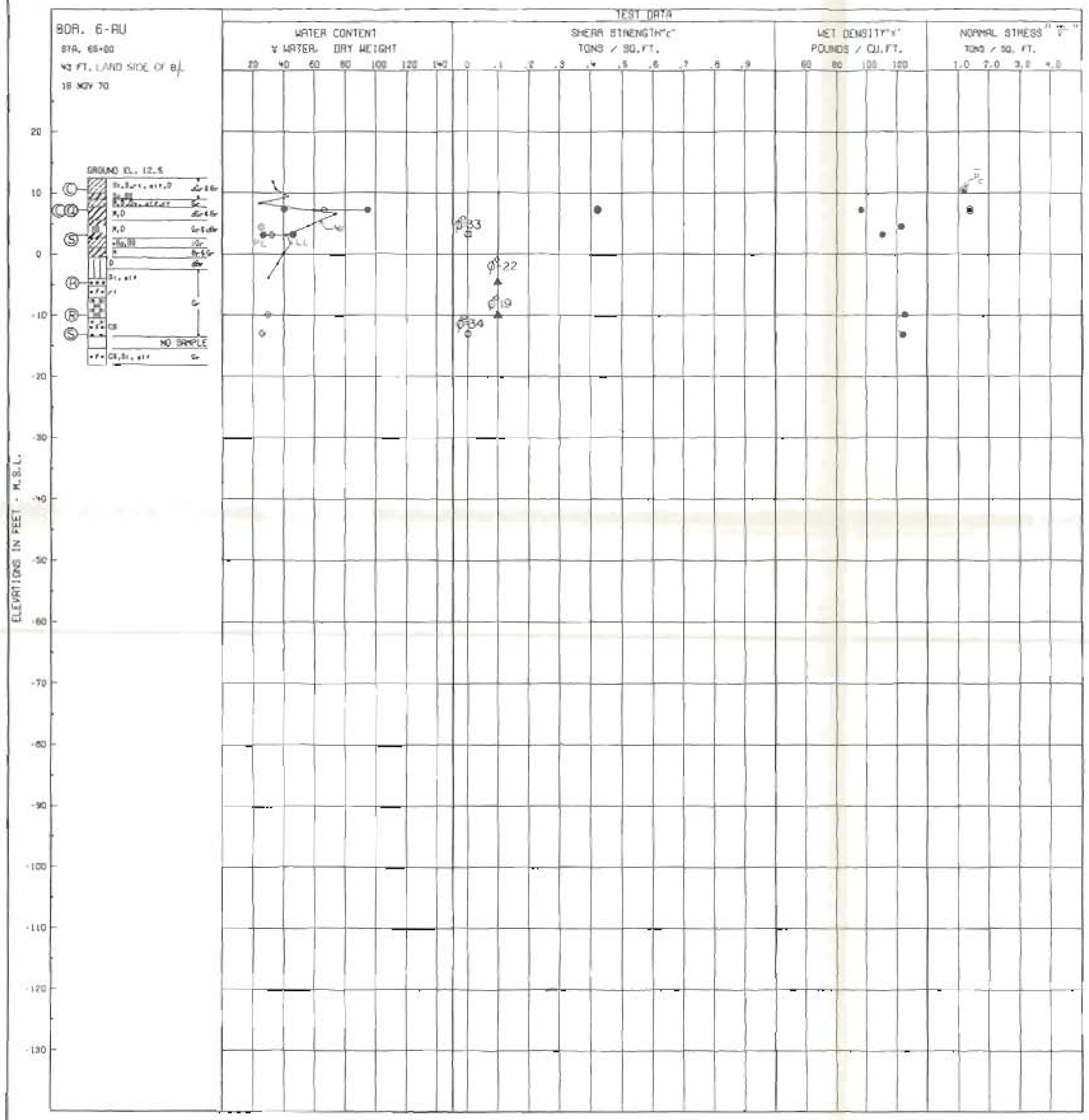
LAKE PONTCHARTRAIN, LA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO.2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

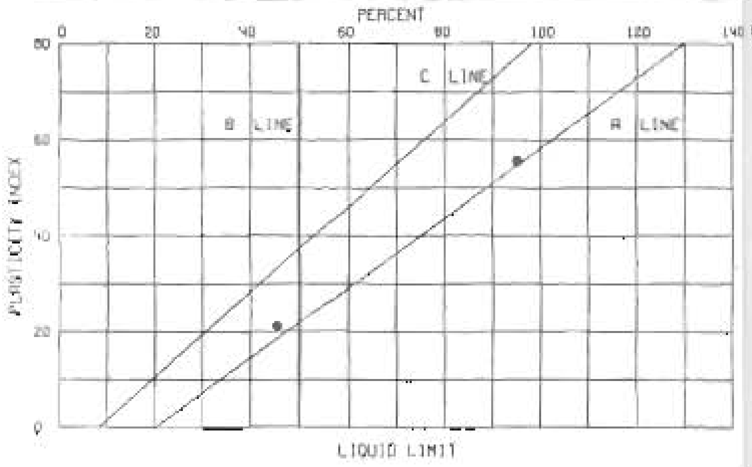
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

UNDISTURBED BORING 5-AU DATA

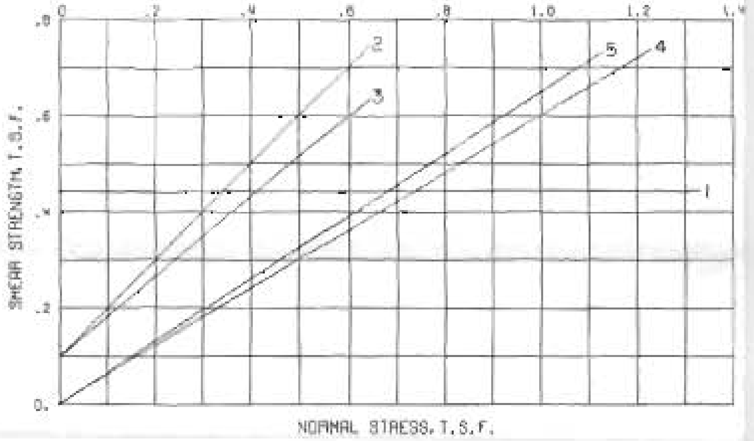
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

MAY 1976 FILE NO. H-2-26533





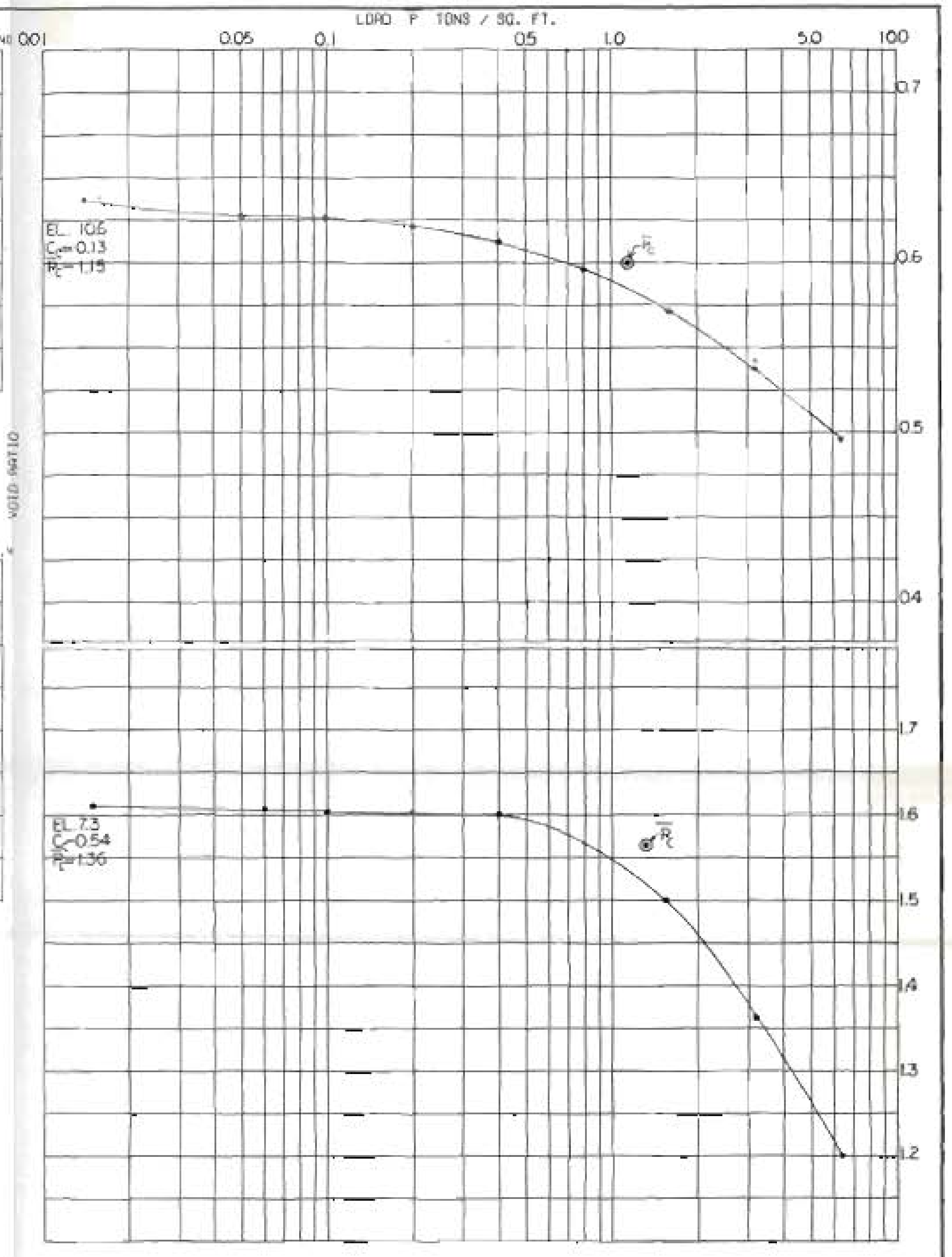
PLASTICITY CHART



SHEAR STRENGTH DATA

BORING NO.	ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH $\phi°$	STRENGTH C - TSF	CLASS
6-AU	1	7.3	Q	0	0421	CH
	2	-4.7	R	*22	0.100	SP
	3	-10.0		*19	0.100	SM
	4	3.3	S	33	0	CL
	5	-13.3		34	0	SM

* BASED ON DEVIATOR STRESS AT MAXIMUM POSITIVE PORE PRESSURE



CONSOLIDATION DATA

○ - (UC) UNCONFINED COMPRESSION TEST
● - (Q) UNCONSOLIDATED - UNDRAINED SHEAR TEST
▲ - (R) CONSOLIDATED - UNDRAINED SHEAR TEST
□ - (S) CONSOLIDATED - DRAINED SHEAR TEST

BORINGS WERE TAKEN WITH A 5 INCH DIAMETER STEEL TUBE PISTON TYPE SAMPLER

FOR SOIL BORING LEGEND SEE PLATE A
FOR LOCATION OF BORINGS SEE PLATES 2,3,& 4.
FOR DETAIL SHEAR STRENGTH DATA SEE PLATE 66.
FOR GENERAL NOTES SEE PLATE 68.

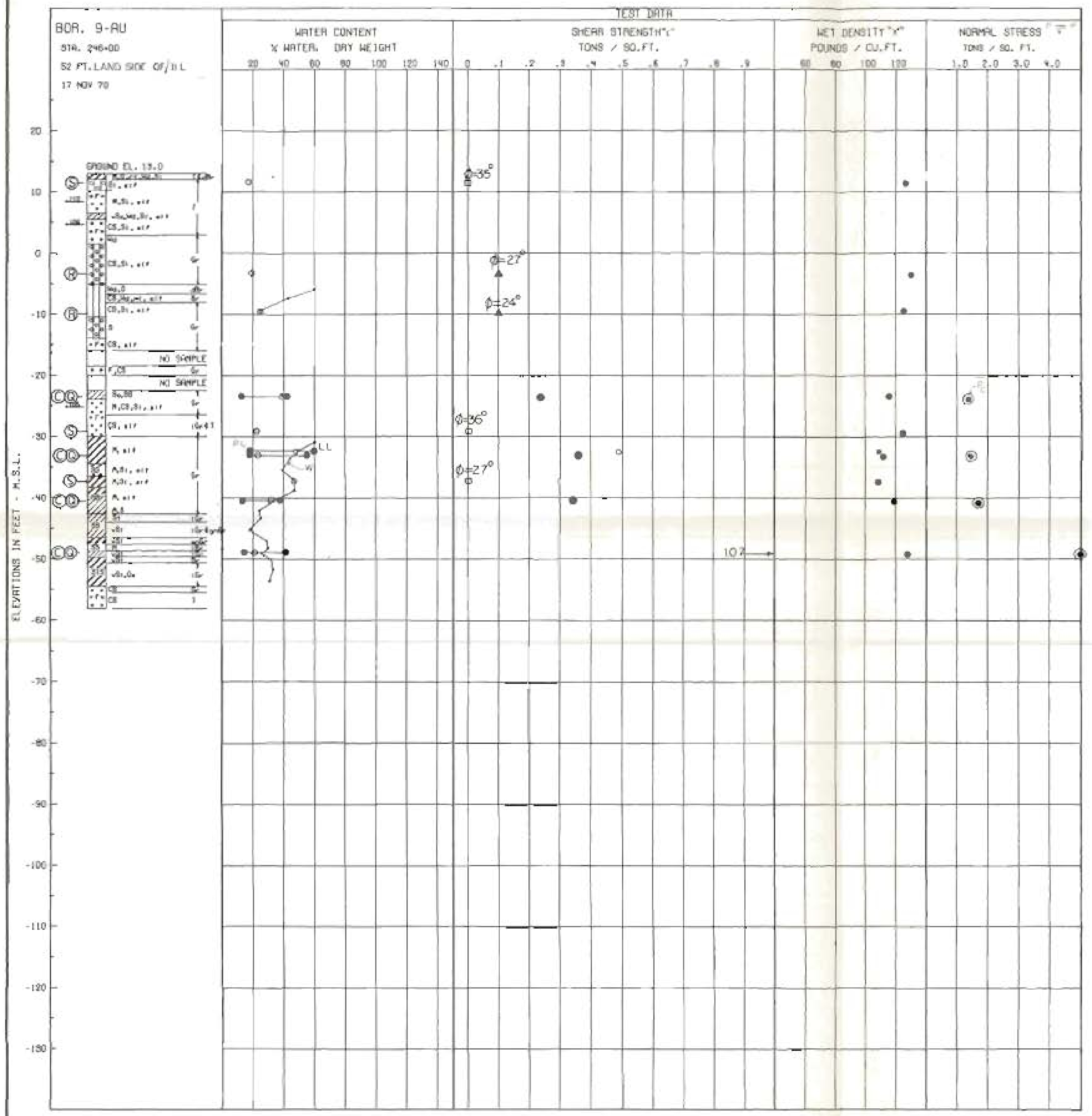
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO.2-GENERAL DESIGN
SUPPLEMENT NO. 5A

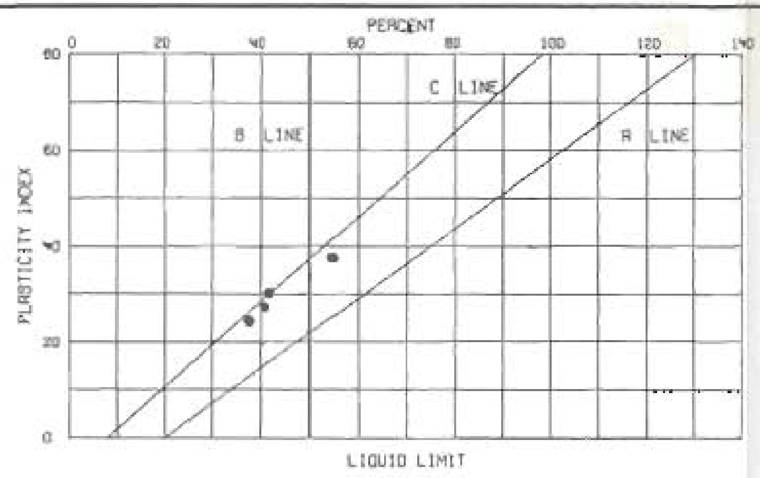
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

UNDISTURBED BORING 6-AU DATA

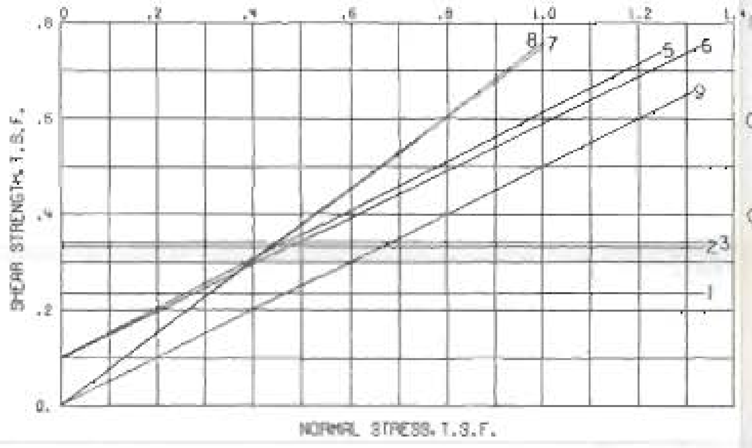
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

MAY 1978 FILE NO. H-2-26333





PLASTICITY CHART

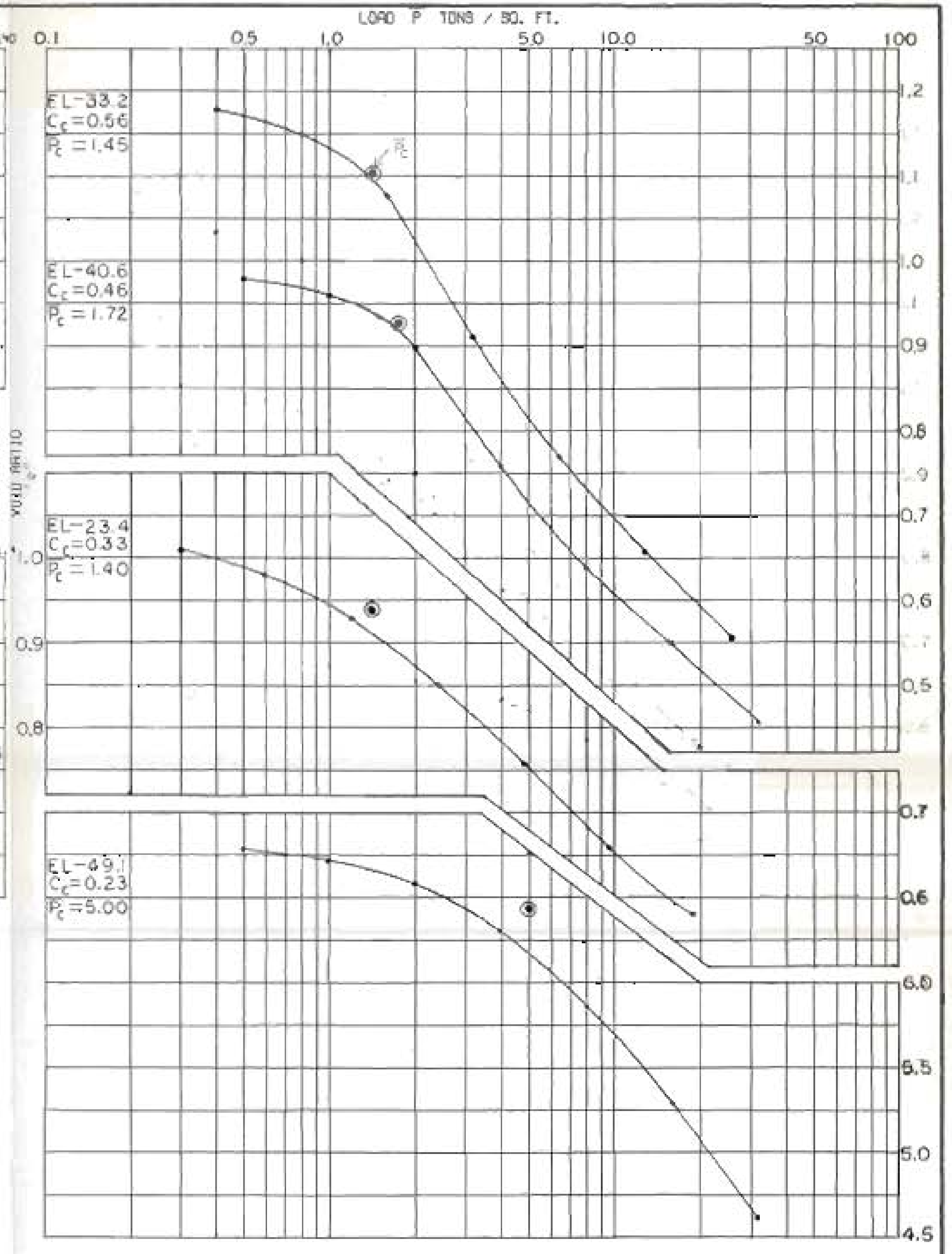


NOTE NO.4 NOT REPRESENTED.

SHEAR STRENGTH DATA

BORING NO.	ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH Φ°	STRENGTH C - TSF	CLASS
9-AU	1	-23.4	Q	0	0.235	CL
	2	-33.2		0	0.330	CH
	3	-40.6		0	0.340	CL
	4	-49.1		0	1.070	CL
	5	-34	R	*27	0.100	SM
	6	-9.7		*24	0.100	SM
	7	11.7	S	35	0	SM
	8	-29.1		36	0	SP
	9	-37.0		27	0	CH

* BASED ON DEVIATOR STRESS AT MAXIMUM POSITIVE PORE PRESSURE.



CONSOLIDATION DATA

o - (UC) UNCONFINED COMPRESSION TEST
● - (Q) UNCONSOLIDATED - UNDRAINED SHEAR TEST
▲ - (R) CONSOLIDATED - UNDRAINED SHEAR TEST
□ - (S) CONSOLIDATED - DRAINED SHEAR TEST

BORINGS WERE TAKEN WITH A 5 INCH DIAMETER STEEL TUBE PISTON TYPE SAMPLER

FOR SOIL BORING LEGEND SEE PLATE A
FOR LOCATION OF BORINGS SEE PLATES 2,3,&4.
FOR DETAIL SHEAR STRENGTH DATA SEE PLATE 87
FOR GENERAL NOTES SEE PLATE 68.

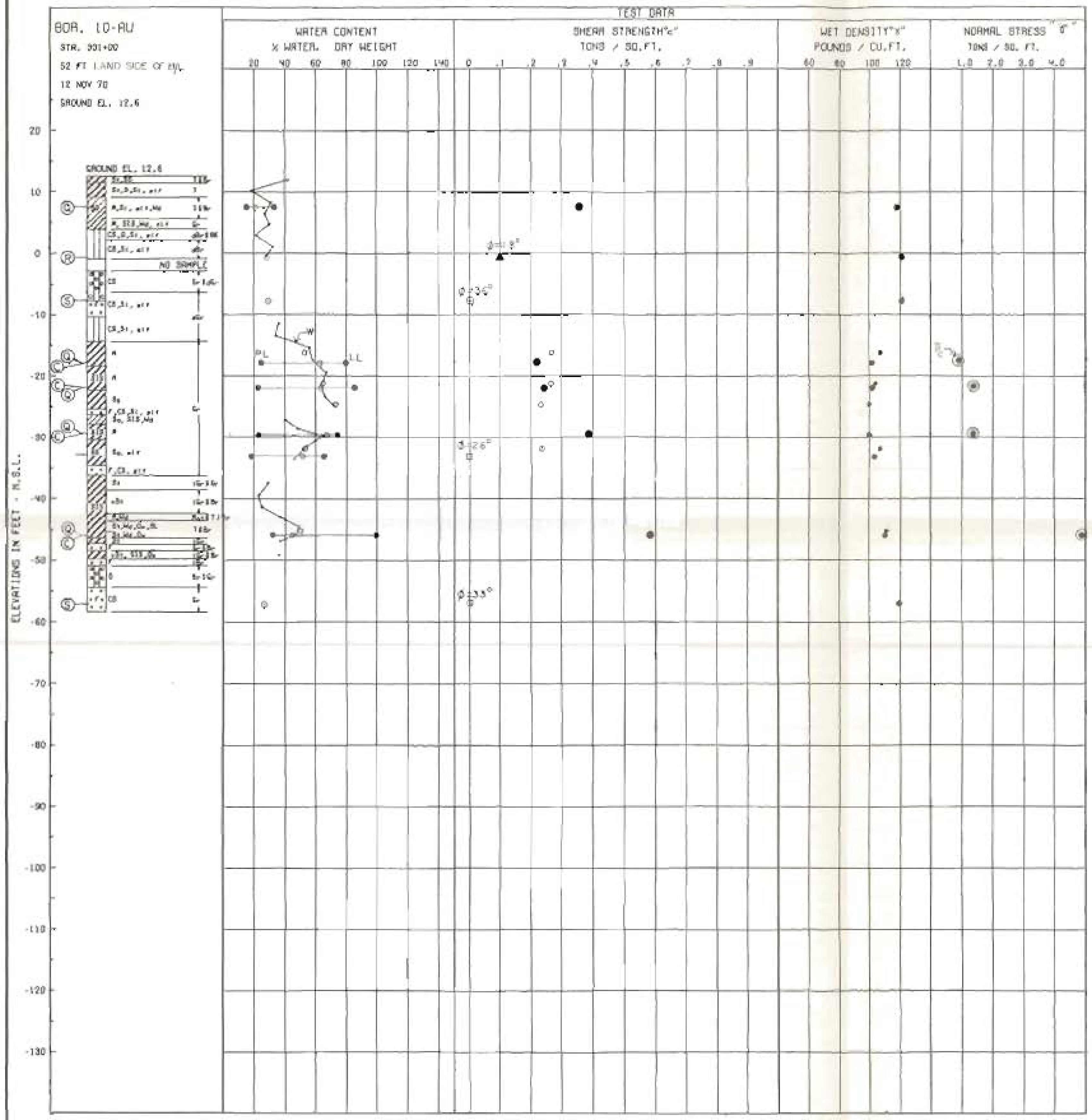
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO.2- GENERAL DESIGN
SUPPLEMENT NO. 5A

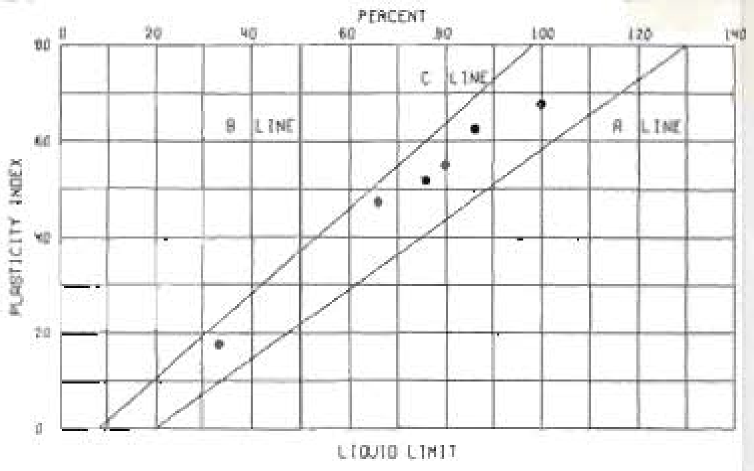
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

UNDISTURBED BORING 9-AU DATA

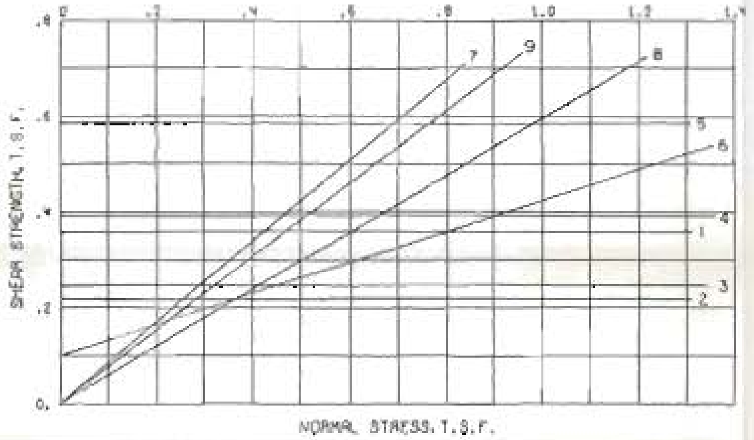
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

MAY 1976 FILE NO. H-2-26533





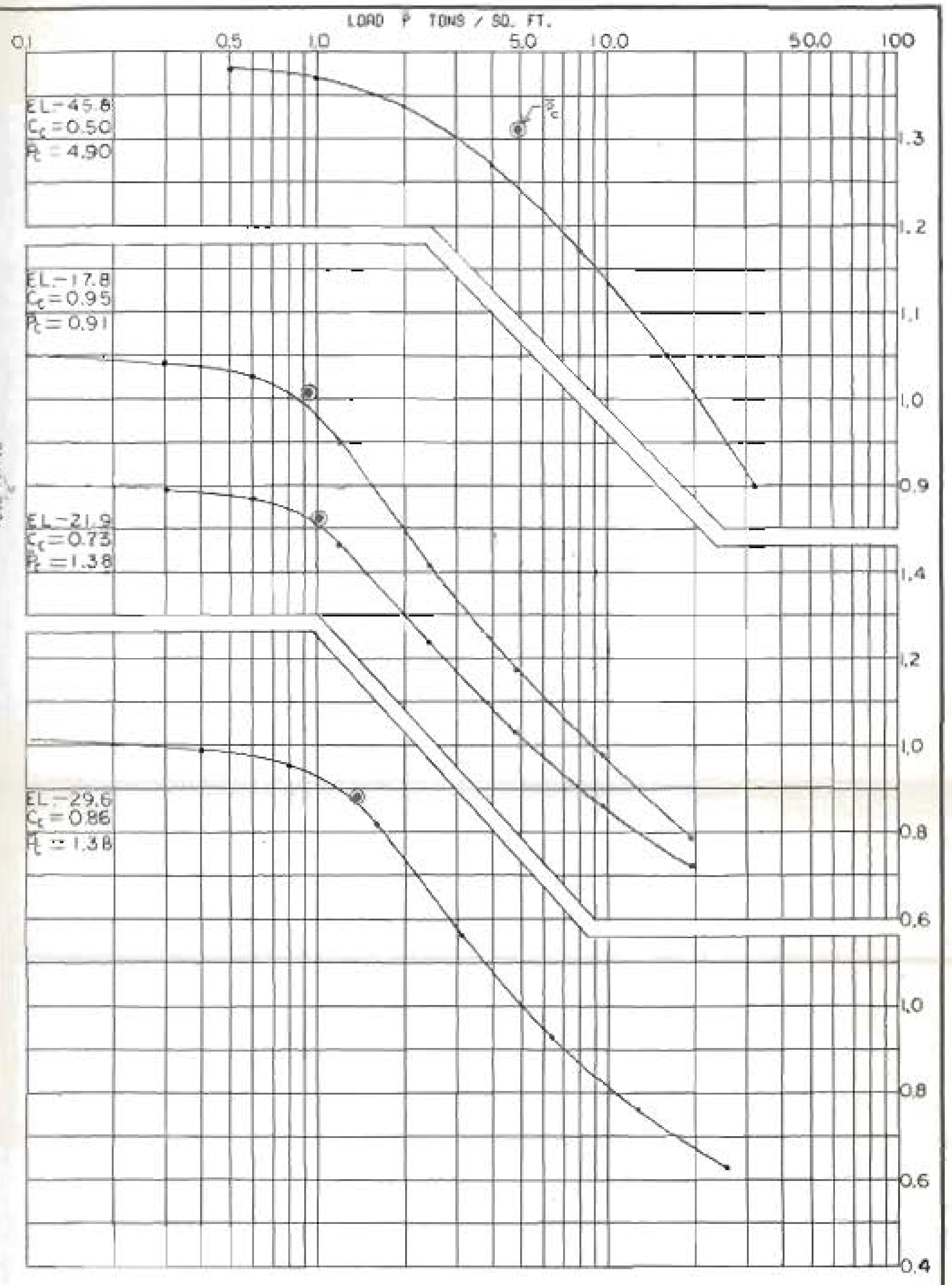
PLASTICITY CHART



SHEAR STRENGTH DATA

BORING NO.	ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH φ°	STRENGTH c - TSF	CLASS
10-AU	1	7.7	Q	0	0.358	CL
	2	-17.8		0	0.222	CH
	3	-21.9		0	0.245	CH
	4	-29.6		0	0.390	CH
	5	-45.8		0	0.565	CH
	6	-0.4	R	*18	0.100	ML
	7	-7.8	S	36	0	SM
	8	-33.0		26	0	CH
	9	-57.0		33	0	SP

*BASED ON DEVIATOR STRESS AT MAXIMUM POSITIVE PORE PRESSURE



CONSOLIDATION DATA

○ - (UC) UNCONFINED COMPRESSION TEST
● - (Q) UNCONSOLIDATED - UNDRAINED SHEAR TEST
▲ - (R) CONSOLIDATED - UNDRAINED SHEAR TEST
□ - (S) CONSOLIDATED - DRAINED SHEAR TEST

BORINGS WERE TAKEN WITH A 5 INCH DIAMETER STEEL TUBE PISTON TYPE SAMPLER

FOR SOIL BORING LEGEND SEE PLATE A
FOR LOCATION OF BORINGS SEE PLATES 2,3,&4.
FOR DETAIL SHEAR STRENGTH DATA SEE PLATE 68.
FOR GENERAL NOTES SEE PLATE 68.

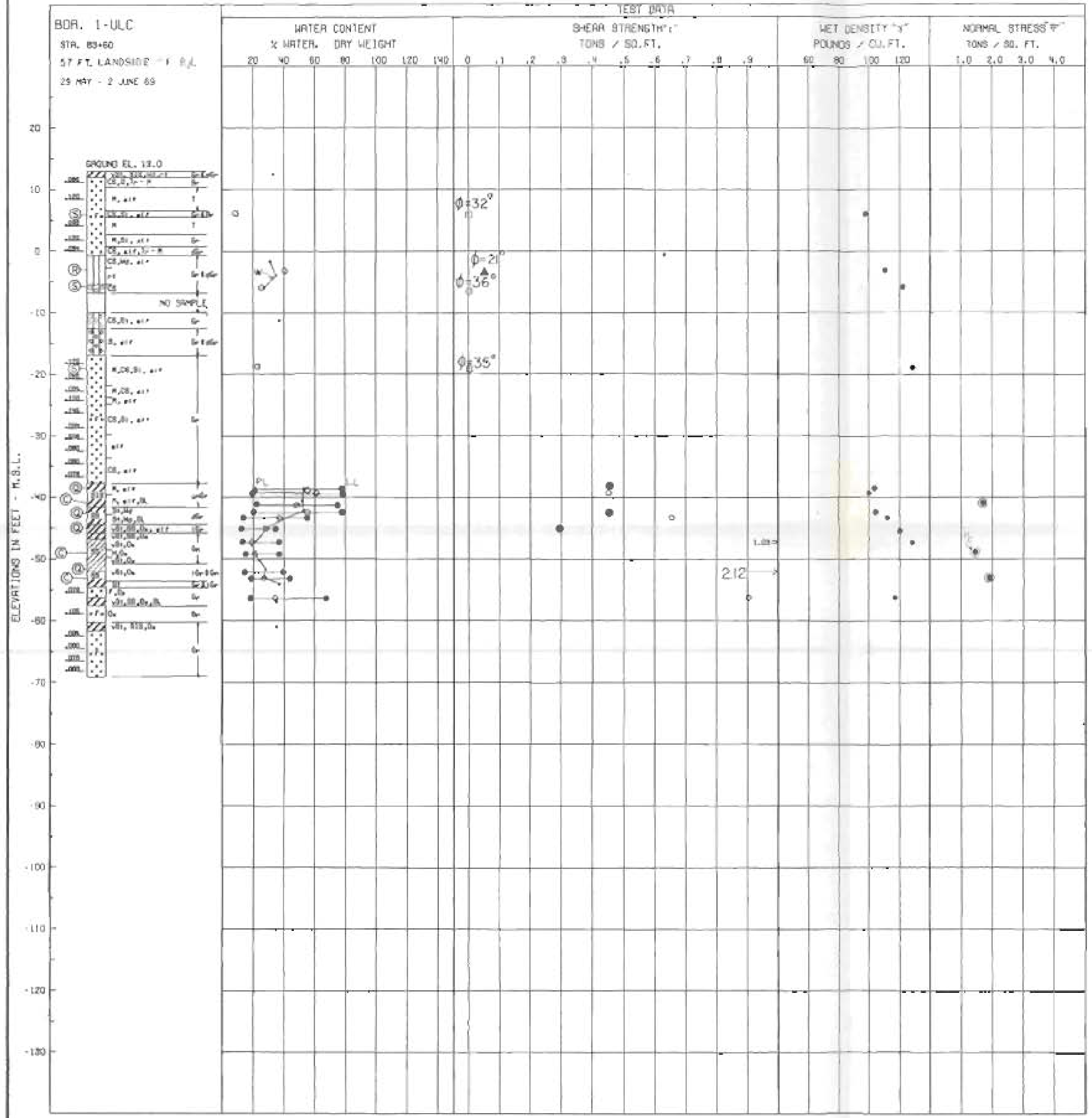
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

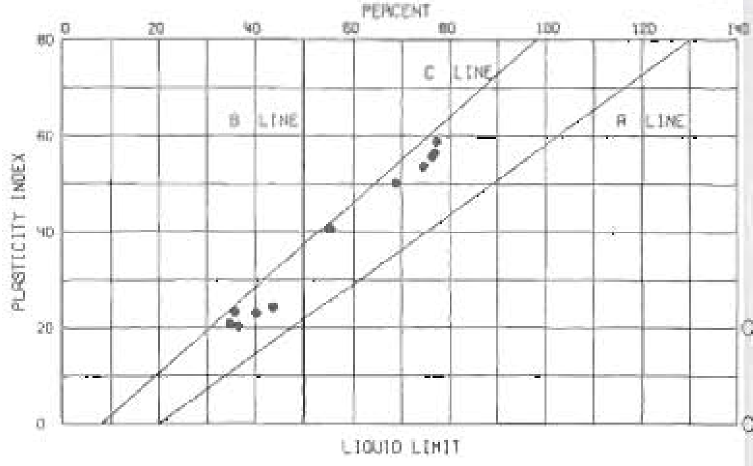
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

UNDISTURBED BORING 10-AU DATA

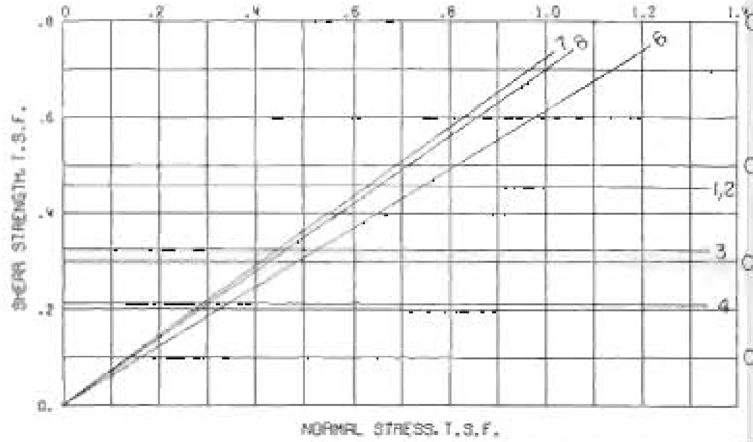
U.S. ARMY ENGINEER DISTRICT NEW ORLEANS
CORPS OF ENGINEERS

MAY 1974 FILE NO. H-2-26533





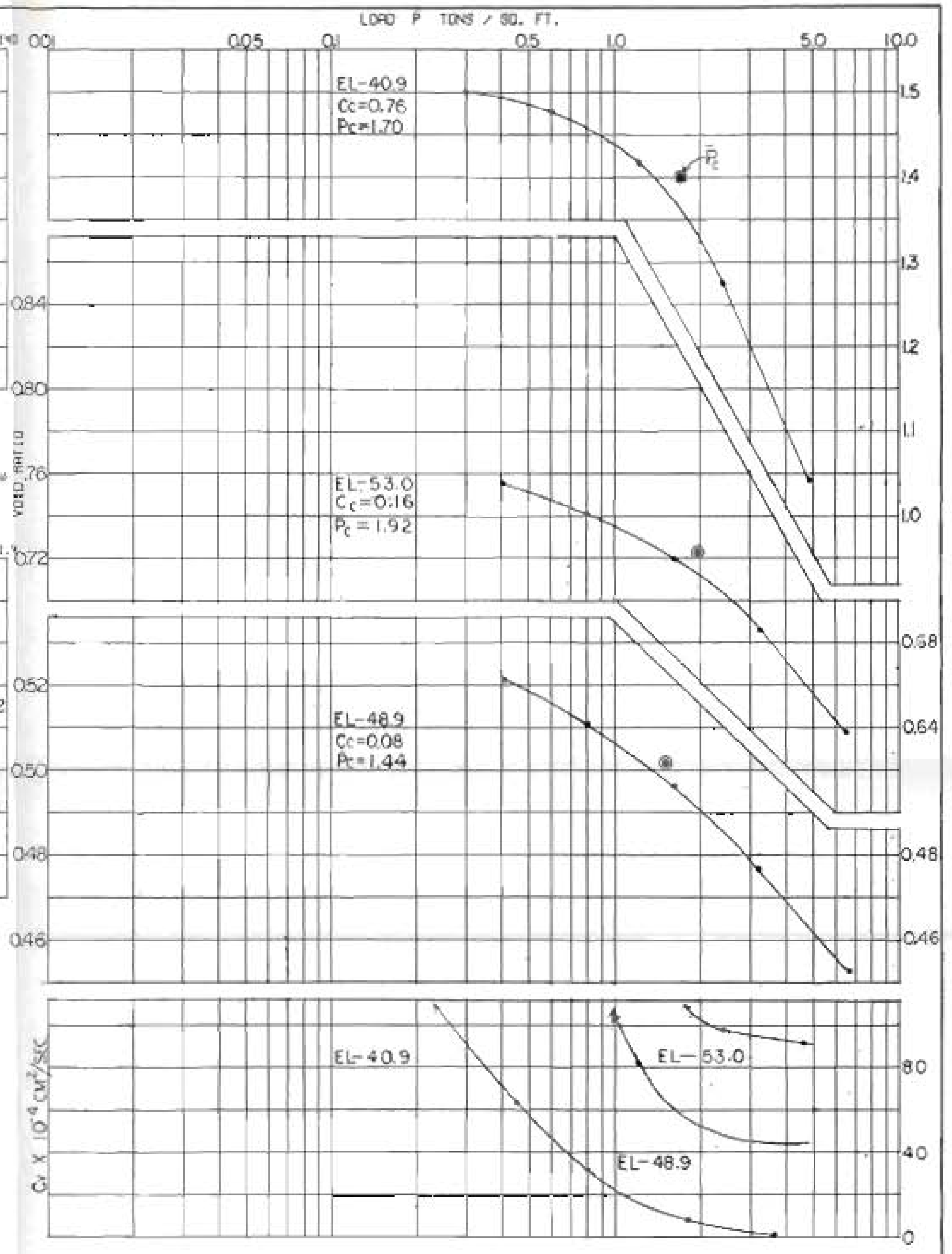
PLASTICITY CHART



SHEAR STRENGTH DATA

BORING NO.	ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH $\Phi°$	STRENGTH C - TSF	CLASS
I-ULC	1	-38.4	Q	0	0.46	CH
	2	-42.4		0	0.46	CH
	3	-45.0		0	0.29	CH
	4	-52.1		0	2.12	CL
	5	-3.1	R	*21	0.10	ML
	6	5.9	S	32	0	SP
	7	-5.9		36	0	SM
	8	-19.1		35	0	SP

* BASED ON DEVIATOR STRESS AT MAXIMUM POSITIVE PORE PRESSURE.



CONSOLIDATION DATA

o - (UC) UNCONFINED COMPRESSION TEST
● - (Q) UNCONSOLIDATED - UNDRAINED SHEAR TEST
▲ - (R) CONSOLIDATED - UNDRAINED SHEAR TEST
□ - (S) CONSOLIDATED - DRAINED SHEAR TEST

BORINGS WERE TAKEN WITH A 5 INCH DIAMETER STEEL TUBE PISTON TYPE SAMPLER

FOR SOIL BORING LEGEND SEE PLATE A
FOR LOCATION OF BORINGS SEE PLATES 2,3,&4.
FOR DETAIL SHEAR STRENGTH DATA SEE PLATE 89
FOR GENERAL NOTES SEE PLATE 68.

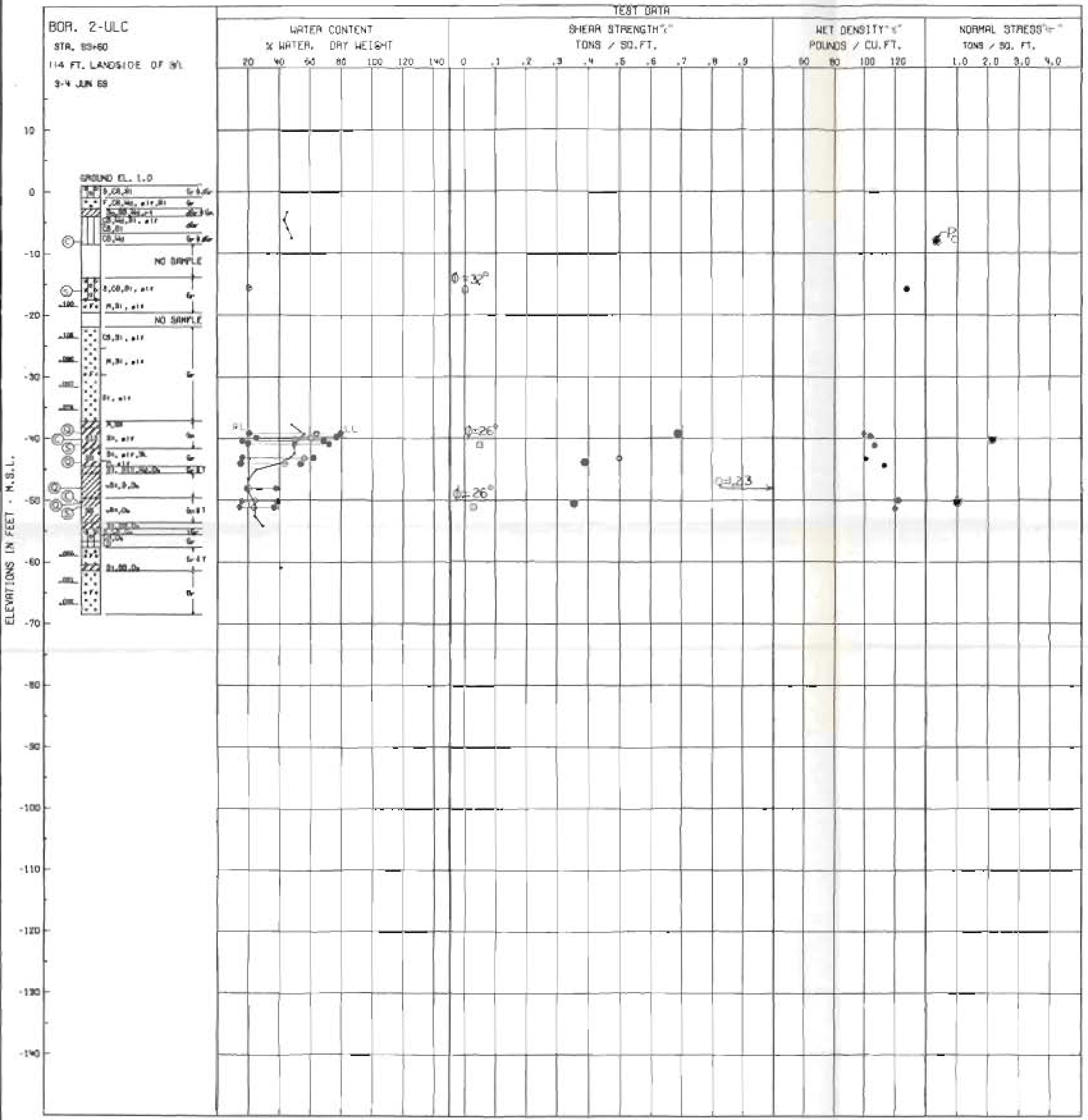
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

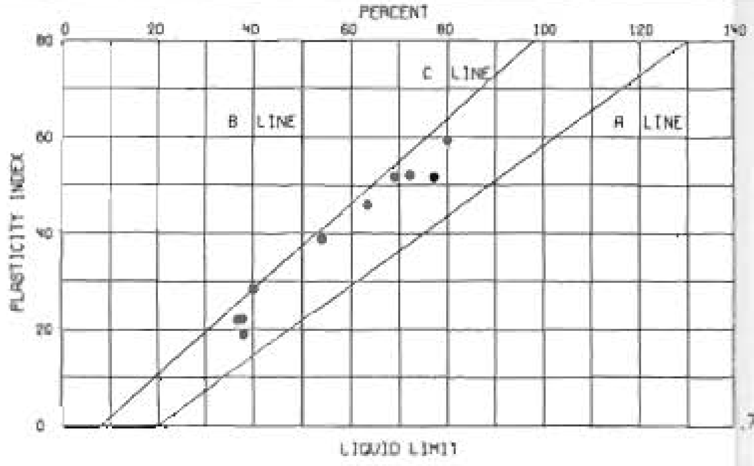
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

UNDISTURBED BORING I-ULC DATA

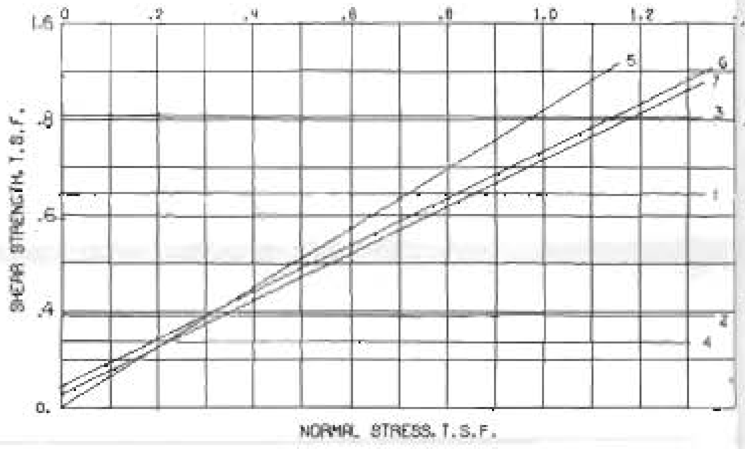
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

MAY 1976 FILE NO. H-2-26533



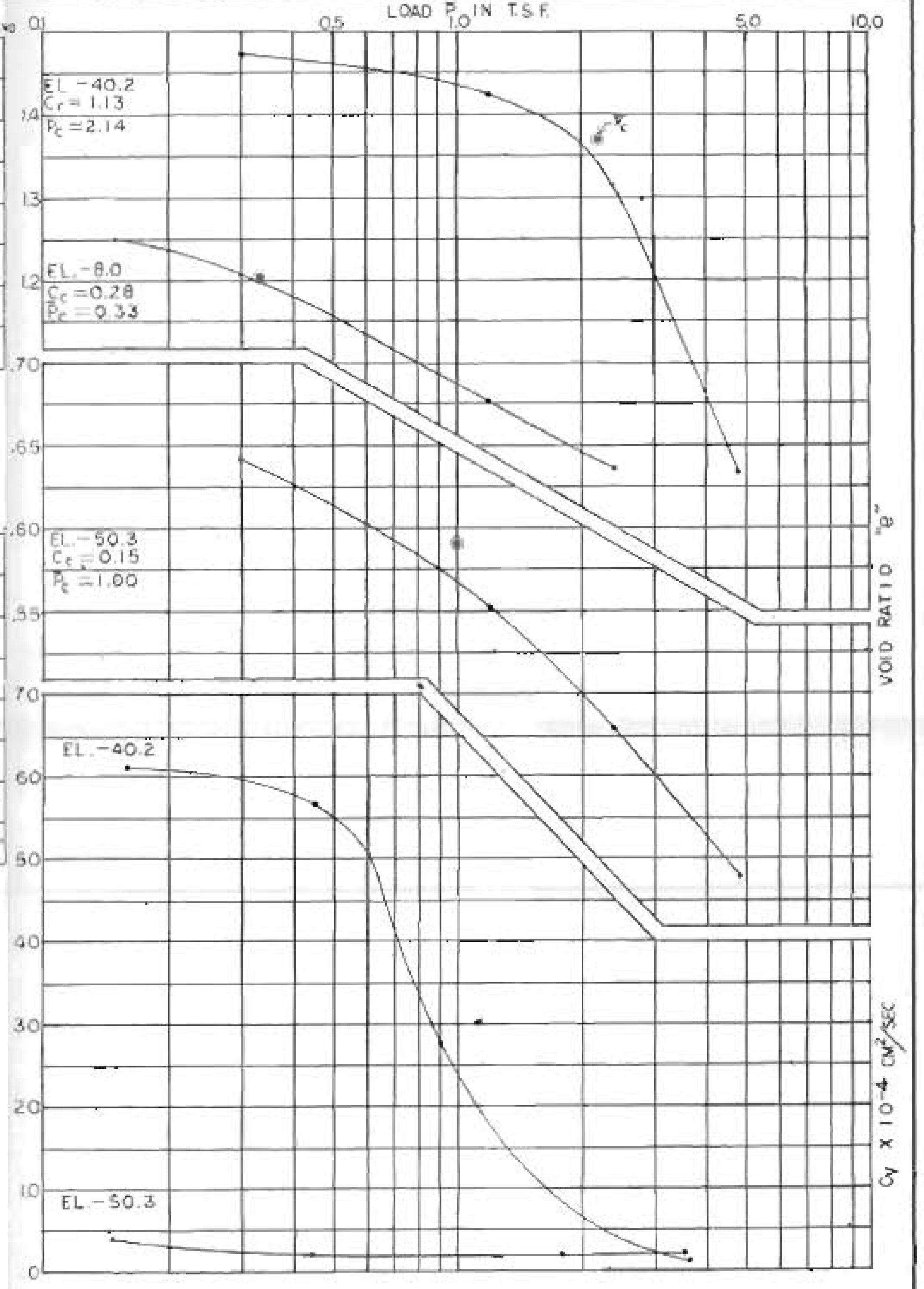


PLASTICITY CHART



SHEAR STRENGTH DATA

BORING NO.	ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH Φ	STRENGTH C - TSF	CLASS
2-ULS	1	-39.4	Q	0	0.69	CH
	2	-43.9		0	0.39	CH
	3	-48.0		0	1.23	CL
	4	-50.5		0	0.35	CL
	5	-15.9	S	32	.0	SM
	6	-40.9		26	0.05	CH
	7	-51.1		26	0.03	CL



O - (UC) UNCONFINED COMPRESSION TEST
● - (Q) UNCONSOLIDATED - UNDRAINED SHEAR TEST
▲ - (R) CONSOLIDATED - UNDRAINED SHEAR TEST
□ - (S) CONSOLIDATED - DRAINED SHEAR TEST

BORINGS WERE TAKEN WITH A 5 INCH DIAMETER STEEL TUBE PISTON TYPE SAMPLER

FOR SOIL BORING LEGEND SEE PLATE A

FOR LOCATION OF BORINGS SEE PLATES 2,3,&4.

FOR DETAIL SHEAR STRENGTH DATA SEE PLATE 90.

FOR GENERAL NOTES SEE PLATE 68

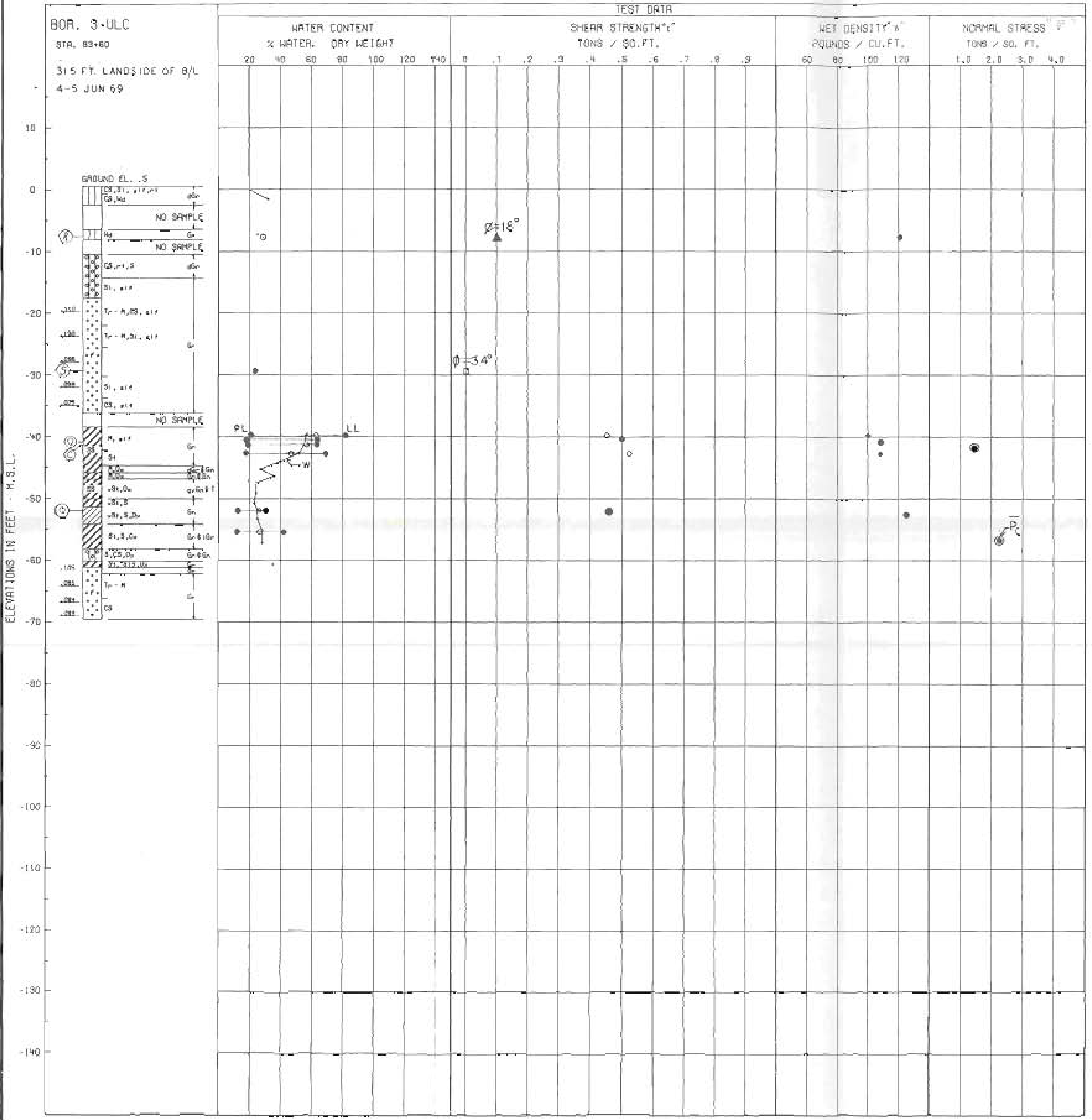
LAKE PONTCHARTRAIN, LA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO.2-GENERAL DESIGN
SUPPLEMENT NO. 5A

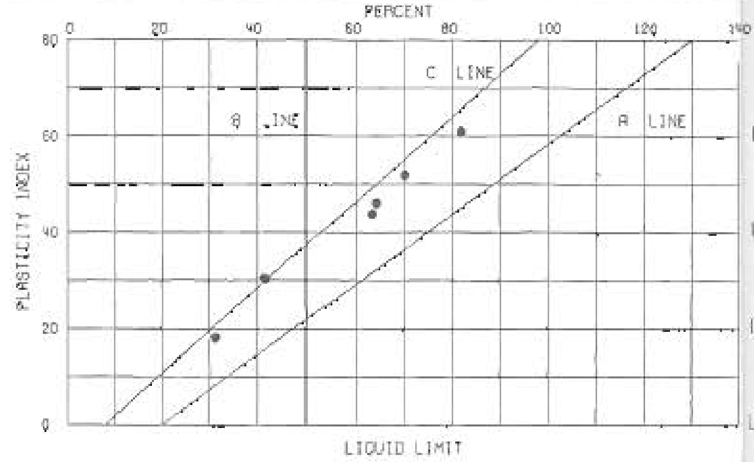
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

UNDISTURBED BORING
2-ULC DATA

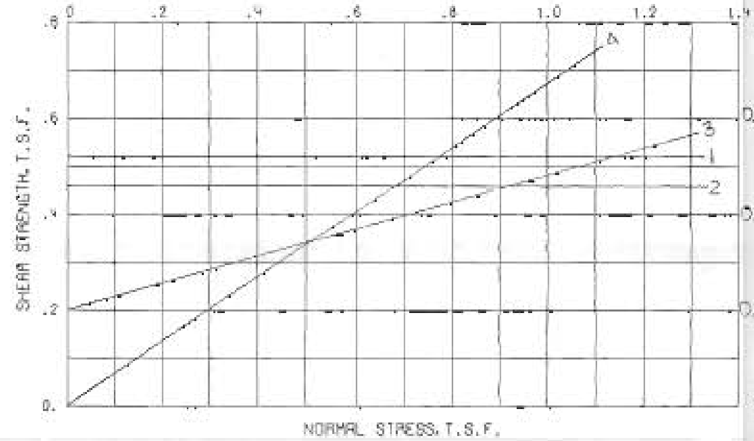
U. S. ARMY ENGINEER DISTRICT NEW ORLEANS
CORPS OF ENGINEERS

MAY 1976 FILE NO. H-2-26533





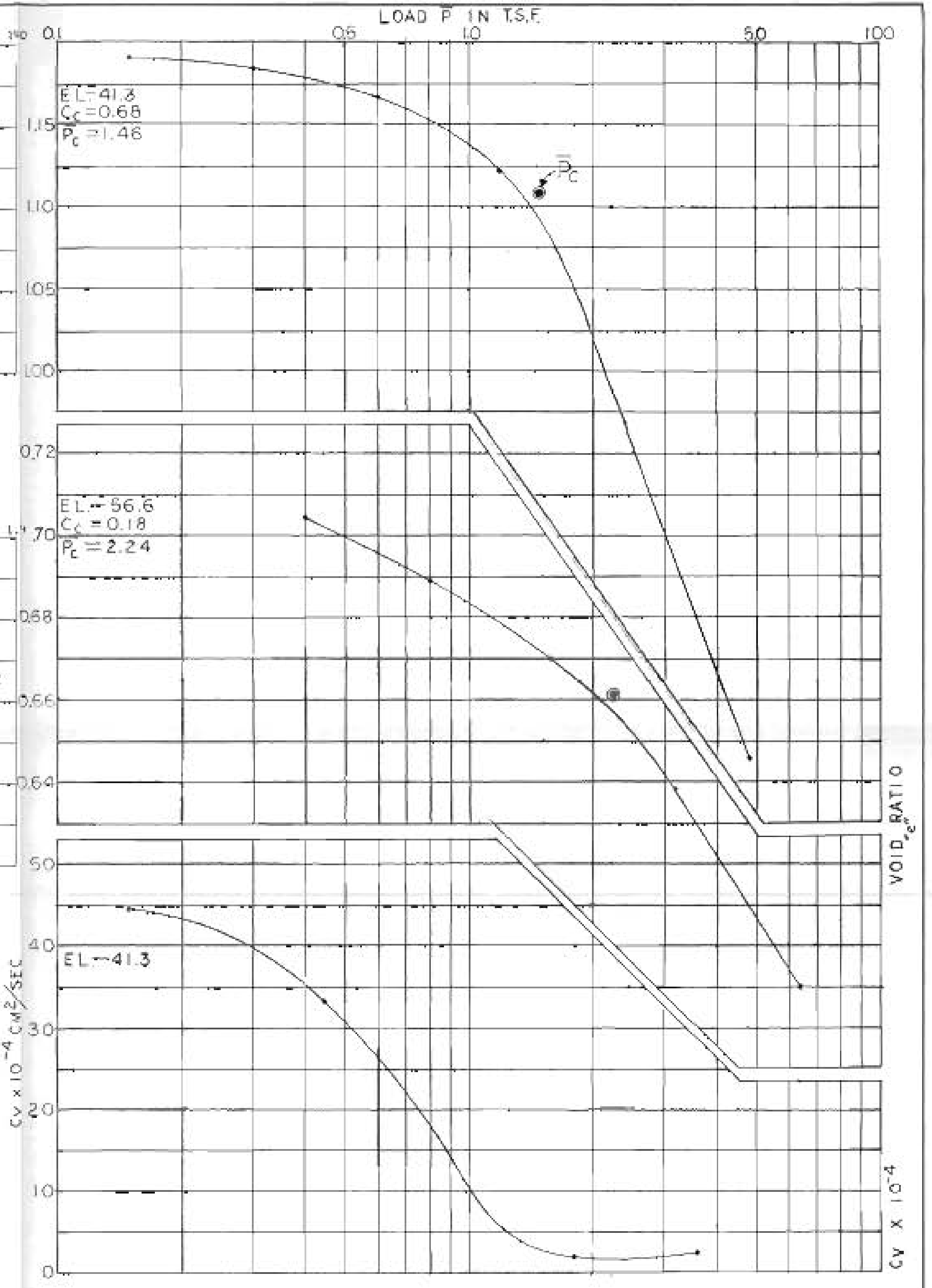
PLASTICITY CHART



SHEAR STRENGTH DATA

BORING NO.	ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH Φ°	STRENGTH C - TSF	CLASS
3-ULC	1	-40.4	Q	0	0.50	CH
	2	-52.4		0	0.46	CL
	3	-7.7	R	*18	0.10	ML
	4	-29.5	S	34	0	SP

* BASED ON DEVIATOR STRESS AT MAXIMUM POSITIVE PORE PRESSURE.



○ - (UC) UNCONFINED COMPRESSION TEST
● - (Q) UNCONSOLIDATED - UNDRAINED SHEAR TEST
▲ - (R) CONSOLIDATED - UNDRAINED SHEAR TEST
□ - (S) CONSOLIDATED - DRAINED SHEAR TEST

BORINGS WERE TAKEN WITH A 5 INCH DIAMETER STEEL TUBE PISTON TYPE SAMPLER

FOR SOIL BORING LEGEND SEE PLATE A

FOR LOCATION OF BORINGS SEE PLATES 2,3,& 4.

FOR DETAIL SHEAR STRENGTH DATA SEE PLATE 91.

FOR GENERAL NOTES SEE PLATE 68.

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 GENERAL DESIGN
SUPPLEMENT NO. 5A

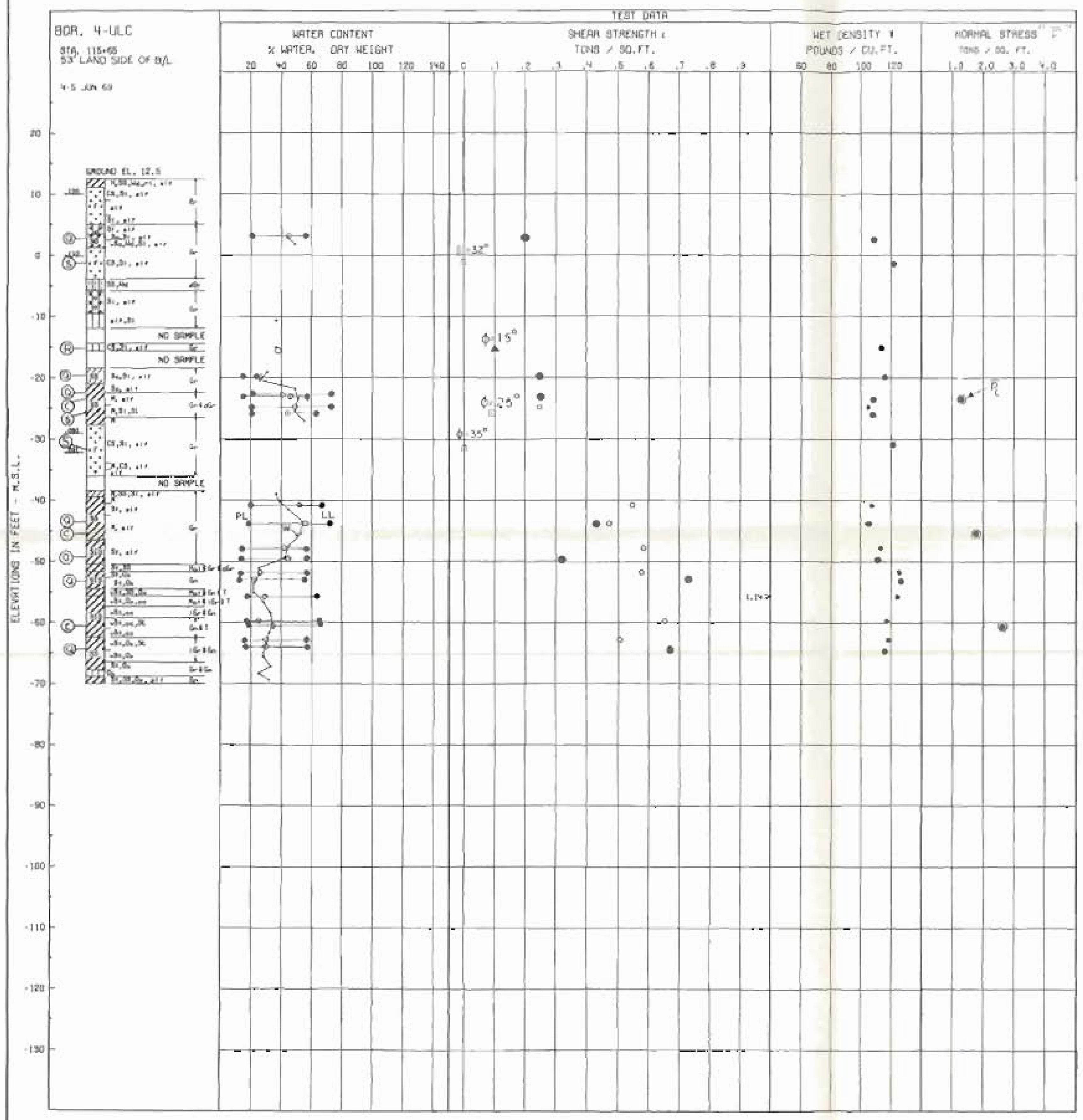
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

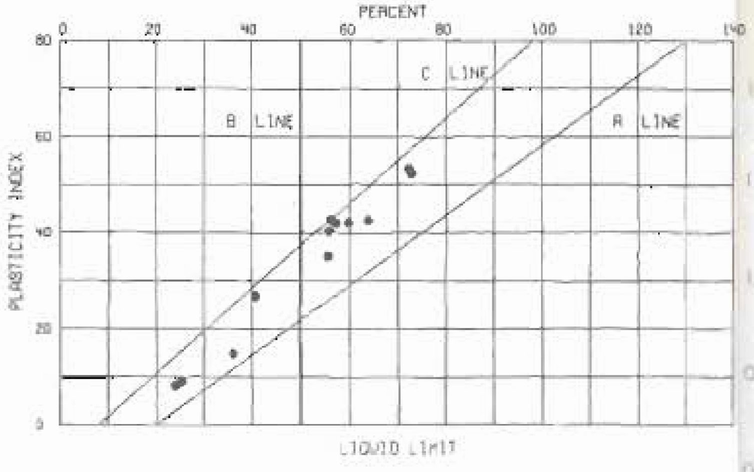
UNDISTURBED BORING
3-ULC DATA

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

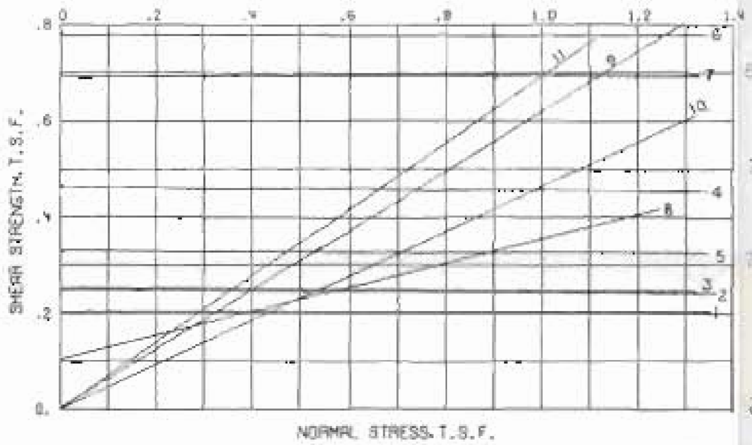
MAY 1970

FILE NO. H-2-26533





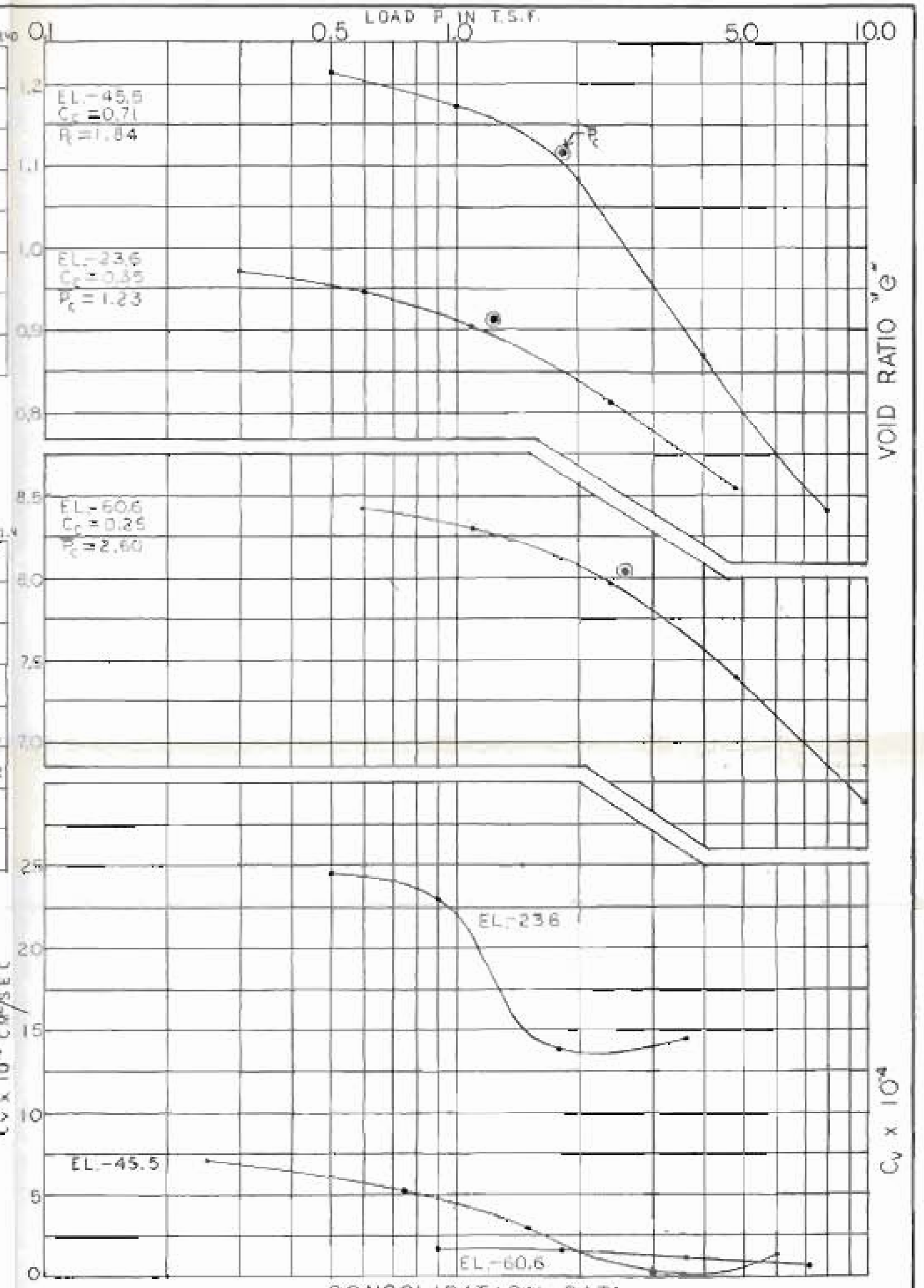
PLASTICITY CHART



SHEAR STRENGTH DATA

BORING NO.	ENVELOPE NO.	EL.	TYPE	STRENGTH φ°	C - TSF	CLASS
4-ULC	1	2.8	Q	0	0.21	CH
	2	-19.7	Q	0	0.25	CL
	3	-22.9	Q	0	0.25	CH
	4	-43.7	Q	0	0.43	CH
	5	-49.4	Q	0	0.32	CH
	6	-53.2	Q	0	0.73	CH
	7	-64.4	Q	0	0.67	CH
	8	-15.2	R	*15	0.10	ML
	9	-1.2	S	32	0	SM
	10	-25.4	S	25	0	CH
	11	-31.7	S	35	0	SP

* BASED ON DEVIATOR STRESS AT MAXIMUM POSITIVE PORE PRESSURE



CONSOLIDATION DATA

o - (UC) UNCONFINED COMPRESSION TEST
● - (Q) UNCONSOLIDATED - UNDRAINED SHEAR TEST
▲ - (R) CONSOLIDATED - UNDRAINED SHEAR TEST
□ - (S) CONSOLIDATED - DRAINED SHEAR TEST

BORINGS WERE TAKEN WITH A 5 INCH DIAMETER STEEL TUBE PISTON TYPE SAMPLER

FOR SOIL BORING LEGEND SEE PLATE A

FOR LOCATION OF BORINGS SEE PLATES 2,3,& 4

FOR DETAIL SHEAR STRENGTH DATA SEE PLATE 92

FOR GENERAL NOTES SEE PLATE 68.

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO.2 GENERAL DESIGN
SUPPLEMENT NO. 5A

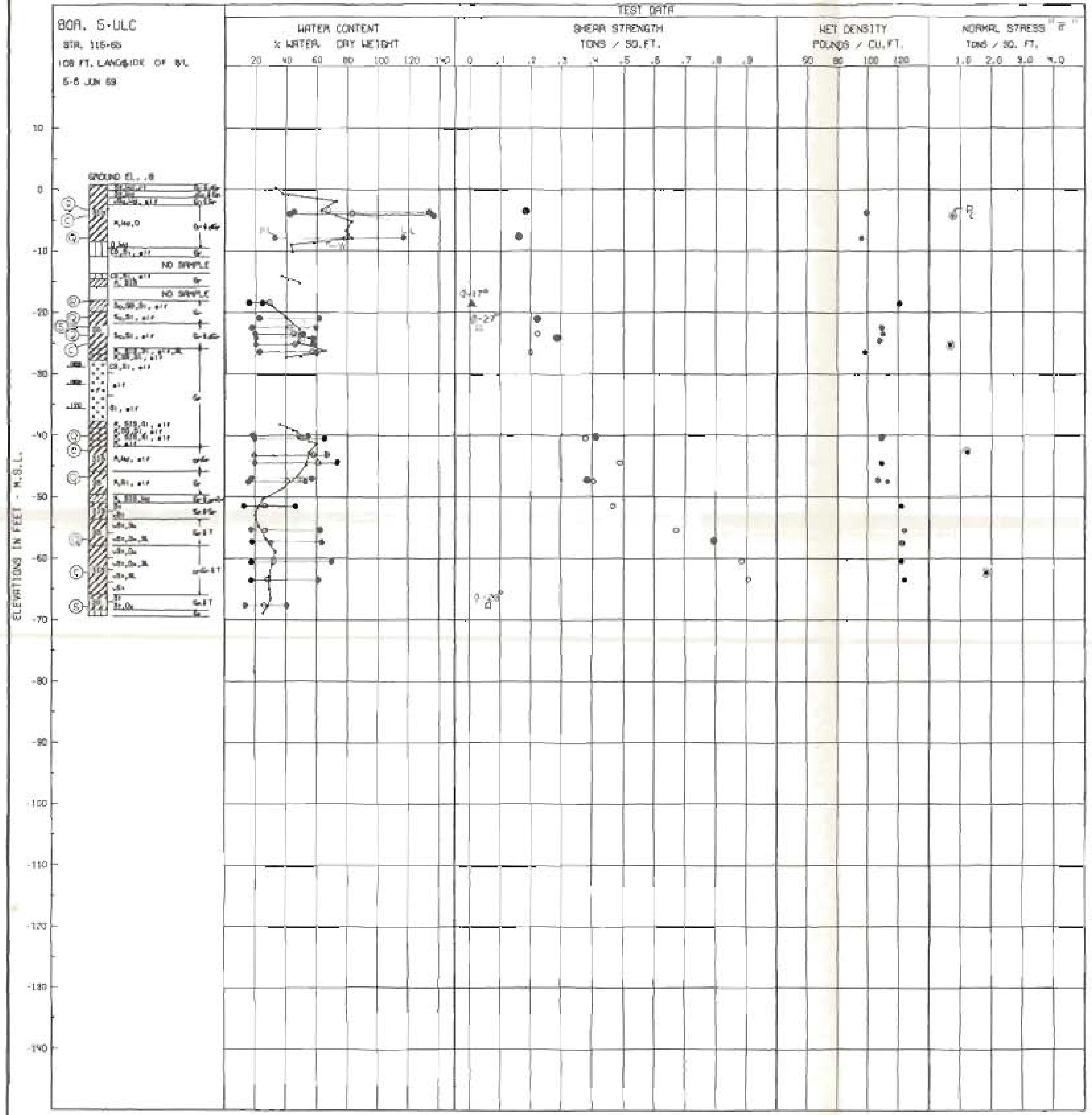
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

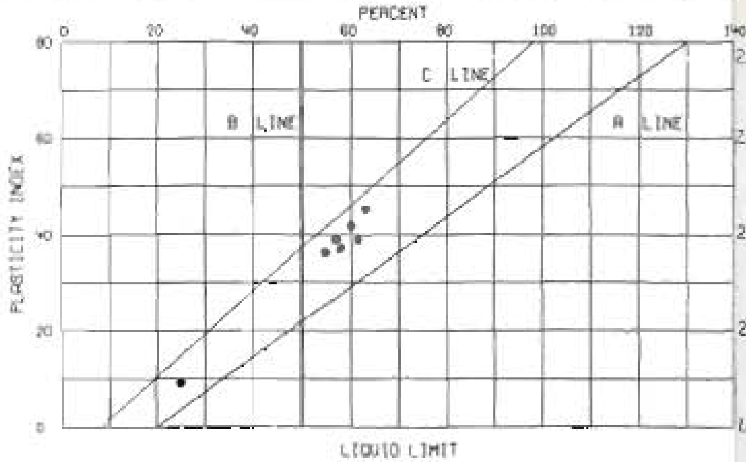
UNDISTURBED BORING 4-ULC DATA

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

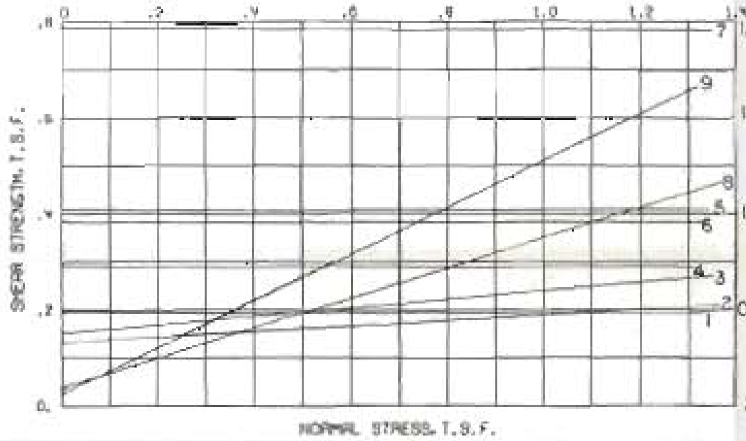
MAY 1976

FILE NO.H-2-26533



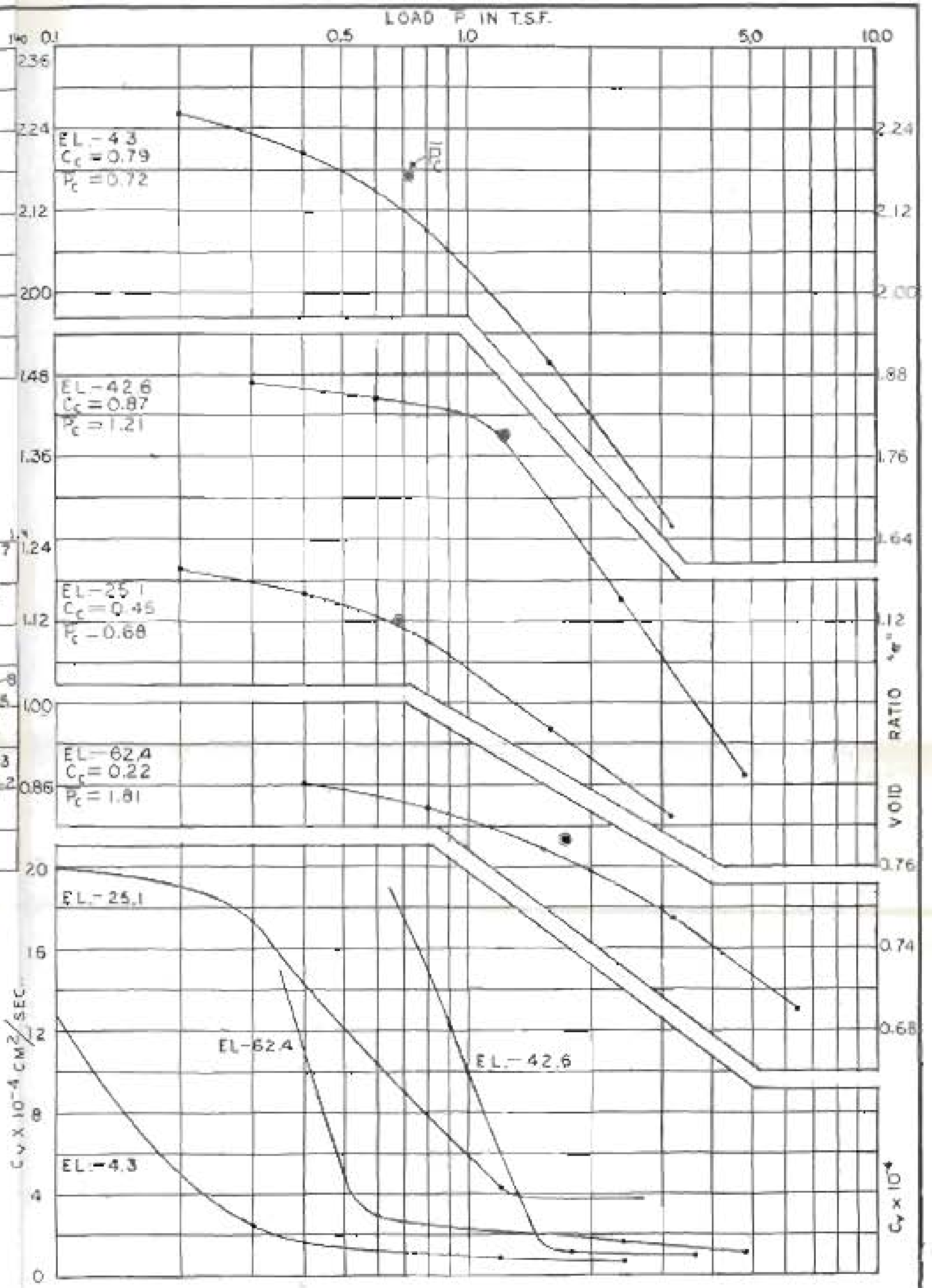


PLASTICITY CHART



SHEAR STRENGTH DATA

BORING NO.	ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH $\Phi°$	STRENGTH C - TSF	CLASS
5-ULC	1	-3.4	Q	0	0.18	CH
	2	-7.7		0	0.16	CH
	3	-21.1		0	0.22	CH
	4	-24.2		0	0.29	CH
	5	-40.2		0	0.41	CH
	6	-47.1		0	0.39	CH
	7	-57.1		0	0.79	CH
	8	-18.5	R	17	0.04	CL
	9	-22.5	S	27	0	CH
	10	-67.8	S	28	0	CH



○ - (UC) UNCONFINED COMPRESSION TEST
● - (Q) UNCONSOLIDATED - UNDRAINED SHEAR TEST
▲ - (R) CONSOLIDATED - UNDRAINED SHEAR TEST
⊡ - (S) CONSOLIDATED - DRAINED SHEAR TEST

BORINGS WERE TAKEN WITH A 5 INCH DIAMETER STEEL TUBE PISTON TYPE SAMPLER

FOR SOIL BORING LEGEND SEE PLATE A
FOR LOCATION OF BORINGS SEE PLATES 2, 3, & 4
FOR DETAIL SHEAR STRENGTH DATA SEE PLATE 93
FOR GENERAL NOTES SEE PLATE 68.

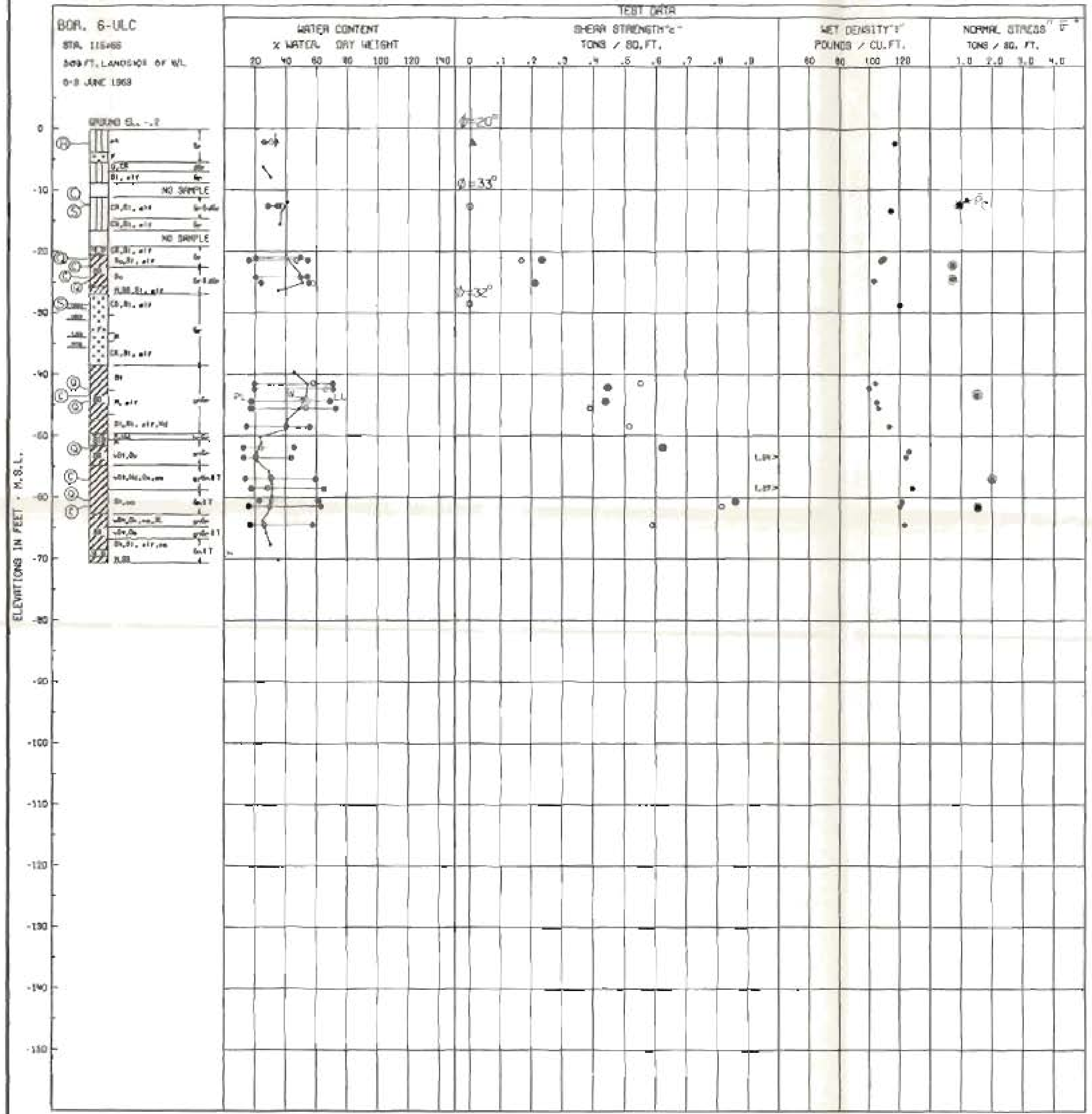
LAKE PONTCHARTRAIN, LA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

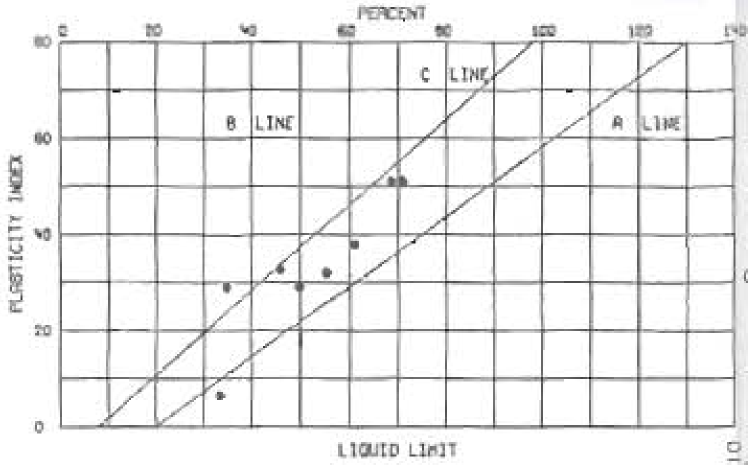
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

UNDISTURBED BORING 5-ULC DATA

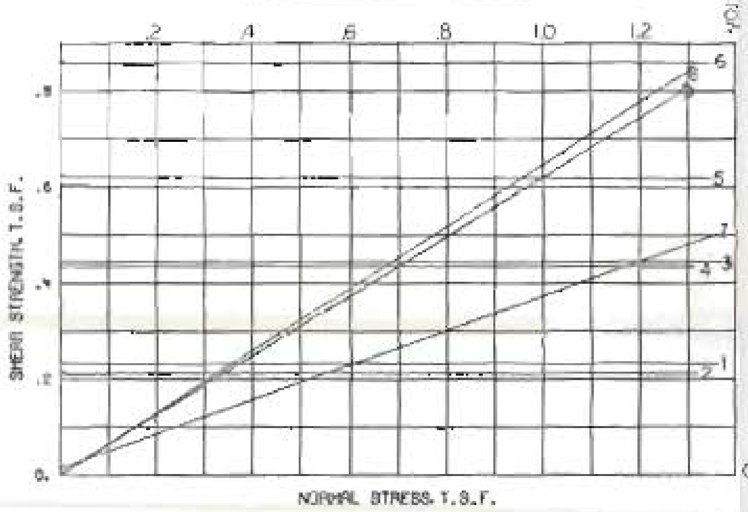
U.S. ARMY ENGINEER DISTRICT NEW ORLEANS
CORPS OF ENGINEERS

MAY 1976 FILE NO. H-2-26533





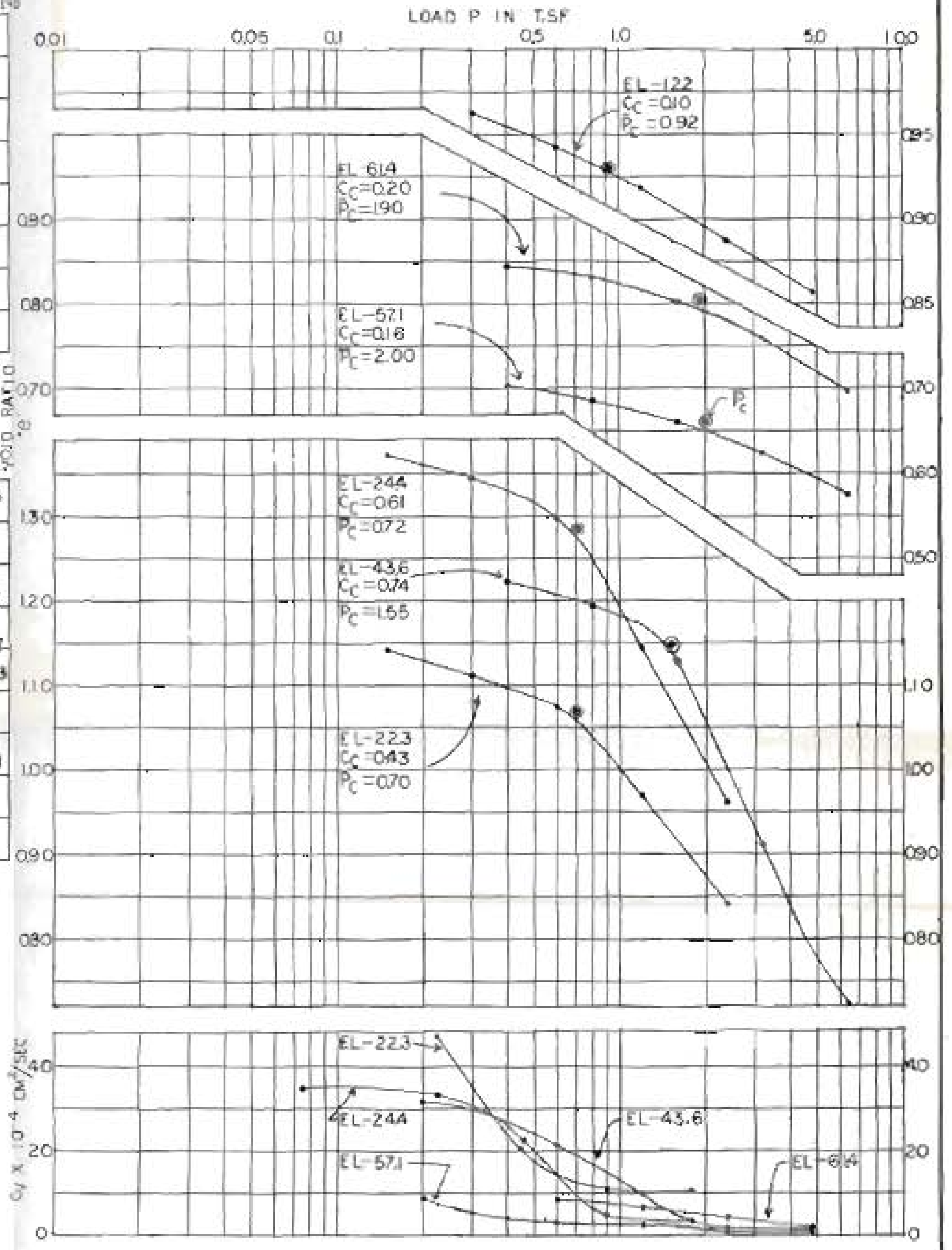
PLASTICITY CHART



SHEAR STRENGTH DATA

BORING NO.	ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH Φ°	STRENGTH C - TSF	CLASS
6ULN	1	-21.2	Q	0	0.23	CH
	2	-25.3		0	0.21	CH
	3	-42.1		0	0.45	CH
	4	-44.4		0	0.44	CH
	5	-52.1		0	0.62	CH
	6	-60.4		0	0.86	CH
	7	-2.3	R	*20	0.10	ML
	8	-13.1	S	33	0	ML
	9	-28.8		32	0	SP-SM

*BASED ON DEVIATOR STRESS AT MAXIMUM POSITIVE PORE PRESSURE



○ - (UC) UNCONFINED COMPRESSION TEST
● - (Q) UNCONSOLIDATED - UNDRAINED SHEAR TEST
▲ - (R) CONSOLIDATED - UNDRAINED SHEAR TEST
□ - (S) CONSOLIDATED - DRAINED SHEAR TEST

BORINGS WERE TAKEN WITH A 5 INCH DIAMETER STEEL TUBE PISTON TYPE SAMPLER
FOR SOIL BORING LEGEND SEE PLATE A
FOR LOCATION OF BORINGS SEE PLATES 2,3 &4.
FOR DETAIL SHEAR STRENGTH DATA SEE PLATE 94
FOR GENERAL NOTES SEE PLATE 68

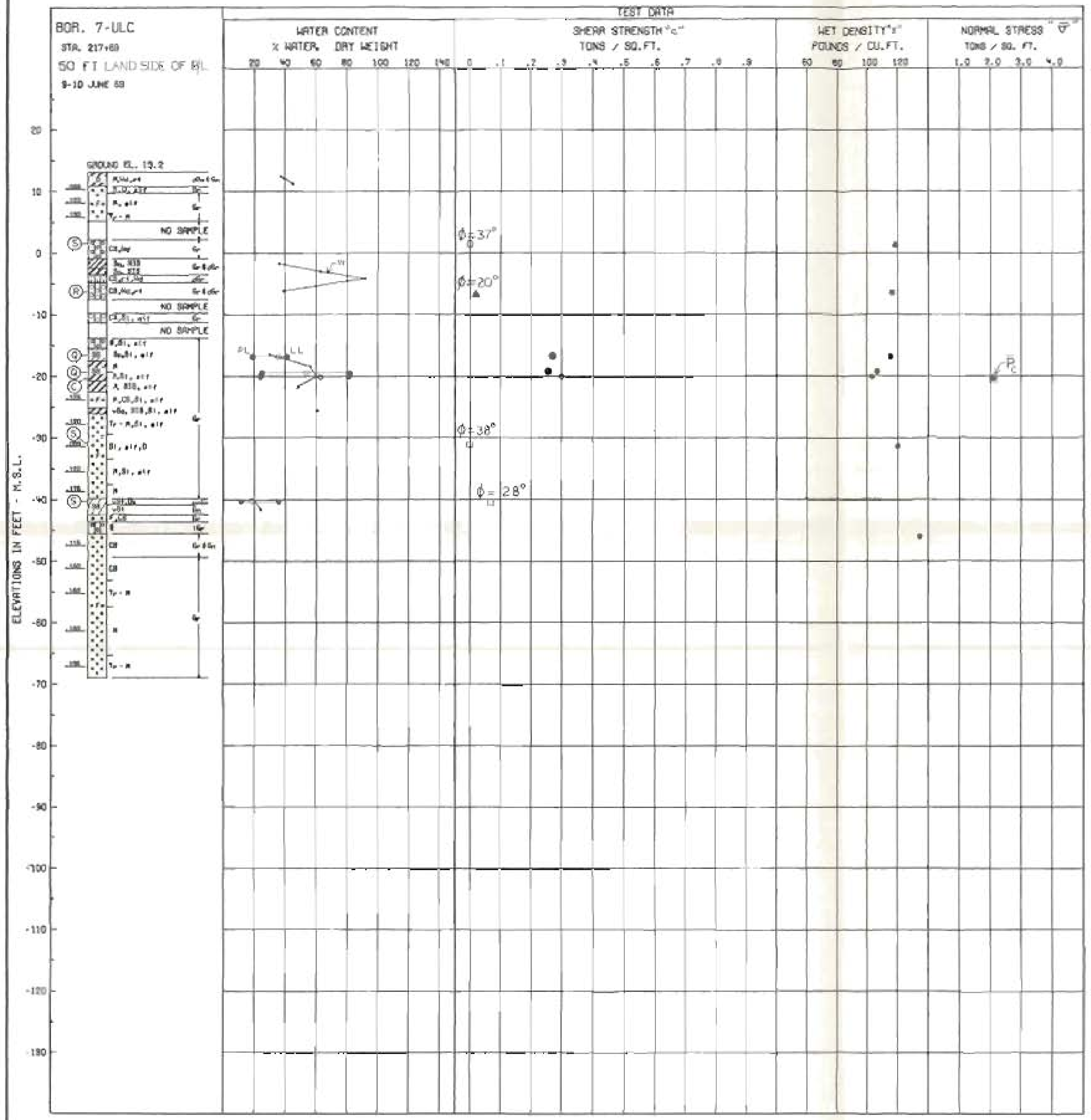
LAKE PONTCHARTRAIN, LA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO.2-GENERAL DESIGN
SUPPLEMENT NO. 5A

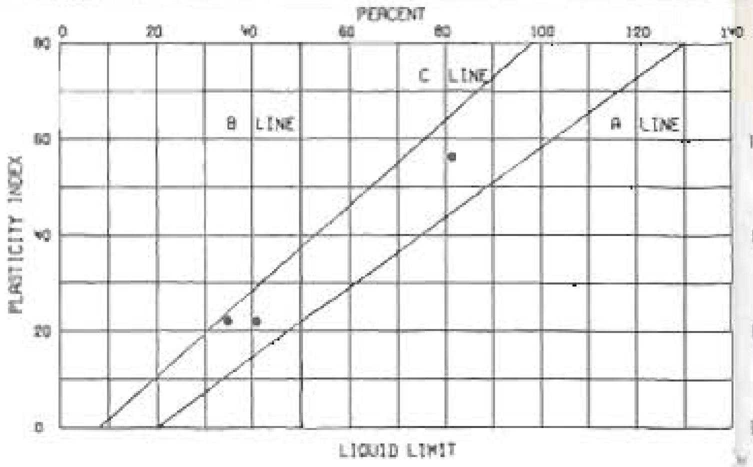
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

UNDISTURBED BORING
6-ULC DATA

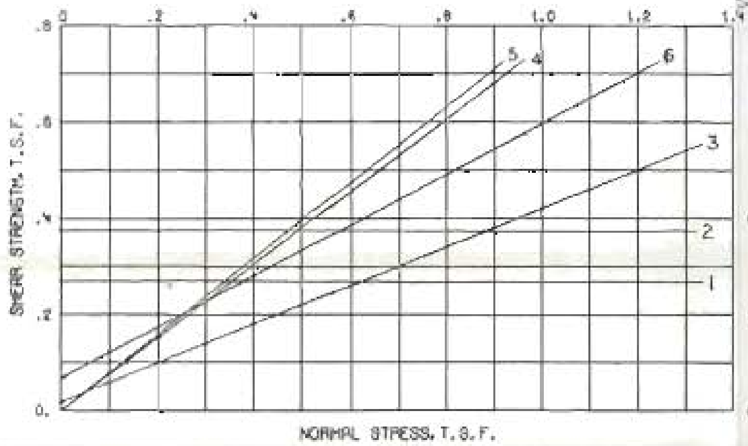
U. S. ARMY ENGINEER DISTRICT NEW ORLEANS
CORPS OF ENGINEERS

MAY 1978 FILE NO. H-2-26533





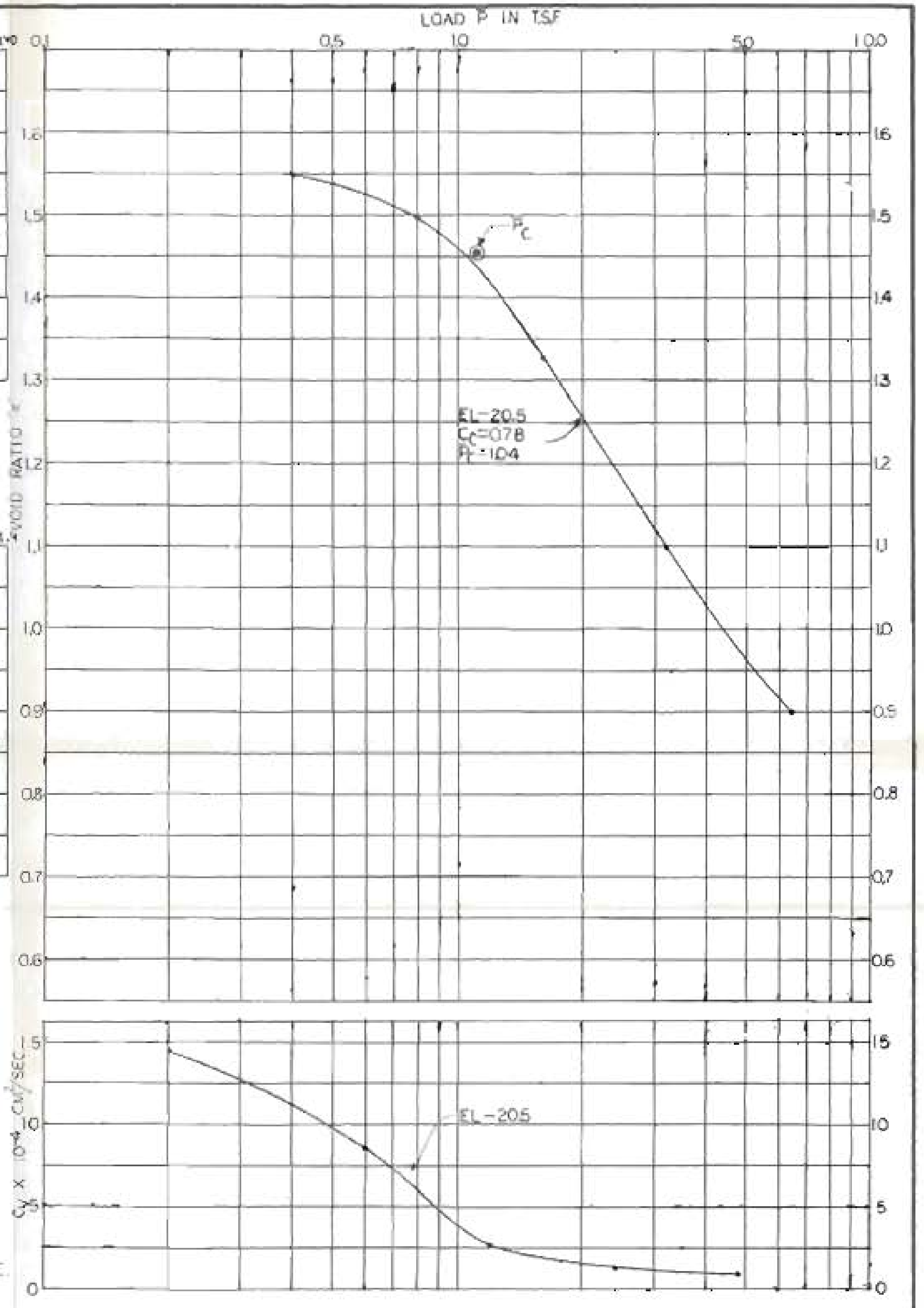
PLASTICITY CHART



SHEAR STRENGTH DATA

BORING NO.	ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH ϕ	STRENGTH C - TSF	CLASS
7-ULC	1	-16.7	Q	0	0.27	CL
	2	-18.8		0	0.26	CH
	3	-6.2	R	*20	0.10	SM
	4	1.3	S	37	0	SM
	5	-31.6		38	0	SP
	6	-40.6		28	.070	CL

* BASED ON DEVIATOR STRESS AT MAXIMUM POSITIVE PORE PRESSURE.



○ - (UC) UNCONFINED COMPRESSION TEST
● - (Q) UNCONSOLIDATED - UNDRAINED SHEAR TEST
▲ - (R) CONSOLIDATED - UNDRAINED SHEAR TEST
□ - (S) CONSOLIDATED - DRAINED SHEAR TEST

BORINGS WERE TAKEN WITH A 5 INCH DIAMETER STEEL TUBE PISTON TYPE SAMPLER

FOR SOIL BORING LEGEND SEE PLATE A

FOR LOCATION OF BORINGS SEE PLATES 2,3,&4.

FOR DETAIL SHEAR STRENGTH DATA SEE PLATE 96.

FOR GENERAL NOTES SEE PLATE 68.

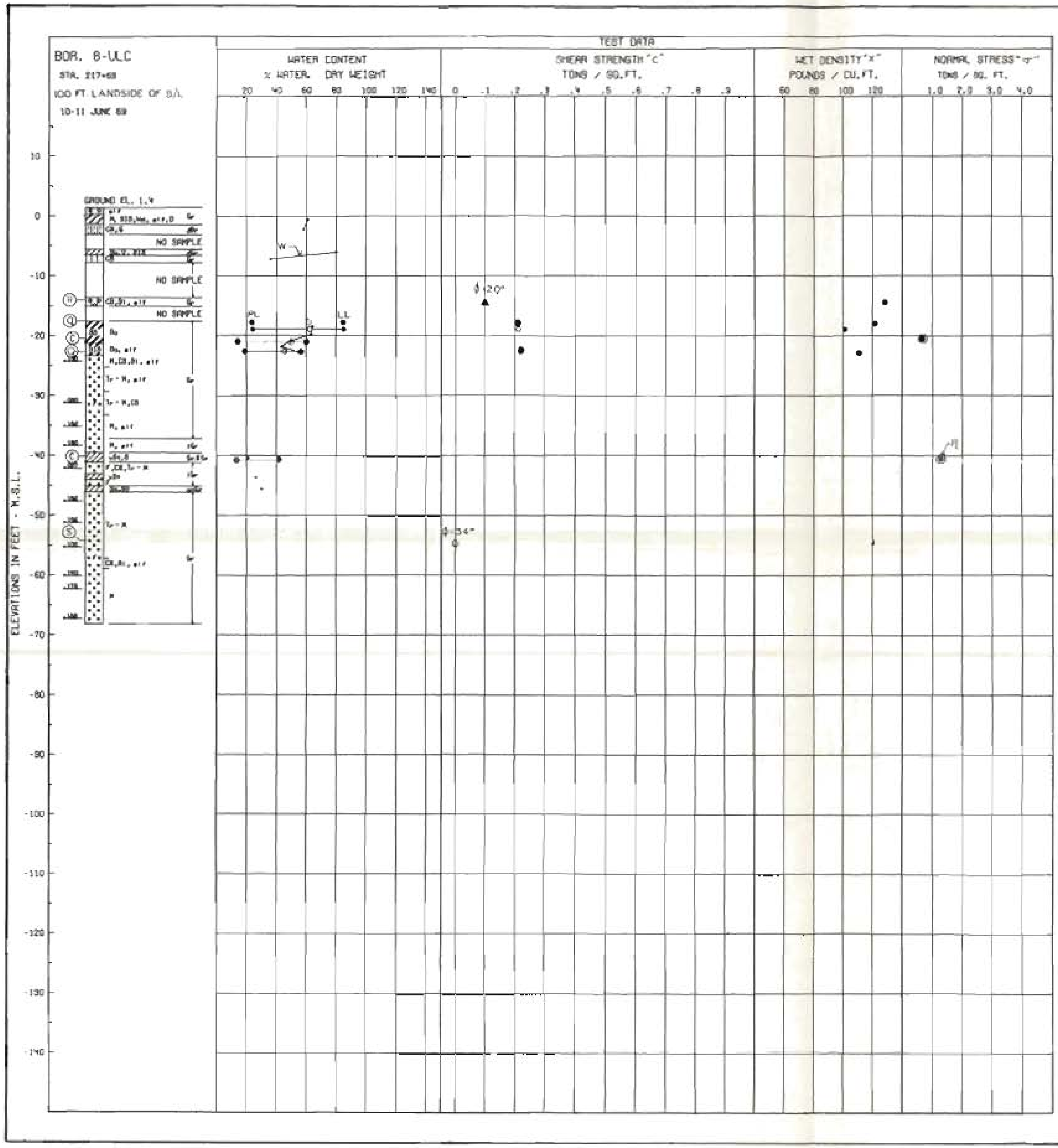
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A

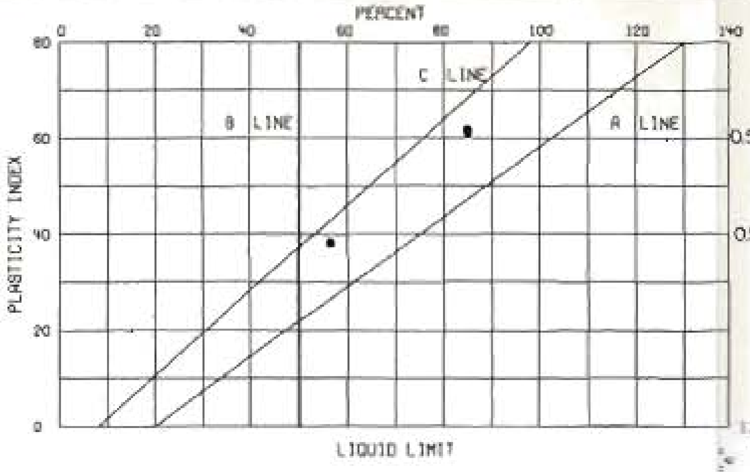
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

UNDISTURBED BORING 7-ULC DATA

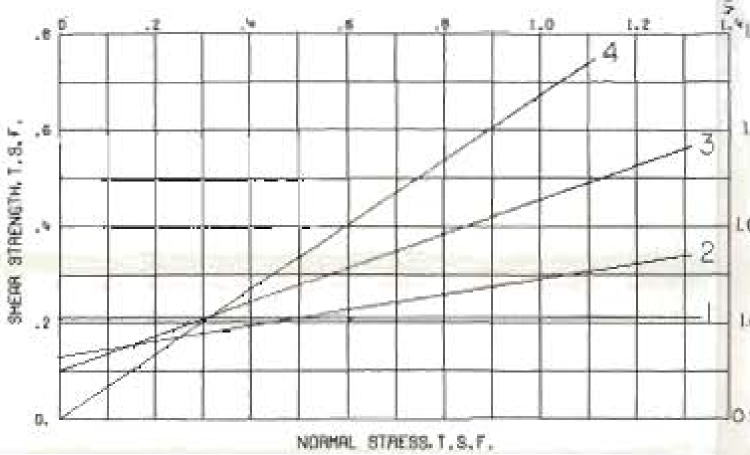
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

MAY 1976 FILE NO. H-2-26533





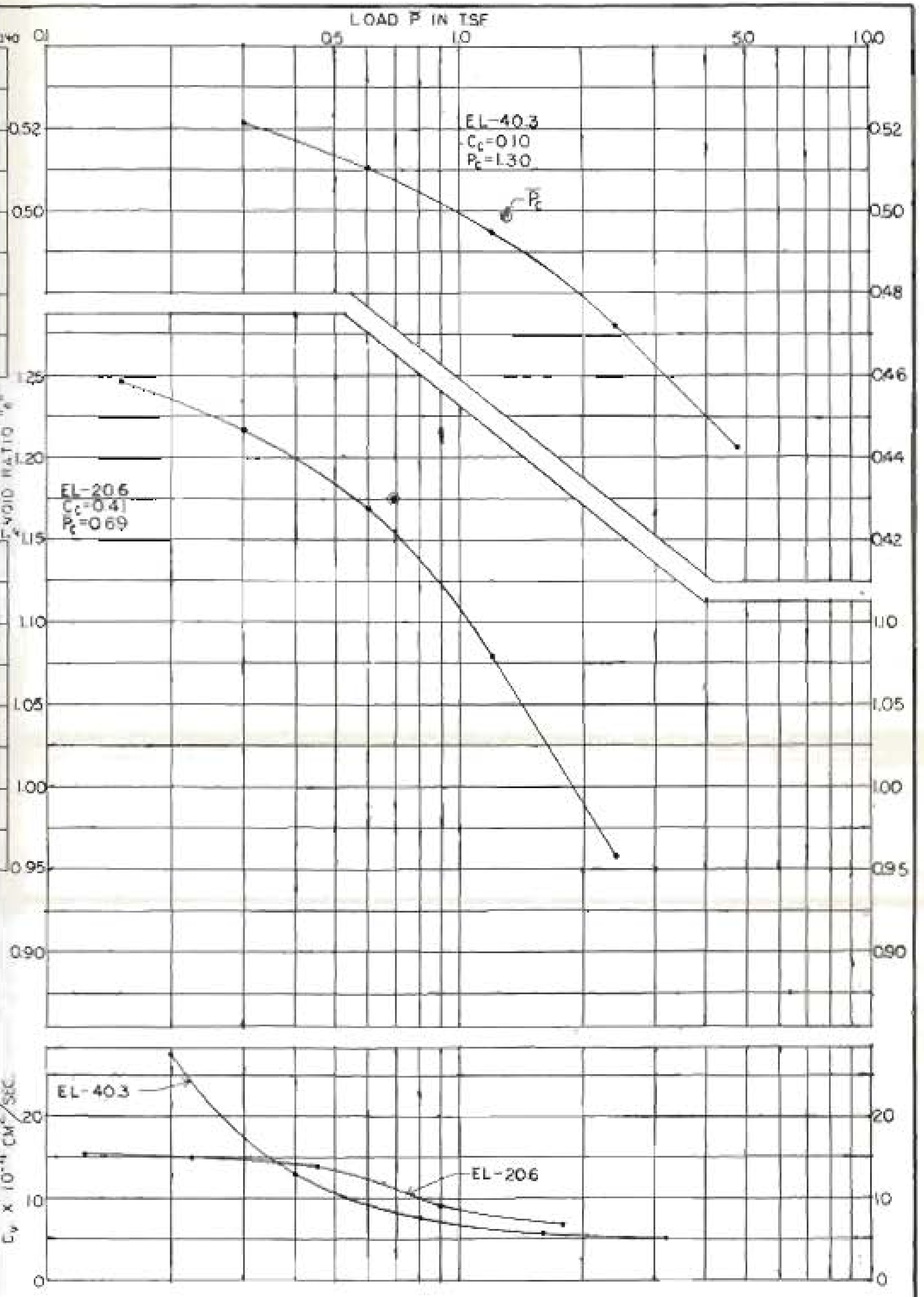
PLASTICITY CHART



SHEAR STRENGTH DATA

BORING NO.	ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH φ	STRENGTH C - TSF	CLASS
8-ULC	1	-18.0	Q	0	0.21	CH
	2	-22.6		0	0.22	CH
	3	-14.6	R	*20.0	0.10	SM
	4	-54.6	S	34.0	0	SP

* BASED ON DEVIATOR STRESS AT MAXIMUM POSITIVE PORE PRESSURE.



○ - (UC) UNCONFINED COMPRESSION TEST
● - (Q) UNCONSOLIDATED - UNDRAINED SHEAR TEST
▲ - (R) CONSOLIDATED - UNDRAINED SHEAR TEST
□ - (S) CONSOLIDATED - DRAINED SHEAR TEST
BORINGS WERE TAKEN WITH A 5 INCH DIAMETER STEEL TUBE PISTON TYPE SAMPLER
FOR SOIL BORING LEGEND SEE PLATE A
FOR LOCATION OF BORINGS SEE PLATES 2,3,&4.
FOR DETAIL SHEAR STRENGTH DATA SEE PLATE 96.
FOR GENERAL NOTES SEE PLATE 68.

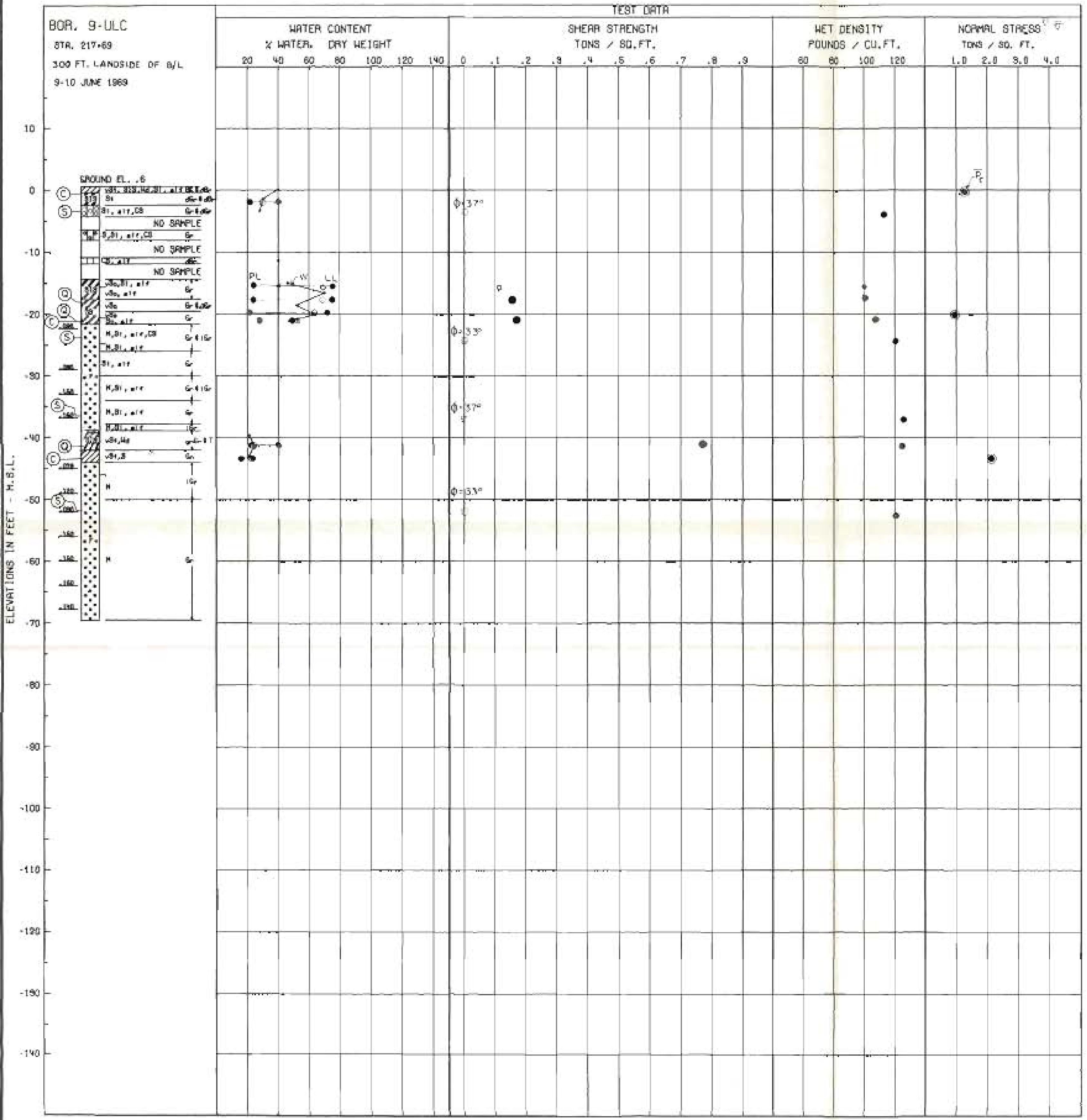
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO.2-GENERAL DESIGN
SUPPLEMENT NO. 5A

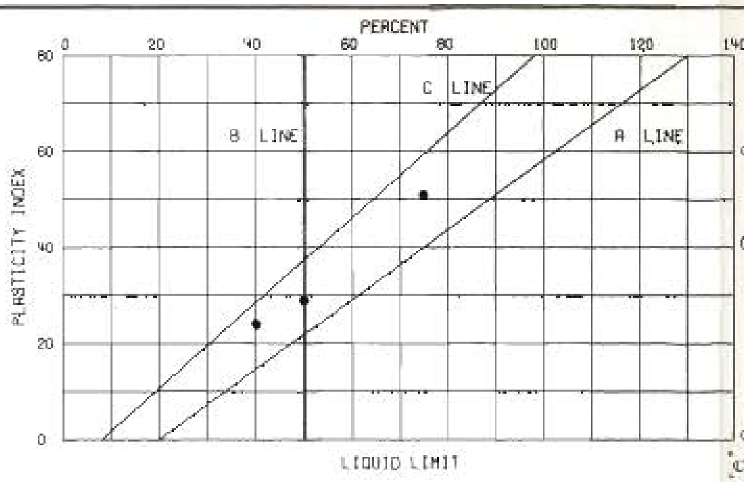
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

UNDISTURBED BORING
8-ULC DATA

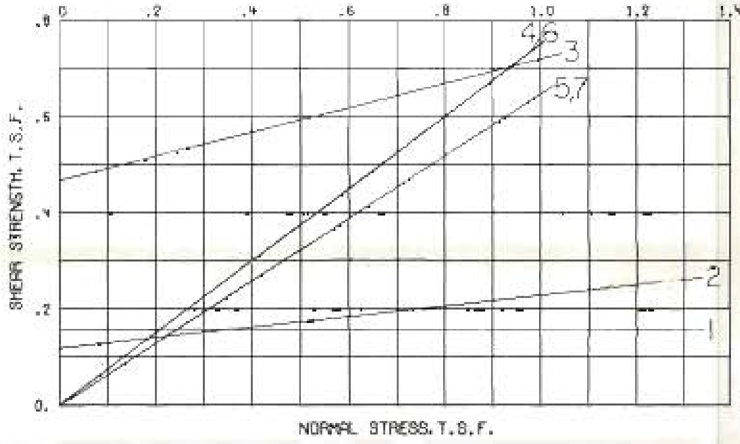
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

MAY 1976 FILE NO.H-2-26533



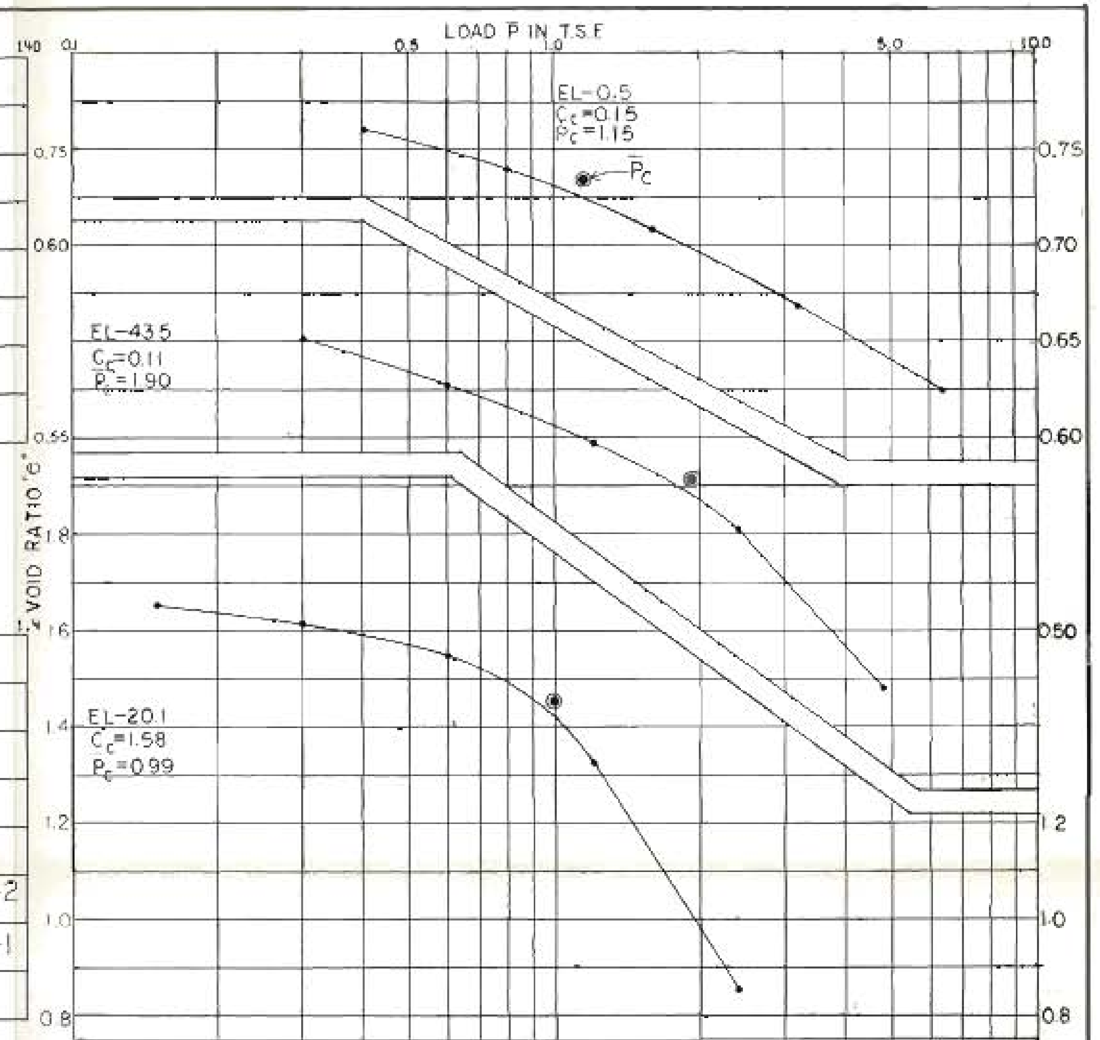


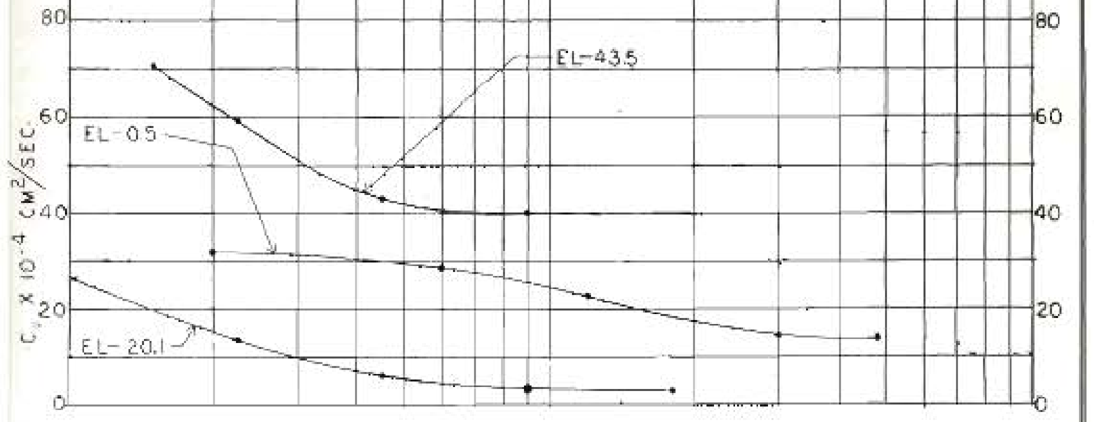
PLASTICITY CHART



SHEAR STRENGTH DATA

BORING NO.	ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH $\Phi°$	STRENGTH C - TSF	CLASS
9-ULC	1	-17.1	Q	0	0.16	CH
	2	-20.9	Q	0	0.17	CH
	3	-41.1	Q	0	0.77	CL
	4	-3.6	S	37	0	SM
	5	-24.3	S	33	0	SP
	6	-37.0	S	37	0	SP-SM
	7	-52.2	S	33	0	SP





○ - (UC) UNCONFINED COMPRESSION TEST
● - (Q) UNCONSOLIDATED - UNDRAINED SHEAR TEST
▲ - (R) CONSOLIDATED - UNDRAINED SHEAR TEST
□ - (S) CONSOLIDATED - DRAINED SHEAR TEST

BORINGS WERE TAKEN WITH A 5 INCH DIAMETER STEEL TUBE PISTON TYPE SAMPLER

FOR SOIL BORING LEGEND SEE PLATE A

FOR LOCATION OF BORINGS SEE PLATES 2,3,&4.

FOR DETAIL SHEAR STRENGTH DATA SEE PLATE 97.

FOR GENERAL NOTES SEE PLATE 68.

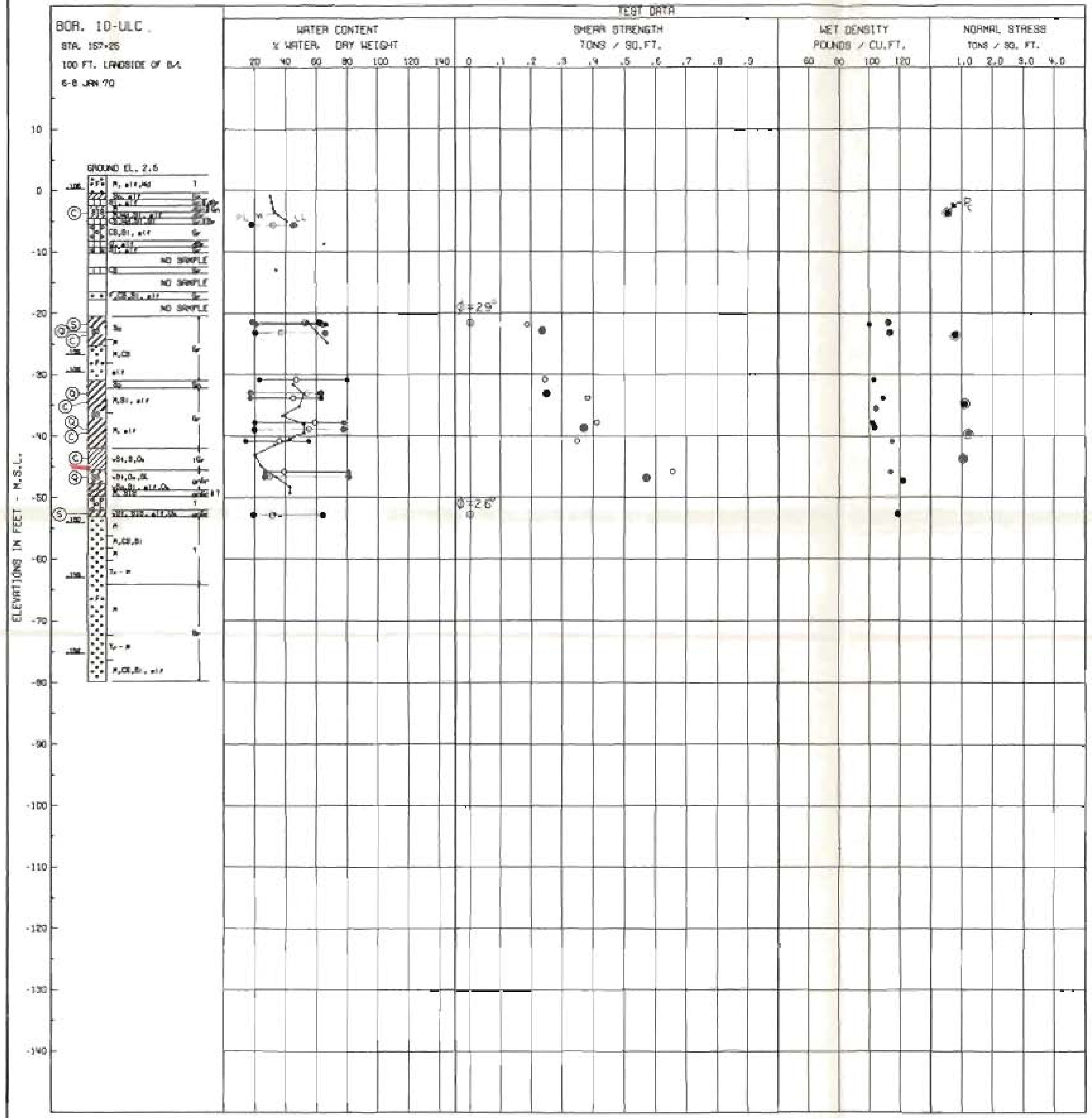
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO.2-GENERAL DESIGN
SUPPLEMENT NO.5A

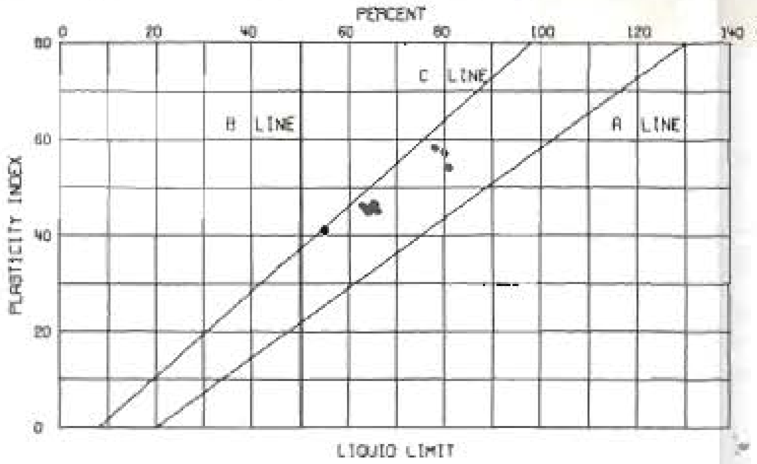
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD

UNDISTURBED BORING 9-ULC DATA

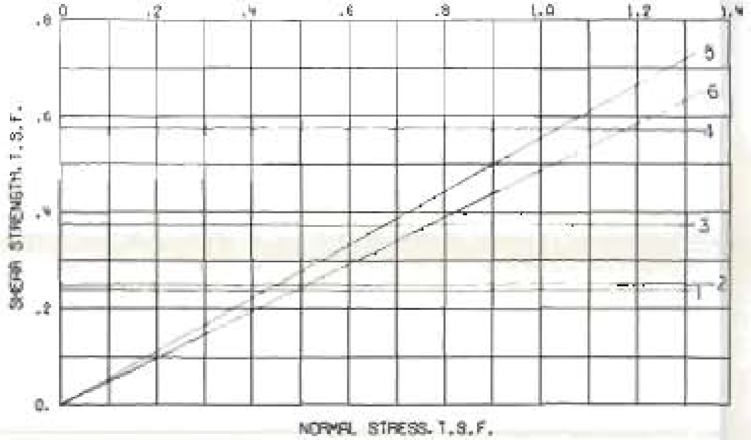
U. S. ARMY ENGINEER DISTRICT NEW ORLEANS
CORPS OF ENGINEERS

MAY 1976 FILE NO. H-2-26533



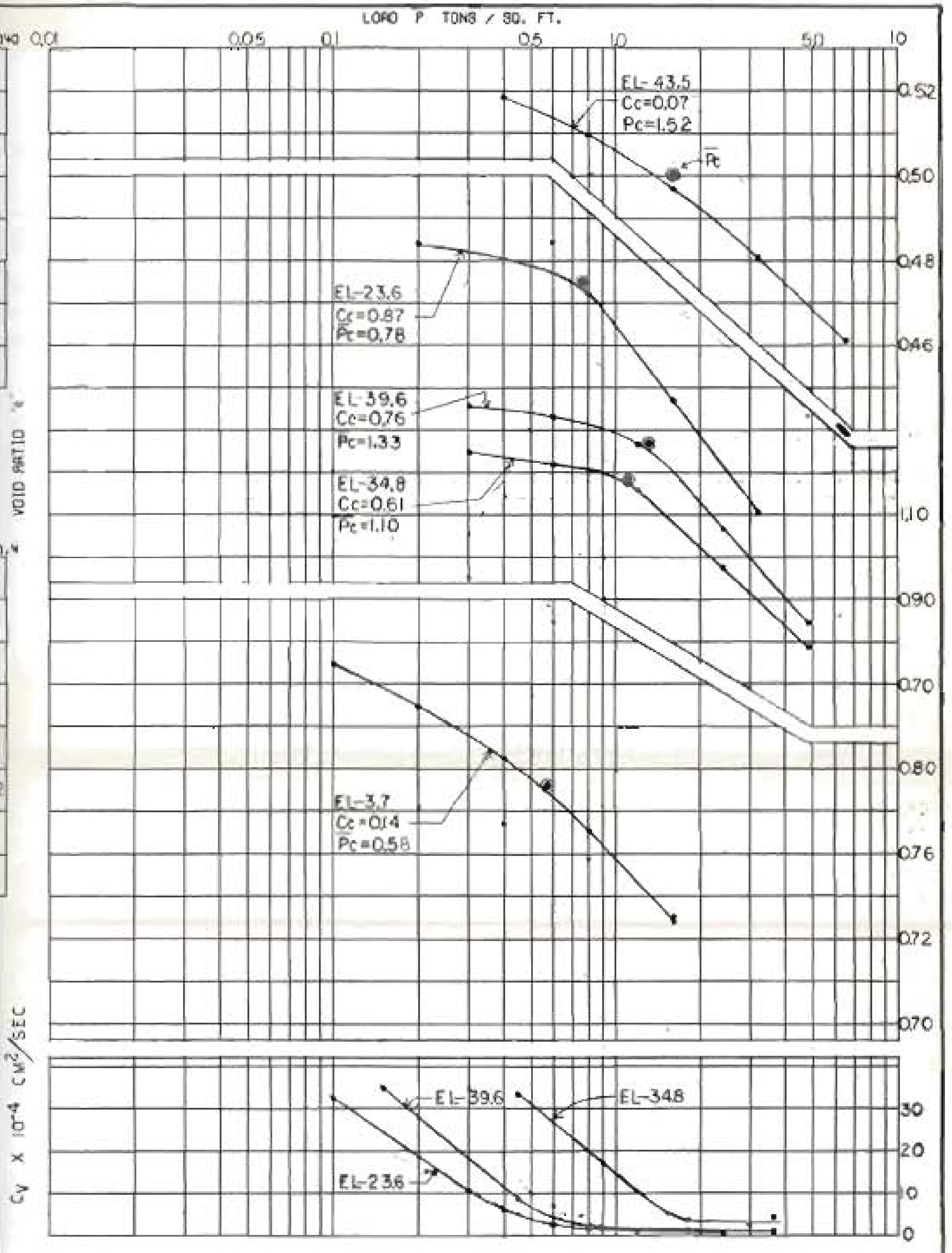


PLASTICITY CHART



SHEAR STRENGTH DATA

BORING NO.	ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH Φ°	STRENGTH C - TSF	CLASS
10-ULC	1	-22.9	Q	0	0.24	CH
	2	33.1		0	0.25	CH
	3	-38.8		0	0.37	CH
	4	-46.8		0	0.58	CH
	5	-21.7	S	29	0	CH
	6	-52.8		26	0	CH



CONSOLIDATION DATA

○ - (UC) UNCONFINED COMPRESSION TEST
● - (Q) UNCONSOLIDATED - UNDRAINED SHEAR TEST
▲ - (R) CONSOLIDATED - UNDRAINED SHEAR TEST
□ - (S) CONSOLIDATED - DRAINED SHEAR TEST

BORINGS WERE TAKEN WITH A 5 INCH DIAMETER STEEL TUBE PISTON TYPE SAMPLER

FOR SOIL BORING LEGEND SEE PLATE A
FOR LOCATION OF BORINGS SEE PLATES 2 3 & 4.
FOR DETAIL SHEAR STRENGTH DATA SEE PLATE 98.
FOR GENERAL NOTES SEE PLATE 68.

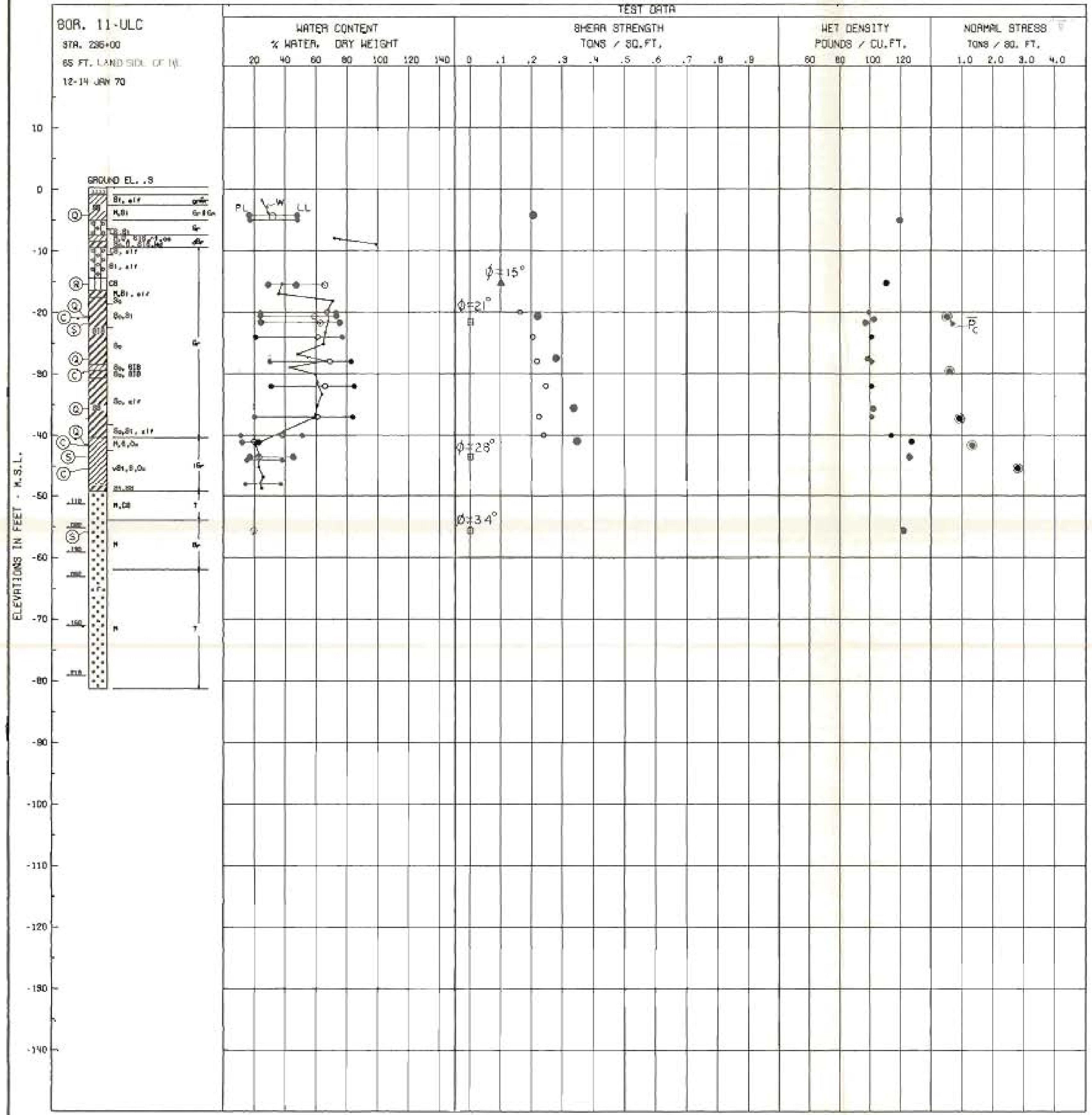
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2-GENERAL DESIGN
SUPPLEMENT NO. 5A

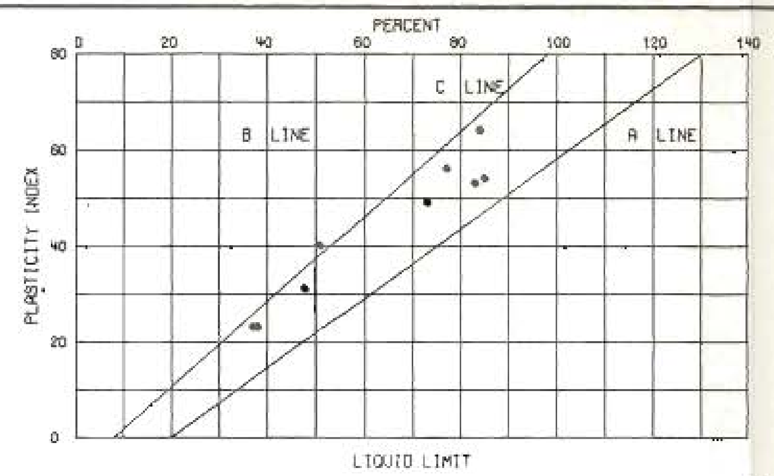
CITRUS LAKEFRONT LEVEE
I. H. N. C. TO PARIS ROAD

UNDISTURBED BORING 10-ULC DATA

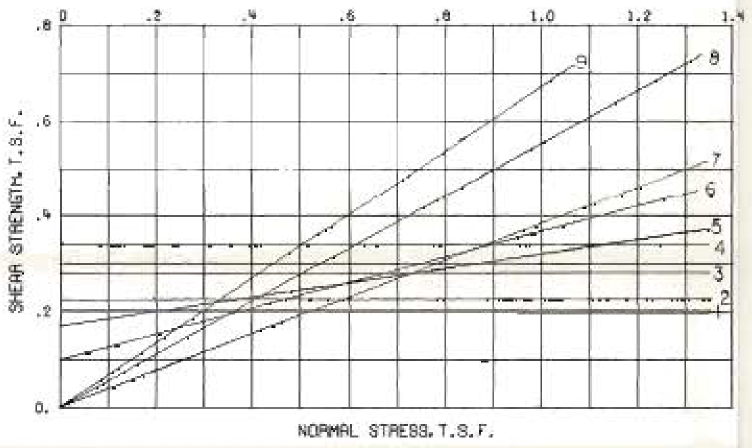
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

MAY 1974 FILE NO. H-2-26533





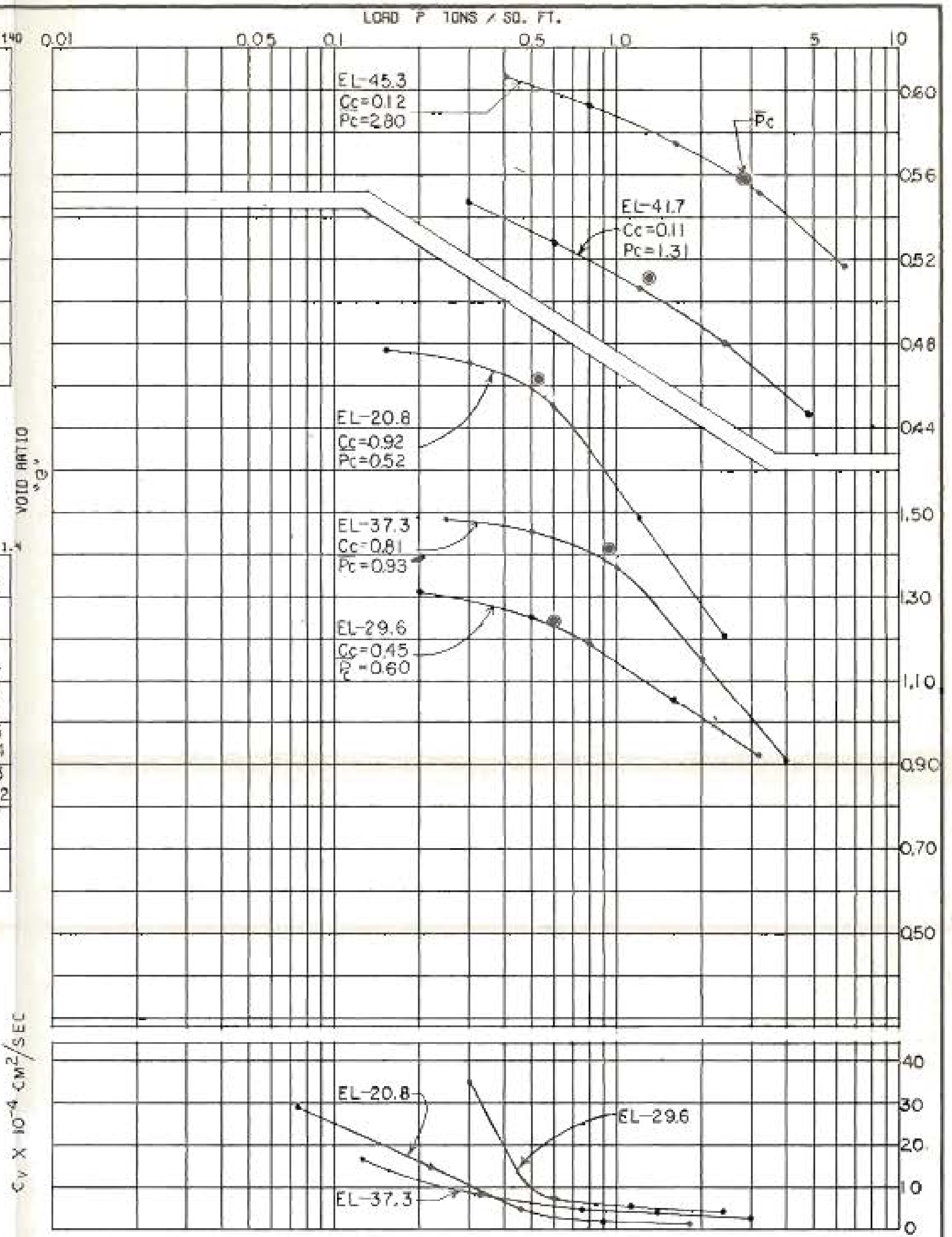
PLASTICITY CHART



SHEAR STRENGTH DATA

BORING NO.	ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH Φ°	STRENGTH C - TSF	CLASS
11-ULC	1	-43	Q	0	0.20	CL
	2	-20.7		0	0.22	CH
	3	27.6		0	0.28	CH
	4	-35.8		0	0.34	CH
	5	-41.1		0	0.35	CL
	6	-15.7	R	*15	0.10	ML
	7	-21.7	S	21	0	CH
	8	-43.5		28	0	CL
	9	-55.9		34	0	SP

* BASED ON DEVIATOR STRESS AT MAXIMUM POSITIVE PORE PRESSURE



CONSOLIDATION DATA

○ - (UC) UNCONFINED COMPRESSION TEST
● - (Q) UNCONSOLIDATED - UNDRAINED SHEAR TEST
▲ - (R) CONSOLIDATED - UNDRAINED SHEAR TEST
□ - (S) CONSOLIDATED - DRAINED SHEAR TEST

BORINGS WERE TAKEN WITH A 5 INCH DIAMETER STEEL TUBE PISTON TYPE SAMPLER

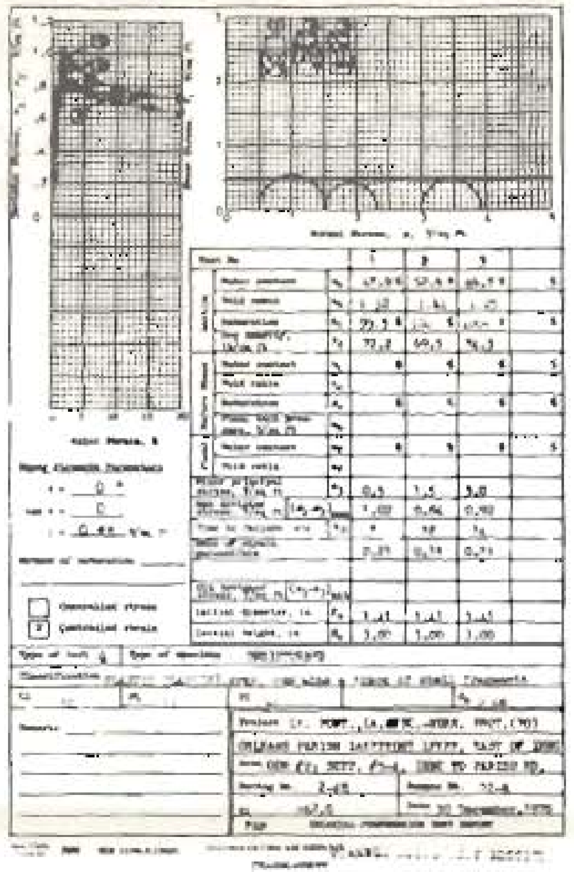
FOR SOIL BORING LEGEND SEE PLATE A
FOR LOCATION OF BORINGS SEE PLATES 2,3,& 4.
FOR DETAIL SHEAR STRENGTH DATA SEE PLATE 99
FOR GENERAL NOTES SEE PLATE 68.

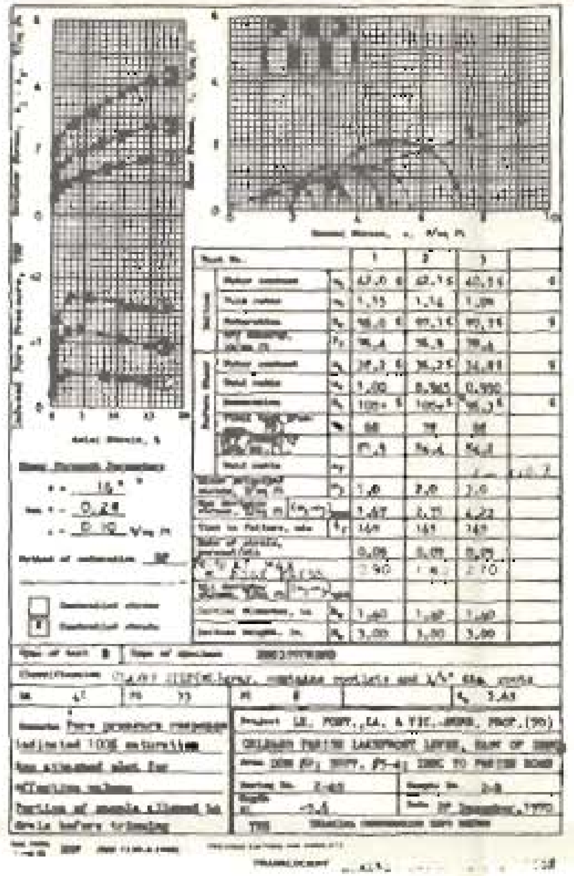
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A
CITRUS LAKEFRONT LEVEE
I. H. N. C. TO PARIS ROAD

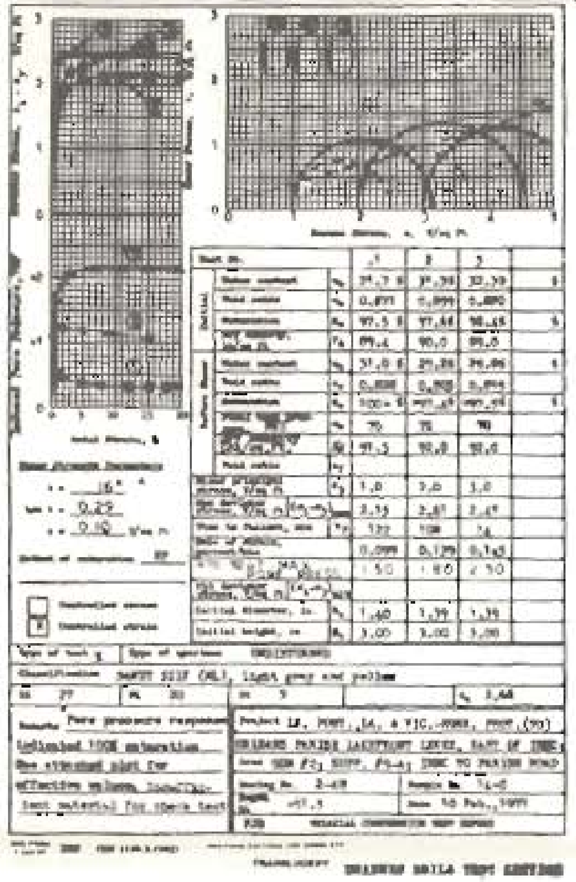
UNDISTURBED BORING 11-ULC DATA

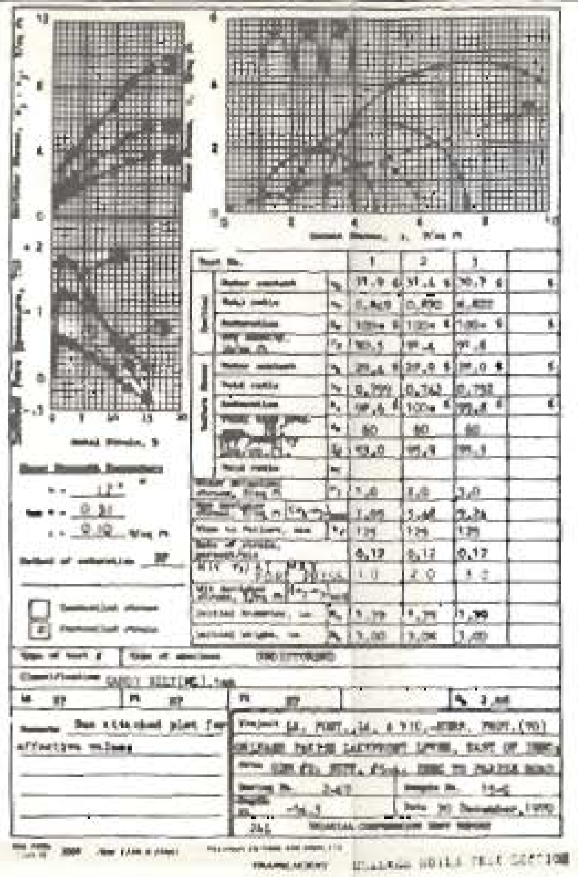
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

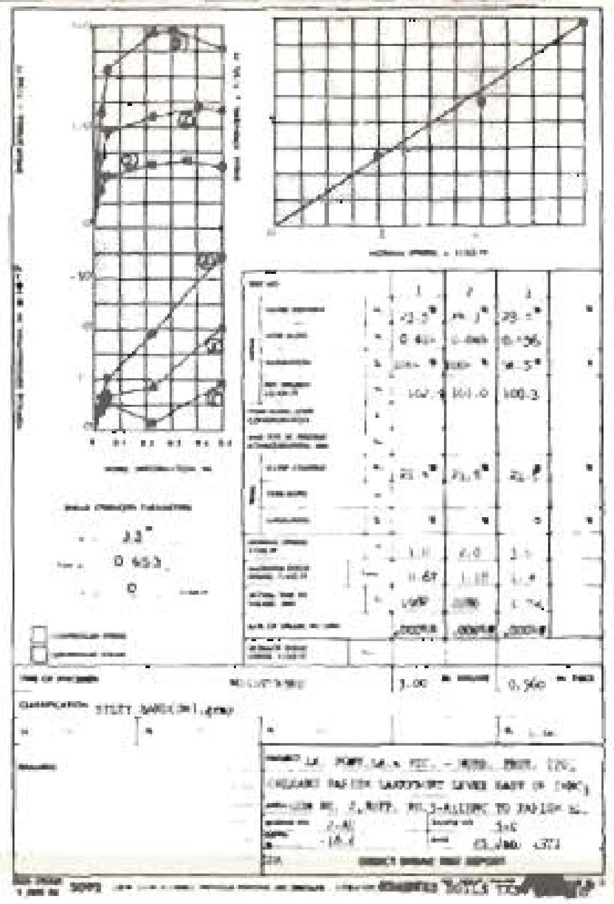
MAY 1976 FILE NO. H-2-26533

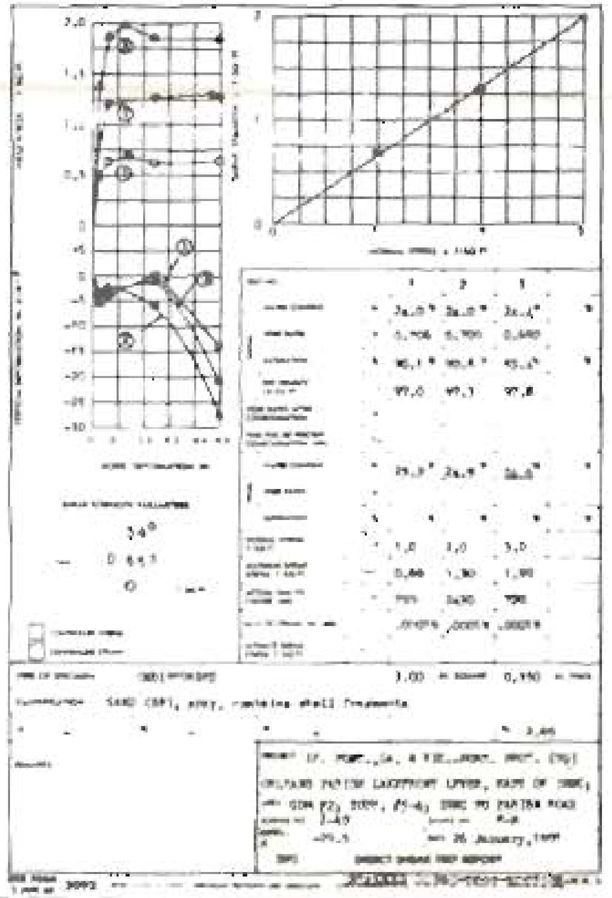


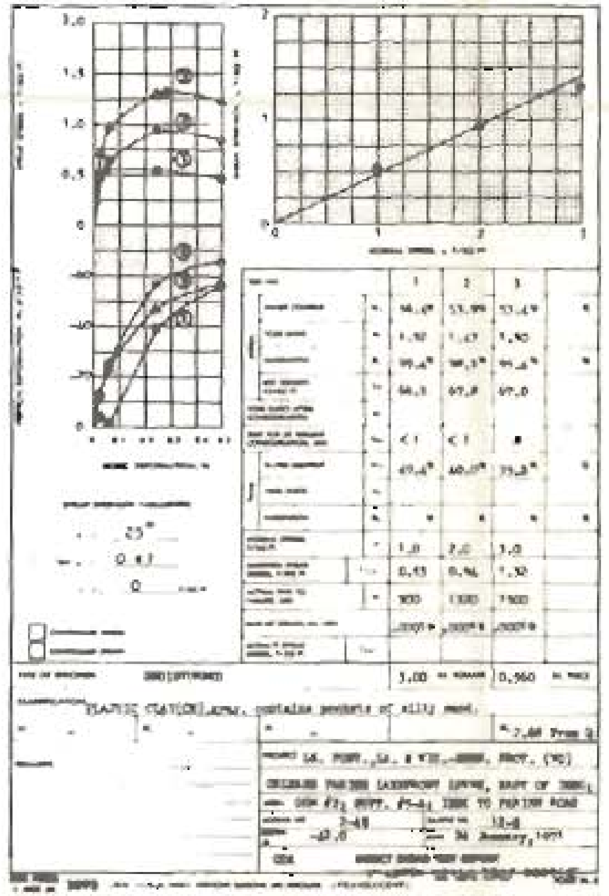


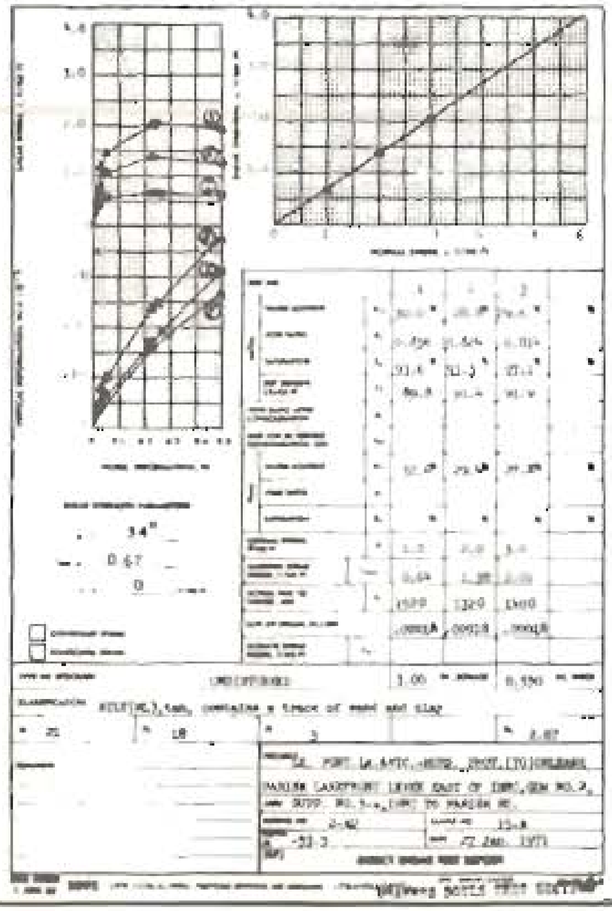


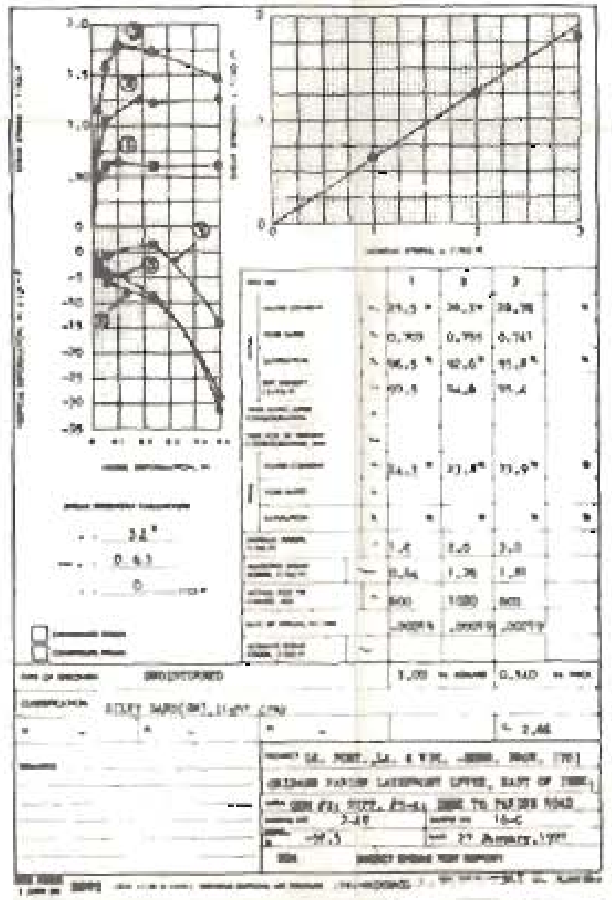












GENERAL NOTES:

(Q) UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST.

(R) CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST.

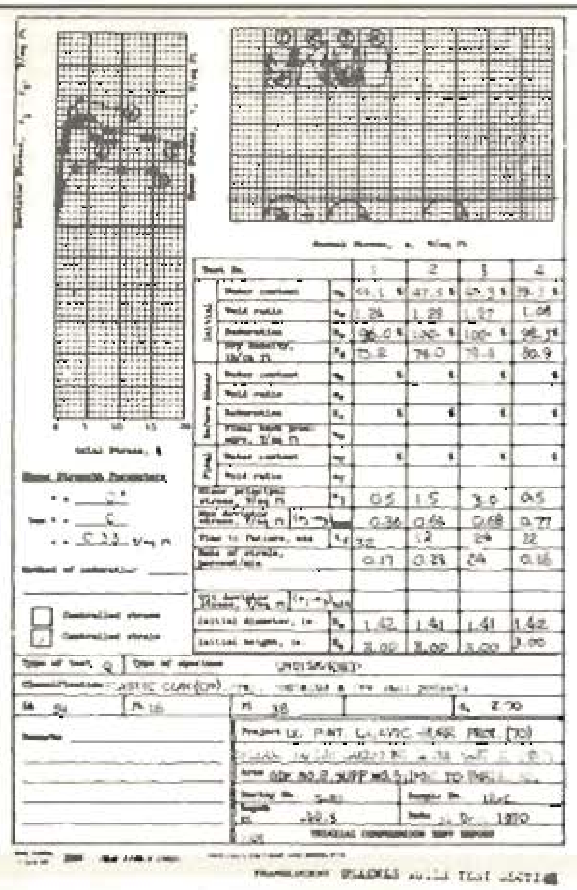
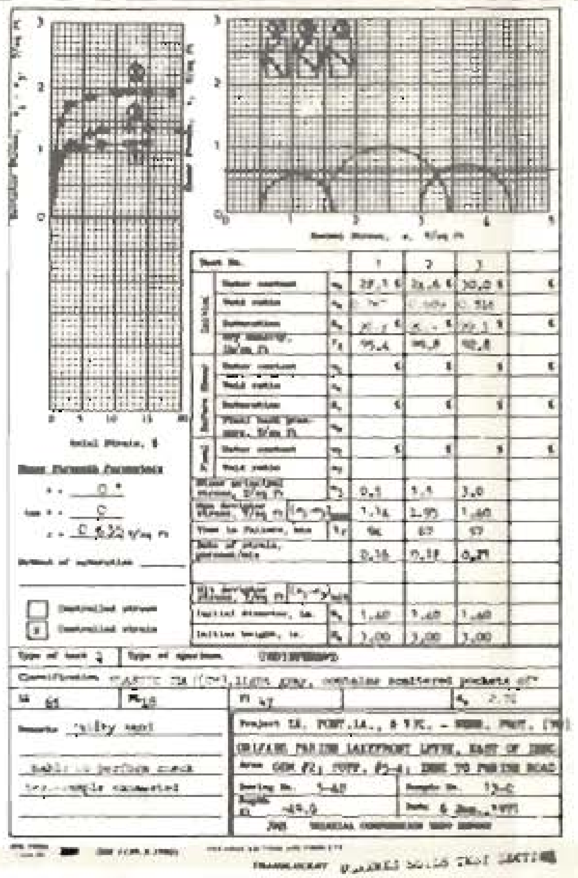
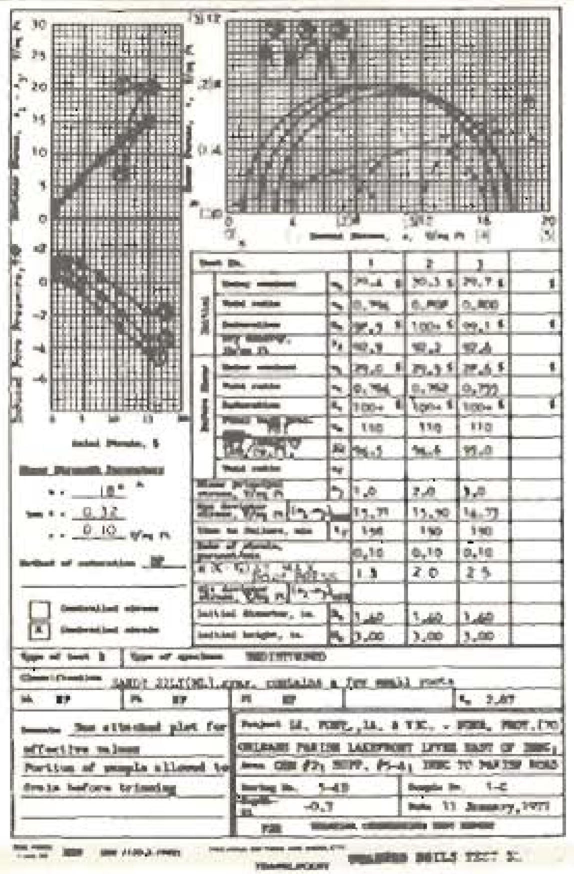
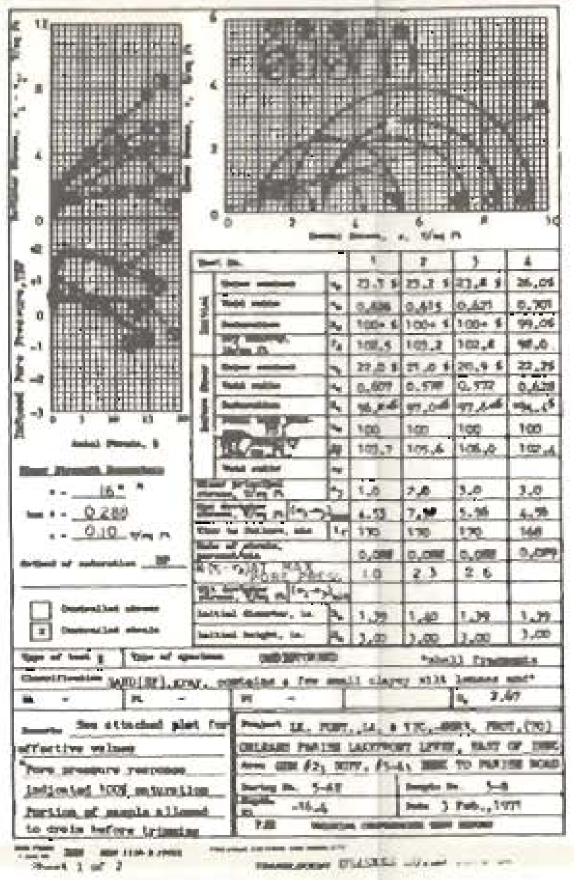
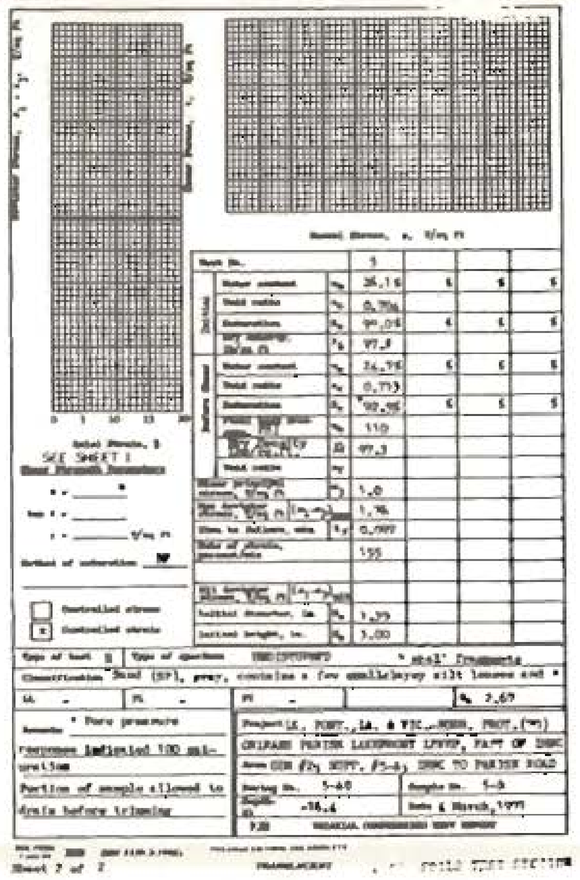
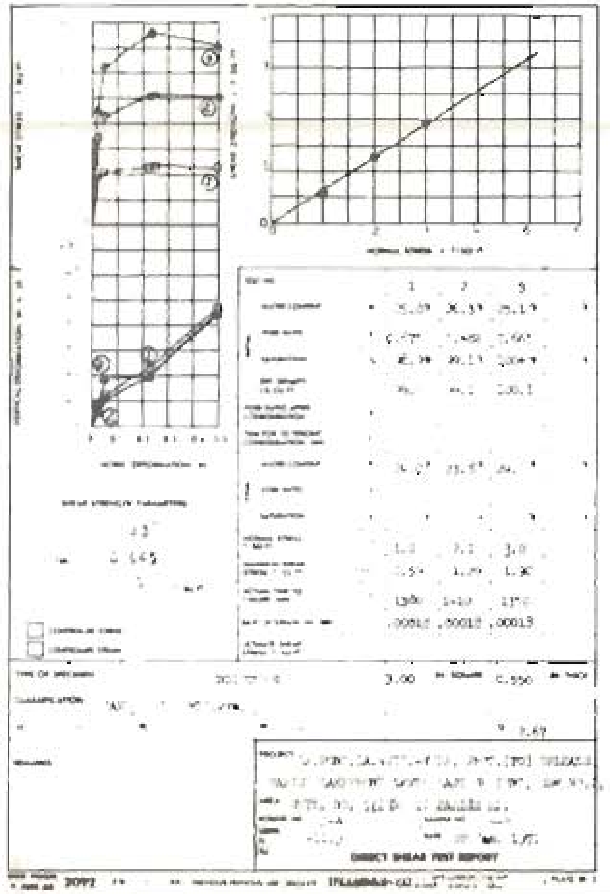
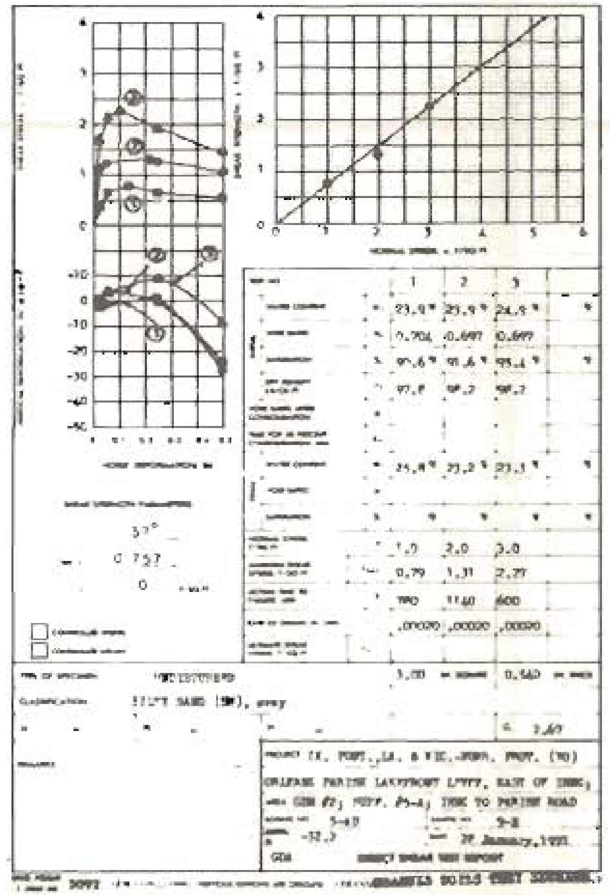
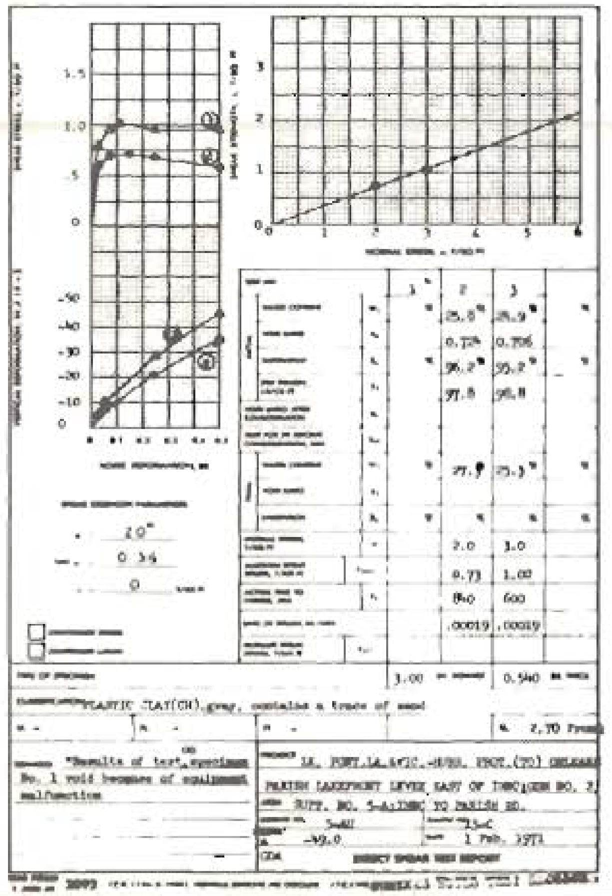
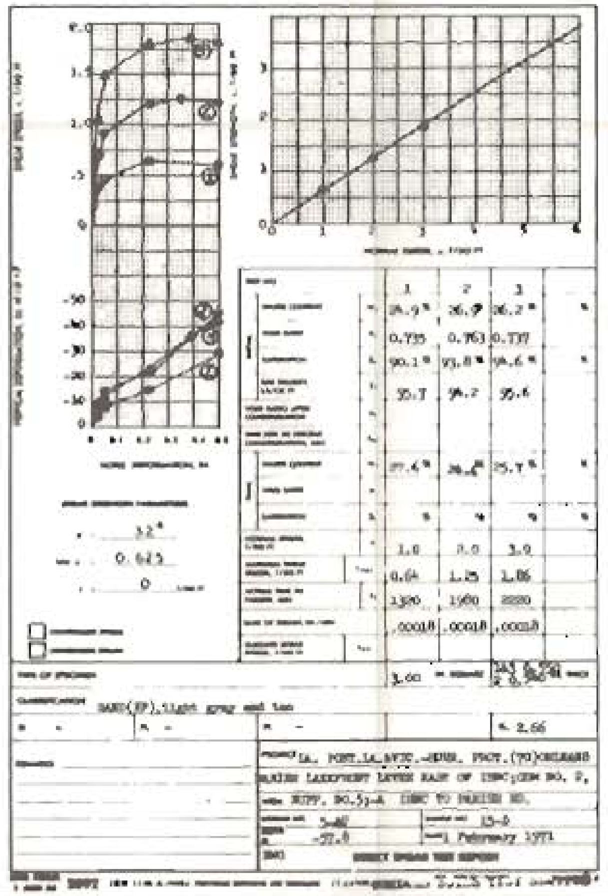
(S) CONSOLIDATED-DRAINED DIRECT SHEAR TEST.

LAKE PONTCHARTRAIN, LA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO 2 - GENERAL DESIGN
SUPPLEMENT NO 5A
CITRUS LAKEFRONT LEVEE
IHNC TO PARIS ROAD

DETAIL SHEAR STRENGTH DATA
BORING 2-AU

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

MAY 1976 FILE NO. H-2-26533

SEE PLATE 84 FOR GENERAL NOTES.

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 – GENERAL DESIGN
SUPPLEMENT NO. 5A
CITRUS LAKEFRONT LEVEE
IHNC TO PARIS ROAD

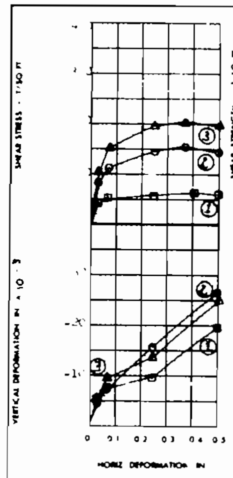
DETAIL SHEAR STRENGTH DATA
BORING 5-AU

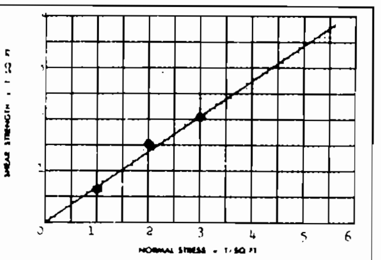
US ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

MAY 1976

FILE NO. H-2-26533

DIRECT SHEAR TEST REPORT — Boring 6-AU, Sample 7-C





SHEAR STRENGTH PARAMETERS

φ = 34°

TAN φ = 0.68

C = 0 T/SQ FT

☐ CONTROLLED STRESS

☐ CONTROLLED STRAIN

TEST NO.		1	2	3	
Initial: Water content	w_o	24.8%	26.6%	24.8%	%
Void ratio	e_o	0.661	0.707	0.681	
Saturation	S_o	99.4%	99.7%	96.5%	%
Dry density, LB/CU FT	γ_d	99.6	96.9	98.-	
Void ratio after consolidation	e_c				
Time for 50 percent consolidation, min	t_{50}				
Final: Water content	w_f	23.9%	24.1%	23.9%	%
Void ratio	e_f				
Saturation	S_f	%	%	%	%
Normal stress, T/SQ FT	σ	1.0	2.0	3.0	
Maximum shear stress, T/SQ FT	τ_{max}	0.63	1.52	2.04	
Actual time to failure, min	t_f	2190	2010	1980	
Rate of strain, in/min		.00019	.00019	.00019	
Ultimate shear stress, T/SQ FT	τ_{ult}				

TYPE OF SPECIMEN — 3.00 IN SQUARE, 0.550 IN THICK

CLASSIFICATION SILTY SAND(SM),gray

LL – PL – PI – G_s 2.65

REMARKS

PROJECT LK. PONT. LA.&VIC.-HURR. PROT. (70) ORLEANS PARISH LAKEFRONT LEVEE EAST OF IHNC, GDM NO.2,

AREA SUPP. NO. 5-A; IHNC TO PARISH RD.

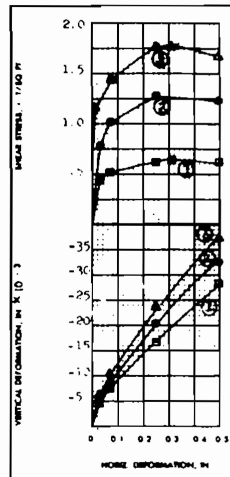
BORING NO. 6-AU SAMPLE NO. 7-C

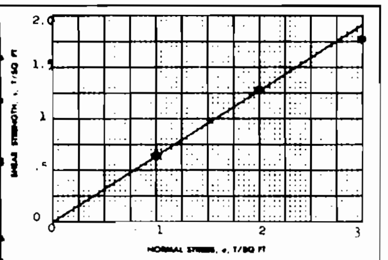
DEPTH/EL. -13.3 DATE 2 February 1971

SWG DIRECT SHEAR TEST REPORT

ENG FORM 1 JUN 65 2092 (EM 1110-2-1906) PREVIOUS EDITIONS ARE OBSOLETE (TRANSLUCENT)

DIRECT SHEAR TEST REPORT — Boring 6-AU, Sample 3-B





SHEAR STRENGTH PARAMETERS

φ = 33°

TAN φ = 0.64

c = 0 T/SQ FT

☐ CONTROLLED STRESS

☐ CONTROLLED STRAIN

TEST NO.		1	2	3	
Initial: Water content	w_o	36.0%	38.0%	37.7%	%
Void ratio	e_o	0.952	1.11	1.06	
Saturation	S_o	97.6%	88.3%	91.8%	%
Dry density, LB/CU FT	γ_d	82.5	76.3	78.0	
Void ratio after consolidation	e_c				
Time for 50 percent consolidation, min	t_{50}				
Final: Water content	w_f	30.5%	36.0%	32.7%	%
Void ratio	e_f				
Saturation	S_f	%	%	%	%
Normal stress, T/SQ FT	σ	1.0	2.0	3.0	
Maximum shear stress, T/SQ FT	τ_{max}	0.64	1.28	1.77	
Actual time to failure, min	t_f	1620	1320	1560	
Rate of strain, in/min		.00020	.00020	.00020	
Ultimate shear stress, T/SQ FT	τ_{ult}				

TYPE OF SPECIMEN UNDISTURBED 3.00 IN SQUARE, 0.540 IN THICK

CLASSIFICATION LEAN CLAY(CL),dark gray, contains sand pockets, finely divided*

LL 46 PL 24 PI 22 G_s 2.58

REMARKS *organic matter and rootlets

PROJECT LK.PONT.LA.&VIC.-HURR. PROT. (70)ORLEANS PARISH LAKEFRONT LEVEE EAST OF IHNC;GDM NO.2,

AREA SUPP. NO. 5;IHNC TO PARISH RD.

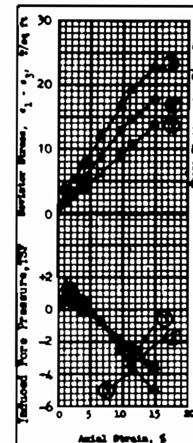
BORING NO. 6-AU SAMPLE NO. 3-B

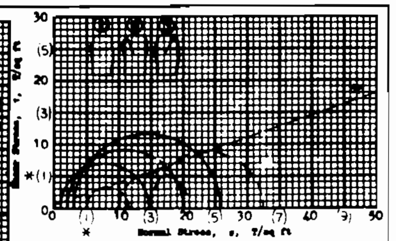
DEPTH/EL. +3.3 DATE 2 February 1971

GDA DIRECT SHEAR TEST REPORT

ENG FORM 1 JUN 65 2092 (EM 1110-2-1906) PREVIOUS EDITIONS ARE OBSOLETE (TRANSLUCENT)

TRIAXIAL COMPRESSION TEST REPORT — Boring 6-AU, Sample 6-C





Shear Strength Parameters

φ = 19°

tan φ = 0.35

c = 0.10 T/sq ft

Method of saturation BP

☐ Controlled stress

☒ Controlled strain

Test No.		1	2	3	
Initial: Water content	w_o	32.1 %	28.0 %	26.7 %	%
Void ratio	e_o	0.804	0.744	0.715	
Saturation	S_o	100+ %	100+ %	99.7 %	%
Dry density, lb/cu ft	γ_d	92.4	95.2	97.2	
Before Shear: Water content	w_c	27.6 %	25.8 %	24.8 %	%
Void ratio	e_c	0.783	0.722	0.677	
Saturation	S_c	94.1* %	95.4*	97.8*	%
Final back pressure, PSI	u_o	70	70	70	
Dry Density lbs/cu.ft.		93.5	96.8	99.4	
Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	1.0	2.0	3.0	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	13.64	17.88	22.88	
Time to failure, min	t_f	125	125	125	
Rate of strain, percent/min		0.12	0.12	0.12	
$*(\bar{\sigma}_1 - \bar{\sigma}_3)$ AT MAX PORE PRESS.		1.3	2.2	3.5	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.39	1.39	1.40	
Initial height, in.	H_o	3.00	3.00	3.00	

Type of test R — Type of specimen UNDISTURBED

Classification SILTY SAND(SM),grey

LL – PL – PI – G_s 2.67

Remarks

* Pore Pressure response indicated 100% saturation

Project LK. PONT.,LA. & VIC.-HURR. PROT.(70) ORLEANS PARISH LAKEFRONT LEVEE EAST OF IHNC;

Area GDM#2; SUPP. #5-A; IHNC TO PARISH ROAD

Boring No. 6-AU Sample No. 6-C

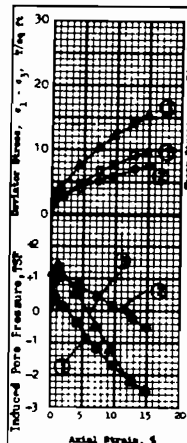
Depth/El -10.0 Date 13 January,1971

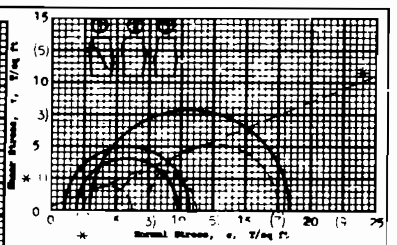
JAL TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 1 JUN 65 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE

TRANSLUCENT USAEWES SOILS TEST SECTION

TRIAXIAL COMPRESSION TEST REPORT — Boring 6-AU, Sample 5-B





Shear Strength Parameters

φ = 22° *

tan φ = 0.41

c = 0.10 T/sq ft

Method of saturation BP

☐ Controlled stress

☒ Controlled strain

Test No.		1	2	3	
Initial: Water content	w_o	24.0 %	27.4 %	24.4 %	%
Void ratio	e_o	0.670	0.768	0.684	
Saturation	S_o	95.6 %	95.2 %	95.2 %	%
Dry density, lb/cu ft	γ_d	99.8	94.3	99.0	
Before Shear: Water content	w_c	23.9 %	26.9 %	24.7 %	%
Void ratio	e_c	0.650	0.729	0.664	
Saturation	S_c	98.2 %	98.5 %	99.3 %	%
Final back pressure, PSI	u_o	60	60	60	
Dry Density lbs/cu.ft.		101.0	96.4	100.2	
Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	1.0	2.0	3.0	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	9.71	7.80	15.35	
Time to failure, min	t_f	185	183	185	
Rate of strain, percent/min		0.081	0.082	0.081	
$*(\bar{\sigma}_1 - \bar{\sigma}_3)$ AT MAX PORE PRESS.		1.5	2.5	4.0	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.41	1.40	1.40	
Initial height, in.	H_o	3.00	3.00	3.00	

Type of test R — Type of specimen UNDISTURBED

Classification SAND(SP),gray

LL NP PL NP PI NP G_s 2.67

Remarks

Project LK. PONT.,LA. & VIC.-HURR. PROT.(70) ORLEANS PARISH LAKEFRONT LEVEE, EAST OF IHNC

Area GDM #2; SUPP. #5-A; IHNC TO PARISH ROAD

Boring No. 6-AU Sample No. 5-B

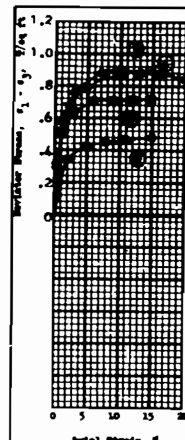
Depth/El -4.7 Date 4 February,1971

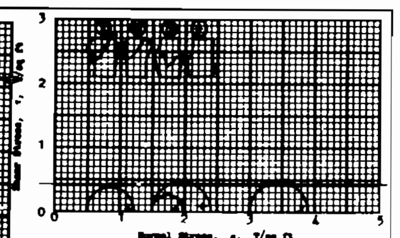
PJR TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 1 JUN 65 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE

TRANSLUCENT USAEWES SOILS TEST SECTION

TRIAXIAL COMPRESSION TEST REPORT — Boring 6-AU, Sample 2-B





Shear Strength Parameters

φ = 0°

tan φ = 0

c = 0.421 T/sq ft

Method of saturation

☐ Controlled stress

☒ Controlled strain

Test No.		1	2	3	4
Initial: Water content	w_o	79.4 %	63.1 %	66.5 %	55.7 %
Void ratio	e_o	2.18	1.63	1.76	1.52
Saturation	S_o	91.1 %	96.8 %	94.5 %	91.6 %
Dry density, lb/cu ft	γ_d	49.1	59.4	56.5	62.0
Before Shear: Water content	w_c	%	%	%	%
Void ratio	e_c				
Saturation	S_c	%	%	%	%
Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.5	1.[illegible]	3.0	1.5
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.72	0.48	0.90	0.91
Time to failure, min	t_f	79	68	31	31
Rate of strain, percent/min		0.19	0.22	0.32	0.48
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.40	1.41	1.40	1.42
Initial height, in.	H_o	3.00	3.00	3.00	3.00

Type of test Q — Type of specimen UNDISTURBED

Classification PLASTIC CLAY(CH),dark gray and brown, contains sand lenses

LL 95 PL 40 PI 55 G_s 2.50

Remarks

Project LK. PONT.,LA. & VIC.-HURR. PROT.(70); ORLEANS PARISH LAKEFRONT LEVEE, EAST OF IHNC

Area GDM #2; SUPP. #5-A, IHNC TO PARISH ROAD

Boring No. 6-AU Sample No. 2-B

Depth/El +7.3 Date 7 January,1971

JMB TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 1 JUN 65 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE

TRANSLUCENT USAEWES SOILS TEST SECTION

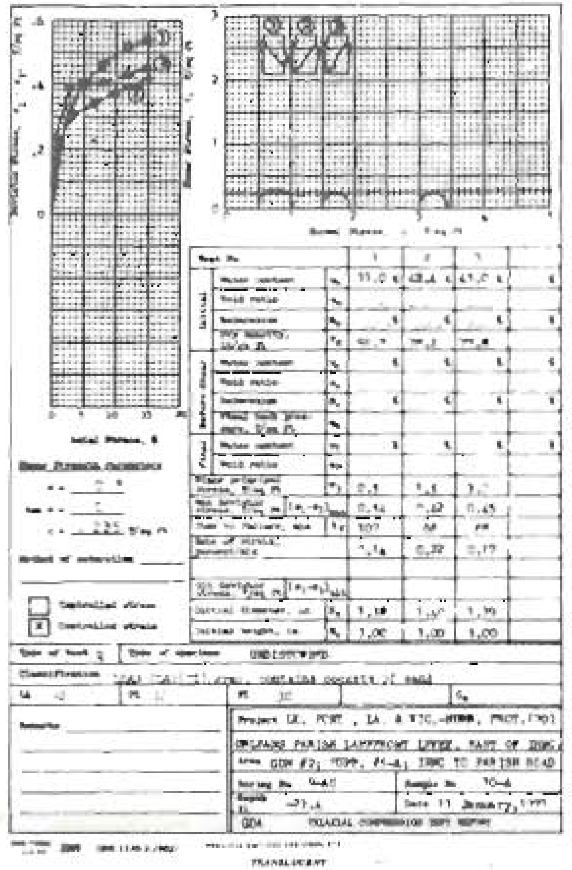
SEE PLATE 84 FOR GENERAL NOTES.

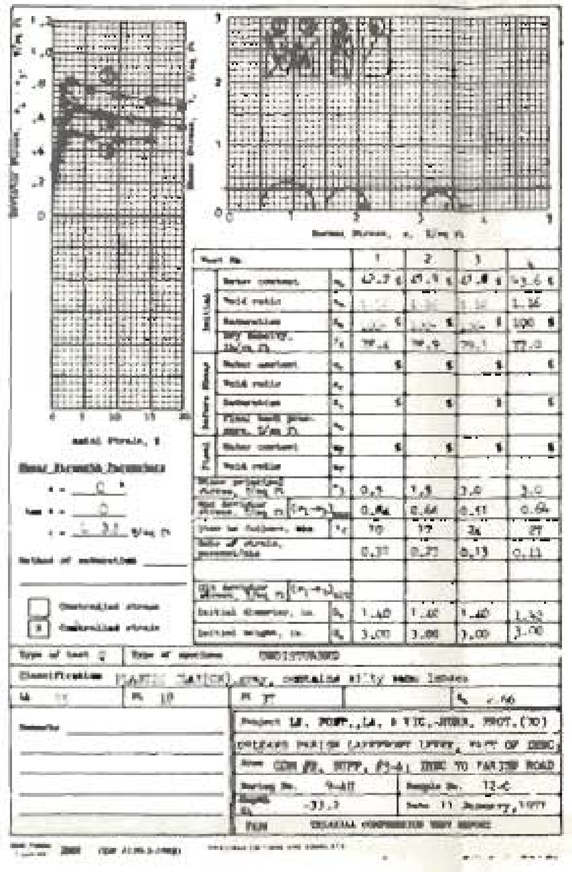
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 – GENERAL DESIGN
SUPPLEMENT NO. 5A
CITRUS LAKEFRONT LEVEE
IHNC TO PARIS ROAD

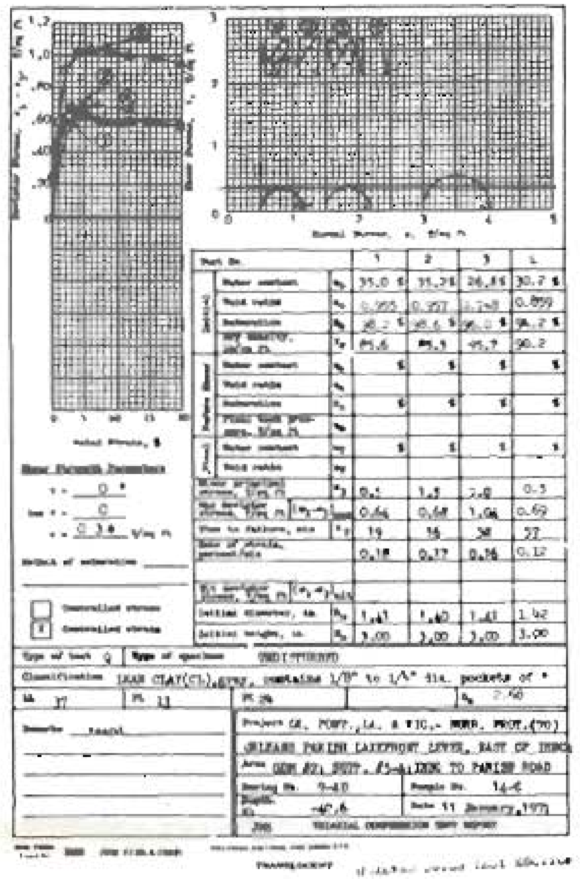
DETAIL SHEAR STRENGTH DATA
BORING 6-AU

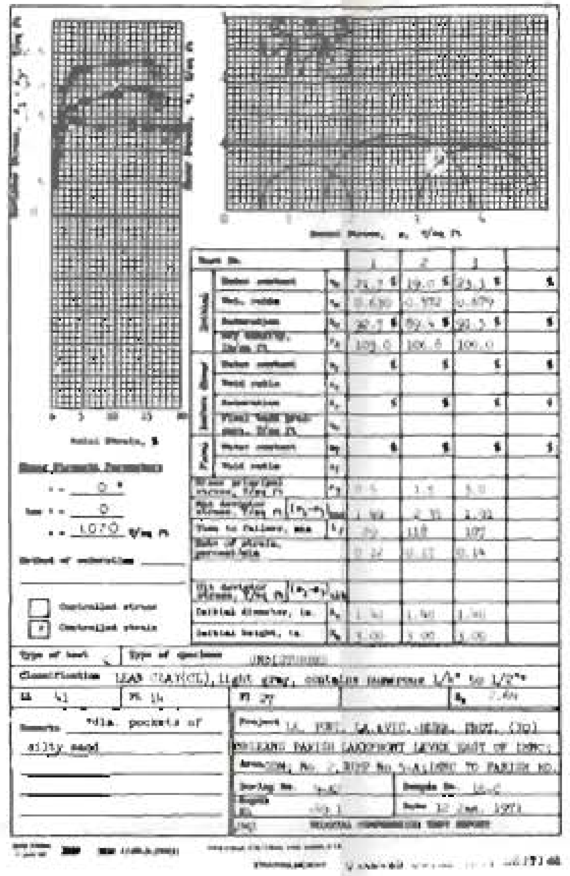
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

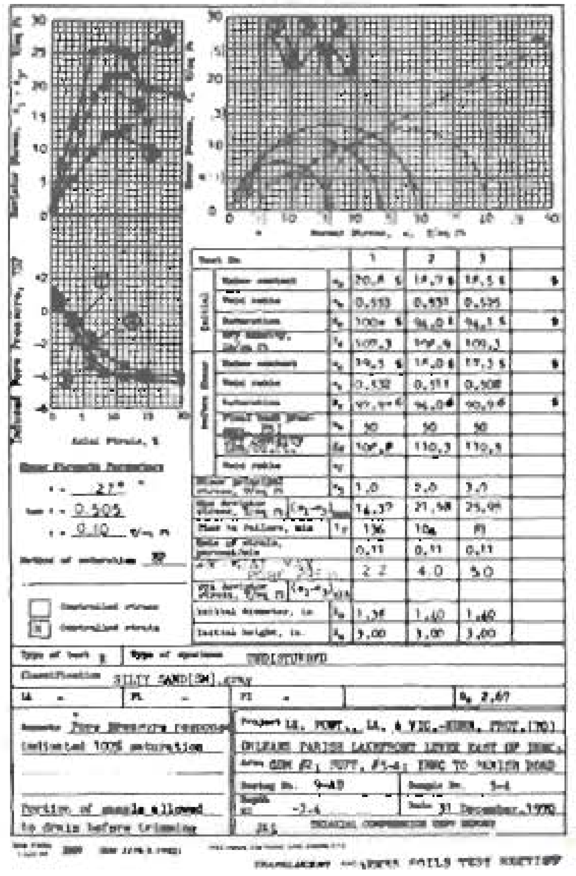
MAY 1976 FILE NO. H-2-26533

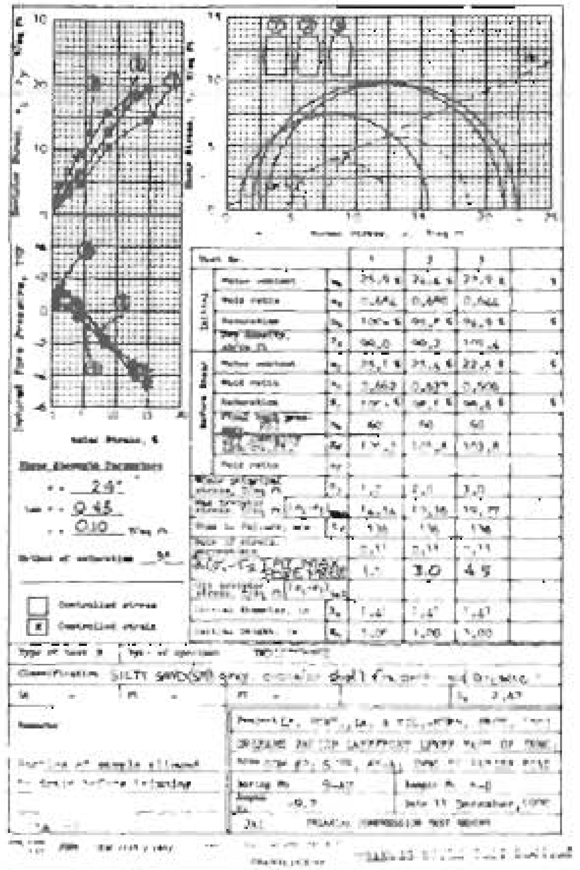


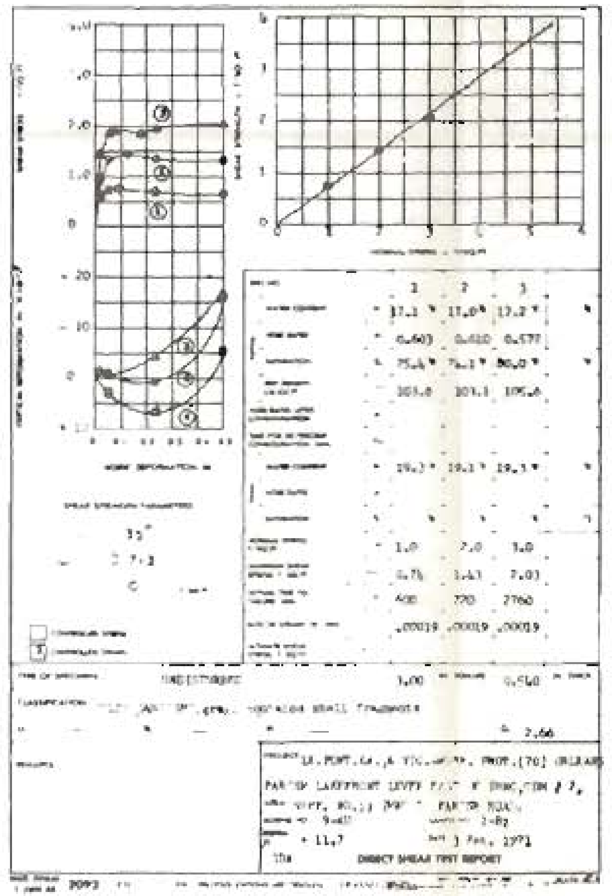


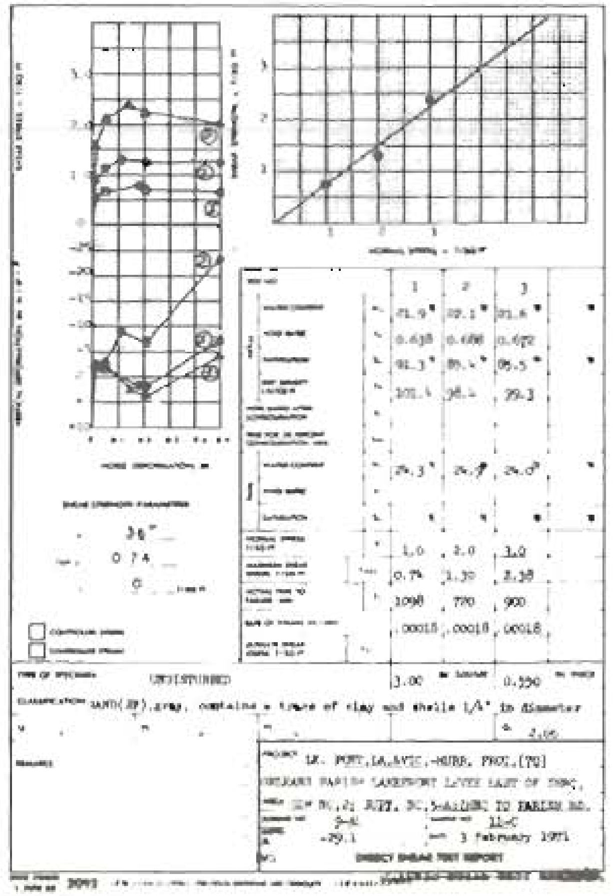


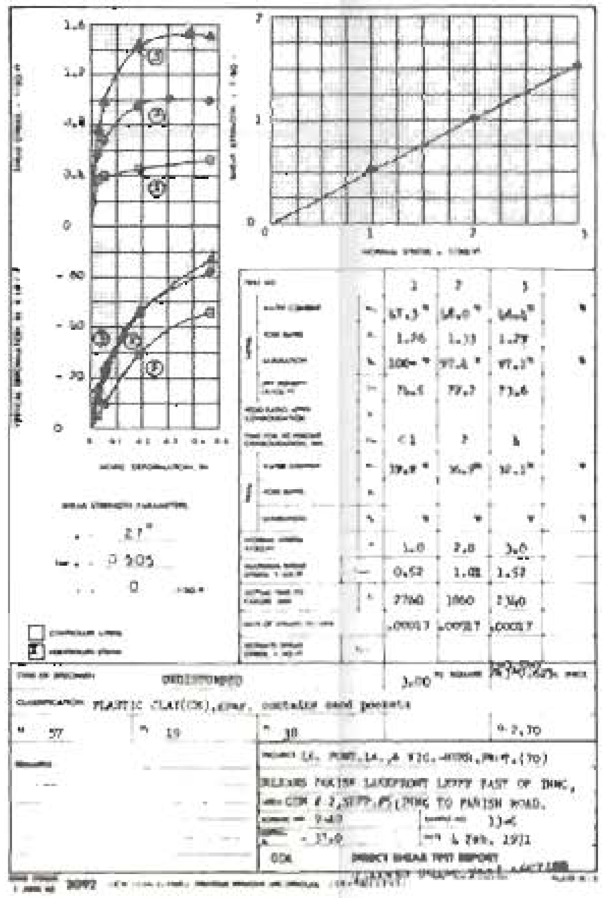












SEE PLATE 84 FOR GENERAL NOTES

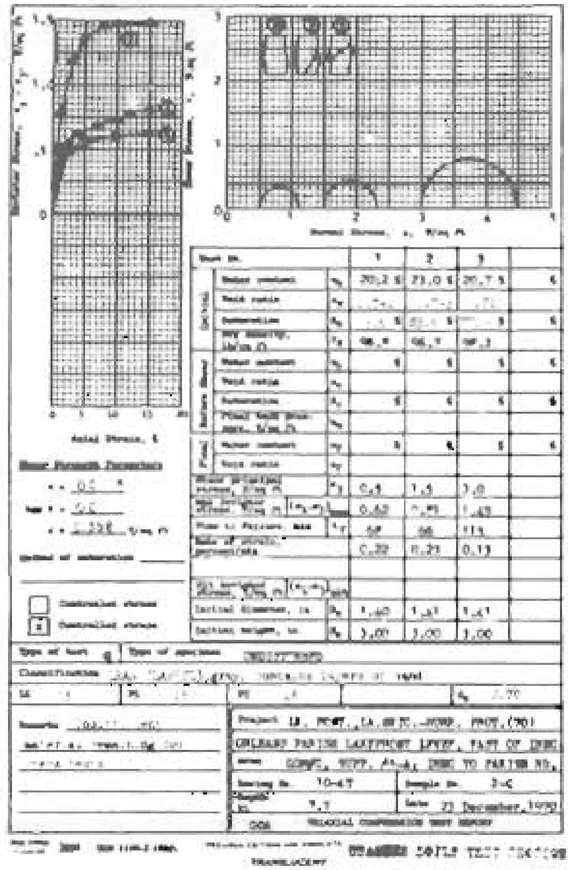
LAKE PONTCHARTRAIN, LA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO 2 – GENERAL DESIGN
SUPPLEMENT NO 5A
CITRUS LAKEFRONT LEVEE
IHNC TO PARIS ROAD

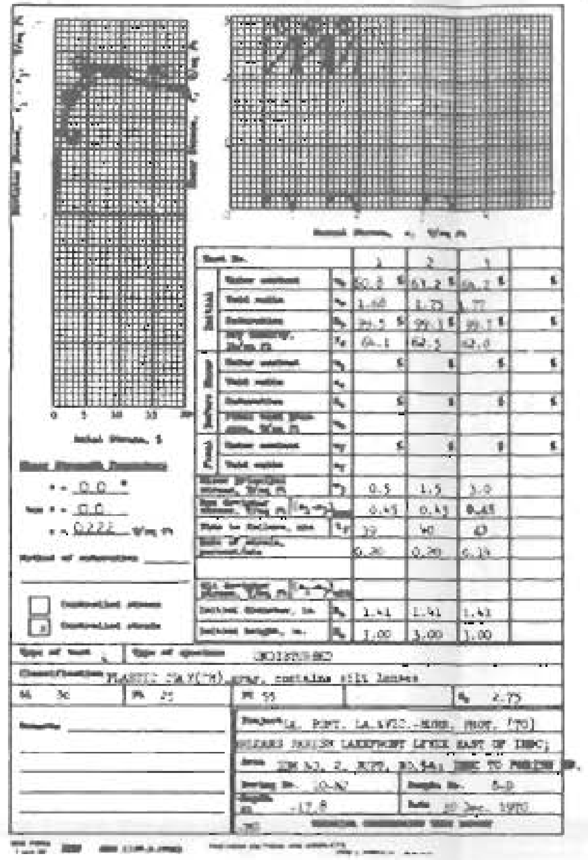
DETAIL SHEAR STRENGTH DATA
BORING 9-AU

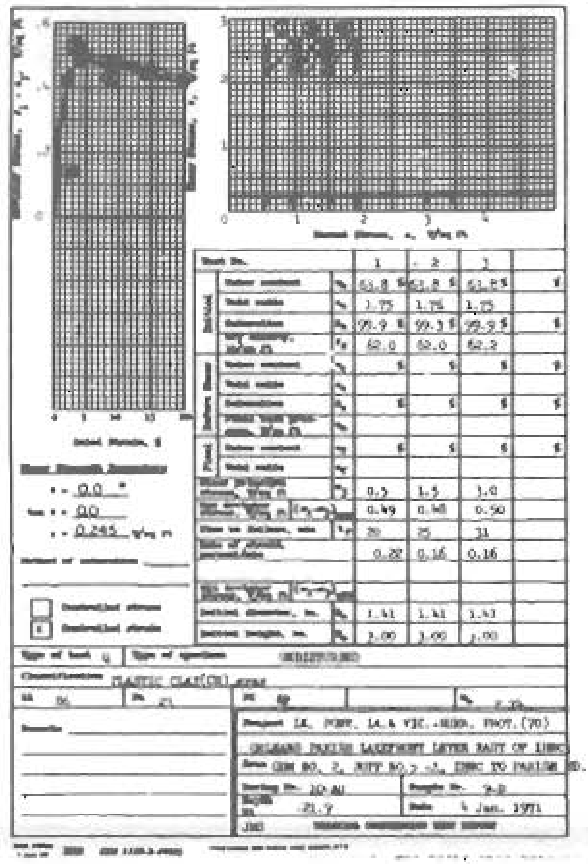
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

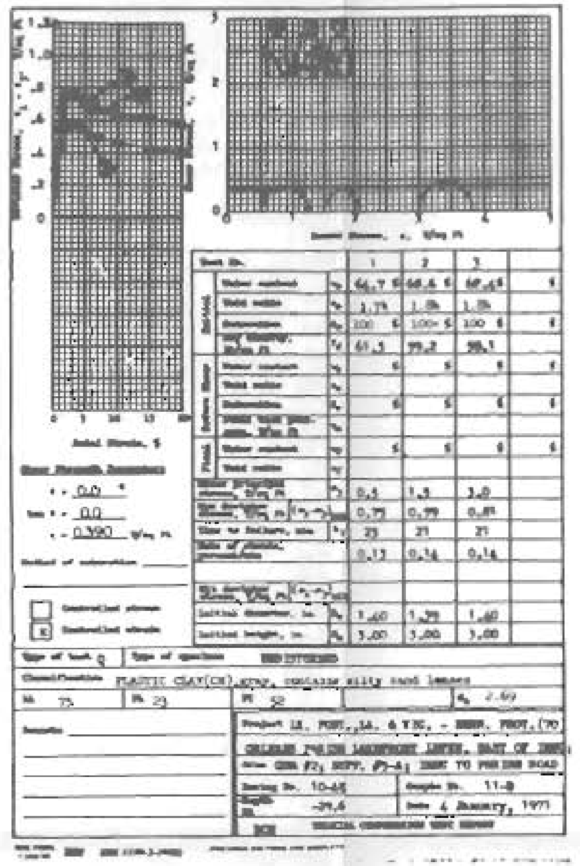
MAY

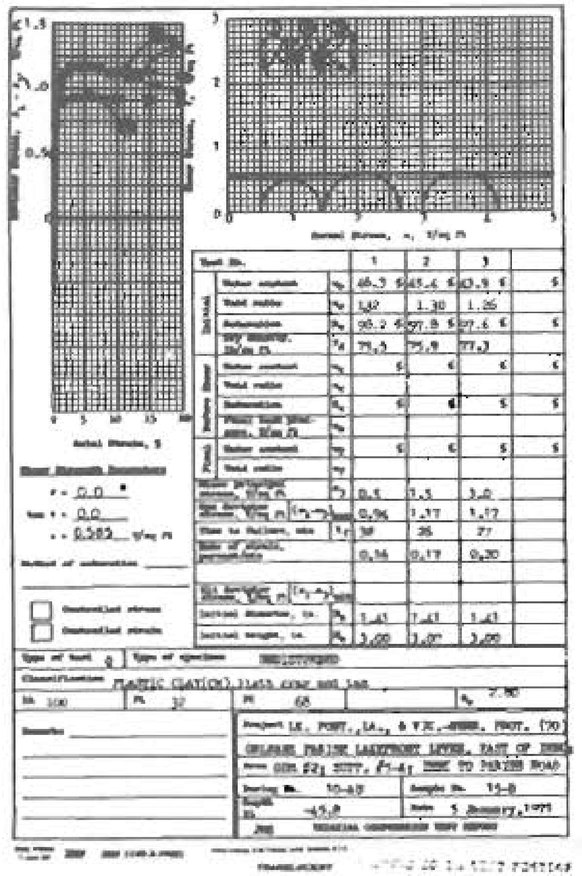
FILE NO. H-2-26533

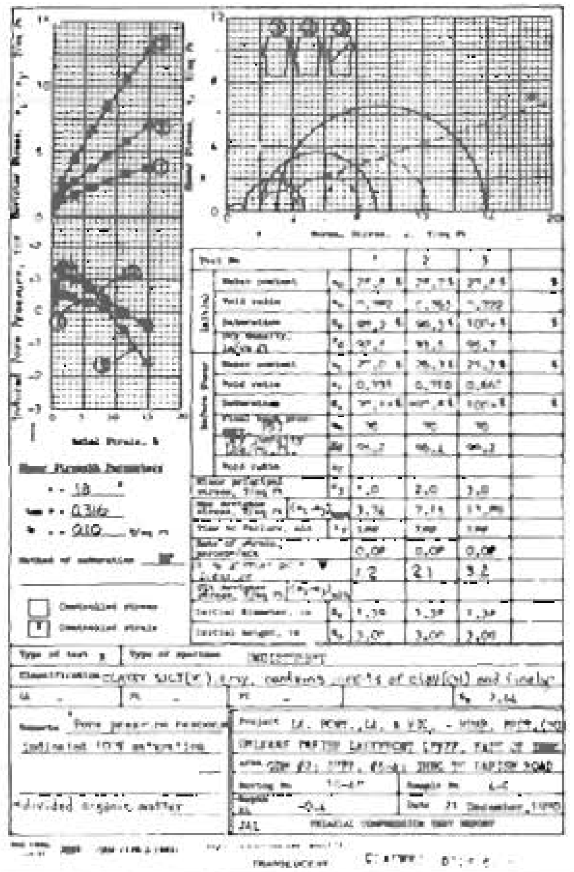


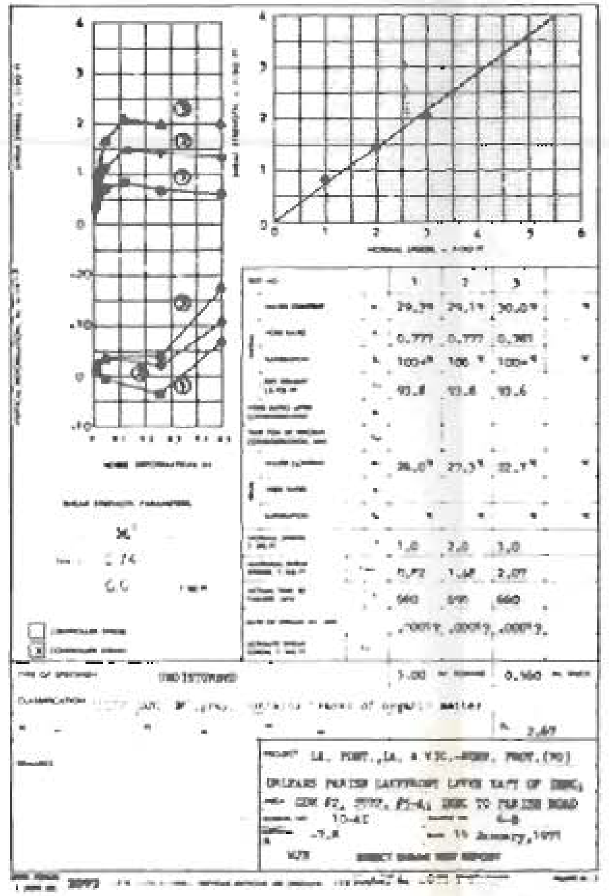


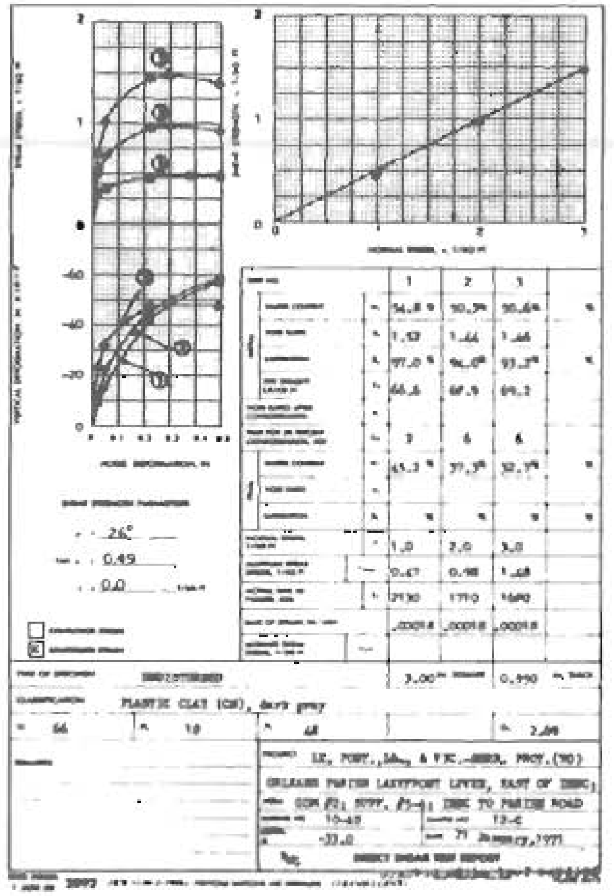


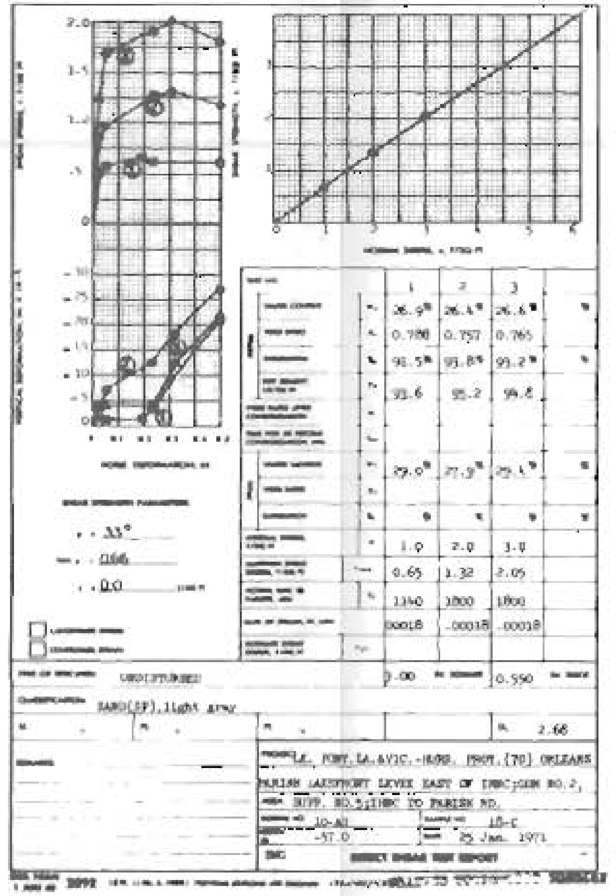












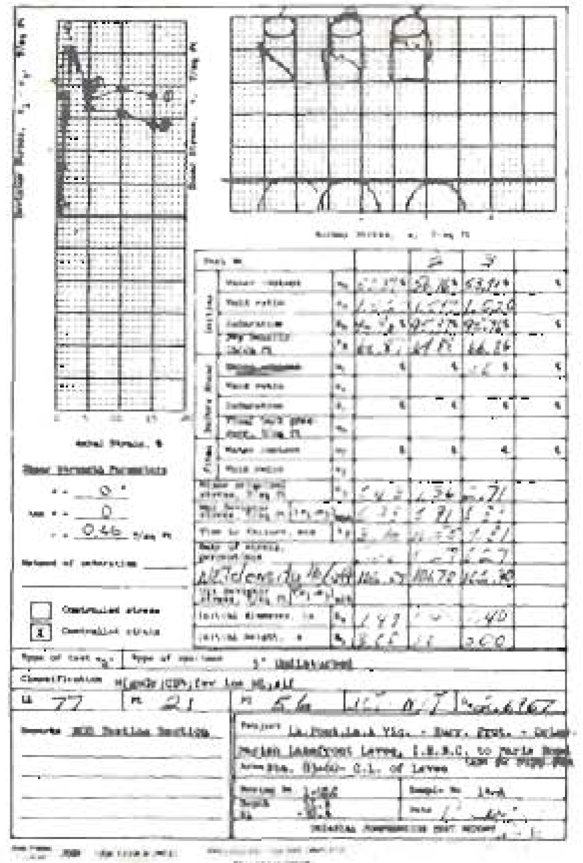
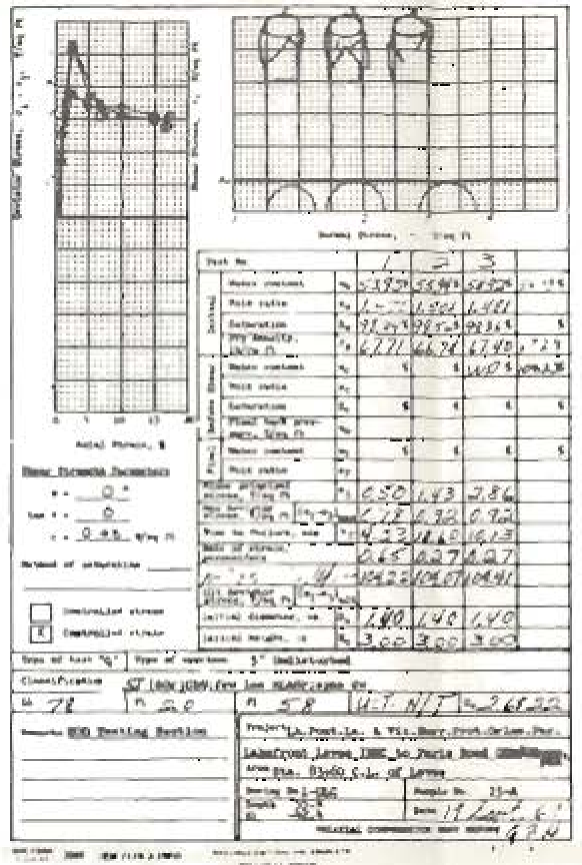
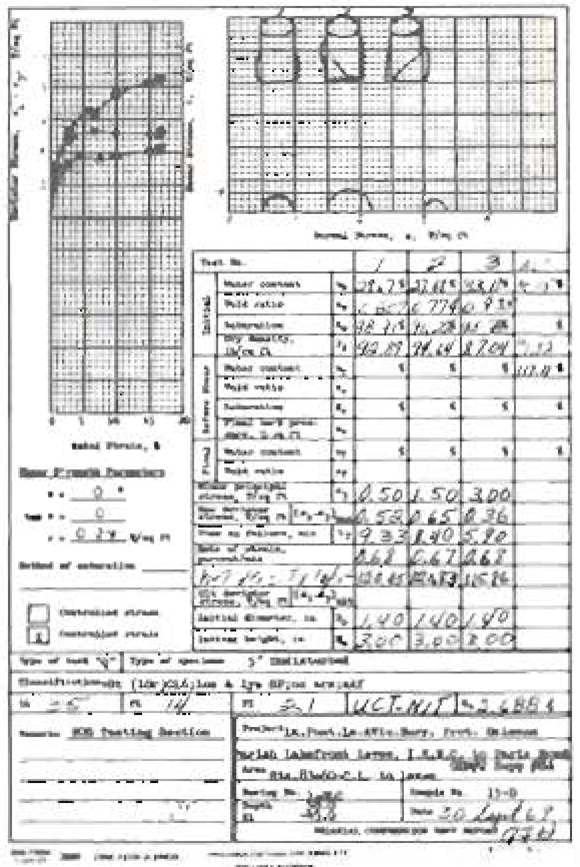
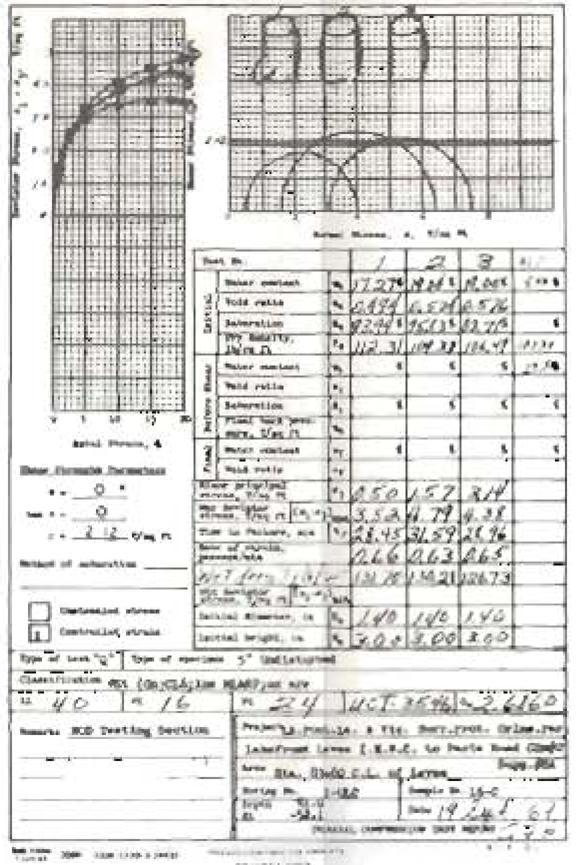
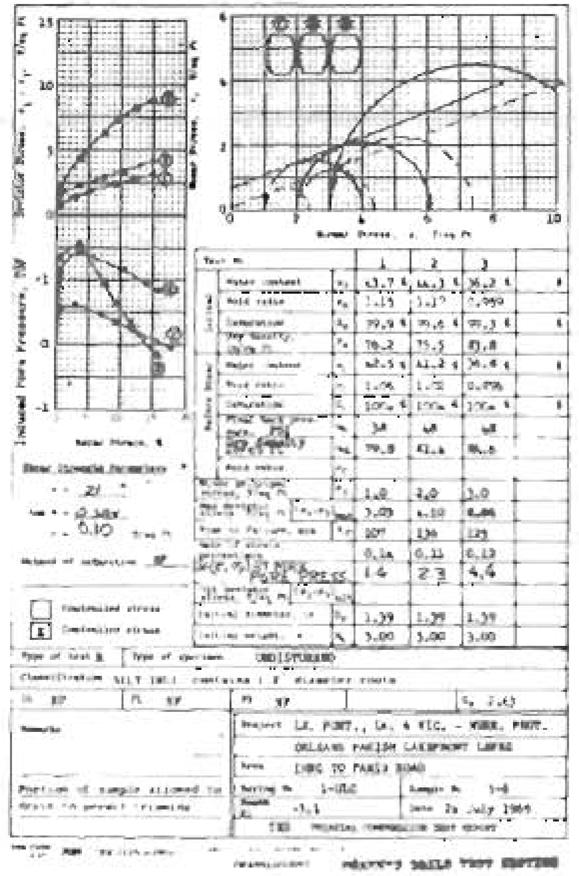
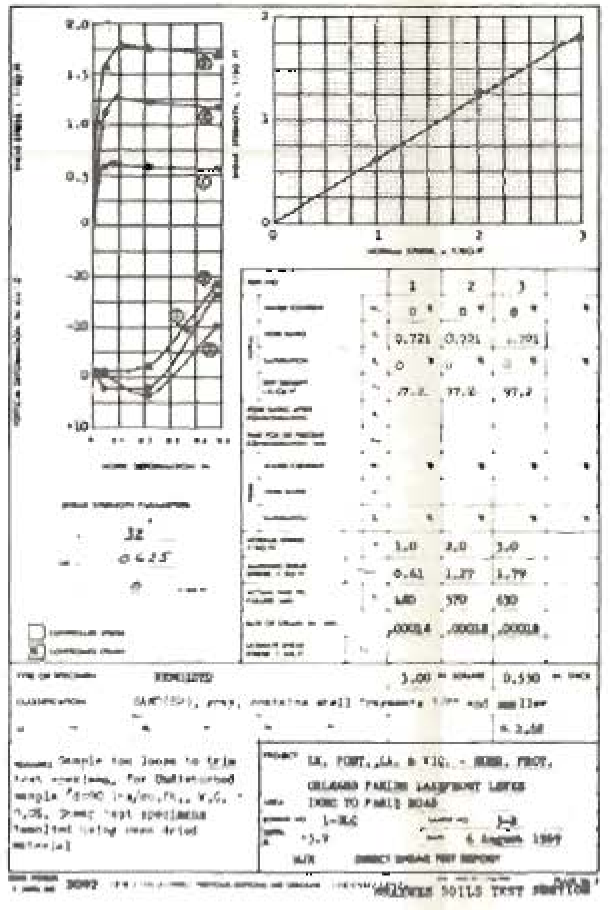
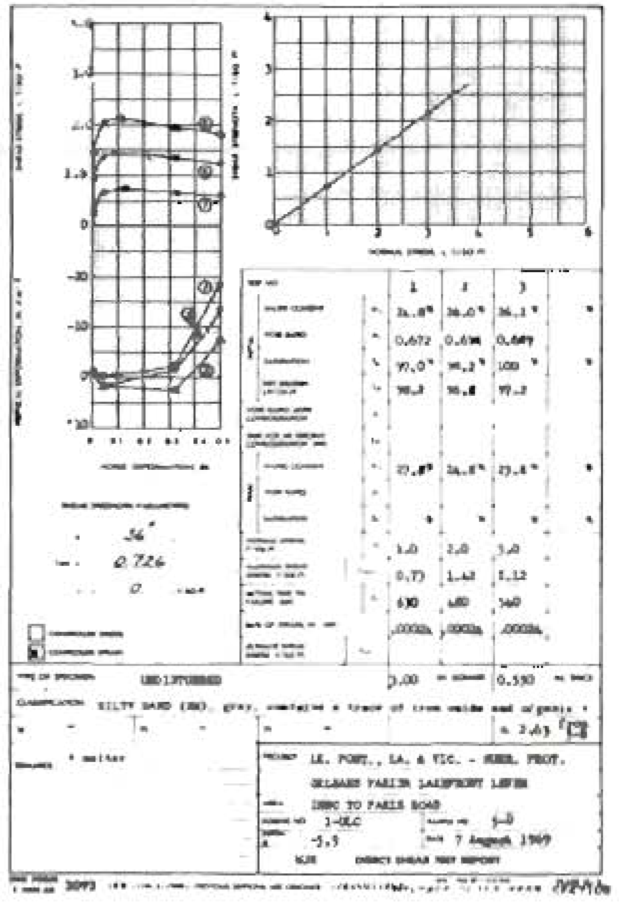
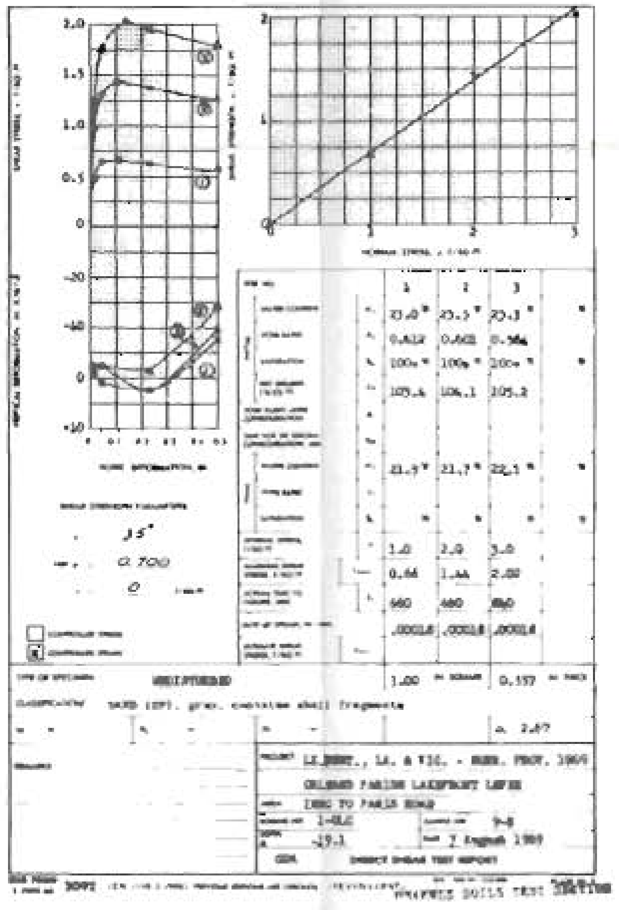
SEE PLATE 84 FOR GENERAL NOTES.

LAKE PONTCHARTRAIN, LA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO.2 – GENERAL DESIGN
SUPPLEMENT NO 5A
CITRUS LAKEFRONT LEVEE
IHNC TO PARIS ROAD

DETAIL SHEAR STRENGTH DATA
BORING 10-AU

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

MAY 1976 FILE NO. H-2-26533

SEE PLATE 84 FOR GENERAL NOTES.

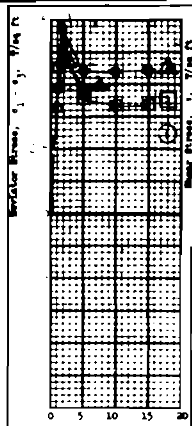
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 – GENERAL DESIGN
SUPPLEMENT NO. 5A
CITRUS LAKEFRONT LEVEE
IHNC TO PARIS ROAD

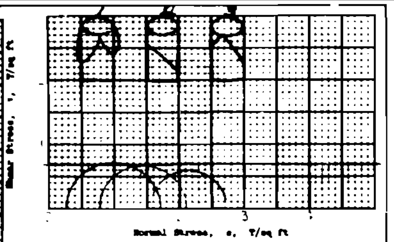
DETAIL SHEAR STRENGTH DATA
BORING 1-ULC

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

MAY 1976

FILE NO. H-2-26533





Test No.		1	2	3	A.
Initial — Water content	w_o	59.04%	61.01%	61.44%	60.50%
Initial — Void ratio	e_o	1.519	1.581	1.6_3	
Initial — Saturation	S_o	100.0 %	100.00%	100.00%	%
Initial — Dry density, lb/cu ft	γ_d	64.39	64.80	64.26	65.15
Before Shear — Water content	w_c	%	%	%	0.457
Before Shear — Void ratio	e_c				
Before Shear — Saturation	S_c	%	%	%	%
Before Shear — Final back pressure, T/sq ft	u_o				
Final — Water content	w_f	%	%	%	%
Final — Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.29	0.79	1.57	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	1.45	1.32	1.16	
Time to failure, min	t_f	3.50	8.43	7.00	
Rate of strain, percent/min		0.64	0.26	0.28	
Wet Density lb/cu ft		105.59	104.24	103.74	105.57
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.40	1.40	1.40	
Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters

φ = 0 °

tan φ = 0

c = 0.69 T/sq ft

Method of saturation ______

☐ Controlled stress

☒ Controlled strain

Type of test "Q" | Type of specimen 5" Undisturbed

Classification St (Gh) CH; lns ML; ars SP; few slf

LL 77 | PL 25 | PI 52 | UCT-1522 | G_s 2.6788

Remarks WOD Testing Section

Project Lk.Pont.La.& Vic.Orleans Par.Lk.Front Levee I.H.N.C. to Paris Road GDM#2 Supp. #5A

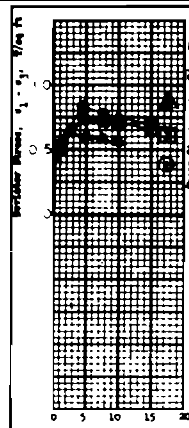
Area Sta. 83 + 60 57'L.S. of Levee C/L

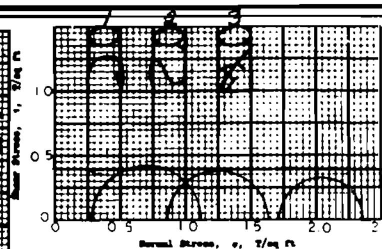
Boring No. 2-ULC | Sample No. 11-B

Depth 40.2 El -39.1 | Date 20 Oct 69

TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 1 JUN 63 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT





Test No.		1	2	3	AVG
Initial — Water content	w_o	37.19%	45.96%	46.31%	43.15%
Initial — Void ratio	e_o	0.973	1.168	1.185	
Initial — Saturation	S_o	100.01%	100.00%	100.00%	%
Initial — Dry density, lb/cu ft	γ_d	84.42	76.84	76.24	79.17
Before Shear — Water content	w_c	%	%	WD%	113.33%
Before Shear — Void ratio	e_c				
Before Shear — Saturation	S_c	%	%	%	%
Before Shear — Final back pressure, T/sq ft	u_o				
Final — Water content	w_f	%	%	%	%
Final — Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.29	0.86	1.71	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.84	0.74	0.64	
Time to failure, min	t_f	6.47	15.50	10.05	
Rate of strain, percent/min		0.66	0.26	0.26	
Wet Density lb/cu ft		115.82	112.16	111.54	113.17
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.40	1.40	1.40	
Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters

φ = 0 °

tan φ = 0

c = 0.39 T/sq ft

Method of saturation ______

☐ Controlled stress

☒ Controlled strain

Type of test "Q" | Type of specimen 5" Undisturbed

Classification M(Gr)CH3; lnshers SP; slf

LL 54 | PL 16 | PI 38 | UCT-773 | G_s 2.6654

Remarks WOD Testing Section

Project Lk.Pont.La.&Vic.Orlns.Parish Lakefront Levee I.H.N.C. to Paris Road GDM #2 Supp. #5A

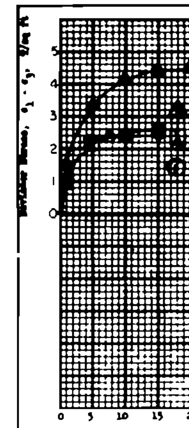
Area Sta. 83+60 57' L.S. of Levee C/L

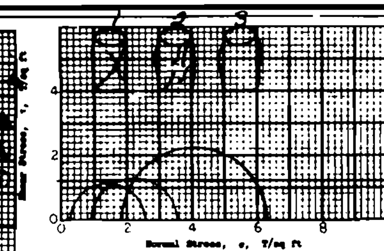
Boring No. 2-ULC | Sample No. 12-C

Depth 33.8 El -32.8 | Date 20 Oct. 69

TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 1 JUN 63 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT





Test No.		1	2	3	AVG
Initial — Water content	w_o	19.51%	19.53%	18.19%	17.09%
Initial — Void ratio	e_o	0.474	0.503	0.486	
Initial — Saturation	S_o	100.00%	100.00%	100.00%	%
Initial — Dry density, lb/cu ft	γ_d	113.01	110.86	112.16	112.01
Before Shear — Water content	w_c	%	%	WD%	133.39%
Before Shear — Void ratio	e_c				
Before Shear — Saturation	S_c	%	%	%	%
Before Shear — Final back pressure, T/sq ft	u_o				
Final — Water content	w_f	%	%	%	%
Final — Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.29	0.93	1.86	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	2.27	2.60	4.41	
Time to failure, min	t_f	6.75	22.90	22.78	
Rate of strain, percent/min		0.65	0.65	0.63	
Wet Density lb/cu ft		135.05	132.51	132.56	133.37
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.40	1.40	1.40	
Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters

φ = 0 °

tan φ = 0

c = 1.23 T/sq ft

Method of saturation ______

☐ Controlled stress

☒ Controlled strain

Type of test "Q" | Type of specimen 5" Undisturbed

Classification vSt (1Gr) CL4-6; Ox ams

LL 38 | PL 19 | PI 19 | UCT-1248 | G_s 2.6720

Remarks WOD Testing Section

Project LK.PONT.La.& Vic.Orleans Parish Lk.Front Levee IHNC to Paris Road GDM #2 Supp. #5A

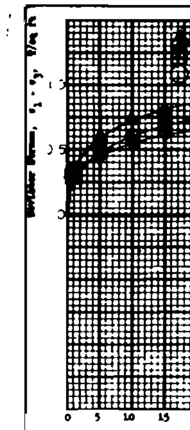
Area 83+60 57' L.S. of Levee C/L

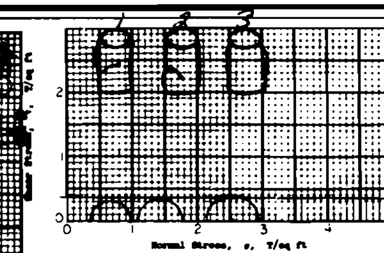
Boring No. 2-ULC | Sample No. 13-C

Depth 49.1 El -48.0 | Date 21 Oct. 69

TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 1 JUN 63 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT





Test No.		1	2	3	AVG
Initial — Water content	w_o	24.20%	23.93%	24.99%	24.37%
Initial — Void ratio	e_o	0.698	0.670	0.708	
Initial — Saturation	S_o	92.17%	95.07%	93.83%	%
Initial — Dry density, lb/cu ft	γ_d	97.73	99.42	97.14	98.10
Before Shear — Water content	w_c	%	%	%	122.00
Before Shear — Void ratio	e_c				
Before Shear — Saturation	S_c	%	%	%	%
Before Shear — Final back pressure, T/sq ft	u_o				
Final — Water content	w_f	%	%	%	%
Final — Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.36	1.07	2.14	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.62	0.69	0.80	
Time to failure, min	t_f	16.14	17.99	19.12	
Rate of strain, percent/min		0.91	0.83	0.77	
Wet Density, lb/cu ft		121.38	123.21	121.43	122.00
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.40	1.40	1.40	
Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters

φ = 0°

tan φ = 0

c = 0.35 T/sq ft

Method of saturation ______

☐ Controlled stress

☒ Controlled strain

Type of test "Q" | Type of specimen 5" Undisturbed

Classification vSt(Gr&T)CL6; lnshers SP; ox ars

LL 38 | PL 16 | PI 22 | UCT-NT | G_s 2.6640

Remarks WOD Testing Section

Project Lk.Pont.La.&Vic.Orleans Parish Lk.Front Lev. IHNC to Paris Road GDM No.2Supp.No.5-A

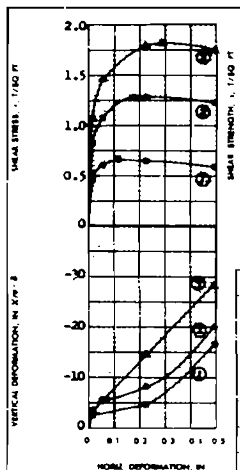
Area Sta.83+60 57' L.S. of Levee C/L

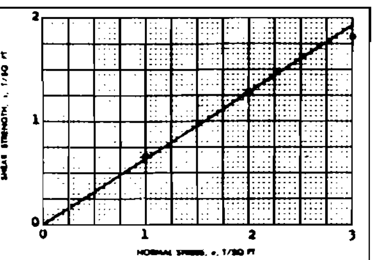
Boring No. 2-ULC | Sample No. 14-A

Depth 51.6 El -50.5 | Date 11 Nov. 69

TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 1 JUN 63 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT





TEST NO.		1	2	3	
Initial — Water content	w_o	21.6%	21.7%	21.6%	%
Initial — Void ratio	e_o	0.580	0.600	0.580	
Initial — Saturation	S_o	99.4%	96.6%	99.4%	%
Initial — Dry density, lb/cu ft	γ_d	105.5	104.2	105.5	
Void ratio after consolidation	e_c				
Time for 50 percent consolidation, min	t_{50}				
Final — Water content	w_f	20.4%	19.5%	19.4%	%
Final — Void ratio	e_f				
Final — Saturation	S_f	%	%	%	%
Normal stress, T/sq ft	σ	1.0	2.0	3.0	
Maximum shear stress, T/sq ft	τ_{max}	0.66	1.28	1.82	
Actual time to failure, min	t_f	720	1050	1620	
Rate of strain, in./min		.00018	.00018	.00018	
Ultimate shear stress, T/sq ft	τ_{ult}				

SHEAR STRENGTH PARAMETERS

φ = 32°

tan φ = 0.625

c = 0 T/SQ FT

☐ CONTROLLED STRESS

☒ CONTROLLED STRAIN

TYPE OF SPECIMEN UNDISTURBED | 3.00 IN. SQUARE | 0.550 IN. THICK

CLASSIFICATION SILTY SAND (SM), gray, contains small shells and shell fragments

LL - | PL - | PI - | G_s 2.67

REMARKS

PROJECT LAKE PONT., LA. & VIC. - HURR. PROT. ORLEANS PARISH LAKEFRONT LEVEE

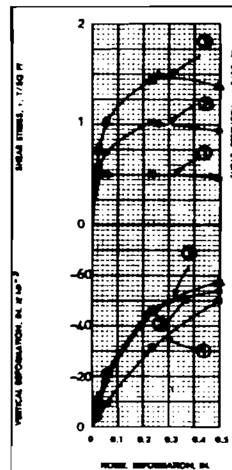
AREA IHNC TO PARIS ROAD

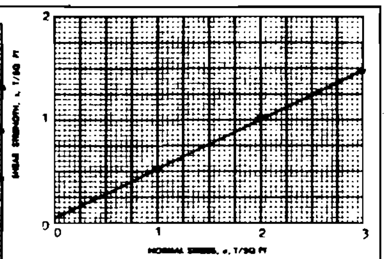
BORING NO. 2-ULC | SAMPLE NO. 5-C

DEPTH EL. -15.9 | DATE 11 August 1969

MJE DIRECT SHEAR TEST REPORT

ENG FORM 1 JUN 66 2092 (EM 1110-2-1906) PREVIOUS EDITIONS ARE OBSOLETE (TRANSLUCENT) GRAVES SOILS TEST SECTION





TEST NO.		①	②	③	
Initial — Water content	w_o	51.9%	50.6%	48.5%	%
Initial — Void ratio	e_o	1.38	1.32	1.34	
Initial — Saturation	S_o	100+%	100+%	97.0%	%
Initial — Dry density, lb/cu ft	γ_d	70.2	72.2	71.5	
Void ratio after consolidation	e_c				
Time for 50 percent consolidation, min	t_{50}	< 1	< 1	< 1	
Final — Water content	w_f	43.2%	34.1%	33.4%	%
Final — Void ratio	e_f				
Final — Saturation	S_f	%	%	%	%
Normal stress, T/sq ft	σ	1.0	2.0	3.0	
Maximum shear stress, T/sq ft	τ_{max}	0.51	1.01	1.48	
Actual time to failure, min	t_f	240	1320	1440	
Rate of strain, in./min		.00019	.00019	.00019	
Ultimate shear stress, T/sq ft	τ_{ult}				

SHEAR STRENGTH PARAMETERS

φ = 26°

tan φ = 0.488

c = 0.05 T/SQ FT

☐ CONTROLLED STRESS

☒ CONTROLLED STRAIN

TYPE OF SPECIMEN UNDISTURBED | 3.00 IN. SQUARE | 0.560 IN. THICK

CLASSIFICATION PLASTIC CLAY (CH), gray, contains sand

LL 72 | PL 20 | PI 52 | G_s 2.68

REMARKS

PROJECT LK.PONT., LA. & VIC. - HURR. PROT.-1969 ORLEANS PARISH LAKEFRONT LEVEE

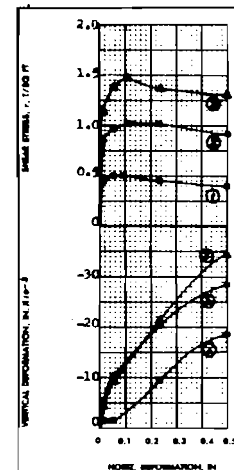
AREA IHNC TO PARIS ROAD

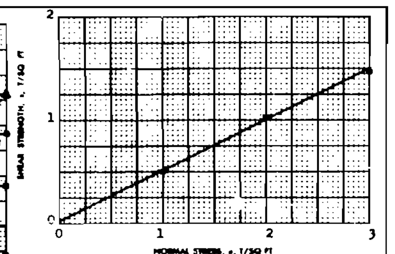
BORING NO. 2-ULC | SAMPLE NO. 11-D

DEPTH EL. -40.9 | DATE 11 August, 1969

GDA DIRECT SHEAR TEST REPORT

ENG FORM 1 JUN 66 2092 (EM 1110-2-1906) PREVIOUS EDITIONS ARE OBSOLETE (TRANSLUCENT) GRAVES SOILS TEST SECTION





TEST NO.		1	2	3	
Initial — Water content	w_o	24.4%	24.2%	24.6%	%
Initial — Void ratio	e_o	0.750	0.741	0.740	
Initial — Saturation	S_o	87.8%	88.2%	89.8%	%
Initial — Dry density, lb/cu ft	γ_d	96.3	96.8	96.9	
Void ratio after consolidation	e_c				
Time for 50 percent consolidation, min	t_{50}	<1	<1	<1	
Final — Water content	w_f	25.6%	23.7%	22.9%	%
Final — Void ratio	e_f				
Final — Saturation	S_f	%	%	%	%
Normal stress, T/sq ft	σ	1.0	2.0	3.0	
Maximum shear stress, T/sq ft	τ_{max}	0.50	1.02	1.47	
Actual time to failure, min	t_f	360	720	660	
Rate of strain, in./min		.00018	.00018	.00018	
Ultimate shear stress, T/sq ft	τ_{ult}				

SHEAR STRENGTH PARAMETERS

φ = 26°

tan φ = 0.488

c = 0.03 T/SQ FT

☐ CONTROLLED STRESS

☒ CONTROLLED STRAIN

TYPE OF SPECIMEN UNDISTURBED | 3.00 IN. SQUARE | 0.557 IN. THICK

CLASSIFICATION SANDY CLAY (CL), gray

LL 37 | PL 15 | PI 22 | G_s 2.70

REMARKS

PROJECT LK. PONT., LA. & VIC. - HURR. PROT. 1969 ORLEANS PARISH LAKEFRONT LEVEE

AREA IHNC TO PARIS ROAD

BORING NO. 2-ULC | SAMPLE NO. 14-B

DEPTH EL. -51.1 | DATE 12 August 1969

GDA DIRECT SHEAR TEST REPORT

ENG FORM 1 JUN 66 2092 (EM 1110-2-1906) PREVIOUS EDITIONS ARE OBSOLETE (TRANSLUCENT) GRAVES SOILS TEST SECTION

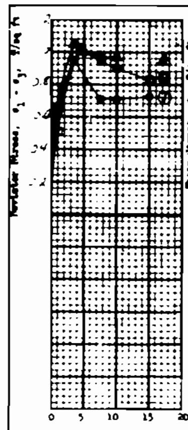
SEE PLATE 84 FOR GENERAL NOTES.

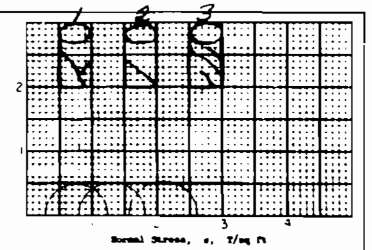
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 – GENERAL DESIGN
SUPPLEMENT NO. 5A
CITRUS LAKEFRONT LEVEE
IHNC TO PARIS ROAD

DETAIL SHEAR STRENGTH DATA
BORING 2-ULC

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

MAY 1976 FILE NO. H-2-26533



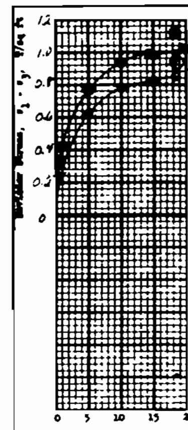


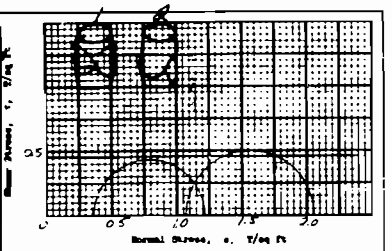
Test No.			1	2	3	AV-
Initial	Water content	w_o	49.42%	48.60%	51.27%	49.% %
	Void ratio	e_o	1.28[illegible]	1.26[illegible]	1.339	
	Saturation	S_o	[illegible] %	[illegible] %	[illegible] %	%
	Dry density, lb/cu ft	γ_d	73.34	73.81	71.51	72.89
Before Shear	Water content	w_c	%	%	NP %	109.[illegible] %
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_o				
Final	Water content	w_f	%	%	%	%
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	0.29	0.79	1.57	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.95	1.03	1.05	
Time to failure, min		t_f	5.45	10.55	13.70	
Rate of strain, percent/min			0.66	0.27	0.26	
Wet Density lb/cu ft			109.58	109.67	108.17	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.40	1.40	1.40	
Initial height, in.		H_o	3.00	3.00	3.00	

Shear Strength Parameters
φ = 0°
tan φ = 0
c = 0.50 T/sq ft
Method of saturation ____
☐ Controlled stress
☒ Controlled strain

Type of test "Q" | Type of specimen 5" Undisturbed
Classification H(Gr)CH*;lns;ML;ln&ars SP;slf thru out
LL 64 | PL 18 | PI 46 | UCT-863 | G_s 2.6797
Remarks: BOD Testing Section
Project Lk. Pont. La. & Vic. Orleans Parish Lk. Front Levee IHNC to Paris Road (DM No. 2 Supp No. 5-A
Area 83+60-258' L.S. of Levee C/L
Boring No. 3-ULC | Sample No. 12-C
Depth El 40.9 -40.[illegible] | Date 22 Oct. 69
TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 1 JUN 65 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE
TRANSLUCENT



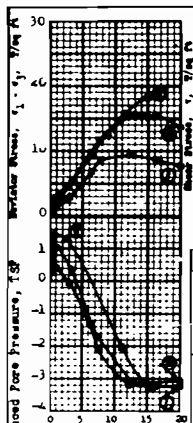


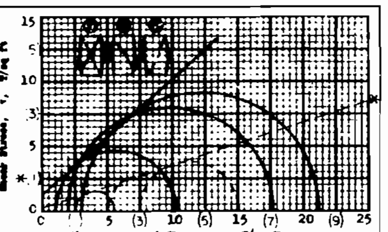
Test No.			1	2	3	AVG
Initial	Water content	w_o	25.16%	28.34 %	NT %	27.25%
	Void ratio	e_o	0.701	0.687		
	Saturation	S_o	96.[illegible] %	100.00%	%	%
	Dry density, lb/cu ft	γ_d	98.31	99.14		98.72
Before Shear	Water content	w_c	%	%	WQ %	125.1%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_o				
Final	Water content	w_f	%	%	%	%
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	0.36	1.07	2.14	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.85	0.99		
Time to failure, min		t_f	28.45	21.85		
Rate of strain, percent/min			0.64	0.64		
Wet Density lb/cu ft			123.04	128.23		
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.40	1.40		
Initial height, in.		H_o	3.00	3.00		

Shear Strength Parameters
φ = 0°
tan φ = 0
c = 0.46 T/sq ft
Method of saturation ____
☐ Controlled stress
☒ Controlled strain

Type of test "Q" | Type of specimen 5" Undisturbed
Classification vSt(Gm)CL-s;ox;ars;ly&ars SP
LL 31 | PL 13 | PI 18 | UCT-NT | G_s 2.6835
Remarks: BOD Testing Section
Project Lk.Pont.La.&Vic.Orleans Parish Lk.Front Levee IHNC to Paris Road DM No. 2 Supp. No. 5-A
Area Sta. 83+60-258'L.S. of Levee C/L
Boring No. 3-ULC | Sample No. 15-C
Depth El 52.9 -52.[illegible] | Date 23 Oct. 69
TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 1 JUN 65 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE



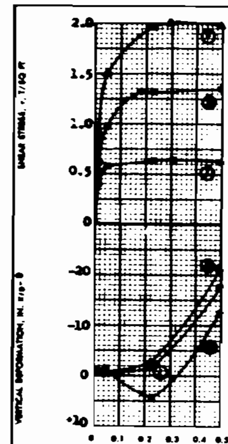


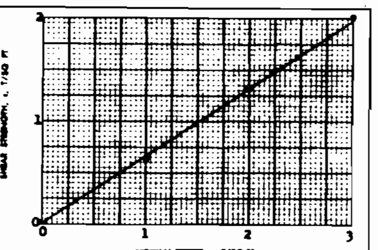
Test No.			1	2	3	
Initial	Water content	w_o	29.0%	28.8%	30.6%	%
	Void ratio	e_o	0.767	0.763	0.807	
	Saturation	S_o	100+%	100+%	100+%	%
	Dry density, lb/cu ft	γ_d	94.0	94.2	91.9	
Before Shear	Water content	w_c	28.5%	27.1%	29.2%	%
	Void ratio	e_c	0.682	0.696	0.770	
	Saturation	S_c	100+%	100+%	100+%	%
	Final back pressure, PSI	u_o	40	40	40	
	Dry density lb/cu ft		98.7	97.9	93.8	
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	1.0	2.0	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	9.25	15.71	18.16	
Time to failure, min		t_f	111	118	125	
Rate of strain, percent/min			0.11	0.11	0.12	
[illegible] PORE PRESS.			1.2	2.2	3.0	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.39	1.40	1.39	
Initial height, in.		H_o	3.00	3.00	3.00	

Shear Strength Parameters
φ = 18°
tan φ = 0.33
c = 0.10 T/sq ft
Method of saturation BP
☐ Controlled stress
☒ Controlled strain

Type of test R | Type of specimen UNDISTURBED
Classification SILT (ML), gray
LL NP | PL NP | PI NP | G_s 2.66
Remarks: Portion of sample allowed to drain to permit trimming
Project LK. PONT., LA. & VIC. - HURR. PROT. 1969
ORLEANS PARISH LAKEFRONT LEVEE
Area IHNC TO PARIS ROAD
Boring No. 3-ULC | Sample No. 4-B
Depth El -7.7 | Date 8 July 1969
JL TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 1 JUN 65 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE
TRANSLUCENT
[illegible] SOILS TEST SECTION





TEST NO.			1	2	3	
INITIAL	WATER CONTENT	w_o	23.6%	23.8%	23.4%	%
	VOID RATIO	e_o	0.718	0.716	0.702	
	SATURATION	S_o	88.1%	89.1%	89.3%	%
	DRY DENSITY, LB/CU FT	γ_d	97.4	97.5	98.3	
VOID RATIO AFTER CONSOLIDATION		e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN		t_{50}				
FINAL	WATER CONTENT	w_f	21.8%	23.5%	24.1%	%
	VOID RATIO	e_f				
	SATURATION	S_f	%	%	%	%
NORMAL STRESS, T/SQ FT		σ	1.0	2.0	3.0	
MAXIMUM SHEAR STRESS, T/SQ FT		τ_{max}	0.64	1.32	2.01	
ACTUAL TIME TO FAILURE, MIN		t_f	1740	1080	1710	
RATE OF STRAIN, IN./MIN			.00018	.00018	.00018	
ULTIMATE SHEAR STRESS, T/SQ FT		τ_{ult}				

SHEAR STRENGTH PARAMETERS
φ = 34°
tan φ = 0.674
c = 0 T/SQ FT
☐ CONTROLLED STRESS
☒ CONTROLLED STRAIN

TYPE OF SPECIMEN UNDISTURBED | 3.00 IN. SQUARE | 0.590 IN. THICK
CLASSIFICATION SAND (SP), gray, contains small shells and shell fragments
LL - | PL - | PI - | G_s 2.68
REMARKS
PROJECT LK. PONT., LA. & VIC. - HURR. PROT.
ORLEANS PARISH LAKEFRONT LEVEE
AREA IHNC TO PARIS ROAD
BORING NO. 3-ULC | SAMPLE NO. 9-D
DEPTH EL -39.5 | DATE 12 August 1969
WJW DIRECT SHEAR TEST REPORT

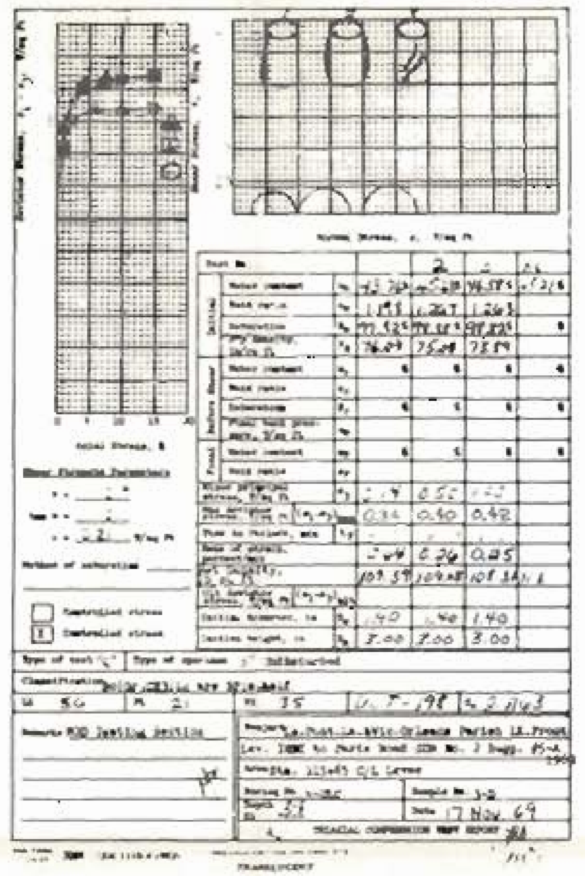
ENG FORM 1 JUN 68 2092 (EM 1110-2-1906) PREVIOUS EDITIONS ARE OBSOLETE (TRANSLUCENT) [illegible] SOILS TEST SECTION

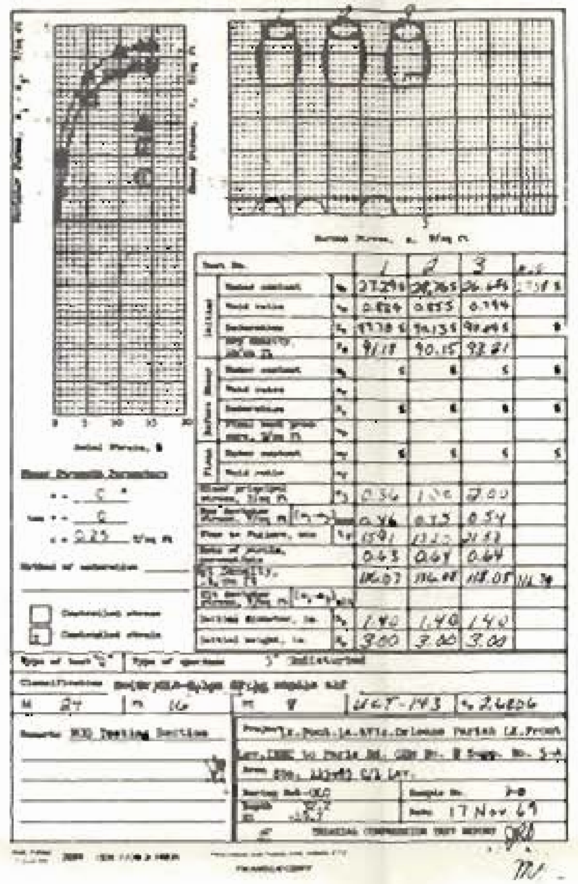
SEE PLATE 84 FOR GENERAL NOTES.

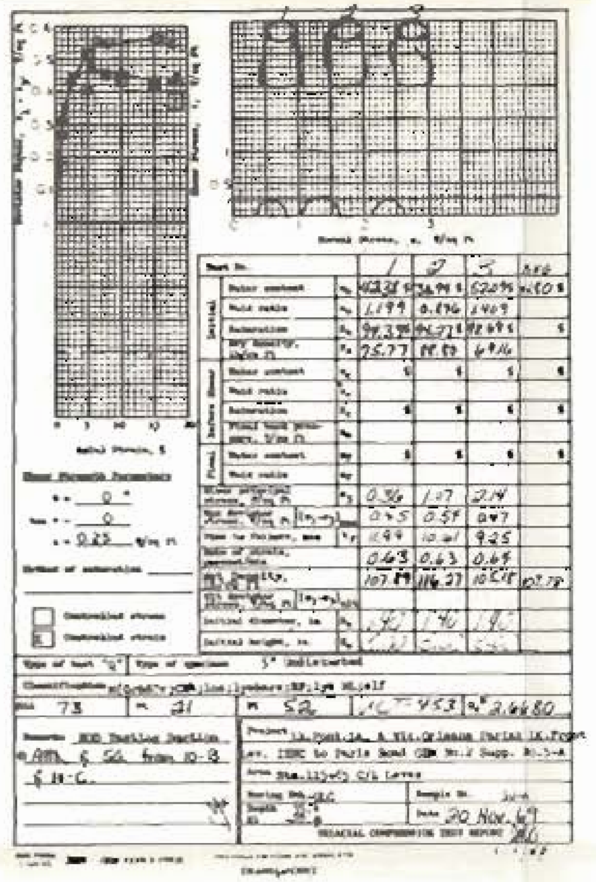
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 – GENERAL DESIGN
SUPPLEMENT NO. 5A
CITRUS LAKEFRONT LEVEE
IHNC TO PARIS ROAD

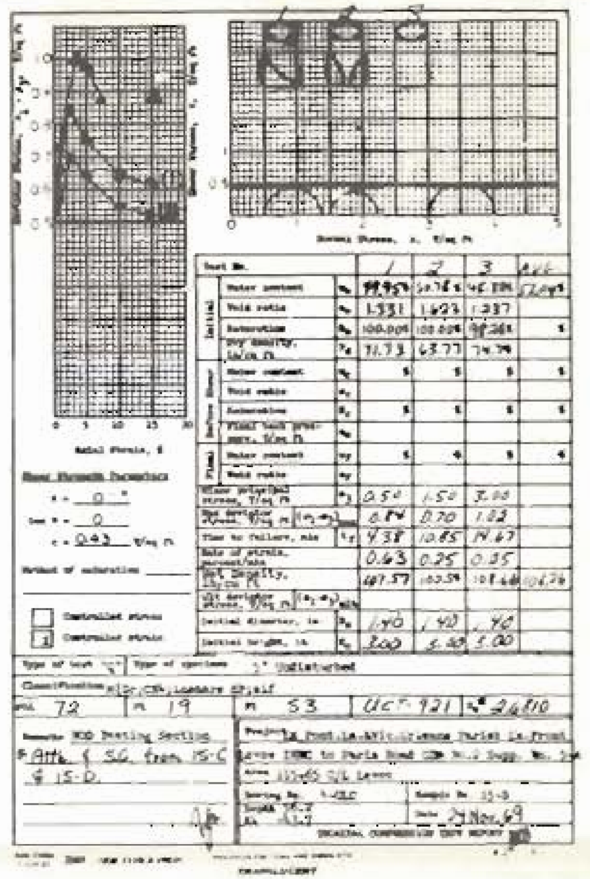
DETAIL SHEAR STRENGTH DATA BORING 3-ULC

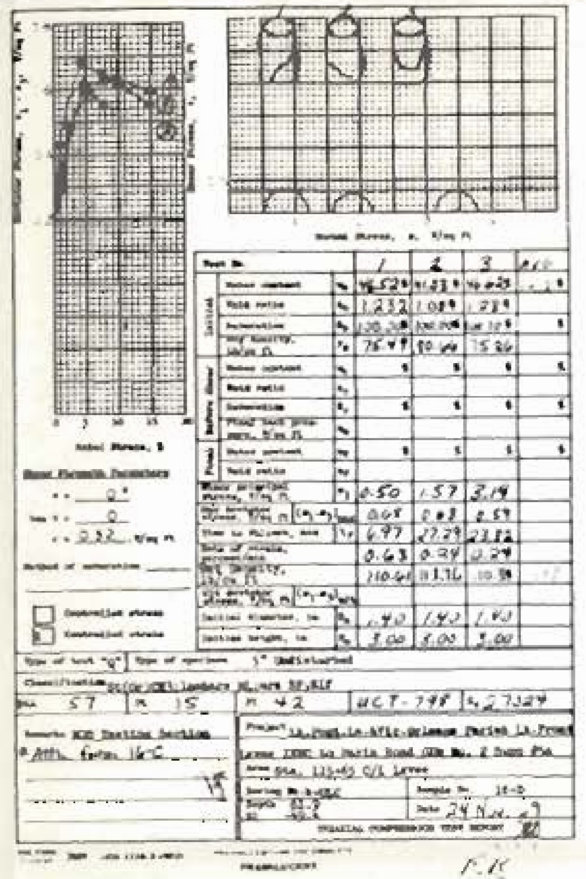
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MAY 1976
FILE NO. H-2-26533

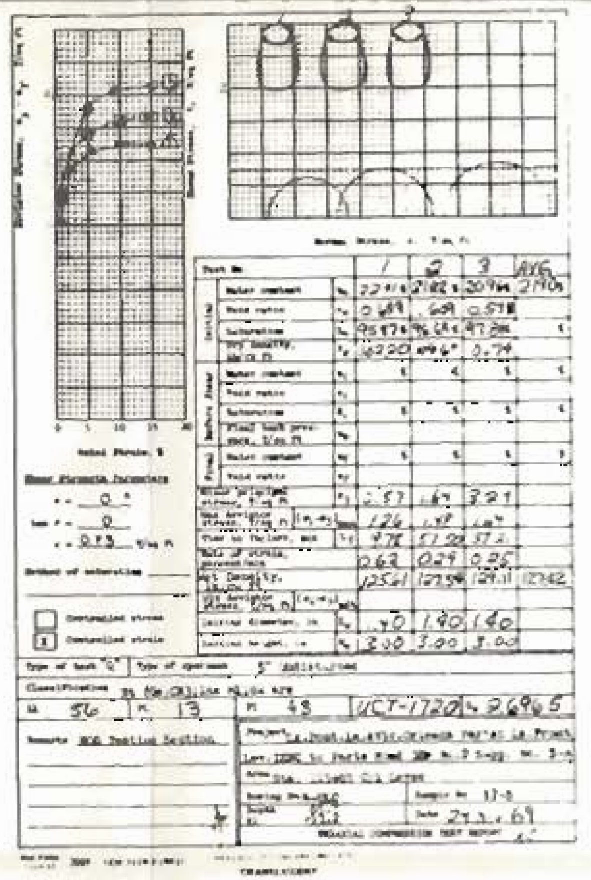


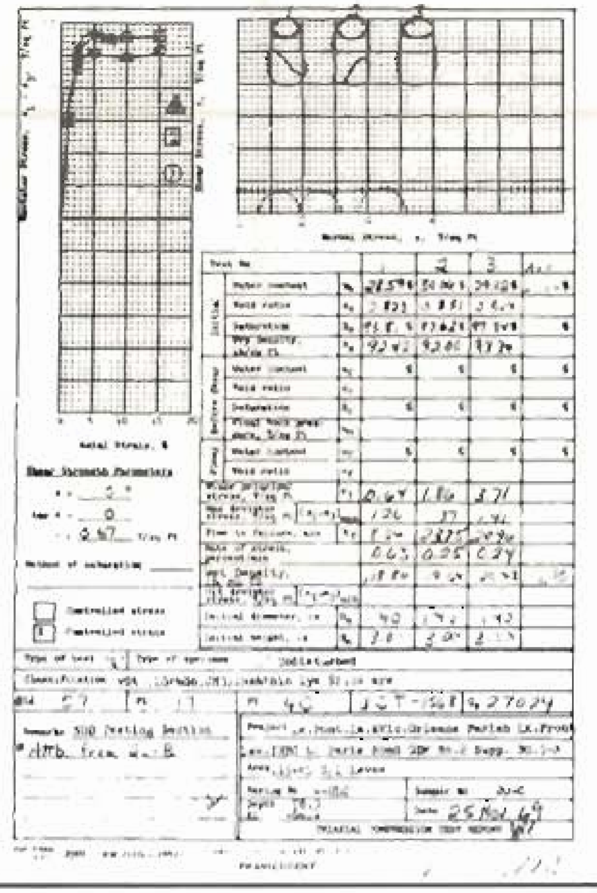


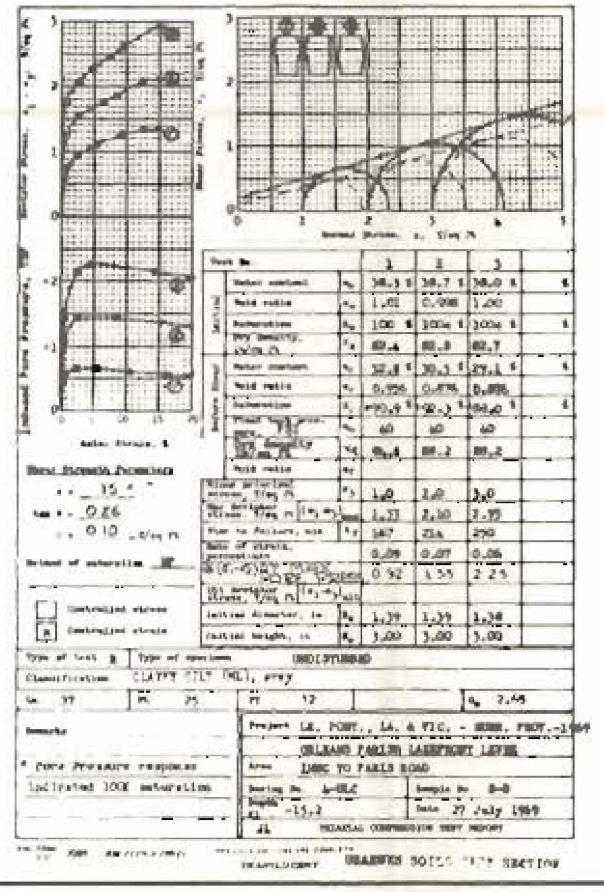


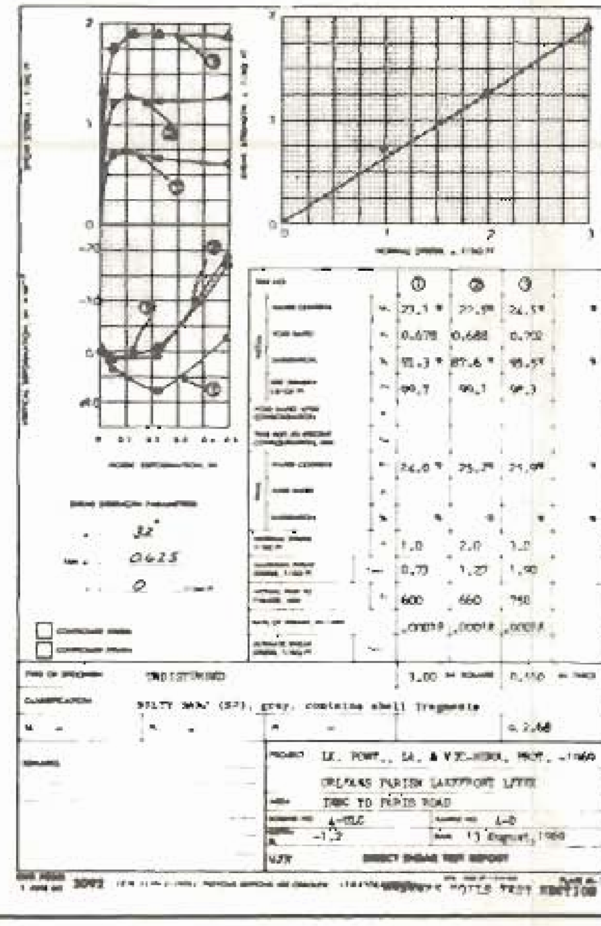


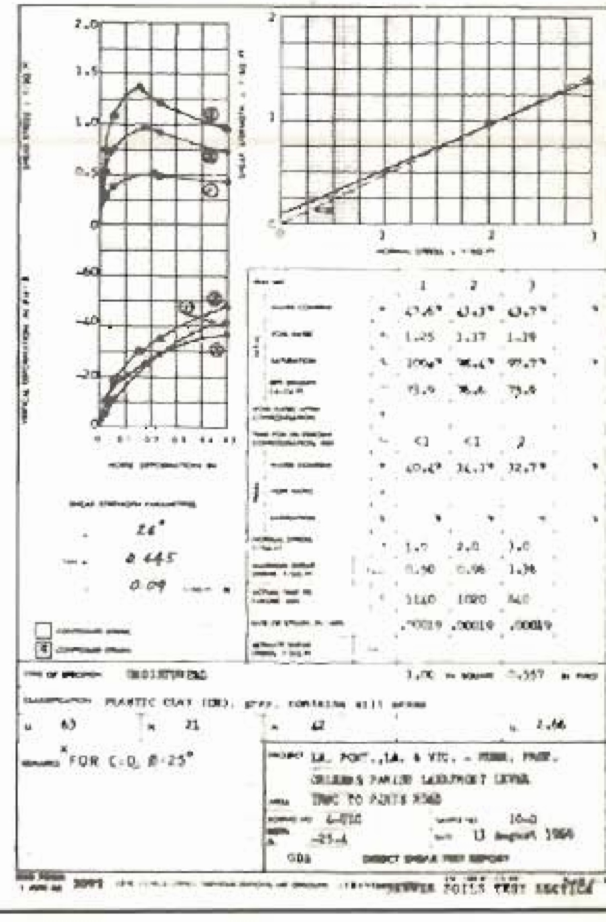


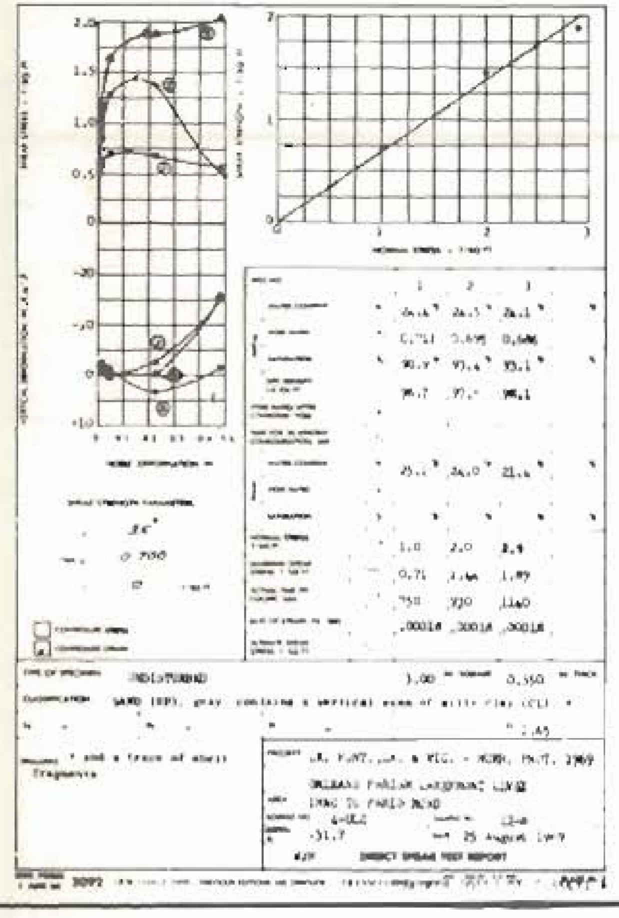












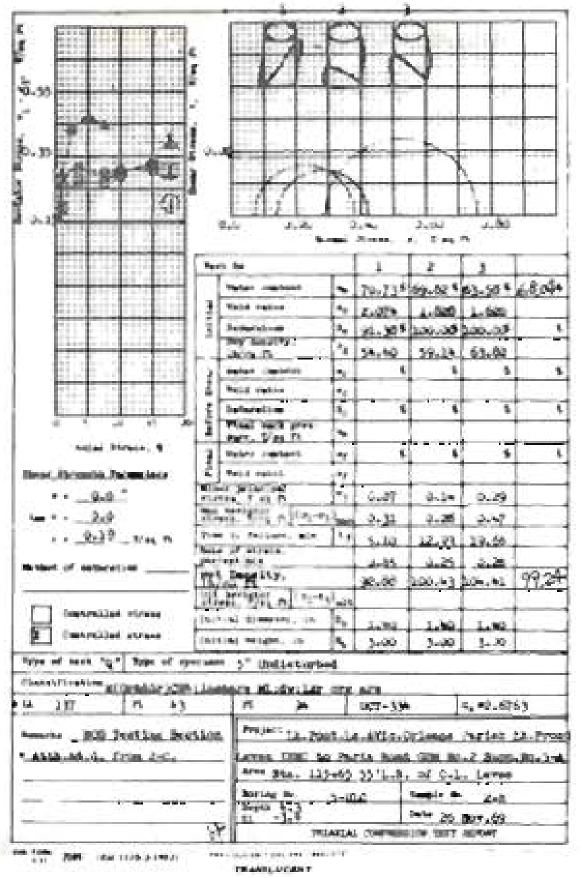
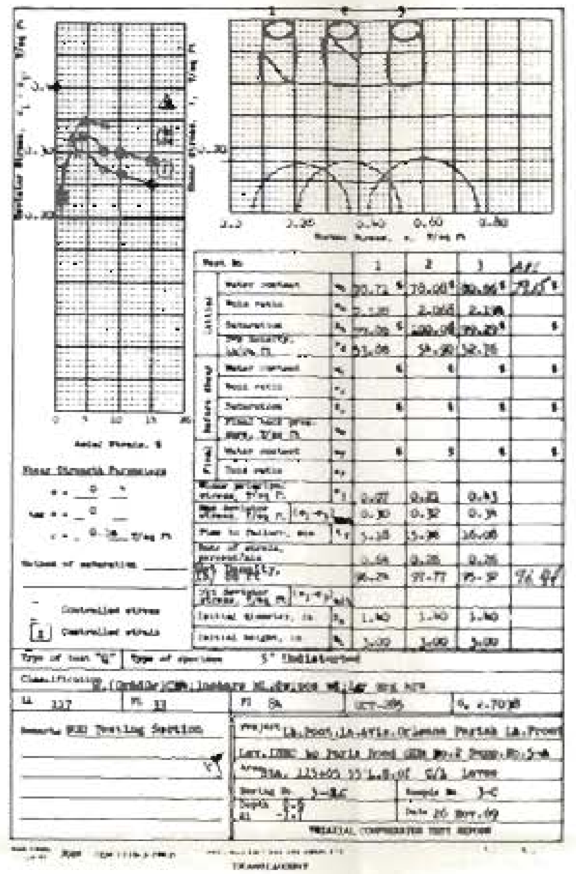
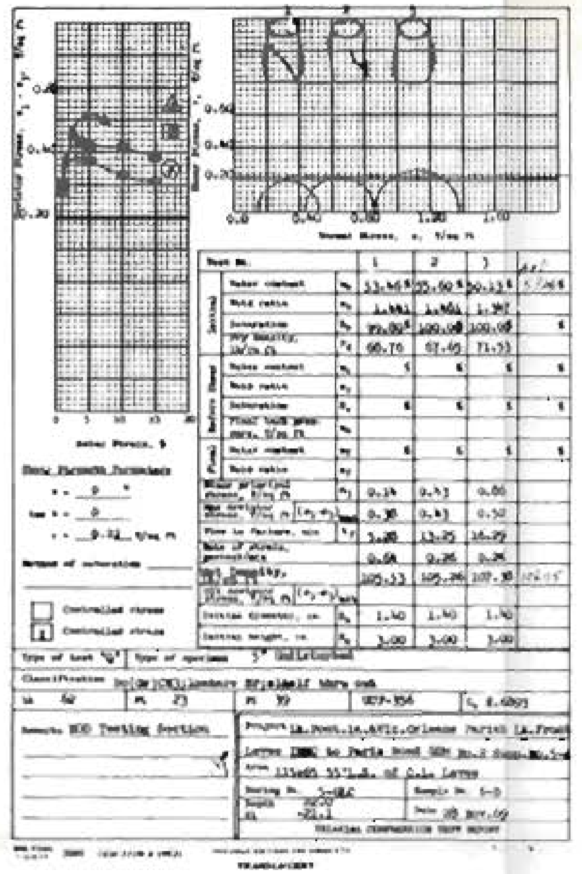
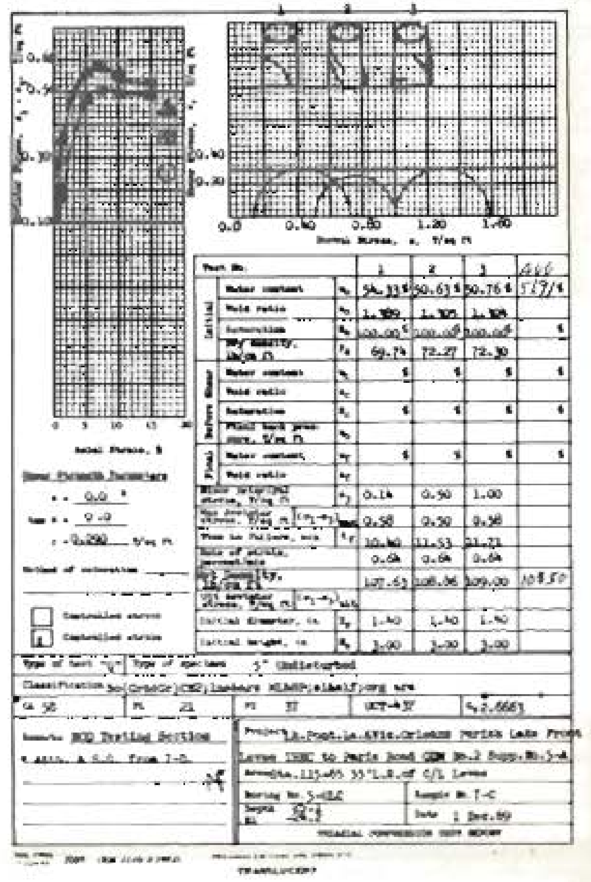
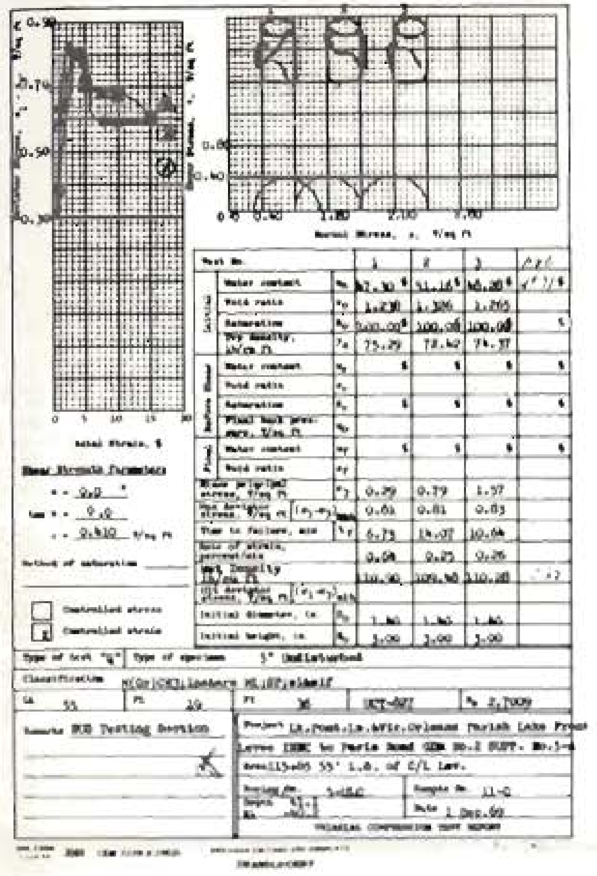
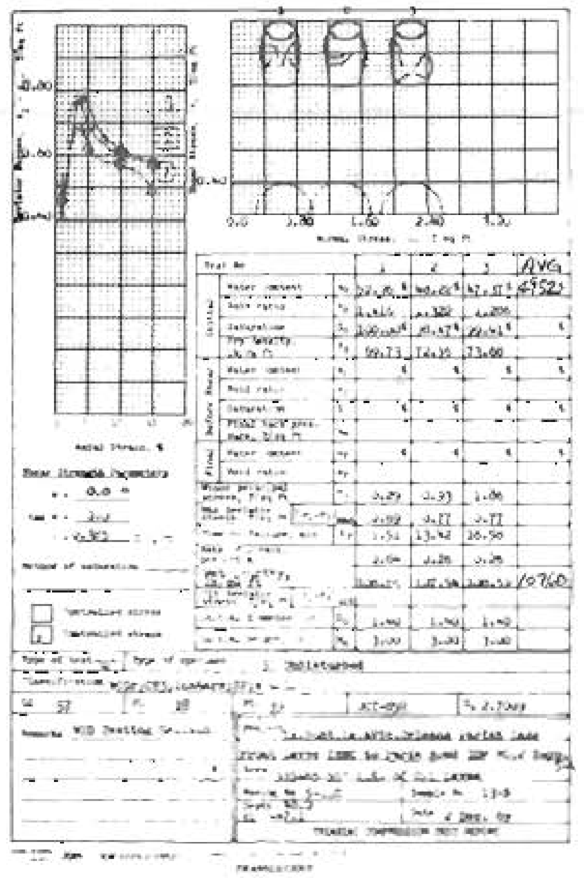
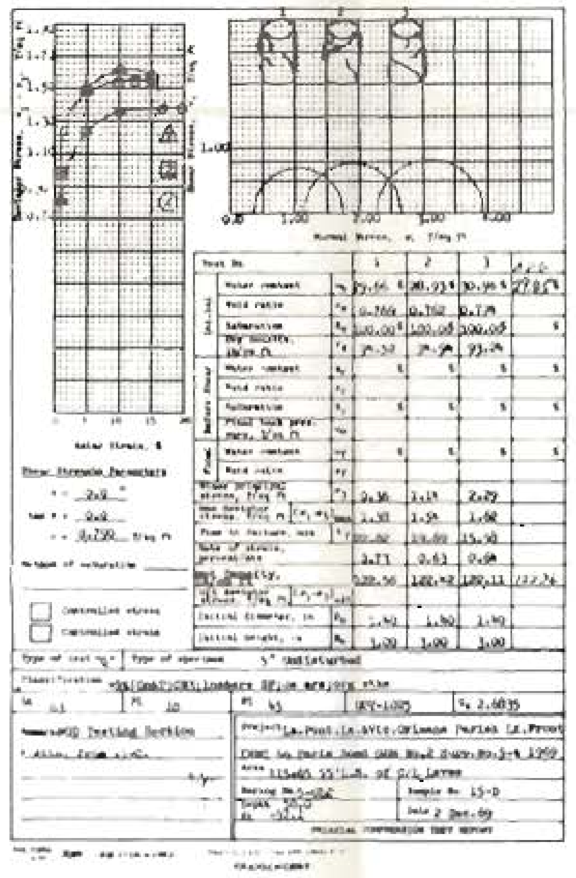
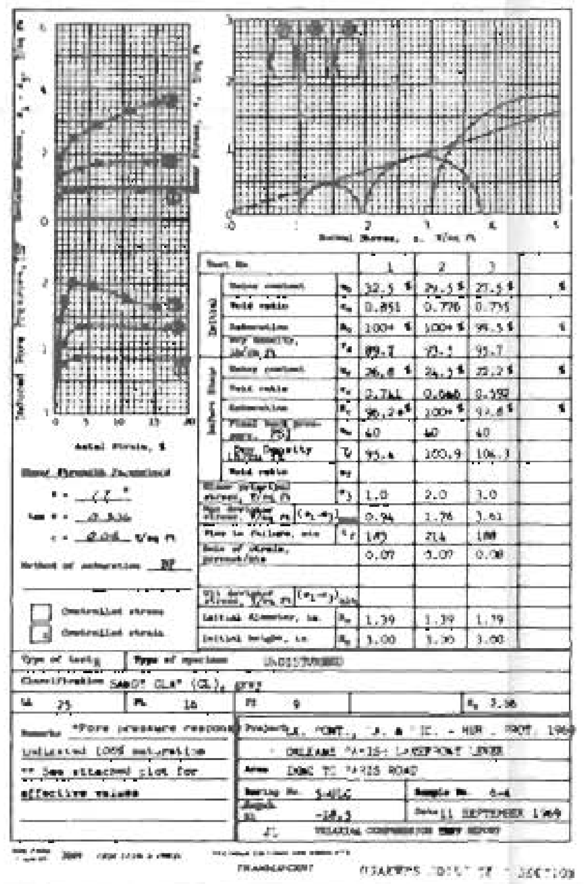
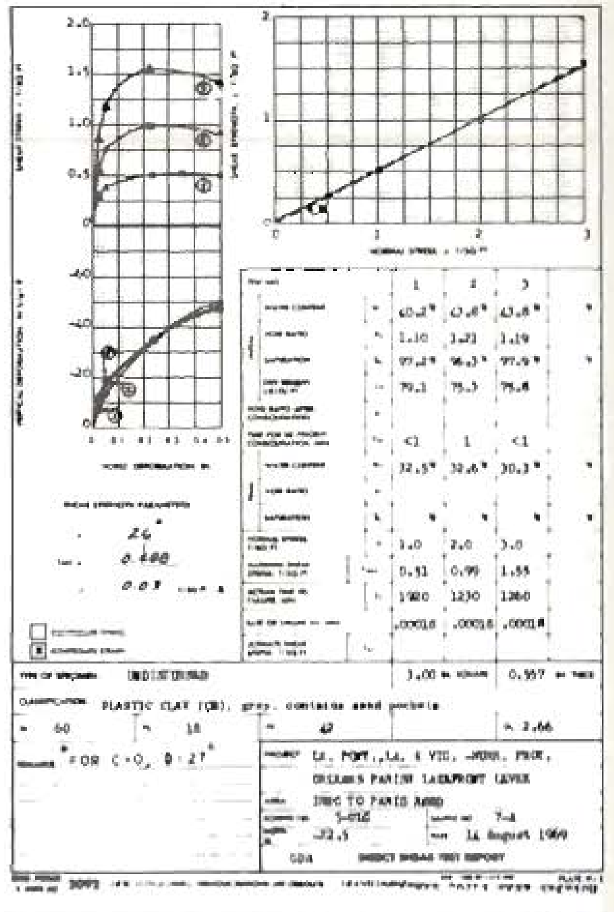
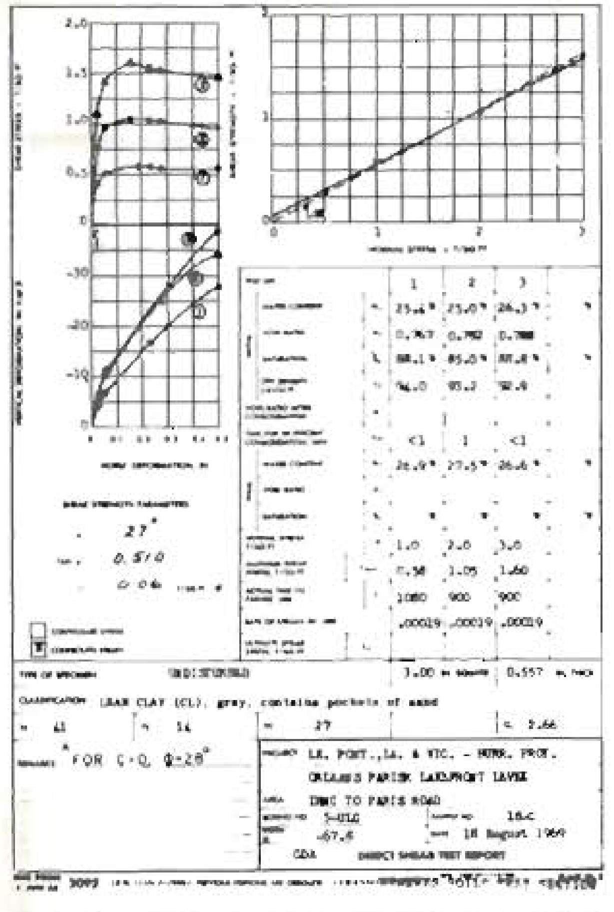
SEE PLATE 84 FOR GENERAL NOTES.

LAKE PONTCHARTRAIN, LA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO 2 – GENERAL DESIGN
SUPPLEMENT NO 5A
CITRUS LAKEFRONT LEVEE
IHNC TO PARIS ROAD

DETAIL SHEAR STRENGTH DATA
BORING 4-ULC

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

MAY 1976 FILE NO. H-2-26533

SEE PLATE 64 FOR GENERAL NOTES.

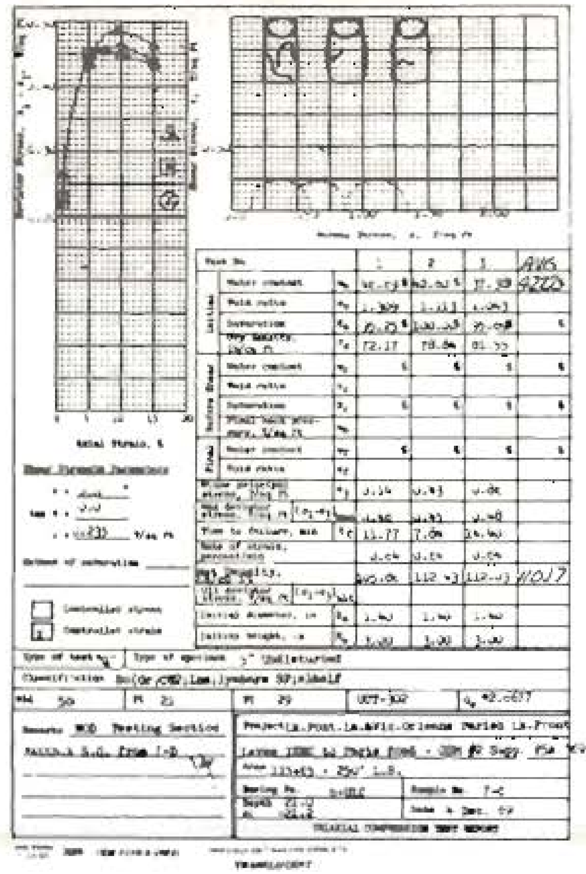
LAKE PONTCHARTRAIN, LA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO 2 – GENERAL DESIGN
SUPPLEMENT NO 5A
CITRUS LAKEFRONT LEVEE
IHNC TO PARIS ROAD

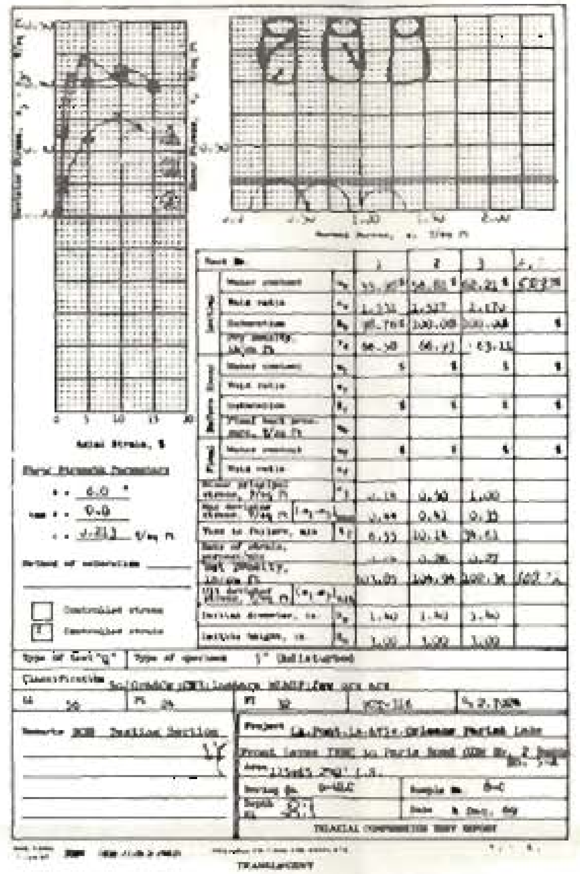
DETAIL SHEAR STRENGTH DATA
BORING 5-ULC

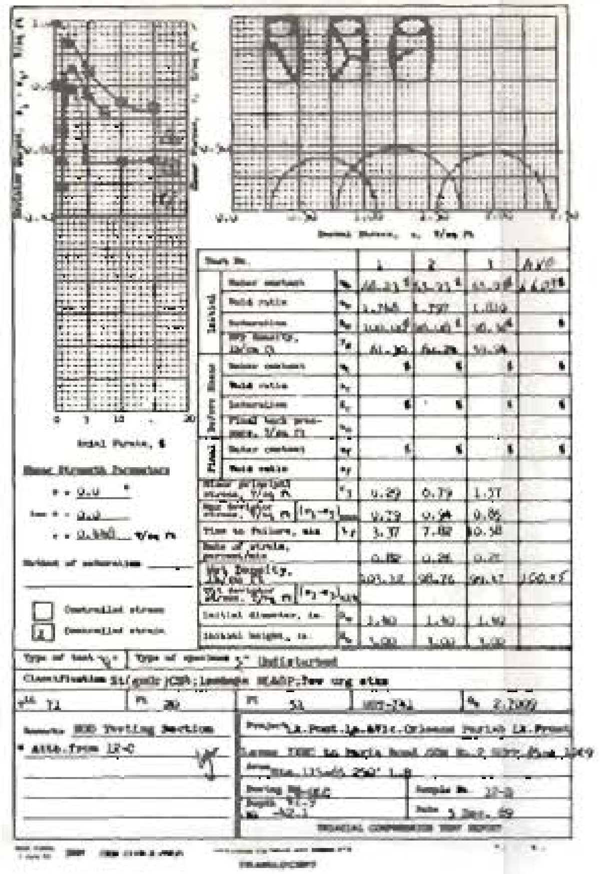
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

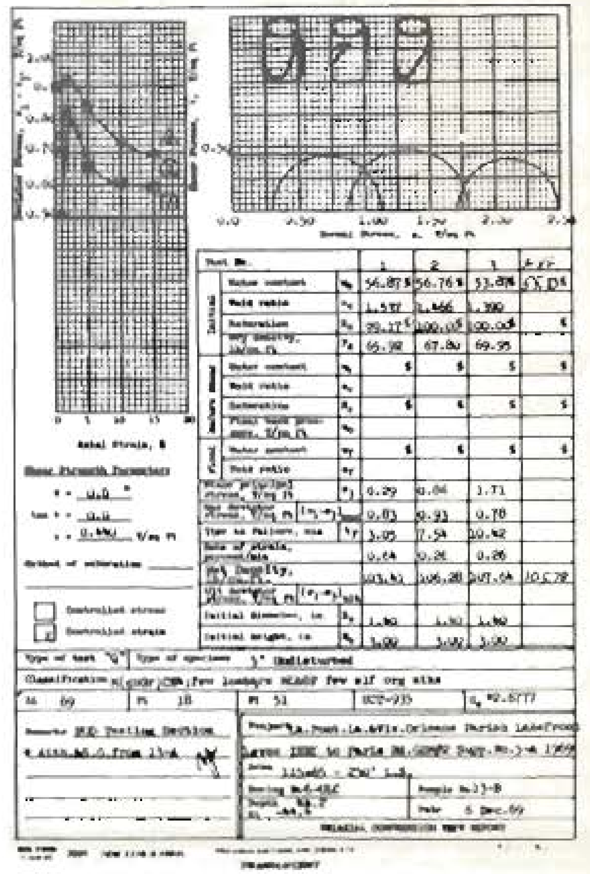
MAY 1975

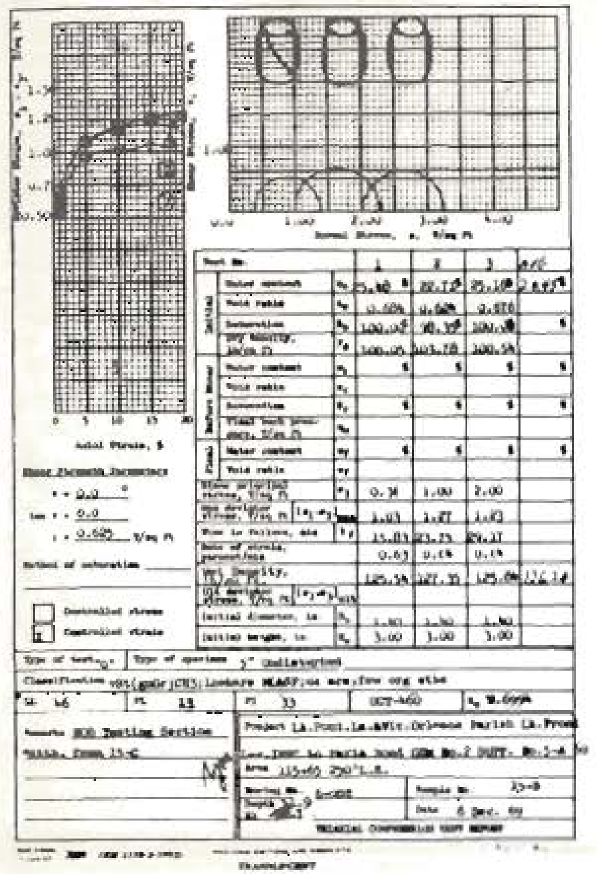
FILE NO. H-2-26533

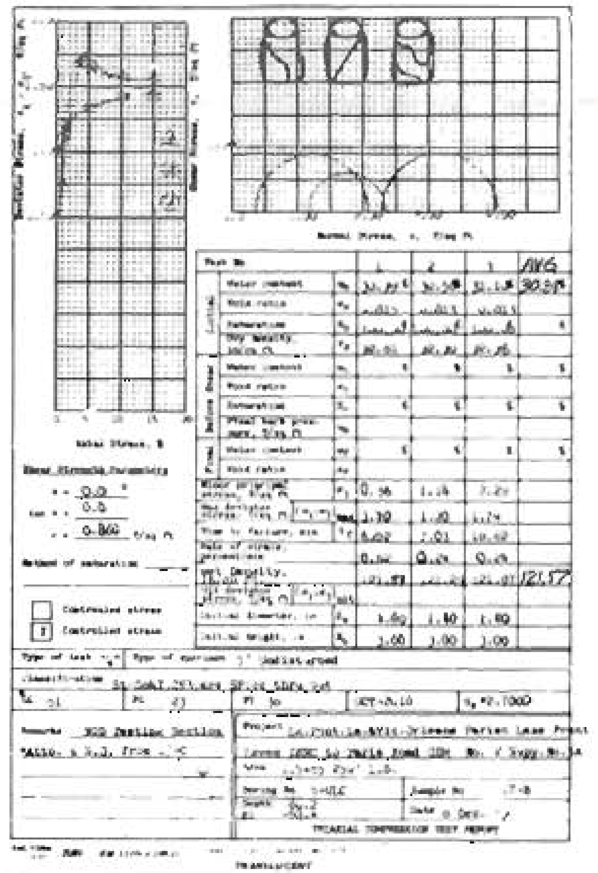


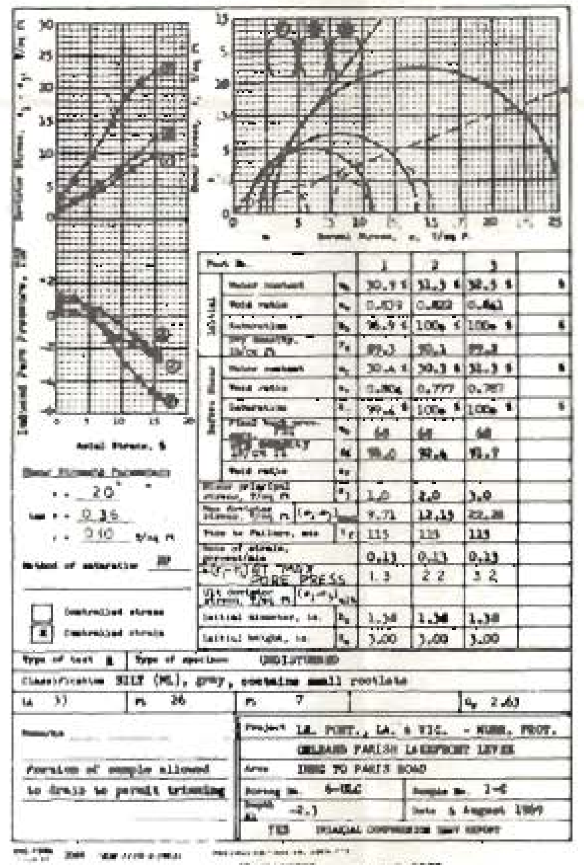


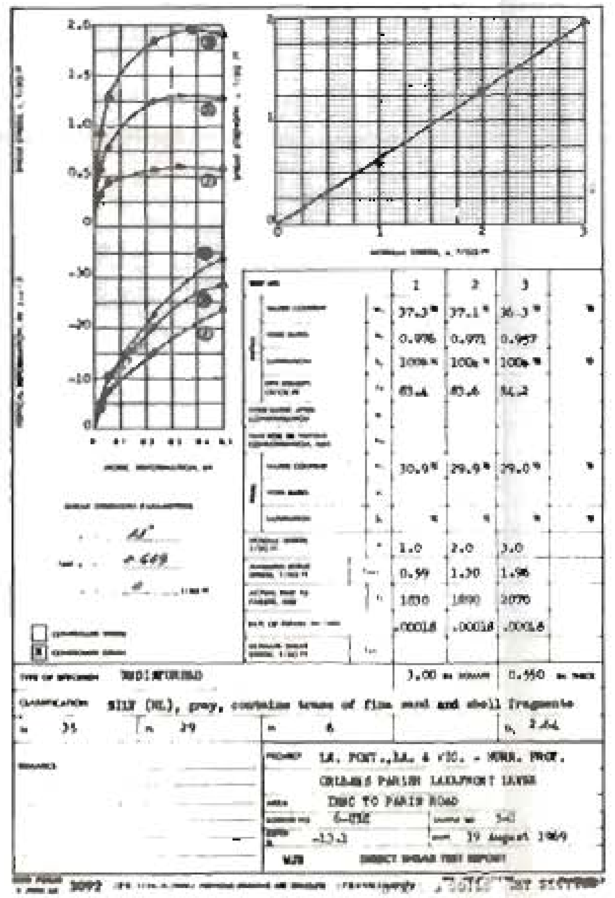


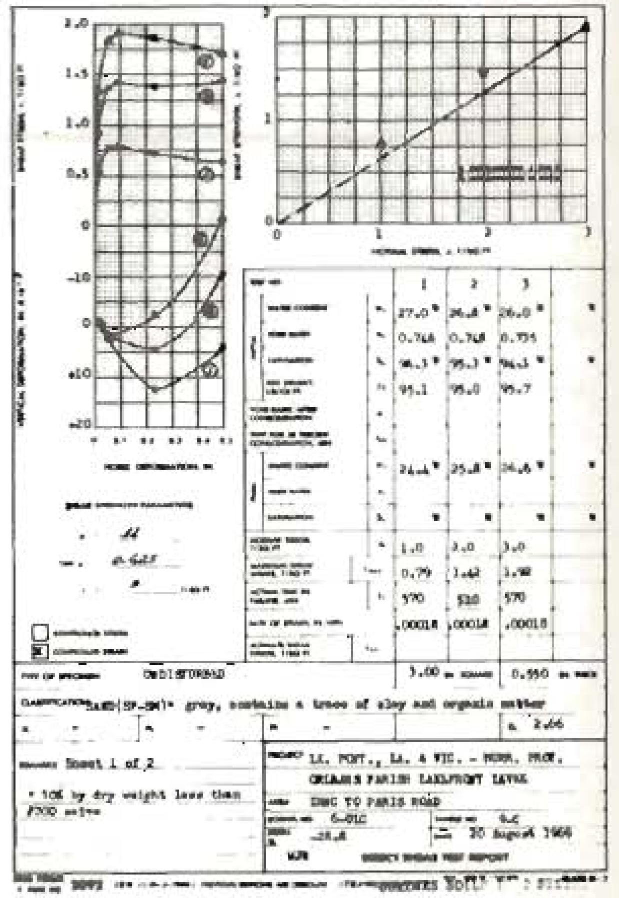


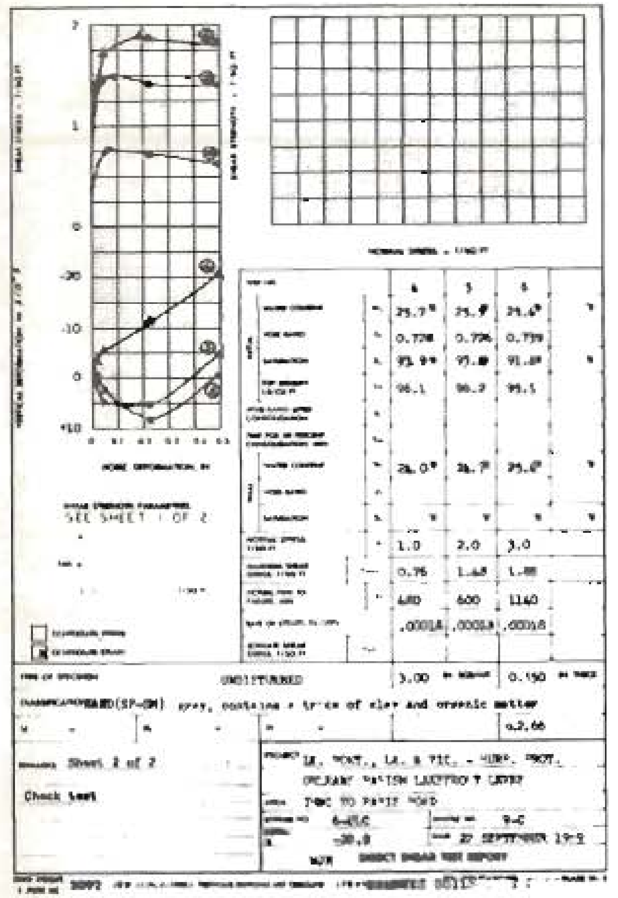












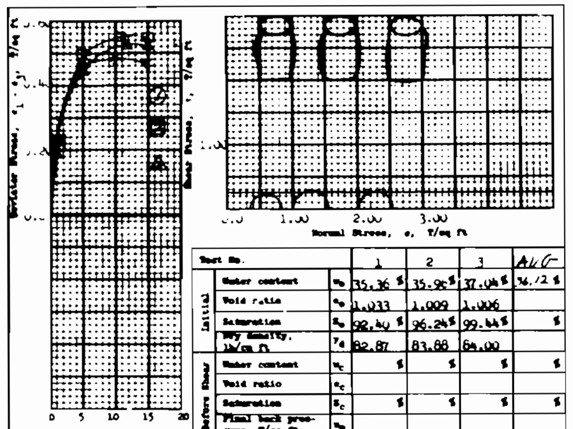
SEE PLATE 84 FOR GENERAL NOTES

LAKE PONTCHARTRAIN, LA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO 2 - GENERAL DESIGN
SUPPLEMENT NO 5A
CITRUS LAKEFRONT LEVEE
IHNC TO PARIS ROAD

DETAIL SHEAR STRENGTH DATA
BORING 6-ULC

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

MAY 1976 FILE NO. H-2-26265

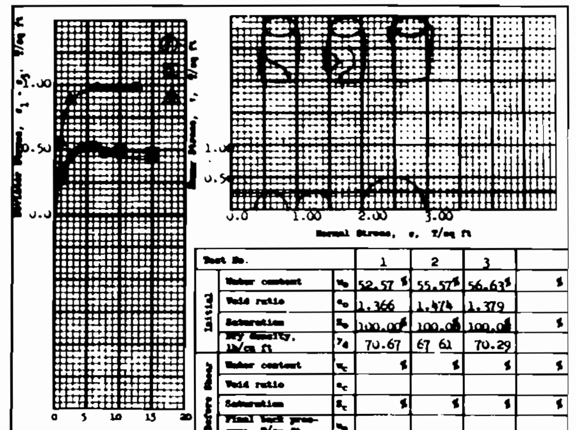


Test No.			1	2	3	AVG
Initial	Water content	w_o	35.36 %	35.96 %	37.04 %	36.12 %
	Void ratio	e_o	1.033	1.009	1.006	
	Saturation	S_o	92.40 %	96.24 %	99.44 %	%
	Dry density, lb/cu ft	γ_d	82.87	83.88	84.00	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_o				
Final	Water content	w_f	%	%	%	%
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	0.36	1.00	2.00	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.48	0.55	0.53	
Time to failure, min		t_f	12.18	11.44	11.85	
Rate of strain, percent/min			0.82	0.94	0.98	
Wet Density, lb/cu ft			112.17	114.04	115.12	113.78
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.40	1.40	1.40	
Initial height, in.		H_o	3.00	3.00	3.00	

Shear Strength Parameters
φ = 0.0°
tan φ = 0.0
c = 0.270 T/sq ft
Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test "Q" — Type of specimen 5" Undisturbed
Classification So(Gr)CL6;lns&lys SP;sl&slf
LL 41 — PL 19 — PI 22 — UCT-389 — G_s 2.7011
Remarks MOD Testing Section
Project Lk.Pont.La.&Vic.Orleans Parish Lk.Front Levee IHNC to Paris Road GDM No. 2 Supp.#5-A
Area 217+69 C/L Levee
Boring No. 7-ULC — Sample No. 8-D
Depth 29.9 — El -16.7 — Date 15 Dec. 69
TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT

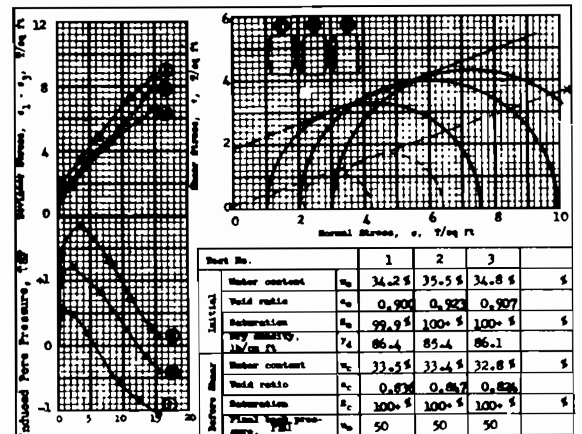


Test No.			1	2	3	
Initial	Water content	w_o	52.57 %	55.57 %	56.63 %	%
	Void ratio	e_o	1.366	1.474	1.379	
	Saturation	S_o	100.00 %	100.00 %	100.00 %	%
	Dry density, lb/cu ft	γ_d	70.67	67.61	70.29	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_o				
Final	Water content	w_f	%	%	%	%
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	0.36	1.00	2.00	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.51	0.53	0.98	
Time to failure, min		t_f	6.48	22.64	27.32	
Rate of strain, percent/min			0.64	0.26	0.24	
Wet Density, lb/cu ft			107.82	105.18	110.10	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.40	1.40	1.40	
Initial height, in.		H_o	3.00	3.00	3.00	

Shear Strength Parameters
φ = 0.0°
tan φ = 0.0
c = 0.26 T/sq ft
Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test "Q" — Type of specimen 5" Undisturbed
Classification M(Gr)CH;lambers ML&SP;few org stks
LL 82 — PL 25 — PI 57 — UCT-467 — G_s 2.6821
Remarks MOD Testing Section
Atth.& S.G. from 9-C & 9-D
Project Lk.Pont.La.&Vic.Orleans Parish Lk.Front Levee IHNC to Paris Rd.GDM No.2 Supp.No.5-A 69
Area 217+69 C/L Levee
Boring No. 7-ULC — Sample No. 9-B
Depth 32.0 — El -18.8 — Date 15 Dec.69
TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT

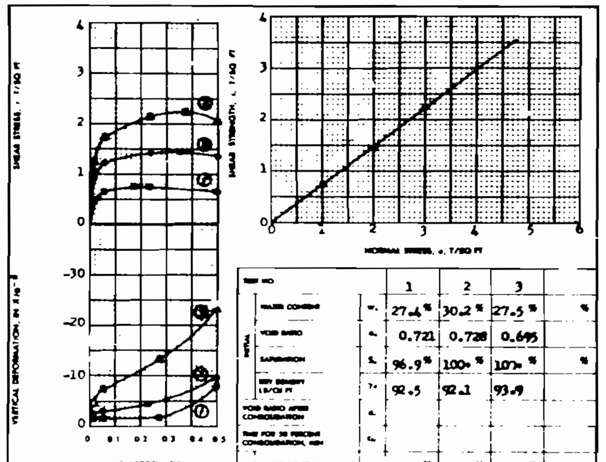


Test No.			1	2	3	
Initial	Water content	w_o	34.2 %	35.5 %	34.8 %	%
	Void ratio	e_o	0.900	0.923	0.907	
	Saturation	S_o	99.9 %	100+ %	100+ %	%
	Dry density, lb/cu ft	γ_d	86.4	85.4	86.1	
Before Shear	Water content	w_c	33.5 %	33.4 %	32.8 %	%
	Void ratio	e_c	0.836	0.847	0.824	
	Saturation	S_c	100+ %	100+ %	100+ %	%
	Final back pressure, PSI	u_o	50	50	50	
	Dry density lb/cu ft		89.4	88.9	90.0	
Final	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	1.0	2.0	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	6.98	7.93	8.56	
Time to failure, min		t_f	115	115	150	
Rate of strain, percent/min			0.13	0.13	0.10	
*$(\sigma_1-\sigma_3)$ AT MAX PORE PRESS.			1.2	2.2	3.4	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.38	1.38	1.39	
Initial height, in.		H_o	3.00	3.00	3.00	

Shear Strength Parameters
φ = 20° *
tan φ = 0.355
c = 0.10 T/sq ft
Method of saturation BP

☐ Controlled stress
☒ Controlled strain

Type of test R — Type of specimen UNDISTURBED
Classification SILTY SAND (SM), dark gray, contains a few clay spots
LL NP — PL NP — PI NP — G_s 2.63
Remarks Portion of sample allowed to drain to permit trimming
Project LK. PONT., LA. & VIC.-HURR. PROT. 1969 ORLEANS PARISH LAKEFRONT LEVEE
Area IHNC TO PARIS ROAD
Boring No. 7-ULC — Sample No. 6-A
Depth El -6.2 — Date 12 August 1969
RCH TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT
SOILS TEST SECTION

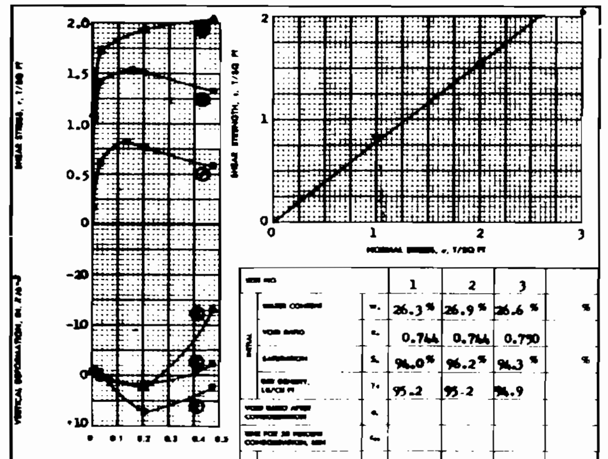


TEST NO			1	2	3	
INITIAL	WATER CONTENT	w_o	27.4 %	30.2 %	27.5 %	%
	VOID RATIO	e_o	0.721	0.728	0.695	
	SATURATION	S_o	96.9 %	100+ %	100+ %	%
	DRY DENSITY LB/CU FT	γ_d	92.5	92.1	93.9	
VOID RATIO AFTER CONSOLIDATION		e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN		t_{50}				
FINAL	WATER CONTENT	w_f	28.6 %	25.5 %	24.8 %	%
	VOID RATIO	e_f				
	SATURATION	S_f	%	%	%	%
NORMAL STRESS, T/SQ FT		σ	1.0	2.0	3.0	
MAXIMUM SHEAR STRESS, T/SQ FT		τ_{max}	0.74	1.45	2.24	
ACTUAL TIME TO FAILURE, MIN		t_f	960	1980	2100	
RATE OF STRAIN, IN./MIN			.00018	.00018	.00018	
ULTIMATE SHEAR STRESS, T/SQ FT		τ_{ult}				

SHEAR STRENGTH PARAMETERS
φ = 37°
tan φ = 0.754
c = 0 T/SQ FT

☐ CONTROLLED STRESS
☒ CONTROLLED STRAIN

TYPE OF SPECIMEN UNDISTURBED — 3.00 IN. SQUARE — 0.557 IN. THICK
CLASSIFICATION SILTY SAND (SM), gray, contains organic matter
LL – PL – PI – G_s 2.55
REMARKS
PROJECT LK. PONT, LA. & VIC. - HURR. PROT. 1969 ORLEANS PARISH LAKEFRONT LEVEE
AREA IHNC TO PARIS ROAD
BORING NO 7-ULC — SAMPLE NO 4-B
DEPTH EL + 1.3 — DATE 20 August 1969
JBMc DIRECT SHEAR TEST REPORT
ENG FORM 1 JUN 65 2092 (EM 1110-2-1906) PREVIOUS EDITIONS ARE OBSOLETE (TRANSLUCENT)
SOILS TEST SECT.

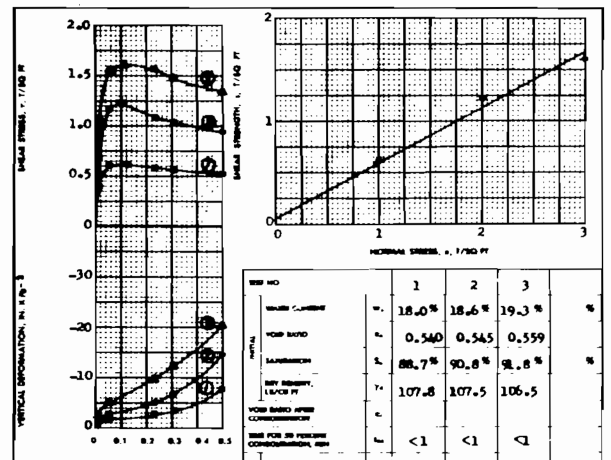


TEST NO			1	2	3	
INITIAL	WATER CONTENT	w_o	26.3 %	26.9 %	26.6 %	%
	VOID RATIO	e_o	0.744	0.744	0.750	
	SATURATION	S_o	94.0 %	96.2 %	94.3 %	%
	DRY DENSITY LB/CU FT	γ_d	95.2	95.2	94.9	
VOID RATIO AFTER CONSOLIDATION		e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN		t_{50}				
FINAL	WATER CONTENT	w_f	24.4 %	24.5 %	24.7 %	%
	VOID RATIO	e_f				
	SATURATION	S_f	%	%	%	%
NORMAL STRESS, T/SQ FT		σ	1.0	2.0	3.0	
MAXIMUM SHEAR STRESS, T/SQ FT		τ_{max}	0.82	1.54	2.05	
ACTUAL TIME TO FAILURE, MIN		t_f	960	1050	2760	
RATE OF STRAIN, IN./MIN			.00017	.00017	.00017	
ULTIMATE SHEAR STRESS, T/SQ FT		τ_{ult}				

SHEAR STRENGTH PARAMETERS
φ = 38°
tan φ = 0.781
c = 0 T/SQ FT

☐ CONTROLLED STRESS
☒ CONTROLLED STRAIN

TYPE OF SPECIMEN UNDISTURBED — 3.00 IN. SQUARE — 0.550 IN. THICK
CLASSIFICATION SAND (SP), gray, contains a trace of shell fragments
LL – PL – PI – G_s 2.66
REMARKS 4% (dry weight) less than #200 sieve
PROJECT LK. PONT., LA. & VIC. - HURR. PROT. 1969 ORLEANS PARISH LAKEFRONT LEVEE
AREA IHNC TO PARIS ROAD
BORING NO 7-ULC — SAMPLE NO 12-C
DEPTH EL -31.6 — DATE 21 August 1969
WJH DIRECT SHEAR TEST REPORT
ENG FORM 1 JUN 65 2092 (EM 1110-2-1906) PREVIOUS EDITIONS ARE OBSOLETE (TRANSLUCENT)
SOILS TEST SECT.



TEST NO			1	2	3	
INITIAL	WATER CONTENT	w_o	18.0 %	18.6 %	19.3 %	%
	VOID RATIO	e_o	0.540	0.545	0.559	
	SATURATION	S_o	88.7 %	90.8 %	91.8 %	%
	DRY DENSITY LB/CU FT	γ_d	107.8	107.5	106.5	
VOID RATIO AFTER CONSOLIDATION		e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN		t_{50}	<1	<1	<1	
FINAL	WATER CONTENT	w_f	22.5 %	21.2 %	20.8 %	%
	VOID RATIO	e_f				
	SATURATION	S_f	%	%	%	%
NORMAL STRESS, T/SQ FT		σ	1.0	2.0	3.0	
MAXIMUM SHEAR STRESS, T/SQ FT		τ_{max}	0.61	1.22	1.60	
ACTUAL TIME TO FAILURE, MIN		t_f	720	600	660	
RATE OF STRAIN, IN./MIN			.00018	.00018	.00018	
ULTIMATE SHEAR STRESS, T/SQ FT		τ_{ult}				

SHEAR STRENGTH PARAMETERS
φ = 28°
tan φ = 0.532
c = 0.07 T/SQ FT

☐ CONTROLLED STRESS
☒ CONTROLLED STRAIN

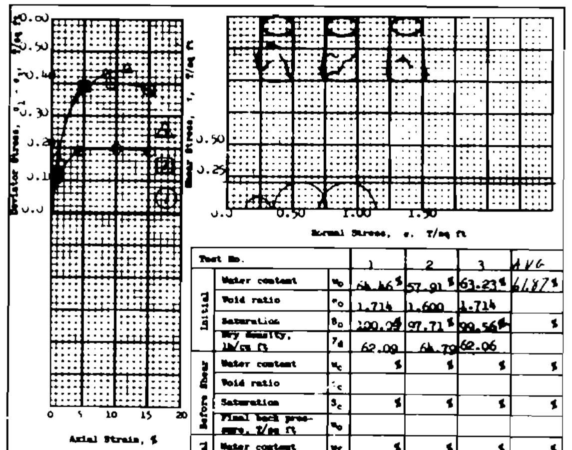
TYPE OF SPECIMEN UNDISTURBED — 3.00 IN. SQUARE — 0.557 IN. THICK
CLASSIFICATION LEAN CLAY (CL), gray, contains sand and silt pockets
LL 35 — PL 13 — PI 22 — G_s 2.66
REMARKS
PROJECT LK. PONT., LA. & VIC. - HURR. PROT. 1969 ORLEANS PARISH LAKEFRONT LEVEE
AREA IHNC TO PARIS ROAD
BORING NO 7-ULC — SAMPLE NO 14-B
DEPTH EL -40.6 — DATE 21 August 1969
JBMc DIRECT SHEAR TEST REPORT
ENG FORM 1 JUN 65 2092 (EM 1110-2-1906) PREVIOUS EDITIONS ARE OBSOLETE (TRANSLUCENT)
SOILS TEST SECT.

SEE PLATE 84 FOR GENERAL NOTES.

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 – GENERAL DESIGN
SUPPLEMENT NO. 5A
CITRUS LAKEFRONT LEVEE
IHNC TO PARIS ROAD

DETAIL SHEAR STRENGTH DATA
BORING 7-ULC

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MAY 1976 — FILE NO. H-2-26533



Axial Strain, %

Shear Strength Parameters

φ = 0 °

tan φ = 0

c = 0.210 T/sq ft

Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Test No.			1	2	3	AVG
Initial	Water content	w_o	64.46 %	57.91 %	63.23 %	61.87 %
	Void ratio	e_o	1.714	1.600	1.714	
	Saturation	S_o	100.29 %	97.71 %	99.56 %	%
	Dry density, lb/cu ft	γ_d	62.09	64.79	62.06	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_o				
Final	Water content	w_f	%	%	%	%
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	0.14	0.36	0.71	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.19	0.41	0.43	
Time to failure, min		t_f	6.61	35.91	32.34	
Rate of strain, percent/min			0.63	0.26	0.26	
Wet Density lb/cu ft.			102.11	102.31	101.30	101.91
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.40	1.40	1.40	
Initial height, in.		H_o	3.00	3.00	3.00	

Type of test "Q" | Type of specimen 5" Undisturbed

Classification So(Gr)CH:lns and few small ars SP; few org shells

LL 85 | PL 24 | PI 61 | UCT - 98 | G_s 2.7040

Remarks NOD Testing Section
* Atth. from 6-C

Project Lk.Pont.La.&Vic.Orleans Parish Lk. Front Levee IHNC to Paris Road GDM No. 2; Supp. No. 5A 1969

Area Sta. 217+69 55' L/S of C/L Levee

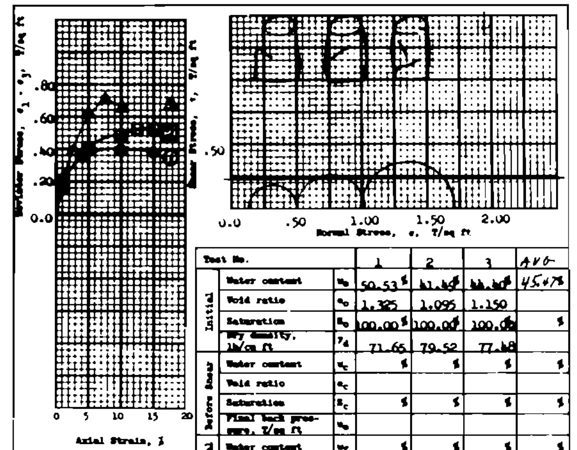
Boring No. 8-ULC | Sample No. 6-A

Depth 19.4 | El -18.0 | Date 16 Dec 69

TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE

TRANSLUCENT



Axial Strain, %

Shear Strength Parameters

φ = 0 °

tan φ = 0

c = 0.22 T/sq ft

Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Test No.			1	2	3	AVG
Initial	Water content	w_o	50.53 %	41.46 %	44.40 %	45.47 %
	Void ratio	e_o	1.325	1.095	1.150	
	Saturation	S_o	100.00 %	100.00 %	100.00 %	%
	Dry density, lb/cu ft	γ_d	71.65	79.52	77.48	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_o				
Final	Water content	w_f	%	%	%	%
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	0.14	0.50	1.00	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.36	0.52	0.72	
Time to failure, min		t_f	6.54	48.83	29.83	
Rate of strain, percent/min			0.64	0.26	0.25	
Wet Density lb/cu ft			107.85	112.51	111.88	110.75
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.40	1.40	1.40	
Initial height, in.		H_o	3.00	3.00	3.00	

Type of test "Q" | Type of specimen 5" Undisturbed

Classification So(Gr)CH:lns & ars ML; lg ars SP; alf

LL 57 | PL 19 | PI 38 | UCT - [illegible] | G_s 2.6670

Remarks NOD Testing Section

Project Lk.Pont.La.&Vic.Orleans Parish Lk. Front Levee IHNC to Paris Road GDM #2; Supp. # 5A 1969

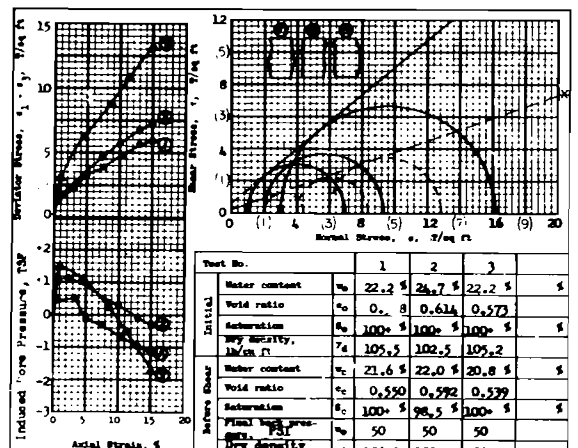
Area Sta. 217+69 55' L/S of C/L Levee

Boring No. 8-ULC | Sample No. 7-B

Depth 24.0 | El -22.6 | Date 22 Dec 69

TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE



Axial Strain, %

Shear Strength Parameters

φ = 20 ° *

tan φ = 0.355

c = 0.10 T/sq ft

Method of saturation BP

☐ Controlled stress
☒ Controlled strain

Test No.			1	2	3	
Initial	Water content	w_o	22.2 %	24.7 %	22.2 %	%
	Void ratio	e_o	0. 8	0.614	0.573	
	Saturation	S_o	100+ %	100+ %	100+ %	%
	Dry density, lb/cu ft	γ_d	105.5	102.5	105.2	
Before Shear	Water content	w_c	21.6 %	22.0 %	20.8 %	%
	Void ratio	e_c	0.550	0.592	0.539	
	Saturation	S_c	100+ %	98.5 %	100+ %	%
	Final back pressure, PSI	u_o	50	50	50	
	Dry density lb/cu ft		106.7	108.9	107.5	
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	1.0	2.0	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	5.94	7.24	13.13	
Time to failure, min		t_f	107	113	123	
Rate of strain, percent/min			0.14	0.13	0.12	
*(5·5)A MAX PORE PRESS.			1.2	2 2	3 4	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.38	1.38	1.38	
Initial height, in.		H_o	3.00	3.00	3.00	

Type of test R | Type of specimen UNDISTURBED

Classification SILTY SAND (SM), dark gray, contains shell fragments

LL - | PL - | PI - | G_s 2.65

Remarks Portion of sample allowed to drain to permit trimming. All specimens slumped while trimming.

Project LK. PONT., LA. & VIC. - HUHR. PROT. 1969 ORLEANS PARISH LAKEFRONT LEVEE

Area IHNC TO PARIS ROAD

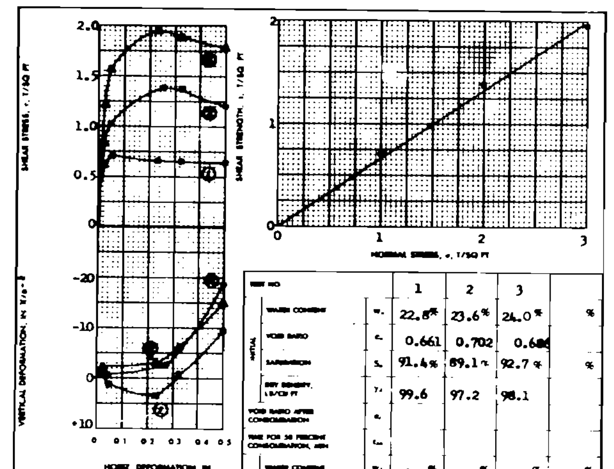
Boring No. 8-ULC | Sample No. 5-B

El -14.6 | Date 13 August 1969

RCH TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE

TRANSLUCENT USAEWES SOILS TEST SECTION



HORIZ. DEFORMATION, IN

SHEAR STRENGTH PARAMETERS

φ 34°

TAN φ 0.674

c 0 T/SQ FT

☐ CONTROLLED STRESS
☒ CONTROLLED STRAIN

TEST NO			1	2	3	
INITIAL	WATER CONTENT	w_o	22.8 %	23.6 %	24.0 %	%
	VOID RATIO	e_o	0.661	0.702	0.686	
	SATURATION	S_o	91.4 %	89.1 %	92.7 %	%
	DRY DENSITY, LB/CU FT	γ_d	99.6	97.2	98.1	
VOID RATIO AFTER CONSOLIDATION		e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN		t_{50}				
FINAL	WATER CONTENT	w_f	23.8 %	23.7 %	22.4 %	%
	VOID RATIO	e_f				
	SATURATION	S_f	%	%	%	%
NORMAL STRESS, T/SQ FT		σ	1.0	2.0	3.0	
MAXIMUM SHEAR STRESS, T/SQ FT		τ_{max}	0.70	1.38	1.95	
ACTUAL TIME TO FAILURE, MIN		t_f	360	1.40	1320	
RATE OF STRAIN, IN./MIN			.00018	.00018	.00018	
ULTIMATE SHEAR STRESS, T/SQ FT		τ_{ult}				

TYPE OF SPECIMEN UNDISTURBED | 3.00 IN. SQUARE | 0.557 IN. THICK

CLASSIFICATION SILTY SAND (SP), gray, crumbly

LL - | PL - | PI - | G_s 2.65

REMARKS

PROJECT LK. PONT., LA. & VIC. - HURR. PROT. 1969 ORLEANS PARISH LAKEFRONT LEVEE

AREA IHNC TO PARIS ROAD

BORING NO 8-ULC | SAMPLE NO 16-B

EL -54.6 | DATE 25 August 1969

JBMc DIRECT SHEAR TEST REPORT

ENG FORM 2092 1 JUN 60 (EM 1110-2-1906) PREVIOUS EDITIONS ARE OBSOLETE USAEWES SOILS TEST SECTION

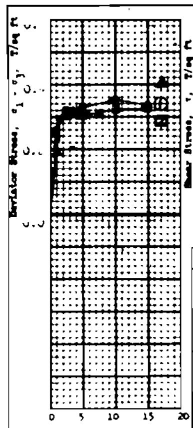
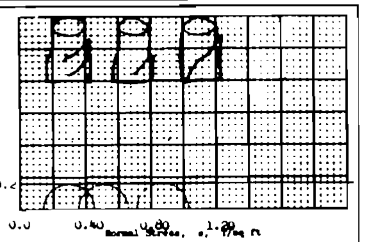
SEE PLATE 84 FOR GENERAL NOTES.

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A
CITRUS LAKEFRONT LEVEE
IHNC TO PARIS ROAD

DETAIL SHEAR STRENGTH DATA BORING 8ULC

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

MAY 1976 | FILE NO. H-2-26533

Axial Strain, %

Shear Strength Parameters

φ = 0.0 °

tan φ = 0.0

c = 0.160 T/sq ft

Method of saturation

Test No.			1	2	3	AVG
Initial	Water content	w_o	66.68%	72.07%	68.83%	69.19 %
	Void ratio	e_o	1.736	1.882	1.786	
	Saturation	S_o	100.00%	100.0%	100.0%	%
	Dry density, lb/cu ft	γ_d	61.12	58.02	60.02	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_o				
Final	Water content	w_f	%	%	%	%
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	0.14	0.36	0.71	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.32	0.31	0.32	
Time to failure, min		t_f	3.88	9.85	12.98	
Rate of strain, percent/min			0.64	0.26	0.26	
Wet Density lb/cu ft			101.87	99.84	101.34	101.02
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.40	1.40	1.40	
Initial height, in.		H_o	3.00	3.00	3.00	

☐ Controlled stress
☒ Controlled strain

Type of test "Q" Type of specimen 5" Undisturbed

Classification vSo(Gr)CH4; lns & lyr ML; lns & Ars SP; org stks; slf

LL 75 PL 24 PI 51 UCT - 216 G_s 2.6807

Remarks MOD Testing Section
* Atth. from 5-C

Project Lk.Pont.La.&Vic.-Orleans Parish Lk. Front Levee IHNC to Paris Road - GDM No. 2 Supp. No. 5A 1969

Area Sta. 217+69 L/S Levee

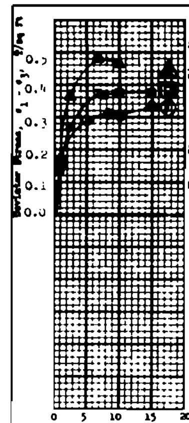
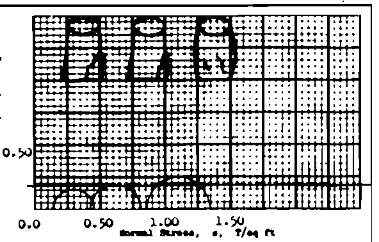
Boring No. 9-ULC Sample No. 5-D

Depth 17.7 El -17.1 Date 22 Dec. 69

TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE

TRANSLUCENT

Axial Strain, %

Shear Strength Parameters

φ = 0°

tan φ = 0

c = 0.17 T/sq ft

Method of saturation

Test No.			1	2	3	AVG
Initial	Water content	w_o	50.26%	58.20%	48.0%	52.16 %
	Void ratio	e_o	1.361	1.585	1.257	
	Saturation	S_o	100.00%	99.51%	100.0%	%
	Dry density, lb/cu ft	γ_d	71.61	65.41	74.91	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_o				
Final	Water content	w_f	%	%	%	%
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	0.14	0.43	0.86	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.31	0.38	0.48	
Time to failure, min		t_f	13.02	10.24	10.35	
Rate of strain, percent/min			0.64	0.64	0.64	
Wet Density lb/cu ft			107.60	103.48	110.87	107.32
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.40	1.40	1.40	
Initial height, in.		H_o	3.00	3.00	3.00	

☐ Controlled stress
☒ Controlled strain

Type of test "Q" Type of specimen 5" Undisturbed

Classification So(Gr)CH2; lns & ars ML & SP; few org stks; slf

LL 50 PL 22 PI 28 UCT - 259 G_s 2.7062

Remarks MOD Testing Section

Project Lk.Pont.La.&Vic.-Orleans Parish Lk. Front Levee IHNC to Paris Road GDM No. 2; Supp. No. 5A 1969

Area Sta. 21 +69 L/S Levee

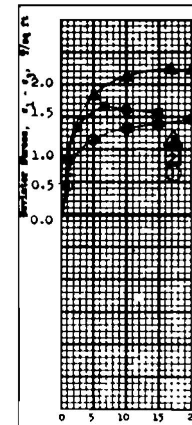
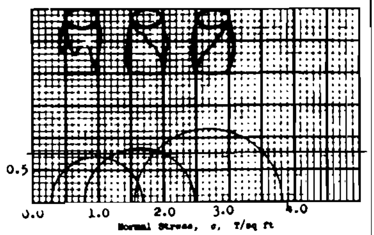
Boring No. 9-ULC Sample No. 6-D

Depth 21.5 El -20.9 Date 29 Dec 69

TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE

TRANSLUCENT

Axial Strain, %

Shear Strength Parameters

φ = 0°

tan φ = 0

c = 0 77 T/sq ft

Method of saturation

Test No.			1	2	3	AVG
Initial	Water content	w_o	24.93%	24.20%	24.70%	24.61 %
	Void ratio	e_o	0.655	0.672	0.664	
	Saturation	S_o	100.00%	96.22%	99.31%	%
	Dry density, lb/cu ft	γ_d	100.65	99.68	100.11	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_o				
Final	Water content	w_f	%	%	%	%
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	0.29	0.79	1.57	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	1.39	1.66	2.24	
Time to failure, min		t_f	23.78	10.78	26.72	
Rate of strain, percent/min			0.63	0.63	0.63	
Wet Density lb/cu ft			125.74	123.80	124.84	124.79
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.40	1.40	1.40	
Initial height, in.		H_o	3.00	3.00	3.00	

☐ Controlled stress
☒ Controlled strain

Type of test "Q" Type of specimen 5" Undisturbed

Classification vSt(smGr & T)CL4; lns & ars ML; few org ars; spks dv

LL 40 PL 16 PI 24 UCT - 2170 G_s 2.6661

Remarks MOD Testing Section

Project Lk.Pont.La.&Vic.-Orleans Parish Lk. Front Levee; IHNC to Paris Road; GDM No. 2, Supp. No. 5A 1969

Area Sta. 217+69 - 250 Ft. L/S Levee

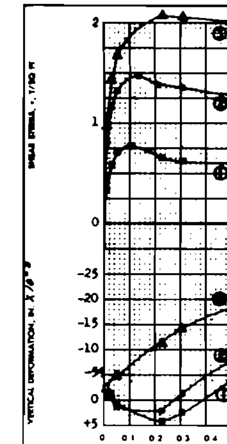
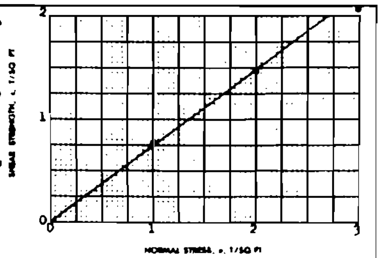
Boring No. 9-ULC Sample No. 11-D

Depth 41.7 El -41.1 Date 29 Dec 69

TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE

TRANSLUCENT

HORIZ DEFORMATION, IN

SHEAR STRENGTH PARAMETERS

φ = 37

tan φ = 0.754

c = 0 T/SQ FT

TEST NO			1	2	3	
INITIAL	WATER CONTENT	w_o	41.0%	34.6%	38.0%	%
	VOID RATIO	e_o	1.09	0.970	1.03	
	SATURATION	S_o	100%	94.9%	98.1%	%
	DRY DENSITY LB/CU FT	γ_d	79.6	84.3	81.9	
VOID RATIO AFTER CONSOLIDATION		e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN		t_{50}				
FINAL	WATER CONTENT	w_f	34.4%	32.8%	32.0%	%
	VOID RATIO	e_f				
	SATURATION	S_f	%	%	%	%
NORMAL STRESS T/SQ FT		σ	1.0	2.0	3.0	
MAXIMUM SHEAR STRESS, T/SQ FT		τ_{max}	0.76	1.47	2.11	
ACTUAL TIME TO FAILURE, MIN		t_f	660	840	1320	
RATE OF STRAIN, IN / MIN			.00017	.00017	.00017	
ULTIMATE SHEAR STRESS, T/SQ FT		τ_{ult}				

☐ CONTROLLED STRESS
☒ CONTROLLED STRAIN

TYPE OF SPECIMEN UNDISTURBED 3.00 IN SQUARE 0.557 IN THICK

CLASSIFICATION SILTY SAND (SM), gray

LL NP PL NP PI NP G_s 2.66

REMARKS S test performed in-lieu of avg. R test

PROJECT LK. PONT., LA. & VIC. - HURR. PROT. 1969 ORLEANS PARISH LAKEFRONT LEVEE

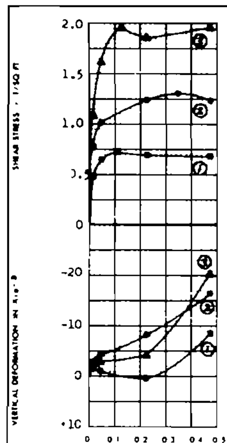
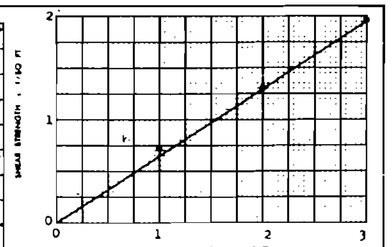
AREA IHNC TO PARIS ROAD

BORING NO 9-ULC SAMPLE NO 2-B

ELEV -3.6 DATE 26 AUGUST 1969

JHN DIRECT SHEAR TEST REPORT

ENG FORM 2092 1 JUN 68 (EM 1110-2-1906) PREVIOUS EDITIONS ARE OBSOLETE (TRANSLUCENT) WES SOILS TEST SECTION

HORIZ DEFORMATION, IN

SHEAR STRENGTH PARAMETERS

φ = 33°

tan φ = 0.649

c = 0 T/SQ FT

TEST NO			1	2	3	
INITIAL	WATER CONTENT	w_o	27.2%	27.1%	27.3%	%
	VOID RATIO	e_o	0.745	0.730	0.749	
	SATURATION	S_o	96.8%	98.4%	96.6%	%
	DRY DENSITY LB/CU FT	γ_d	94.8	95.6	94.6	
VOID RATIO AFTER CONSOLIDATION		e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN		t_{50}				
FINAL	WATER CONTENT	w_f	26.8%	25.5%	25.7%	%
	VOID RATIO	e_f				
	SATURATION	S_f	%	%	%	%
NORMAL STRESS T/SQ FT		σ	1.0	2.0	3.0	
MAXIMUM SHEAR STRESS, T/SQ FT		τ_{max}	0.72	1.30	1.96	
ACTUAL TIME TO FAILURE, MIN		t_f	690	2040	780	
RATE OF STRAIN, IN / MIN			.00017	.00017	.00017	
ULTIMATE SHEAR STRESS, T/SQ FT		τ_{ult}				

☐ CONTROLLED STRESS
☒ CONTROLLED STRAIN

TYPE OF SPECIMEN UNDISTURBED 3.00 IN SQUARE 0.550 IN THICK

CLASSIFICATION SILTY SAND (SP), gray, contains pockets of small shells, small *

LL - PL - PI - G_s 2.65

REMARKS * fragments, pockets of clay and finely divided organic matter

PROJECT LK. PONT., LA. & VIC. - HURR. PROT. 1969 ORLEANS PARISH LAKEFRONT LEVEE

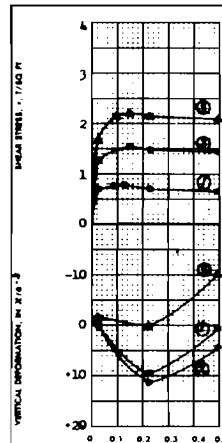
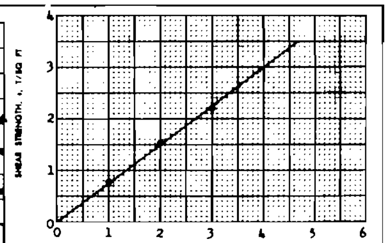
AREA IHNC TO PARIS ROAD

BORING NO 9-ULC SAMPLE NO 7-C

ELEV -24.3 DATE 26 August 1969

AJH DIRECT SHEAR TEST REPORT

ENG FORM 2092 1 JUN 68 (EM 1110-2-1906) PREVIOUS EDITIONS ARE OBSOLETE (TRANSLUCENT) WES SOILS TEST SECTION

HORIZ DEFORMATION, IN

SHEAR STRENGTH PARAMETERS

φ = 37°

tan φ = 0.754

c = 0 T/SQ FT

TEST NO			1	2	3	
INITIAL	WATER CONTENT	w_o	22.4%	21.8%	22.9%	%
	VOID RATIO	e_o	0.689	0.689	0.698	
	SATURATION	S_o	86.5%	84.2%	87.3%	%
	DRY DENSITY LB/CU FT	γ_d	98.3	98.3	97.8	
VOID RATIO AFTER CONSOLIDATION		e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN		t_{50}				
FINAL	WATER CONTENT	w_f	22.6%	24.1%	23.1%	%
	VOID RATIO	e_f				
	SATURATION	S_f	%	%	%	%
NORMAL STRESS T/SQ FT		σ	1.0	2.0	3.0	
MAXIMUM SHEAR STRESS, T/SQ FT		τ_{max}	0.78	1.52	2.20	
ACTUAL TIME TO FAILURE, MIN		t_f	780	900	870	
RATE OF STRAIN, IN / MIN			.00018	.00018	.00018	
ULTIMATE SHEAR STRESS, T/SQ FT		τ_{ult}				

☐ CONTROLLED STRESS
☒ CONTROLLED STRAIN

TYPE OF SPECIMEN UNDISTURBED 3.00 IN SQUARE 0.557 IN THICK

CLASSIFICATION SAND (SP - SM)**, gray, contains shells, shell fragments, and pockets*

LL - PL - PI - G_s 2.66

REMARKS * of clay - crumbly
** 6%(dry weight) less than # 200 sieve

PROJECT LK. PONT., LA. & VIC. - HURR. PROT. 1969 ORLEANS PARISH LAKEFRONT LEVEE

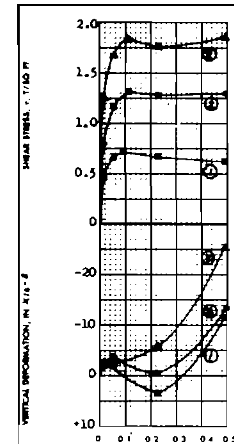
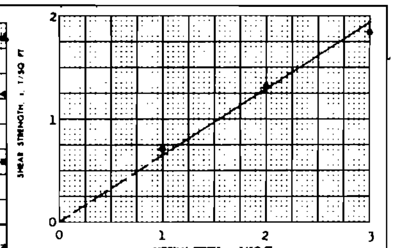
AREA IHNC TO PARIS ROAD

BORING NO 9-ULC SAMPLE NO 10-D

ELEV -37.0 DATE 27 August 1969

JHMc DIRECT SHEAR TEST REPORT

ENG FORM 2092 1 JUN 68 (EM 1110-2-1906) PREVIOUS EDITIONS ARE OBSOLETE (TRANSLUCENT) WES SOILS TEST SECTION

HORIZ DEFORMATION, IN

SHEAR STRENGTH PARAMETERS

φ = 33°

tan φ = 0.649

c = 0 T/SQ FT

TEST NO			1	2	3	
INITIAL	WATER CONTENT	w_o	23.2%	23.3%	24.0%	%
	VOID RATIO	e_o	0.688	0.686	0.676	
	SATURATION	S_o	89.4%	90.0%	94.1%	%
	DRY DENSITY LB/CU FT	γ_d	98.0	98.1	98.7	
VOID RATIO AFTER CONSOLIDATION		e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN		t_{50}				
FINAL	WATER CONTENT	w_f	23.0%	22.5%	21.7%	%
	VOID RATIO	e_f				
	SATURATION	S_f	%	%	%	%
NORMAL STRESS T/SQ FT		σ	1.0	2.0	3.0	
MAXIMUM SHEAR STRESS, T/SQ FT		τ_{max}	0.71	1.31	1.84	
ACTUAL TIME TO FAILURE, MIN		t_f	600	720	660	
RATE OF STRAIN, IN / MIN			.00018	.00018	.00018	
ULTIMATE SHEAR STRESS, T/SQ FT		τ_{ult}				

☐ CONTROLLED STRESS
☒ CONTROLLED STRAIN

TYPE OF SPECIMEN UNDISTURBED 3.00 IN SQUARE 0.550 IN THICK

CLASSIFICATION SAND (SP), gray, contains a trace of organic matter

LL - PL - PI - G_s 2.65

REMARKS

PROJECT LK. PONT., LA. & VIC. - HURR. PROT. 1969 ORLEANS PARISH LAKEFRONT LEVEE

AREA IHNC TO PARIS ROAD

BORING NO 9-ULC SAMPLE NO 14-C

ELEV -52.2 DATE 28 August 1969

WJH DIRECT SHEAR TEST REPORT

ENG FORM 2092 1 JUN 68 (EM 1110-2-1906) PREVIOUS EDITIONS ARE OBSOLETE (TRANSLUCENT) WES SOILS TEST SECTION

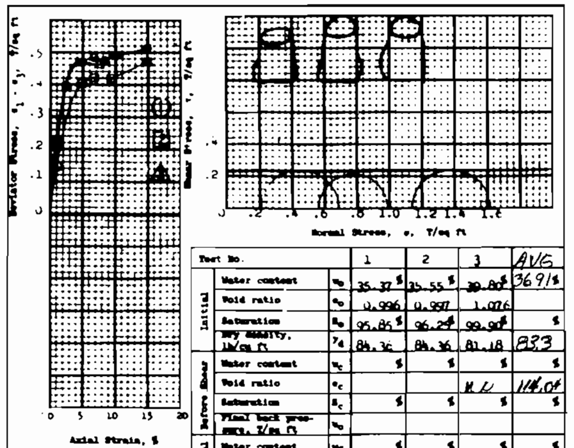
SEE PLATE 84 FOR GENERAL NOTES.

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 – GENERAL DESIGN
SUPPLEMENT NO. 5A
CITRUS LAKEFRONT LEVEE
IHNC TO PARIS ROAD

DETAIL SHEAR STRENGTH DATA
BORING 9-ULC

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

MAY 1976 FILE NO. H-2-26533



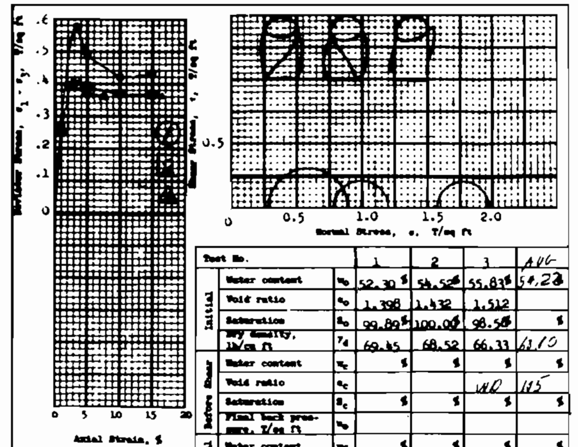
Test No.			1	2	3	AVG
Initial	Water content	w_o	35.37 %	35.55 %	39.80 %	36.91 %
	Void ratio	e_o	0.996	0.997	1.076	
	Saturation	S_o	95.86 %	96.24 %	99.90 %	%
	Dry density, lb/cu ft	γ_d	84.36	84.36	81.18	83.3
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c			WD	114.04
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_b				
Final	Water content	w_f	%	%	%	%
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	0.21	0.57	1.14	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.48	0.42	0.47	
Time to failure, min		t_f	10.33	25.30	16.42	
Rate of strain, percent/min			0.64	0.26	0.26	
Wet Density, lb/cu ft.			114.25	114.32	113.44	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.40	1.40	1.40	
Initial height, in.		H_o	3.00	3.00	3.00	

Shear Strength Parameters
ϕ = 0.0 °
tan ϕ = 0.0
c = 0.236 T/sq ft
Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test "Q" | Type of specimen 5" Undisturbed
Classification So(Gr)CH4;lns;lys&lg ars SP
LL 66 | PL 21 | PI 45 | UCT-374 | G_s 2.7014
Remarks MOD Testing Section
Attb.UCT&S.G.from 7-C & 7-D
Project Lk.Pont.La.&Vic.Hurr.Prot.1970 Orlns. Par.Lk.Frnt.Lev.IHNC toS.Pt.GDM #2 Supp 5-A
Area Sta.157+25 100'L.S.of C.L.
Boring No. 10-ULC | Sample No. 7-C
Depth 25.4 | El -22.9 | Date 25 Feb.70
TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 1 JUN 65 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE
TRANSLUCENT



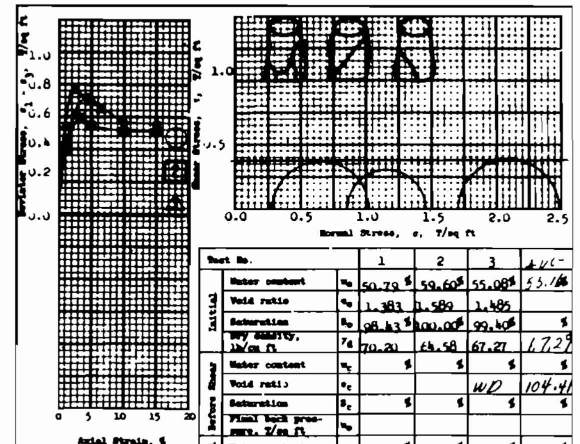
Test No.			1	2	3	AVG
Initial	Water content	w_o	52.30 %	54.52 %	55.83 %	54.22
	Void ratio	e_o	1.398	1.432	1.512	
	Saturation	S_o	99.89 %	100.00 %	98.58 %	%
	Dry density, lb/cu ft	γ_d	69.45	68.52	66.33	68.10
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c			WD	105
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_b				
Final	Water content	w_f	%	%	%	%
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	0.29	0.79	1.57	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.58	0.41	0.40	
Time to failure, min		t_f	5.35	12.46	9.78	
Rate of strain, percent/min			0.64	0.26	0.27	
Wet Density lb/cu ft			105.83	105.89	103.33	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.40	1.40	1.40	
Initial height, in.		H_o	3.00	3.00	3.00	

Shear Strength Parameters
ϕ = 0.0 °
tan ϕ = 0.0
c = 0.248 T/sq ft
Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test "Q" | Type of specimen 5" Undisturbed
Classification M(Gr)CH3; lns & lys SP,slf,sl
LL 63 | PL 17 | PI 46 | *UCT - 769 | G_s *2.6668
Remarks MOD Testing Section
*Attb.,UCT, & SG from 10-B & 10-C
Project Lk.Pont. La. & Vic. Hurr. Prot.- 1970 Orleans Par. Lk. Front Levee IHNC to So Point GDM No. 2, Supp. No. 5A
Area Sta. 157+25 - 100 Ft. L.S. of C.L.
Boring No. 10-ULC | Sample No. 10-A
Depth 35.6 | El -33.1 | Date 26 Feb 70
TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 1 JUN 65 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE
TRANSLUCENT



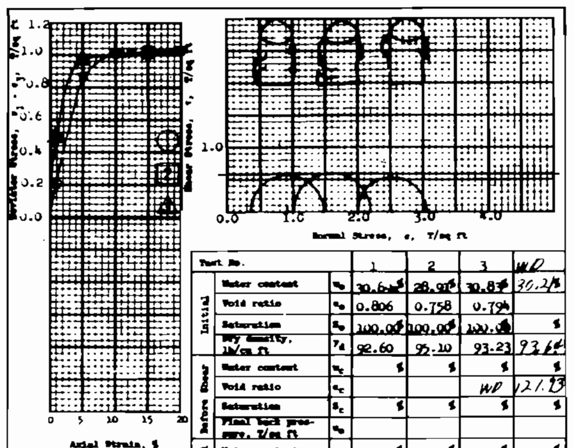
Test No.			1	2	3	AVG
Initial	Water content	w_o	50.79 %	59.60 %	55.08 %	55.16
	Void ratio	e_o	1.383	1.589	1.485	
	Saturation	S_o	98.43 %	100.00 %	99.40 %	%
	Dry density, lb/cu ft	γ_d	70.20	64.58	67.27	67.29
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c			WD	104.41
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_b				
Final	Water content	w_f	%	%	%	%
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	0.29	0.86	1.71	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.72	0.59	0.77	
Time to failure, min		t_f	6.63	12.94	10.28	
Rate of strain, percent/min			0.64	0.26	0.26	
Wet Density lb/cu ft			105.83	103.15	104.40	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.40	1.40	1.40	
Initial height, in.		H_o	3.00	3.00	3.00	

Shear Strength Parameters
ϕ = 0.0 °
tan ϕ = 0.0
c = 0.373 T/sq ft
Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test "Q" | Type of specimen 5" Undisturbed
Classification M(Gr)CH3; lns & ars SP; SIF
LL 78 | PL 20 | PI 58 | *UCT-827 | G_s * 2.6737
Remarks MOD Testing Section
*Attb.,UCT., & S.G. from 11-C and 11-D
Project Lk.Pont.La.&Vic. Hurr. Prot.-1970, Orleans Parish Lk. Front Lev., IHNC to South Point, GDM No. 2, Supp. No. 5-A
Area Sta. 157 + 25 - 100 ft. LS of CL
Boring No. 10-ULC | Sample No. 11-C
Depth 41.3 | El -38.8 | Date 27 Feb 70
TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 1 JUN 65 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE
TRANSLUCENT



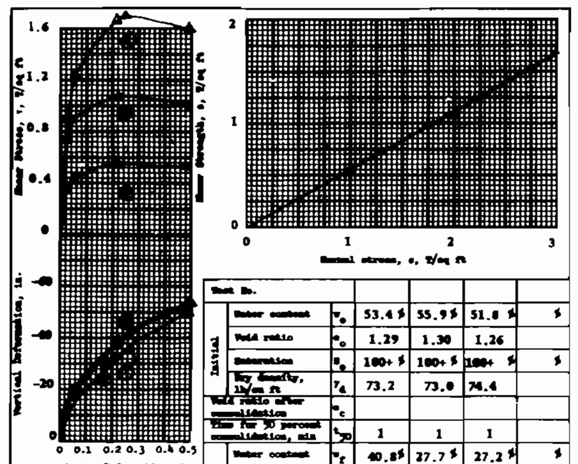
Test No.			1	2	3	WD
Initial	Water content	w_o	30.64 %	28.97 %	30.83 %	30.24
	Void ratio	e_o	0.806	0.758	0.794	
	Saturation	S_o	100.00 %	100.00 %	100.00 %	%
	Dry density, lb/cu ft	γ_d	92.60	95.10	93.23	93.64
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c			WD	121.23
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_b				
Final	Water content	w_f	%	%	%	%
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	0.36	1.00	2.00	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	1.11	1.19	1.04	
Time to failure, min		t_f	23.34	19.45	16.79	
Rate of strain, percent/min			0.63	0.64	0.64	
Wet Density lb/cu.ft.			121.18	122.62	121.93	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.40	1.40	1.40	
Initial height, in.		H_o	3.00	3.00	3.00	

Shear Strength Parameters
ϕ = 0.0 °
tan ϕ = 0.0
c = 0.575 T/sq ft
Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test "Q" | Type of specimen 5" Undisturbed
Classification vSt(gnGr)CH4;lns&lysSP,org stks,ox ars,SL
*LL 81 | PL 27 | PI 54 | *UCT- 1312 | G_s 2.6788
Remarks MOD Testing Section
* Attb.&UCT from 13-B2
Project La.Pont.,La.&Vic.-Hurr. Prot. 1970 Orleans Parish Lakefront Levee IHNC to South Point GDM No. 2 Supp. No. 5-A
Area Sta. 157+25- 100' LS of CL
Boring No. 10-ULC | Sample No. 13-C
Depth 49.3 | El -46.8 | Date 25 Feb 70
TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 1 JUN 65 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE
TRANSLUCENT



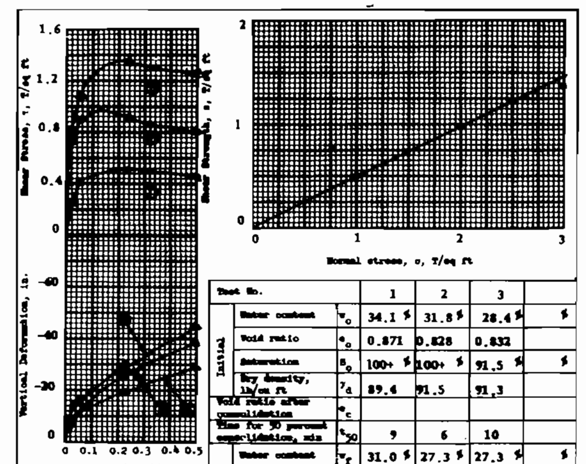
Test No.						
Initial	Water content	w_o	53.4 %	55.9 %	51.8 %	%
	Void ratio	e_o	1.29	1.30	1.26	
	Saturation	S_o	100+ %	100+ %	100+ %	%
	Dry density, lb/cu ft	γ_d	73.2	73.0	74.4	
Void ratio after consolidation		e_c				
Time for 50 percent consolidation, min		t_{50}	1	1	1	
Final	Water content	w_f	40.8 %	27.7 %	27.2 %	%
	Void ratio	e_f				
	Saturation	S_f	%	%	%	%
Normal stress, T/sq ft		σ	1.0	2.0	3.0	
Maximum shear stress, T/sq ft		τ_{max}	0.55	1.07	1.68	
Actual time to failure, min		t_f	1260	1320	1470	
Rate of strain, in./min			.00018	.00018	.00018	
Ultimate shear stress, T/sq ft		τ_{ult}				

Shear Strength Parameters
ϕ' = 29 °
tan ϕ' = 0.552
c' = 0 T/sq ft

☐ Controlled stress
☐ Controlled strain

Type of specimen UNDISTURBED | 3.00 in. square | 0.549 in. thick
Classification PLASTIC CLAY (CH), Dark gray, contains pockets of sand
LL 65 | PL 19 | PI 46 | | G_s 2.69
Remarks
Project LAKE PONT. HURRICANE PROTECTION 1970
Area
Boring No. 10-ULC | Sample No. 7-B
Depth/El. 24.2 /El.-21.7 | Date 5 May 70
DIRECT SHEAR TEST REPORT

ENG FORM 1 JUN 66 2092 PREVIOUS EDITIONS ARE OBSOLETE PLATE IX-3



Test No.			1	2	3	
Initial	Water content	w_o	34.1 %	31.8 %	28.4 %	%
	Void ratio	e_o	0.871	0.828	0.832	
	Saturation	S_o	100+ %	100+ %	91.5 %	%
	Dry density, lb/cu ft	γ_d	89.4	91.5	91.3	
Void ratio after consolidation		e_c				
Time for 50 percent consolidation, min		t_{50}	9	6	10	
Final	Water content	w_f	31.0 %	27.3 %	27.3 %	%
	Void ratio	e_f				
	Saturation	S_f	%	%	%	%
Normal stress, T/sq ft		σ	1.0	2.0	3.0	
Maximum shear stress, T/sq ft		τ_{max}	0.50	0.98	1.37	
Actual time to failure, min		t_f	1320	870	1230	
Rate of strain, in./min			.00018	.00018	.00018	
Ultimate shear stress, T/sq ft		τ_{ult}				

Shear Strength Parameters
ϕ' = 26 °
tan ϕ' = 0.490
c' = 0 T/sq ft

☐ Controlled stress
☒ Controlled strain

Type of specimen UNDISTURBED | 3.00 in. square | .549 in. thick
Classification PLASTIC CLAY(CH), light gray, contains small 1/4" shells
LL 64 | PL 19 | PI 45 | | G_s 2.68
Remarks
Project LAKE PONT. HURRICANE PROTECTION 1970
Area
Boring No. 10-ULC | Sample No. 15-A
Depth/El. 55.3 /El.-52.8 | Date 6 May 70
DIRECT SHEAR TEST REPORT

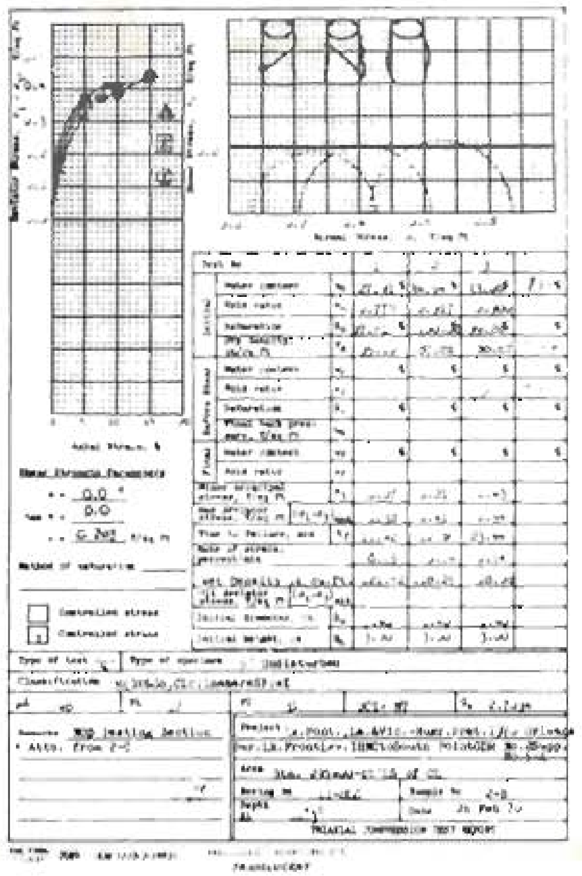
ENG FORM 1 JUN 66 2092 PREVIOUS EDITIONS ARE OBSOLETE PLATE IX-3

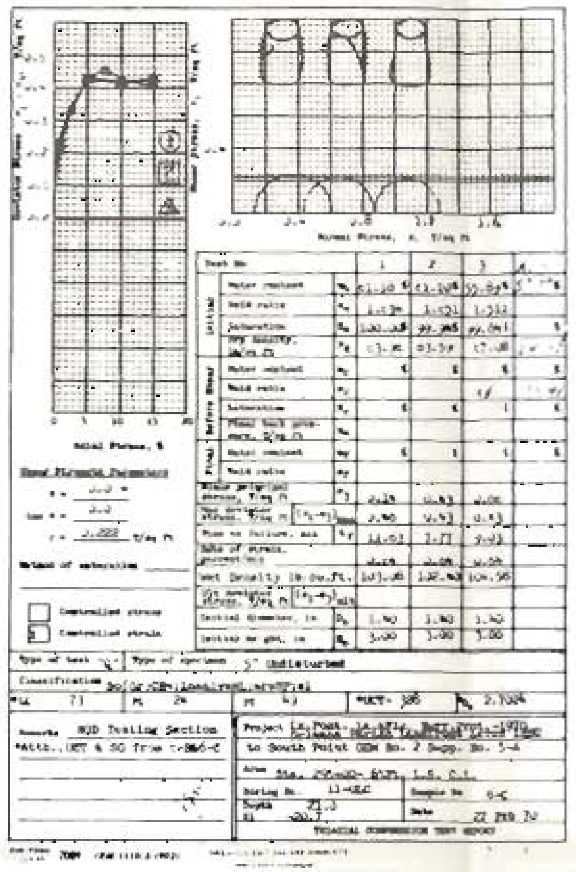
SEE PLATE 84 FOR GENERAL NOTES.

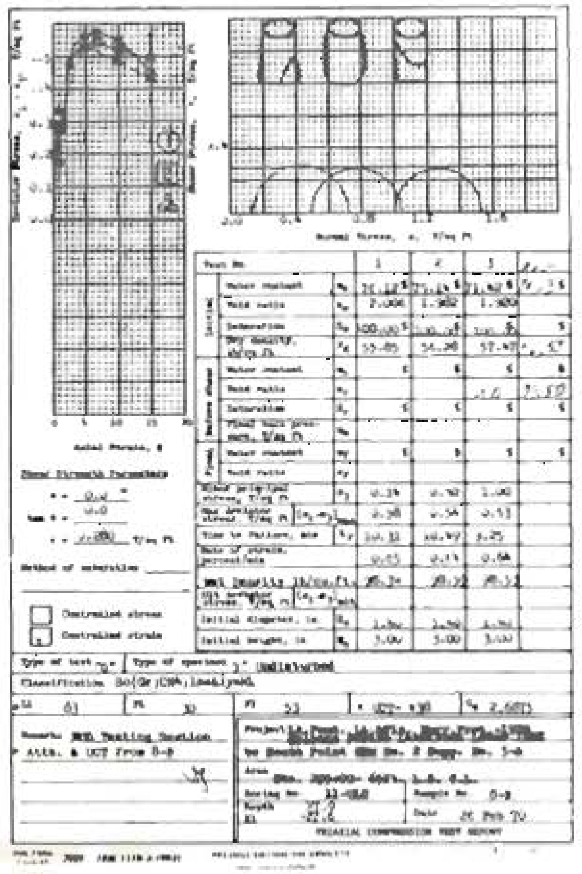
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 – GENERAL DESIGN
SUPPLEMENT NO. 5A
CITRUS LAKEFRONT LEVEE
IHNC TO PARIS ROAD

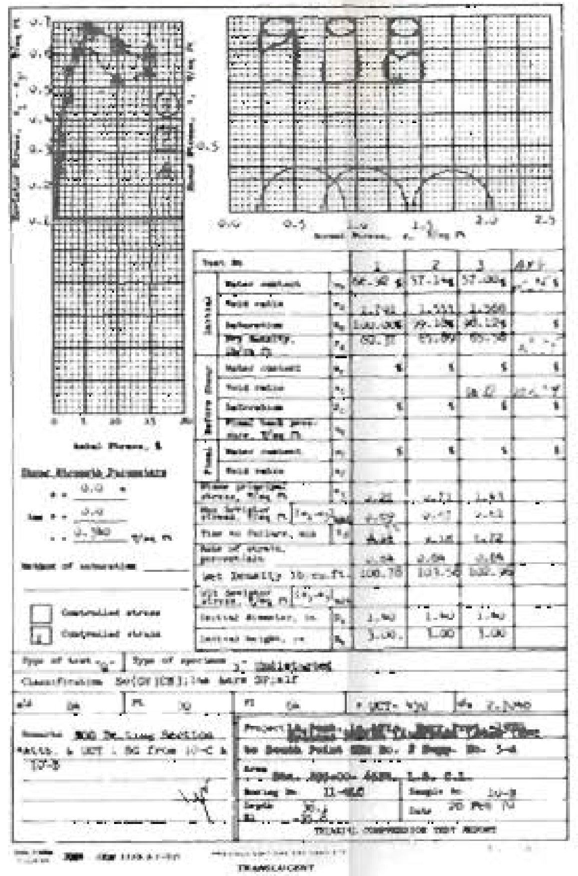
DETAIL SHEAR STRENGTH DATA
BORING 10-ULC

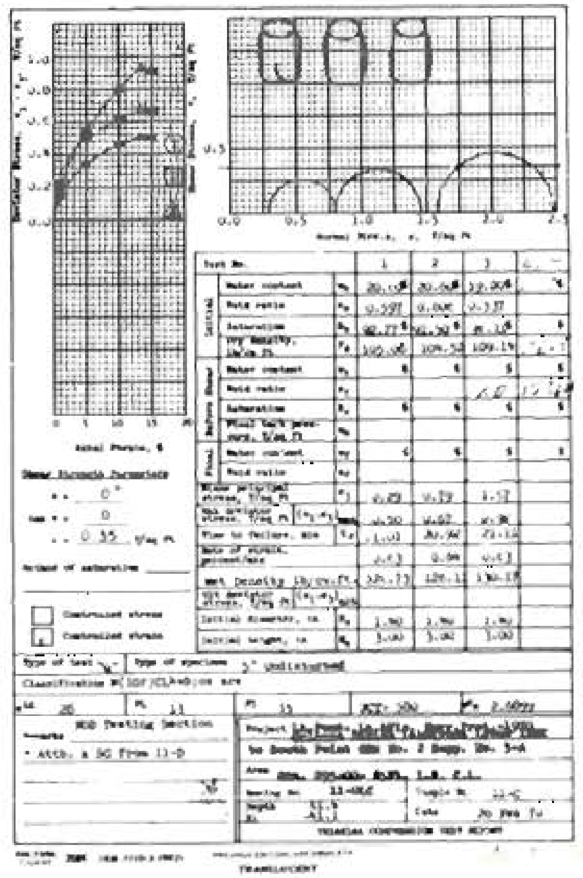
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MAY 1976 FILE NO. H-2-26533

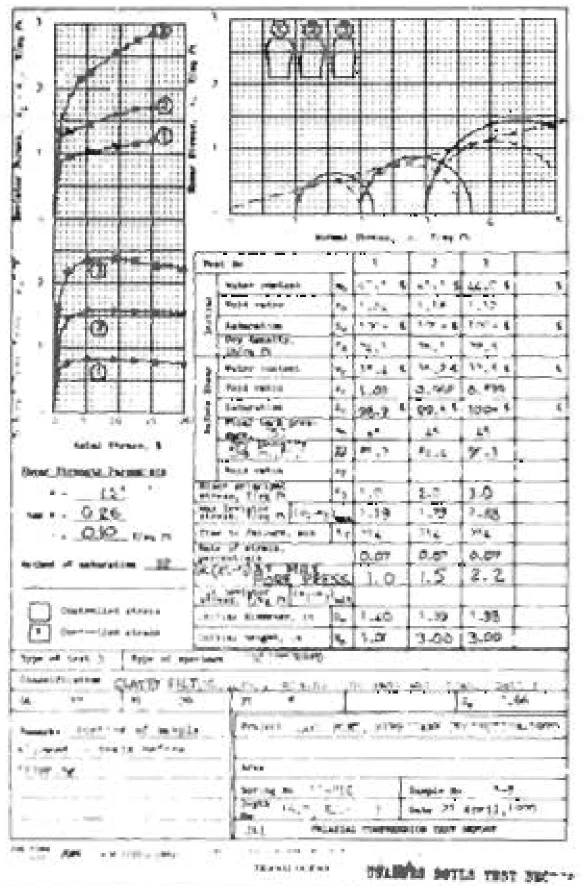


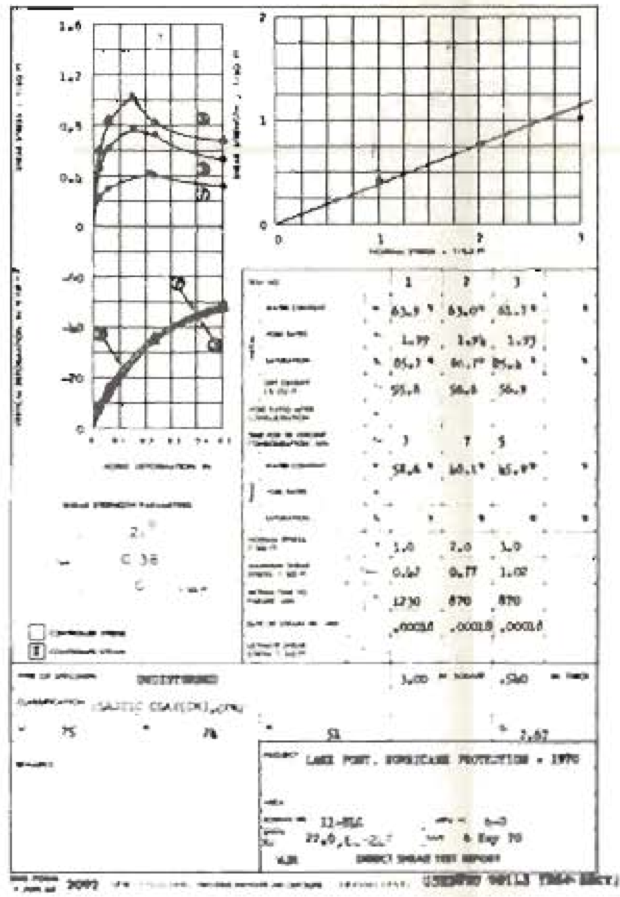


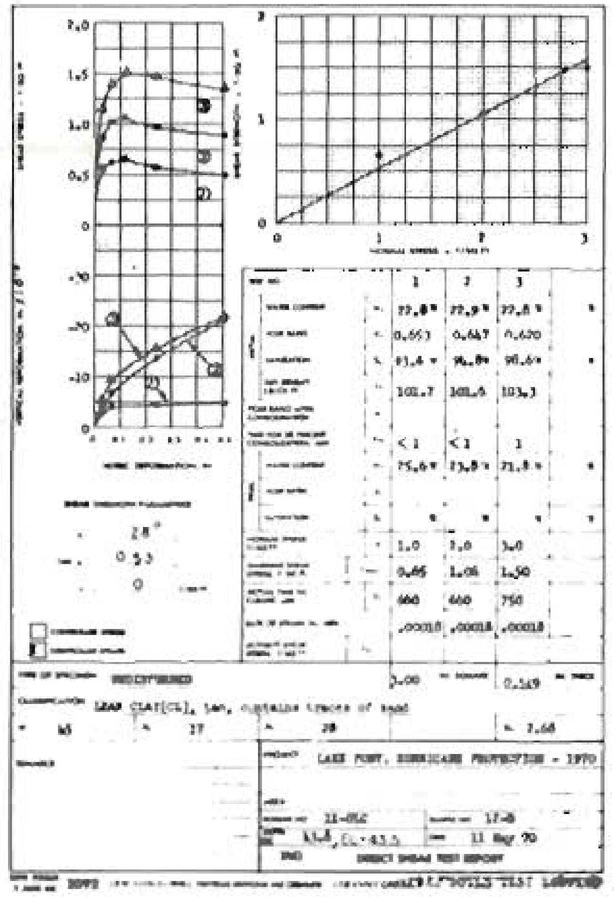


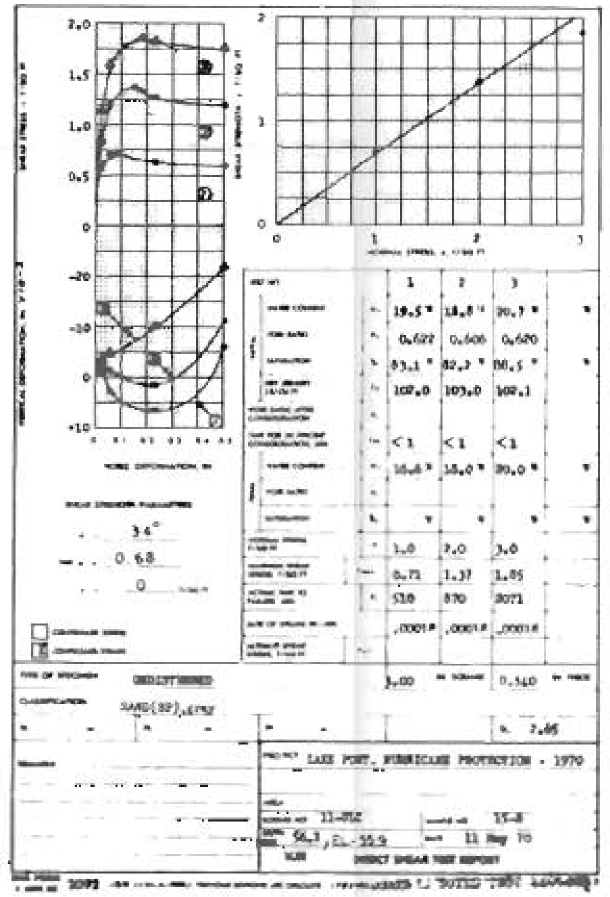












SEE PLATE 64 FOR GENERAL NOTES.

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A
CITRUS LAKEFRONT LEVEE
IHNC TO PARIS ROAD

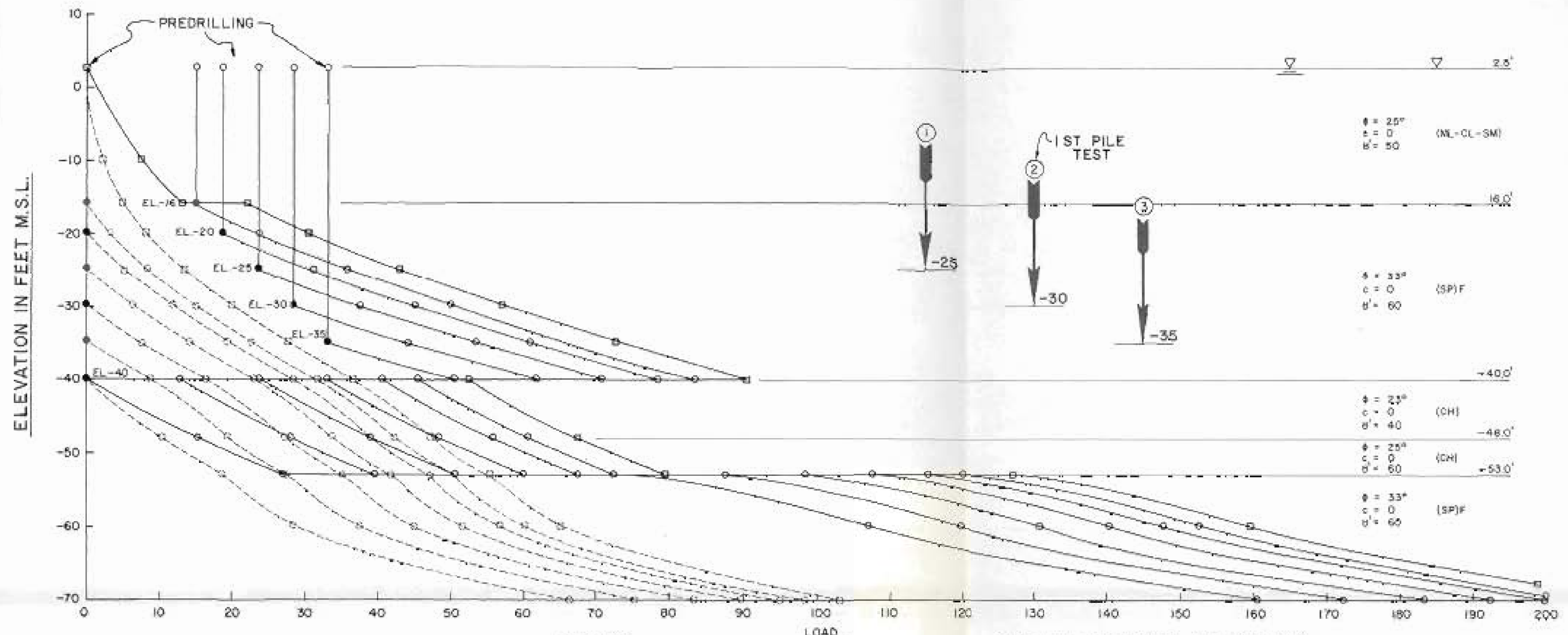
DETAIL SHEAR STRENGTH DATA
BORING 11-ULC

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MAY 1976 FILE NO. H-2-26533

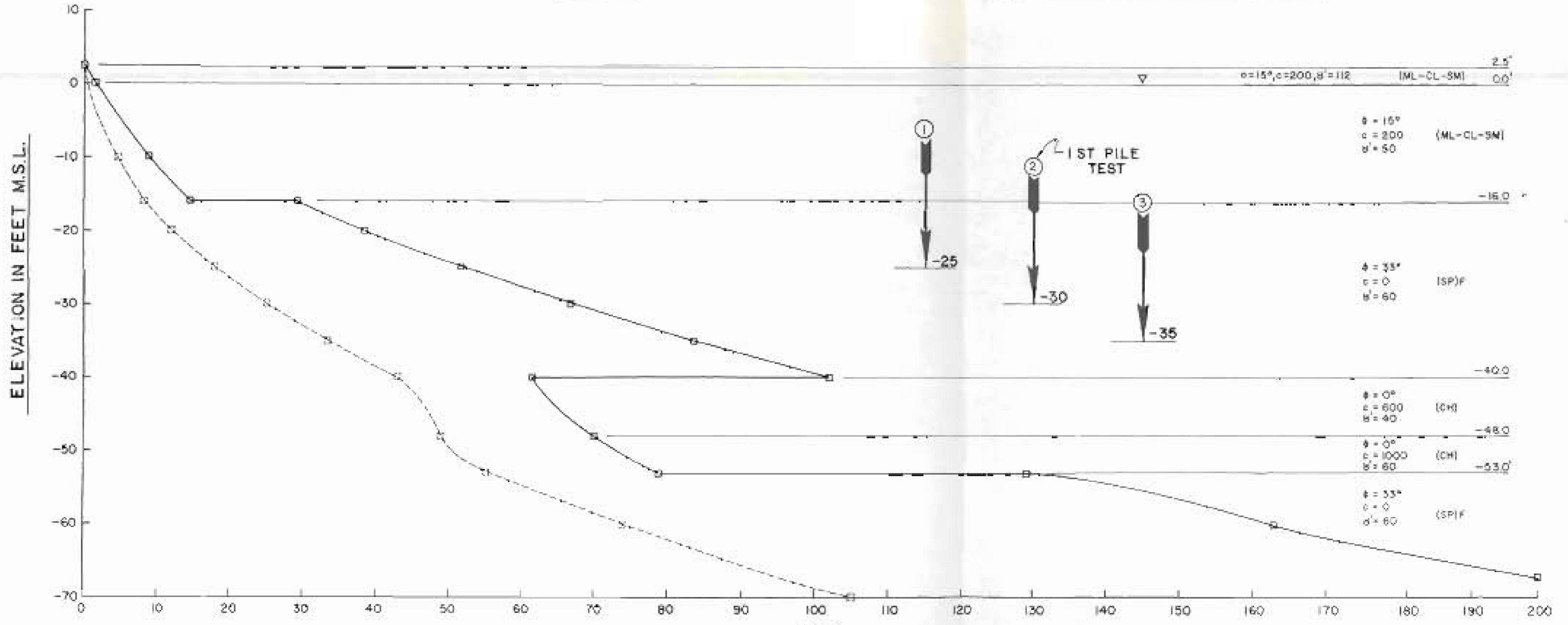
PLATE 100

PILE CAPACITIES

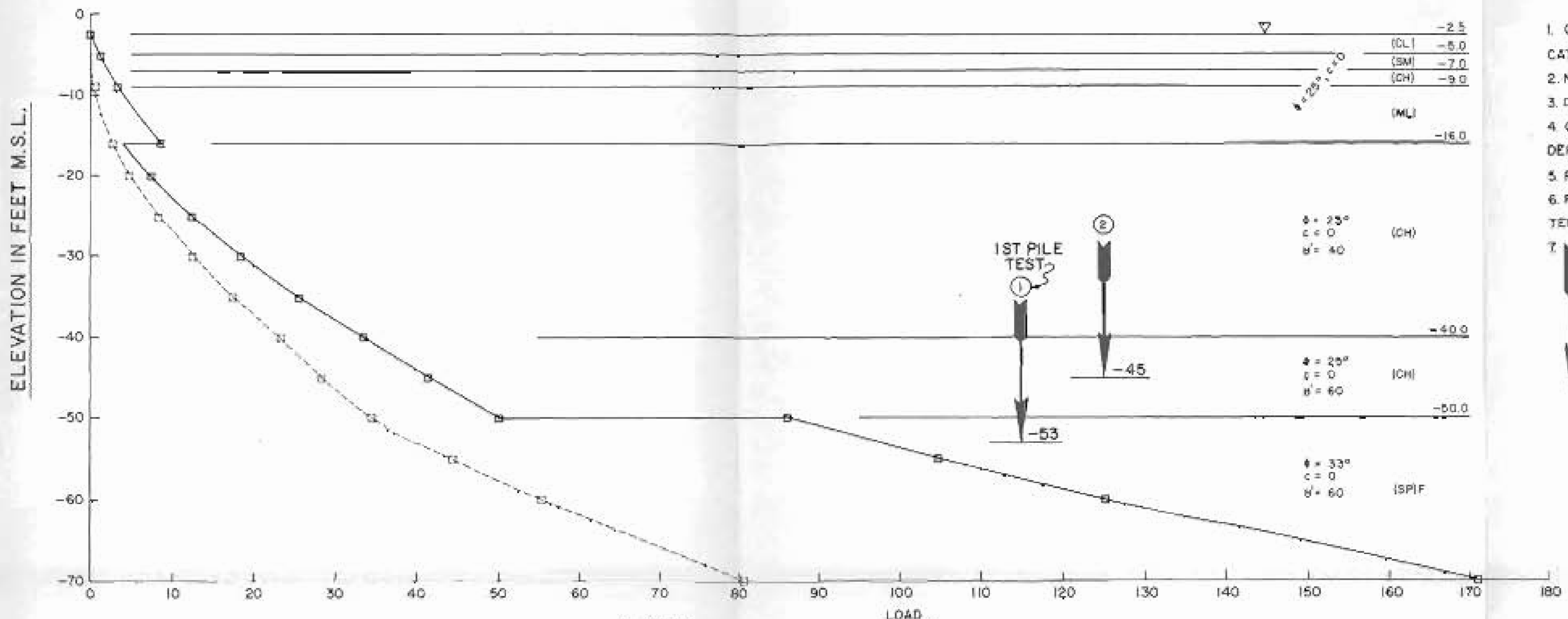
PILE LOAD VS TIP ELEVATION



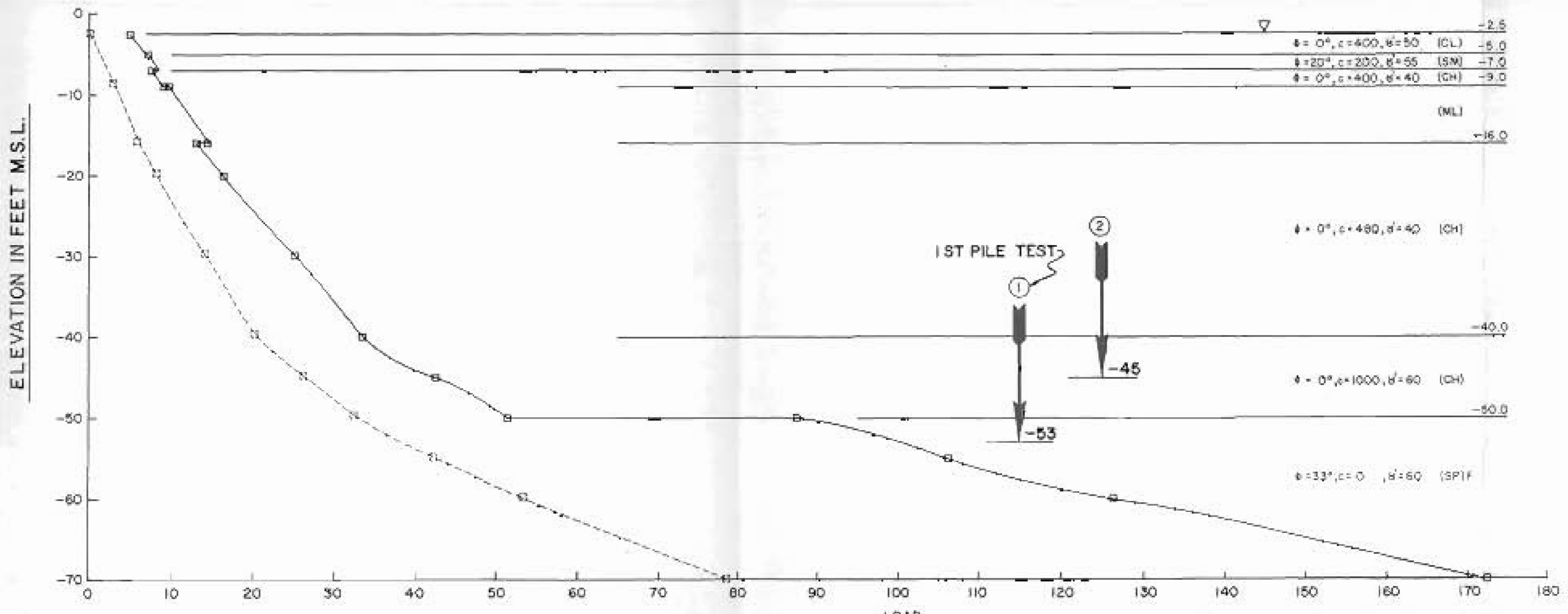
S-CASE LOAD (TONS) STA.2+15.79 TO STA.29+30.39 W/L



Q-CASE LOAD (TONS) STA.2+15.79 TO STA.29+30.39 W/L



S-CASE LOAD (TONS) STA.106+90 W/L TO STA.109+05 W/L



Q-CASE LOAD (TONS) STA.106+90 W/L TO STA.109+05 W/L

GENERAL NOTES

1. CONTINUOUS CURVE INDICATES COMPRESSION, AND DASHED CURVE INDICATES TENSION.
2. NO FACTOR OF SAFETY WAS APPLIED TO CURVE CALCULATIONS.
3. □-SYMBOL DENOTES NO PREDRILLING FOR CURVE.
4. ○-SYMBOL DENOTES PREDRILLING FOR CURVE; ●-SYMBOL DENOTES DEPTH OF PREDRILLING.
5. RESISTANCE DUE TO SKIN FRICTION IGNORED IN PREDRILLED AREA.
6. FACTORS OF SAFETY TO BE APPLIED: 1.75 IN COMPRESSION AND 2.0 IN TENSION.
7. RECOMMENDED PILE TEST PROGRAM (NO PREDRILLING) AT GATE NO. 1 AND GATE NO. 5.

CRITICAL PILE LOADING

MONOLITH LOCATION	MAX. AXIAL TENSION LOAD (TONS)	% TENSION OF LOAD ALLOWABLE (PER CENT)	MAX. AXIAL COMP. LOAD (TONS)	% COMP. OF LOAD ALLOWABLE (PER CENT)	CASE NO.
GATE NO. 1	19.2	96	37.5	93.8	1
GATE NO. 2	11.3	56.5	32.4	81	1
GATE NO. 3	9.5	47.5	27.7	69.3	1
GATE NO. 4	5.8	29	27.6	69	1
GATE NO. 5	15.2	76	37.3	93.3	1
T-WALL (VIC. AIRPORT)	19.2	96	37.3	93.3	1
T-WALL (VIC. LINCOLN BEACH)	13.8	69	28.2	70.5	1

LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 GENERAL DESIGN
SUPPLEMENT NO. 5A
CITRUS LAKEFRONT LEVEE
I.H.N.C. TO PARIS ROAD
PILE CAPACITIES
STA. 2+15.79 W/L TO STA. 29+30.39 W/L
STA. 106+90 W/L TO STA. 109+05 W/L
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
MAY 1976

UNIFIED SOIL CLASSIFICATION

MAJOR DIVISION		TYPE	LETTER SYMBOL	SYMBOL	TYPICAL NAMES
COARSE – GRAINED SOILS More than half of material is larger than No. 200 sieve size.	GRAVELS More than half of coarse fraction is larger than No. 4 sieve size.	CLEAN GRAVEL (Little or No Fines)	GW		GRAVEL, Well Graded, gravel-sand mixtures, little or no fines
			GP		GRAVEL, Poorly Graded, gravel-sand mixtures, little or no fines
		GRAVEL WITH FINES (Appreciable Amount of Fines)	GM		SILTY GRAVEL, gravel-sand-silt mixtures
			GC		CLAYEY GRAVEL, gravel-sand-clay mixtures
	SANDS More than half of coarse fraction is smaller than No. 4 sieve size.	CLEAN SAND (Little or No Fines)	SW		SAND, Well-Graded, gravelly sands
			SP		SAND, Poorly-Graded, gravelly sands
		SANDS WITH FINES (Appreciable Amount of Fines	SM		SILTY SAND, sand-silt mixtures
			SC		CLAYEY SAND, sand-clay mixtures
FINE – GRAINED SOILS More than half the material is smaller than No. 200 sieve size.		SILTS AND CLAYS (Liquid Limit < 50)	ML		SILT & very fine sand, silty or clayey fine sand or clayey silt with slight plasticity
			CL		LEAN CLAY; Sandy Clay; Silty Clay; of low to medium plasticity
			OL		ORGANIC SILTS and organic silty clays of low plasticity
		SILTS AND CLAYS (Liquid Limit > 50)	MH		SILT, fine sandy or silty soil with high plasticity
			CH		FAT CLAY, inorganic clay of high plasticity
			OH		ORGANIC CLAYS of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS			Pt		PEAT, and other highly organic soil
WOOD			Wd		WOOD
SHELLS			SI		SHELLS
NO SAMPLE					

NOTE: Soils possessing characteristics of two groups are designated by combinations of group symbols

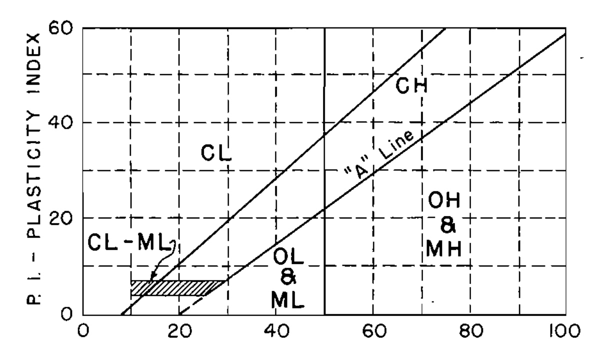
DESCRIPTIVE SYMBOLS

COLOR

COLOR	SYMBOL
TAN	T
YELLOW	Y
RED	R
BLACK	BK
GRAY	Gr
LIGHT GRAY	lGr
DARK GRAY	dGr
BROWN	Br
LIGHT BROWN	lBr
DARK BROWN	dBr
BROWNISH-GRAY	br Gr
GRAYISH-BROWN	gyBr
GREENISH-GRAY	gnGr
GRAYISH-GREEN	gyGn
GREEN	Gn
BLUE	Bl
BLUE-GREEN	BlGn
WHITE	Wh
MOTTLED	Mot

CONSISTENCY FOR COHESIVE SOILS

CONSISTENCY	COHESION IN LBS./SQ. FT. FROM UNCONFINED COMPRESSION TEST	SYMBOL
VERY SOFT	< 250	vSo
SOFT	250 - 500	So
MEDIUM	500 - 1000	M
STIFF	1000 - 2000	St
VERY STIFF	2000 - 4000	vSt
HARD	> 4000	H



L. L. – LIQUID LIMIT

PLASTICITY CHART

For classification of fine - grained soils

MODIFICATIONS

MODIFICATION	SYMBOL
Traces	Tr-
Fine	F
Medium	M
Coarse	C
Concretions	cc
Rootlets	rt
Lignite fragments	lg
Shale fragments	sh
Sandstone fragments	sds
Shell fragments	slf
Organic matter	O
Clay strata or lenses	CS
Silt strata or lenses	SIS
Sand strata or lenses	SS
Sandy	S
Gravelly	G
Boulders	B
Slickensides	SL
Wood	Wd
Oxidized	Ox

NOTES:

FIGURES TO LEFT OF BORING UNDER COLUMN "W OR D_{10}"
Are natural water contents in percent dry weight
When underlined denotes D_{10} size in mm *
FIGURES TO LEFT OF BORING UNDER COLUMNS "LL" AND "PL"
Are liquid and plastic limits, respectively
SYMBOLS TO LEFT OF BORING
▽ Ground-water surface and date observed
Ⓒ Denotes location of consolidation test **
Ⓢ Denotes location of consolidated-drained direct shear test **
Ⓡ Denotes location of consolidated-undrained triaxial compression test **
Ⓠ Denotes location of unconsolidated-undrained triaxial compression test **
Ⓣ Denotes location of sample subjected to consolidation test and each of the above three types of shear tests **
FW Denotes free water encountered in boring or sample
FIGURES TO RIGHT OF BORING
Are values of cohesion in lbs./sq. ft. from unconfined compression tests
In parenthesis are driving resistances in blows per foot determined with a standard split spoon sampler ($1\frac{3}{8}$" I.D., 2" O.D.) and a 140 lb. driving hammer with a 30" drop
Where underlined with a solid line denotes laboratory permeability in centimeters per second of undisturbed sample
Where underlined with a dashed line denotes laboratory permeability in centimeters per second of sample remoulded to the estimated natural void ratio

* The D_{10} size of a soil is the grain diameter in millimeters of which 10% of the soil is finer, and 90% coarser than size D_{10}.

**Results of these tests are available for inspection in the U.S. Army Engineer District Office, if these symbols appear beside the boring logs on the drawings.

GENERAL NOTES:

While the borings are representative of subsurface conditions at their respective locations and for their respective vertical reaches, local variations characteristic of the sub-surface materials of the region are anticipated and, if encountered, such variations will not be considered as differing materially within the purview of clause 4 of the contract.

Ground-water elevations shown on the boring logs represent ground-water surfaces encountered on the dates shown. Absence of water surface data on certain borings implies that no ground-water data is available, but does not necessarily mean that ground water will not be encountered at the locations or within the vertical reaches of these borings.

Consistency of cohesive soils shown on the boring logs is based on driller's log and visual examination and is approximate, except within those vertical reaches of the borings where shear strengths from unconfined compression tests are shown.

REVISION	DATE	DESCRIPTION	BY
3	5-3-71	ADDED UPPER LIMIT LINE (P.I.= 0.9 (LL-8)) ON PLASTICITY CHART	LMVED-G LETTER D'T'D 29 APRIL 1971
2	6-8-64	SYMBOL FW, NOTE REVISED	ORAL FROM L.M.V.G.G. 5 JUNE 1964
1	9-17-63	IST. PAR. OF GENERAL NOTES REVISED	L. M. V. D MULTIPLE LETTER, DATED 5 SEPT., 1963

SOIL BORING LEGEND

U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
FILE NO. H-2-21800

LAKE PONTCHARTRAIN, LOUISIANA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A
CITRUS LAKEFRONT LEVEE
IHNC TO PARIS ROAD

APPENDIX A
CORRESPONDENCE RELATIVE TO COORDINATION WITH OTHER AGENCIES

LAKE PONTCHARTRAIN, LOUISIANA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A
CITRUS LAKEFRONT LEVEE
IHNC TO PARIS ROAD
APPENDIX A
CORRESPONDENCE RELATIVE TO COORDINATION
WITH OTHER AGENCIES

1. Department of the Army, New Orleans District, Corps of Engineers, 2 April 1968 letter.

2. US Department of the Interior, Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife, 15 May 1968 letter.

3. Department of the Army, New Orleans District, Corps of Engineers, 8 April 1968 letter.

4. US Department of the Interior, Federal Water Pollution Control Administration, 15 May 1968 letter.

5. Department of the Army, New Orleans District, Corps of Engineers, 15 July 1969 letter.

6. US Department of the Interior, Federal Water Pollution Control Administration, 5 August 1969 letter.

7. Department of the Army, New Orleans District, Corps of Engineers, 3 July 1969 letter.

8. US Department of the Interior, Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife, 21 August 1969 letter.

9. Department of the Army, New Orleans District, Corps of Engineers, 21 July 1975 letter.

10. Southern Railway System, 2 September 1975 letter.

11. Department of the Army, New Orleans District, Corps of Engineers, 21 November 1975 letter.

C O P Y

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

LMNED-PP

2 April 1968

Mr. C. Edward Carlson, Regional Director
U. S. Department of the Interior
Fish and Wildlife Service
Peachtree-Seventh Building
Atlanta, Georgia 30323

Dear Mr. Carlson:

Please refer to our letter dated 21 April 1967 requesting your views and comments on the general design memorandum for the Lake Pontchartrain Barrier Plan feature of the "Lake Pontchartrain, La. and Vicinity" project.

Our letter dated 21 April 1967 indicated that your views and comments would be requested for each supplement to the general design memorandum. However, we now feel that your views on the entire Lake Pontchartrain Barrier Plan would be preferable. The layout of the Lake Pontchartrain Barrier Plan, as described in House Document No. 231, 89th Congress, 1st Session, is shown in inclosure 1. The plan, layout of which is shown on inclosure 2, now under consideration is essentially the same as that presented in the House Document, with the following exceptions:

a. Barrier. The Chief of Engineers has approved a change in the alignment of the barrier in the Chef Menteur Pass area to that shown on inclosure 3. The barrier elevation will be 9 feet mean sea level or the elevation of existing U. S. Highway 90, whichever is higher. The remaining structures sites will remain as specified in the House Document, except that consideration is being given to widening the Rigolets Lock from 84 feet to 110 feet. The modification of the width of the Rigolets Lock is not for public release.

b. Seabrook Lock. The Chief of Engineers has approved a change in the controlling elevation of the Seabrook Lock from 13.2 feet 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. In addition, auxiliary control structures, located on each side of the lock, will be added to provide for passage of flows or salinity control and riparian use when the lock is passing traffic.

c. Levees. Based on revised parameters for the standard project hurricane, as developed by the U. S. Weather Bureau, the levee grades recommended in House Document No. 231 were increased by as much as 1 to 2 feet.

d. St. Charles Parish Levees. The St. Charles Parish Lakefront levee will extend across the Parish Line Canal and tie into the Jefferson Parish Lakefront levee, rather than having a levee extending south approximately 3.5 miles along the west side of the Parish Line Canal to the Illinois Central Railroad. Drainage structures will be provided in the Lakefront levee to allow gravity drainage of the area.

We have received your comments on Seabrook Lock and the Citrus Back Levee, i.e., the levee along the north bank of the Gulf Intracoastal Waterway from the Inner Harbor Navigation Canal to the Michoud Canal, by letters dated 7 June 1967 and 22 June 1967, respectively. Your views, recommendations, and comments on the remainder of the Lake Pontchartrain Barrier Plan are requested.

Because of the urgency of providing protection to the areas vulnerable to hurricane flooding, we are operating on a much compressed planning schedule. Accordingly, it would be very much appreciated if your comments are provided not later than 1 June 1968.

Sincerely yours,

THOMAS J. BOWEN
Colonel, CE
District Engineer

3 Incl
1. Gen map (file H-2-23693) dtd Nov 65
2. Gen map (file H-2-23693) rev May 67
3. Map - barrier alignment (file H-2-24066, plate 2)

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

May 15, 1968

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 April 2, 1968, (LMNED-PP), requesting our views on the Lake Pontchartrain Barrier Plan feature of the Lake Pontchartrain, Louisiana, and Vicinity project.

The overall barrier plan and its influence on fish and wildlife resources have been discussed in prior Bureau reports, most recently our letter report of June 21, 1967.

As indicated in past reports, we are of the opinion that hurricane control structures in the Rigolets and Chef Menteur tidal passes will have little appreciable effect on salinities in Lakes Maurepas, Pontchartrain, and Borgne. Therefore, no adverse effects on fish and wildlife resources in these areas are expected.

Previous model tests have indicated that acceptable salinity levels for the preservation of fish and wildlife resources in Lake Pontchartrain can be obtained by utilization of the Seabrook Lock facility, which includes an auxiliary control structure on each side of the lock. Use of these auxiliary structures should insure that adequate diversion flows for salinity control and riparian use can be provided. The capability for adjusting salinities as may be required for fish and wildlife would tend to prevent the occurrence of detrimental effects.

New levee construction and levee enlargement works as planned, including the modified St. Charles Parish levee, are not expected to directly affect fish and wildlife resources to any great degree. Indirectly, the levee system will hasten urban and industrial development of additional marshland that now provides moderate quality habitat for wildlife. Your staff has indicated that the Parish Line Canal is no longer classed as a navigable waterway. Blockage of the channel, however, will inconvenience boat owners who now use the canal.

We are pleased with your previous recognition of the need for a salinity surveillance system at the Seabrook Lock upon its completion. This Bureau and the Louisiana Wild Life and Fisheries Commission will be glad to participate in the development and monitoring of such a system.

We appreciate the opportunity to provide these comments at this time. If current plans are modified, we request the opportunity for further review and comment.

A copy of this letter has been sent to the Louisiana Wild Life and Fisheries Commission. Any comments that agency wishes to make will be forwarded to you.

Sincerely yours,

W. L. Towns

W. L. Towns
Acting Regional Director

COPY

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

LMNED-PP

8 April 1968

Mr. William C. Galegar, Regional Director
Federal Water Pollution Control Administration
Third Floor--1402 Elm Street
Dallas, Texas 75202

Dear Mr. Galegar:

Please refer to our letter dated 21 April 1967 requesting your views and comments on the general design memorandum for the Lake Pontchartrain Barrier Plan feature of the "Lake Pontchartrain, La. and Vicinity" project.

Our letter dated 21 April 1967 indicated that your views and comments would be requested for each supplement to the general design memorandum. However, we now feel that your views on the entire Lake Pontchartrain Barrier Plan would be preferable. The layout of the Lake Pontchartrain Barrier Plan, as described in House Document No. 231, 89th Congress, 1st Session, is shown in inclosure 1. The plan, layout of which is shown on inclosure 2, now under consideration is essentially the same as that presented in the House Document, with the following exceptions:

a. Barrier. The Chief of Engineers has approved a change in the alignment of the barrier in the Chef Menteur Pass area to that shown on inclosure 3. The barrier elevation will be 9 feet mean sea level or the elevation of existing U. S. Highway 90, whichever is higher. The remaining structures sites will remain as specified in the House Document, except that consideration is being given to widening the Rigolets Lock from 84 feet to 110 feet. The modification of the width of the Rigolets Lock is not for public release.

b. Seabrook Lock. The Chief of Engineers has approved a change in the controlling elevation of the Seabrook Lock from 13.2 feet 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. In addition, auxiliary control structures, located on each side of the lock, will be added to provide for passage of flows or salinity control and riparian use when the lock is passing traffic.

c. Levees. Based on revised parameters for the standard project hurricane, as developed by the U. S. Weather Bureau, the levee grades recommended in House Document No. 231 were increased by as much as 1 to 2 feet.

d. St. Charles Parish Levees.. The St. Charles Parish Lakefront levee will extend across the Parish Line Canal and tie into the Jefferson Parish Lakefront levee, rather than having a levee extending south approximately 3.5 miles along the west side of the Parish Line Canal to the Illinois Central Railroad. Drainage structures will be provided in the Lakefront levee to allow gravity drainage of the area.

We have received your comments on Seabrook Lock and the Citrus Back Levee, i.e., the levee along the north bank of the Gulf Intracoastal Waterway from the Inner Harbor Navigation Canal to the Michoud Canal, by letter dated 23 June 1967. Your views, recommendations, and comments on the remainder of the Lake Pontchartrain Barrier Plan are requested.

Because of the urgency of providing protection to the areas vulnerable to hurricane flooding, we are operating on a much compressed planning schedule. Accordingly, it would be very much appreciated if your comments are provided not later than 1 June 1968.

Sincerely yours,

THOMAS J. BOWEN
Colonel, CE
District Engineer

3 Incl
1. Gen Map (file H-2-23693) dtd Nov 65
2. Gen map (file H-2-23693) rev May 67
3. Map - barrier alignment (file H-2-24-66, plate 2)

UNITED STATES
DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
SOUTH CENTRAL REGION
1402 ELM STREET, 3RD FLOOR
DALLAS, TEXAS 75202

May 15, 1968

Your Ref: LMNED-PP

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

Dear Sir:

Reference is made to your letter of April 8, 1968 requesting review and comment on the remainder of the Lake Pontchartrain Barrier Plan.

We have reviewed the information submitted in accordance with Executive Order 11288, Sections 1(3) and 1(7) in regard to water pollution control measures and find as follows:

a. All contractors should perform construction operations in a manner that will reduce turbidity and siltation to the lowest practicable level.

b. All contractors should take precautions to prevent water pollution by accidental spillage of hazardous materials which would result in substantial harm to fish or shellfish. Also, all contractors should provide and maintain sanitation facilities that will adequately treat domestic wastes to conform with Federal and local health regulations.

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

The comments of the Louisiana Stream Control Commission have been incorporated in our review.

Colonel Thomas J. Bowen
C/E, New Orleans, Louisiana

5/15/68

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

Sincerely yours,

WILLIAM C. GALEGAR
Regional Director

cc: Louisiana Stream Control Commission

COPY

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

LMNED-PP

15 July 1969

Mr. William C. Galegar, Regional Director
Federal Water Pollution Control Administration
Third Floor - 1402 Elm Street
Dallas, Texas 75202

Dear Mr. Galegar:

Please refer to our letter dated 8 April 1968 requesting your views on the entire Lake Pontchartrain Barrier Plan and your reply dated 15 May 1968. We are now considering a modification to that portion of the current plan located in the vicinity of the Rigolets Pass.

The layout of the Lake Pontchartrain Barrier Plan, provided with our letter of 8 April 1968, and the plan now under consideration are essentially the same; however, two additional schemes for the Rigolets Control Structure and Closure are presently being evaluated. The new schemes are as follows:

a. A control structure with sixteen 50-foot bays and a sill elevation of -30 feet m.s.l. (mean sea level). The structure would be located in the main channel of the Rigolets and constructed inside a cellular sheet pile cofferdam. A closure dam would extend from the east end of the structure thence across the Rigolets. This scheme required no approach channels. (Refer to inclosed layout.)

b. A control structure with twenty-three 50-foot bays and a sill elevation of -20 feet m.s.l. The layout is the same as for the above scheme.

It is requested that you furnish your views and comments on the above schemes at your earliest conveniience.

Sincerely yours,

Incl
Layout

HERBERT R. HAAR, JR.
Colonel, CE
District Engineer

UNITED STATES
DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
SOUTH CENTRAL REGION
1402 ELM STREET, 3RD FLOOR
DALLAS, TEXAS 75202

August 5, 1969

Your Ref: LMNED-PP

Colonel Herbert R. Haar, Jr.
District Engineer
U. S. Army Engineer District, New Orleans
P. O. Box 60267
New Orleans, Louisiana 70160

Attention: LMNED-PP

Dear Sir:

Reference is made to your letter of July 15, 1969 requesting our comments on the modifications to your Lake Pontchartrain Barrier Plan in the vicinity of the Rigolets Pass.

We have reviewed this modification in regard to water pollution control measures and recommend that the final plans and specifications for the project require the contractors to:

1. Provide and maintain sanitation facilities that will adequately treat domestic wastes to conform with Federal and State health regulations.

2. Perform construction operations in a manner that will reduce turbidity and siltation to the lowest practicable level.

3. Take precautions to prevent water pollution by accidental spillage of hazardous materials which would result in substantial harm to fish or shellfish.

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

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

Sincerely yours,

JERRY T. THORNHILL, Assistant Chief
Federal Activities Coordination

cc: Louisiana Stream Control Commission

Louisiana State Department of Health

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

LMNED-PP

3 July 1969

Mr. C. Edward Carlson, Regional Director
U. S. Department of the Interior
Fish and Wildlife Service
Peachtree-Seventh Building
Atlanta, Georgia 30323

Dear Mr. Carlson:

Please refer to our letter dated 2 April 1968 requesting your views on the entire Lake Pontchartrain Barrier Plan and your reply dated 15 May 1968. We are now considering a modification to that portion of the current plan located in the vicinity of the Rigolets Pass.

The layout of the Lake Pontchartrain Barrier Plan, provided with our letter of 2 April 1968, and the plan now under consideration are essentially the same; however, two additional schemes for the Rigolets Control Structure and Closure are presently being evaluated. The new schemes are as follows:

a. A control structure with sixteen 50-foot bays and a sill elevation of -30 feet m.s.l. (mean sea level). The structure would be located in the main channel of the Rigolets and constructed inside a cellular sheet pile cofferdam. A closure dam would extend from the east end of the structure thence across the Rigolets. This scheme required no approach channels. (Refer to inclosed layout.)

b. A control structure with twenty-three 50-foot bays and a sill elevation of -20 feet m.s.l. The layout is the same as for the above scheme.

It is requested that you furnish your views and comments on the above schemes at your earliest conveniience.

Sincerely yours,

HERBERT R. HAAR, JR.
Colonel, CE
District Engineer

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

August 21, 1969

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

Dear Sir:

This is in reply to your letter of July 3, 1969, (LMNED-PP), requesting our comments on the two additional schemes you are considering in modifying plans for the Rigolets Control Structure and Closure, a part of the Lake Pontchartrain Barrier Plan. The new schemes described in your letter are as follows:

a. A control structure with sixteen 50-foot bays and a sill elevation of -30 feet mean sea level. The structure would be located in the main channel of the Rigolets and constructed inside a cellular sheet pile cofferdam. A closure dam would extend from the east end of the structure across the Rigolets. This scheme requires no approach channels.

b. A control structure with twenty-three 50-foot bays and a sill elevation of -20 feet m.s.l. The layout is the same as for the above scheme.

The control structure described under "b" above is identical in dimensions to the structure originally planned. The influence of the original structure on fish and wildlife was discussed in prior Bureau reports and most recently in our letter of May 15, 1968. Apparently, the structure described under "a" above is designed to pass approximately the same volume of water as structure "b". Therefore, we are of the opinion that the proposed modifications to the planned structure will have little effect on salinities in adjacent waters and no significant adverse effects on fish and wildlife resources. The proposed location of the structures in the main channel of the Rigolets does not alter our views.

We appreciate the opportunity to provide these comments at this time. If current plans are further modified, we request the opportunity for further review and comment.

A copy of this letter has been sent to the Louisiana Wild Life and Fisheries Commission. Any comments that agency wishes to make will be forwarded to you.

Sincerely yours,

W. L. Towns
Acting Regional Director

COPY

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

IN REPLY REFER TO
LMNED-MP

21 July 1975

Mr. P. T. Sarris
Southern Railway System
125 Spring Street, S.W.
Atlanta, GA 30303

Dear Mr. Sarris:

Reference is made to the meeting held in this office on 14 July 1975 attended by yourself and Mr. Fred Radford of your company and Messrs. Joe Dicharry, Stan Shelton, Joe Joachim, Bob Guizerix, and Van Steinweinder of this office. The subject of the meeting was the Citrus Lakefront levee, Inner Harbor Navigation Canal (IHNC) to Paris Road, portion of the Lake Pontchartrain, Louisiana, and Vicinity hurricane protection project.

The first topic of conversation was the proposed swing gate to be installed across your tracks in the vicinity of Jourdan Road. The question of horizontal clearance on both sides of the tracks was discussed. Inclosure 1 (in duplicate) is an advance copy of the design drawing for this gate with the pertinent distances marked in blue. At the meeting, you had informed my staff that for mainline tracks the railroad criteria called for 18 feet horizontal clearance on each side of the tracks for maintenance purposes. It should be noted that the horizontal clearance provided at your bridge crossing the IHNC is approximately 8.0 feet and the same holds true for the bridges east of South Point. This information was obtained from Mr. Radford on 16 July 1975 by telephone conversation. Therefore, we believe that the spacing shown on inclosure 1 seems to be adequate.

A copy of the profile of the elevation of the south rail along the subject reach is inclosure 2 as per your request at the meeting.

The problem of attempting to fit our levee between your tracks and the newly-widened Hayne Boulevard was also discussed. Your office had previously furnished this office with certain criteria pertaining to the relationship of our levee to your embankment. This criteria is as follows:

a. The vertical distance from the bottom of the south rail to the top of the drainage culvert under the tracks shall not be less than 5.5 feet.

b. The elevation of the top of the catch basins between the levee and the railroad embankment shall be no higher than 6.0 feet m.s.l.

c. The distance from the south rail to the centerline of the ditch between the levee and the railroad embankment shall be no closer than 15.0 feet.

d. The spacing of the catch basins shall be no farther apart than 600 feet.

At the meeting you were informed that we have been able to meet the b and c criteria. Previously, you have been informed that our design studies indicate that the spacing between catch basins should be 900 feet. The vertical distance of 5.5 feet below bottom of south rail has been hard to meet. We are limited on the landside of our levee to the Hayne Boulevard right-of-way. Using a 1V on 2.8H landside slope, 10-foot crown width, 1V on 3H lakeside slope and an elevation of 6.0 feet m.s.l. for the top of the catch basin the vertical distance has worked out to be less than 5.0 feet. My staff informed you that we could lower the invert elevation of the catch basin 1 foot. Therefore, you agreed to change the required distance from 5.5 feet to 5.0 feet.

Furthermore, as can be seen on inclosure 2 and as discussed at the meeting, the elevation of the south rail is below 9.0 feet m.s.l. for approximately 3,500 feet from approximate station 109+00 to 144+00. Within this reach the top of the catch basin is less than 3 feet below the south rail. Along the rest of this project reach, this distance is 3 feet or greater. During the discussion on this matter, it was suggested that an alternative would be to lower the top of the catch basins to elevation 5.0 feet m.s.l. and inset the catch basins into the toe of the levee. The 15-foot horizontal distance from south rail to centerline of catch basin would remain constant for the entire project reach. But, it was agreed that this may cause soils stability problems and it was not discussed further.

To alleviate this problem, you agreed to allow us to aline the centerline of our catch basins and ditch 12 feet from the south rail instead of 15 feet. This would place the top of the catch basins in this reach at elevation 5.0 feet m.s.l., instead of 6.0 and provide at least 3 feet vertical distance below the south rail.

LMNED-MP 21 July 1975
Mr. P. T. Sarris

The spacing of the catch basins was briefly discussed. You opined that the spacing should be less than 900 feet. It should be noted that the criteria used to determine the 900-foot spacing is identical to the method used to determine the 600-foot spacing on the Paris Road to South Point reach. However, if you wish, you may furnish this office with the criteria upon which you based your statement.

We are expediting the preparation of the general design memorandum for this reach. Therefore, your prompt reply with your comments will be greatly appreciated.

I look forward to hearing from you in the near future.

Sincerely yours,

FREDERIC M. CHATRY
Acting Chief, Engineering Division

2 Incl
1. Railroad Gate Dwg. (dupe)
2. South Rail Profile

Southern Railway System

Assistant Vice President - M W & S

Atlanta, Georgia 30303

R. A. KELSO
CHIEF ENGINEER, DESIGN AND CONSTRUCTION

99 SPRING STREET, S. W.
TELEPHONE
(404) 688-0800

September 2, 1975 pts/wjk

178-26

NEW ORLEANS, LOUISIANA - Citrus Lakefront Levee - IHNC to Paris Road.

Mr. Frederic M. Chatry
Acting Chief, Engineering Division
New Orleans District, Corps of Engineers
P. O. Box 60267
New Orleans, Louisiana 70160

Dear Mr. Chatry: (LMNED-MP)

Reference is made to July 14 informal meeting held in Corps of Engineers office, requested by my office, and attended by Southern's P. T. Sarris and F. H. Radford and several members of your staff. Your July 21 letter, addressed to Mr. Sarris, outlines the items which were reviewed at the July 14 meeting and in general appears to be along the lines discussed.

I had no knowledge, until the July 14 meeting, that a swing gate was proposed to be installed across our double track in the vicinity of Jourdan Road (between Inner Harbor Navigation Canal and Paris Road).

Would you please advise me the reason or reasons why a closure gate is required across our main tracks in order for my further consideration and handling.

For my further review, I would appreciate your furnishing me typical cross sections showing the proposed catch basin installations in the vicinity of project stations 30+00, 50+00, 125+00, 158+00, 210+00, 250+00, 312+00, and 325+00. The cross sections should indicate (1) top of rail elevation, (2) distance from track to center catch basin, (3) 12" discharge pipe from catch basin to Lake Pontchartrain with minimum vertical distance from top of pipe to base of rail, and (4) toe of lakeside levee referenced to center of proposed catch basins. I realize that the above listed stations may be 300 to 400 feet away from possible point of catch basin locations; therefore, please provide me with the cross section at the nearest proposed catch basin location to each respective station listed above.

Insofar as the 900 ft. vs. the 600 ft. catch basin spacing is concerned, you advised that the criteria used to determine that 900 ft. catch basin spacing was adequate is identical to the method used in determining the 600 ft. catch basin spacing being used for the Paris Road to South Point reach. My reasoning for insisting that no greater than 600 ft. catch basin spacing be designed for the Citrus Lakefront Levee is that the catch basins located between the track and the existing levee are presently spaced approximately 400 feet apart. Since the South Point to Paris Road catch basins have been approved at 600 ft. spacing, I am agreeable to the same spacing for the Paris Road to IHNC, but not to your 900 ft. suggested spacing.

Have you given consideration at this time as to disposition of the existing catch basins?

After reviewing the cross sections requested herein, it may be mutually beneficial that we meet again to finally resolve any differences we may still have.

In closing your letter, you advise that preparation of general design memorandum is being expedited. Can you provide me with approximate date the Citrus Lakefront Levee will be advertised for construction?

Yours very truly,

R. G. Kiko

Chief Engineer,
Design and Construction

Cy: Mr. J. P. McNamara, Chief Engineer
Board of Levee Commissioners of the
Orleans Levee District
200 Wild Life and Fisheries Building
418 Royal Street
New Orleans, Louisiana 70130

COPY

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

IN REPLY REFER TO
LMNED-MP

21 November 1975

Mr. R. A. Kelso
Southern Railway System
99 Spring Street, S.W.
Atlanta, Georgia 30303

Dear Mr. Kelso:

This is in reply to your letter of 2 September 1975 concerning the Citrus Lakefront levee of the Lake Pontchartrain, Louisiana, and Vicinity hurricane protection project.

A closure gate across your tracks in the vicinity of Jourdan Road is required because the railroad embankment in that area is below the required grade of the hurricane protective works. The required grade in the vicinity of Jourdan Road is 13.5 feet above mean sea level (m.s.l.) whereas the rail elevation at the crossing is 9.99 feet m.s.l. A closure gate is not required at the crossing east of Downman Road. The required grade and rail elevation there are 10.5 feet m.s.l. and 12.9 feet m.s.l., respectively. We are proceeding with our designs for the closure gate in the vicinity of Jourdan Road in accordance with the gate drawing forwarded to you with my letter of 21 July 1975.

The typical levee cross-sections you requested are attached as inclosures 1, 2 and 3. The levee from station 28+31 to station 64+00 is behind the New Orleans Lakefront Airport; therefore, the drainage of the levee and railroad embankments between these stations cannot be treated in the same manner as that for the remainder of the reach. Drainage of the embankments between those stations will be accommodated by a continuous ditch as indicated on inclosure 1 with an outlet to Lake Pontchartrain at approximate station 64+00 similar to those designed for the remainder of the reach. As illustrated on inclosure 2, the catch basins between stations 109+00 and 144+00, where the elevation of the south rail is below 9.0 feet m.s.l., have not been recessed into the toe of the levee as was briefly considered. Rather, the top of the catch basin has been lowered to elevation 5.0 feet m.s.l. with the centerline of the catch basin 12 feet from the south rail. The levee cross-sections provided as inclosures 1, 2, and 3 are in accordance with the criteria discussed in our 14 July 1975 meeting and in my 21 July 1975 letter.

We have reevaluated the matter of the spacing of the catch basins and are prepared to utilize a 600-foot spacing contingent upon the approval by the Southern Railraod of the inclosed typical levee cross sections. The existing catch basins will be removed and the drain pipes plugged and sealed. We currently expect to advertise this levee for construction in March 1977.

I hope this has answered your questions concerning the Citrus Lakefront levee. If I may be of further assistance, please contact me.

Sincerely yours,

FREDERIC M. CHATRY
Chief, Engineering Division

3 Incl
As stated

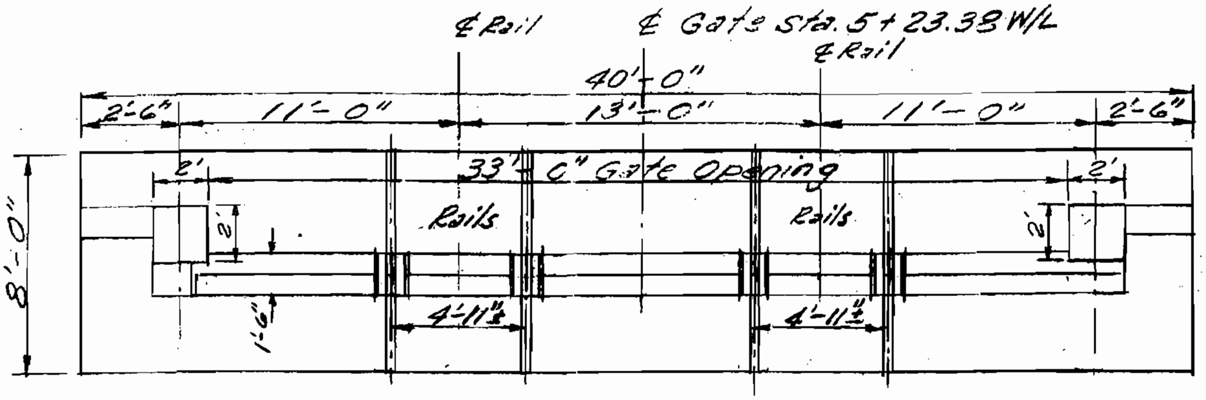
CF: wo incl
Mr. John P. McNamara, Chief Engineer
Board of Levee Commissioners of the
Orleans Levee District
200 Wildlife and Fisheries Building
418 Royal Street
New Orleans, Louisiana 70130

LAKE PONTCHARTRAIN, LOUISIANA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A
CITRUS LAKEFRONT LEVEE
IHNC TO PARIS ROAD

APPENDIX B
STRUCTURAL DESIGN CALCULATIONS

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN G DM
NEW ORLEANS LAKE FRONT LEVEE

Sheet No 1.
Computed by T.S.T.
Ckd by JGB



Swing Gate at Sta. 5+23.38 W/L   Gate #2
Top of Gate El. 13.0
Base of Slab El. 7.33
High water El. 13.0
Wind Pressure = 50#/□'
Train on Monolith = 80^k per axle   use 160^k for two axles

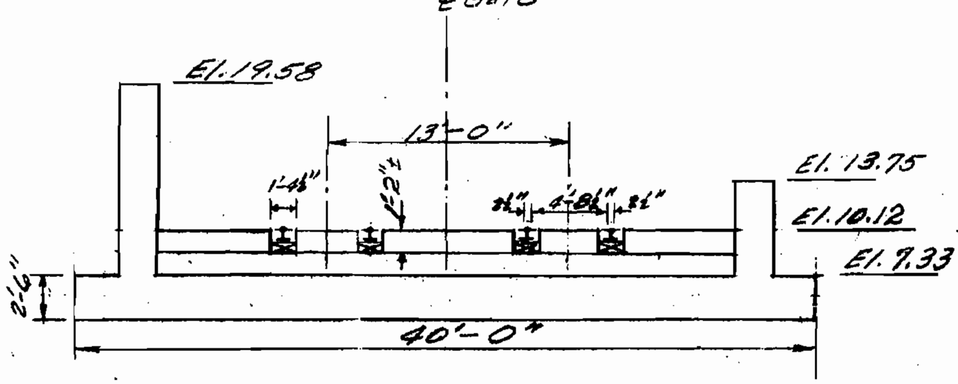


Figure B-1

LAKE PONT. & VIC. (HURR. PROT.) Sheet No 2

BARRIER PLAN GDM Computed by T.S.T.

Ckd by JGB

NEW ORLEANS LAKE FRONT LEVEE

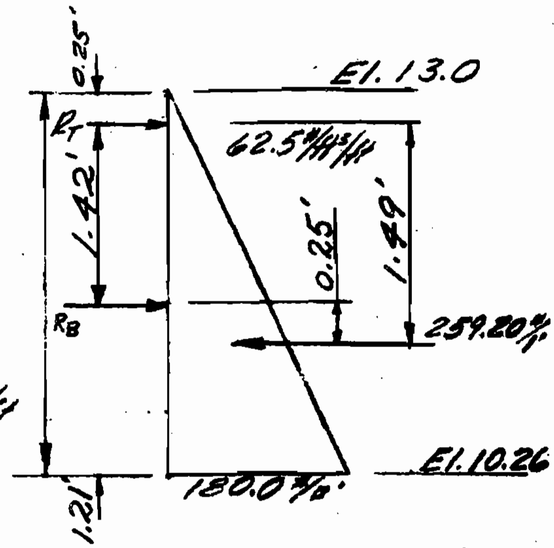
40'-0" SWING GATE MONOLITH (RAILROAD GATE) - Gate #2

REACTIONS

Water at Elev. 13.0

62.5 × 2.88 = 180.00 #/ft²

180.00 × 2.88 × 0.5 = 259.20 #/ft



$$R_T = \frac{259.20 \times 0.25}{1.42} = -45.63\ \#/ft$$

$$R_B = \frac{259.20 \times 1.67}{1.42} = 304.83\ \#/ft$$

GIRDER DESIGN

1. TOP Girder

12"
2"
3½"
1½"
¾"
19.75 = 1'-7¾"

Span = 33'-0" + 1'-7¾" = 34'-7¾"

Load = 45.63#/'

$$Moment = \frac{45.63(34.65)^2}{8} = 6848.1\ ft\text{-}lb = 82,176.6\ in\text{-}lb$$

$$S_{req'd} = \frac{82,176.6}{20,000} = 4.11\ in^3$$

Try W12X36 $S = 46.0\ in^3$; $I = 281.0\ in^4$; $d/A_f = 3.45$
$d = 12.24\ in$; $A = 10.6\ in^2$
$f_s = 1786\ psi$

$$\Delta = \frac{5WL^3}{384EI}$$

$$= \frac{5 \times 45.63 \times 34.65 (34.65 \times 12)^3}{384 \times 29 \times 10^6 \times 281}$$

$$= 0.182'' = \tfrac{3}{16}'' < \frac{l}{360} = 1.155'' = 1\tfrac{5}{32}''$$

USE W 12 × 36

Figure B-2

LAKE PONT. & VIC. (HURR. PROT.) Sheet № 3
BARRIER PLANT GDM Computed by T.S.T.
NEW ORLEANS LAKE FRONT LEVEE Ck'd by JSB

40'-0" SWING GATE MONOLITH (RAILROAD GATE)
Gate #2

2. Bottom Girder

Span = 34'-7¾" = 34.65'

Load = 304.83 #/'

$$Moment = \frac{304.83(34.65)^2}{8} = 45,748 \text{ ft-lb} = 548,979 \text{ in-lb}$$

$$S_{req'd} = \frac{548979}{20000} = 27.45 \text{ in}^3$$

Try W12X36 $S = 46.0 in^3$; $I = 281.0 in^4$; $d/A_f = 3.45$
$d = 12.24 in$; $A = 10.60 in^2$
$f_s = 11,734$ psi

$$\Delta = \frac{5WL^3}{384EI}$$

$$= \frac{5 \times 304.83 \times 34.65(34.65 \times 12)^3}{384 \times 29 \times 10^6 \times 281.0}$$

$$= 1.210'' = 1\tfrac{7}{32}'' \approx 1\tfrac{5}{32}'' \text{ o.k.}$$

Use W 12 × 36

Figure B-3

LAKE PONT. & VIC. (HURR. PROT.) Sheet № 4
BARRIER PLAN GDM Computed by T.S.T.
Ckd by JGB
NEW ORLEANS LAKE FRONT LEVEE
40'-0" SWING GATE MONOLITH (RAILROAD GATE)
Gate #2

3. Skin Plate

Use 5/16" skin Pl $t = 0.3125"$

$$I = \frac{12 \times 0.3125^3}{12} = 0.0305 \text{ in}^4$$

$$S = \frac{2 \times 0.0305}{0.3125} = 0.19520 \text{ in}^3$$

Max. Load = 62.5 #/ft² × 2.63 = 164.38 #/ft

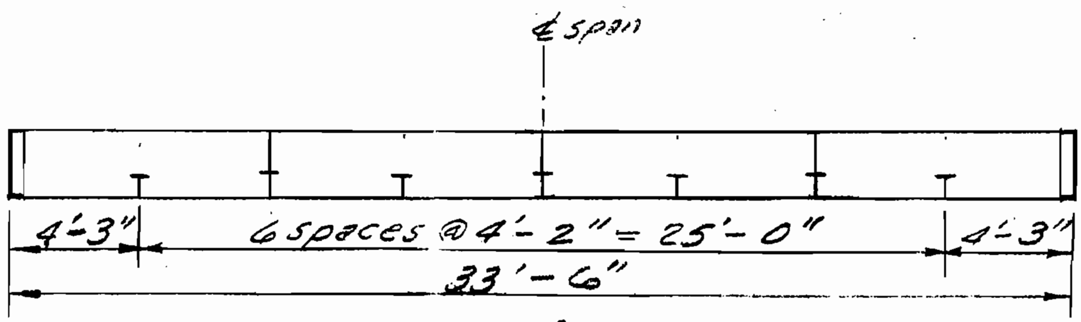
$M_{max.} = S \times f = 0.1952 \times 20{,}000 = 3904$ in-lb

$$(\text{Int. Span})\ M = \frac{164.38 \times L^2 \times 12}{12} = 3904 \text{ in-lb}$$

$L = 4.87'$, USE 4'-2"

$$(\text{End Span})\ M = \frac{164.38 \times L^2 \times 12}{10} = 3904 \text{ in-lb}$$

$L = 4.45'$, USE 4'-3"



$$(\text{Interior})\ M = \frac{164.38 \times 4.17^2 \times 12}{12} = 2858.4 \text{ in-lb}$$

$$f_s = \frac{2858.4}{0.1952} = 14{,}643 \text{ psi}$$

$$(\text{End})\ M = \frac{164.38 \times 4.25^2 \times 12}{10} = 3562.9 \text{ in-lb}$$

$$f_s = \frac{3562.9}{0.1952} = 18{,}253 \text{ psi}$$

Figure B-4

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet No. 5
Computed by T.S.T.
Ckd by JGB

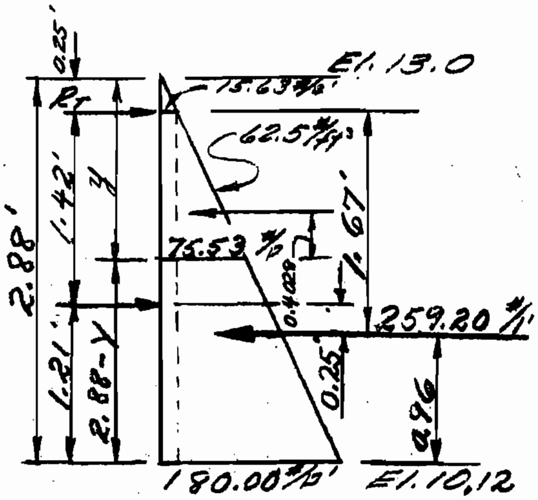
40'-0" SWING GATE MONOLITH (RAILROAD GATE)
Gate #2

$62.5 \times 0.25 = 15.63$ #/ft'
$62.5 \times 2.88 = 180.00$ #/ft'

$R_T = -45.63$ #/ft
$R_B = 304.83$ #/ft

Pt. of zero shear

$$\frac{62.5y^2}{2} = 45.63$$
$$y^2 = 1.460$$
$$y = 1.2084$$



Max. Moment

$$M_{max} = 62.5 \times 0.9584 - \tfrac{1}{2} \times 1.2084 \times 62.5 \times 0.4028$$
$$= 59.90 - 18.38$$
$$= \underline{41.52 \text{ ft-lb}}$$

Design Vertical Members

Spacing @ 4'-3"
$M = 41.52 \times 4.25 \times 12 = 2118$ in-lb

$$S_{req'd} = \frac{2118}{18000} = 0.120 \text{ in}^3$$

Try MT 4x11.25 with 5/16" PL

Note: Min. Thickness of Metal is 5/16", (For Corrosion requirement)

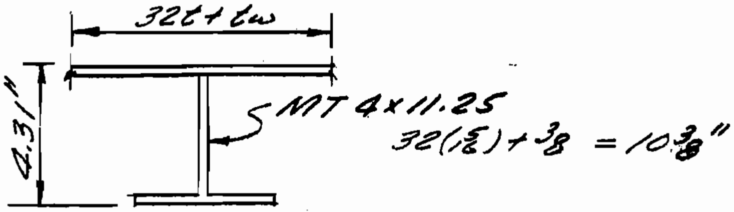
Figure B-5

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet № 6
Computed by T.S.T.
Ckd by JGB

40'-0" SWING GATE MONOLITH (RAILROAD GATE) Gate #2

PROPERTIES OF $\frac{5}{16}$" SKIN PL WITH MT 4 × 11.25



TYPE	AREA	y	Ay	Ay^2	I_o
PL 10.375 × 5/16	3.24	0.157	0.509	0.080	—
MT 4×11.25	3.30	3.30	10.89	35.94	4.70
	$\Sigma A = 6.54$		$\Sigma Ay = 11.40$	36.02	4.70

$$\bar{y} = \frac{\Sigma Ay}{\Sigma A} = \frac{11.40}{6.54} = 1.74''$$

$$I = I_o + \Sigma Ay^2 - (\Sigma Ay \times \bar{y})$$
$$= 4.70 + 36.02 - (11.40 \times 1.74)$$
$$= 20.88 \text{ in}^4$$

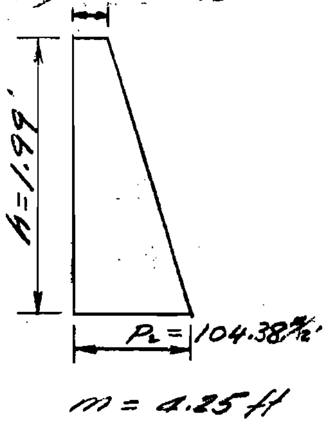
$$S_{Top} = \frac{I}{C_T} = \frac{20.88}{1.74} = 12.0 \text{ in}^3$$

$$S_{Bott.} = \frac{I}{C_B} = \frac{20.88}{2.57} = 8.12 \text{ in}^3$$

Figure B-6

LAKE PONT. & VIC. (HURR. PROT.) Sheet № 7
BARRIER PLAN GDM Computed by T.S.T.
NEW ORLEANS LAKE FRONT LEVEE CKd by JGB
40'-0 SWING GATE MONOLITH (RAILROAD GATE)
Gate #2

Check Deflection



$$\Delta_{Max} = \frac{5h^4 m}{768EI}(P_1 + P_2)$$

$$= \frac{5(1.42\times12)^4 \times 4.25\times12}{768(29\times10^6)(20.88)}\left(\frac{15.63+104.38}{144}\right)$$

$$= 0.00004'' \quad neg.$$

use MT4×11.25 with $\frac{5}{16}''$ PL

TOP Girder (W12×36)

$$L_u = 8'-5''$$

$$d/A_f = 3.45$$

$$I_f = \frac{bh^3}{12} = \frac{0.540(6.565)^3}{12} = 12.73 \text{ in}^4$$

$$A = A_f + \tfrac{1}{6}A_w$$
$$= (0.540\times6.565)+\tfrac{1}{6}[12.24 - 2(0.54)]\times0.305$$
$$= 4.11 \square''$$

$$r_y = \sqrt{\frac{I}{A}} = \sqrt{\frac{12.73}{4.11}} = 1.76$$

$$\frac{L}{r_y} = \frac{101}{1.76} = 57.4$$

Formula 4

$$C_b = 1.00 \; ; \; C_c = 126.1$$

$$K_2 = 1 - \frac{\left(\frac{L}{r}\right)^2}{2C_c^2 C_b}$$

$$= 1 - \frac{(57.4)^2}{2(126.1)^2\times1.0} = 0.8964$$

$$F_b = 0.50K_2F_y$$
$$= 0.5\times0.8964\times36000$$
$$= 16,135 \text{ psi}$$

Figure B-7

LAKE PONT. & VIC. (HURR. PROT.) Sheet № 8
BARRIER PLAN G.D.M. Computed by T.S.T.
NEW ORLEANS LAKE FRONT LEVEE CKd by JGB
40'-0" SWING GATE MONOLITH (RAILROAD GATE) Gate #2

Formula 5

$$F_b = \frac{10{,}000000}{\ell d/A_f}$$

$$= \frac{10{,}000000}{101\ (3.45)} = 28{,}699\ psi \quad \text{use } 18{,}000\ psi$$

$$f_b = 1786\ psi \qquad f_b < F_b$$

Bottom Girder (W12×36)

$$L_u = 8'-5''$$

$$d/A_f = 3.45$$

$$I_f = \frac{bh^3}{12} = \frac{0.808(8.222)^3}{12} = 17.46\ in^4$$

$$A = A_f + \tfrac{1}{6} A_w$$

$$= (0.808 \times 8.222) + \tfrac{1}{6}[8.75 - 2(0.808)] \times 0.510$$

$$= 4.67\ \square''$$

$$r_y = \sqrt{\frac{37.43}{7.25}} = 1.94$$

$$\frac{L}{r_y} = \frac{98}{1.94} = 50.5$$

Formula 4

$$K_2 = 1 - \frac{(50.5)^2}{2(126.1)^2 \times 1.0} = 0.92$$

$$F_b = 0.5 \times 0.92 \times 36000$$

$$= 16{,}560\ psi$$

Formula 5

$$F_b = \frac{10\ 000000}{101\ (3.45)}$$

$$= 28699\ psi \quad \text{use } 18000\ psi$$

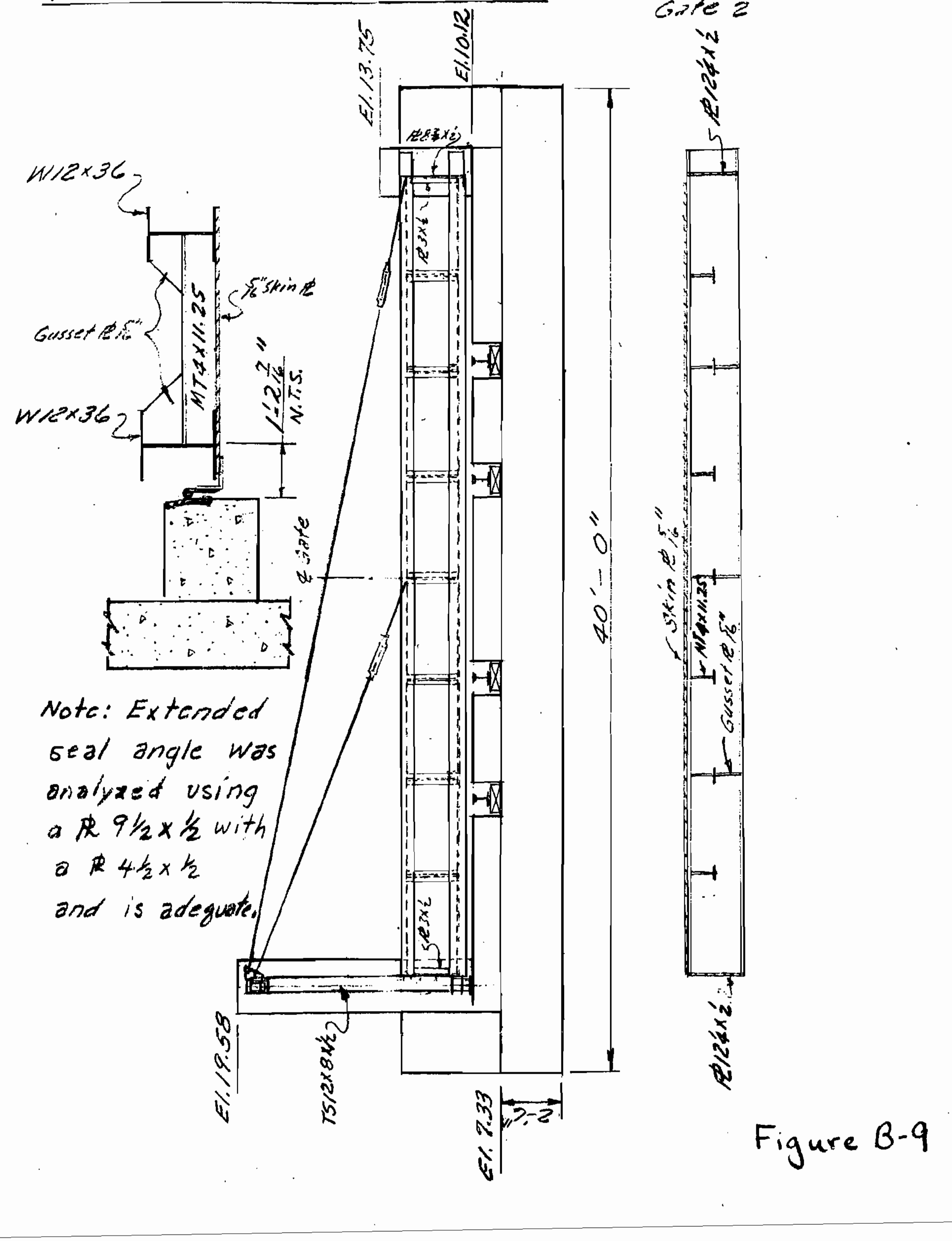
$$f_b = 11{,}934\ psi \qquad f_b < F_b$$

Figure B-8

LAKE PONT & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet No 9
Computed by T.
Ckd by JGB

<u>40'-0" SWING GATE MONOLITH</u> (RAILROAD GATE)
Gate 2



Note: Extended seal angle was analyzed using a ℘ 9½ x ½ with a ℘ 4½ x ½ and is adequate.

Figure B-9

LAKE PONT. & VIC. (HURR PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet No 10
Computed by T.S.T.
CKd by JGB

40'-0" SWING GATE MONOLITH (RAIL ROAD GATE)
Gate #2

MEMBER	SIZE	NO	WT/FT	LENGTH	WEIGHT (TOTAL)
Top Girder	W 12×36	1	36	34.42	1239.1
Bott Girder	W12×36	1	36	34.42	1239.1
Skin Plate	5/16 × 1'-11"	1	24.4	33.40	815.0
Vertical Ts	MT4×11.25	7	11.25	1.37	107.9
Seal Angle	PL 12½ × ½ and PL 4½ × ½	1 ea	28.95	33.50	969.8
Bars (Bothsides)	Bar 1½ × 1½	1	7.65	1.87	14.3
Stiffener PL	PL 8⅜ × 5/16	14	8.965	0.96	120.5
End PL	PL 12¼ × ½	1	20.83	1.37	28.5
End PL	PL 3 × ½	1	5.10	0.85	4.3
Structural Tube	TS 12×8×½	1	60.95	6.98	425.4
			Steel Gate Weight		4963.9#

MEMBER	WEIGHT	ARM	MOMENT
Top Girder	1239.1	6.15	7620.5
Bott. Girder	1239.1	6.15	7620.5
Skin Plate	815.0	0.156	127.1
Vertical Ts	107.9	3.30	356.1
Seal Angle	969.8	0.93	901.9
Bars (Bothside)	14.3	0.75	10.7
Stiffener PL	120.5	7.93	955.6
End PL	28.5	6.43	183.3
End PL	4.3	12.30	52.9
TS 12×8×½	425.4	6.15	2616.2
	4963.9	4.12	20444.8

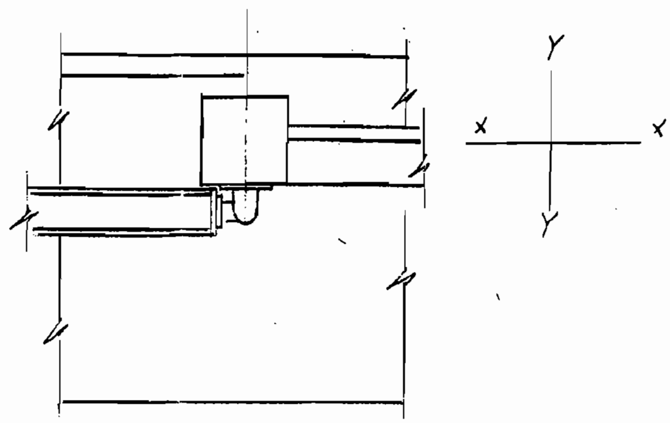
Figure B-10

LAKE PONT. & VIC. (HURR. PROT.) Sheet No 11
BARRIER PLAN GDM Computed by TST
NEW ORLEANS LAKE FRONT LEVEE Ckd by JGB

40'-0" SWING GATE MONOLITH (RAILROAD GATE)

COLUMN DESIGN

LOAD CASES



CASE I — Gate closed, water @ El. 13.0, NO Wind
100% Forces used.

CASE II — Gate closed, Water @ El. 13.0, Wind from F.S. - 75% Forces used.

CASE III — Gate Open (parallel to Wall), NO Water, NO Wind — 100% Forces used.

CASE IV — Gate Open (perpendicular to wall), NO Water, NO Wind — 100% Forces used.

Figure B-11

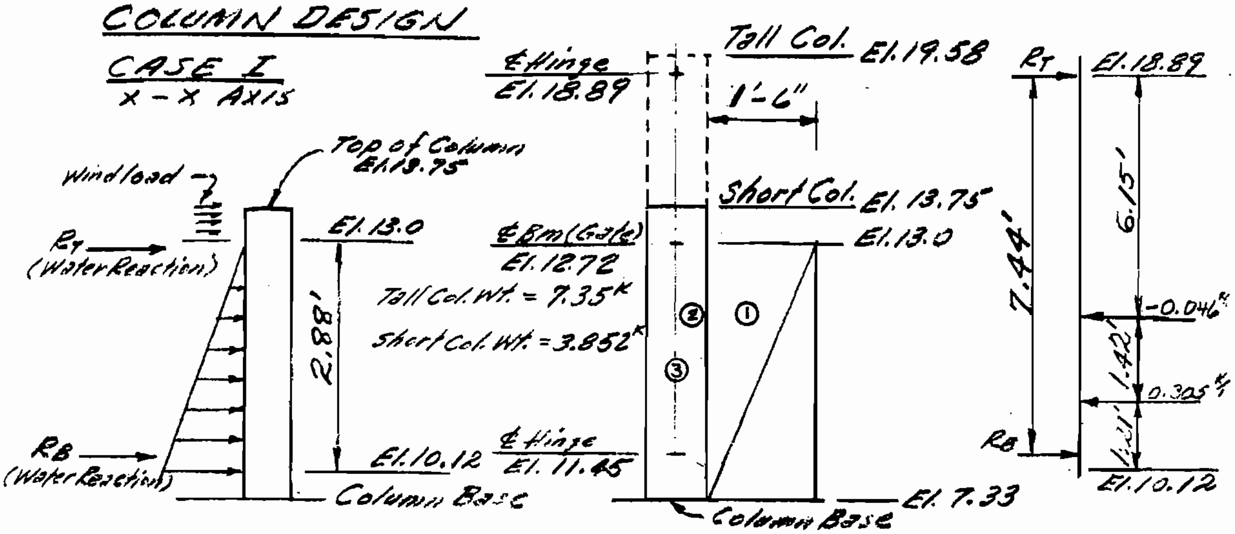
LAKE PONT. & VIC. (HURR. PROT.) Sheet No. 12
BARRIER PLAN GDM Computed by T.S.T.
NEW ORLEANS LAKE FRONT LEVEE Ckd by

40'-0" SWING GATE MONOLITH (RAILROAD GATE)

COLUMN DESIGN

CASE I

X - X AXIS



Gate Loads

Water : $W_T = -0.046$ k/' ; $W_B = 0.305$ k/' (See Gate Design Sheet No. 2)

(Tall Col.) $R_T = \frac{[0.305(0.12)+0.046(1.54)]17.325}{7.44} = 0.252^K$

$M_T = 0.252 \times 11.56 = 2.91^{'K}$

(Short Col.) $R_T = 0.046 \times 17.325 = 0.80^K$

$M_T = 0.80 \times 5.39 = 4.31^{'K}$

Wind :

(Tall Col.) $R_w = 0.05(2)(6.58) = \underline{0.66}^K$; $M_w = 0.66(8.96) = \underline{5.91}^{'K}$

(Short Col.) $R_w = 0.05(2)(0.75) = \underline{0.08}^K$; $M_w = 0.08(6.045) = \underline{0.48}^{'K}$

Wall Loads

Water :

① $1/3(1/2)(1.5)(5.67)(0.0625)(5.67) = 0.50^K \times 2.84 = 1.42^{'K}$

② $1/2(5.67)(2.0)(0.0625)(5.67) = 2.01^K \times 1.89 = 3.80^{'K}$

$\Sigma V_w = 2.51^K$ $\Sigma M_w = 5.22^{'K}$

(Tall Col.) $\Sigma H = 3.22^K$ $\Sigma M = 11.75^{'K}$

(Short Col.) $\Sigma H = 3.39^K$ $\Sigma M = 10.01^{'K}$

Z - Z Axis

① $0.50^K \times 1.50 = 0.75^{'K}$

$\Sigma H = 0.50^K$ $\Sigma M = 0.75^{'K}$

Figure B-12

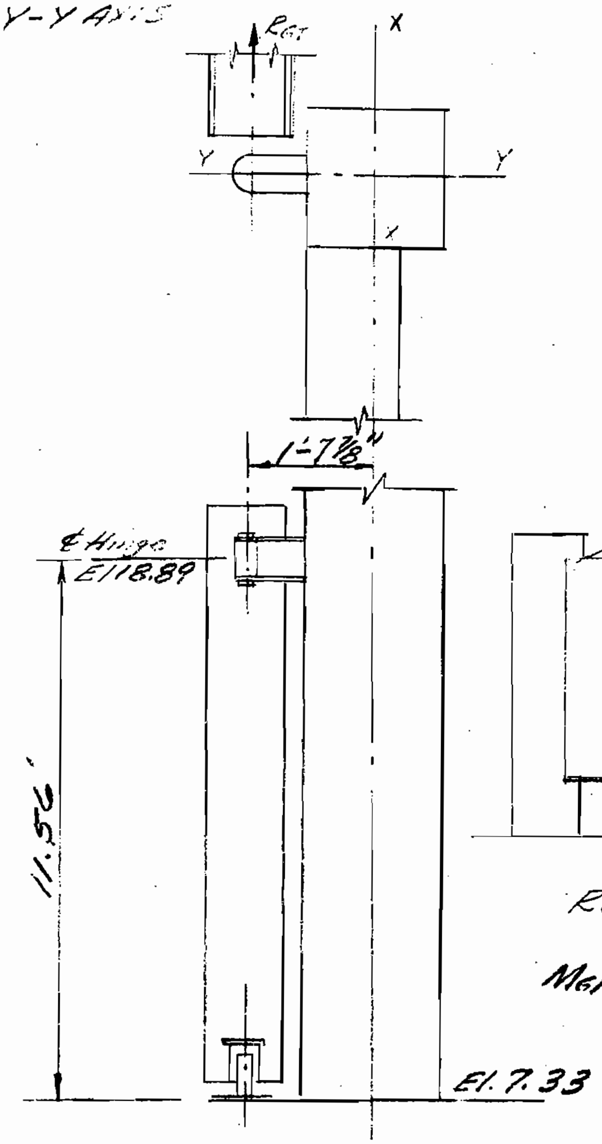
LAKE PONT & VIC. (HURR. PROT.). Sheet No 13
BARRIER PLAN GDM Computed by TST
NEW ORLEANS LAKE FRONT LEVEE Ckd by JGB 9-71

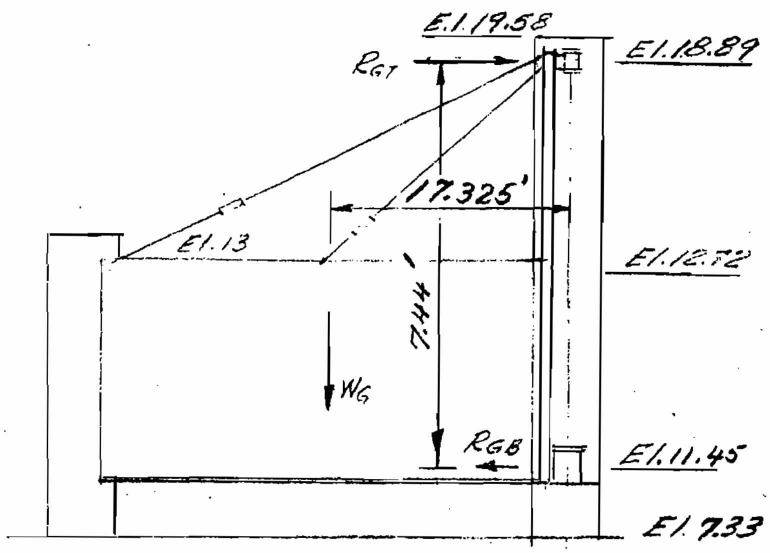
<u>40'-0" SWING GATE MONOLITH (RAILROAD GATE)</u>

<u>COLUMN DESIGN</u>

<u>CASE I</u>

Y-Y AXIS





$$R_{GT} = \frac{W_G(17.325)}{7.44} \quad \frac{5.0(17.325)}{7.44} = 11.64^{k}$$

$$M_{GT} = 11.64(11.56) = 134.56^{\prime k}$$

Z-Z AXIS

$$M = 11.64(1.66) = 19.32^{\prime k}$$

$$M_2 = 0.75 - 19.32 = -18.67^{\prime k}$$

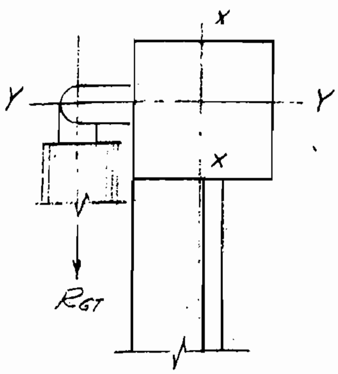
Figure B-13

LAKE PONT. & VIC. (HURR. PROT.) Sheet No. 14
BARRIER PLAN G D M Computed by TST
NEW ORLEANS LAKE FRONT LEVEE Ckd by JGB

40'-0" SWING GATE MONOLITH (RAILROAD GATE)

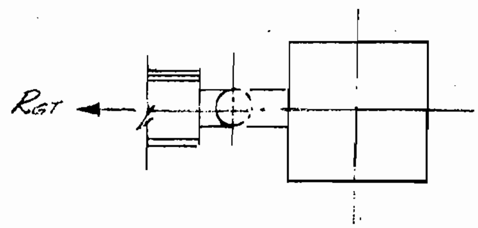
COLUMN DESIGN

CASE II — Y-Y AXIS



$R_{GT} = 11.64^{K}$ (see sht 13)
$M_{GT} = 134.56^{'K}$

CASE III — X-X AXIS



$R_{GT} = 11.64^{K}$ (see sht 13)
$M_{GT} = 134.56^{'K}$

CASE II — Z-Z Axis,
$M = 19.32^{'K}$ (see sht. 13)

Axial Load (P) — Column Wt.
Short Col. : $2 \times 2 \times 6.42 \times 0.15 = 3.85^{K}$
Tall Col. : $2 \times 2 \times 12.25 \times 0.15 = 7.35^{K}$

SUMMARY

I. Short Column

CASE	P	M_x	M_y	M_z
I	3.94^{K}	$16.26^{'K}$	$90.69^{'K}$	$-21.35^{'K}$
75%	2.96^{K}	$12.20^{'K}$	$68.02^{'K}$	$-16.04^{'K}$
II	3.94^{K}	0	$90.69^{'K}$	$27.35^{'K}$
III	3.94^{K}	$16.26^{'K}$	0	0

II. Tall Column

CASE	P	M_x	M_y	M_z
I	7.43^{K}	$21.45^{'K}$	$90.69^{'K}$	$-21.35^{'K}$
75%	5.57^{K}	$16.09^{'K}$	$68.02^{'K}$	$-16.04^{'K}$
II	7.43^{K}	0	$90.69^{'K}$	$27.35^{'K}$
III	7.43^{K}	$21.45^{'K}$	0	0

Figure B-14

LAKE PONT & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE
EAST IHNC

Sheet No. 15
Comp. by JGB
Chkd by 757
Date 8 July 71

40'-0" SWING GATE MONOLITH (RAILROAD GATE)

COLUMN DESIGN

SUMMARY OF LOADS

ITEM	Axial P	Shear H	Moments M_x	M_y	M_z
SHORT COLUMN					
Water Loads:					
Gate		0.80	4.31		
Wall		2.51	5.22		0.75
Water Total ①		3.31	9.53		0.75
Wind from F.S above 13.0		0.08	0.48		
Wind Total ②		0.08	0.48		
Dead Loads ③	3.85				
CASE I SUM ①③ 100% TOTALS	3.85	3.31	9.53		0.75
CASE II SUM ①,②, and ③ 75% TOTALS	3.85 2.89	3.39 2.54	10.01 7.51	0 0	0.75 0.56
CASES III & IV ③	3.85	0	0	0	0
TALL COLUMN					
Water Loads					
Gate		0.05	0.62		
Wall		2.51	5.22		0.75
Water Total ①		2.56	5.84		0.75
Wind from F.S (above 13.0) ②		0.66	5.91		
Dead Loads ③	7.35	11.64		134.56	-19.32

Figure B-15

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKEFRONT LEVEE
EAST IHNC

Sheet No. 16
Comp. by JGB
Chkd by TSJ
Date 8 July 71

40'-0" SWING GATE MONOLITH (RAILROAD GATE)

COLUMN DESIGN

SUMMARY OF LOADS

ITEM	Axial P	Shear H	Moments M_x	M_y	M_z
TALL COLUMN					
CASE I SUM 1 2 100% TOTALS	7.35	14.20	5.84	134.56	-18.57
CASE II SUM 1 2 3	7.35	14.86	11.75	134.56	-18.57
75% TOTALS	5.51	11.15	8.81	100.92	-13.93
CASE III 3 100% TOTALS	7.35	11.64	0	134.56	-19.32
CASE IV 3 100% TOTALS	7.35	11.64	134.56	0	0

Figure B-16

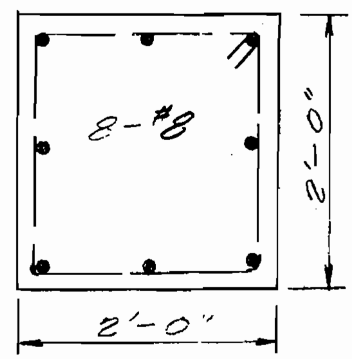
LAKE PONT. & VIC. (HURR. PROT.) Sheet No 17 -
BARRIER PLAN GDM Computed by TST
NEW ORLEANS LAKE FRONT LEVEE Ckd by JGB 9-71

<u>40'-0" SWING GATE MONOLITH</u> (RAILROAD GATE),
<u>COLUMN DESIGN</u>

Use the computer program K29045 "Concrete General Flexure Analysis" to solve for concrete and reinforcing steel stresses for an assumed section.

I. <u>Section Assumed</u>: — For short column only

Allowables: $f_c = 1.050$ ksi
$f_{st} = 16.0$ ksi
$f_{sc} = 13.0$ ksi



CASE	Max. fc (ksi)	Max fst (ksi)	Max. fsc (ksi)
I	0.107	2.15	0.90
II	0.089	1.84	0.73
III	0.01	0.10	0.10
IV	0.01	0.10	0.10

$$\rho = \frac{8(0.79)}{24 \times 24} = 0.011$$

$$0.01 < \rho < 0.08$$

<u>Shear</u>

$V_{max} = 3.31$ (CASE I)

$$v = \frac{V}{bd} = \frac{3.31}{(24.(} = 0.007 \text{ ksi} < 0.060 \text{ ksi}$$

No stirrup Req'd

<u>Bond</u>

$$u = \frac{V}{\underset{3-\#8s}{\Sigma o}\, jd} = \frac{3.31}{(9.4)(0.875)(21.0)} = 0.019 \text{ ksi} < 0.263 \text{ ksi}$$

Figure B-17

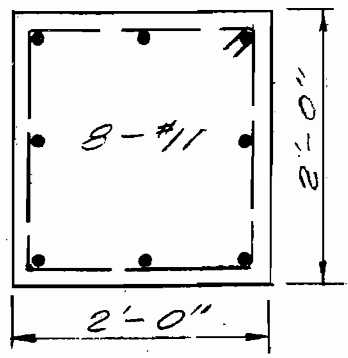
LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN G D M
NEW ORLEANS LAKE FRONT LEVEE

Sheet № 18
Computed by TST
Ckd by. JGB 9.71

40'-0" SWING GATE MONOLITH (RAILROAD GATE)
COLUMN DESIGN

II. Section Assumed: — For Tall Column only

Allowable: $f_c = 1.050$ ksi
$f_{st} = 16.0$ ksi
$f_{sc} = 13.6$ ksi



CASE	Max. f_c (ksi)	Max. f_{st} (ksi)	Max. f_{sc} (ksi)
I	0.83	14.01	7.86
II	0.66	10.79	6.40
III	0.74	13.42	6.71
IV	0.74	13.42	6.71

$$p = \frac{8(1.56)}{24 \times 24} = 0.022$$

$$0.01 < p < 0.08$$

Shear

$$H_{max.} = 14.20^k$$

$$V_t = \frac{V}{bd} = \frac{14.20}{(24)(21)} = 0.028 \text{ ksi} < 0.060 \text{ ksi}$$

Bond

$$u = \frac{V}{\Sigma_0 jd} = \frac{14.20}{(13.29)(0.875)(21)} = 0.058 \text{ ksi} < 0.187 \text{ ksi}$$

3-#11

Figure B-18

40'-0" SWING GATE MONOLITH (RAILROAD GATE)
COLUMN DESIGN

Torsion (Tall Column)

$M_t = 19.32^{'k} = 231.84^{''k}$ (CASE III)

$b = 24''$

$h = 24''$

$v_t = \frac{5M_t}{b^2 h} = \frac{5(231.84)}{(24)^2(24)} = 0.0839$ ksi

Combine flexural shear stress with torsional shear stress.

$V = V_t + V_f = 0.0839 + 0.028 = 0.1119$ ksi > 0.060 ksi

Stirrup is Req'd

Compute Equivalent Flexural Shear

$V = vbd = 0.1119(24)(21) = 56.40^{k}$

$V_c = 0.060(24)(21) = 30.24^{k}$

$v' = V - V_c = 56.40 - 30.24 = 26.12^{k}$

Use #4 Stirrup ($A_v = 0.40$ sq in)

$\text{spacing} = \frac{A_v f_v d}{v'} = \frac{0.40(20.0)(21.0)}{26.16} = 6.42''$ use 6"

Use #4 Stirrup @ 6"

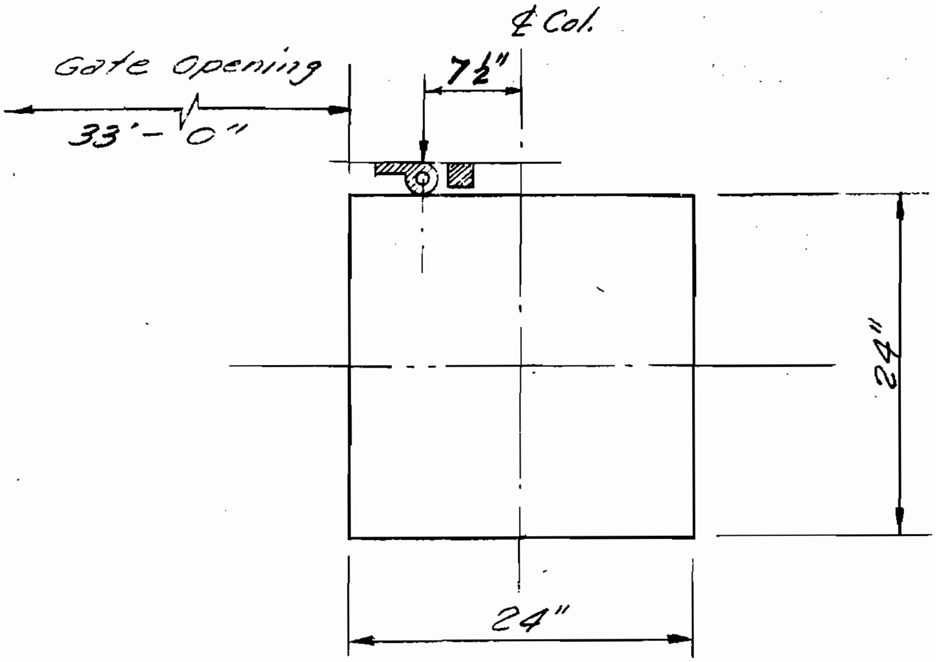
LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN G D M
NEW ORLEANS LAKE FRONT LEVEE

Sheet No. 20
Computed by T.S.T.
Ckd by JGB 9-71

TORSIONAL ANALYSIS ON SWING GATE COLUMN

40'-0" SWING GATE MONOLITH
(RAILROAD GATE #2)

Assume Loads transmitted thru. Rubber seal to col.



Load on gate (Water)

$0.0625(3.0)^2 \times 0.5 = 0.2813\ ^{k}/'$

$M_t = 0.2813 \times 16.5 \times 0.625 = 2.90\ ^{'k}$

Max. shear stress, $v_t = \frac{\eta M_t}{b^2 h}$

$= \frac{5(2900)12}{(24)^2 24}$

$= 12.6$ psi

Total Shear stresses = Flexural Shear + Torsional Shear

= 28.00 psi + 12.6 psi

= 40.6 psi < 60 psi o.k.

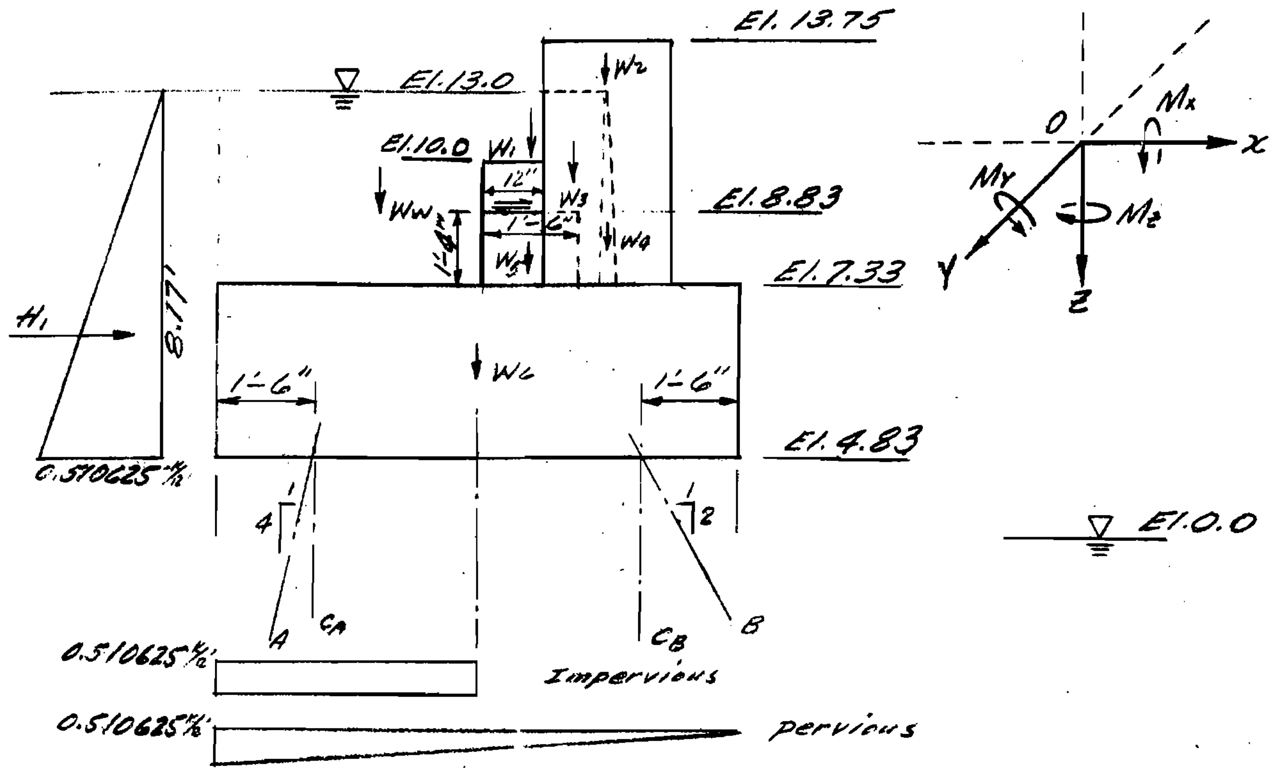
NO stirrup Needed.

Figure B-20

LAKE PONT. & VIC. (HURR. PROT.) BARRIER PLAN GDM NEW ORLEANS LAKE FRONT LEVEE

Sheet No 21
Computed by TST.
Ckd by JGB 9-71

40'-0" SWING GATE MONOLITH (RAIL ROAD GATE)
Gate # 2



LOAD CASES

CASE I — Water @ El. 13.0, no wind, impervious soil.

CASE II — Water @ El. 13.0, no wind, pervious soil.

CASE III — No Water, no wind, 2 train, 2 wheel axles on edge F.S.

CASE IV — No Water, no wind, 2 train, 2 wheel axles on edge P.S.

CASE V — No water, no wind, 2 train, 4 wheel axles on slab F.S.

CASE VI — No water, no wind, 2 train, 4 wheel axles on slab P.S.

CASE VII — No water, wind from P.S., 2 train, 4 wheel axles on slab floodside, Longitudinal force towards F.S. (75% forces used)

CASE VIII — No water, wind from F.S., 2 train, 4 wheel axles on slab protected side, longitudinal force towards protected side (75% forces used)

Figure B-21

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet № 22
Computed by TST.
Ckd by LLW

40'-0" SWING GATE MONOLITH (RAILROAD GATE)
Gate #2

MOMENT ABOUT X-X AXIS

ITEM	COMPUTATION	F_z (K)	F_Y (K)	Arm (ft)	M_{x-x} (ft-K)
Conc. Slab, W_1	(2.5)(8)(40)(0.15)	120.00		-4.00	-480.00
Conc. Col., W_2	(6.42+12.25)(2)(2)(0.15)	11.20		-6.00	-67.20
Wall Wt., W_3	(1)(5)(5.67)(0.15)	4.25		-5.50	-23.38
Wall Wt., W_4	½(5.67)(5)(0.24)(0.15)	0.51		-6.08	-3.10
Sill Bm., W_5	(2.93)(1.5)(35.42)(0.15)	23.35		-4.75	-110.91
Subtotal - Concrete only		159.31			-684.59
Water Wt., W_W	(5.67)(5)(40)(0.0625)	70.88		-2.50	-283.50
Water Wt. W_{W_1}	-(2.93)(1.0)(35.42)(0.0625)	-6.49		-4.50	29.21
Water Force, H_1	½(8.17)²(40)(0.0625)		-83.44	2.72	-226.96
Gate Wt., W_1	Closed	5.00		-4.23	-21.15
Imp. uplift	-(8.17)(4)(40)(0.0625)	-81.70		-2.00	163.40
Case I Total (100%)		147.00	-83.44		-1023.59
Water Wt., W_W	(5.67)(5)(40)(0.0625)	70.88		-2.50	-283.50
Water Wt., W_{W_1}	-(2.93)(1)(35.42)(0.0625)	-6.49		-4.50	29.21
Water Force, H_1	½(8.17)²(40)(0.0625)		-83.44	2.72	-226.96
Gate Wt., W_1	Closed	5.00		-4.23	-21.15
perv. uplift	-½(8.17)(8)(40)(0.0625)	-81.70		-2.67	218.14
Case II Total (100%)		147.00	-83.44		-968.85
Train	1 Cooper 80	160.00		—	—
Gate Wt., W_1	opened	2.50		-4.23	-10.58
Case III Total (100%)		321.81	—		-695.17

Figure B-22

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet No. 23
Computed by T.S.T.
Ckd by LLW

40'-0" SWING GATE MONOLITH (RAILROAD GATE) Gate #2
MOMENT ABOUT X-X AXIS (Con't)

ITEM	COMPUTATION	F_z (K)	F_y (K)	Arm (ft)	M_{x-x} (ft-K)
Train	1 Cooper 80	160.00		-8.00	-1280.00
Gate Wt. W_1	opened	2.50		-4.23	-10.58
Case IV	Total (100%)	321.81	—		-1975.19
Train	1 Cooper 80	160.00		—	—
		160.00		-5.00	-800.00
Gate Wt. W_1	opened	2.50		-4.23	-10.58
Case V	Total (100%)	481.81	—		-1495.17
Train	1 Cooper 80	160.00		-3.00	-480.00
		160.00		-8.00	-1280.00
Gate Wt. W_1	opened	2.5		-4.23	-10.58
Case VI	Total (100%)	481.81	—		-2455.17
Train	2 Cooper 80	160.00		—	—
		160.00		-5.00	-800.00
Gate Wt. W_1	opened	2.50		-4.23	-10.58
Wind From Protectedside					
Wall	(5.67)(3)(0.050)		0.85	5.34	4.54
Col. (Tall)	(12.25)(2)(0.05)		1.23	8.63	10.61
Col. (Short)	(6.42)(2)(0.05)		0.64	5.71	3.65
Sill	(2.93)(35.42)(0.05)		5.19	3.97	20.60
Train (Long F.)	0.15 (160)		24.00	5.43	130.32
Case VII	Total	481.81	31.91		-1325.45
	75%	361.36	23.93		-994.09
Train	1 Cooper 80	160.00		-3.00	-480.00
		160.00		-8.00	-1280.00
Gate Wt. W_1	opened	2.50		-4.23	-10.58
Wind From Floodside					
Wall	(5.67)(3)(0.05)		-0.85	5.34	-4.54
Col. (Tall)	(12.25)(2)(0.05)		-1.23	8.63	-10.61
Col. (Short)	(6.42)(2)(0.05)		-0.64	5.71	-3.65
Sill	(2.93)(35.42)(0.05)		-5.19	3.97	-20.60
Train (Long F.)	-(0.15)(160)		-24.00	5.43	-130.32
Case VIII	Total	481.81	-31.91		-2624.89
	75%	361.36	-23.93		-1968.67

Figure B-23

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet № 24
Computed by TST
Ckd by LLW

40'-0" SWING GATE MONOLITH (RAILROAD GATE)
Gate #2

MOMENT ABOUT Y-Y AXIS

ITEM	COMPUTATION	Fz(K)	Fx(K)	Arm(ft)	My-y(ft-k)
Conc. Slab, W6	(2.5)(8)(40)(0.15)	120.00		-20.00	-2400.00
Conc. Col, W2	(2)(2)(6.42)(0.15)	3.85		-2.50	-9.63
Conc. Col, W2	(2)(2)(12.25)(0.15)	7.35		-37.50	-275.63
Wall Wt, W3	(1)(2.5)(5.67)(0.15) +				
Wall Wt, W4	½(5.67)(2.5)(0.24)(0.15)	2.38		-0.75	-1.79
Wall Wt, W3	(1)(2.5)(5.67)(0.15) +				
Wall Wt, W4	½(5.67)(2.5)(0.24)(0.15)	2.38		-39.25	-93.42
Sill Bm, W5	(2.93)(1.5)(35.42)(0.15)	23.35		-20.00	-467.00
Subtotal - Concrete only		159.31			-3247.47
Water Wt-Sill	(5.67)(5)(40)(0.0625) - (1)(2.93)(35.42)(0.0625)	64.39		-20.00	-1287.80
Gate Wt, W1		5.00		-37.58	-187.90
Imp. uplift	-(8.17)(4)(40)(0.0625)	-81.70		-20.00	1634.00
Case I Total (100%)		147.00	—		-3089.17
Water Wt-Sill	(5.67)(5)(40)(0.0625) - (1)(2.93)(35.42)(0.0625)	64.39		-20.00	-1287.80
Gate Wt, W1		5.00		-37.58	-187.90
Perv. uplift	-½(8.17)(8)(40)(0.0625)	-81.70		-20.00	1634.00
Case II Total (100%)		147.00	—		-3089.17
Train	1 Cooper 80	160.00		-20.00	-3200.00
Gate Wt, W1	opened	2.50		-37.58	-93.95
Case III Total (100%)		321.81			-6541.42
Train	1 Cooper 80	160.00		-20.00	-3200.00
Gate Wt, W1	opened	2.50		-37.58	-93.95
Case IV Total (100%)		321.81			-6541.42

Figure B-24

LAKE PONT & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet № 25
Computed by TST
Ckd by. LLW

40'-0" SWING GATE MONOLITH (RAILROAD GATE) Gate #2
MOMENT ABOUT Y-Y AXIS (con't)

ITEM	COMPUTATION	F_z (k)	F_x (k)	Arm (ft)	M_{Y-Y} (ft-k)
Train	2 Cooper 80	320.00		-20.00	-6400.00
Gate wt.	opened	2.50		-37.58	-93.95
Case V Total (100%)		481.81			-9741.42
Train	2 Cooper 80	320.00		-20.00	-6400.00
Gate wt.	opened	2.50		-37.58	-93.95
Case VI Total (100%)		481.81			-9741.42
Train	2 Cooper 80	320.00		-20.00	-6400.00
Gate wt.	opened	2.50		-37.58	-93.95
Case VII & VIII Total		481.81			-9741.42
75%		361.36			-7306.07

Figure B-25

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet No 26
Computed by TST
Ckd by LLW

40'-6" SWING GATE MONOLITH (RAILROAD GATE)
Gate #2
MOMENT ABOUT Z-Z AXIS

ITEM	COMPUTATION	Fy (K)	Fx (K)	Arm (ft)	M_{z-z} (ft-K)
Farside	Water Force				
On Wall & Col.	$-\frac{1}{2}(5.67)^2(3.5)(0.0625)$	-3.52		38.25	-134.64
On Gate @ Hinge	$-\frac{1}{2}(5.67)^2(16.5)(0.0625)$	-16.58		37.58	-623.08
Near Side					
On Gate @ Col.	$-\frac{1}{2}(5.67)^2(16.5)(0.0625)$	-16.58		2.50	-41.45
On Wall & Col.	$-\frac{1}{2}(5.67)^2(3.5)(0.0625)$	-3.52		1.75	-6.16
On Base slab	-(2.5)(40)(0.44125)	-43.53		20.00	-870.60
Case I & II Total (100%)		-83.73	—		-1675.93
Case III, IV, V & VI Total		0.00	—		0.00
Far side	Wind Force				
Wall	(5.67)(1.5)(0.050)	0.43		39.25	16.88
Col	(2)(12.25)(0.050)	1.23		37.50	46.13
Near Side					
Wall	(5.67)(1.5)(0.050)	0.43		0.75	0.32
Col	(2)(6.42)(0.050)	0.64		2.50	1.60
Sill	(2.93)(35.42)(0.050)	3.72		20.00	74.40
Train (Long force)	(0.15)(160)	24.00		20.00	480.00
Case VII Total		30.45	—		619.33
75%		22.84	—		464.50
Case VIII Total		-30.45	—		-619.33
75%		-22.84	—		-464.50

Figure B-26

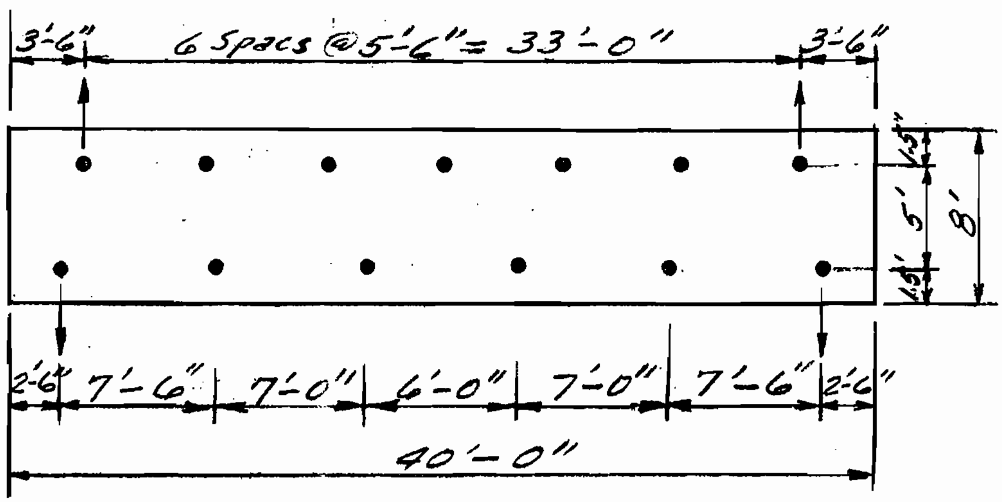
LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet No 27
Computed by T.S.T
Ckd by LLW

40'-0" SWING GATE MONOLITH (R.R. GATE)
Gate #2

SUMMARY OF LOADS ON GATE MONOLITH

CASE	Fx (K)	Fy (K)	Fz (K)	Mx-x (ft-K)	My-y (ft-K)	Mz-z (ft-K)
I	0.00	-83.44	147.00	-1023.59	-3089.17	-1675.93
II	0.00	-83.44	147.00	-968.85	-3089.17	-1675.93
III	0.00	——	321.81	-695.17	-6541.42	0.00
IV	0.00	——	321.81	-1975.17	-6541.42	0.00
V	0.00	——	481.81	-1495.17	-9741.42	0.00
VI	0.00	——	481.81	-2455.17	-9741.42	0.00
VII	0.00	23.93	361.36	-994.09	-7306.07	464.50
VIII	0.00	-23.93	361.36	-1968.67	-7306.07	-464.50



Pile Spacing in Gate Monolith

Figure B-27

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet № 28
Computed by TST
CKd by LLW

40'-0" SWING GATE MONOLITH (R. R. GATE)
Gate #2

	Fx (K)	Fy (K)	Fz (K)
1. Case I (100%)			
Pile "A" Group	-1.4	0.0	-23.6
Pile "B" Group	1.2	0.0	63.5
Pile "C_A" Group	-1.4	0.0	8.0
Pile "C_B" Group	-1.4	0.0	11.2
2. Case II (100%)			
Pile "A" Group	-1.4	0.0	-22.4
Pile "B" Group	-1.3	0.0	63.4
Pile "C_A" Group	-1.4	0.0	10.2
Pile "C_B" Group	1.4	0.0	9.1
3. Case III (100%)			
Pile "A" Group	-0.5	0.0	42.1
Pile "B" Group	-0.3	0.0	17.4
Pile "C_A" Group	-0.4	0.0	49.3
Pile "C_B" Group	0.4	0.0	1.8
4. Case IV (100%)			
Pile "A" Group	0.7	0.0	15.7
Pile "B" Group	-1.0	0.0	19.6
Pile "C_A" Group	0.7	0.0	-1.8
Pile "C_B" Group	0.7	0.0	52.0
5. Case V (100%)			
Pile "A" Group	-0.3	0.0	53.0
Pile "B" Group	0.0	0.0	26.4
Pile "C_A" Group	-0.2	0.0	56.0
Pile "C_B" Group	-0.2	0.0	21.0
6. Case VI (100%)			
Pile "A" Group	0.6	0.0	33.2
Pile "B" Group	-0.9	0.0	28.1
Pile "C_A" Group	0.7	0.0	17.7
Pile "C_B" Group	0.7	0.0	58.6

Figure B-28

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN SDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet No. 29
Computed by T.S.T.
Ckd by LLW

40'-0" SWING GATE MONOLITH (R.R. GATE)
Gate #2

7. Case VII (75%)	F_x (K)	F_y (K)	F_z (K)
Pile "A" Group	0.3	0.0	64.6
Pile "B" Group	1.7	0.0	73.0
Pile "C_A" Group	-1.5	0.0	54.5
Pile "C_B" Group	-1.5	0.0	9.6
8. Case VIII (75%)			
Pile "A" Group	0.1	0.0	15.3
Pile "B" Group	-0.3	0.0	35.9
Pile "C_A" Group	0.1	0.0	11.7
Pile "C_B" Group	0.1	0.0	43.5

I. For Top slab Reinforcing

Case I Loading (100%)

Pile "A_{zv}" $= 22.90 \times 2 \div 40 = 1.145^k \times 3.5 = 4.01'^k$

Pile "A_{xv}" $= 0.34 \times 2 \div 40 = 0.017^k \times 3.5 = 0.06'^k$

Pile "C_A" $= -11.20 \times 4 \div 40 = -1.210^k \times 3.5 = -3.92'^k$

$W_w = 1 \times 5 \times 5.67 \times 0.0625 = 1.772^k \times 2.5 = 4.43'^k$

$-W_1 = 1 \times 2.93 \times 1 \times 0.0625 = -0.183^k \times 0.5 = -0.09'^k$

$-W_w = 1 \times 4 \times 8.17 \times 0.0625 = -2.043^k \times 3.0 = -6.13'^k$

$W_s = 1 \times 5 \times 2.5 \times 0.15 = 1.875^k \times 2.5 = 4.69'^k$

$\Sigma V = 1.463^k \qquad \Sigma M = 3.05'^k$

$b = 12"$

$F = \frac{3.05}{152} = 0.02$

$d = 4.5"$, $h = 4.5 + 3 = 7.5" < 30"$ o.k.

$A_s = \frac{3.05}{1.44 \times 26} = 0.081^{\square"}$

Min. $A_s = 0.0025 \times 26 \times 12 = 0.78^{\square"}$

use #8 @ 12" in Top of Base

Figure B-29

LAKE PONT. & VIC. (HURR. PROT) — Sheet Nº 30
BARRIER PLAN GDM — Computed by TST
NEW ORLEANS LAKE FRONT LEVEE — Ckd by LLW

40'-0" SWING GATE MONOLITH (R.R. GATE) Gate #2

II. For Bottom slab Reinforcing

Case III Loading (100%)

Pile "Av" Group = ~~40.843~~ × 2 ÷ 40 = $2.042^k \times 3.5 = 7.15'^k$

Pile "Axv" Group = 0.121 × 2 ÷ 40 = $0.006^k \times 3.5 = 0.02'^k$

Pile "CA" Group = 49.3 × 4 ÷ 40 = $4.930^k \times 3.5 = 17.26'^k$

2 Train Lds = −80 ÷ 40 = $-2.000^k \times 5 = -10.00'^k$

Ws = −1×5×2.5×0.15 = $-1.875^k \times 2.5 = -4.69'^k$

$\Sigma V = 3.103^k \quad \Sigma M = 9.74'^k$

$b = 12"$

$F = \frac{9.74}{152} = 0.0641$

$d = 8"$, $h = 8"+4 = 12" < 30"$ o.k.

$As = \frac{9.74}{1.44 \times 26} = 0.26^{\square"}$

Min $As = 0.0025 \times 26 \times 12 = 0.78^{\square"}$

use #8 @ 12" in Bottom of Base

Longitudinal Steel

$0.0025bt = 0.0025(12)(30) = 0.90^{\square"}$

$0.45^{\square"}$ @ Each face

use #6 @ 11"

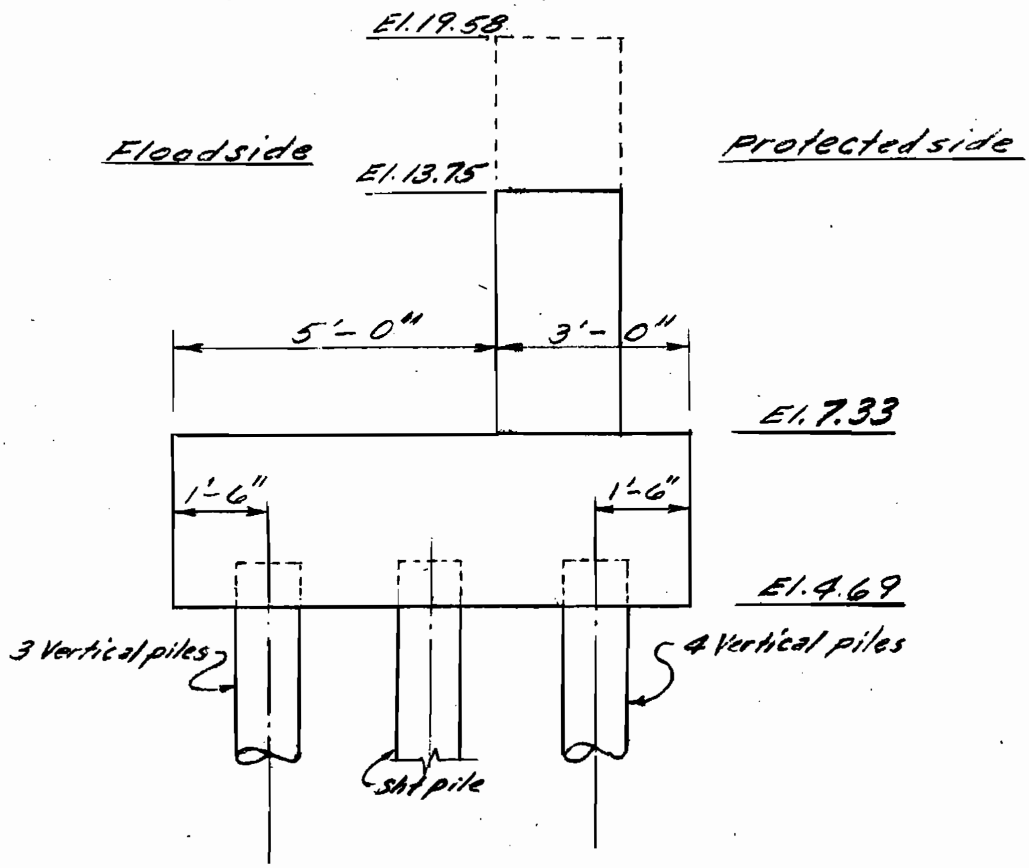
Figure B-30

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet No 31
Computed by TST.
Ckd by JGB 9-71

40'-0" SWING GATE MONOLITH (RAILROAD GATE)
Gate #2

Torsional Analysis on Swing Gate



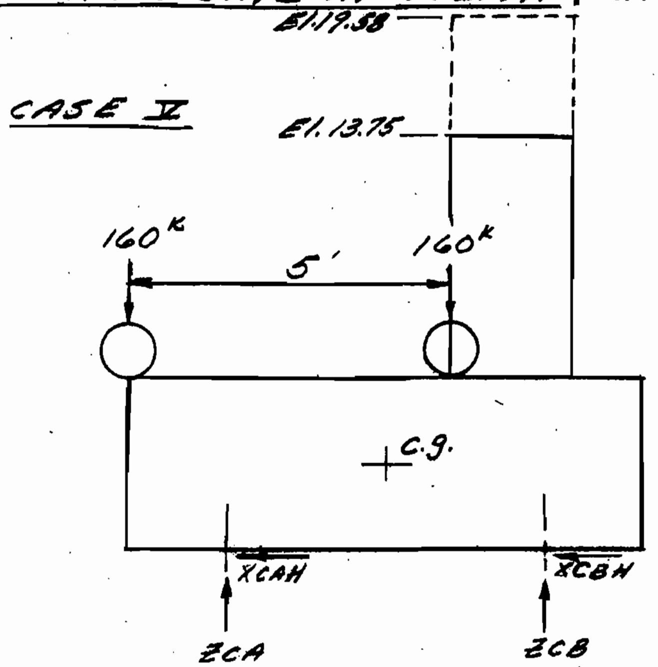
Consider Case V Loading

Case V – No Water, no wind 2 Train, 4 wheel axles on Slab Floodside

Figure B-31

LAKE PONT. & VIC. (HURR. PROT.) Sheet No. 32
BARRIER PLAN GDM Computed by TST
NEW ORLEANS LAKE FRONT LEVEE Ckd by LLW

40'-0" SWING GATE MONOLITH (RAILROAD GATE)
Gate #2



$X_B = 0.0$

ITEM	V	H	$\bar{x}$	M (+)
Train (Cooper 80)	-160.00^K		4.00'	-640.00^{IK}
Train (Cooper 80)	160.00^K		-1.00'	160.00^{IK}
$Z_{CA} = 4(56.0)$	224.00^K		2.50'	560.00^{IK}
$Z_{CB} = 5(21.0)$	105.00^K		-2.50'	-262.50^{IK}
$X_{CAH} = 4(-0.2)$		-0.80^K	-1.25'	1.00^{IK}
$X_{CBH} = 5(0.0)$		0.00	1.25'	0.00^{IK}
			$\Sigma M =$	-181.50^{IK}

Figure B-32

LAKE PONT. & VIC. (HURR. PROT.).
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet No 33
Computed by TST
Ckd by LLW

40'-0" SWING GATE MONOLITH (R.R. GATE)
Gate #2

Torsional Analysis on swing Gate (Cont)

Torsional Moment divides equally between columns

$$M_t = \frac{181.5}{2} = 90.75^{'K}$$

$n = 5$ (Base on Australian Code)

$b = 2.5'$

$h = 8.0'$

$$v_t = \frac{5(90750)(12)}{(30)^2(96)} = 63.02\,psi > 60\,psi$$

Stirrups Required

$$\text{Min Stirrup Spacing} = \frac{d}{2} = \frac{26}{2} = 13''$$

Torsional Moment Resisted by Concrete

$$M_t = \frac{v_t b^2 h}{5} = \frac{(0.06)(30)^2(96)}{5} = 1036.8^{''K} = 86.4^{'K}$$

Area Steel Req'd

$$A_{st} = \frac{M_t' S}{0.8\, b_c h_c f_v}$$

when M_t = Excess of Torsion Moment above that was taken by Concrete.

b_c = Small dimension stirrup

h_c = Large dimension stirrup

$M_t = 90.75 - 86.4 = 4.35^{'K}$

$$A_{st} = \frac{4350(12)(12)}{0.8(24)(90)(20000)} = 0.018^{\square''}$$

since #8, 12" is provided for bending in top and bottom transverse steel and the steel required for torsion is only $0.01^{\square''}$ - neglect stirrups

Figure B-33

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet No 34
Computed by TST
Ckd by LLW

40'-0" SWING GATE MONOLITH (R.R. GATE) Gate #2

Stem Design

$M = \frac{1}{2}(5.67^2)(0.0625)(\frac{5.67}{3}) = 1.899'^k$

Stem thickness @ base $= 14\frac{7}{8}''$

$F = \frac{1.899}{152} = 0.01250$

$d = \sqrt{\frac{12000(0.01250)}{12}} = 3.54''$

$t = 3.54 + 2.5 = 6.04'' < 14\frac{7}{8}''$ o.k.

$As = \frac{1.899}{1.44(12.375)} = 0.107^{\square''}$

Min. $As = 0.0025(12)(12.375) = 0.37^{\square''}$

Use #6 @ 12" Ea. face

$v = \frac{1.005}{(12)(12.375)} = 0.0068\,ksi < 0.060\,ksi$ o.k.

$u = \frac{1.005}{(2.4)(0.815)(12.375)} = 0.039\,ksi < 0.351\,ksi$ o.k.

Temperature Reinforcing

$As = 0.0040 \times 12 \times 14.835 = 0.712^{\square''}$ $0.36^{\square''}$ E.F.

Use #6 @ 12" E.F.

Figure B-34

LAKE PONT. & VIC. (HURR. PROT.) Sheet No 35
BARRIER PLAN GDM Computed by TST
Ckd by LLW
NEW ORLEANS LAKE FRONT LEVEE
40'-0" SWING GATE MONOLITH (RAILROAD GATE)
Gate #2

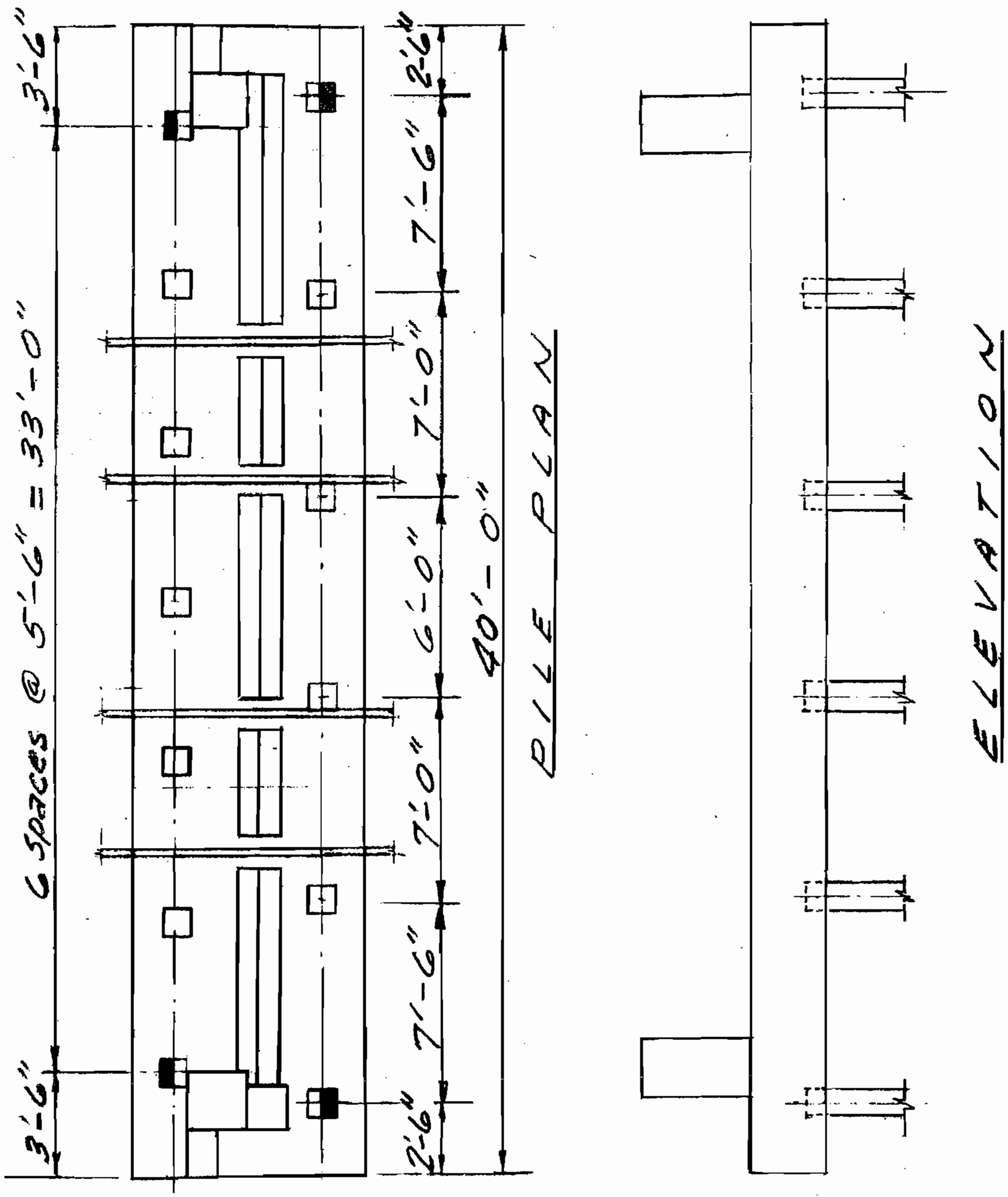


Figure B-35

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet No 36
Computed by T.S.T.
Ckd by JGB 10-70

OVERHEAD GATE DESIGN (@ HAYNE BLVD)

Water TO El. 13.0, NO Wave Load, F_b = 20,000 psi

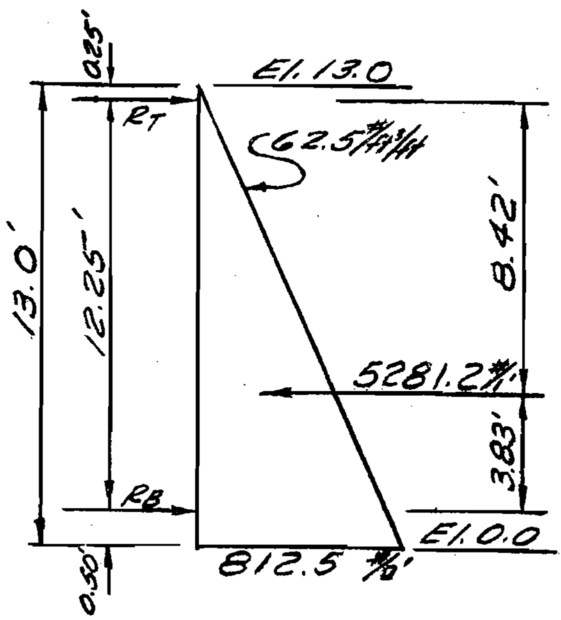
REACTIONS

$62.5 \times 13.0 = 812.50$ #/ft²

$812.5 \times 13.0 \times 0.5 = 5281.2$ #/ft

$$R_T = \frac{5281.2 \times 3.83}{12.25} = 1651.19^{\#}$$

$$R_B = \frac{5281.2 \times 8.42}{12.25} = 3630.02^{\#}$$



GIRDER DESIGN

1. TOP Girder

Span = 31.08'; Load = 1651.19#

$$\text{Moment} = \frac{1651.19(31.08)^2}{8} = 199{,}374 \text{ ft-lb} = 2{,}392{,}500 \text{ in-lb}$$

$$S_{req'd} = \frac{2392500}{20{,}000} = 119.63 \text{ in}^3$$

Try W21×68, $S = 139.9 \text{ in}^3$; $I = 1478.3 \text{ in}^4$
f_s = 17100 psi < 20,000 psi

$$\Delta = \frac{5WL^3}{384EI}$$

$$= \frac{5 \times 1651.19 \times 31.08(31.08 \times 12)^3}{384 \times 29 \times 10^6 \times 1478.3}$$

$$= 0.813 = \tfrac{7}{8}'' \text{ o.k.} \left(\simeq \tfrac{1}{427} \text{ span}\right)$$

Use W21×68

Figure B-36

2. Bottom Girder

span = 31.08'; Load = 3630.02#

$$Moment = \frac{3630.02(31.08)^2}{8} = 438,310 \text{ ft-lb} = 5259,720 \text{ in-lb}$$

$$S_{req'd} = \frac{5259,720}{20,000} = 262.99 \text{ in}^3$$

Try W30×108; $S = 299.2 \text{ in}^3$; $I = 4461 \text{ in}^4$
$f_s = 17579 \text{ psi} < 20,000 \text{ psi}$

$$\Delta = \frac{5WL^3}{384EI}$$
$$= \frac{5 \times 3630.02 \times 31.08 (31.08 \times 12)^3}{384 \times 29 \times 10^6 \times 4461}$$
$$= 0.590'' \cong \tfrac{5}{8}'' \text{ o.k.} \left(\tfrac{1}{590} \text{ span}\right)$$

use W30×108

3. Skin Plate

use $\frac{3}{8}''$ skin PL

$$I = \frac{12 \times \overline{0.375}^3}{12} = 0.053 \text{ in}^4$$

$$S = \frac{2 \times 0.053}{0.375} = 0.283 \text{ in}^3$$

Load (Maximum) = 62.5 × 12.75 = 796.9 #/ft

$M_{max.} = S \times f = 0.283 \times 20,000 = 5660$ in-lb

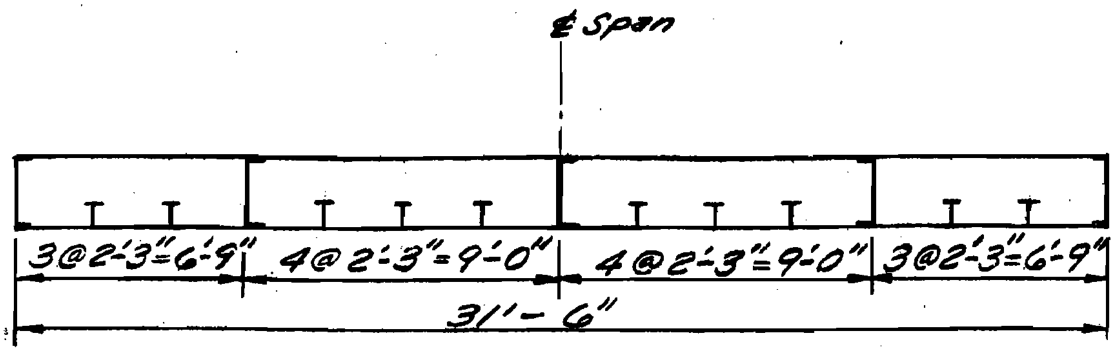
(Int. Span) $M = \frac{796.9 \times L^2 \times 12}{12} = 5660$ in-lb
$L = 2.67'$

(End Span) $M = \frac{796.9 \times L^2 \times 12}{10} = 5660$ in-lb
$L = 2.43'$

Figure B-37

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet No 38
Computed by T.S.T.
Ckd by JGB 10-70



(Interior) $M = \frac{796.9 \times \overline{2.25}^2 \times 12}{12} = 4034$ in-lb

$f_s = \frac{4034}{0.283} = 14{,}254$ psi

(End) $M = \frac{796.9 \times \overline{2.25}^2 \times 12}{10} = 4841$ in-lb

$f_s = \frac{4841}{0.283} = 17{,}106$ psi

$62.5 \times 0.25 = 15.63$ #/'

$62.5 \times 13.0 = 812.5$ #/'

$R_T = \frac{5281.2(3.83)}{12.25} = 1651.18$#

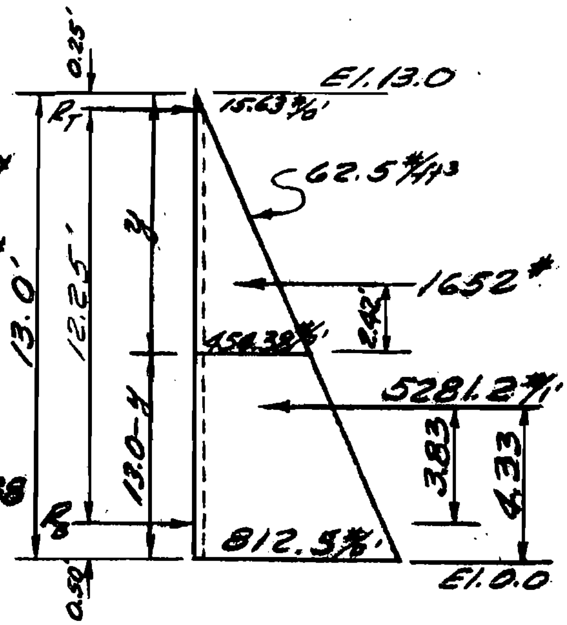
$R_B = \frac{5281.2(8.42)}{12.25} = 3630.02$#

Pt. of Zero Shear

$\frac{62.5y^2}{2} = 1651.18$

$y^2 = \frac{3302.36}{62.5} = 52.838$

$y = 7.27'$



Max. Moment

$M_{max.} = 1651.18 \times 7.02 - \frac{1}{6} \times \overline{7.27}^2 \times 62.5 \times 2.42$

$= 11591 - 4000$

$= \underline{7591 \text{ ft-lb}}$

Figure B-38

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet No. 39
Computed by T.S.T.
Ckd by JGB 10-70

Design Vertical Members

Spacing @ 2'-3"

$M = 7591 \times 2.25 \times 12 = 204{,}957$ in-lb

$S_{req'd} = \frac{204{,}957}{18{,}000} = 11.39 \text{ in}^3$

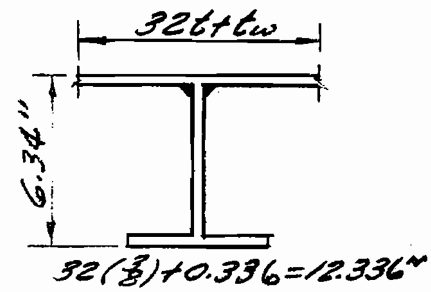
$"d"_{(Min)} = \frac{12.25 \times 12}{24} = 6.13$ in

Use WT5×27; $S = 27.1 \text{ in}^3$; $I = 87.6 \text{ in}^4$; Wt. = 22.5#/'
Plate width = 12.396 in; $f_s = 7560$ psi

$\Delta_{Max} = \frac{5h^4m}{768EI}(P_1 + P_2)$

$= \frac{5(12.25 \times 12)^4\, 2.25 \times 12}{768(29 \times 10^6)(87.6)}\left(\frac{15.63 + 781.15}{144}\right)$

$= 0.180" \cong \frac{3}{16}" \left(= \frac{1}{780} \text{ span}\right)$



TOP Girder (W21×68) Trial #1

$L_u = 13'-6"$

$d/A_f = 3.73$

$I_f = \frac{bh^3}{12} = \frac{0.685(8.27)^3}{12} = 32.29 \text{ in}^4$

$A = A_f + \frac{1}{6}A_w$

$= (8.27 \times 0.685) + \frac{1}{6}[21.13 - 2(0.685)] \times 0.43$

$= 7.08 \square"$

$r_y = \sqrt{\frac{I}{A}} = \sqrt{\frac{32.29}{7.08}} = 2.14$

$\frac{L}{r_y} = \frac{162}{2.14} = 75.7 > 40$

Use Formula (4)

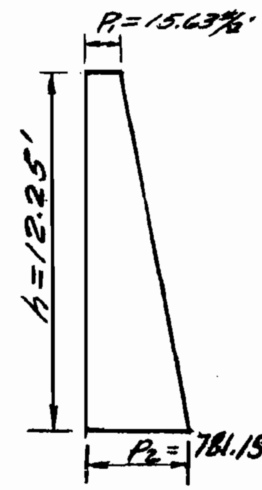


Figure B-39

LAKE PONT. & VIC (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet No 40
Computed by T.S.T.
Ckd by JGB 10-70

Formula 4

$C_b = 1.00 \; ; \; C_c = 126.1$

$K_2 = 1 - \frac{(\ell/r)^2}{2C_c^2 C_b}$

$= 1 - \frac{(75.7)^2}{2(126.1)^2 1.00} = 0.819$

$F_b = 0.5 K_2 F_y$

$= 0.5 \times 0.820 \times 36000$

$= 14750$ psi

Formula 5

$F_b = \frac{10000000}{162(3.73)} = 16{,}500$ psi $< 17{,}100$ psi N.G.

Bottom Girder (W30×108) Trial #1

$L_u = 13'-6''$

$d/A_f = 3.74$

$I_f = \frac{bh^3}{12} = \frac{0.76(10.484)^3}{12} = 72.98 \text{ in}^4$

$A = A_f + \frac{1}{6} A_w$

$= (10.484 \times 0.76) + \frac{1}{6}[29.82 - 2(0.76)] \times 0.548$

$= 10.55 \, \square''$

$r_y = \sqrt{\frac{72.98}{10.55}} = 2.630$

$\frac{L}{r_y} = \frac{162}{2.63} = 61.60 > 40$ Use Formula 4

$K_2 = 1 - \frac{(61.6)^2}{2(126.1)^2 1.00} = 0.881$

$F_b = 0.5 K_2 F_y$

$= 0.5 \times 0.881 \times 36000$

$= 15860$ psi

Formula 5

$F_b = \frac{10{,}000{,}000}{162(3.74)}$

$= 16{,}500$ psi

< 17579 psi N.G.

Figure B-40

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet No 41
Computed by T.S.
Ckd by JGB 10-7

<u>Top Girder</u> (W21×68)

<u>Trial #1</u> $L_u = 9'-0'' = 108''$

$$\frac{L}{r_y} = \frac{108}{2.14} = 50.5 > 40$$

use Formula (5)

$$F_b = \frac{10,000,000}{108(3.73)} = 24,824 \text{ psi} \quad \text{use } 18,000 \text{ psi}$$

$$S = \frac{2392500}{18000} = 132.9 \text{ in}^3 < 139.9 \text{ in}^3$$

OK

<u>use W21×68 (S = 139.9 in³)</u>

<u>Bottom Girder</u> (W30 × 108)

$L_u = 9'-0''$

$$\frac{L}{r_y} = \frac{108}{2.63} = 41.06 > 40$$

use Formula (5)

$$F_b = \frac{10,000,000}{108(3.74)} = 24,757 \text{ psi}$$

use $F_b = 18,000$ psi

$$S = \frac{5259720}{18000} = 292.2 \text{ in}^3 < 299.2 \text{ in}^3$$

<u>use W30×108</u> (S = 299.2 in³)

Figure B-41

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKEFRONT LEVEE

Sheet No 42
computed by T.S.T.
Ckd by

MEMBER	SIZE	NO	Wt/FT	LENGTH	WEIGHT (TOTAL)	ARM	MOMENT
TOP Girder	W21×68	1	68	34.1	2319	11.00	25,509
Bott. Girder	W30×108	1	108	34.1	3683	15.38	56,644
Skin Plate	3/8 × 13.45	1	205.79	31.5	6482	0.188	1,219
Vertical Ts	WT5×27	10	27	12.75	3442	4.60	15,833
Vertical [s	C10×20	4	20	12.75	1020	5.375	5482.5
Seal Angle	L 3×3×3/8	1	7.2	30	216	0.515	111
Bars (Both sides)	1 3/4 × 1 3/4	2	10.413	13	270.7	0.875	-237
Stiffener PL	PL 1.33 × 3/8	5	20.4	1.5	153.0	11.000	1683.0
Stiffener PL	PL 2.0 × 3/8	5	30.6	2.0	306.0	15.813	4838.8
Horizontal L	L 5×3×3/8	1	9.8	32	313.6	7.14	2239
Diagonal [s	C10×20	2	20	8.5	340.0	5.375	1827.6
Diagonal [s	C6×10.5	2	10.5	10.0	210	3.375	709.0
Horizontal [s	C6×10.5	1	10.5	18.0	189	3.375	638.0
Vertical [	C6×10.5	1	10.5	5.0	52.5	3.375	177.0
Vertical [	C10×20	1	20	5.0	100	5.375	538.0
					19097	6.14	117212

Figure B-42

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet No 43
Computed by T.S.T.
Ckd by JGB 10-70

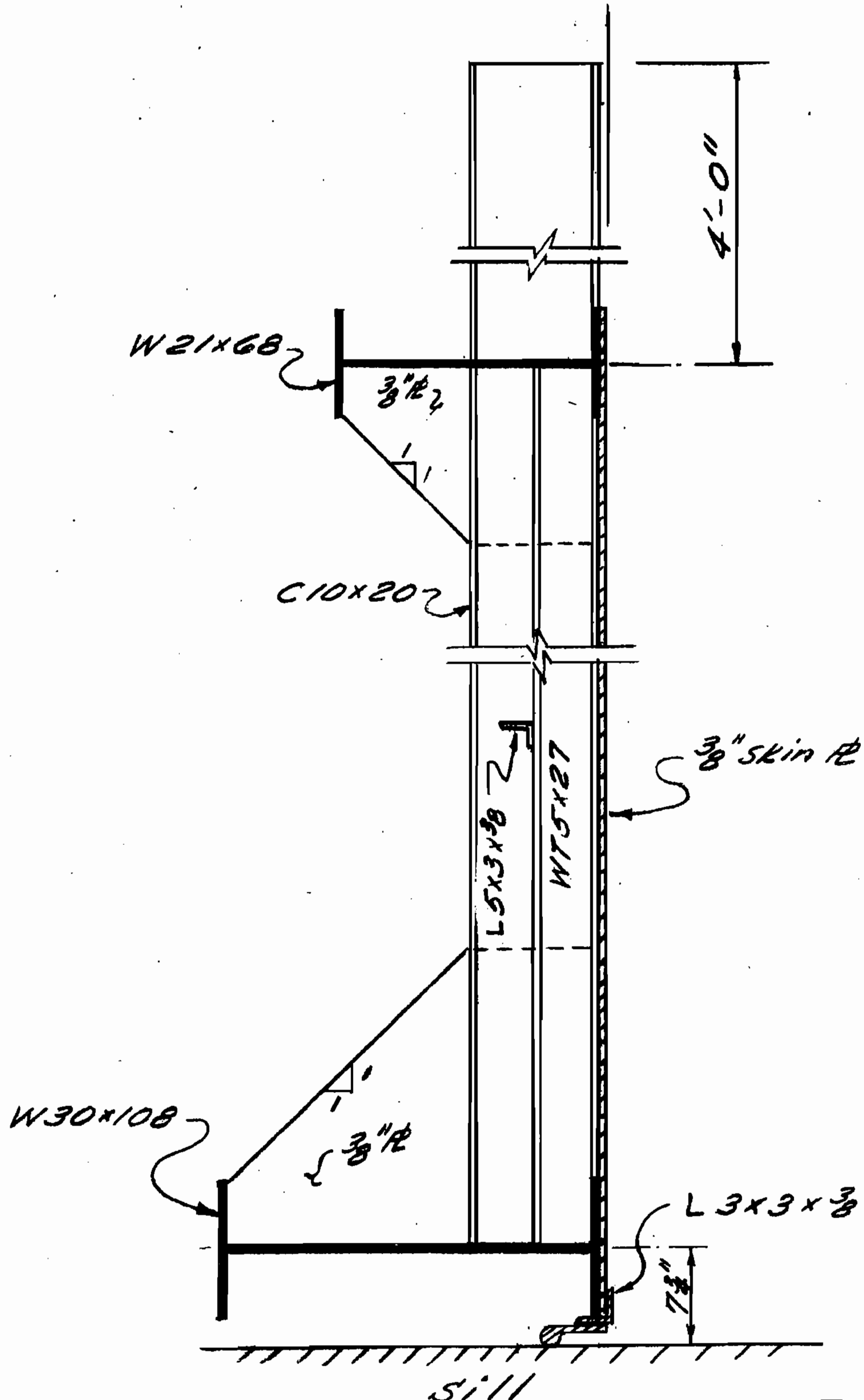


Figure B-43

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKEFRONT LEVEE

Sheet No. 44
Computed by TST
Ckd by LLW

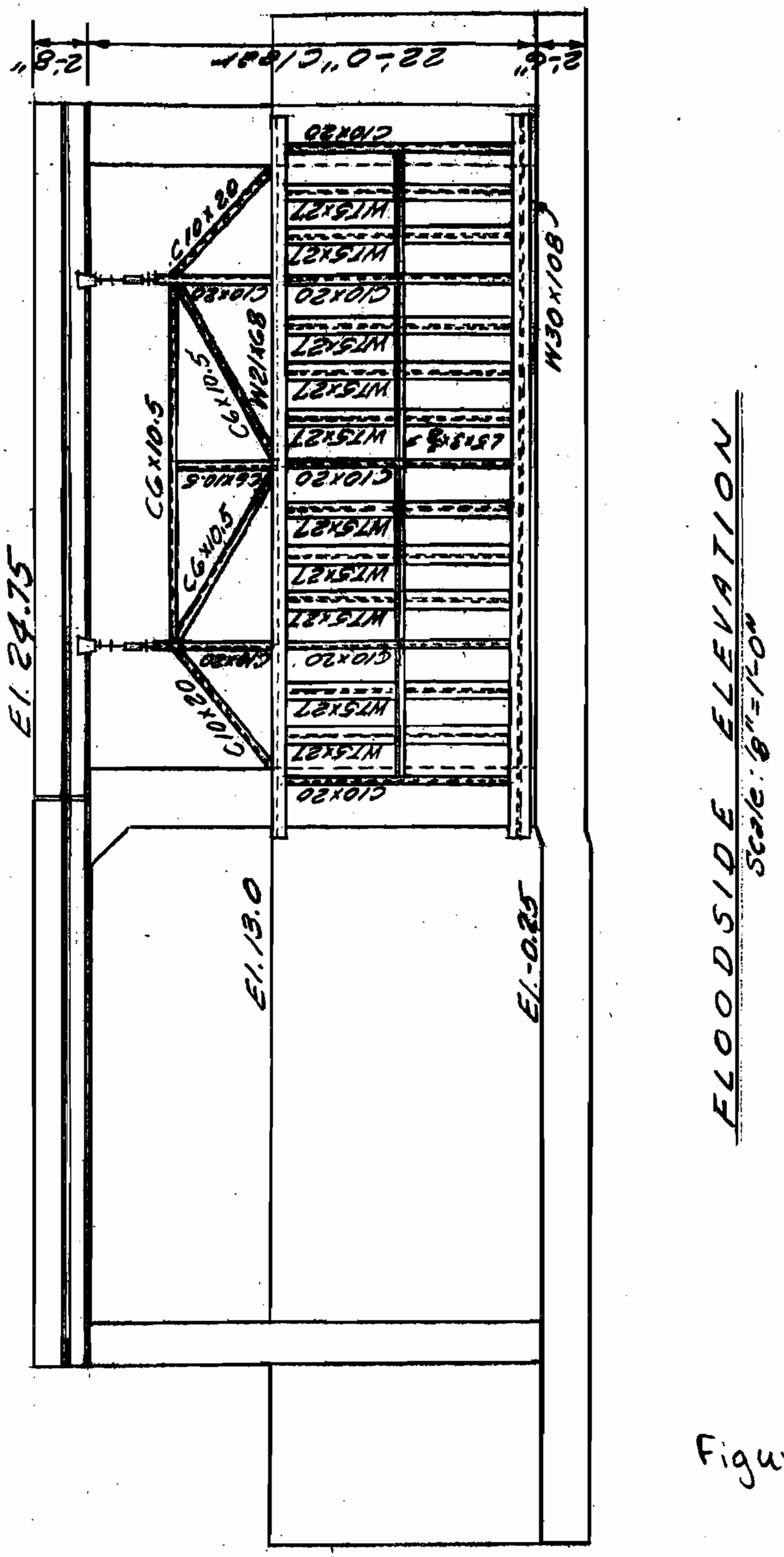
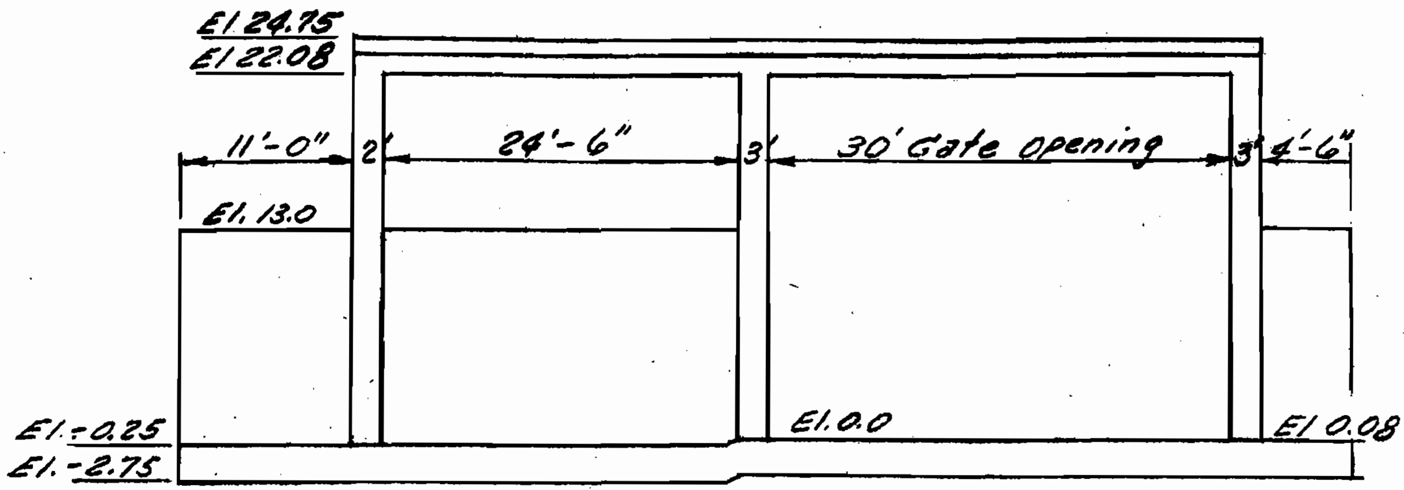


Figure B-44

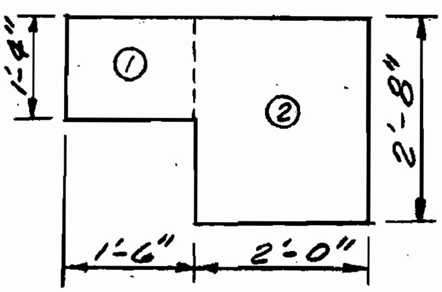
LAKE PONT. & VIC. (HURR. PROT) Sheet No. 45
BARRIER PLAN GDM Computed by T.S.T.
NEW ORLEANS LAKE FRONT LEVEE Ckd by LLW

CONCRETE GATE FRAME DESIGN



Flood Side Elevation

Moment of Inertia — Beam



Area (A)	Y	AY	AY^2	I_o
① 16x18 = 288	8	2304	18432	6144
② 32x24 = 768	16	12288	196608	65536
1056		14592	215040	71680

$$\bar{y} = \frac{\Sigma AY}{\Sigma A} = \frac{14592}{1056} = 13.818182"$$

$$I = I_o + \Sigma AY^2 - \Sigma A \cdot \bar{y}^2$$
$$= 71680 + 215040 - (1056 \times 13.818182^2)$$
$$= 286720 - 201635$$
$$= 85085 \text{ in}^4$$

Figure B-45

LAKE PONT. & VIC. (HURR. PROT.) Sheet No 46
BARRIER PLAN GDM Computed by TST
NEW ORLEANS LAKE FRONT LEVEE. Ckd by LLW

Loading

a) Dead Load

concrete: $2.67 \times 2 \times 0.15 = 0.80^{k}/'$

concrete: $1.50 \times 1.33 \times 0.15 = 0.30^{k}/'$

$5/2 \times 31.8 = 0.03^{k}/'$

$1.13^{k}/'$

b) Live Load

use two 10^{k} load @ 18 ft. apart.

c) Wind Load

$0.05^{k}/_{0}' \times 2 = 0.10^{k}$ per ft length (Column)

Load Cases Considered (Bending about x-x axis)

Case 1x — Gate open, no wind, one hanger load placed 4.5' from end column.

Case 2x — Gate closed, no wind.

Case 3x — Gate open, wind from Right (75%)

Case 4x — Gate closed, wind from Right (75%)

Case 5x — Gate closed, wind from Left (75%)

Case 6x — Gate open, Hanger loads placed between center column, no wind.

Case 7x — Gate open, no wind, one hanger load placed 0.92' from end column.

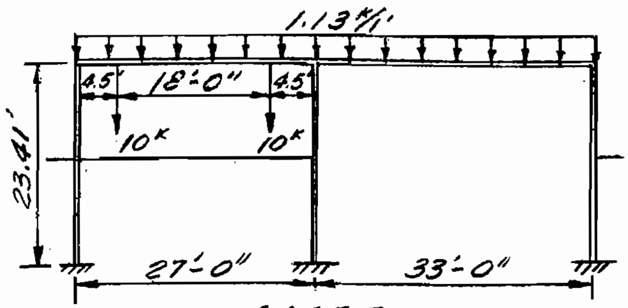
Note: Above 7 cases are the most critical load cases selected from the 24 load cases considered.

Figure B-46

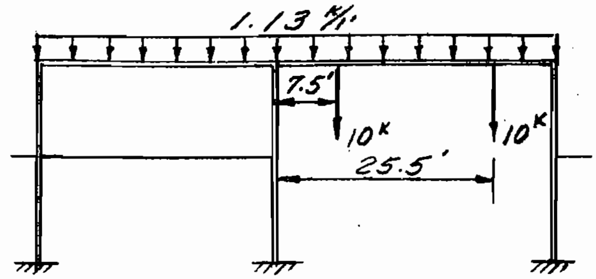
LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKEFRONT LEVEE

Sheet No 47
Computed by TST
Ckd by LLW

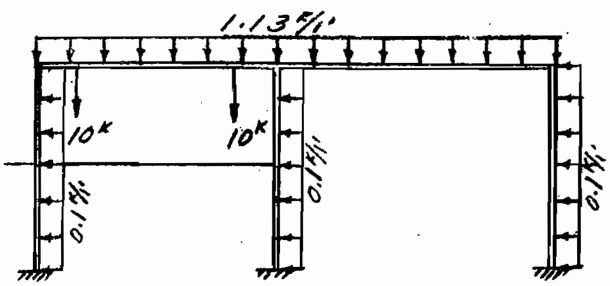
LOAD CASES



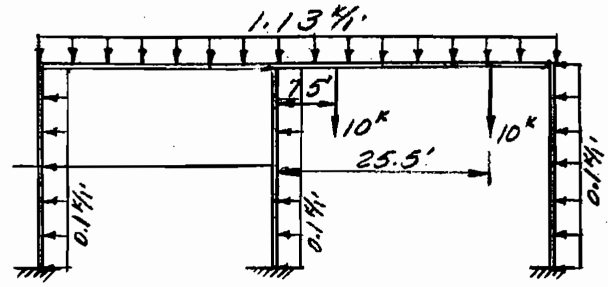
CASE I



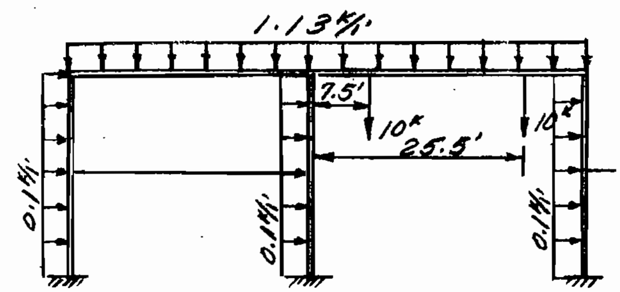
CASE II



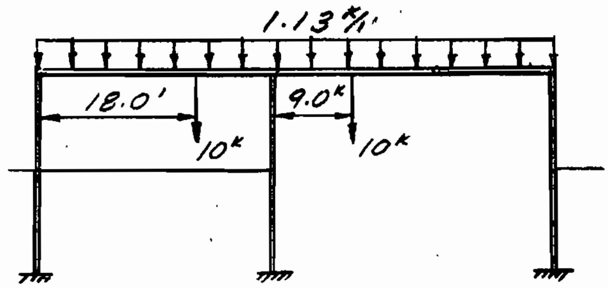
CASE III



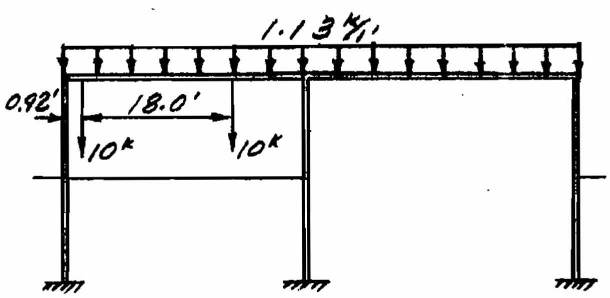
CASE IV



CASE V



CASE VI



CASE VII

Figure B-47

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKEFRONT LEVEE

Sheet № 48
Computed by TST
Ckd by LLW

LOAD CASES ABOUT THE X-X AXIS

CASE	M_{1-2}	M_{2-1}	M_{2-3}	M_{3-2}	M_{4-3}	M_{3-4}	M_{3-5}	M_{5-3}	M_{6-5}	M_{5-6}	R_1	R_4	R_6	H_1	H_4	H_6
1	-20.4	-35.3	35.3	-130.8	-11.0	-2.9	133.7	-53.1	16.6	53.1	21.7	49.9	16.2	2.4	0.6	-3.0
2	-13.4	-20.4	20.4	-113.2	-40.7	-59.6	172.8	-97.1	37.0	97.1	11.8	49.6	26.4	1.4	4.3	-5.7
3	-32.0	-37.7	37.7	-125.8	-35.7	-15.2	141.0	-44.5	-6.1	44.5	22.0	50.1	15.7	4.2	3.4	0.5
75%	-24.0	-28.3	28.3	-94.4	-26.8	-11.4	105.8	-33.4	-4.6	33.4	16.5	37.6	11.8	-3.2	-2.6	-0.4
4	-24.9	-22.9	22.8	-109.2	-65.4	-72.0	180.1	-88.5	14.3	88.5	12.1	49.9	25.9	3.2	7.0	-3.2
75%	-18.7	-17.1	17.1	-81.2	-49.1	-54.0	135.1	-66.4	10.7	66.4	9.2	37.4	19.4	-2.4	-5.3	2.4
5	-1.9	-18.0	18.0	-118.1	-16.0	-47.3	165.4	-105.7	59.8	105.7	11.6	49.4	26.8	-0.3	1.5	-8.2
75%	-1.4	-13.5	13.5	-88.6	-12.0	-35.5	124.1	-79.3	44.9	79.3	8.7	37.1	20.1	0.2	-1.1	6.2
6	-16.7	-28.2	28.2	-142.2	-22.6	-27.3	169.5	-69.5	25.3	69.5	14.4	55.1	18.3	1.9	2.1	-4.1
7	-19.0	-32.1	32.1	-129.5	-12.5	-4.5	134.0	-52.5	15.7	52.5	24.3	47.3	16.2	2.2	0.7	-2.9

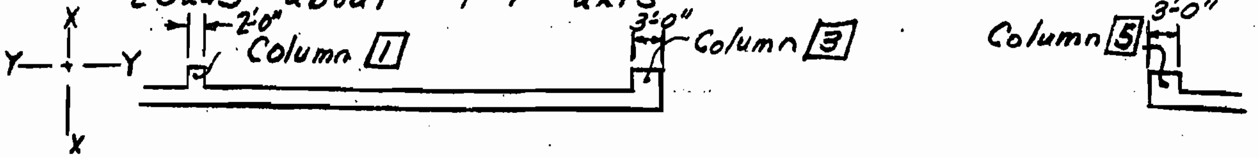
Figure B-48

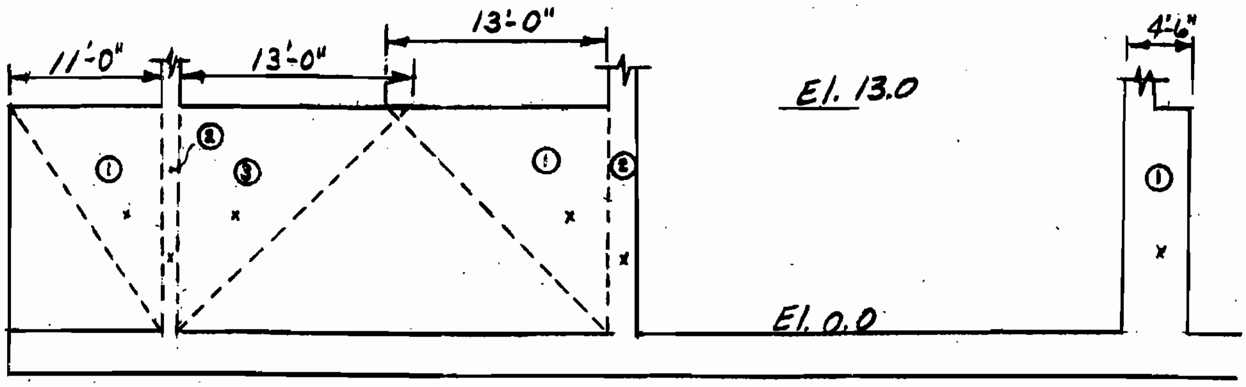
LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

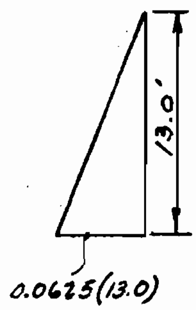
Sheet № 49
Comp by JGB
Chkd by TST
Date Jan 71

COLUMN DESIGN

Loads about Y-Y axis







Water Loads

Water to El. +13.0

Column [1]	Force	Arm	Mom (Abt. 0.0)
① $\frac{1}{3}(\frac{1}{2})(11.0)(13.0)(0.0625)(13.0) =$	19.4	6.5	126.1
② $\frac{1}{2}(2.0)(13.0)(0.0625)(13.0) =$	10.6	4.33	45.9
③ $\frac{1}{3}(\frac{1}{2})(13.0)(13.0)(0.0625)(13.0) =$	22.9	6.5	148.9
	$\Sigma H = 52.9$		$\Sigma M = 320.9$

Column [3]			
① Same as ③ Column [1]	22.9	6.5	148.9
② $\frac{1}{2}(3.0)(13.0)(0.0625)(13.0) =$	15.8	4.33	68.4
Gate $\frac{1}{2}(0.0625)(13.0)(13.0)(\frac{30.0}{2}) =$	79.2	4.33	342.9
	$\Sigma H = 117.9$		$\Sigma M = 560.2$

Column [5]			
① $\frac{1}{2}(4.5)(13.0)(0.0625)(13.0) =$	23.8	4.33	103.1
Gate Same as Column [3]	79.2		342.9
	$\Sigma H = 103.0$		$\Sigma M = 446.0$

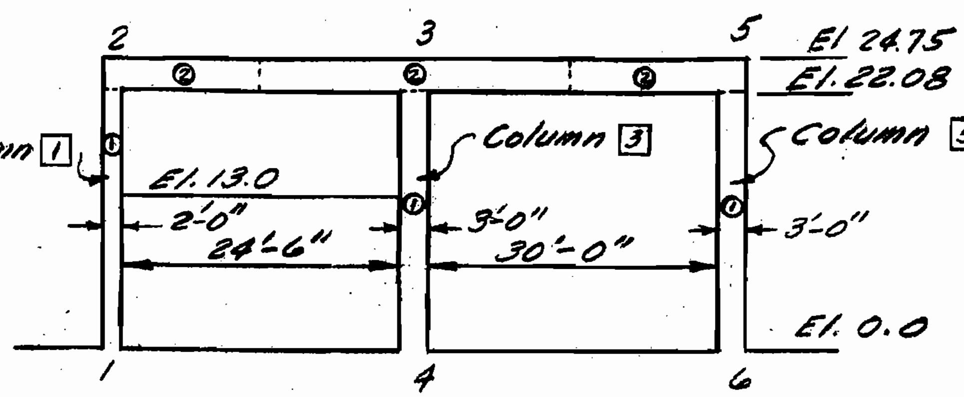
Figure B-49

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet № 50
Computed by TST
Ckd by LLW

COLUMN DESIGN

Loads about Y-Y axis
Wind above El. +13.0



Column 1

	Force	Arm	Moment
① 2.0(9.08)(0.050)	0.91^k	17.54'	$15.96^{'k}$
② 14.25(2.67)(0.050)	1.90^k	23.42'	$44.50^{'k}$
	$\Sigma H = 2.81^k$		$\Sigma M = 60.46^{'k}$

Column 3

	Force	Arm	Moment
① 3.0(9.08)(0.05)	1.36^k	17.54'	$23.85^{'k}$
② 30.25(2.67)(0.05)	4.04^k	23.42'	$94.62^{'k}$
	$\Sigma H = 5.40^k$		$\Sigma M = 118.47^{'k}$

Column 5

	Force	Arm	Moment
① 3.0(9.08)(0.05)	1.36^k	17.54'	$23.85^{'k}$
② 18.0(2.67)(0.05)	2.40^k	23.42'	$56.21^{'k}$
	$\Sigma H = 3.76^k$		$\Sigma M = 80.06^{'k}$

Figure B-50

LAKE PONT. & VIC. (HURR. PROT.) Sheet № 51
BARRIER PLAN GDM Computed by TST
NEW ORLEANS LAKEFRONT LEVEE Ckd by LLW

COLUMN DESIGN (Bending about Y-Y axis)

Load Cases Considered

Case 1Y – Gate Closed, water to El. +13.0, NO wind.

Case 2Y – Gate opened, NO water, NO wind

Case 3Y – Gate Closed, water to El. +13.0, wind from flood side (Take 75% Results)

Case 4Y – Gate opened, NO water, wind from flood Side (Take 75% Results)

Case 5Y – Gate Closed, water to El. +13.0, wind from protected side (Take 75% Results)

Case 6Y – Gate opened, NO water, wind from protected side (Take 75% Results)

Case 1Y Water, NO wind

$M_{1Y} = 320.9^{'K}$

$H_{1Y} = 52.9^{K}$

$M_{4Y} = 560.2^{'K}$

$H_{4Y} = 117.9^{K}$

$M_{6Y} = 446.0^{'K}$

$H_{6Y} = 103.0^{K}$

Case 2Y No water, NO wind

$M_{1Y} = 0$

$H_1 = 0$

$M_{4Y} = 0$

$H_4 = 0$

$M_{6Y} = 0$

$H_6 = 0$

Figure B-51

LAKE PONT. & VIC. (HURR PROT.) Sheet No 52
BARRIER PLAN GDM Computed by T.S.T
NEW ORLEANS LAKEFRONT LEVEE Ckd by LLW

COLUMN DESIGN (Bending about Y-Y axis)

Case 3Y [Water + Wind Above El. 13.0] x 0.75

$M_{1Y} = 0.75(320.9+60.5) = 0.75(380.9) = 286.1^{'K}$

$H_1 = 0.75(52.9+2.8) = 0.75(55.7) = 41.8^{K}$

$M_{4Y} = 0.75(560.2+118.5) = 0.75(678.7) = 509.0^{'K}$

$H_4 = 0.75(117.9+5.4) = 0.75(123.3) = 92.5^{K}$

$M_{6Y} = 0.75(446.0+80.1) = 0.75(526.1) = 394.6^{'K}$

$H_6 = 0.75(103.0+3.8) = 0.75(106.8) = 80.1^{K}$

Case 4Y [Wind Above El. 13.0 + Wind Below El. 13.0] x 0.75

$M_{1Y} = 0.75(60.5+97.6) = 0.75(158.1) = 118.6^{'K}$

$H_1 = 0.75(2.8+13.8) = 0.75(16.6) = 12.5^{K}$

$M_{4Y} = 0.75(118.5+66.6) = 0.75(185.1) = 138.8^{'K}$

$H_4 = 0.75(5.4+10.2) = 0.75(15.6) = 11.7^{K}$

$M_{6Y} = 0.75(80.1+19.0) = 0.75(99.1) = 74.3^{'K}$

$H_6 = 0.75(3.8+2.9) = 0.75(6.7) = 5.0^{K}$

Case 5Y [Water - Wind Above El. 13.0] x 0.75

$M_{1Y} = 0.75(320.9-60.5) = 0.75(260.4) = 195.3^{'K}$

$H_1 = 0.75(52.9-2.8) = 0.75(50.1) = 37.6^{K}$

$M_{4Y} = 0.75(560.2-118.5) = 0.75(441.7) = 331.3^{'K}$

$H_4 = 0.75(117.9-5.4) = 0.75(112.5) = 84.4^{K}$

$M_{6Y} = 0.75(446.0-80.1) = 0.75(365.9) = 274.4^{'K}$

$H_6 = 0.75(103.0-3.8) = 0.75(99.2) = 74.4^{K}$

Case 6Y Same as Case 4, Except wind from protected side

COLUMN DESIGN (Bending about Y-Y axis)

Summary of Results

Load Cases	M_{1Y} $^{'K}$	H_1 ^{K}	M_{4Y} $^{'K}$	H_4	M_{6Y} $^{'K}$	H_6
1	320.9	52.9	560.2	117.9	446.0	103.0
2	0.00	0.00	0.00	0.00	0.00	0.00
3	286.1	41.8	509.0	92.5	394.6	80.1
4	118.6	12.5	138.8	11.7	74.3	5.0
5	195.3	37.6	331.3	84.4	274.4	74.4
6	118.6	12.5	138.8	11.7	74.3	5.0

Since the results for Cases 3, 4, 5 and 6 are less than those for cases 1 and 2, wind loads causing bending about the Y-Y axis are not a governing factor in the design. Therefore, consider only the results of Cases 1 and 2 combination with the results for bending about the X-X axis

Loads about Y-Y axis

Wind Below El. 13

Gate open (With Gate closed water load governs over wind)

Column $\boxed{1}$

		Force	Arm	Moment
① $\frac{1}{2}(11.0)(13.0)(0.050)$	=	3.58^K	$8.67'$	$31.04^{'K}$
Gate: $(\frac{31.5}{2})(13.0)(0.05)$	=	10.24^K	$6.5'$	$66.56^{'K}$
		$\Sigma H = 13.82^K$		$\Sigma M = 97.60^{'K}$

Column $\boxed{3}$

Gate : $\Sigma H = 10.24^K$ $\Sigma M = 66.56^{'K}$

Column $\boxed{5}$

		Force	Arm	Moment
① $4.50(13.0)(0.05)$	=	2.93^K	$6.5'$	$19.00^{'K}$
		$\Sigma H = 2.93^K$		$\Sigma M = 19.00^{'K}$

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet No. 54
Computed by TST
Ckd by LLW

COLUMN DESIGN (Cont'd)

Final Load Cases (Bending About x-x & Y-Y Axises)

Case 1 — Gate opened, one hanger load placed 4.5' from end column, wind from floodside. (75%)

Case 2 — Gate closed, no wind, water to El. 13.0

Case 3 — Gate opened, no water, wind from the right side of gate. (75%)

Case 4 — Gate closed, water to El. 13.0, wind from the right side of gate. (75%)

Case 5 — Gate closed, water to El. 13.0, wind from left side of gate (75%)

Case 6 — Gate opened, hanger loads placed between center column, wind from floodside (75%)

Case 7 — Gate opened, one hanger load placed 0.92 from end column, wind from flood side. (75%)

Note:

Case 1 — Case 1x (75%) + Case 4Y

Case 2 — Case 2X + Case 1Y

Case 3 — Case 3X + Case 2Y (75%)

Case 4 — Case 4X + Case 1Y (75%)

Case 5 — Case 5X + Case 1Y (75%)

Case 6 — Case 6X (75%) + Case 4Y

Case 7 — Case 7X (75%) + Case 4Y

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKEFRONT LEVEE

Sheet No 55
Computed by TST
Ckd by LLW

COLUMN DESIGN (cont'd)

Added dead weight of col. to computer printout.

column 1 @ joint 1

Loadcase	M_x^{IK}	M_y^{IK}	R^K	H_x^K	H_y^K
1	-15.3	118.6	27.7	1.8	12.5
2	-13.4	320.9	27.0	1.4	49.3
3	-24.0	0.0	27.9	-3.2	0.0
4	-18.7	89.0	20.6	-2.4	37.0
5	-1.4	89.0	20.1	0.2	-37.0
6	-12.5	118.6	22.2	1.4	12.5
7	-14.3	118.6	29.6	1.7	12.5

Column 3 @ Joint 4

Loadcase	M_x^{IK}	M_y^{IK}	R^K	H_x^K	H_y^K
1	-11.0	138.8	54.5	0.5	11.7
2	-40.7	560.2	72.4	4.3	117.9
3	-26.8	0.0	54.7	-2.6	0.0
4	-49.1	420.2	54.5	-5.3	88.4
5	-12.0	420.2	54.2	-1.1	88.4
6	-17.0	138.8	58.4	1.6	11.7
7	-9.4	138.8	52.6	0.53	11.7

Column 5 @ Joint 6

Loadcase	M_x^{IK}	M_y^{IK}	R^K	H_x^K	H_y^K
1	16.6	74.3	29.3	-2.3	-5.0
2	37.0	446.0	49.2	-5.7	103.0
3	-4.6	0.0	28.9	-0.4	0.0
4	10.7	334.5	36.5	2.4	77.3
5	44.7	334.5	37.2	6.2	77.3
6	19.0	74.3	30.8	-3.1	5.0
7	11.8	74.3	29.3	-2.2	5.0

Figure B-55

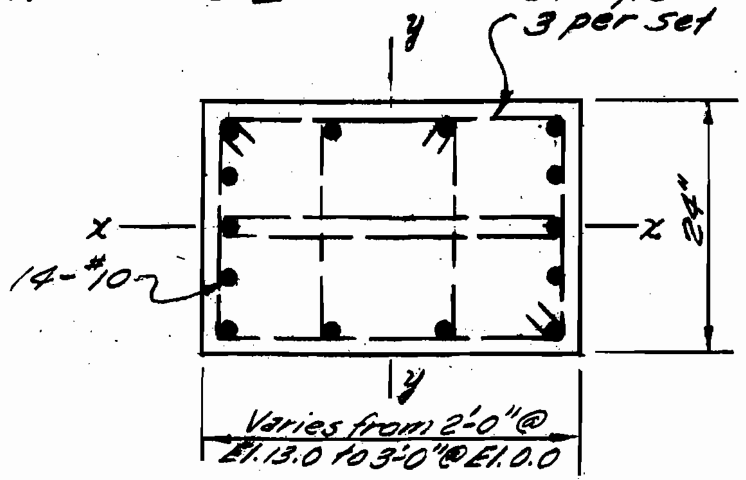
LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet No. 56
Computed by T.S.T.
Ckd by LLW

COLUMN DESIGN

Column #1

Loading Condition — Case II



$N = 27.00^k$

$M_x = -13.4'^k$

$M_y = 320.9'^k$

$f_y = 40{,}000$ psi

$f'_c = 3000$ psi

$n = 9$

$b = 24''$

$t = 36''$

$g_x = 0.80$

$g_y = 0.86$

$A_g = 24'' \times 36'' = 864$ sq. in.

(1) Compute $\dfrac{N}{f'_c A_g} = \dfrac{27.0}{3(24 \times 36)} = 0.010$

From Table 26

$$\left.\begin{array}{l} \text{For } g_x = 0.80 \\ \dfrac{P_b}{f'_c A_g} = 0.20 > 0.010 \\ \text{For } g_y = 0.86 \\ \dfrac{P_b}{f'_c A_g} = 0.20 > 0.010 \end{array}\right\} \text{Tension Control}$$

(2) Assume 14-#10 bars, as shown

$A_{st} = 14 \times 1.27 = 17.78 \square''$

$P_g = \dfrac{17.78}{864} = 0.0206$

Properties of reinforcement about Y-Y Axis

$A_{s1} = 2 \times 5 \times 1.27 = 12.7 \square''$; $P_{y1} = \dfrac{12.7}{864} = 0.0147$

$A_{s2} = 2 \times 2 \times 1.27 = 5.08 \square''$; $P_{y2} = \dfrac{5.08}{864} = 0.0059$

$P'_y = P_{y1} + 0.5 P_{y2} = 0.0147 + 0.00295 = 0.01765$

Figure B-56

LAKE PONT. & VIC. (HURR. PROT) Sheet № 57
BARRIER PLAN GDM Computed by TST
NEW ORLEANS LAKE FRONT LEVEE Ckd by LLW

COLUMN DESIGN (Column #1)

properties of reinforcement about X-X Axis

$As_1 = 2 \times 4 \times 1.27 = 10.16^{\square''}; \; P_{x_1} = \frac{10.16}{864} = 0.0118$

$As_2 = 2 \times 3 \times 1.27 = 7.62^{\square''}; \; P_{x_2} = \frac{7.62}{864} = 0.0088$

$P_x' = 0.0118 + 0.0044 = 0.0162$

(3) Table 34 (ACI Reinforced Concrete Design Handbook)

$P_g = 0.0206$

For $g_y = 0.86$

$K = 0.40$

Read $D_y' = 0.150$

For $g_x = 0.88$

$K = 0.75$

Read $D_x' = 0.162$

Table 26 (ACI Reinforced Concrete Design Handbook)

$f_y = 40{,}000\,psi$

$f_c' = 3000\,psi$

For $g_y = 0.86$

Read: $C_y' = 1.74$

For $g_x = 0.88$

Read: $C_x' = 1.71$

$M_{xx} = 27.0\left[\frac{0.162(24)}{12}\right] + 0.0162\left[\frac{36(24)^2}{1.71}\right]$

$= 8.75 + 196.45$

$= 205.20^{'K}$

$M_{yy} = 27.0\left[\frac{0.15(36)}{12}\right] + 0.01765\left[\frac{24(36)^2}{1.74}\right]$

$= 12.15 + 315.51$

$= 327.66^{'K}$

Figure B-57

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet No. 58
Computed by TST
Ckd by LLW

COLUMN DESIGN (cont'd)

Column #1

$$\frac{M_x}{M_{xx}} + \frac{M_y}{M_{yy}} \leq 1$$

$$\frac{13.4}{205.20} + \frac{320.9}{327.66} \leq 1$$

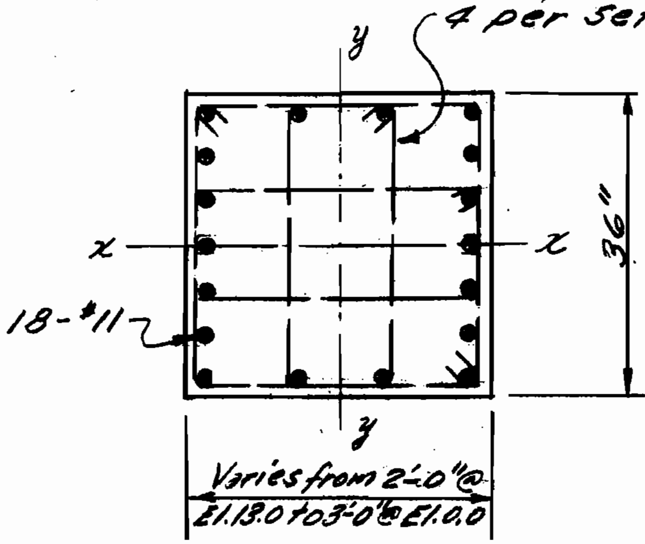
$$0.065 + 0.979 \leq 1$$

$$1.044 \approx 1$$ say o.k.

Column #3

Loading Condition – Case II

$N = 72.40^k$
$M_x = -40.7^{1k}$
$M_y = 560.2^{1k}$
$f_y = 40{,}000\,psi$
$f_c' = 3000\,psi$
$n = 9$
$b = 36''$
$t = 36''$
$g_x = g_y = 0.86$
$A_g = 1296\ sq.in$



(1) Compute $\frac{N}{f_c' A_g} = \frac{72.4}{3(36 \times 36)} = 0.02$

From Table 26

For $g_x = g_y = 0.86$

$\frac{P_b}{f_c' A_g} = 0.20 > 0.02$

} Tension Control

Figure B-58

COLUMN DESIGN (Column #3)

(2) Assume 18 – #11 bars, as shown

$A_{st} = 18 \times 1.56 = 28.08$ sq. in

$P_g = \frac{28.08}{1296} = 0.0217$

Properties of reinforcement about Y-Y

$A_{s1} = 2 \times 7 \times 1.56 = 21.84 \square''$; $P_{y1} = \frac{21.84}{1296} = 0.0169$

$A_{s2} = 2 \times 2 \times 1.56 = 6.24 \square''$; $P_{y2} = \frac{6.24}{1296} = 0.0048$

$P_y' = P_{y1} + 0.5 P_{y2} = 0.0169 + 0.5(0.0048) = 0.0193$

Properties of reinforcement about X-X

$A_{s1} = 2 \times 4 \times 1.56 = 12.48 \square''$; $P_{x1} = \frac{12.48}{1296} = 0.0096$

$A_{s2} = 2 \times 5 \times 1.56 = 15.60 \square''$; $P_{x2} = \frac{15.60}{1296} = 0.0120$

$P_x' = P_{x1} + 0.5 P_{x2} = 0.0096 + 0.5(0.012) = 0.0156$

(3) Table 34 (ACI Reinforced Concrete Design Handbook)

$P_g = 0.0217$

For $g_y = 0.86$

$K = 0.30$

Read $D_y' = 0.146$

For $g_x = 0.86$

$K = 1.25$

Read $D_x' = 0.171$

Figure B-59

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet No 60
Computed by T.S.T.
Ckd by LLW

Table 26 (ACI Reinforced Concrete Design Handbook)

$f_y = 40{,}000\ psi$

$f_c' = 3000\ psi$

For $g_x = g_y = 0.86$

Read $C_x' = C_y' = 1.75$

$$M_{xx} = N\left(\frac{D_x' b}{12}\right) + P_x'\left(\frac{t b^2}{C_x'}\right)$$

$$= 72.4\left[\frac{0.171(36)}{12}\right] + 0.0156\left[\frac{36(36)^2}{1.75}\right]$$

$$= 37.14 + 415.91$$

$$= 453.05'^{k}$$

$$M_{yy} = N\left(\frac{D_y' t}{12}\right) + P_y'\left(\frac{b t^2}{C_y'}\right)$$

$$= 72.4\left[\frac{0.146(36)}{12}\right] + 0.0193\left[\frac{36(36)^2}{1.75}\right]$$

$$= 31.71 + 514.55$$

$$= 546.26'^{k}$$

$$\frac{M_x}{M_{xx}} + \frac{M_y}{M_{yy}} \leq 1$$

$$\frac{13.4}{453.05} + \frac{560.2}{546.26} \leq 1$$

$$0.030 + 1.026 \leq 1$$

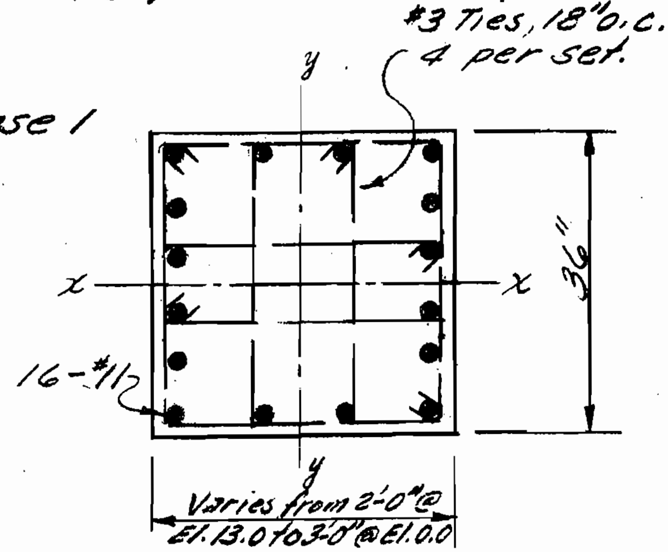
$$1.056 \approx 1 \quad \text{say o.k.}$$

Figure B-60

LAKE PONT. & VIC. (HURR. PROT.) Sheet No. 61
BARRIER PLAN GDM Computed by TST.
NEW ORLEANS LAKE FRONT LEVEE Ckd by LKW

COLUMN DESIGN (Cont'd)
Column #5

Loading Condition – Case 1



$N = 49.20^k$
$M_x = 37.0'^k$
$M_y = 446.0'^k$
$f_y = 40{,}000\ psi$
$f'_c = 30{,}00\ psi$
$n = 9$
$b = 36''$
$t = 36''$
$g_x = g_y = 0.86$
$A_g = 1296\ sq.in.$

(1) Compute $\frac{N}{f'_c A_g} = \frac{49.2}{3(36\times36)} = 0.013$

From Table 26

$$\left.\begin{array}{l} For\ g_x = g_y = 0.86 \\ \frac{P_b}{f'_c A_g} = 0.20 > 0.013 \end{array}\right\}\ \text{Tension Control}$$

(2) Assume 16 – #11 bars, as shown

$A_{st} = 16\times1.56 = 24.96\ sq.in$

$P_g = \frac{24.96}{1296} = 0.0193$

Properties of reinforcement about Y–Y

$A_{s1} = 2\times6\times1.56 = 18.72\ \square''$; $P_{y1} = \frac{18.72}{1296} = 0.0144$
$A_{s2} = 2\times2\times1.56 = 6.24\ \square''$; $P_{y2} = \frac{6.24}{1296} = 0.0048$

$P'_y = P_{y1} + 0.5 P_{y2} = 0.0144 + 0.5(0.0048) = 0.0168$

Figure B-61

COLUMN DESIGN (cont'd)

column #5

properties of reinforcement about x - x

$As_1 = 2 \times 4 \times 1.56 = 12.48^{\square''}; P_{x1} = \frac{12.48}{1296} = 0.0096$
$As_2 = 2 \times 4 \times 1.56 = 12.48^{\square''}; P_{x2} = \frac{12.48}{1296} = 0.0096$
$P_x' = P_{x1} + 0.5 P_{x2} = 0.0096 + 0.5(0.096) = 0.0144$

(3. Table 34 (ACI Reinforced Concrete Design Handbook)

$P_g = 0.0193$
For $g_y = 0.86$
$K = 0.30$
Read $D_y' = 0.146$
For $g_x = 0.86$
$K = 1.25$
Read $D_x' = 0.171$

Table 26 (ACI Reinforced Concrete Design Handbook)

$f_y = 40{,}000$ psi
$f_c' = 3000$ psi

For $g_x = g_y = 0.86$
Read $C_x' = C_y' = 1.75$

$M_{xx} = N\left(\frac{D_x' b}{12}\right) + P_x'\left(\frac{t b^2}{C_x'}\right)$
$= 49.2\left[\frac{0.171(36)}{12}\right] + 0.0144\left[\frac{36(36)^2}{1.75}\right]$
$= 25.24 + 383.91$
$= 409.15^{'K}$

Figure B-62

LAKE PONT. & VIC. (HURR. PROT.) Sheet № 63
BARRIER PLAN GDM Computed by TST
NEW ORLEANS LAKEFRONT LEVEE Ckd by LLW

COLUMN DESIGN (Cont'd)

Column #5

$$M_{yy} = N\left(\frac{D_y' t}{12}\right) + P_y'\left(\frac{bt^2}{C_y'}\right)$$

$$= 49.2\left[\frac{0.146\,(36)}{12}\right] + 0.0168\left[\frac{36\,(36)^2}{1.75}\right]$$

$$= 21.55 + 447.90$$

$$= 469.45^{\,\prime k}$$

$$\frac{M_x}{M_{xx}} + \frac{M_y}{M_{yy}} \leq 1$$

$$\frac{37.0}{409.15} + \frac{446.0}{469.45} \leq 1$$

$$0.090 + 0.950 \leq 1$$

$$1.040 \leq 1$$ say o.k.

Figure B-63

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet No 64
Computed by TST
Ckd by LLW

COLUMN DESIGN

Column $\boxed{1}$ at joint (1)

Check Shear

$V = 49.3^k$ (EH Load Case II)

$$v = \frac{V}{bd}$$

$$= \frac{49.3}{(36)(32.5)} = 0.042 \text{ ksi} < 0.060 \text{ ksi}$$

No web reinforcement required

Column $\boxed{5}$ at joint (6)

Check Shear

$V = 103^k$ (EH Load Case II)

$$v = \frac{V}{bd} = \frac{103}{(36)(32.5)} = 0.088 \text{ ksi} > 0.060 \text{ ksi}$$

Web Reinforcement Required

$$V' = V - V_c$$
$$= 103 - (0.060)(36)(32.5)$$
$$= 32.8^k$$

$$S = \frac{A_v f_v d}{V'}$$
$$= \frac{2(0.31)(20)(32.5)}{32.8}$$
$$= 12.3''$$

Use #5 stirrups @ 8" at base of Column

Figure B-64

LAKE PONT. & VIC. (HURR. PROT.) Sheet No. 65
BARRIER PLAN GDM Computed by TST
Ckd. by LLW
NEW ORLEANS LAKE FRONT LEVEE

COLUMN DESIGN

Column $\boxed{3}$ at Joint (4)

check shear

$V_{max.} = 117.9^K$ (ΣH_y Load Case I)

$v = \frac{V}{bd}$

$= \frac{117.9}{(36)(32.5)} = 0.101\ ksi > 0.060\ ksi$

Web reinforcement required

$V' = V - V_c$

$= 117.9 - (0.060)(36)(32.5)$

$= 47.7^k$

$S = \frac{A_v f_v d}{V'}$

$= \frac{2(0.31)(20)(32.5)}{47.7}$

$= 8.4''$

use #5 stirrups @ 8" at base of Column

Shear @ El. 3.0

(1) $\frac{1}{3}(\frac{1}{2})(10)(10)(0.0625)(10) = 10.4$

(2) $\frac{1}{2}(3)(10)(0.0625)(10) = 9.4$

Gate: $\frac{1}{2}(0.0625)(10)(10)(\frac{30}{2}) = 46.9$

$\Sigma M = 66.7^K < 70.2 = V_c$

∴ No web reinforcement required @ 3' above base

Check Bond

$u = \frac{V}{\Sigma_o j d}$

$= \frac{117.9}{(31)(0.875)(32.5)} = 0.134\ ksi < 0.187\ ksi$

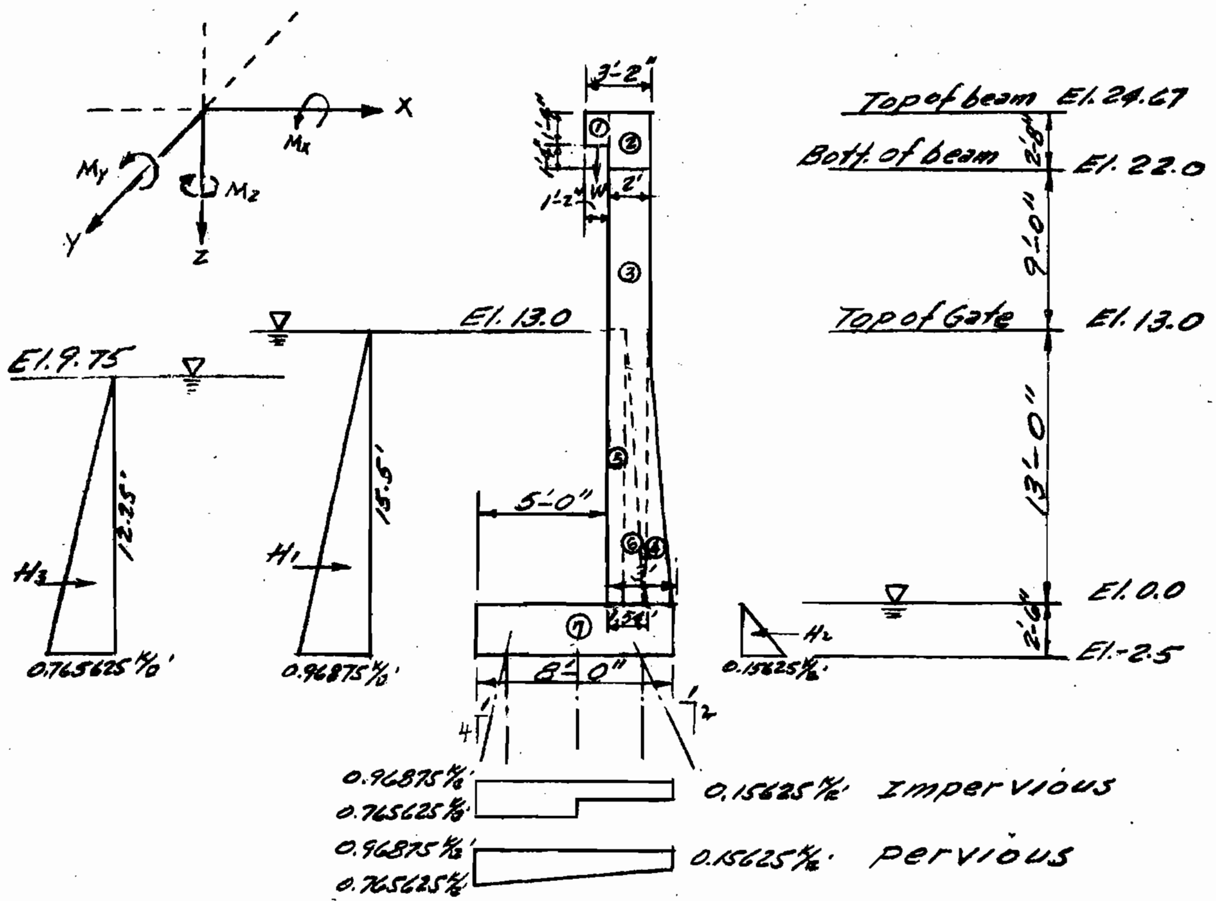
O.K.

Figure B-65

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet No 66
Computed by TST.
Ckd by JGB

30'-0" OVERHEAD GATE @ HAYNES BLVD



LOAD CASES

CASE I — Water @ El. 13.0, no wind, impervious soil.

CASE II — Water @ El. 13.0, no wind, pervious soil.

CASE III — Water @ 9.75, no wind, impervious soil

CASE IV — Water @ 9.75, no wind, pervious soil

CASE V — NO Water, no Wind, truck on edge slab floodside

CASE VI — NO Water, no Wind, truck on edge slab protected side

CASE VII — NO Water, Wind from F.S., truck on edge slab P.S. - 75%

CASE VIII — NO Water, Wind from P.S., truck on edge slab F.S. - 75%

Figure B-66

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet No. 67
Computed by LLW
Checked by TST

30'-0" OVERHEAD GATE @ HAYNE BLVD

MOMENT ABOUT X-X AXIS

ITEM	COMPUTATION	F_Z K	F_Y K	ARM Ft	M_{X-X} Ft-K
Gate Wt.	(Including misc wt)	23.00		-4.27	-98.21
Conc. Bm ①	(1.17)(1.33)(62.5)(0.15)	14.59		-4.42	-64.49
Conc. Bm ②	(2.67)(2)(62.5)(0.15)	50.06		-6.00	-300.36
Conc. Col. ③	2(3×2×22.04×0.15)	39.67		-6.00	-238.02
Conc. Col. ③	(2)(2)(22.33)(0.15)	13.40		-6.00	-80.40
Conc. Col. ④	2(½×3×1×12.96×0.15)	5.83		-7.33	-42.73
Conc. Col. ④	½(2)(1)(13.25)(0.15)	1.99		-7.33	-14.59
T-Wall ⑤	(1)(13.25)(40)(0.15)	79.50		-5.50	-437.25
T-Wall ⑥	½(0.55)(13.25)(40)(0.15)	21.86		-6.18	-135.09
Conc. Slab ⑦	(8)(2.5)(78)(0.15)	234.00		-4.00	-936.00
SUB-TOTAL		483.90	—		-2347.14
Imp. Uplift	-15.5(78)(4)(0.0625)	-302.25		-2.00	604.50
	-2.5(78)(4)(0.0625)	-48.75		-6.00	292.50
Water Wt.	(13)(78)(5)(0.0625)	316.88		-2.50	-792.20
Water Force $\vec{H}_1$	½(15.5)²(78)(0.0625)		-585.61	5.17	-3027.60
Water Force $\vec{H}_2$	½(2.5)²(78)(0.0625)		15.23	0.833	12.69
CASE I Totals (100%)		449.78	-570.38		-5257.25
Perv. Uplift	-0.15625(78)(8)	-97.50		-4.00	390.00
	-½(0.8125×8×78)	-253.50		-2.67	676.85
Water Wt.	(13)(78)(5)(0.0625)	316.88		-2.50	-792.20
Water Force $\vec{H}_1$	½(15.5)²(78)(0.0625)		-585.61	5.17	-3027.60
Water Force $\vec{H}_2$	½(2.5)²(78)(0.0625)		15.23	0.833	12.69
CASE II Totals (100%)		449.78	-570.38		-5087.40
Imp. Uplift	-12.25(4)(78)(0.0625)	-238.88		-2.00	477.76
	-2.5(4)(78)(0.0625)	-48.75		-6.00	292.50
Water Wt.	9.75(5)(78)(0.0625)	237.66		-2.50	-594.15
Water Force $\vec{H}_3$	½(12.25)²(78)(0.0625)		-365.78	4.083	-1493.48
Water Force $\vec{H}_2$	½(2.5)²(78)(0.0625)		15.23	0.833	12.69
CASE III Totals (100%)		433.93	-350.55		-3651.82

Figure B-67

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet No. 68
Computed by LLW
Checked by TST

30'-0" OVERHEAD GATE @ HAYNE BLVD

MOMENT ABOUT X-X AXIS (Cont)

ITEM	COMPUTATION	F_z K	F_y K	ARM Ft	M_{x-x} Ft-K
Perv. Uplift	-0.15625(8)(78)	-97.50		-4.00	390.00
	-1/2(0.609375)(8)(78)	-190.13		-2.67	507.65
Water Wt.	9.75(5)(78)(0.0625)	237.66		-2.50	-594.15
Water Force H_3	1/2(12.25)²(78)(0.0625)		-365.78	4.083	-1493.48
Water Force H_2	1/2(2.5)²(78)(0.0625)		15.23	0.833	12.69
CASE IV Totals (100%)		433.93	-350.55		-3524.43
Truck	(2 Trucks)(H20-S16-44)	64.00		—	—
Uplift	-0.15625(8)(78)	-97.50		-4.00	390.00
CASE V Totals (100%)		450.40	—		-1957.14
Truck	(2 Trucks)(H20-S16-44)	64.00		-8.00	-512.00
Uplift	0.15625(8)(78)	-97.50		-4.00	390.00
CASE VI Totals (100%)		450.40	—		-2469.14
Truck	(2 Trucks)(H20-S16-44)	64.00		-8.00	-512.00
Uplift	0.15625(8)(78)	-97.50		-4.00	390.00
Wind on Bm	-2.67(62.5)(0.050)		-8.34	25.83	-215.42
Wind on Cols.	-8(22)(0.050)		-8.80	13.50	-118.80
Wind on Wall	-40(13)(0.050)		-26.00	9.00	-234.00
CASE VII Totals (75%)		337.80	-32.36		-2278.02
Truck	(2 Trucks)(H20-S16-44)	64.00		—	—
Uplift	0.15625(8)(78)	-97.50		-4.00	390.00
Wind on Bm	2.67(62.5)(0.050)		8.34	25.83	215.42
Wind on Cols.	8(22)(0.050)		8.80	13.50	118.80
Wind on Wall	40(13)(0.050)		26.00	9.00	234.00
CASE VIII Totals (75%)		337.80	32.36		-1041.69

Figure B-68

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKEFRONT LEVEE

Sheet No. 69
Computed by LLW
Checked by TST

30'-0" OVERHEAD GATE @ HAYNE

MOMENT ABOUT Y-Y AXIS

ITEM	COMPUTATION	F_z K	F_x K	Arm Ft	M_{y-y} Ft-K
Conc. Slab ①	2.5(8)(78)(0.15)	234.00		-39.00	-9126.00
Conc. Col. ③	3(2)(22)(0.15)	19.80		-72.00	-1425.60
Conc Col ③	3(2)(22.08)(0.15)	19.87		-39.00	-774.93
Conc. Col. ③	2(2)(22.33)(0.15)	13.40		-12.00	-160.80
Conc. Col. ④	½ (3)(1)(12.92)(0.15)	2.91		-72.00	-209.52
④	½(3)(1)(13)(0.15)	2.93		-39.00	-114.27
④	½ (2)(1)(13.25)(0.15)	1.99		-12.00	-23.88
T-Wall ⑤	(1)(13.25)(11)(0.15) +				
⑥	½(0.55)(13.25)(11)(0.15)	27.87		-5.50	-153.29
T-Wall ⑤	(1)(13.25)(24.5)(0.15) +				
⑥	½(0.55)(13.25)(24.5)(0.15)	62.08		-25.25	-1567.52
T-Wall ⑤	(1)(12.92)(4.5)(0.15) +				
⑥	½(0.54)(12.92)(4.5)(0.15)	11.08		-75.75	-839.31
SUB-TOTAL		395.93	–		-14395.12
Gate & Bm Wt ①&②	See GFRAME Comp. Printout	12.09		-12.00	-145.08
" "	for reactions @	47.77		-39.00	-1863.03
" "	Cols. (Gate closed)	27.94		-72.00	-2011.68
Water Wt.	(13)(78)(5)(0.0625)	316.88		-39.00	-12358.32
Imp. Uplift	-(15.5)(78)(4)(0.0625)	-302.25		-39.00	11787.75
	-(2.5)(78)(4)(0.0625)	-48.75		-39.00	1901.25
CASE I Totals (100%)		449.61	–		-17084.23
Gate & Bm Wt. ①&②	See GFRAME Computer	12.09		-12.00	-145.08
" "	printout for reactions	47.77		-39.00	-1863.03
" "	@ Cols. (Gate Closed)	27.94		-72.00	-2011.68
Water Wt.	(13)(78)(5)(0.0625)	316.88		-39.00	-12358.32
Perv. Uplift.	-0.15625(8)(78)	-97.50		-39.00	3802.50
	-½(0.8125)(8)(78)	-253.50		-39.00	9886.50
CASE II Totals (100%)		449.61	–		-17084.23

Figure B-69

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet No 70
Computed by: LLW
Checked by: TST

30'-0" OVERHEAD GATE AT HAYNE BLVD.

MOMENT ABOUT Y-Y AXIS, Con't

ITEM	COMPUTATION	F_z K	F_x K	Arm Ft	$M_{y\text{-}y}$ Ft-K
Gate & Bm. Wt. ①②	See GFRAME Computer	12.09		-12.00	-145.08
" "	printout for Reactions	47.77		-39.00	-1863.03
" "	@ Cols. (Gate closed)	27.94		-72.00	-2011.68
Water Wt.	9.75(5)(78)(0.0625)	237.66		-39.00	-9268.74
Imp. Uplift	-12.25(4)(78)(0.0625)	-238.88		-39.00	9316.32
	-2.5(4)(78)(0.0625)	-48.75		-39.00	1901.25
CASE III Totals (100%)		433.76	—		-16466.08
Gate & Bm. Wt. ①②	(Gate Closed)	12.09		-12.00	-145.08
" "		47.77		-39.00	-1863.03
" "		27.94		-72.00	-2011.68
Water Wt.	9.75(5)(78)(0.0625)	237.66		-39.00	-9268.74
Perv. Uplift:	-0.15625(8)(78)	-97.50		-39.00	3802.50
	-½(0.609375)(8)(78)	-190.13		-39.00	7415.07
CASE IV Totals (100%)		433.76	—		-16466.08
Gate & Bm. Wt. ①②	See GFRAME Computer	27.04		-12.00	-324.48
" "	printout for Reactions	44.57		-39.00	-1738.23
" "	@ Cols. (Gate Open)	16.18		-72.00	-1164.96
Truck Wt.	(2 trucks)(H20-S16-44)	64.00		-60.50	-3872.00
Uplift	-0.15625(8)(78)	-97.50		-39.00	3802.50
CASE V & VI Totals (100%)		450.22	—		-17692.29
Gate & Bm. Wt. ①②	(Gate Open)	27.04		-12.00	-324.48
" "		44.57		-39.00	-1738.23
" "		16.18		-72.00	-1164.96
Truck Wt.	(2 trucks)(H20-S16-44)	64.00		-60.50	-3872.00
Uplift	-0.15625(8)(78)	-97.50		-39.00	3802.50
CASE VII & VIII Totals (75%)		337.67	—		-13269.22

Figure B-70

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet No. 71
Computed by: LLW
Checked by: TST

30'-0" OVERHEAD GATE AT HAYNE BLVD.

MOMENT ABOUT Z-Z AXIS

ITEM	COMPUTATION	F_Y K	F_X K	Arm Ft	M_{z-z} Ft-K
Far Side	Water Force (El. 13.0)				
On Wall & Col.	$-\frac{1}{2}(13)^2(7.5)(0.0625)$	-39.61		74.25	-2941.04
On Gate @ Col.	$-\frac{1}{2}(13)^2(15)(0.0625)$	-79.22		72.00	-5703.84
Near Side					
On Gate @ Col.	$-\frac{1}{2}(13)^2(15)(0.0625)$	-79.22		39.00	-3089.58
On Wall & Col.	$-\frac{1}{2}(13)^2(40.5)(0.0625)$	-213.89		20.25	-4331.27
On Base Slab	$-2.5(78)(0.89063)$	-173.67		39.00	-6773.13
	$+2.5(78)(0.078125)$	15.23		39.00	593.97
CASE I & II Totals (100%)		-570.38	–		-22244.89
Far Side	Water Force (El. 9.75)				
On Wall & Col.	$-\frac{1}{2}(9.75)^2(7.5)(0.0625)$	-22.28		74.25	-1654.29
On Gate @ Col.	$-\frac{1}{2}(9.75)^2(15)(0.0625)$	-44.56		72.00	-3208.32
Near Side					
On Gate @ Col.	$-\frac{1}{2}(9.75)^2(15)(0.0625)$	-44.56		39.00	-1737.84
On Wall & Col.	$-\frac{1}{2}(9.75)^2(40.5)(0.0625)$	-120.31		20.25	-2436.28
On Base Slab	$-(2.5)(78)(0.68750)$	-134.06		39.00	-5228.34
	$+(2.5)(78)(0.078125)$	15.23		39.00	593.97
CASE III & IV Totals (100%)		-350.54	–		-13671.10
CASE V & VI Totals		0.00	–		0.00
Far Side	Wind Force				
On Wall	$-13(4.5)(0.050)$	-2.93		75.25	-220.48
On Col.	$-22(3)(0.050)$	-3.30		72.00	-237.60
On [illegible]	$-2.67(62.5)(0.050)$	-8.34		42.25	-352.37
Near Side					
On Col. (3')	$-22.08(3)(0.050)$	-3.31		39.00	-129.09
On Wall	$-24.5(13)(0.050)$	-15.93		25.25	-402.23
On Col. (2')	$-22.33(2)(0.050)$	-2.20		12.00	-26.76
On Wall	$-11(13)(0.050)$	-7.15		5.50	-39.33
CASE VII Totals (75%)		-32.39			-1055.90
Case VIII Same as VII except opposite direction					
CASE VIII Totals 75%		32.39			1055.90

Figure B-71

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

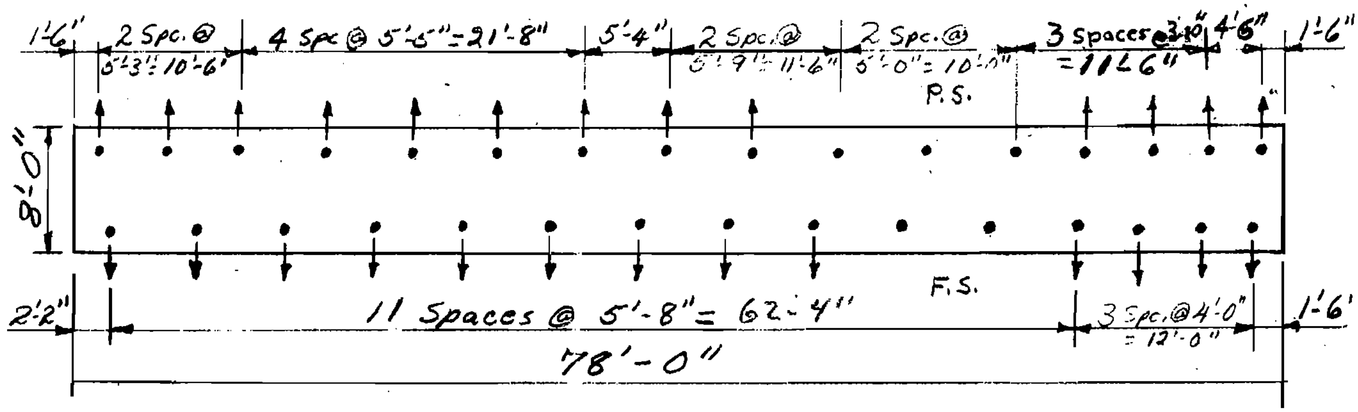
Sheet No 72
Computed by: LLW
Checked by: TST

30'-0" OVERHEAD GATE AT HAYNE BLVD

SUMMARY OF LOADS ON GATE MONOLITH

CASE	F_x K	F_y K	F_z K	M_{x-x} Ft.-K	M_{y-y} Ft.K	M_{z-z} Ft.-K
I	0.00	-570.38	449.78	-5257.25	-17084.23	-22244.89
II	0.00	-570.38	449.78	-5087.40	-17084.23	-22244.89
III	0.00	-350.55	433.93	-3651.82	-16466.08	-13671.10
IV	0.00	-350.55	433.93	-3524.43	-16466.08	-13671.10
V	0.00	0.00	450.40	-1957.14	-17692.29	0.00
VI	0.00	0.00	450.40	-2469.14	-17692.29	0.00
VII	0.00	-32.39	337.80	-2278.02	-13269.22	-1055.90
VIII	0.00	32.39	337.80	-1041.69	-13269.22	1055.90

No pile spacing greater than 10'-0" O.C.



pile spacing in gate monolith

Figure B-72

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet No. 73
Computed by: LLW
Chk'd by: TST

30'-0" OVERHEAD GATE AT HAYNE BLVD.

Pile Reactions from Computer Printout.

1. Case I (100%)

		X	Y	Z
Pile "A" Group	=	-1.3	0.0	-38.4
Pile "B" Group	=	1.1	0.0	75.0
Pile "C_A" Group	=	-1.3	0.0	-9.7
Pile "C_B" Group	=	-1.3	0.0	20.5

2. Case II (100%)

		X	Y	Z
Pile "A" Group	=	-1.5	0.0	-36.3
Pile "B" Group	=	1.3	0.0	74.9
Pile "C_A" Group	=	-1.6	0.0	-3.0
Pile "C_B" Group	=	-1.6	0.0	15.9

3. Case III (100%)

		X	Y	Z
Pile "A" Group	=	-1.0	0.0	-16.6
Pile "B" Group	=	0.8	0.0	49.3
Pile "C_A" Group	=	-1.0	0.0	4.3
Pile "C_B" Group	=	-0.9	0.0	14.2

4. Case IV (100%)

		X	Y	Z
Pile "A" Group	=	-1.1	0.0	-15.0
Pile "B" Group	=	1.0	0.0	49.2
Pile "C_A" Group	=	-1.1	0.0	9.3
Pile "C_B" Group	=	-1.1	0.0	7.0

5. Case V (100%)

		X	Y	Z
Pile "A" Group	=	0.7	0.0	21.1
Pile "B" Group	=	-0.9	0.0	13.6
Pile "C_A" Group	=	0.6	0.0	0.6
Pile "C_B" Group	=	0.6	0.0	38.8

Figure B-73

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet No 74
Computed by: LLW
Chkd by TST

30'-0" OVERHEAD GATE AT HAYNE BLVD.

Pile Reactions from Computer Printout (Con't)

6. Case VI (100%)

		X	Y	Z
Pile "A" Group	=	1.4	0.0	19.0
Pile "B" Group	=	-1.6	0.0	15.6
Pile "C_A" Group	=	1.3	0.0	-20.4
Pile "C_B" Group	=	1.3	0.0	67.7

7. Case VII (75%)

		X	Y	Z
Pile "A" Group	=	1.2	0.0	8.9
Pile "B" Group	=	-1.5	0.0	17.0
Pile "C_A" Group	=	1.2	0.0	-25.1
Pile "C_B" Group	=	1.2	0.0	63.6

8. Case VIII (75%)

		X	Y	Z
Pile "A" Group	=	0.3	0.0	21.2
Pile "B" Group	=	-0.4	0.0	4.9
Pile "C_A" Group	=	0.2	0.0	10.2
Pile "C_B" Group	=	0.3	0.0	16.3

Figure B-74

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet № 75
Computed by: LLW
Chkd by: TST

30'-0" OVERHEAD GATE AT HAYNE BLVD

1. For Top Slab Reinforcing

Case I Loading (100% Loading)

Pile "A_V" = $37.25 \times 13 \div 78 = 6.208^k \times 3.5 = 21.73^{'k}$

Pile "X_{AV}" = $0.3153 \times 13 \div 78 = 0.053^k \times 3.5 = 0.19^{'k}$

Pile "C_H" = $9.70 \times 2 \div 78 = 0.249^k \times 3.5 = 0.87^{'k}$

$W_w = 5 \times 1 \times 13 \times 0.0625 = 4.063^k \times 2.5 = 10.16^{'k}$

$-W_w = -4 \times 1 \times 15.5 \times 0.0625 = -3.875^k \times 3.0 = -11.63^{'k}$

$W_s = 2.5 \times 1 \times \times 5 \times 0.15 = 1.875^k \times 2.5 = 4.69^{'k}$

$\Sigma V = 8.573^k \quad \Sigma M = 26.01^{'k}$

$b = 12''$

$F = \frac{26.01}{152} = 0.171$

$d = 13''$; $t = 13'' + 4'' = 17'' < 30''$ ok

$A_s = \frac{26.01}{1.44 \times 26} = 0.70^{\square''}$

Min. $A_s = 0.0025 \times 12 \times 26 = 0.78^{\square''}$

USE #8, 12" in top of slab

Figure B-75

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet № 76
Computed by: LLW
Chk'd by: TST

30'-0" OVERHEAD GATE AT HAYNE BLVD.

2. For Bottom slab Reinforcing

Case VIII Loading

Pile "A_V"	=	$20.567 \times 13 \div 78$	$= 3.428^K \times 3.5$	$= 12.00^{1K}$
Pile "X_{AV}"	=	$-0.073 \times 13 \div 78$	$= -0.012^K \times 3.5$	$= -0.04^{1K}$
Pile "C_R"	=	$10.20 \times 2 \div 78$	$= 0.262^K \times 3.5$	$= 0.92^{1K}$
2 Truckids	=	$-64 \div 78$	$= -0.821^K \times 5.0$	$= -4.11^{1K}$
W_s	=	$-2.5 \times 1 \times 5 \times 0.15$	$= -1.875^K \times 2.5$	$= -4.69^{1K}$
W_W	=	$4 \times 1 \times 2.5 \times 0.0625$	$= 0.625^K \times 3.0$	$= 1.88^{1K}$
			$\Sigma V = 1.607^K$	$\Sigma M = 5.96^{1K}$

$b = 12''$

$F = \frac{5.96}{152} = 0.039$

$d = 6\frac{1}{2}''$; $t = 6\frac{1}{2}'' + 4'' = 10\frac{1}{2}'' < 30''$ OK

$A_s = \frac{5.96}{1.44 \times 26} = 0.16^{\square''}$

min $A_s = 0.0025 \times 12 \times 26 = 0.78^{\square''}$

USE #8, 12" in Bottom of Slab

Longitudinal steel

$0.0025\,bt = 0.0025 \times 12 \times 30 = 0.90^{\square''}$

$0.45^{\square''}$ Each Face

USE #6, 11" Each Face

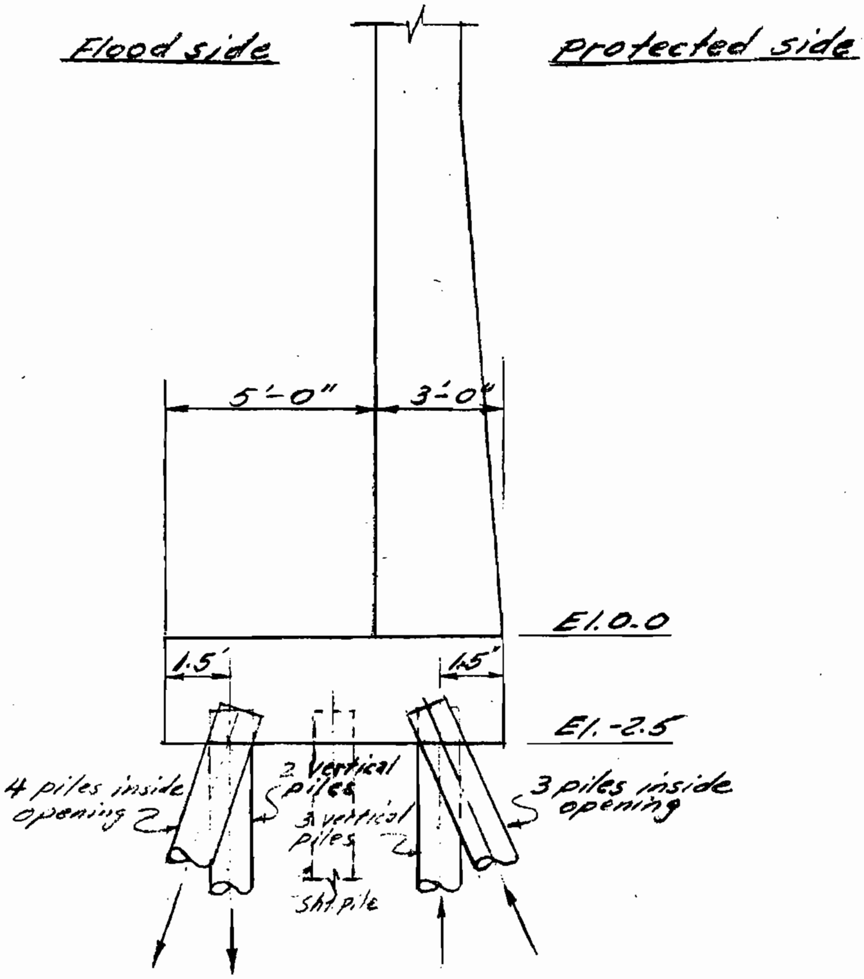
Figure B-76

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet No 77
Computed by: LLW
Ckd by: TST

30'-0" OVERHEAD GATE @ HAYNES BLVD

TORSIONAL ANALYSIS ON OVERHEAD GATE



consider case V Loading

Case V Loading — No Water, no wind, truck on edge slab flood side.

Figure B-77

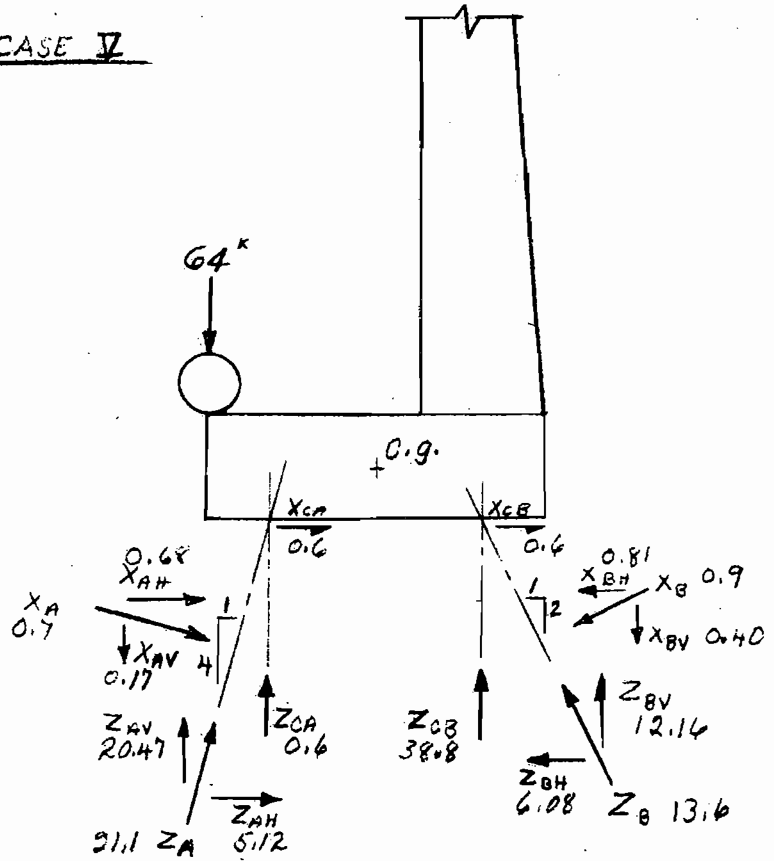
LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet No 78
Computed by: LLW
Chk'd by: TST

30'-0" OVERHEAD GATE AT HAYNE BLVD.

Torsional Analysis on Overhead Gate (Con't)

CASE V



ITEM	V	H	$\bar{x}$	M+D
2 Trucks	-64.00^K		4.00'	-256.00^{1K}
$Z_{AV} = 4(20.47)$	81.88^K		2.50'	204.70^{1K}
$Z_{AH} = 4(5.12)$		20.48^K	−1.25'	-25.60^{1K}
$X_{AV} = 4(0.17)$	-0.68^K		2.50'	-1.70^{1K}
$X_{AH} = 4(0.68)$		2.72^K	−1.25'	-3.40^K
$Z_{CA} = 2(0.60)$	1.20^K		2.50'	3.00^{1K}
$X_{CA} = 2(0.60)$		1.20^K	−1.25'	-1.50^{1K}
$Z_{CB} = 3(38.80)$	116.40^K		−2.50	-291.00^{1K}
$X_{CB} = 3(0.60)$		1.80^K	−1.25	-2.25^{1K}
$Z_{BV} = 3(12.16)$	36.48^K		−2.50	-91.20^{1K}
$Z_{BH} = 3(6.08)$		-18.24^K	−1.25	22.80^{1K}
$X_{BV} = 3(0.40)$	-1.20^K		−2.50	3.00^{1K}
$X_{BH} = 3(0.81)$		-2.43^K	−1.25	3.04^{1K}
				-436.11^{1K}

Figure B-78

30'-0" OVERHEAD GATE AT HAYNE BLVD.

Torsional Analysis on Overhead Gate (Con't)

Torsional Moment divides equally between Columns.

$M_t = \frac{436.11}{2} = 218.055^{'K}$

$n = 5$ (based on Australian Code)
$b = 2.5'$
$h = 8.0'$

$v_t = \frac{n M_t}{b^2 h} = \frac{5(218055)(12)}{(30)^2(96)} = 151.43$ psi

Stirrups Req'd

Min. Stirrup spacing $= \frac{d}{2} = \frac{27}{2} = 13.5''$

Torsional Moment resisted by Concrete

$M_t = \frac{v_t b^2 h}{5} = \frac{(0.060)(30)^2(96)}{5} = 1036.8^{''K}$ or 86.4 ft. Kips

Area steel Req'd

$A_{st} = \frac{M_t'}{0.8 b_c h_c f_v}$

where M_t = excess of torsional moment above that taken by concrete.
b_c = small dim. stirrup
h_c = large dim. stirrup
$M_t = 218.055 - 86.4 = 131.655^{'K}$

$A_{st} = \frac{131655(12)(12)}{0.8(24)(90)(20,000)} = 0.55^{\square''}$

Use #8 @ 12" = 2(0.79) = 1.58 $^{\square''}$

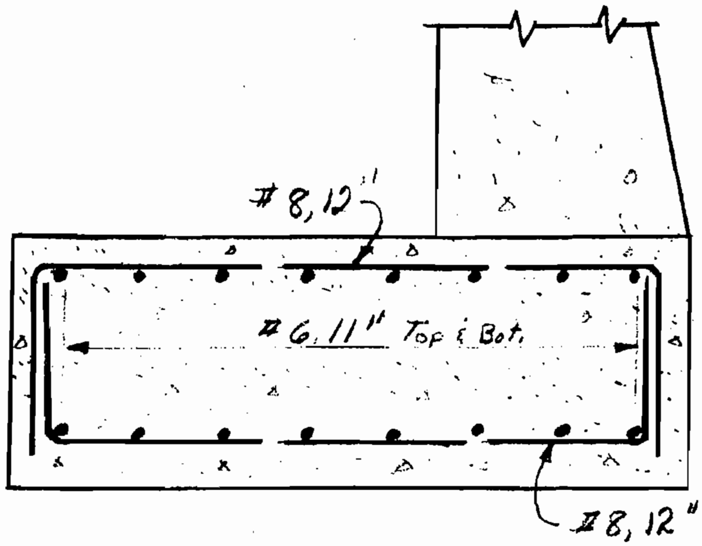
Same as req'd for bending in top and bottom transverse steel.

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet No 80
Computed by: LLW
Chk'd by: TST

30'-0" OVERHEAD GATE AT HAYNE BLVD.

Torsional Analysis of Overhead Gate (Con't)



SECTION ACROSS OPENING

Longitudinal Steel Req'd

$$A_{s\ell} = \frac{M_t (b_c + h_c)}{0.8\, b_c h_c f_s} = \frac{131655(12)(24+90)}{0.8(24)(90)(20{,}000)} = 5.21 \,\square''$$

18 - #6 provided as min steel
$18(0.44) = 7.92 \,\square''$

Figure B-80

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet No 82
Computed by TST
Ckd by LLW

Concrete Beam Design

Max. Moment in beam ③-⑤, use same reinf. in beam ②-③

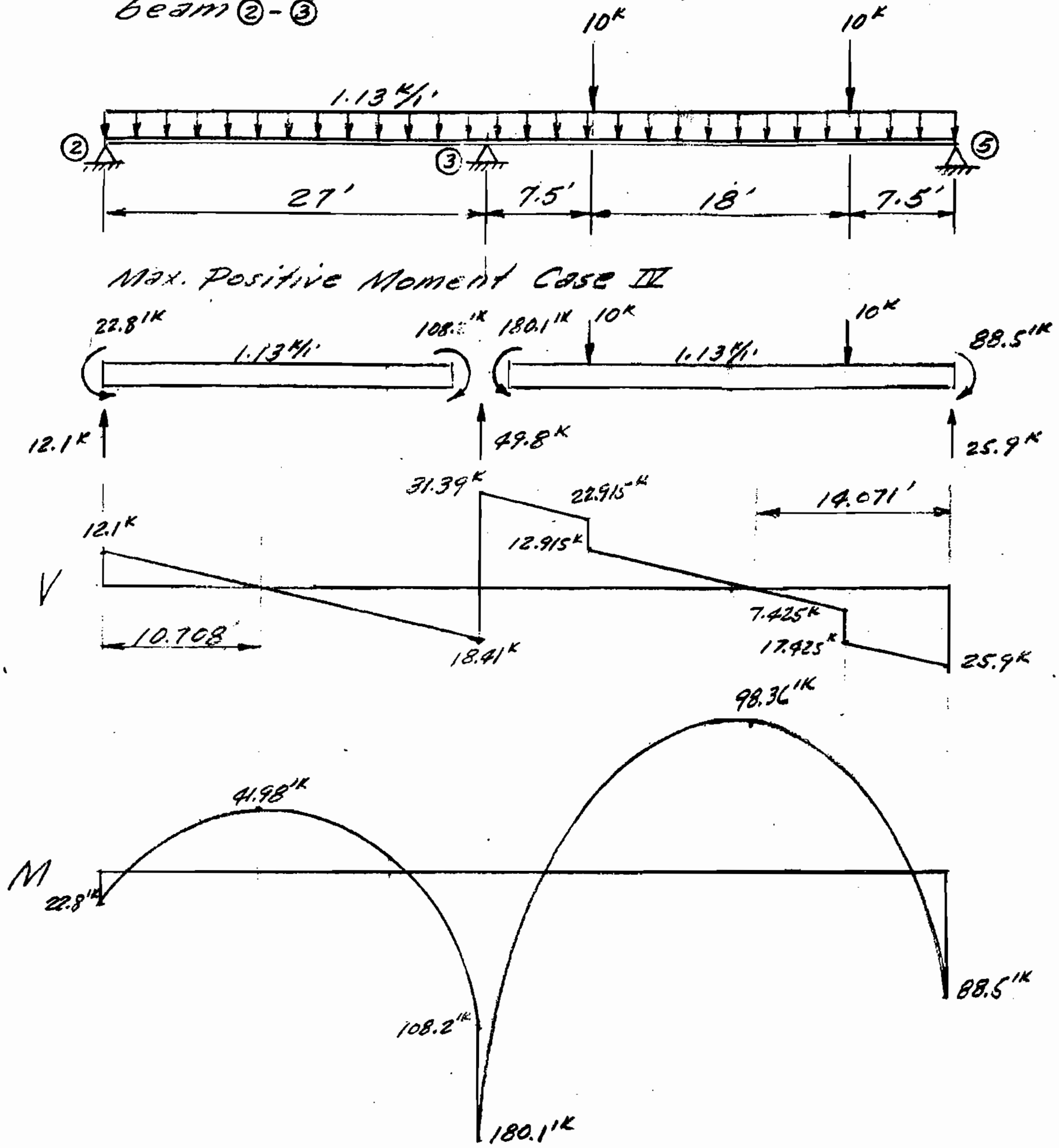


Figure B-81

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet № 82
Computed by TST
Ckd by LLW

Concrete Beam Design

Positive Reinforcing

$M = 98.36 \times 0.75 = 73.77'^{k}$

$F = \dfrac{73.77}{152} = 0.4853$

$b = 24''$

$d = \sqrt{\dfrac{0.4853(12000)}{24}} = 15.58''$

$h = 15.58 + 3'' = 18.58'' < 32''$ o.k

$As = \dfrac{73.77}{1.44(29)} = 1.76 \square''$

use 4 – #6 bars, $As = 1.76 \square''$, $\Sigma_o = 9.4''$

Negative Reinforcing

$M = 180.1 \times 0.75 = 135.08'^{k}$

$F = \dfrac{135.08}{152} = 0.889$

$d = \sqrt{\dfrac{0.889 \times 12000}{24}} = 21.08''$

$h = 21.08 + 3'' = 24.08'' < 32''$ o.k.

$As = \dfrac{135.08}{1.44(29)} = 3.23 \square''$

use 4 – #9 bars, $As = 4.0 \square''$, $\Sigma_o = 14.2''$

Figure B-82

LAKE PONT. & VIC (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet No. 83
Computed by TST
Ckd by LLW

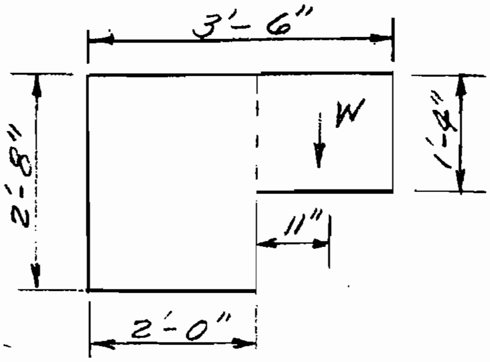
Concrete Beam Design

Shear : V_{max} - Case VI

$V = 55.1^K$

$v = \dfrac{55100}{(24)(29)+(18)(13)}$

$= 59.2\,psi < 60\,psi$ o.k.



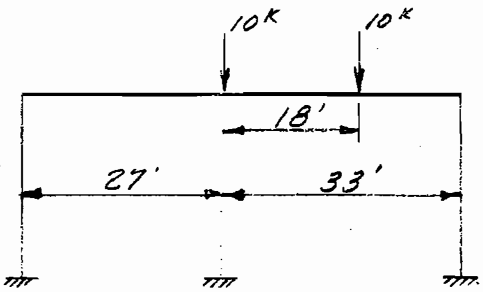
Check Torsion

Load condition — one load over column #3 and other load over the beam.

$(1.33)(1.5)(13.5+16.5)(1.75)(0.15) = 15.71^{1K}$

$10+10\left(\frac{45}{33}\right)\times 1.92 \qquad = 27.93^{1K}$

$T_u = 43.64^{1K}$



$v_{tu} = 1.5\sqrt{f'_c}$

$= 1.5\sqrt{3000} = 82.16\,psi$ (Allowable)

$v_{tu} = \dfrac{3T_u}{\phi\,\Sigma x^2 y}$

$= \dfrac{3(523680)}{1[(24)^2(32)+(18)^2(16)]} = 66.52\,psi$ (Actual) $< 82.16\,psi$ o.k

Torsion Reinforcement not req'd.

Figure B-83

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

Sheet No 84
Computed by TST
Ckd. by LLW

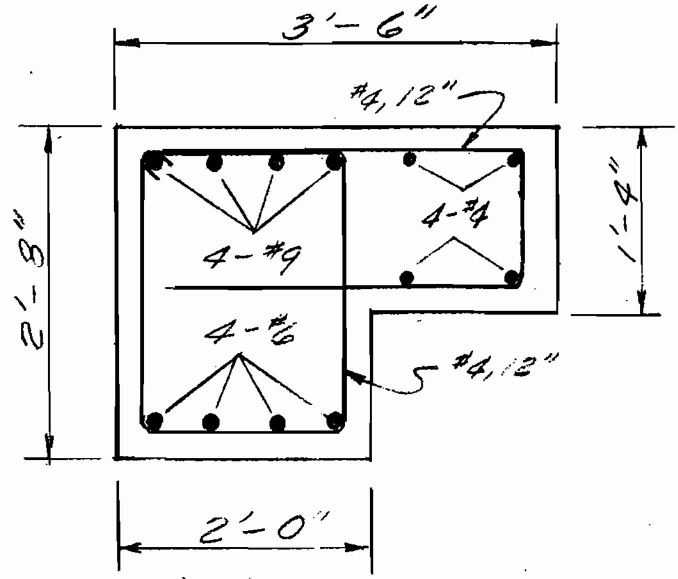
Bond

$V_{max} = 55100^{\#}$

$$U = \frac{V}{\Sigma o\, j d}$$

$$= \frac{55100}{(14.2)(0.875)(29)} = 152.91\ psi < 165\ psi$$

o.k.



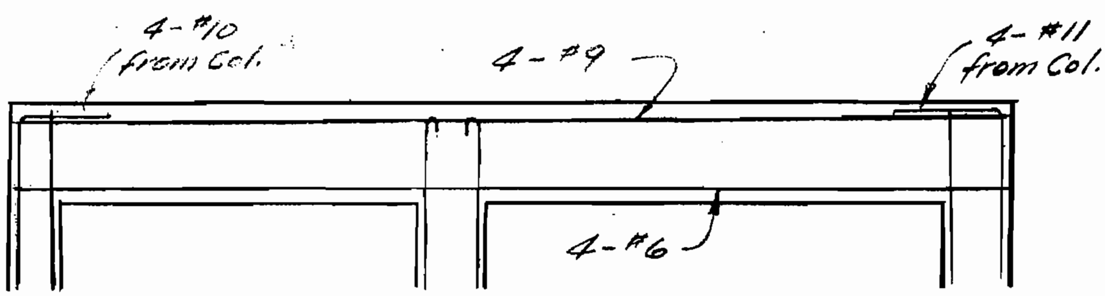


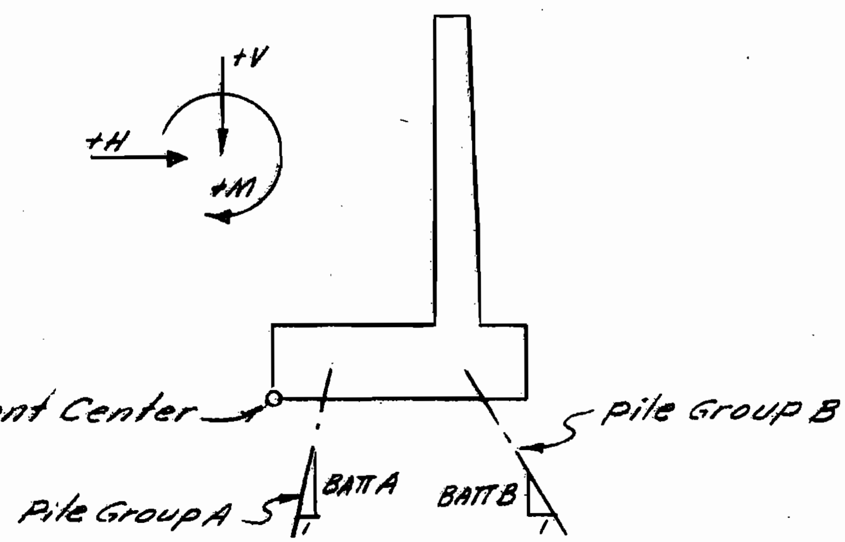
Figure B-84

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKEFRONT LEVEE

Sheet No 85
Computed by TST
Ckd by LHW

BATTER PILE FOUNDATION

Analyze foundation using Hrennikoff's Method with computer 3-D program, K29010. This program obtains the pile loading when the resultant moment, vertical force, and horizontal force are known.



The following values are known or assumed

1. Pile resistance is skin friction, no end bearing
2. Pile head is hinged at the base slab.

Maximum moment in pile due to a transverse load on the pile head = 0.5 R Q_A

Ref. — Journal #3509 May, 1963 of Soil Mechanics and Foundations Division "Laterally Loaded piles in a Layered Soil System" by M.T. Davission and H.L. Gill page 72 Figure 5B when 0.5 = Max. moment coefficient (l_{max}=5). The equivalent K value for pile in stratified soil with a subgrade modulus that vaies linearly with depth, is obtained from program K29022

$$R = \sqrt[4]{\frac{EI}{K}} = \sqrt{\frac{4.29 \times 10^6 \times 1728}{167.35}} = \sqrt[4]{44.3 \times 10^6} = 82.0''$$

Figure B-85

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKEFRONT LEVEE

Sheet No. 86
Computed by TST
CKd by LAW

BATTER PILE FOUNDATION

Q = Max. transverse load on pile head
Allowable pile head deflection = y_A

$$y_A = \frac{1.375 R^3 Q_A}{E I}$$

Ref. — Journal #3509 page 72 Fig 5B
1.375 = Deflection Coefficient (l_{max} = 5)

$$y_A = \frac{1.375(82)^3 Q_A}{4.29\times10^6(1728)} = 102.3\times10^{-6} Q_A \ (Q_A \text{ in lb})$$

3-D program K29010 obtains the actual axial and transverse loads on the piles by Hrennikoff's method and compares them to the allowables. Allowable transverse loads are computed from the axial loads thusly:

Tension Pile

$$\frac{f_a}{F_a} + \frac{f_b}{F_b} = 1$$

$$f_a = \frac{P}{A} = \frac{P}{144} = 0.00694P$$

$$F_a = F_b = 700 \text{ psi}$$

$$f_b = \frac{M}{S} = \frac{41.0 Q_A}{288} = 0.142 Q_A$$

$$\frac{f_a}{F_a} + \frac{f_b}{F_b} = 1$$

$$\frac{0.00694P}{700} + \frac{0.142 Q_A}{700} = 1$$

$$0.142 Q_A = 700 - 0.00694P$$

$$Q_A = 4929.6 - 0.0489P$$

$$y_A = 102.3\times10^{-6}(4929.6 - 0.0489P)$$
$$= 0.504 - 5.00\times10^{-6}P$$

Figure B-86

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKEFRONT LEVEE

Sheet No 87
Computed by TST
Ckd by LLW

BATTER PILE FOUNDATION

Compression pile

$$f_a = \frac{P}{A} = \frac{P}{144} = 0.00694P$$

$F_a = F_b$ = fc – effective prestress after losses
= 1750 – 840
= 910 psi

$$f_b = \frac{M}{S} = \frac{41 Q_A}{288} = 0.142 Q_A$$

$$\frac{f_a}{F_a} + \frac{f_b}{F_b} = 1$$

$$\frac{0.00694P}{910} + \frac{0.142Q_A}{910} = 1$$

$$0.142 Q_A = 910 - 0.00694P$$

$$Q_A = 6408 - 0.048P$$

$$y = 88.0 \times 10^{-6} Q_A$$

$$= 88.0 \times 10^{-6}(6408 - 0.0489P)$$

$$= 0.5639 - 4.303 \times 10^{-6} P$$

LAKE PONT. & VIC. (HURR. PROT.) Sheet № 88
BARRIER PLAN GDM Computed by TST
NEW ORLEANS LAKEFRONT LEVEE Ckd by LLW

BATTER PILE FOUNDATION

Tension Pile

plot of Q and y ; k = 167.35 psi

P	Q	y
60,000	1.996[k]	0.204"
50,000	2.485[k]	0.254"
40,000	2.974[k]	0.304"
30,000	3.463[k]	0.354"
20,000	3.952[k]	0.404"
10,000	4.441[k]	0.454"
0	4.930[k]	0.504"

Compression Pile

plot of Q and y ; k = 167.35 psi

P	Q	y
80,000	2.496[k]	0.220"
70,000	2.985[k]	0.263"
60,000	3.474[k]	0.306"
50,000	3.963[k]	0.349"
40,000	4.452[k]	0.392"

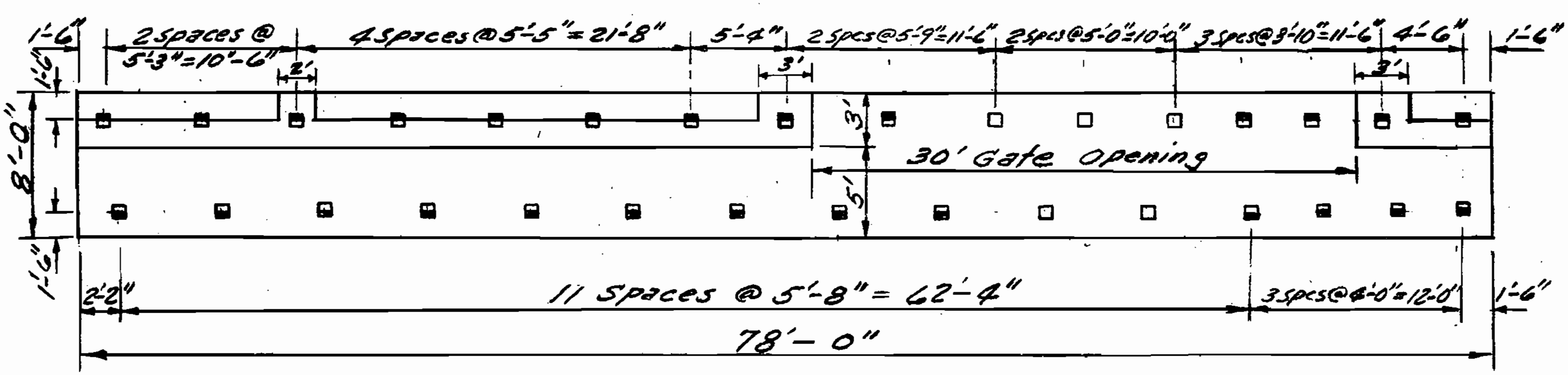
Figure B-88

Sheet No 89
Computed by TST
Ckd by LLW

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

30'-0" OVERHEAD GATE @ HAYNES BLVD

Figure B-89



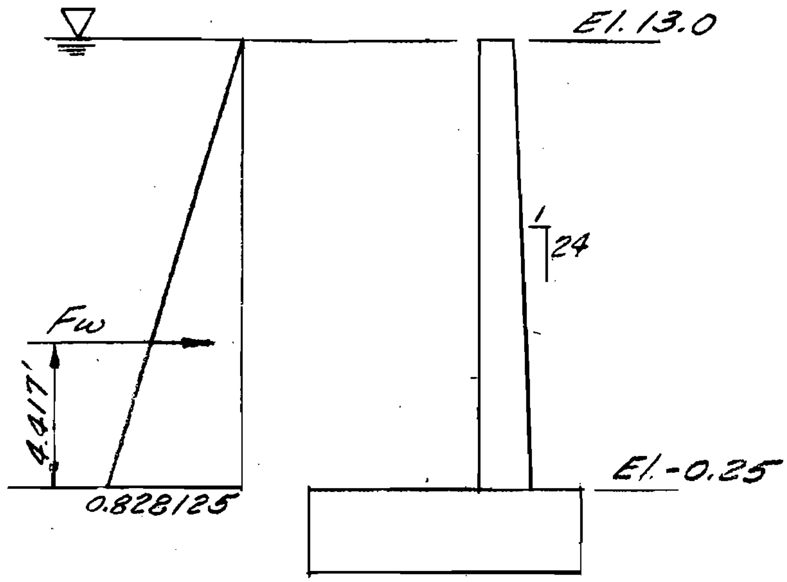
PILE PLAN
Scale: 1/8" = 1'-0"

LAKE PONT. & VIC. (HURR. PROT.)
BARRIER PLAN GDM
NEW ORLEANS LAKE FRONT LEVEE

sheet № 90
Computed by TST
Ckd by LLW

T-WALL DESIGN

At overhead Gate Monolith



Horizontal Force on wall

water; $F_w = \frac{1}{2}(13.25)(0.828125) = 5.49^{K}$

Moment on wall

water: $M_w = 5.49\ (4.417) = 24.25^{'K}$

Reinforcing Required

$d = 12 + \frac{159}{24} - 2.5 = 16.13''$

$A_s = \frac{24.25}{(1.44)(16.13)} = 1.044^{\square''}$

Min $A_s = (0.0025)(12)(16.13) = 0.48^{\square''}$

use #8 @ 9" Floodside; #7 @ 12" Protected side

Figure B-90

T-WALL DESIGN (Continuing)

Check shear and Bond

Shear: $v = \frac{5490}{12 \times 16.13} = 28.4 psi < 60 psi$

Bond: $u = \frac{5490}{(4.2)(0.875)(16.13)} = 92.61 psi < 186 psi$

Temperature Steel (Horizontally)

$A_s = (0.0040)(12)(18.63) = 0.89^{\square''}; 0.445^{\square''} E.F.$

Use #6 @ 12" horizontally each face

LAKE PONTCHARTRAIN, LOUISIANA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL
SUPPLEMENT NO. 5A
CITRUS LAKEFRONT LEVEE
IHNC TO PARIS ROAD

APPENDIX C
HYDROLOGY AND HYDRAULICS

LAKE PONTCHARTRAIN, LOUISIANA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL
SUPPLEMENT NO. 5A
CITRUS LAKEFRONT LEVEE
IHNC TO PARIS ROAD
APPENDIX C
HYDROLOGY AND HYDRAULICS

TABLE OF CONTENTS

TABLES

PLATES

LAKE PONTCHARTRAIN, LOUISIANA AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A
CITRUS LAKEFRONT LEVEE
IHNC TO PARIS ROAD

APPENDIX C
HYDROLOGY AND HYDRAULICS

1. General. This appendix presents all hydrologic and hydraulic design criteria and analyses associated with the Citrus Lakefront levee. The overall plan of improvement is described in detail in the main body of this memorandum and references to the main text are cited where appropriate.

2. Tidal Hydraulics.

a. General. The Hydrology and Hydraulic Analysis design memorandum for the Lake Pontchartrain and Vicinity Barrier-Low Level plan was presented in a series of three separate reports entitled Design Memorandum No. 1 and subtitled Part I-Chalmette, Part II-Barrier, and Part III-Lakeshore. The reports were approved on 27 October 1966, 18 October 1967 and 6 March 1969, respectively. These memoranda presented detailed descriptions of the climatology and hydrologic regimen of the area and detailed descriptions and analyses of the hydraulic methods and procedures used in design of the features for the plan. Also included in the memoranda are essential data, assumptions and criteria used, and results of studies which provide the basis for determining surges, routings, wind tides, wave runup and overtopping, and frequencies. All basic hydraulic information required for design of the Citrus lakefront protective structures from the Inner Harbor Navigation Canal to Paris Road is included in Part III-Lakeshore.

b. Design hurricane.

(1) Selection of design hurricane. The standard project hurricane (SPH) was selected as the design hurricane (Des H) due to the urban nature of the project area. A design hurricane of lesser intensity would indicate a lower net levee grade and expose the project area to disastrous flooding in the event of the occurrence of a hurricane approximating SPH character.

(2) Design hurricane characteristics. The design hurricane for the Citrus lakefront has a frequency occurrence of

once in about 300 years. The design hurricane would have a central pressure index of 27.4 inches of mercury; a maximum 5-minute average wind velocity offshore of 100 m.p.h., 30 feet above the surface at a radius of 30 nautical miles; a forward speed of 6 knots; and the hurricane would progress along a track critical to the area of interest. Plate C-1 shows the hurricane track, isovels and wind direction at the critical hour for the Citrus area. Detailed information on the design hurricane is presented in Design Memorandum No. 1, Hydrology and Hydraulic Analysis, Part I-Chalmette.

TABLE C-1
DATA USED TO DETERMINE WAVE CHARACTERISTICS
DESIGN HURRICANE

Pertinent Factors		Citrus Lakefront Levee
F	- Length of fetch, miles	5
U	- Windspeed, m.p.h.	83
s.w.l.	- Stillwater elevation, feet	8.5
d	- Average depth of fetch, feet	21.4
d_t	- Depth at toe of structure, feet	11.5

TABLE C-2
WAVE CHARACTERISTICS
DESIGN HURRICANE

Characteristics		Citrus Lakefront Levee
H_s	- Significant wave height, feet	7.5
T	- Wave period, seconds	6.8
L_o	- Deepwater wave length, feet	236.8
d/L_o	- Relative depth	0.0904
H_s/H_o'	- Shoaling coefficient	0.9418
H_o'	- Deepwater wave height, feet	7.97
H_o'/T^2	- Wave steepness	0.172

c. Design wave runup freeboard and design elevations. The design hurricane would produce a maximum wind tide level of 8.5 along the Citrus lakefront and 12.0 along the IHNC. Design elevations for the protective structures and respective runup and freeboard for specific reaches are shown in Table C-3 below:

TABLE C-3
WAVE RUNUP FREEBOARD AND
DESIGN ELEVATIONS OF PROTECTIVE STRUCTURES

Reach	Type of Protective Work	Wind Tide Level (ft msl)	Runup (ft)	Freeboard (ft)	Net Design Elev. (ft msl)
Sta. 0+00 W/L to Sta. 10+13.20 W/L	Floodwall	12.0	-	1.0[1]	13.0
Sta. 10+13.20 W/L to Sta. 34+26 W/L	Floodwall	8.5	-	2.0	10.5
Sta. 28+31 B/L to Sta. 64+00 B/L	Levee	8.5	-	2.0	10.5
Sta. 64+00 B/L to Sta. 289+58.59 B/L	Levee	8.5	5.0	-	13.5
Sta. 100+00 W/L to Sta. 101+20 W/L	Floodwall	8.5	5.0	-	13.5
Sta. 101+20 W/L to Sta. 114+23.81 W/L	Floodwall	8.5	-	2.0	10.5
Sta. 114+23.81 W/L to Sta. 115+43.81 W/L	Floodwall	8.5	5.0	-	13.5
Sta. 304+31.48 W/L to Sta. 331+50 W/L	Levee	8.5	5.0	-	13.5

3. Description of drainage area. The Citrus area is comprised mainly of developed land and land for which developments are planned. The area is relatively flat ranging in elevation from -8.0 to 0.0. It is presently drained by six pumping stations three of which are located near the new levee alinement and discharge into Lake Pontchartrain. They are located on the landside of Hayne Boulevard at the St. Charles, Citrus and Jahncke Canals and have capacities of 1,000, 460 and 1,000 cubic feet per second (c.f.s.), respectively. The other three are

[1] The elevations for the protective works along the IHNC have already been set. Therefore the recent change in freeboard requirements was not applied to the reach of floodwall along the IHNC.

located on the Dwyer Canal discharging into the IHNC (120 c.f.s.) and Elaine and Grant Streets discharging into the MR-GO (90 c.f.s. and 32 c.f.s., respectively). The new hurricane protection levee will not interfere with the operation of these pumping stations. The entire area is subject to periodic inundation from hurricane surges.

4. Proposed drainage improvements. The only runoff that will be intercepted by this new levee is that which will flow between the new levee and the existing railroad embankment. The runoff from the levee and railroad embankment will be collected in the ditch and discharged into the lake through drainage culverts that will be drilled through the railroad embankment. Catch basins will be installed to collect the flow for each culvert.

5. Hydraulic computations.

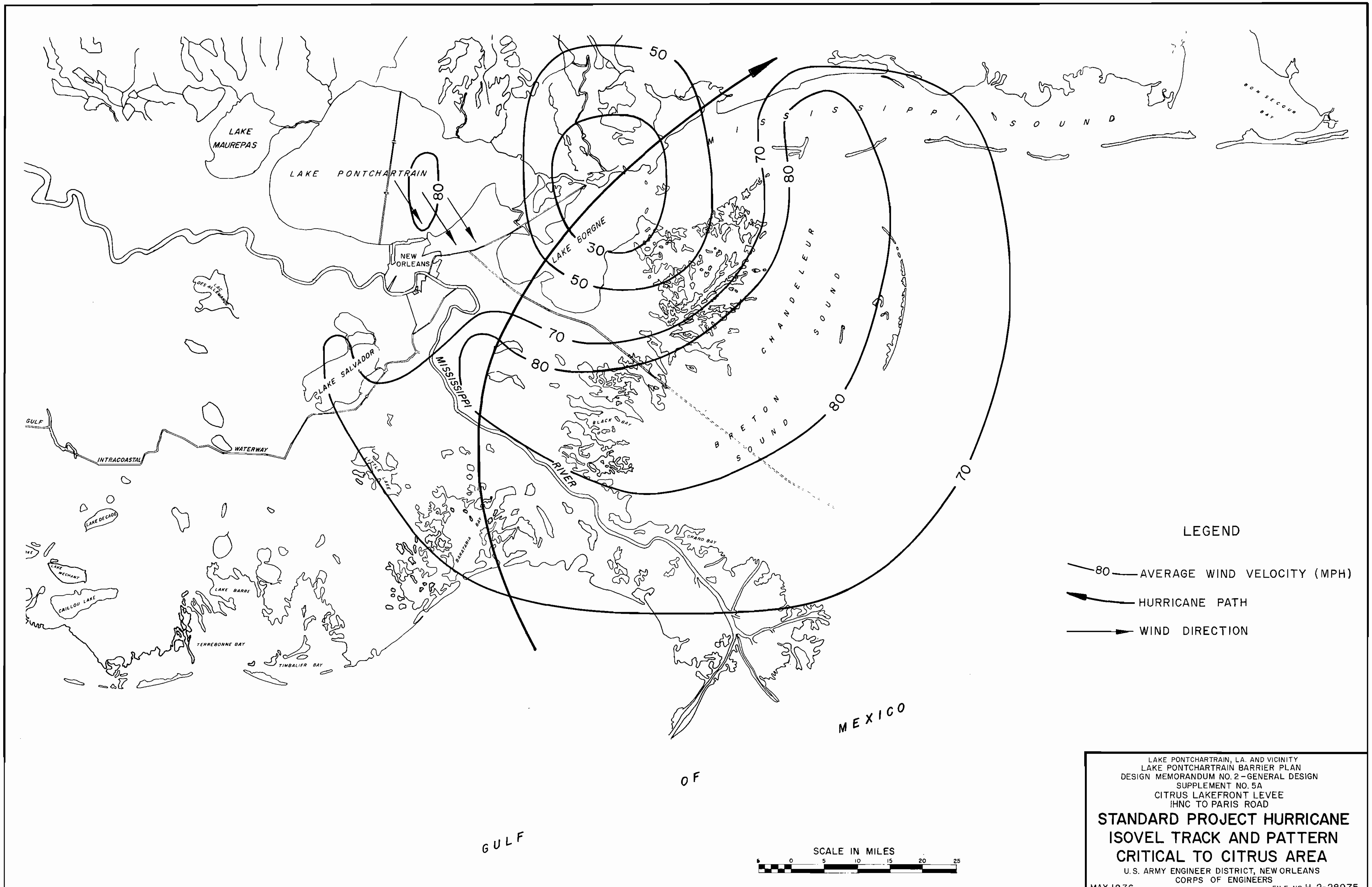
a. Embankment runoff. Runoff from the lakeside levee slope was computed using the rational method because the area is small. The formula used was Q = CIA in which Q is the runoff in c.f.s.; C is the coefficient of imperviousness; I is the rainfall intensity in inches per hour; and A is the drainage area in acres. The values of "C" were estimated from a table of typical values shown in a publication by the US Army Engineer School, Fort Belvoir, Virginia, titled "Student Reference Drainage," dated January 1964. All the surfaces were considered to be impervious with vegetal cover. Values of "C" used were 0.43 for the levee crown and 0.58 for the levee slope. The values of "I" were obtained from the US Weather Bureau Technical Paper No. 25, "Rainfall Intensity - Duration -Frequency Curves" dated December 1955. The curves used are shown on Plate C-2.

b. Drainage culvert rating curve. A rating curve for the embankment drainage culverts was computed using the continuity equation, Q = AV, where Q is the discharge in c.f.s., A is the cross-sectional area in square feet and V is the average velocity in the culverts. For these computations the culverts were assumed flowing full. For the determination of entrance and exit losses, values of 40 percent and 100 percent of the velocity head were used, respectively. Friction losses were computed according to the Darcey-Weisbach equation, $H_f = f(L/D)(V^2/2_g)$, in which H_f = head loss due to friction (ft.), f = friction factor; L = length of culvert (ft.); D = diameter of culvert (ft.); V = average velocity (ft./sec.); g = acceleration due to gravity (ft./sec.^{2}). The rating curve is shown on Plate C-3.

c. Collector ditch. The Manning Formula with a roughness coefficient of 0.070 was used to determine friction losses in the collector ditch between the levee and the railroad embankment. This formula and coefficient was also used to verify the velocity which had been assumed to determine the time of concentration needed to determine the value of "I" in the use of the rational method. The coefficient of imperviousness, C, was assumed to be 0.53 for the collector ditch. The collector ditch will have a 1 foot slope towards each catch basin from the mid-point between the catch basins.

6. Embankment drainage structures and culvert spacing. The structures between B/L Stations 64+50 and 331+50 will consist of 12-inch diameter corrugated metal pipes with catch basins collecting the flow. Dimensions and inverts of the catch basins and culverts can be obtained from the tables shown on Plate 34 of the main text. The slope of these culverts will be approximately 1 vertical on 60 horizontal. These structures were designed to convey the flow from a 25-year frequency rainfall assuming that the spacing between the catch basins will be such that the water in the collector ditch will not overtop the railroad embankment. The culvert catch basins will be on 600-foot centers. The hydraulic analysis showed that the catch basins could be spaced at 900-foot intervals and sufficiently drain the area. But, as was explained in paragraph 65 of the main text, we have complied with the railroad's recommendation of 600-foot spacings. A grating on the catch basins will be provided to trap debris. Losses through the grating were considered minimal provided it is kept free of debris. Riprap protection will be provided around the catch basins to protect against localized scouring. Details of the riprap are shown on Plate 34 of the main text.

7. Collector pipe. Between B/L Station 28+31 and B/L Station 64+00, the 12-inch diameter pipes can not be drilled through the railroad embankment and discharge into the lake. Therefore, a collector pipe (corrugated metal) will be installed between the new levee and railroad embankment to convey the runoff from the area between the levee and embankment to a 30-inch CMP culvert drilled through the embankment at B/L Station 64+00. The collector pipe will vary in size from 24 inches to 30 inches. Catch basins on 600-foot centers will convey the flow to the collector pipe in this reach. The Rational Method for designing storm water systems was used in designing the collector pipe. The same frequency rainfall was used to design both this collector pipe and the preceding embankment drainage structures. Friction losses in the pipe were computed using the Darcey-Weisbach equations, as explained in paragraph 5b of this Appendix. For details of these drainage facilities see Plate 33 in the main text.



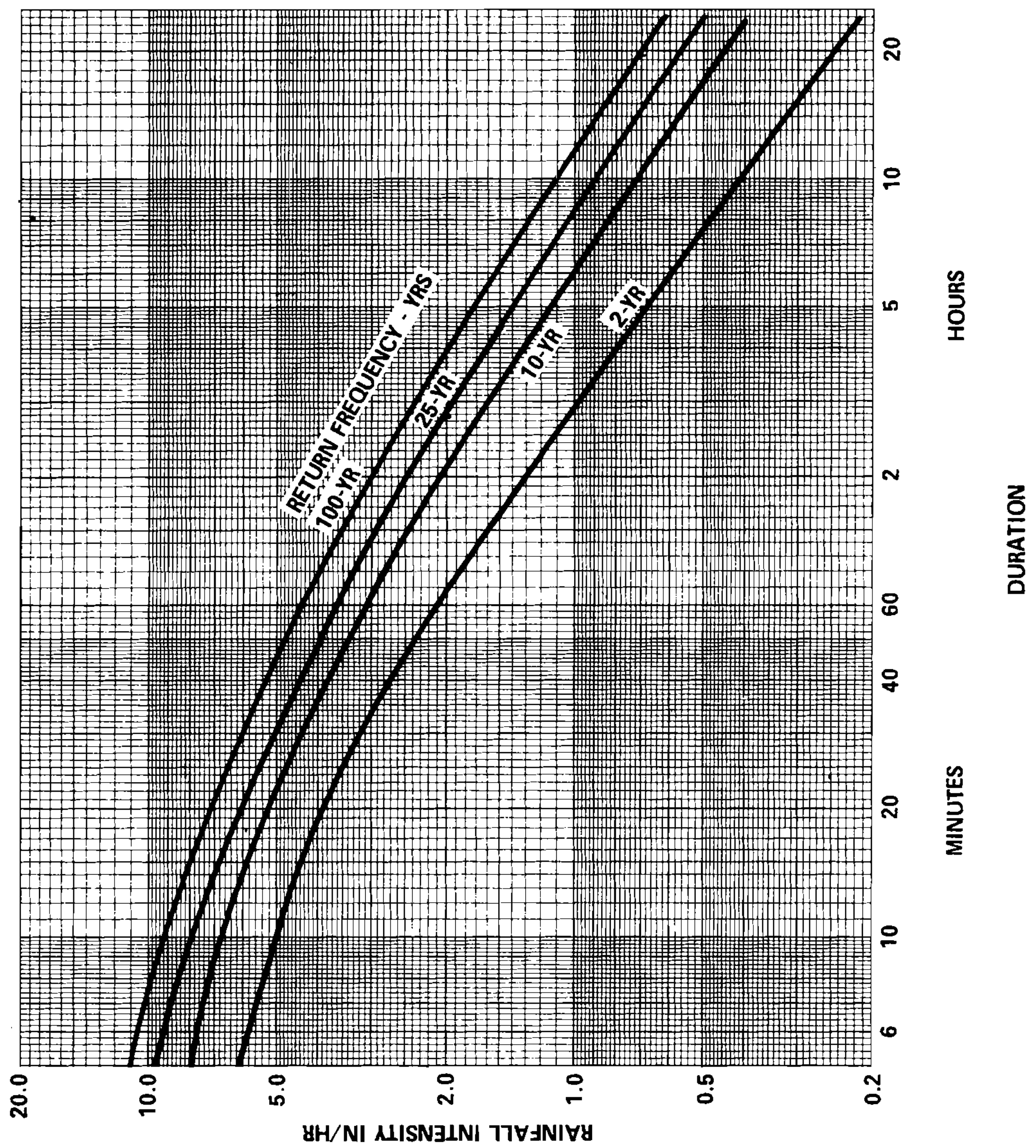
LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 - GENERAL DESIGN
SUPPLEMENT NO. 5A
CITRUS LAKEFRONT LEVEE
IHNC TO PARIS ROAD

STANDARD PROJECT HURRICANE
ISOVEL TRACK AND PATTERN
CRITICAL TO CITRUS AREA

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

MAY 1976 FILE NO. H-2-28975

PLATE C-1

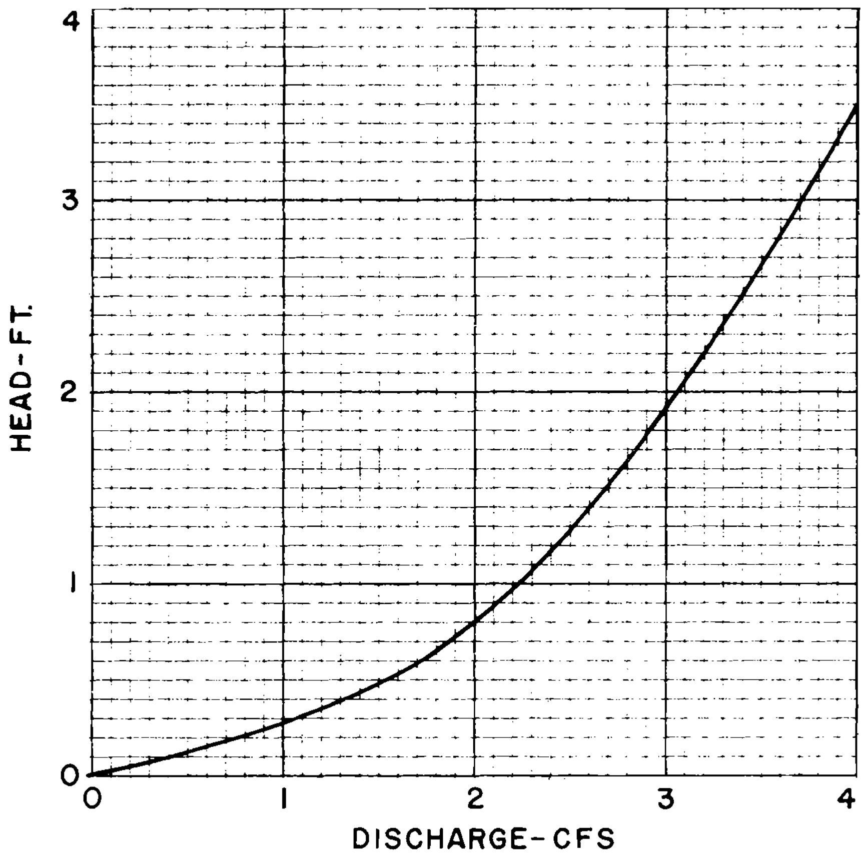


LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 – GENERAL DESIGN
SUPPLEMENT NO. 5A
CITRUS LAKEFRONT LEVEE
IHNC TO PARIS ROAD

RAINFALL INTENSITY – DURATION – FREQUENCY CURVES

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

MAY 1976 FILE NO. H-2-25975



LAKE PONTCHARTRAIN, LA. AND VICINITY
LAKE PONTCHARTRAIN BARRIER PLAN
DESIGN MEMORANDUM NO. 2 – GENERAL DESIGN
SUPPLEMENT NO. 5A
CITRUS LAKEFRONT LEVEE
IHNC TO PARIS ROAD

RATING CURVE
12"ϕ X 60' LEVEE DRAINAGE
OUTLET PIPES

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

MAY 1976 FILE NO. H-2-25975