1353

[redacted]

U. S. ARMY, CORPS OF ENGINEERS

5-CU ✓
5-CU-A

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

10-CU ✓
10-CU-A
15-CU ✓
18-CU ✓
30-CU ✓
37-CU ✓
43-CU ✓
45-CU ✓

1-4-C 16-17-C 42-44-C
7-9-C 19-36-C
11-14-C 38-42-C

DESIGN MEMORANDUM No. 3
GENERAL DESIGN
SUPPLEMENT No. 1
CHALMETTE EXTENSION

(CEL) CHALMETTE EXTENSION LEVEE

21-D ✓
77.8 ✓

✓ = only ones that go deep enough for Pleistocene

Prepared by:

Waldemar S. Nelson & Company, Inc.
Engineers & Architects
New Orleans, La.

U. S. Army Engineer District, New Orleans
Corps of Engineers, U. S. Army
New Orleans, La.

SEPTEMBER 1968

17

INCL 5

LMVED-TD (NOD 21 Oct 68) 1st Ind
SUBJECT: Lake Pontchartrain, Louisiana and Vicinity, Chalmette Area Plan, General Design Memorandum No. 3, Supplement No. 1, Chalmette Extension Levee

DA, Lower Mississippi Valley Division, Corps of Engineers, Vicksburg, Miss. 39180 13 Dec 68

TO: Chief of Engineers, ATTN: ENGCW-V/ENGCW-E

Subject supplement is forwarded for review and approval pursuant to para 17a, ER 1110-2-1150. Approval is recommended, subject to the attached comments.

FOR THE DIVISION ENGINEER:

A. J. DAVIS
Chief, Engineering Division

2 Incl
wd 2 cy incl 1
Added 1 incl (14 cy)
2. Comments

CF:
NOD-LMNED-PP
w/cy incl 1 & 2

ENGCW-EZ (LMNED-PP, 21 Oct 68) 2d Ind
SUBJECT: Lake Pontchartrain, Louisiana and Vicinity, Chalmette Area Plan, General Design Memorandum No. 3, Supplement No. 1, Chalmette Extension Levee

DA, Office of the Chief of Engineers, Washington, D. C. 20315 12 August 1969

TO: Division Engineer, Lower Mississippi Valley

1. Reference letter, LMNED-BE, 13 June 1969, subject: "Lake Pontchartrain, Louisiana and Vicinity - Chalmette Area Plan - Economic Reanalysis of the Chalmette Extension," and the 1st indorsement, LMVPD-E, 30 June 1969, thereon.

2. Supplement No. 1 to General Design Memorandum No. 3 for subject project, as modified by the economic reanalysis furnished by the letter referenced in paragraph 1 above, is approved, subject to the comments of the Division Engineer, (a) attached as Inclosure 2 to the 1st indorsement and (b) furnished in the 1st indorsement referenced in paragraph 1 above, and the following comments.

3. Supplement No. 1, Paragraph 40, Drainage Structure. Consideration should be given to changing the 2-72" paved invert corrugated metal pipes to 2-reinforced concrete boxes with collars at all joints. This would afford better corrosion resistance to the salt water.

4. Economic Reanalysis of the Chalmette Extension.

a. Paragraph 4j. It should be noted that over 74 percent of the benefits used to justify Chalmette Levee Extension is based on future development (36%) and land enhancement (38%). Although the Corps of Engineers has no policy concerning the amount of future benefits and land enhancement that can be used to justify a project, it does require cost-sharing when obvious windfall benefits accrue to limited special interests, except hurricane protection projects are generally not recommended for cost-sharing. This is due to the special standards (30 percent local, 70 percent Federal) applied to these projects which have been recognized to encompass land enhancement benefits. Nevertheless, the 70/30 percent cost-sharing arrangement does not relieve the District of the responsibility of presenting sufficient information to show that the land enhancement benefits are widespread and that "windfall benefits of unconscionable magnitude to limited special interests" does not exist. Therefore, the following items should be considered by the Division Engineer in making his determination:

(1) Identify the land owners within the project area.

ENGCW-EZ (LMNED-PP, 21 Oct 68) 2d Ind 12 August 1969
SUBJECT: Lake Pontchartrain, Louisiana and Vicinity, Chalmette Area Plan, General Design Memorandum No. 3, Supplement No. 1, Chalmette Extension Levee

(2) Give the acreage of each land owner.

(3) Identify the land use before and after for each land owner.

(4) Discuss possible alternatives, if any.

b. Paragraph 5. The estimate for hydraulic sand fill presented on pages 14 and 15 of the reanalysis report indicate that a production rate of 450,000 cubic yards per month effective placement for a 20-inch dredge was the basis of the estimate. Analysis of dredge capability from data available in OCE indicates that the effective placement rate which can be expected from a 20-inch dredge under the conditions involved for the subject project would be in the vicinity of 300,000 cubic yards per month. A study of the estimated costs based on this latter production rate indicates that the $1.20 per cubic yard for hydraulic sand fill is low. The District Engineer should investigate further the unit price for hydraulic sand fill and should be satisfied that the unit price included in the project estimate is adequate.

c. Paragraph 7b. The annual O.M.&R. and economic loss on lands presented in this paragraph of the reanalysis appears to be low and should be verified.

FOR THE CHIEF OF ENGINEERS:

wd all incl

Homer B. Willis
WENDELL E. JOHNSON
for Chief, Engineering Division
Civil Works

32403686

TC202 N46L3P6 no.3 Suppl.1 1968

LMVED-TD (NOD 21 Oct 68) 3d Ind
SUBJECT: Lake Pontchartrain, Louisiana and Vicinity, Chalmette Area Plan, General Design Memorandum No. 3, Supplement No. 1, Chalmette Extension Levee

DA, Lower Mississippi Valley Division, Corps of Engineers, Vicksburg, Miss. 39180 5 Sep 69

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

Forwarded for information and appropriate action.

FOR THE DIVISION ENGINEER:

A. J. DAVIS
Chief, Engineering Division

13 December 1968

DEPARTMENT OF THE ARMY
LOWER MISSISSIPPI VALLEY DIVISION, CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI 39180

COMMENTS ON SUPPLEMENT NO. 1, GDM NO. 2, CHALMETTE EXTENSION LEVEE, LAKE PONTCHARTRAIN, LA., AND VICINITY HURRICANE PROTECTION PROJECT, CHALMETTE AREA PLAN

1. Para 1, page 1. This paragraph does not tell the complete story. Reference should be made to the FCA of 1962 with the text explaining fully the transfer of this work from the Mississippi River Delta at and below New Orleans Project to the subject project.

2. Para 2, page 2. Rewrite to agree with para 32i(5), page 16. As written, the indication is that no additional stability analyses will be required for interim lifts. The supplemental analyses described in para 32i(5) should be reviewed by LMVD prior to or concurrently with the plans and specifications for the applicable work.

3. Para 6, page 4. The reference to para 2 should be to para 3.

4. Para 14, page 7, Project Location Map, and Plate 1. Para 14 makes reference to Bayou Lawler in describing the project works. Bayou Lawler is not shown on the Project Location Map and is almost illegible on Plate 1. This should be corrected.

5. Para 15b, page 8. The reference to para 14 should be to para 17.

6. Para 31, page 13. The impression is given that the levee was purposely located and designed to obtain a factor of safety of 3.2, while, in fact, the factor of safety resulted from the design levee section and its location with respect to the proposed MR-GO borrow.

7. Paras 32j, k, and l, pages 16 and 17. a. The procedures used to determine settlement and shear strength increases assume that the entire applied load is effective in consolidating (reducing the void ratio of) the foundation in accordance with the theory of one-dimensional consolidation. Data from construction of the test embankments on soft foundations in the Atchafalaya Basin indicate the above assumption is not entirely valid due to lateral spreading and displacement of foundation material which occurs partially with no volume change. An exact procedure is not available

Incl 2

for predicting the portion of the applied load which is effective in reducing the void ratio and increasing the shear strength of the foundation soils. However, the shear strength increases presented in this design memorandum seem to have been selected in a conservative manner.

b. Data in Section VI, para 97, page 64 of the Interim Report, Field Tests of Levee Construction, Test Sections I, II, and III, East Atchafalaya Basin Protection Levee, indicate as much as 45 percent of the observed vertical settlement may result from lateral, no-volume-change movement of the foundation. Therefore, the cost estimates (para 49, pages 36 to 39) for embankment quantities should include an allowance for increased settlement to adjust for lateral spreading of the foundation. The entire levee foundation area should be evaluated to determine those areas in which an adjustment to the embankment quantities should be made.

8. Para 32t, page 18. The shear strengths used for stratas 4 and 5 (see Plate 20) are apparently R rather than S strengths which are considered satisfactory. However, the basis for establishing the selected strength values should be presented.

9. Para 32cc, page 21. Para 32i(5), page 16, states that plans and specifications for the first lift construction will be prepared based on Q stability analyses performed for this initial lift. However, stability analyses for the initial lift have only been presented for the reach from Stas 770+00 to 940+00. Further, the stability analyses for subsequent lifts and shapings (prior to the final shaping) have only been presented for the reach from Stas 770+00 to 940+00. The stability analyses for the first lift in each reach should be submitted for LMVD review in advance of or with the plans and specifications for the lift.

10. Paras 34 and 36c, pages 21, 22, 24, and 25, and Plates 61 and 81.

a. Para 36c indicates that the first lift of hydraulic sand fill as shown on Plate 15 will serve as a preload fill for the drainage structure at Sta 1353+40. However, it is noted that essentially no preload fill is provided in the areas to be occupied by the inlet and stilling basins and the operating tower. The initial excavation to elevation -8.0, and the subsequent preload sand fill should be widened at the structure site to provide preload sand fill in the areas of the inlet and stilling basins and operating tower. This additional width should be provided for a distance of about 40 feet on each side of the drainage structure centerline. In order to provide the maximum feasible preload fill for the structure, the height of the fill above these areas and at the centerline of the levee should be the maximum possible within the criteria of providing a minimum factor of safety of 1.3 for the Q stability condition.

b. The proposed sequence of construction for the drainage structure should be indicated. Presumably, it is intended to bring the levee above the drainage structure to final grade and section immediately after completion of the structure. Since the inlet and stilling basins, the operating tower and intermediate pier for the service bridge are not proposed to be supported on piles, this construction sequence will require that essentially all settlement induced by preloading take place prior to construction of the structure to prevent significant differential movement or distress of the structure components. Therefore, it may be necessary for the preload fill to remain in place for a period greater than one year. Settlement plates should be installed under the preload fill and monitored until essentially all significant settlement has taken place. Prior to degrading the preload fill, undisturbed borings and shear testing should be performed for the structure site to verify design assumptions made for shear strength increases with regard to stability of the levee section and bearing capacity of the operating tower.

c. The stability analyses at the 72-inch pipe drainage structure (Plate 61) have been performed assuming the inlet and outlet channels excavated to els -8.0 and -7.0, respectively. The area to be excavated to these elevations is small compared to the area in which the 1 on 4 slope will toe out at natural ground at approximate el +1. Considering the problem to be three dimensional, a conventional stability analysis assuming the inlet and outlet channel bottoms at el -4 would be a satisfactory approach. The 72-inch pipe drainage structure should be of sufficient length to provide a factor of safety of 1.3 for a conventional type stability analysis with the inlet and outlet channel bottoms assumed at el -4.0. The increased shear strengths to be used in the stability analyses should be those due to the first lift previously placed and subsequently excavated for construction of the drainage structure. The stability analyses should be performed for the conditions outlined in para 34, page 21, of the design memorandum.

11. Para 41b(1), page 30. The levee between Stas 940+00 and 1039+00 should be constructed in two lifts and three shapings.

12. Para 41g, page 32, and Plates 12 and 13. The text states that foreshore protection will consist of 1.75 feet of riprap while Plates 12 and 13 show the riprap to be 2.0 feet thick. This difference should be resolved.

13. Para 42c, page 33. a. The cost estimates indicate approximately 3.9 million cubic yards of hydraulic sand fill will be required from the Mississippi River and the Mississippi River batture in the vicinity of English Turn Bend. Based on the information presented on Plate 52, we cannot determine if the required volume of sand is available in the proposed

area or if it can be safely removed without endangering the stability of the bank and adjacent Mississippi River levee. NOD should insure that the required volume of sand can be obtained from this area. Further, the plan for excavation of sand from the area also should be thoroughly investigated to insure that the Mississippi River main line levee will not be endangered.

b. Based on a study of WES TR No. 3-60, Distribution of Soils Bordering the Mississippi River from Donaldsonville to Head of Passes, dated June 1962, it seems that an additional source of sand about four miles closer to the levee construction is available on the right descending bank of the Mississippi River at Twelve Mile Point (see Plates 7 and 30 of referenced report). Although excavation of sand from this area will require an underwater crossing of the hydraulic pipeline, we consider that this sand source should be included in the construction plans and specifications as an alternate borrow source for sand. This site should also be investigated to determine the quantity of sand available for borrow in this area without endangering the Mississippi River main line levee. Further, this source of sand could supplement the English Turn Bend source should it become necessary.

c. In the event the additional studies recommended above indicate that insufficient sand is available from both the English Turn Bend and Twelve Mile Point sites, it will be necessary to reconsider the levee design and construction procedures proposed.

14. Para 49, pages 36, 37, 38, and 39. a. The cost account numbers should be given for all accounts. The title of the "Item No." column should be changed to "Cost Acct. No." and the "Description" column changed to "Item."

b. The foreshore protection chargeable to the MR-GO account should be shown as a subfeature under Levees and Floodwall and properly footnoted.

c. The estimated cost of $8 per ton for riprap should be reexamined in view of recent decreases in bid prices.

d. Information from NOD indicates that the $1 per cubic yard unit price cited for Embankment (hydraulic-sand) 1st lift in Table 1 was based on opposite borrow. Based on using the English Turn Bend borrow area, this unit price should be approximately $1.50 to $1.75 per cubic yard.

15. Para 50, page 39. a. The large cost increase in the Levees and Floodwalls account should be explained in clear, concise terms. The general statement presented is not satisfactory.

b. The word "changeable" in the footnote should be "chargeable."

16. Para 51, page 40. The reference to para 51 in subparas a through e should be to para 50.

17. Plate 12. The intended use for Types A, B, and C riprap indicated in the chart shown in the upper right corner of the plate should be explained. Apparently, as indicated by para 41g, the riprap foreshore protection is to be 1.75 ft. (21 inches) thick. However, the chart only shows gradations for 12-in., 18-in., and 24-in. riprap. This discrepancy should be resolved.

18. Plates 12 and 13. The location and details of the foreshore protection indicated on these plates should be revised to agree with final approved plan adopted in GDM No. 2, Supplement No. 4, MR-GO, Foreshore Protection.

19. Plate 14. The note on this plate indicates that the final shaping will be commenced one year after completion of the first lift. This does not seem reasonable in view of the much longer times required for final shaping of adjacent reaches on similar foundations.

20. Plates 15, 57, 61, and 81. The 1 on 5 levee slope from Sta 1120+90 to Sta 1535+40, as shown on Plate 57, does not agree with the 1 on 4 levee slope for the final shaping section as shown on Plate 15 or the 1 on 4 levee slope at the drainage structure as shown on Plates 61 and 81. This discrepancy should be resolved.

21. Plate 17. The minimum cross section for stability requirements indicated for the first lift construction is confusing. Since the crown of the first lift is level at el 13.0, a cross section smaller in width than the minimum section indicated would be as or more stable than the minimum cross section shown. This should be clarified.

22. Plate 56. The stratification shown for the final shaping section for Stas 940+00 to 1039+00 cannot be checked. The section indicates a PT stratum between els -12.5 and -10.5 and an SM stratum below el -40.7. The undisturbed boring logs (Plates 26 and 30) and the general type boring logs for this reach do not indicate this type stratification. This discrepancy should be resolved.

23. Plates 56, 57, and 58. The applicable levee sections should be modified so as to raise all factors of safety shown in the levee stability calculations charts on these plates to 1.3.

24. Plate 57. a. The stability analyses for the reach between Stas 1120+90 and 1535+40 should also be performed with the net levee grade at els 17.5 and 17.0 as the levee will be constructed to these elevations

from Stas 1120+90 to 1210+00 and Stas 1215+00 to 1305+00, respectively. Modifications, if necessary, should be made to the design levee sections for these reaches to secure a factor of safety of 1.3 for the stability analyses.

b. The stratification shown with the design levee section for the reach between Stas 1120+90 to 1535+40 is not considered representative of the entire reach. Apparently, the stratification has been developed from boring 30-CU (Plate 39) for the entire reach. Study of the logs of borings for the entire reach (Plates 6 to 10, 39, and 42) and the Generalized Soil and Geologic Profile (Plate 19) indicate that the reach should be subdivided and analyzed in three separate reaches. These reaches are approximately as follows: Sta 1120+90 to 1180+00, 1180+00 to 1350+00, and 1350+00 to 1535+40. Based on the water contents and consistencies shown with the boring logs, additional undisturbed and shear test data would be required for the reach between approximate Stas 1120+90 and 1180+00 as boring 30-CU does not represent conditions for this reach. The stratification and shear strengths from boring 30-CU are considered appropriate for the reach between approximate Stas 1180+00 and 1350+00 while boring 37-CU stratification and shear strength are considered satisfactory for the remaining reach between approximate Stas 1350+00 and 1535+40. The above should be considered when performing the analyses discussed in subpara a above.

25. Plate 53. The inclined line shown on the plots of Stratum 4 and Stratum 5 should be labeled "R Line" rather than "S Line."

26. Plate 55. The title block of this plate is in error and should be corrected.

27. Plate 59. a. The stratification shown for the stream closure between Stas 1039+00 and 1041+00 apparently is based on boring 15-CU. However, boring 14-C (Plate 5) made at the stream closure location indicates a considerably different stratification. Therefore, the stratification for this reach should be reevaluated.

b. The shear strength values for the reach should also be reexamined. The consistencies and water contents shown with boring 14-C (Plate 5) differ appreciably from those in boring 15-CU (Plate 33) used to select the design shear strengths. It would be desirable to obtain additional undisturbed borings and shear test data for the stream closure reach to properly evaluate the stability of the stream closure section.

c. The original shear strength values of C = 400 psf and C = 560 psf indicated between els -17.0 and -24.0 and -24.0 and -28.0, respectively, for the stream closure section between Stas 1039+00 and 1041+00 do not agree with those shown with boring 15-CU (Plate 33).

d. Similarly, the original shear strength value of C = 400 psf indicated between els -17.0 and -23.0 for the stream closure section between Stas 1535+40 and 1537+00 does not agree with that shown with boring 43-CU (Plate 45).

28. Plate 60. The stability of the channel slope of the MR-GO should be investigated and presented for conditions with excavation to el -60.0.

29. Plate 64 and para 48. Para 48 does not indicate when, where or how the pipelines will be relocated. However, we understand from NOD that all of the existing pipelines shown on Plate 64 are to be relocated over the levee. Since the levee is to be constructed in stages over a period of time, it will not be possible to relocate these pipelines on top of the levee, if the levee is to support the pipelines, until the levee is completed. It will also be necessary for the existing pipelines to be removed from beneath the levee base prior to constructing the first lift. If the plans for relocating these pipelines have not considered the above, local interests should be informed of these requirements and restrictions, and cost estimates for the relocations revised if necessary.

30. Plates 70 and 71. The axes of intersecting truss members do not in all cases meet at a common point. This will result in bending stresses which have been neglected in the design. It is preferable to eliminate these stresses by making the axes of members concentric at the joints; however, if this is not done, the design should be checked to insure the effect of bending is not critical. It is also noted that pipe truss members are indicated to be welded to plate elements (beam webs and flanges). Bending in such plate elements will result in objectionable nonuniform distribution of stress at the connection. Such connections should not be used for major members. If used for connection of secondary members, ample allowance should be made for the nonuniform stress distribution.

31. Plates 74 and 77. a. The slope of the levee centerline in the levee to floodwall transition area on each side of the highway openings should be shown on the Elevation view.

b. The joint detail for the connection of the "I" and "T"-walls should be shown on the plates. The joint should be designed considering probable vertical settlement and horizontal deflection differences between the two type walls. A joint should be designed to incorporate these movements but remain watertight.

32. Plates 74, 77, and 81. The size of the steel sheet piling to be used as cutoff beneath the "T" walls and 72-inch pipe drainage structure should be indicated.

33. Plate 76. The note on "Section at Buttress" which reads "Recess in Buttress for Clamping Mechanism" should read "Recess in Buttress for Locking Device."

34. Plates 76 and 79. The vertical reinforcement bars in the buttress will be ineffective where bent to clear the recess for the locking device. The buttresses should be redesigned so that the need for bending the bars is avoided.

35. Plate 78. a. The loading diagram shown in the lower left corner of the plate should be labeled "Loads to Foundation for Wall" and the loading diagram shown at the top center of the plate should be labeled "Loads to Foundation for Buttress."

b. The horizontal resultant force on the wall in the loading diagram "Loads to Foundation for Wall" is erroneously labeled as the vertical resultant.

c. The vertical downward force of 48.6^k shown at the center of the buttress footing in the loading diagram "Loads to Foundation for Buttress" should be labeled as the footing weight.

d. At several locations on the plate, the term Ft-Kips is erroneously shown as Ft/kips.

36. Plate 81. Show the steel sheet pile cutoff wall on the plan of the drainage structure.

37. Plate 82. The size of the steel sheet piles to be used for the "I"-type walls should be shown on the plate. It is indicated in the estimate on page 37 that MA-22 piles are to be used. Stiffer sheet piles should be used since with the indicated design load applied to the wall, the MA-22 piles will be overstressed and the deflection will be excessive. Suggest that MZ-27 piles be used for the "I"-type walls.

38. Appendix D. a. The sheets are not indicated as having been checked. They should be checked.

b. Sheets 5 thru 8 and 10 thru 13. Loading case designations should agree with those indicated on Plates 75 and 78.

13 December 1968

39. Appendix D, Sheet 16. The value of "T" used in the Buttress design should be 3'-0" to agree with the dimension shown on Plate 79. The values of "d" used in the footing designs are in error. These discrepancies should be corrected.

40. Numerous editorial and typing errors exist throughout the text and on the plates.

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

LMNED-PP 21 October 1968

SUBJECT: Lake Pontchartrain, Louisiana and Vicinity, Chalmette Area Plan, General Design Memorandum No. 3, Supplement No. 1, Chalmette Extension Levee

Division Engineer, Lower Mississippi Valley
ATTN: LMVED-TD

1. The subject general design memorandum is submitted herewith for review and approval in accordance with the provisions of ER 1110-2-1150 dated 1 July 1966.

2. Waldemar S. Nelson and Company, Inc., Engineers and Architects, New Orleans, Louisiana, prepared this design memorandum under the provisions of Contract No. DA-16-047-CIVENG-66-320.

3. Approval of the subject design memorandum is recommended.

1 Incl (16 cys)
GDM No. 3, Supp. No. 1

R. J. PEISINGER, JR.
LTC, CE
Acting District Engineer

LAKE PONTCHARTRAIN, LOUISIANA AND VICINITY
CHALMETTE AREA PLAN
DESIGN MEMORANDUM NO. 3 - GENERAL
SUPPLEMENT NO. 1
CHALMETTE EXTENSION

STATUS OF DESIGN MEMORANDA

Design Memo No.		
1	Hydrology and Hydraulic Analysis	
	Part I - Chalmette	Approved 27 Oct 66
	Part II - Barrier	Approved 18 Oct 67
	Part III - Lakeshore	Submitted 30 Sept 68
	Part IV - Chalmette Extension	Approved 1 Dec 67
2	Lake Pontchartrain Barrier Plan, GDM, Advance Supplement, Inner Harbor Navigation Canal Levees	Approved 31 May 67
2	Lake Pontchartrain Barrier Plan, GDM, Citrus Back Levee	Approved 29 Dec 67
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 1, Lake Pontchartrain Barrier, Rigolets Control Structure, Closure Dam, and Adjoining Levees	Scheduled Oct 68
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 2, Lake Pontchartrain Barrier, Rigolets Lock and Adjoining Levees	Scheduled Oct 68
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 3, Lake Pontchartrain Barrier, Chef Menteur Complex	Scheduled Oct 68
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 4, New Orleans East Back Levees	Scheduled Aug 69
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 5, Orleans Parish Lakefront Levees	Scheduled Apr 70
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 6, St. Charles Parish Lakefront Levees	Scheduled Dec 68

STATUS OF DESIGN MEMORANDA (cont'd)

Design Memo No.	Title	Status
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 7, St. Tammany Parish, Mandeville Seawall	Scheduled Feb 71
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 8, IHNC Remaining Levees	Approved 6 Jun 68
2	Lake Pontchartrain Barrier Plan, GDM, Supplement No. 9, New Orleans East Levee from South Point to GIW	Scheduled Mar 69
3	Chalmette Area Plan, GDM	Approved 31 Jan 67
3	Chalmette Area Plan GDM, Supplement No. 1, Chalmette Extension	Submitted 21 Oct 68
4	Lake Pontchartrain Barrier Plan and Chalmette Area Plan, GDM, Florida Avenue Complex, IHNC	Not scheduled
5	Chalmette Area Plan, DDM, Bayous Bienvenue and Dupre	Submitted 25 Jun 68
6	Lake Pontchartrain Barrier Plan, DDM, Rigolets Control Structure and Closure	Scheduled Sep 69
7	Lake Pontchartrain Barrier Plan, DDM, Chef Menteur Control Structure and Closure	Scheduled Sep 69
8	Lake Pontchartrain Barrier Plan, DDM, Rigolets Lock	Scheduled Nov 69
9	Lake Pontchartrain Barrier Plan, DDM, Chef Menteur Navigation Structure	Scheduled Sep 69
10	Lake Pontchartrain Barrier Plan, DDM, St. Charles Parish Drainage Structure	Scheduled Jan 70
11	Beautification	Not scheduled

STATUS OF DESIGN MEMORANDA (cont'd)

Design Memo No.	Title	Status
12	Source of Construction Materials	Approved 30 Aug 66
1	Lake Pontchartrain, La., and Vicinity, and Mississippi River-Gulf Outlet, La., GDM, Seabrook Lock	Scheduled Oct 68
2	Lake Pontchartrain, La. and Vicinity, and Mississippi River-Gulf Outlet, La., DDM, Seabrook Lock	Scheduled Apr 69

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LIST OF PLATES

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APPENDIXES

PERTINENT DATA

Location of Project		Southeastern La. St. Bernard Parish (Metropolitan Area of New Orleans)
Hydrologic Data		
Temperature:	Maximum monthly	87.1 degrees F.
	Minimum monthly	43.0 degrees F.
	Average annual	69.7 degrees F.
Annual Precipitation:	Maximum	85.73 inches
	Minimum	31.07 inches
	Average	60.58 inches
Hydraulic design criteria - Interior Drainage		
Assumed values of "n":		
Corrugated metal pipe drainage structures		0.021
Hydraulic Design Criteria - Tidal		
Design Hurricane - Standard Project Hurricane (SPH)		
Frequency		1 in 200 years
Central Pressure Index (CPI)		27.6
Maximum 5 min. Average Wind		100 MPH
Levees		
Method of Construction		Hydraulic 1/
Levee length (approximate)		15.3 miles
Elevation - varies		17.5-16.5 feet 2/*
Crown width		10 feet

(See Page B for Footnotes)

PERTINENT DATA (cont'd)

Rights-of-way

Levee - as finally constructed	843 acres
Temporary easement for levee material storage	460 acres

Estimated First Cost

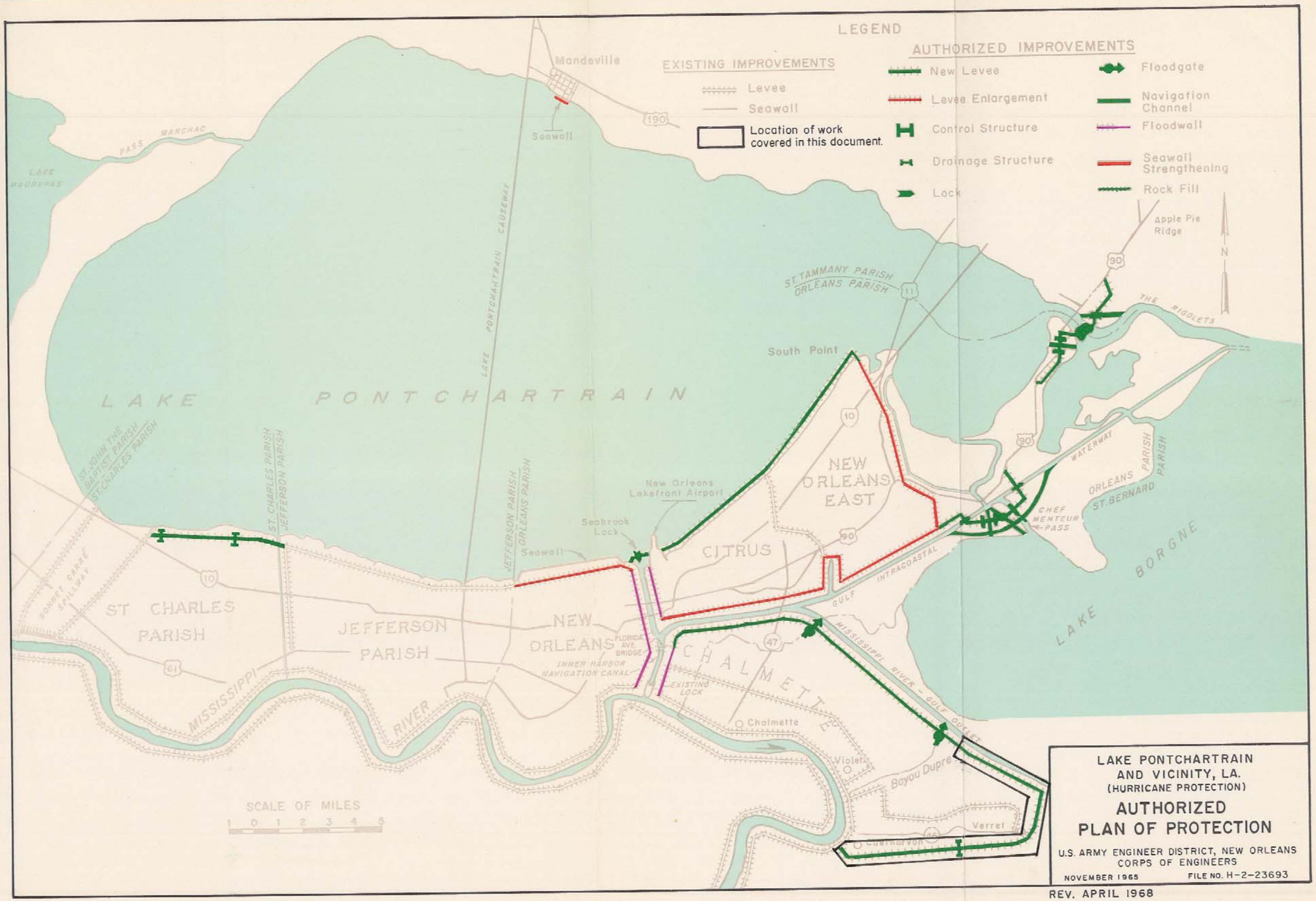
Levees and Floodwall	$16,341,000
Engineering and design	2,157,000
Supervision and administration	1,471,000
Relocations	738,000
Lands and damages	1,093,000
TOTAL	$21,800,000

*Elevations in this memorandum are in feet referred to mean sea level unless otherwise noted.

1/ Except closure levee at Caernarvon which will be constructed of haul material.

2/ Varies ----

Elevation	Stations	
17.5	770-1210	
17.5-17.0	1210-1215	transition
17.0	1215-1305	
17.0-16.5	1305-1310	transition
16.5	1310-1578+13	tie in with Miss. River levee



LEGEND
EXISTING IMPROVEMENTS
Levee
Seawall
Location of work covered in this document.
AUTHORIZED IMPROVEMENTS
New Levee
Levee Enlargement
Control Structure
Drainage Structure
Lock
Floodgate
Navigation Channel
Floodwall
Seawall Strengthening
Rock Fill
LAKE PONTCHARTRAIN
Mandeville
Seawall
PASS MANCHAC
LAKE MAUREPAS
LAKE PONTCHARTRAIN CAUSEWAY
ST. TAMMANY PARISH
ORLEANS PARISH
South Point
Apple Pie Ridge
THE RIGOLETS
NEW ORLEANS EAST
CITRUS
New Orleans Lakefront Airport
Seabrook Lock
ST. JOHN THE BAPTIST PARISH
ST. CHARLES PARISH
JEFFERSON PARISH
ORLEANS PARISH
BONNET CARRE SPILLWAY
ST CHARLES PARISH
JEFFERSON PARISH
NEW ORLEANS
FLORIDA AVE BRIDGE
INNER HARBOR NAVIGATION CANAL
EXISTING LOCK
CHALMETTE
Chalmette
MISSISSIPPI RIVER
GULF INTRACOASTAL WATERWAY
CHEF MENTEUR PASS
ORLEANS PARISH
ST. BERNARD PARISH
LAKE BORGNE
MISSISSIPPI RIVER - GULF OUTLET
Violet
Bayou Dupre
Verret
Caernarvon
SCALE OF MILES
1 0 1 2 3 4 5
N
LAKE PONTCHARTRAIN AND VICINITY, LA.
(HURRICANE PROTECTION)
AUTHORIZED PLAN OF PROTECTION
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NOVEMBER 1965
FILE NO. H-2-23693
REV. APRIL 1968

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN
SUPPLEMENT NO. 1 - CHALMETTE EXTENSION
TO
DESIGN MEMORANDUM NO. 3 - GENERAL DESIGN

PROJECT AUTHORIZATION

1. Authority. a. Public Law 298-89th Congress, 1st Session approved 27 October 1965, authorized the Lake Pontchartrain, La. and Vicinity, hurricane protection project, substantially in accordance with the recommendations of the Chief of Engineers in House Document No. 231, Eighty-Ninth Congress, 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. 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 Chief of Engineers stated:

> "...For the Chalmette area, the reporting officers find that the most suitable plan would consist of about 17.3 miles of new and enlarged levees extending generally along the southerly banks of the Gulf Intracoastal Waterway and the Mississippi River-Gulf Outlet channel to Bayou Dupre and thence westerly to the Mississippi River levee at Violet...The Board (of Engineers for 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."

c. By LMNED-PR letter dated 29 November 1966, it was recommended that the approved plan of hurricane protection for the Chalmette area contained in Design Memorandum No. 3, General Design, Lake Pontchartrain, La. and Vicinity, Chalmette Area Plan, be modified, under the discretionary authority of the Chief of Engineers, to provide for enlargement of the protected area by construction of a levee from the Mississippi River levee near Caernarvon, La., to the vicinity of Verret, La., thence to and along the Mississippi River-Gulf Outlet (MR-GO) spoil bank to a junction with the approved plan levee at the Bayou Lawler crossing of the MR-GO spoil bank; and elimination of the levee in the approved plan from the Bayou Lawler and MR-GO spoil bank junction to Violet, La. This recommendation was approved by OCE on 31 Jan. 1967 in 2nd indorsement to the basic letter. LMNED-PR letter dated 29 November 1966, subject Lake Pontchartrain, La. and Vicinity Modification of the Chalmette Area Plan to Include Larger Area and indorsements thereto are included herein as Appendix A.

2. Purpose and scope. This supplement presents the essential data, assumptions, criteria, and computations for development the plan, design, and costs for the Chalmette Extension levee in sufficient detail to provide an adequate basis for preparing plans and specifications for the levee without additional design analyses.

3. Local cooperation. The conditions of local cooperation pertinent to the Chalmette area, as specified in the report of the District Engineer, further stated in the report of the Board of Engineers for Rivers and Harbors and concurred in the report of the Chief of Engineers, are applicable to the extension and are as follows:

> "...The separate plan for protection of the Chalmette area to 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 Stated:
>
> "(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 constructions work;
>
> "(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 sub-paragraphs (1)

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

"(5)...,

"(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..

"(8) Acquire adequate easements or other interest in land to prevent encorachment 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..."

INVESTIGATIONS

4. Project document investigations. Studies and investigations made in connection with the project document (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 hurricane damage and characteristics of hurricanes; extensive tidal hydraulics investigations involving both office and model studies; an economic survey; preliminary 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 the Chaomette Extension include:

a. Aerial and topographic surveys of the Chalmette Area levee locations and adjacent areas;

b. Soil investigations including general type borings and laboratory evaluation of undisturbed boring cores;

c. Detailed design studies for levee and gap closure construction including bank and levee section stability determinations;

d. Tidal hydraulic studies required for establishing design grades for levees and structures;

e. General hydraulic studies to establish the required sizes for drainage structures to provide for the outflow of interior drainage of the additional protected area;

f. Real estate requirements;

g. Cost estimates for levees, structures and relocations; and

h. Economic studies for evaluation of justification or proposed works.

LOCAL COOPERATION

6. Local cooperation requirements. The conditions of local cooperation as specified by the authorizing laws are quoted in paragraph 2. Essentially local interests must:

a. Provide all lands, easements, and rights-of-way, including borrow and spoil-disposal areas;

b. Accomplish necessary alterations and relocations to existing facilities required by construction of the project;

c. Hold and save the United States free from damages due to the construction works;

d. Bear 30 per cent of the first cost including the fair market value of items (a) and (b) above;

e. Provide all interior drainage facilities necessary for reclamation and development of the protected area;

f. Maintain and operate the project works in accordance with regulations prescribed by the Secretary of the Army.

7. Status of local cooperation. On 2 November 1965 the Governor of the State of Louisiana designated the State of La. Department of Public Works as '...the agency to coordinate the efforts of local interest and to see that the local commitments are carried out promptly...' By state of Louisiana Executive Order dated 17 January 1966, the Board of Commissioners of the Orleans Levee District was designated as the local agency to provide the required local cooperation for all portions of the Lake Pontchartrain, La. and Vicinity, project in Orleans, Jefferson, St. Charles, and St. Tammany Parishes. Assurances were requested through the State of Louisiana Department of Public Works from the Board of Commissioners of the Orleans Levee District for the section of the Chalmette area plan falling in Orleans Parish on 21 January 1966, and from the St. Bernard Parish Police Jury and the Board of Commissioners of the Lake Borgne Basin Levee District for the remainder of the Chalmette area plan on 8 February 1966. An acceptable joint act of assurance for the portion of the Chalmette area plan, exclusive of the approved mofidication thereto located in St. Bernard Parish, supported by resolutions adopted by the St. Bernard Parish Police Jury and the Board of Commissioners of the Lake Borgne Basin Levee District on 15 and 16 August 1966, respectively, was approved and accepted on behalf of the United States on 28 September 1966. An act of assurance for the portion of the Chalmette area plan located in Orleans Parish, supported by a resolution of the Board of Commissioners of the Orleans Levee District dated 28 July 1966, was approved and accepted on behalf of the United States on 10 October 1966.

8. In addition, an acceptable joint act of assurance for the Chalmette area plan modification, supported by resolutions adopted by the St. Bernard Parish Police Jury and the Board of Commissioners of the Lake Borgne Basin Levee District on 6 June 1967, was approved and accepted, on behalf of the United States on 6 July 1967.

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

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

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

Mr. Irvin J. G. Janssen, President
Board of Commissioners
Lake Borgne Basin Levee District
104 Bergeron Building
2006 Packenham Drive
Chalmette, Louisiana

Mr. Valentine Riess, President
St. Bernard Parish Police Jury
Chalmette, Louisiana

10. Views of local interests. The Board of Commissioners of the Orleans Levee District, the Board of Commissioners of the Lake Borgne Basin Levee District, and the St. Bernard Parish Police Jury represent local interests and are in agreement with the general plan.

11. Estimated cost to local interests. The total non-Federal cost is estimated to be $6,540,000, which includes $1,831,000 for lands, damages and relocations, and $4,709,000 cash contribution.

LOCATION OF PROJECT AND TRIBUTARY AREA

12. Location of project. The project area covered in Design Memorandum No. 3, General Design, is located in southeast Louisiana on the left descending bank of the Mississippi River in Orleans and St. Bernard Parishes. The additional project area, as covered by this supplementary report, is in St. Bernard Parish and is south of, and adjacent to, the original project area. The supplementary

area is bounded on the west by the Mississippi River, on the north by Bayous Lawler and Dupre, on the northeast by the MR-GO, and on the southeast and south by a line drawn from the MR-GO to Louisiana Highway 46 at Verret, thence westerly to the Caernarvon Canal, thence northwesterly to the Mississippi River levee at Caernarvon. A general plan, index and vicinity map is shown on Plate 1.

13. Tributary area. The additional area to be protected, which is generally rural in nature, will increase the total area of lands within the Chalmette Area Plan from approximately 31,300 acres to approximately 50,100 acres, an increase of 18,800 acres which include 4,100 acres of wooded area, 4,500 acres of cleared area, and 10,200 acres of marshland.

PROJECT PLAN

14. Project works. The project plan presented in Design Memorandum No. 3, General Design, is to be modified as hereinafter outlined; the proposed reach of levee between the MR-GO at Bayou Lawler and the Mississippi River levee at Violet is to be eliminated; the levee along the south bank of the MR-GO is to be extended from Bayou Lawler to a point approximately 6 miles southeast of Bayou Dupre; thence in a southwesterly direction, for approximately 2-1/2 miles to and across Louisiana Highway 46 at Verret; thence west for approximately 8 miles to a point on the east bank of the Caernarvon Canal; thence northwest to a tie with the Mississippi River levee at Caernarvon. Gap closure structures will be provided for Louisiana Highway 46 at Verret and Louisiana Highway 39 at Caernarvon, and for the Louisiana Southern Railroad at Caernarvon. Sector-gated control structures at the junction of Bayous Bienvenue and Dupre with the MR-GO, discussed in Design Memorandum No. 3, General Design, and Design Memorandum No. 5, Detail Design, will provide for discharge of intercepted drainage flows east of the Mississippi River Levee from Violet to Poydras and north of Louisiana Highway 46 from Poydras to Verret. Multiple lines of corrugated metal pipe culverts fitted with both flap and vertical lift gates will provide for the outflow of intercepted drainage for the reach between Verret and Caernarvon. Alteration of 2 water mains, 10 gas pipelines, 1 oil pipeline, 2 buried telephone cables, 1 aerial telephone cable, and 4 aerial electric power transmisstion lines, will be required to clear the levee for the proposed extension from Bayou Lawler to Caernarvon.

DEPARTURES FROM PROJECT DOCUMENT PLAN

15. General. The project document plan (H.D. 231/89th Congress), including departures therefrom, is discussed in Design Memorandum No. 3, General Design, Chalmette Area Plan, dated Nov. 1966 and approved 31 January 1967. Additionally, as covered by this supplementary memorandum, the following authorized changes were made:

a. At the request of the State of Louisiana, Department of Public Works, St. Bernard Parish Police Jury, Board of Commissioners of the Lake Borgne Basin Levee District and other local interests, a modification in the alignment of the levee was adopted by the Chief of Engineers. The return levee from the MR-GO to Violet was deleted and replaced by an extension of the levee along the MR-GO to a point approximately 4-1/2 miles southeast of Bayou Lawler, thence southwesterly across Louisiana Highway 46 at Verret, thence westerly to the Caernarvon Canal with a return levee tie-in to the Mississippi River levee at Caernarvon, with provisions for intercepted drainage and necessary highway and railroad levee gap closure structures, see Appendix A.

b. The net levee grades, described in paragraph 14, for the added area were established in accordance with rhe results of tidal hydraulic studies utilizing the latest hurricane parameters developed by the U.S. Weather Bureau and information obtained from the passage of the major hurricane "Betsy" in September 1965.

HYDROLOGY

16. General. The Hydrology and Hydraulic Analysis Design Memorandum for the Lake Pontchartrain, Louisiana and Vicinity Project is presented in four separate reports --- Parts I, II, III, and IV entitled, "Chalmette", "Barrier", "Lakeshore", and "Chalmette Extension", respectively. The data for the Chalmette Area Plan are covered in "Design Memorandum No. 1, Hydrology and Hydraulic Analysis, Part I-Chalmette", and "Part IV-Chalmette Extension" including the presentation therein of detailed descriptions and analyses of the methods and procedures used in the tidal hydraulic design. Included in the descriptions and analyses are the essential data, climatology, assumptions and criteria used and the results of studies which provide the basis for determining surges, routing, wind tides, runup; overtopping and frequencies. The hydraulic analysis for the discharge of interior drainage is covered in Appendix B.

17. Design elevations. The design hurricane critical to the

Chalmette area plan is a Standard Project Hurricane (SPH) having a frequency of about one in 200 years; a central pressure index of 27.6 inches of mercury; a maximum 5-minute average wind velocity of 100 m.p.h., 30 feet above ground level, at a radius of 30 nautical miles from the center; and a forward speed of 11 knots, on a track critical to the area in question. Detailed information on the design hurricane is contained in "Design Memorandum No. 1-Hydrology and Hydraulic Analysis, Part I-Chalmette" and "Part IV-Chalmette Extension". The design hurricane will produce maximum wind tide levels to elevations as follows: Bayou Dupre to Verret, 12.5 feet Mean Sea Level, * Verret to Toca, 12.2; and Toca to Caernarvon, 11.8. Wave runup over the entire length of the project varies from 4.4 to 4.8 feet, dictating a design net grade of 17.5 from Bayou Lawler to a point midway between Verret and Toca, and 17.0 from this point to Toca, and 16.5 from Toca to Caernarvon. A smooth transition shall be used at locations where a change is made in elevation.

DRAINAGE

18. Hydraulic design interior drainage. The hydraulic design for the interior drainage of the Chalmette supplemental area south of Louisiana Highway 39 from Caernarvon to Poydras and Louisiana Highway 46 from Poydras to Verret is covered in Appendix B of this memorandum. The drainage of the supplemental area east of the Mississippi River Levee from Violet to Poydras and north of La. Highway 46 from Poydras to Verret is covered in Design Memorandum No. 5, Detail Design, Chalmette Area Plan, Bayous Bienvenue and Dupre Control Structures.

GEOLOGY

19. Physiography. The physiography of the area, which is located within the Central Gulf Coastal Plain, is covered in paragraph 3 of Design Memorandum No. 1, Hydrology and Hydraulic Analysis Part IV-Chalmette Extension and paragraph 18 of Design Memorandum No.3, General Design, Chalmette Area Plan.

20. General geology. The geologic history of the area is discussed in paragraph 19 of Design Memorandum No, 3, General Design,

*Elevations in this memorandum are in feet referred to Mean Sea Level unless otherwise noted.

Par. 20.

Chalmette Area Plan.

21. Subsidence. Progressive subsidence and downwarping have been occurring in the project area since the end of the Pleistocene epoch. The surface of the Pleistocene has been downwarped towards the south and west to a maximum depth of about 500 feet at the edge of the continental shelf. At present, the rate of subsidence within the project area is approximately 0.39 feet per century.

22. Mineral deposits. Although oil and gas production does not presently exist in the immediate vicinity of the project, oil, gas, salt, sulphur, and other minerals may exist in the subsurface. Exploration for and production of these minerals will not be adversely affected by the proposed hurricane protection levees and structures.

23. Investigations performed. General purpose borings as well as 5 inch undisturbed core borings were made for this project. The 5 inch undisturbed cores were taken to a maximum depth of 100 feet and the general purpose borings to a maximum depth of 70 feet along the MR-GO and 60 feet for the remainder of the project. In addition, geologic information from other sources was available for the interpretation of the subsurface and foundation conditions of the area, said information including the data obtained from boring logs and laboratory analysis of the general purpose and undisturbed borings reviewed in Design Memorandum No. 3, General Design.

24. Foundation conditions. A detailed description of the subsurface is included in the Soils section of this Memorandum.

SOILS

25. General. This section covers the soils, foundation investigation and conditions, and the design for the extension of the Chalmette Area Plan of the hurricane protection system.

26. Field investigation. A total of 39 general purpose and 10 undisturbed core borings were taken and tested by the Corps of Engineers along the levee alignment. General purpose borings are designated as C borings and undisturbed core borings designated at CU or CU-A. Borings 1-C through 4-C, 6-C through 9-C and 11-C through 13-C extend to a depth of 70 feet; 14-C, 16-C and 17-C, 19-C thru 42-C, and 44-C extend to a depth of 60 feet; 5-CU-A extends to a

depth of 67 feet; 15-CU to 90 feet; and 5-CU, 10-CU, 10-CU-A, 18-CU, 30-CU, 37-CU, 43-CU and 45-CU extend to a depth of 100 feet, all depths being below the existing ground surface.

27. The location and logs of the general purpose type borings taken along the project alignment are shown on plates 2 thru 10, inclusive. The location, logs, and analysis data of the 5 inch undisturbed core borings are shown on plates 20 through 51, inclusive, and 3, 4, 5, 6, 8, 9, and 10 respectively. The locations of borings No. 18-D through 27-D, inclusive, being along the centerline of the MR-GO, are shown on plates 2 through 4, inclusive. The logs for borings No. 18-D through 27-D, inclusive, are shown on plate 52. The location of borings No. R-76.8, R-77.0 and 77.8, taken in the Mississippi River and on the river batture at English Turn Bend, and the logs therefor are shown on plate 52.

28. Laboratory tests. Visual classifications were made on all samples obtained from the soil borings. Water content determinations were made on all cohesive soil samples. Consolidation (C) tests and unconfined compression (UC), unconsolidated-undrained (Q), consolidated-undrained (R), and consolidated-drained (S) shear tests were performed on representative soils samples from the undisturbed borings. Atterberg liquid and plastic limit tests were performed on the cohesive soil samples tested. A few unconfined compression (UC) shear tests were performed on selected cohesive soil samples from the general purpose type borings and these data are shown on the soil boring logs. The results of the tests on undisturbed soil samples from undisturbed borings 5-CU, 5-CU-A, 10-CU, 10-CU-A, 15-CU, 18-CU, 30-CU, 37-CU, 43-CU, and 45-CU are shown on plates 20 through 51 inclusive.

29. Foundation conditions. a. A generalized soil profile of the subsurface strata along the levee alignment is shown on plate 19. The profile indicates that the subsurface overlying the Pleistocene consists of soft Recent soils. The Recent soils generally consist of peat (PT), clays with organic material (CHO), fat clays (CH), some lean clays (CL), some clayey sands (SC) and isolated areas of fine sand (SP). The soft Recent deposits are generally underlaid by near-shore sands which overlie the stiff Pleistocene clays. The Pleistocene downwarps from an elevation of approximately -65 at Bayou Lawler (sta. 770+00) to an elevation of approximately -100 along the lower portion of the project area. Along the levee alignment paralleling the MR-GO (sta. 770+00 to sta. 1040+00), the natural Recent soils have been covered with

hydraulic spoil from the excavation of the MR-GO channel. This spoil, varying from 4 to 10 feet in depth, generally consists of soft and medium clays with silt and sand lenses. Underlying this filled area is a varying depth stratum of old marsh which consists primarily of soft organic clays with wood fragments and areas of peat. This stratum generally extends to an elevation of -10. The subsurface from -10 to -40 consists of soft gray clays with silt strata and lenses and some pockets of silty sand. The strata from -40 to -60 consists of medium to stiff gray clays. From sta. 1040+00 to sta. 1110+00 the levee alignment is across virgin marsh. The top stratum of material consists primarily of peat and very soft organic clay with wood fragments and is approximately 5 feet in thickness. Underlying this marsh are essentially the same subsurface soils strata that underlie the levee alignment from sta. 770+00 to sta. 1040+00. From sta. 1110+00 to sta. 1200+00 the levee alignment crosses a natural levee formed by distributary deposits which consist of medium to stiff clays, silt, silty sands and strata of fine sand below elevation -40. From sta. 1200+00 to sta. 1460+00, the levee alignment is across virgin marsh. The top stratum of the material varies in depth from 5 to 20 feet and consists of peat and very soft organic clays. Underlying this stratum are the Intradelta soils consisting of soft to medium clays with silt and sandy silt layers and lenses. Generally below elevation -40, the subsurface strata consist of medium to stiff clays with silt lenses and layers and an occasional sand pocket. From sta. 1460+00 to sta. 1578+12.87 at the Mississippi River levee, the levee alignment is on a natural levee formation of distributary deposits from the Mississippi River consisting primarily of soft silty clays.

b. Water contents. The clays in the natural levee deposits have water contents ranging from 40 to 70 percent. The water contents of the very soft and soft clays range from 30 to 700 percent depending on the organic content. The Recent clays below elevation -40 have water contents ranging from 20 to 80 percent.

30. <u>Type of protection.</u> Essentially, the proposed protection will consist of conventional earthen levees. Where these levees cross Louisiana Highway 46 at Verret, the Louisiana Southern Railroad and Louisiana Highway 39 at Caernarvon, roller gate type gap closure structures will be provided including the necessary pile supported inverted T type concrete floodwall, with an I-wall (steel sheet piles with concrete cap) being used as a flexible wall connection between the inverted T type floodwall and the earthen levee.

31. Location of protection. The location of the proposed protection along the project alignment was established so that the levee has a shear stability factor of safety of 3.2 with respect to the MR-GO on the floodside of the levee form the MR-GO reach and a factor of safety of 1.3 with respect to the drainage intercept canal on the protected side of the Verret-Caernarvon levee reach.

32. Stability analyses. a. Preliminary stability analyses were conducted to compare stabilities of various trial levee sections. The method of planes was employed for the analyses. The analyses indicated that the shear strengths "in situ" were inadequate for proper stability if the levee were constructed to final section in one operation. They further indicated that a "stage" or "Lift" construction scheme was necessary so that gains in subsoil shear strength could be achieved through consolidation under the intermittent "lifts" of embankment material so as to arrive at proper stability for the final levee section.

b. It should be noted that the levee construction from sta. 770+00 to sta. 1039+00 is over an area where spoil from the dredging of the MR-GO has been placed over an 8 to 10 year period to an elevation varying from 4.0 to 10.0. This area is from 2,000 to 4,000 feet in width. There has been considerable consolidation of the underlying strata as evidenced by the borings which indicate that the original ground has been depressed from 2 to 4 ft. by the surcharge of the spoil.

c. After a detailed study of the soil boring information of the area under consideration, a diagram was prepared showing the typical soil constants variations, with depth in the soils. Values for the soil constants were assigned to each stratum with due regard to material classification, depth, Atterberg limits, etc. The constants used are:

L	-	Thickness of stratum
$\bar{P}_o$	-	Overburden pressure
e_o	-	Initial void ratio
C_Q	-	Apparent cohesion from "Q" tests
C_R	-	Apparent cohesion from "R" tests

C_c	-	Compression index
P_c	-	Load constant
$\bar{P}_c$	-	Preconsolidation load
ϕ_R	-	Apparent angle of internal friction from "R" tests
γ	-	Unit weight of material
C_v	-	Coefficient of consolidation

d. Figure 1 shows the relationship between shear strength and consolidating pressure. Both the "Q" and "R" test values are plotted. If, for any given stratum, the "R" line did not cross the "Q" line at a pressure equal to the pre-consolidation load ($\bar{P}_c$) for the stratum, the "R" line was moved parallel to itself so that the "Q" and "R" lines intersected at this pressure. It was estimated that the "R" line on this diagram would indicate the quick shear strength of the stratum if it were consolidated by a load (P_c) greater than $\bar{P}_c$. Thus, if P_c for a stratum was known, the shear strength could be estimated. Data for the "Q" and "R" tests were taken from the results of tests run on representative samples from the undisturbed borings.

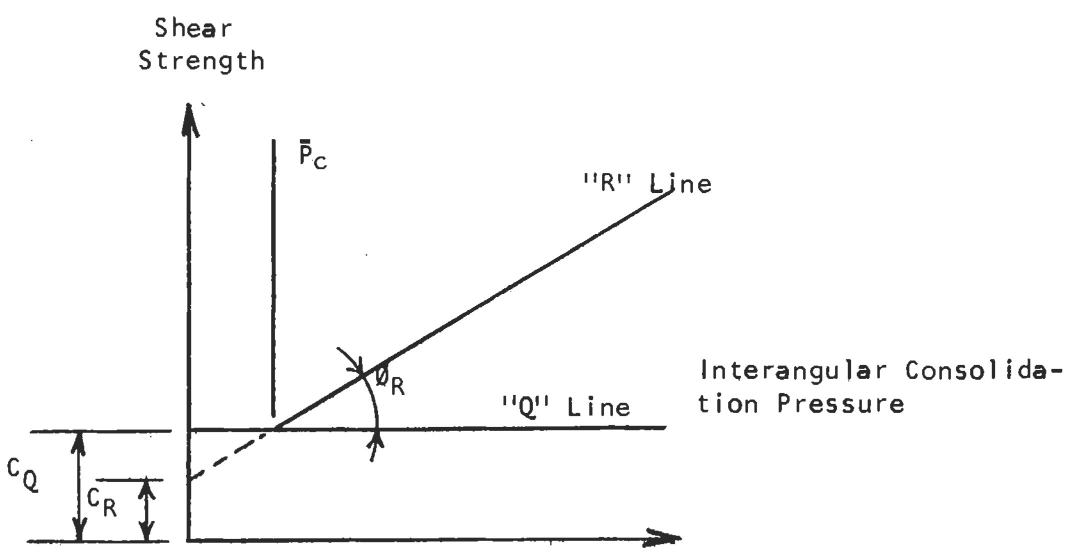


FIGURE 1

e. To estimate consolidation and rates of consolidation, each stratum was identified with one or more of the e-log P curves prepared from the results of consolidation tests on samples from the undisturbed borings. In the case where no direct correlation could be made with a material that has been tested,an estimate of the materials's behavior was made by using information from tests run on several similar materials.

f. For the purpose of estimating the relationship between time and consolidation, it was assumed that the soils possessed internal drainage and the maximum distance to a free draining surface within a stratum was determined by examination of the boring logs. See plates 20,23,26,30,33,36,39,42,45 and 49 for results of the consolidation tests.

g. With the above data, it was possible to estimate the increases in shear strength underlying a surface loading. The methods of estimating the shear strength increases was based on the relationship between void ratio and pressure (e-log P curves) and the relationship between pressure and shear strength (see figure 1). Time was incorporated into the estimate by assuming that the relationship between time and void ratio follows Terzaghi's theory of consolidation.

h. With the above information available, it was possible to begin selecting a sequence of construction operations,i.e., lifts, shapes, time intervals, etc. A "Lift" was considered to be an operation in which new material was deposited on the levee site. This can be hydraulic or hauled fill. A "shaping" is an operation in which material previously deposited is reworked into a different cross-sectional shape. For example, a fill of 210 feet wide and 5 feet deep at the centerline may be shaped into a fill 150 feet wide and 7 feet deep at the centerline.

i. The selection of the intermediate levee sections was made on the basis of the following considerations:

(1) All material required for the final cross section and intermediate shape-ups, considering consolidation and shrinkage of the levee embankment and ultimate settlement of the subsurface strata, would be placed in one or more lifts.

(2) Each lift or shaping would consolidate the foundation soils and cause a predictable increase in strength.

(3) Each shaping would utilize all material remaining above the existing ground elevation from the previous lift or shaping.

(4) Each lift or shaping would be stable with a factor of safety (FOS) of 1.3 or greater when checked with the predicted average shear strengths applicable.

(5) Based on the foregoing, it is estimated that a gross grade and levee section approximately equal to project net grade will be obtained in approximately 5 years. The first lift levee sections were designed on the basis of the (Q) strengths from the undisturbed soil borings and will be used for preparation of the plans and specifications. In order to insure an adequate design of interim levee lifts and provide assurance against major construction failures, additional soils borings and tests will be made during the intervals between successive construction lifts. Supplemental design analyses, utilizing the additional information obtained, will be made and preparation of plans and specifications for the interim lifts will be based on these analyses.

(6) The last lift for each design section would be increased by an amount sufficient to provide material for maintenance of the levee beyond the 5 year construction period.

j. To begin the design procedure, a trial first lift was selected that provided more than enough material needed for the final cross section, considering settlement. This lift was proportioned so as to be stable when checked with the shear strengths assigned on the basis of the "Q" tests. With the surface loaded with the first lift, the total consolidation in each stratum and the corresponding void ratio, e_f, were calculated. The void ratio was then assumed to vary with time from the initial void ratio, e_o, to e_f, according to the following relationship:

$$e_t = e_o - U_t(e_o - e_f)$$

where

e_o = Initial void ratio

e_f = Final void ratio

e_t = Void ratio at time-t

U_t = Percent consolidation at time-t

k. With this relationship, it was possible to determine e_t at any time after the surface load was applied. For a given e_t, it was then possible to use the consolidation data (e-log P curves), to determine the P_c corresponding to e_f, and with this new P_c it was possible, by using curves such as Figure 1, to determine the new shear strength. The procedure outlined above was incorporated into a program written for an electronic computer to facilitate the design procedure.

l. For some arbitrary time interval, i.e., 2 years, the total settlement at the centerline of the first lift was computed and the settlement at any other point on the cross section was assumed to be proportional to the fill height at that point. The material remaining above the original ground elevation was calculated using the assumed settlement.

m. The first shaping was then selected. The first shaping consists of the material remaining from the first lift and should have a centerline as high as stability requirements permit. The stability of this was checked using the calculated interim shear strengths. If the section was stable, the consolidation after a second arbitrary time interval was calculated. The total settlement at the end of the second time interval was determined and the end area remaining was calculated. The new increased shear strengths were calculated and another shaping, the second shaping, was chosen with an end area equal to that remaining in the first shaping. This second shaping also satisfied the conditions of stability with the latest increased shear strengths.

n. A third time interval was selected and consolidation by stratum was tabulated for the second shaping, if required. The values of the strength constants at the end of the third time interval were determined as previously outlined. These strength constants at this point were then used to check the stability of the final cross section.

o. The end area remaining in the second shaping, after settlement, was sufficient to provide enough end area for the third, or final, shaping as required. If, at any time, it became apparent that the end area available for the final cross section was too great, or too samll, then the sequence of operations was adjusted accordingly and the entire procedure started again.

p. Variations in the procedure to optimize the sequencing of lifts and shapings included:

(1) Variations in the number of initial lifts to provide the necessary material for the final levee sections,

(2) Variations in the length of the time intervals between lifts and shapings, and

(3) Variations in the heights, widths, etc., of the interim shapings.

q. The settlements and gains in shear strength used in the stability analyses are based on assumptions and theoretical analyses which are of necessity imprecise, and may vary from values experienced during and after construction. Accordingly, settlement monuments and piezometers will be installed prior to construction of the first lift, and undisturbed borings will be made prior to proceeding with additional lifts and/or shaping operations, in order that actual settlements and gains in shear strength may be determined. The data thus obtained may require some alteration of the time intervals between successive construction phases used in this memorandum. Major revisions of these intervals are not, however, anticipated.

r. To illustrate the design technique, a detailed discussion will be given on the design of the levee construction between stations 770+00 & 940+00. Design data for this reach of levee was based on Boring 5-CU. See plates 20 through 22.

s. The subsurface disclosed by Boring 5-CU was divided into eight significant soil strata. Stratum 1, extended between the surface at approximately elevation 8 and elevation -2, stratum 2 between elevations -2 and -10, stratum 3 between elevations -10 and -20, stratum 4 between elevations -20 and -24, stratum 5 between elevations -24 and -36, stratum 6 between elevations -36 and -54, stratum 7 between elevations -54 and -66, and stratum 8 between elevations -66 and -70.

t. Strata 4, 5, and 8 were classified as non-compressible sands or silts and no increases in shear strength due to consolidation were used in these strata. The shear strengths of these strata were based on "S" test data. Strata 1, 2, 3, 6, and 7 were classified as compressible clays and increases in shear strength due to consolidation were estimated as outlined above.

u. Initial design (Q) strengths for each stratum are shown on plate 20 and the diagram, for each stratum, showing shear strength Vs. pressure is shown on plate 53. The idealized e-log P curves used for design are shown on plate 54.

v. In addition to the above, the following data was required for estimates of consolidation in the clay strata:

Stratum	Max. length of drainage Path. - Ft.	C_v Ft.^{2}/Mo.	C_c	$\bar{P}_c$ T.S.F.	$\bar{e}_o$	Ø Degrees
1.	5	0.51	0.55	0.50	1.52	13
2.	8	0.51	0.54	0.60	1.70	13
3.	10	1.26	0.56	0.85	1.42	13
6.	18	1.70	1.15	1.00	1.67	13
7.	12	1.70	0.79	1.40	1.67	13

w. A trial first lift was selected that provided 845 square feet of end area. Plate 12 shows the design section. The stability of the first lift was checked using the initial (Q) shear strengths. The stability calculations are shown on plate 55.

x. The first lift applies a load of approximately 0.368 TSF on the original surface at the centerline of the fill. The settlement, increases in shear strength, etc., at the levee centerline, were computed as though the fill were of constant thickness and of infinite width. Plate 54 shows a plot of the first lift elevation Vs. time in months. Also, shown on plate 54 are curves, for each clay stratum, showing the relationship between void ratio and time.

y. At t = 6 months the first lift was reshaped into the first shaping which had a centerline elevation equal to the project net grade. See plate 12 for the design section. To determine the end area of the material above the original ground line, the settlement across the width of the first lift was assumed to be proportional to the fill height. For example, the settlement at the centerline after 6 months was calculated to be 0.71 feet and the fill height at this point was 7 feet. Eighty feet to each side of the centerline the fill height was 3 feet and the assumed settlement at these points was equal to 3×0.71/7 or 0.30 feet. At 95 feet to either side of the centerline the fill height, and therefore the assumed settlement, was equal to zero. The end area of the first lift after 6 months was estimated to be approximately 760.5 square feet. The first shaping was proportioned so that its end area was equal to 752.5 square feet. See plate 12.

z. At t = 6 months the following values for the various soils constants were used:

Stratum	e_o	P_c T.S.F.	Shear Strength T.S.F.
1.	1.50	0.525	0.075
2.	1.68	0.652	0.142
3.	1.40	0.900	0.186
6.	1.61	1.117	0.312
7.	1.63	1.573	0.464

The stability and settlement calculations for the first shaping were based on these values. See plate 55 for the stability calculations and plate 54 for the curves showing the relationship between centerline elevations Vs. time and void ratios Vs. time for the first shaping.

aa. At t = 54 months the centerline elevation was estimated to be approximately 15.8 and the amount of material remaining above the original ground line as estimated to be 587 square feet in end area and the various soil constants were up-dated as follows:

Stratum	eo	P_c T.S.F.	Shear Strength T.S.F.
1.	1.43	0.684	0.111
2.	1.60	0.847	0.193
3.	1.35	1.104	0.233
6.	1.46	1.497	0.399

Stratum	e_o	P_c T.S.F.	Shear Strength T.S.F.
7.	1.53	2.053	0.574

bb. At t = 54 months the desired levee cross section was checked for stability and calculations for the ultimate settlement were made. See plate 56 for the stability calculations and plate 54 for the curve showing centerline elevations Vs. time. Using the estimated settlement of the levee beyond t = 54 months and an estimated shrinkage factor of 10%, an estimate of the amount of material required for maintenance beyond t = 54 months was made and the first lift increased as shown on plate 12.

cc. The above procedure was utilized for the design of all levee reaches. However, only the stability analyses for the final levee cross sections are shown for the levees from sta. 940+00 to sta. 1578+00. See plates 56 through 62.

33. Levee construction. Using sections representative of existing conditions along the project alignment, the slopes and berm distances for the recommended first lifts were determined by the method of planes using the design (Q) shear strengths and a minimum factor of safety of 1.3 against shear failure. Subsequent lifts and/or shapings were determined by the method of planes using increased shear strengths as discussed in paragraph 32. The levee berms are necessary for providing levee shear stability and for wave run-up as a means of dissipating a portion of the wave energy and thereby reducing the required levee grade. Stability analyses are shown on plates 55 through 62.

34. Drainage structure. Using sections and data representative of existing conditions at the drainage structure site, the slope and berm distances were determined by the method of planes using design (Q) shear strengths in the foundation soils and a minimum factor of safety of 1.3 against shear failure. Both conventional and mass stability analyses were used and the results of these are shown on plate 61. A hurricane water condition of elevation 12.2 was applied and stability was checked for failure toward the protected side of the levee. The stability was also checked for failure to the floodside of the levee with a water elevation of 0.0 applied. The excavation for the construction of the drainage structure was designed using (Q) shear strengths in the foundation soils and a minimum factor of safety of 1.3.

The excavation plan and stability analysis are shown on plate 62. The footing under the operating tower will exert bearing pressures of approximately 750 pounds per square foot on the soil immediately beneath the footing. Based on the increased shear strengths, there will be a factor of safety of approximately 2 against failure. The area will have been subjected to a surcharge prior to placement of the operating tower. Therefore, a negligible amount of settlement is anticipated in the operating tower.

35. Gap closure structures. The subsurface beneath the La. Highway 39 and Louisiana Southern Railroad gap closure structure at Caernarvon and the Louisiana Highway 46 gap closure structure at Verret consists of very soft and and soft fay clays with silt and sand lenses and some shallow depth strata of lean clays and silt. Although not identical, the subsurface materials and strata at the two structure sites are similar. Since there is no suitable stratum of reasonable depth in which to seat point bearing piling at these locations, the concrete piling must transfer their load to the soil through skin friction. The point resistance of the piling embedded in this soft clay is considered to be negligible and therefore was omitted. Bearing capacities and lengths for the gated structures and T-wall foundation piling were determined by applying a factor of safety of 2.0 to the (S) and (Q) shear strengths as follows: $\emptyset$ developed = $\tan^{-1} \frac{\tan \emptyset}{F.S.}$, C developed = $\frac{C}{F.S.}$. It is assumed for design purposes that the load will be transferred to the soil through skin friction acting on the lower two-thirds of the pilings for the (S) test data and the entire length for the (Q) test data. In calculating the (S) shear strengths, a conjugate stress ratio (K_O) = 1.0 and 0.7 was used in determining the normal load on the pile surface in compression and tension, respectively. Bearing capacities were determined for single acting piling as well as group action. Design lengths of 52 feet for piling supporting a load of 23.5 tons per pile were determined for the Caernarvon structure. For the Verret structure the lengths were determined to be 42 feet with loads of 17 tons per pile. Because of the depth of the anticipate consolidation causing settlement of the ground surface, it was not considered practical to design the piling to eliminate all settlement of the floodwall. Therefore, negative skin friction was not used in determining the required pile penetrations. The floodwall is designed to maintain structural integrity during the anticipated

period of settlement. In order to maintain the continity of final net grade of the required protection, the floodwalls will be constructed to a gross grade as shown on plates 74 and 77. After anticipated settlement is obtained, the floodwalls will be at design grade. The method of analysis used in the stability studies of the inverted T floodwalls was that presented by A. Hrennikoff in paper No. 2401, ASCE Transactions titled, "Analysis of Pile Foundation With Batter Piles". Analysis was performed for each of the required loading conditions for each location. Computations are attached as Appendix D. Approximate values of K were obtained from unconfined compression test results based on methods presented in a paper by Terzaghi, "Evaluation of Coefficients of Subgrade Reaction", GEOTECHNIQUE, London, England, Vol. V, 1966 and a paper by Bengt B. Broms, "Lateral Resistance of Piles in Cohesive Soils" No. 3825, Journal of the Soil Mechanics and Foundation Division, ASCE, March, 1964. Low average unconfined compression (q_u) values, based on test results from Borings 18-CU at Verret and 45-CU at Caernarvon, of 800 psf for Verret location and 500 psf for Caernarvon resulted in K values of 178 psi and 111 psi, respectively. See plates 75 and 78 for critical pile loads. Stability studies of the I-type floodwall were made using the method of planes utilizing soils data obtained from test results from Borings 18-CU and 45-CU. The I-walls were analyzed for a hurricane condition with a still water elevation of 12.2 at Verret and 11.8 at Caernarvon with a five-foot broken wave on the flood side and ground water at elevation 2 on the protected side at Caernarvon and elevation 1 on the protected side at Verret. The walls were investigated for both (Q) and (S) design shear strengths for a factor of safety of 1.5 with static water level at the top of the wave and a factor of safety of 1.25 with the dynamic force of the wave added. Controlling cases are shown on plate 82. The effect of drag force on the wall was investigated and found to be not critical. To assure final design grade after anticipated settlement is obtained, the walls will be constructed to gross grades as shown on plates 74 and 77. Steel sheet pile cut-offs will be used beneath structures to provide protection against seepage. For location of the floodwalls, see plates 6, 10, 11, 74 and 77.

36. <u>Method of construction.</u> a. Levees. Conventional earth levees which constitute the basic flood protection will be built by stage-construction methods. This construction will take place over a period of several years to compensate for settlement due to consolidation of the subsurface strata as well as that of the levee fill material and to take advantage of increased shear strenghts in

the subsurface strata due to the aforementioned consolidation thereof. The project levees will be constructed of hydraulic material obtained from the Mississppi River and the MR-GO and from local borrow obtained from the flotation cut and the existing back levee as shown on the Design and Stage Construction Sections, plates 12 through 18. The material required for the final cross section and the intermediate shaping, taking into consideration the shrinkage and consolidation of the levee embankment as well as the ultimate settlement of the subsurface strata, will be placed in one or more lifts. The height of the various lifts and shapings shown on the stage-construction plans are not to be exceeded during the construction period. Due to the nature and existing shear strengths of the soils in the subsurface strata, slides and base failure will occur if the fill is over-loaded either by fill material or an excessive depth of run-off water from the hydraulic placement of the levee material. The height of the various lifts and shapings was based on providing a factor of safety of 1.3 against shear failure during all stages of construction.

b. The highway ramps, which are part of the levee gap closure structures at Verret (sta. 1119+74) and Caernarvon (sta. 1574+79), will be constructed of hauled fill in one lift to final section using accepted compation methods as required by paragraph 203.13 of Section 203 of the Standard Specifications for Roads and Bridges, October, 1966, State of Louisiana Department of Higways. The highway construction shall be in accordance with the requirements and specifications of the Louisiana Department of Highways.

c. The gated drainage structure at sta. 1353+40 will be constructed in open excavation in the dry as shown on plates 62 and 81. To minimize the settlement under the structures, the levee will be constructed at the site as previously discussed and as shown on plate 15. Subsequent to the placing of the hydraulic first lift of sand as shown on plate 15, the levee will be removed, as shown on the referenced plates, and the drainage structure installed. During the pre-loading period, the outflow from interior drainage will be maintained by temporary gaps in the levee in the vicinity of the drainage structure site. The corrugated metal pipe culverts will be cambered approximately 1.5 feet at the centerline of the levee to compensate for anticipated additional settlement. To safeguard against seepage around and under the structure the following will be provided: (1) Five 10x10 foot steel diaphragms spaced at 20 ft. c.c. will be installed on each pipe of the structure as shown on plate 81; (2) steel sheet pile cutoff walls at the upstream end of the inlet basin and downstream end of the stilling basin as shown on plates 61 and 81; and (3) a 10 ft. thick clay plug out-off (floodside only) behind stilling basin headwall and wing walls extending from top of flood side berm down to elevation -11.0 as shown on plate 61. During the excavation sump pumps will be operated to maintain a dry hole. Upon completion of the excavation to elevation -11, a ditch will be dug around the periphery of the excavation at elevation -11 draining to sumps at each end where sump pumps will be operated. Sump pumps will discharge over the protective dike and into the existing drainage canal on the north side and into the marsh on the south side. Pumps will be large enough to take care of surface runoff from rains that may occur.

DESCRIPTION OF PROPOSED STRUCTURES

37. Criteria for structural design. a. General. Structural design has been done in accordance with standard practice and with criteria set forth in Engineering Manuals for Civil Works Construction published by the Office, Chief of Engineers.

b. Unit weights. The following values of unit weights were used in the design:

Unit Weights	Lbs. per cubic foot
Water	62.5
Concrete	150
Earth	See plates 20-51

c. Design loads. Listed below are the assumed loads used in the design.

(1) Earth pressure (lateral). See plate 82.

(2) Water loads:

(a) Design still water elevations as follows:

(1) Verret gap closure - El. 12.2 ft.

(2) Caernarvon gap closure - El. 11.8 ft.

(b) Wave forces for both gap closure structures are from a 5 ft. broken wave.

(3) Wind loads:

(a) A 60 MPH wind was applied to both gap closure gates.

d. 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, of 6 January 1958, revised August, 1963. Concrete will be designated by basic minimum strength of 3,000 psi. concrete. Steel sheet piling meeting the requirements of ASTM A328-54, "Standard Specifications For Steel Sheet Piling", will be used. For convenient reference, pertinent allowable stresses are tabulated below:

Reinforced Concrete	Stress p.s.i.
f'_c	3,000
f_c	1,050
v (without web reinforcement)	60
v (with web reinforcement)	274
f_s	20,000
Minimum tensile steel	0.0025 bd
Shrinkage and temperature steel	0.0020 bt
Structural steel (ASTM A-36)	
Basic stress	18,000

The allowable stresses are increased by 33-1/3% for Group 2 loading.

38. Gap closure structures. a. Verret gap closure. At La. Highway 46 the embankment section of the closure levee will tie into a gap closure designed to provide the requisite protection while maintaining normal use of this highway. This gap closure is shown on plate 66. The structure consists of a pile supported reinforced concrete gate section, tied to the embankment levee

on each side by a pile supported inverted T type floodwall with a concrete capped steel sheet pile I-wall making the transition between the inverted T-wall and the full levee section. The grade of the highway will be raised to elevation 8.0 in order to allow maximum time of egress from the unprotected areas prior to closing the gate during time of rising waters. A roller gate riding on standard gauge railroad track will be provided for the closure. The gate will be a trussed structure with skin plate on the floodside of the trusses. The reasons for placing the skin plate on the floodside of the gate are as follows:

(1) Using a 60 MPH design wind loading, the resultant force for dead and live load indicates that with the skin plate on the floodside the structure will be stable (regardless of wind direction) but that with the skin plate on the wall side the structure will not be stable with the wind load applied on the floodside unless an adequate counterweight is provided, all as indicated on the Loading Diagram on the aforementioned drawing.

(2) If the skin plate is placed on the wall side, the welds of said plate will be placed in tension due to hurricane wind and wave forces, whereas, the welds will be under compressive forces if skin plate is placed on floodside of the structure.

(3) Satisfactory sealing of the closure can be accomplished as detailed on plate 72. With the skin plate on the floodside, the bottom seal can be readily positioned and adjusted.

(4) Wheels and framework of the structure will be protected from logs, boats and debris of all kinds during on-set of hurricane. Cleaning of debris from rails and structure following hurricane, in order to re-open highway to use, will be a relatively simple matter as opposed to clearing a mass of debris lodged within the structural framing which might occur if the skin plate is placed on the wall side of the structure.

(5) With skin plate on floodside, four locking devices will be used, two at top of gate and two mounted on bottom framework of gate. With skin plate on wall side, only the two at top of gate could be used for locking gate in position.

(6) When gate is in an open (stored) position, it will present a clean covered appearance and prevent a debris and

trash gathering situation that would develop if open framework is exposed to the elements (both natural and human). Maintenance will be easier and a less expensive task.

b. Caernarvon gap closure. At Louisiana Highway 39 and La. Southern Railroad Company tracks, the embankment section of the closure levee will tie into a gap closure designed to provide the requisite protection while maintaining normal use of the highway and railroad. This gap closure is shown on plate 67. This structural complex consists of two pile supported reinforced concrete gate sections, one at the highway and one at the railroad. These gate sections will be joined to each other by a pile supported inverted T type floodwall, and to the levee embankment on each side by an inverted T type floodwall, with a concrete capped steel sheet pile I-wall making the transition between the inverted T wall and the full earthen levee section. At this structure the grade of the railroad will remain as is, except for minor grade adjustments, since it was judged impractical to raise the railroad grade. The grade of the highway will be raised to elevation 8.0 to allow maximum time of egress from adjacent unprotected areas prior to closing the gate during time of rising waters. Roller gates riding on standard gauge railroad track will be provided for each closure. The gate structures for both of these enclosures will be trussed structures with skin plate on the floodside of the trusses. See para.(a) of this section for reasons for placing skin plate on floodside of structure.

39. <u>Utility crossings.</u> a. Utility lines of the following companies will cross the proposed levee extension:

(1) Creole Gas Pipeline Company
(2) Southern Natural Gas Company
(3) United Gas Pipeline Company
(4) Louisiana Power and Light Company
(5) Shell Oil Company
(6) South Central Bell Telephone Company
(7) St. Bernard Parish Water District No. 2
(8) Crescent Pipeline Co., Inc.

b. Alteration of two water mains, 10 gas pipelines, one oil pipeline, 2 telephone cables, one aerial telephone cable and 4 aerial electric power transmission lines will be required. Locations and details of these crossings are shown on plates 63, 64, and 65.

40. Drainage structure. a. A multiple line of corrugated metal pipe culvert will be provided to accommodate the outflow of intercepted drainage for the reach between Verret and Caernarvon. This structure will be located at sta. 1353+40 as shown on plate 8. Details of this structure are shown on plate 81.

b. The structure will consist of two 72 inch diameter corrugated metal pipe culverts with paved inverts, and concrete "U" frame inlet basin and stilling basin with automatic flap gates and independent vertical lift slide gates in concrete operating towers. In order to reduce applied foundation loads the tower will be located in the floodside berm. A service bridge will be provided for access to the tower for operation. Service bridge will be at elevation 16.5. The vertical lift gates will be closed before storm tides reach elevation 3.0 to preclude the possibility of back-flow in the event that flap gates fail to close. After the tide recedes the vertical lift gates will be opened. The lifting mechanism for the vertical slide gate will be an enclosed gear pedestal type, operating on a 12:1 gear ratio, with a lifting capacity of 15,400 pounds. An adapter bracket will be provided with the lift mechanism to permit motorized operation using a small portable power unit. Slots are provided in the walls of the inlet basin and the stilling basin for placement of stop logs for dewatering during maintenance work.

c. The operating tower and the service bridge will be supported on spread footings. At the time of construction existing material will be removed at the site down to elevation -11 (see plate 62), and selected fill material will be placed for proper bedding of the culverts.

41. Levees. a. The levees will be built by stage-construction methods consisting of lifts and shapings. The lifts will be made hydraulically except for the closure levee at Caernarvon which will be constructed with hauled fill. The levee along the MR-GO from baseline sta. 770+00 to sta. 1001+40.59= 1001+25.85 C.S. and from that point across the marsh to sta. 118+35 at Verret will be constructed from borrow obtained from the MR-GO between elevations -40 and -60. From sta. 1120+90 at Verret to the levee closure with the Miss. River levee at Caernarvon sta. 1578+12.87, the borrow material will be obtained from the Mississippi River (sand-hydraulic) and the river batture (hauled-fill) in the vicinity of English Turn Bend. The lifts will be made as high and narrow as the design and stage construction criteria will allow. Since it will be

necessary to place some of the first lift material outside of the final right-of-way limits, temporary easements will be required. After required intervals, the initial lift material will be reshaped to final levee section in one or two shaping operations. The shaping work will be performed by conventional earth-moving equipment.

b. The area being traversed by the levee is extremely valuable to the fishing, trapping, shrimp-breeding, oyster, and wild fowl interests. Therefore, it will be required that all hydraulic runoff be controlled in such a manner as to be returned to the MR-GO. No direct discharge of dredge effluent into marsh, natural streams and/or channels will be allowed. Proper spoil control will be utilized to protect adjacent areas. Retaining dikes for placing and containing the lifts will be constructed by dragline obtaining borrow from inside the area which is to be covered with hydraulic material. Overflow structures, weirs, and open ditches sufficient to adequately control the hydraulic runoff within the limits of tight retaining dikes will be installed to assure proper removal of water. After completion of each hydraulic fill lift and after all hydraulic runoff therefrom has been satisfactorily discharged, lateral ditches will be cut to provide positive drainage of rainfall off of the fill soil.

(1) From sta. 770+00 to sta. 118+35 the levee will be constructed of hydraulic fill obtained from the MR-GO as follows:

Sta. 770+00 to 940+00 - 1 lift and 2 shapings;
Sta. 940+00 to 1039+00 - 2 lifts and 2 shapings, and
Sta. 1039+00 to 1118+35 - 1 lift and 1 shaping.

Design and stage construction details are shown on plates 12, 13 and 14.

(2) From sta. 1120+90 to sta. 1535+40, the Verret-Caernarvon reach, the levee construction will be as shown on plate 15. During the initial construction phases, the existing back levee along this reach will act as the north retaining dike for the new levee. A borrow canal, 96 feet bottom width by 9 feet depth with 1 on 3 side slopes as shown on plate 15, will be cut along the centerline of the new levee. The material from this cut will be stockpiled south of the centerline of the new levee, as shown on plate 15, in such a manner as to be used as the south retaining dike for the reach. Following thereafter, sand fill obtained from the Mississippi River will be hydraulically placed

as the first lift. After a required time interval, the sand fill will be shaped to form a core for the new levee. The two retaining dikes will then be degraded and used to form a clay blanket over the hydraulic fill. Any additional material required at this time will be obtained from the existing drainage intercept canal, as shown on plate 15, and/or from the Mississippi River batture at English Turn Bend. This material will be placed to elevation 12 thereby providing greater protection than the existing back levee at that time. Again, after a required time interval, the material will be shaped into the final levee section.

b. When compared to two other methods of construction the procedure outlined in (2) above, was found to be the most practical and economical for this reach. The two alternate methods considered were: Alternate 1, hauled fill; and Alternate 2, hydraulic fill from adjacent borrow.

c. Alternate 1 was considered to be uneconomical because of the difficulty of obtaining suitable fill material in the quantity required. Approximately 4 million cubic yards of material would have to be located within economical hauling distance of the project and studies indicate that this material, if obtainable, would cost more than twice as much as the material obtained from the Mississippi River.

d. Alternate 2 was determined to the impractical because of the difficulties involved in confining hydraulic runoff, while maintaining an adequate source of water for the dredging operations. Suitable locations for the borrow pits, constructing and maintaining canals for circulating dredge water, and protection of the surrounding marshes from hydraulic runoff are several of the more important factors affecting the acceptability of this scheme.

e. A stream closure as shown on plate 18 will be required from sta. 1535+40 to sta. 1537+00. From sta. 1537+00 to sta. 1559+00, two lifts and one shaping will be required; from sta. 1559+00 to sta. 1578+12, one lift and one shaping will be required.

f. Due to the low strengths of the soils in the subsurface strata, it is to be noted that close control of the construction procedures, as outlined herein and as shown on the design and stage construction drawings, (plates 12 through 18), is critical to the successful completion of the project work. The various control elevations for the heights of lifts and shapings are shown on the referenced plates. These elevations have been established following exhaustive studies based on the requirement of providing a factor of safety of 1.3 against levee shear failure. The fill is not to be placed to a height greater than that shown on the design drawings for each lift and/or shaping. Along certain reaches, an increase of 1 foot above design grade will produce a factor of safety lower than 1.3 and could lead to incipient failure. Also, a surfeit of hydraulic runoff will not be allowed to stand or pond thereon. Runoff water shall not be allowed to reach an elevation that will endanger the retaining dikes. Extreme caution must be exercised to prevent over-topping or blow-out of retaining dikes. It is possible that levee shear failure and slides will occur if recommended design and construction procedures are not followed.

g. Foreshore protection will be required along the MR-GO. Ultimately, the banks of the MR-GO will stabilize generally at a slope not flatter than 1 on 3. However, erosion of the foreshore area between the levee and the channel bank caused by ship-generated waves will pose a threat to the integrity of the levee. Accordingly, foreshore protection will be provided to protect the levee from such erosion. The foreshore protection will consist of 1.75 feet of rip rap on 0.75 feet of shell, placed on a 1 on 3 slope, between elevations -3.0 and 3.0. Details of the foreshore protection, including gradation of the rip rap, are shown on plates 12 and 13.

h. Along the levee reach under consideration, the MR-GO has an authorized bottom width of 500 feet and depth of 36 feet. The right-of-way is 1,500 feet wide. Studies are underway to investigate the economical feasibility of increasing the channel dimensions to 750 feet by 50 feet . Since the widening in this reach would be on the north side, these increased dimensions would not affect the top of the existing channel slopes. The channel passes through extremely soft and unstable terrain and some loss of ground surface due to wave wash has taken place causing an extremely irregular bank line. Indentations in the ground surface extend back, in many places, almost to the right-of-way line.

i. Based on the foregoing, the foreshore protection will be tentatively located on the channelward slope of the existing front retaining dike, which is approximately on the MR-GO right-of-way line, for cost estimating purposes. To determine the most practical and economical location for construction of the foreshore protection, a detailed study will be undertaken and the results will be made a part of the MR-GO GDM No. 2, Supplement No. 4, Foreshore Protection.

SOURCES OF CONSTRUCTION MATERIALS

42. Sources of construction materials. a. "Lake Pontchartrain and Vicinity, Louisiana , Design Memorandum No. 12, Sources of Construction Materials", dated June, 1966.

b. Hydraulic fill material (clay) to be obtained from the MR-GO, sta 770+00 to sta 1100+00 (as may be required). This borrow to be obtained between El. -40 and -60. Boring logs and data shown on plate 52.

c. Hydraulic fill material (sand) to be obtained from the Mississippi River and the Mississippi River batture in the vicinity of English Turn Bend. Boring logs and data are shown on plate 52.

COORDINATION WITH OTHER AGENCIES

43. General. As previously mentioned, the State of La., Department of Public Works, was appointed project coordinator for the State by Governor McKeithen. This agency has functioned to coordinate the needs, desires and interests of State agencies, and provided liaison between these agencies and the Corps of Engineers. The project plan presented herein for the Chalmette Extension is acceptable to the above agency.

44. U.S. Department of the Interior, Fish and Wildlife Service. In addition to the coordination referred to in paragraph 54, of "Design Memorandum No. 3-General-Chalmette Area Plan", the Regional Director, U.S. Fish and Wildlife Service, Atlanta, Georgia, was informed by letter dated 23 September 1966 of the proposed modifications to the Chalmette Area Plan and was requested to furnish views and comments thereon. By letter report dated 23 November 1966 the Acting Regional Director stated that the proposed project modifications are not expected to

directly affect fish and wildlife resources to any great extent. The 23 November 1966 letter report was reviewed and concurred in by the Louisiana Wilflife and Fisheries Commission. Copies of the above correspondence are included as Appendix C.

45. <u>U.S. Department of the Interior, Federal Water Pollution Control Administration.</u> a. In addition to the coordination referred to in paragraph 77 of "Design Memorandum No. 3-General-Chalmette Area Plan," the Regional Director, Federal Water Pollution Control Administration, Dallas, Texas, was informed by letter dated 5 Oct., 1967 that detailed studies for the Chalmette Extension were underway and was requested to furnish views and comments thereon. The Regional Director, in his letter of response dated 14 November 1967 stated that the Chalmette Extension does not change the water quality control comments on the authorized Chalmette Area Plan as stated in Mr. Keith S. Kraase's letter dated 10 December 1963, and that consideration be given to the following:

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

(2) Performing dredging and construction operations to reduce turbidity and siltation to the lowest practical level.

(3) Coordination of this project with the Louisiana Stream Control Commission and the Louisiana State Department of Health.

b. Provisions relative to control of accidental spillages and maintenance of adequate sanitary facilities by construction contractors will be incorporated into the construction plans and specifications. By letters dated 21 November 1967 the Louisiana Stream Control Commission and Louisiana State Department of Health were informed that detailed studies for the Chalmette Extension were underway and were requested to furnish comments and views. In the Louisiana Stream Control Commission and the Louisiana State Department of Health letters of response dated 28 November 1967 and 22 March 1968, respectively, no objection to the Chalmette Extension was expressed, relative to water quality degradation. Copies of the aforementioned correspondence with the Federal Water Pollution Control Administration, the Louisiana Stream Control Commission, and the Louisiana State Department of Health are included as Appendix C.

BEAUTIFICATION

46. Beautification. Construction of the protective works covered herein, primarily located across marsh and wooded areas, will alter the existing terrain only to the extent of superimposing a levee thereon. No borrow is to be taken from the area and all fill removed from existing levees will be used in the construction of the new levees. Earthen levees will be sodded in accordance with standard levee construction and maintenance practice. The concrete floodwalls, which are an integral part of the levee gap closure structures at Verret and Caernarvon, are both massive and functional. It is considered that the unadorned concrete wall, with a rough-textured rubbed finish will create an appearance which will produce an overall effect which is both appropriate and pleasing. The structural steel gap closure gates will be painted. Upon completion of construction, indigenous shrubs, plants or other appropriate vegetation will be planted adjacent to the floodwalls to act as a screening and beautification measure.

REAL ESTATES REQUIREMENTS

47. General. All rights-of-way will be acquired by the local interests or agencies involved and furnished without cost to the United States. There will be no right-of-way acquisition by the United States.

RELOCATIONS

48. Utility crossings. The authorizing law requires that local interests, prior to construction, agree to "accomplish all necessary alterations and relocations to roads, railroads, pipelines, cables, wharves, drainage structures and other facilities required for the construction of the project." Modifications and/or relocations of utilities will be required for the following:

a. One 8 inch and one 16 inch gas main crossing at sta. 1042+60 owned by Creole Gas Pipeline Co.;

b. One 14 inch oil pipeline crossing at sta. 1042+90 owned by Crescent Pipeline Co.;

c. One 6 inch gas pipeline crossing at sta. 1293+63 owned by Shell Oil Co.;

d. Two 20 inch and one 26 inch gas mains crossing at sta. 1294+64 and one 12 inch and one 16 inch gas mains crossing at sta. 1329+34 owned by Southern Natural Gas Co.;

e. One 20 inch gas main crossing at sta. 1424+20 and one 16 inch gas main crossing at sta. 1445+28 owned by United Gas Pipeline Co.

COST ESTIMATES

49. General. Based on July 1968 price levels, the estimated first cost for the Chalmette Extension is $21,800,000. This estimate consists of $1,093,000 for Lands and Damages, $738,000 for Relocations, $16,341,000 for Levees and Floodwalls, $2,157,000 for Engineering and Design and $1,471,000 for Supervision and Administration. Detailed estimates of first cost are shown in table 1.

TABLE 1
DETAILED ESTIMATE OF FIRST COST
CHALMETTE EXTENSION

Item No.	Description	Estimated quantity	Unit	Unit Price	Estimated amount
	CONSTRUCTION				
11	Levees & floodwalls:				
	Excavation & stockpile	1,659,680	c.y.	$ 0.50	$ 829,840
	Embankment (hydraulic-clay) 1st lift	3,339,010	c.y.	1.00	3,339,010
	Embankment (hydraulic-clay) 2nd lift	1,563,090	c.y.	1.00	1,563,090
	Embankment (hydraulic-sand) 1st lift	3,865,310	c.y.	1.00	3,865,310
	Embankment (hauled fill)	371,800	c.y.	2.50	929,500
	First shaping	1,340,940	c.y.	0.50	670,470
	Second shaping	71,010	c.y.	0.50	35,505
	Final shaping	1,974,400	c.y.	0.75	1,480,800
	Stream closures:				
	Embankment (hydraulic-clay)	45,840	c.y.	1.25	57,300
	Embankment (hydraulic-sand)	11,830	c.y.	1.40	16,562
	Embankment (hauled fill)	5,180	c.y.	2.50	12,950
	Shaping	14,400	c.y.	0.75	10,800

Item No.	Description	Estimated quantity	Unit	Unit price	Estimated amount
	Fertilizing	460	acre	$ 50.00	$ 23,000
	Seeding	460	acre	100.00	46,000
	Clearing	471	acre	150.00	70,650
	Gap closure structures:				
	Excavation	1,000	c.y.	1.00	1,000
	Embankment (hauled fill)	2,630	c.y.	2.50	6,575
	Removal of old pavement	1,950	s.y.	2.00	3,900
	Flexible base course	4,560	s.y.	2.85	12,996
	Bituminous pavement	1,946	s.y.	1.50	2,919
	MA-22 steel sheet piling	6,472	s.f.	3.50	22,652
	12"x12" prestressed concrete piling	13,260	l.f.	5.50	72,930
	Floodwall-reinforced concrete	530	c.y.	70.00	37,100
	Concrete, stab. slab	60	c.y.	35.00	2,100
	Cement	790	bbl.	5.00	3,950
	Reinforcing steel	84,800	lb.	0.16	13,568
	Structural steel	46,560	lb.	0.75	34,920
	Misc. metal work	3,512	lb.	1.00	3,512
	Gate machinery			L.S.	15,000
	Rubber seals			L.S.	1,135
	Adjustment of railroad, etc.			L.S.	5,000
	Landscaping			L.S.	1,000
	Drainage structure:				
	Excavation	118,000	c.y.	1.00	118,000
	Dewatering			L.S.	80,000
	Selected fill	48,200	c.y.	1.50	72,300
	Asbestos bonded-paved invert 72" corrugated metal pipe	550	l.f.	100.00	55,000
	Operating tower	1	ea.	25,000.00	25,000
	Flap gates	2	ea.	4,000.00	8,000
	Vertical lift gates	2	ea.	8,000.00	16,000
	Service bridge	1	ea.	3,500.00	3,500
	Riprap	1,050	ton	15.00	15,750
	Shell	280	c.y.	5.00	1,400
	Concrete	304	c.y.	80.00	24,320
	Reinforcing steel	15,200	lb.	0.16	2,432
	Cement	418	bbl.	5.00	2,090
	Portable power unit	1	ea.	3,000.00	3,000
	Subtotal				$13,617,836
	Contingencies 20%±				2,723,164
	Subtotal				$16,341,000

Par. 49

Item No.	Description	Estimated quantity	unit	Unit price	Estimated amount
30.	Engineering & Design, 13.2%±				$ 2,157,000
31.	Supervision & Administration, 9%±				1,471,000
	TOTAL COST Levees & Floodwalls				$19,969,000
	RELOCATIONS				
	Modification of Existing Utility Crossings:				
1.	1 @ 8" & 1 @ 16" gas pipelines			L.S.	85,000
2.	1 @ 14" oil pipeline			L.S.	50,000
3.	1 @ 6" gas pipeline			L.S.	43,500
4.	2 @ 20" & 1 @ 26" gas pipelines			L.S.	120,000
5.	1 @ 12" & 1 @ 16" gas pipelines			L.S.	90,000
6.	1 @ 20" gas pipelines			L.S.	60,000
7.	1 @ 16" gas pipelines			L.S.	52,000
8.	1 @ 10" & 1 @ 4" transite water mains			L.S.	1,500
9.	2 buried and 1 aerial telephone cables			L.S.	1,000
	Subtotal				$ 503,000
	Contingencies, 20%±				101,000
	Subtotal				$ 604,000
	Engineering & design, 13.2%±				79,700
	Supervision & administration, 9% ±				54,300
	TOTAL COST, Relocations				$ 738,000
	LANDS, (right-of-way & easements):				
	Sta. 770+00 to sta. 1039+00	364	acre	$1,000.00	364,000
	Sta. 1039+00 to sta. 1120+90	96	acre	750.00	72,000
	Sta. 1120+90 to sta. 1537+00	359	acre	750.00	269,250
	Sta. 1537+00 to sta. 1559+00	15	acre	4,000.00	60,000
	Sta. 1559+00 to sta. 1578+12.87	9	acre	7,500.00	67,500
	Easements	460	acre	100.00	46,000
	Relocations			L.S.	50,000
	Subtotal				$ 928,750
	Contingencies, 15%±				139,250
	TOTAL Land Value				$ 1,068,000
	Acquisition costs (tracts)				25,000
	TOTAL Land Costs				$ 1,093,000

Item No.	Description	Estimated quantity	Unit	Unit Price	Estimated amount
	Foreshore protection:				
	Excavation & back-fill	54,500	c.y.	$ 1.00	$ 54,500
	Riprap	49,340	ton	8.00	394,720
	Shell	9,480	c.y.	3.50	33,180
	Subtotal				$482,400
	Contingencies, 20%±				96,480
	Subtotal				$578,880
	Engineer & design, 13.2%±				76,412
	Supervision & administration, 9%±				52,099
	TOTAL COST Foreshore Protection *				$707,391*

COMPARISON OF COSTS

50. Comparison of estimates. The estimate of $21,800,000 for the Chalmette Extension levee represents an increase of $5,733,000 over the latest PB-3 effective 1 July 1968. The estimates presented in the PB-3 are the 29 November 1966 LMNED-PR report (Appendix A) estimates escalated to July 1968 price levels. Table 2 shows a comparison of the LMNED-PR letter report dated 29 November 1966, PB-3, and design memorandum estimates. Reasons for the difference between the design memorandum and PB-3 estimates are as follows:

a. Levees and floodwalls. The increase of $3,341,000 reflects the added cost as a result of general refinements in the cost estimate based on the more detailed information available.

b. Engineering and design. The increase of $1,377,000 reflects the added E&D as a result of applying to the construction cost the E&D percentage determined by use of the 1962-1965 OCE curves plus 20 percent contingencies.

c. Supervision and administration. The increase of $371,000 reflects the added S&A as a result of the increased construction cost and applying to the construction cost the S&A percentage determined by use of the 1962-1965 OCE curves plus 20 percent contingencies.

d. Lands and damages. The increase of $502,000 reflects an increase in unit values for land based on the detailed appraisals made for this memorandum.

*Changeable to MR-GO project, see "Mississippi River-Gulf Outlet General Design Memorandum No. 2, Supplement No. 4, Foreshore Protection," submitted 29 April, 1968.

e. Relocations. The increase of $142,000 reflects additional pipeline relocations found necessary subsequent to preparation of the 29 Nobember 1966 report and increases in E&D and S&A percentages as described above.

51. The estimate of $21,800,000 as presented herein, also represents an increase of $7,409,000 over the estimate included in the 29 November 1966 LMNED-PR report. Reasons for the difference between the design memorandum and the 29 November 1966 LMNED-PR report estimates are as follows:

a. Levees and floodwalls. The increase of $4,708,000 is comprised of $3,341,000 as described in paragraph 51a and $1,367,000 which represents the increase in cost as a result of escalating the report estimate to reflect July 1968 price levels for preparation of the current PB-3.

b. Engineering and design. The increase of $1,460,000 is comprised of $1,377,000 as described in paragraph 51b and $83,000 which reflects the added E&D as a result of escalating the report estimate to reflect July 1968 price levels for preparation of the PB-3.

c. Supervision and administration. The increase of $482,000 is comprised of $371,000 as described in paragraph 51c and $111,000 which reflects the added S&A as a result of escalating the report estimate to reflect July 1968 price levels for preparation of the PB-3.

d. Lands and damages. The increase of $556,000 is comprised of $502,000 as described in paragraph 51d and $54,000 which reflects the added cost as a result of escalating the report cost for the preparation of the current PB-3.

e. Relocations. The increase of $203,000 is comprised of $142,000 as described in paragraph 51d and $61,000 which reflects the added cost as a result of escalating the report cost for preparation of the current PB-3.

TABLE 2
CHALMETTE EXTENSION LEVEE
COMPARISON OF ESTIMATES

	Feature	LMNED-PR report 29 Nov 66	PB-3 eff. 1 Jul 68	Design Memo No.3 Supp.No.1	Difference Supp.No.1 PB-3	Difference Supp.No.1 Report
11	Levees & floodwalls	$11,633,000	$13,000,000	$16,341,000	+$3,341,000	+$4,708,000
30	Engineering & design	697,000	780,000	2,157,000	+ 1,377,000	+ 1,460,000
31	Supervision & administration	989,000	1,100,000	1,471,000	+ 371,000	+ 482,000
	Subtotal	$13,319,000	$14,880,000	$19,969,000	+$5,089,000	+$6,650,000
	Lands & damages	537,000	591,000	1,093,000	+ 502,000	+ 556,000
	Relocations	535,000	596,000	738,000	+ 142,000	+ 203,000
	Subtotal	$ 1,072,000	$ 1,187,000	$ 1,831,000	+$ 644,000	+ 759,000
	Total Chalmette Extension levee	$14,391,000	$16,067,000	$21,800,000	+$5,733,000	+$7,409,000

LAKE PONTCHARTRAIN, LA. & VICINITY
CHALMETTE AREA PLAN
GENERAL DESIGN MEMORANDUM

SUPPLEMENT NO. 1 - CHALMETTE EXTENSION

SCHEDULE FOR DESIGN AND CONSTRUCTION

Contracts	Design * Start	Design * Complete	Construction Advertise	Construction Award	Construction Complete	Estimated Construction Cost (includes contingencies)	
1. Levee, 1st lift (Sta. 940+00 to Sta. 1039+00), Clearing	1967	Apr 69	May 69	Jun 69	Nov 69	$ 340,000 1,183,793 $1,523,793	FY 69 FY 70
2. Levee, 1st lift including excavation & stockpile and hydraulic embankment (Sta. 1120+90 to Sta. 1535+40), Clearing	1967	Mar 70	Apr 70	May 70	Oct 71	$ 800,000 4,793,964 700,000 $6,293,964	FY 70 FY 71 FY 72
3. Levee, 1st lift (Sta. 1039+00 to Sta. 1118+35, includes stream closure), Clearing	1967	Apr 70	May 70	Jun 70	Feb 71	$ 216,207 1,405,554 $1,621,761	FY 70 FY 71
4. Levee, 2nd lift (Sta. 940+00 to Sta. 1039+00)	1967	Oct 70	Nov 70	Dec 70	Jun 71	$1,875,708	FY 71

*Includes preparation of Supplement No. 1 to General Design Memorandum No. 3 and plans and specifications for same for the period from start to final approval.

SCHEDULE FOR DESIGN AND CONSTRUCTION (cont'd)

Contracts	Design: Start	Design: Complete	Construction: Advertise	Construction: Award	Construction: Complete	Estimated Construction Cost (includes contingencies)	
5. Levee, 1st lift (Sta. 770+00 to Sta. 940+00), Clearing	1967	May 71	Jun 71	Jul 71	Sep 71	$ 784,006	FY 72
6. 72" pipe drainage structure	1967	Sep 71	Oct 71	Nov 71	May 72	511,747	FY 72
7. Gap closure structure-Verret (Sta. 1118+35 to Sta. 1120+90)	1967	Sep 71	Oct 71	Nov 71	Jul 72	113,772	FY 72 FY 73
8. Levee, final shaping (Sta. 1039+00 to Sta. 1118+35, includes stream closure), Fertilizing & Seeding	1967	Jan 72	Feb 72	Mar 72	Aug 73	423,625	FY 72 FY 73
9. Levee, 1st shaping (Sta. 770+00 to Sta. 940+00)	1967	Feb 72	Mar 72	Apr 72	Oct 72	33,654	FY 72 FY 73
10. Levee, 1st lift (Sta. 1535+40 to Sta.1572+35; Sta. 1575+00 to Sta. 1578+12), Clearing	1967	Apr 72	May 72	Jun 72	Nov 72	721,805	FY 72 FY 73
11. Levee, 1st shaping (Sta. 1133+15 to Sta. 1335+40)	1967	Sep 72	Oct 72	Nov 72	Jul 73	644,964	FY 73 FY 74

SCHEDULE FOR DESIGN AND CONSTRUCTION (cont'd)

Contracts	Design: Start	Design: Complete	Construction: Advertise	Construction: Award	Construction: Complete	Estimated Construction Cost (includes contingencies)	
12. Foreshore protection along MR-GO	1967	Sep 72	Oct 72	Nov 72	Apr 73	$ 578,880**	FY 73
13. Gap closure structure-Caernarvon (Sta. 1572+35 to Sta. 1575+00)	1967	Oct 72	Nov 72	Dec 72	Aug 73	174,537	FY 73 FY 74
14. Levee, 1st shaping (Sta. 940+00 to Sta. 1039+00)	1967	May 73	Jun 73	Jul 73	Jan 74	125,956	FY 74
15. Levee, final shaping (Sta. 1559+00 to Sta. 1572+35; Sta. 1575+00 to Sta. 1578+12), Fertilizing & Seeding	1967	Oct 73	Nov 73	Dec 73	Feb 74	13,938	FY 74
16. Levee, final shaping(Sta. 1535+40 to Sta. 1559+00), Fertilizing & Seeding	1967	Oct 74	Nov 74	Dec 74	Mar 75	55,399	FY 75
17. Levee,2nd shaping (Sta. 940+00 to Sta. 1039+00)	1967	Dec 74	Jan 75	Feb 75	Aug 75	42,606	FY 75 FY 76
18. Levee, final shaping(Sta. 1120+90 to Sta. 1535+40), Fertilizing & Seeding	1967	Jun 75	Jul 75	Aug 75	Jul 76	869,069	FY 76 FY 77

**To be funded under MR-GO Project.

SCHEDULE FOR DESIGN AND CONSTRUCTION (cont'd)

Contracts	Design: Start	Design: Complete	Construction: Advertise	Construction: Award	Construction: Complete	Estimated Construction Cost (includes contingencies)	
19. Levee, final shaping (Sta. 940+00 to Sta. 1039+00), Fertilizing & Seeding	1967	Jul 76	Aug 76	Sep 76	Mar 77	$ 226,180	FY 77
20. Levee, final shaping (Sta. 770+00 to Sta. 940+00), Fertilizing & Seeding	1967	Sep 76	Oct 76	Nov 76	May 77	284,516	FY 77
						$16,919,880***	

To maintain the schedule for the Chalmette Extension as shown above, funds will be required by Fiscal Years as follows:

Funds Required:	FY	
	1969	$ 340,000
	1970	2,200,000
	1971	8,075,226
	1972	2,506,821
	1973	2,120,789***
	1974	199,274
	1975	86,005
	1976	874,069
	1977	517,696
		$16,919,880

*** Includes foreshore protection

OPERATION AND MAINTENANCE

52. Federal. All operation and maintenance costs are the responsibility of local interests.

53. Non-Federal. As specified in the authorizing act, local interests will be required to maintain and operate the completed flood protective works in accordance with regulations prescribed by the Secretary of the Army. Maintenance of the levee from Bayou Lawler to the Mississippi River Levee at Caernarvon is estimated to cost $80,000 annually. Maintenance of the two gap closure gates is estimated to cost $500.00 annually. In addition, it is estimated that replacement of these gates will be at 50-year intervals. The estimated annual charge for these replacements is $1,800. Maintenance of the drainage structure at Creedmore Canal is estimated to cost $400.00 annually. The estimated annual replacement cost of the drainage structure is $8,000 based on a replacement interval of 33 years.

ECONOMICS

54. Benefits Chalmette Extension. a. The plan of improvement covered herein will provide protection to some 18,250 acres from hurricane tides of frequencies up to once in about 200 years. Approximately 6,650 acres which are in the area are receiving some protection at the present time from the Bayou Terre aux Boeufs alluvial ridge to the south and the Violet, La. to Verret, La. back levee to the north; this area includes 300 acres of residential development, 50 acres commercial and industrial development, 3,600 acres of woodland, and 2,700 acres of undeveloped land. The remaining 11,600 acres are composed of 1,100 acres of undeveloped land and 10,500 acres of woodland and marshland outside the existing protected area.

b. Benefits will consist of crop and noncrop damage prevented on existing development, noncrop damage prevented on future development within the present partially protected area; enhancements on the additional open land, woodland, and marshland to be protected. The Chalmette Extension levee will also eliminate the need for the levee from Bayou Lawler to Violet, La. (authorized for the Chalmette area under the Lake Pontchartrain & Vic., La. project), thereby saving the average annual costs for that levee.

c. With the proposed improvements in place, average annual crop damage amounting to $13,700 and noncrop damage of $135,000, under present conditions, will be eliminated. An additional $67,200 in noncrop damage will be prevented on future development. Residual damages with the proposed improvement in place are considered to be negligible. The overall average annual flood damage prevented, crop and noncrop combined, will amount to $216,400. Net annual value of enhancement is estimated at $351,200. Net average annual cost of the Bayou Lawler to Violet, La. segment of the authorized Chalmette Area levee system, which will no longer be required, is estimated at $331,200. Total project benefits amount to $898,800 based on July 1968 price levels. See table 4, para. 56, for Annual Charges.

d. Occurrence of recent hurricanes in the Gulf of Mexico (1965-1965) necessitated an upward revision of windspeeds previously furnished by the United States Weather Bureau. Corresponding wind tide levels for specific synthetic hurricanes used in the computation of stage frequencies were raised over those used in the project document.

55. <u>Benefits, Chalmette Area Plan, as Modified.</u> a. The plan of improvement for the entire Chalmette Area Plan, as modified, will provide protection to some 49,050 acres from hurricane tides of frequencies up to once in about 200 years. Approximately 17,150 acres are partially protected at the present time. An estimated 10,500 acres are within the existing Chalmette back levee and an estimated 6,650 acres receive some protection from the Bayou Terre aux Boeufs alluvial ridge to the south and the Violet, La. to Verret, La. back levee to the north. This partially protected area includes 3500 acres of residential development, 1,350 acres commercial and industrial development, 3,600 acres woodland, 200 acres other development, and 8,500 acres of undeveloped land. The remaining 31,900 acres are composed of 1,100 acres of undeveloped land and 30,800 acres of woodland and marshland outside the existing protected area.

b. Benefits will consist of crop and noncrop damage prevented on existing development, noncrop damage prevented on future development, within the present leveed area; enhancements on the additional open land, woodland, and marshland to be protected. The Modified Chalmette Area Plan levees will also eliminate the need for the levee from Bayou Lawler to Violet, La. (authorized for the Chalmette Area under the Lake Pontchartrain, & Vic., La. project), thereby saving the average annual costs for that levee.

c. With the proposed improvements in place, average annual crop damage amounting to $13,700, under present conditions, will be eliminated and average annual noncrop damage of $3,035,200 under present conditions will be reduced to $26,300. An additional $5,425,200 in noncrop damage will be prevented on future development. The overall average annual flood damage prevented, crop and noncrop combined, will amount to $8,447,800. Net annual value of enhancement is estimated at $662,800. Net average annual cost of the Bayou Lawler to Violet, La. segment of the authorized Chalmette area levee system, which will no longer be required, is estimated at $331,200. Total project benefits amount to $9,441,800 based on July 1968 price levels.

d. Occurrence of recent hurricanes in the Gulf of Mexico (1957-1965) necessitated an upward revision of windspeeds previously furnished by the United States Weather Bureau. Corresponding wind tide levels for specific synthetic hurricanes used in the computation of stage frequencies were raised over those used in the project document.

56. Annual charges. Details of the annual charges for the Chalmette Extension levee of $853,200 are shown in table 3.

TABLE 3
CHALMETTE EXTENSION
ESTIMATE OF ANNUAL ECONOMIC COST

Summary of project costs	Federal	Non-Federal	Total
Construction	$19,969,000	$ -	$19,969,000
Lands, damages, relocations	-	1,831,000	1,831,000
	$19,969,000	$1,831,000	$21,800,000
Less cash contribution	- 4,709,000	4,709,000	-
First cost	$15,260,000	$6,540,000	$21,800,000
Interest during construction (5-yrs)	576,000	289,000	865,000
TOTAL PROJECT INVESTMENT	$15,836,000	$6,829,000	$22,665,000

Annual Economic Costs	Federal	Non-Federal	Total
Interest (3-1/8 per cent)	$ 494,900	$ 213,400	$ 708,300
Amortization (100 yrs)	23,900	10,300	34,200
Maintenance & operation	-	80,900	80,900
Replacements	-	9,800	9,800
Economic loss on lands	-	20,000	20,000
TOTAL ANNUAL ECONOMIC COST	$ 518,800	$ 334,400	$ 853,200

57. Economic justification. The average annual benefits of $898,800 and average annual charges of $853,200 result in a favorable benefit-cost ratio of 1.05 to 1. See para. 54.

58. Annual charges. Details of the annual charges for the Modified Chalmette Area Plan of $1,847,000 are shown in table 4.

TABLE 4
MODIFIED CHALMETTE AREA PLAN
ESTIMATE OF ANNUAL ECONOMIC COST

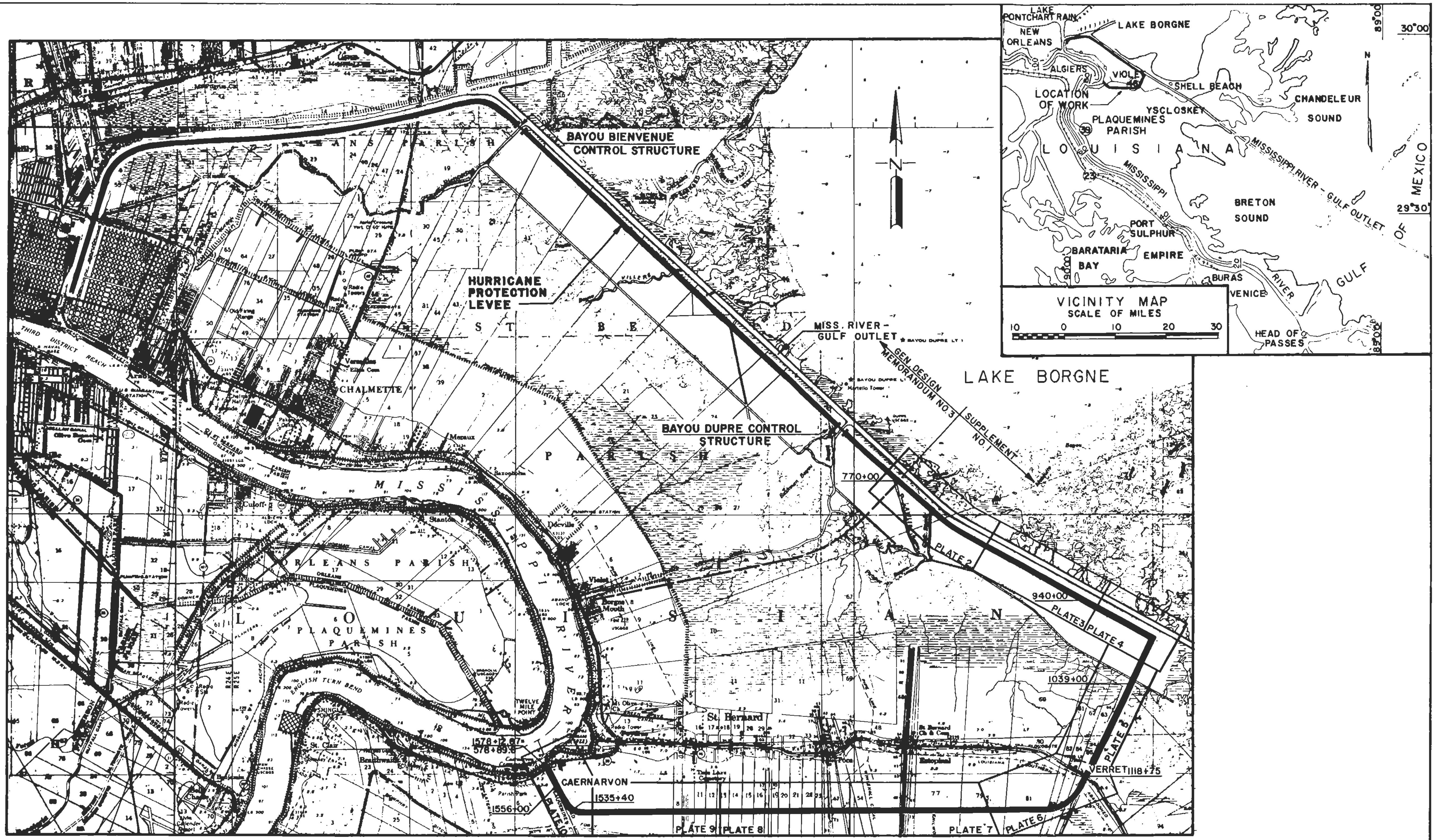
Summary of project costs	Federal	Non-Federal	Total
Construction	$39,249,000	$ -	$39,249,000
Lands, damages, relocations	-	4,794,000	4,794,000
	$39,249,000	$ 4,794,000	$44,043,000
Less cash contribution	-8,419,000	8,419,000	-
First cost	$30,830,000	$13,213,000	$44,043,000
Interest during construction (7 yrs)	3,340,000	1,499,000	4,839,000
TOTAL PROJECT INVESTMENT	$34,170,000	$14,712,000	$48,882,000
Annual economic costs			
Interest (3-1/8%)	1,067,800	459,800	1,527,600
Amortization (100 Yrs.)	51,600	22,200	73,800
Maintenance & operation	-	166,650	166,650
Replacements	-	15,150	15,150
Economic loss on lands	-	63,800	63,800
TOTAL ANNUAL ECONOMIC COST	$ 1,119,400	$ 727,600	$ 1,847,000

59. Economic justification. The average annual benefits of $9,441,800 and average annual charges of $1,847,000 result in a favorable benefit-cost ratio of 5.1 to 1.

RECOMMENDATION

60. Recommendation. The plan of protection presented herein for construction of the Chalmette Extension levee consists of a levee from the Mississippi River levee near Caernarvon, Louisiana to the vicinity of Verret, Louisiana, thence to and along the Miss. River-Gulf Outlet spoil bank to a junction with the approved plan levee at the Bayou Lawler crossing of the Mississippi River-Gulf Outlet spoil bank. Gap closures are provided at vehicular and railroad crossings to preserve access during nonhurricane periods and permit rapid closure when hurricanes impend. This plan is

considered to be the best means of accomplishing the project objective and is, accordingly, recommended for approval.



BORROW AREA

SCALE:
5,000 0 5,000 10,000 15,000 FEET
1 0 1 2 3 MILES

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

DESIGN MEMORANDUM NO. 3 – GENERAL DESIGN
SUPPLEMENT NO. 1 – CHALMETTE EXTENSION

GENERAL PLAN
AND VICINITY MAP

SCALE AS SHOWN

WALDEMAR S. NELSON AND COMPANY INC ENGINEERS AND ARCHITECTS NEW ORLEANS LA.	U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS U.S. ARMY NEW ORLEANS, LA.
DATE SEPTEMBER 1968	FILE NO. H-2-24306

PLATE 1

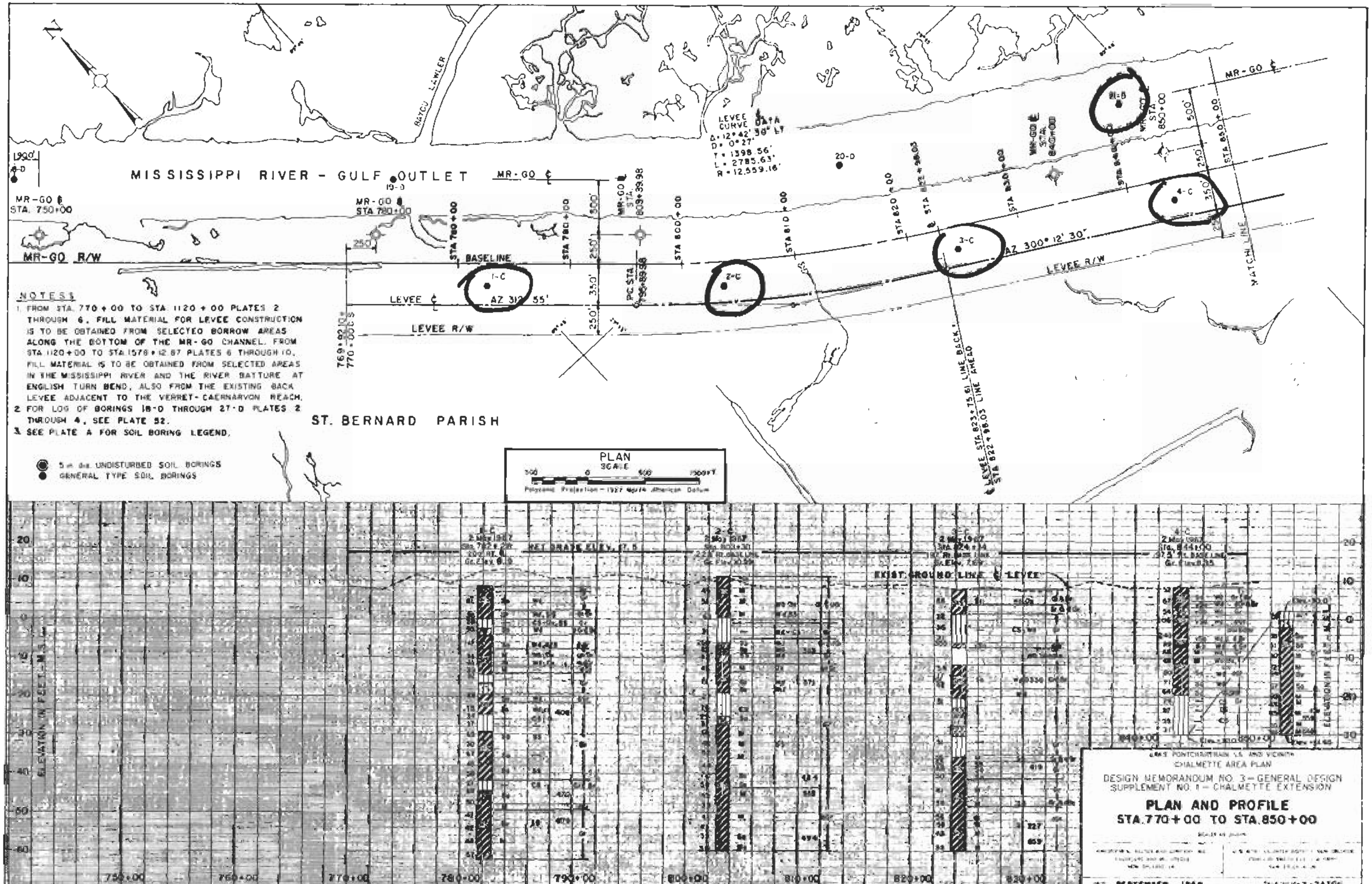
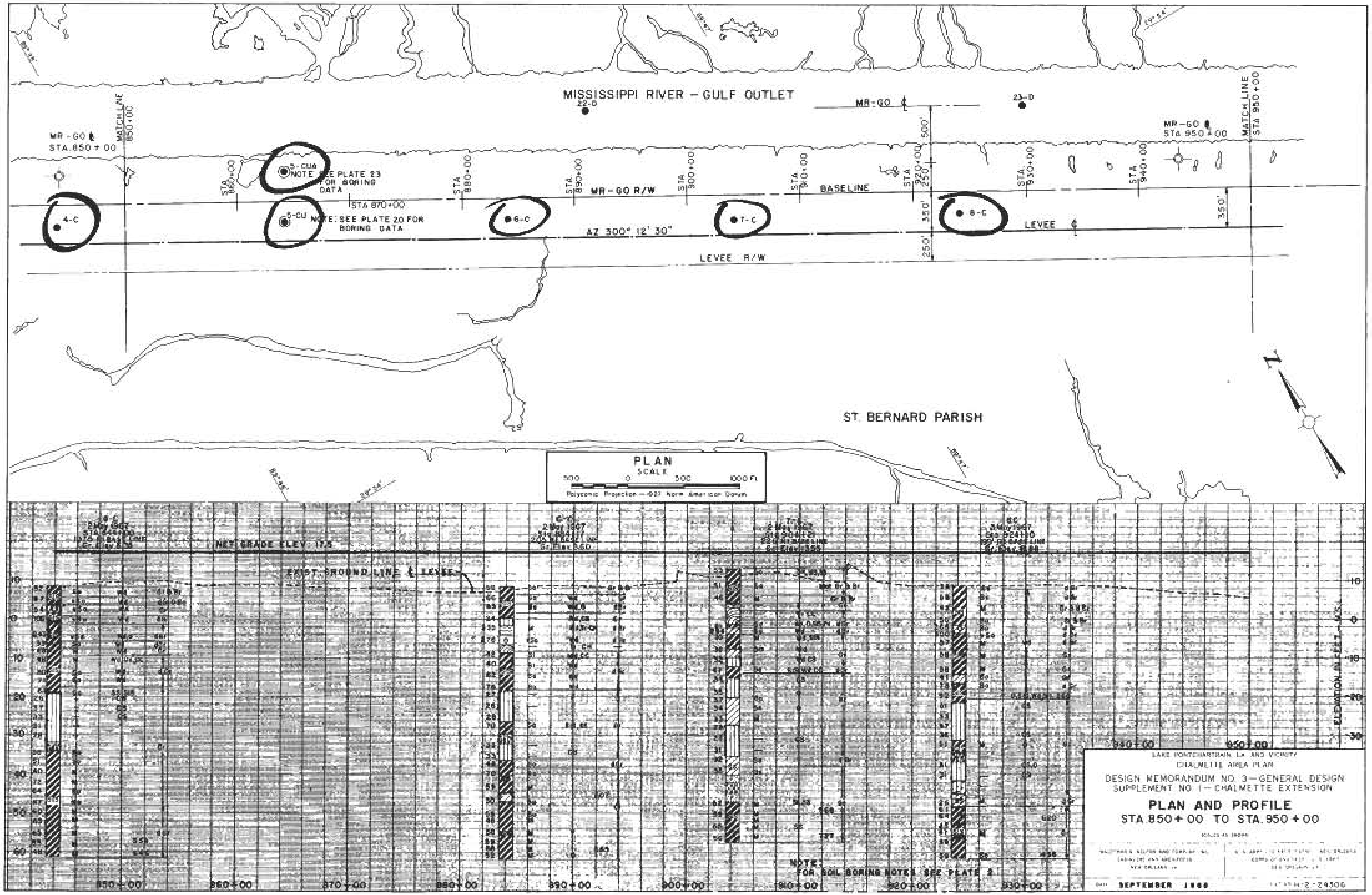

MISSISSIPPI RIVER - GULF OUTLET
BAYOU LAWLER
LEVEE CURVE DATA
Δ = 12° 42' 30" LT
D = 0° 27'
T = 1398.56'
L = 2785.63'
R = 12,559.16'
MR-GO ℄ STA. 750+00
MR-GO ℄ STA 780+00
MR-GO R/W
BASELINE
LEVEE ℄
LEVEE R/W
AZ 300° 12' 30"
MATCH LINE
ST. BERNARD PARISH
NOTES
1. FROM STA. 770+00 TO STA. 1120+00 PLATES 2 THROUGH 6, FILL MATERIAL FOR LEVEE CONSTRUCTION IS TO BE OBTAINED FROM SELECTED BORROW AREAS ALONG THE BOTTOM OF THE MR-GO CHANNEL. FROM STA 1120+00 TO STA 1578+12.87 PLATES 6 THROUGH 10, FILL MATERIAL IS TO BE OBTAINED FROM SELECTED AREAS IN THE MISSISSIPPI RIVER AND THE RIVER BATTURE AT ENGLISH TURN BEND, ALSO FROM THE EXISTING BACK LEVEE ADJACENT TO THE VERRET-CAERNARVON REACH.
2. FOR LOG OF BORINGS 18-D THROUGH 27-D PLATES 2 THROUGH 4, SEE PLATE 52.
3. SEE PLATE A FOR SOIL BORING LEGEND.
5 in dia. UNDISTURBED SOIL BORINGS
GENERAL TYPE SOIL BORINGS
PLAN
SCALE
500 0 500 1000 FT
NET GRADE ELEV. 17.5
EXIST. GROUND LINE ℄ LEVEE
ELEVATION IN FEET—M.S.L.
750+00
760+00
770+00
780+00
790+00
800+00
810+00
820+00
830+00
840+00
850+00
LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN
DESIGN MEMORANDUM NO. 3 — GENERAL DESIGN
SUPPLEMENT NO. 1 — CHALMETTE EXTENSION
PLAN AND PROFILE
STA. 770+00 TO STA. 850+00
SEPTEMBER 1966
H-2-24306

PLATE2



MISSISSIPPI RIVER - GULF OUTLET
MR-GO ℄
MR-GO ℄ STA. 850 + 00
MATCH LINE 850+00
MR-GO ℄ STA 950 + 00
MATCH LINE STA 950 + 00
5-CUa NOTE: SEE PLATE 23 FOR BORING DATA
5-CU NOTE: SEE PLATE 20 FOR BORING DATA
4-C
6-C
7-C
8-C
22-D
23-D
STA 870+00
MR-GO R/W
BASELINE
AZ 300° 12' 30"
LEVEE ℄
LEVEE R/W
ST. BERNARD PARISH
PLAN
SCALE
Polyconic Projection — 1927 North American Datum
NET GRADE ELEV. 17.5
EXIST. GROUND LINE ℄ LEVEE
NOTE: FOR SOIL BORING NOTES SEE PLATE 2
850+00
860+00
870+00
880+00
890+00
900+00
910+00
920+00
930+00
940+00
950+00
LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN
DESIGN MEMORANDUM NO. 3 — GENERAL DESIGN
SUPPLEMENT NO. 1 — CHALMETTE EXTENSION
PLAN AND PROFILE
STA. 850 + 00 TO STA. 950 + 00
SEPTEMBER 1966

PLATE 3

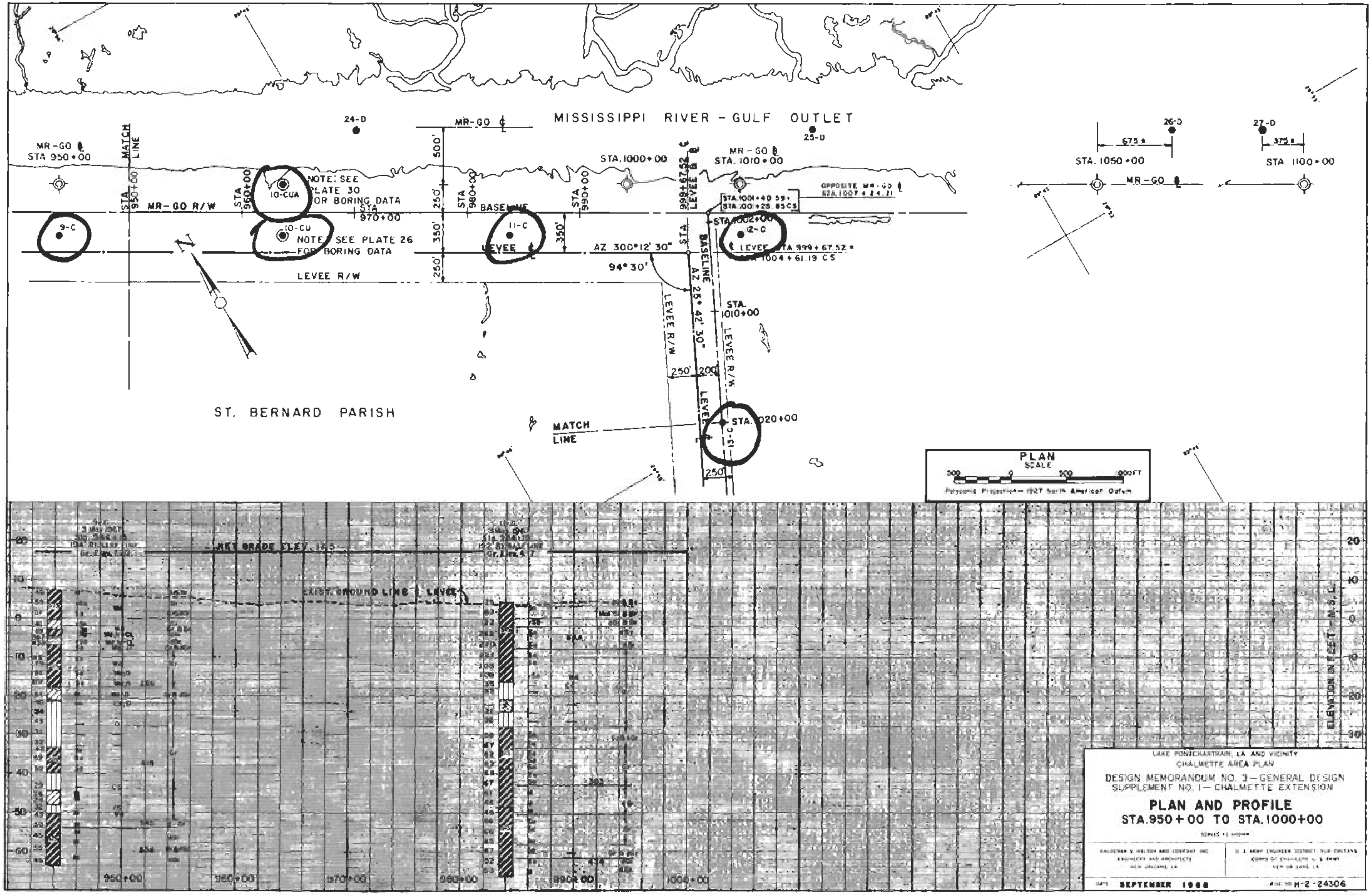

MISSISSIPPI RIVER - GULF OUTLET
MR-GO ℄ STA 950+00
MATCH LINE
STA 950+00
MR-GO R/W
NOTE: SEE PLATE 30 FOR BORING DATA
10-CUA
10-CU
NOTE: SEE PLATE 26 FOR BORING DATA
9-C
11-C
12-C
13-C
24-D
25-D
26-D
27-D
BASELINE
LEVEE
LEVEE R/W
AZ 300°12' 30"
AZ 25° 42' 30"
94° 30'
STA 960+00
STA 970+00
STA 980+00
STA 990+00
STA 1000+00
STA 1010+00
STA 1050+00
STA 1100+00
ST. BERNARD PARISH
MATCH LINE
PLAN
SCALE
NET GRADE ELEV. 15.5
EXIST. GROUND LINE ℄ LEVEE
ELEVATION IN FEET - M.S.L.
LAKE PONTCHARTRAIN, LA AND VICINITY
CHALMETTE AREA PLAN
DESIGN MEMORANDUM NO. 3 — GENERAL DESIGN
SUPPLEMENT NO. 1 — CHALMETTE EXTENSION
PLAN AND PROFILE
STA. 950+00 TO STA. 1000+00
SEPTEMBER
H-2-24306

PLATE 4

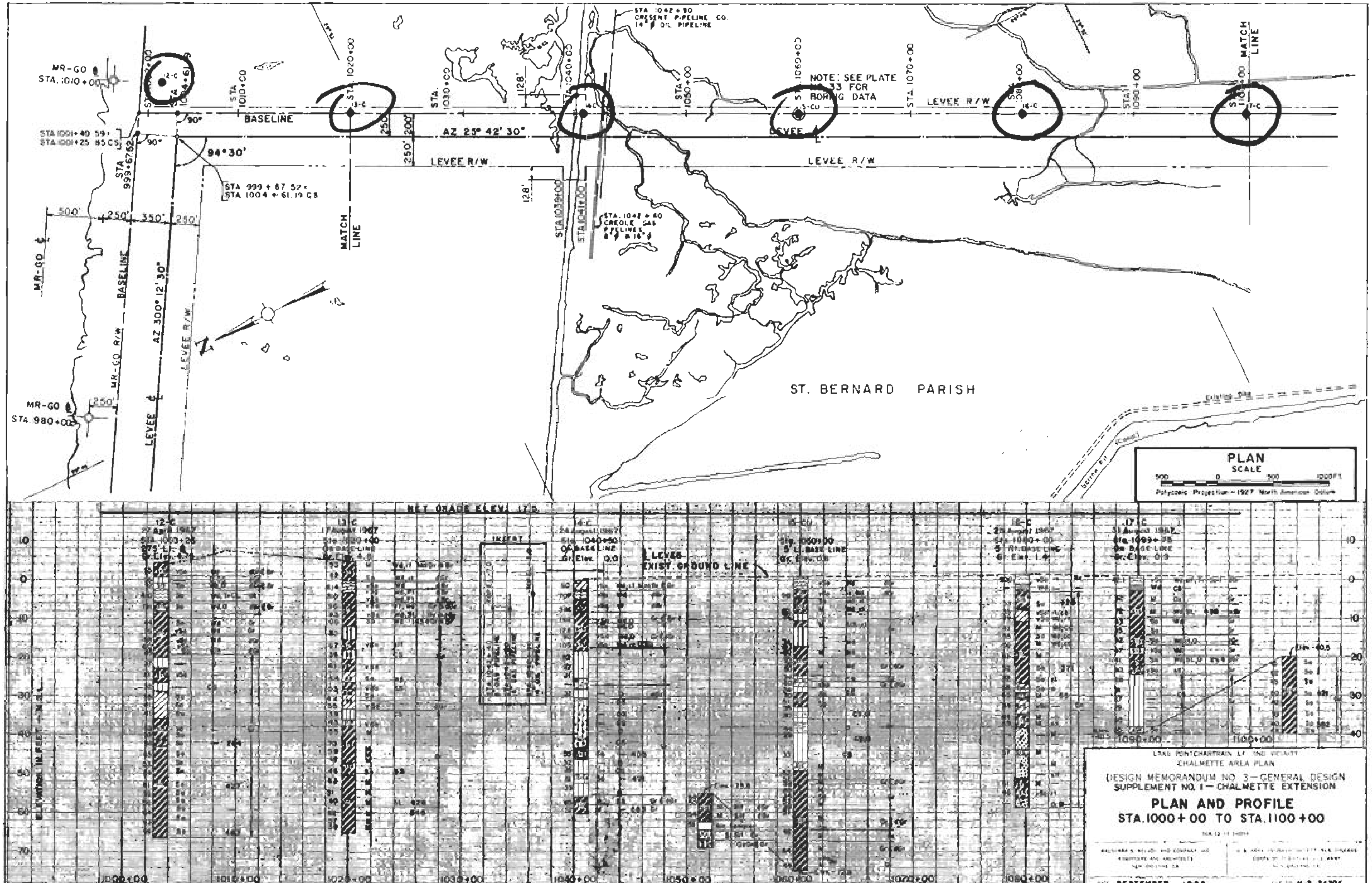
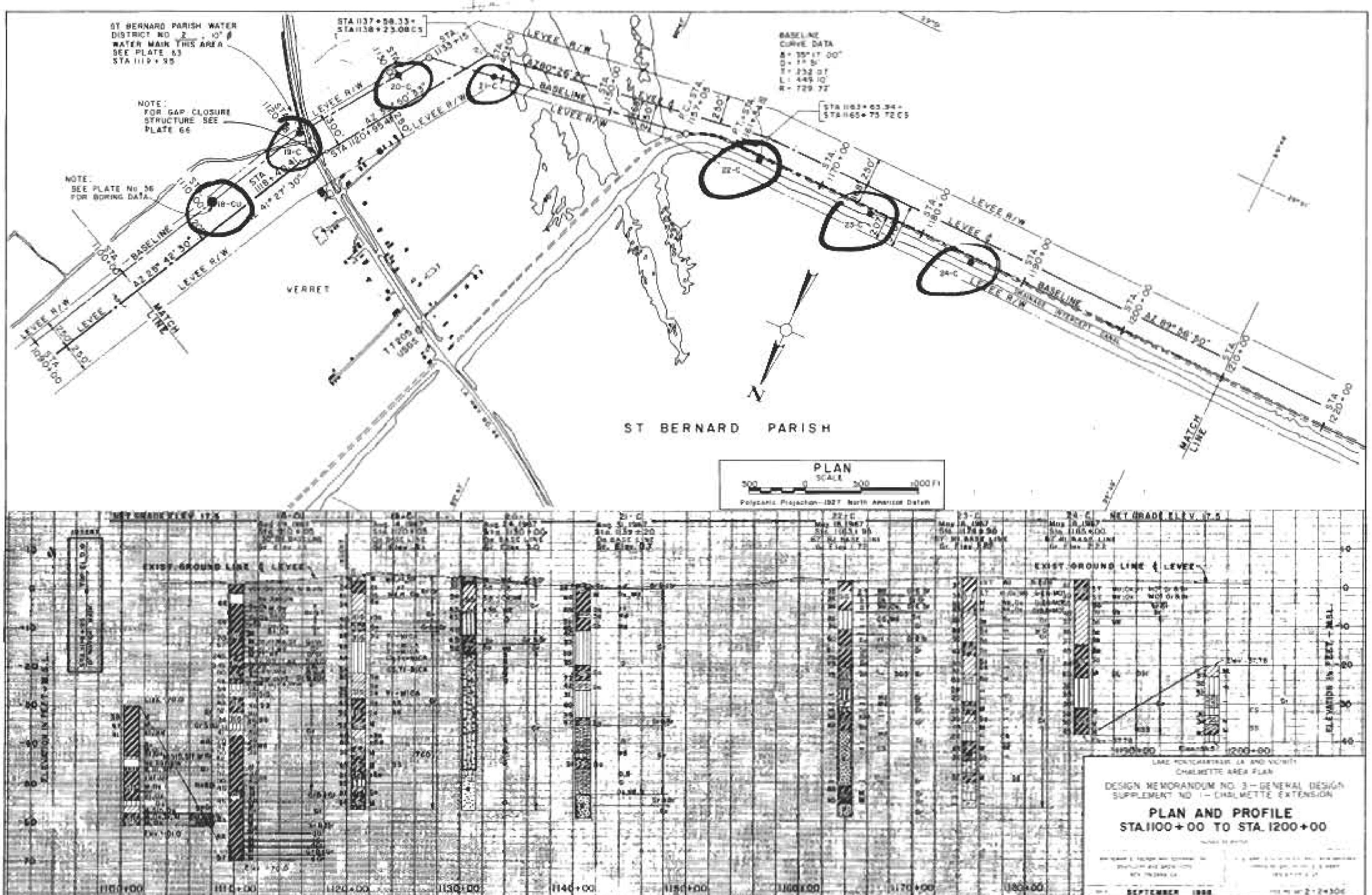
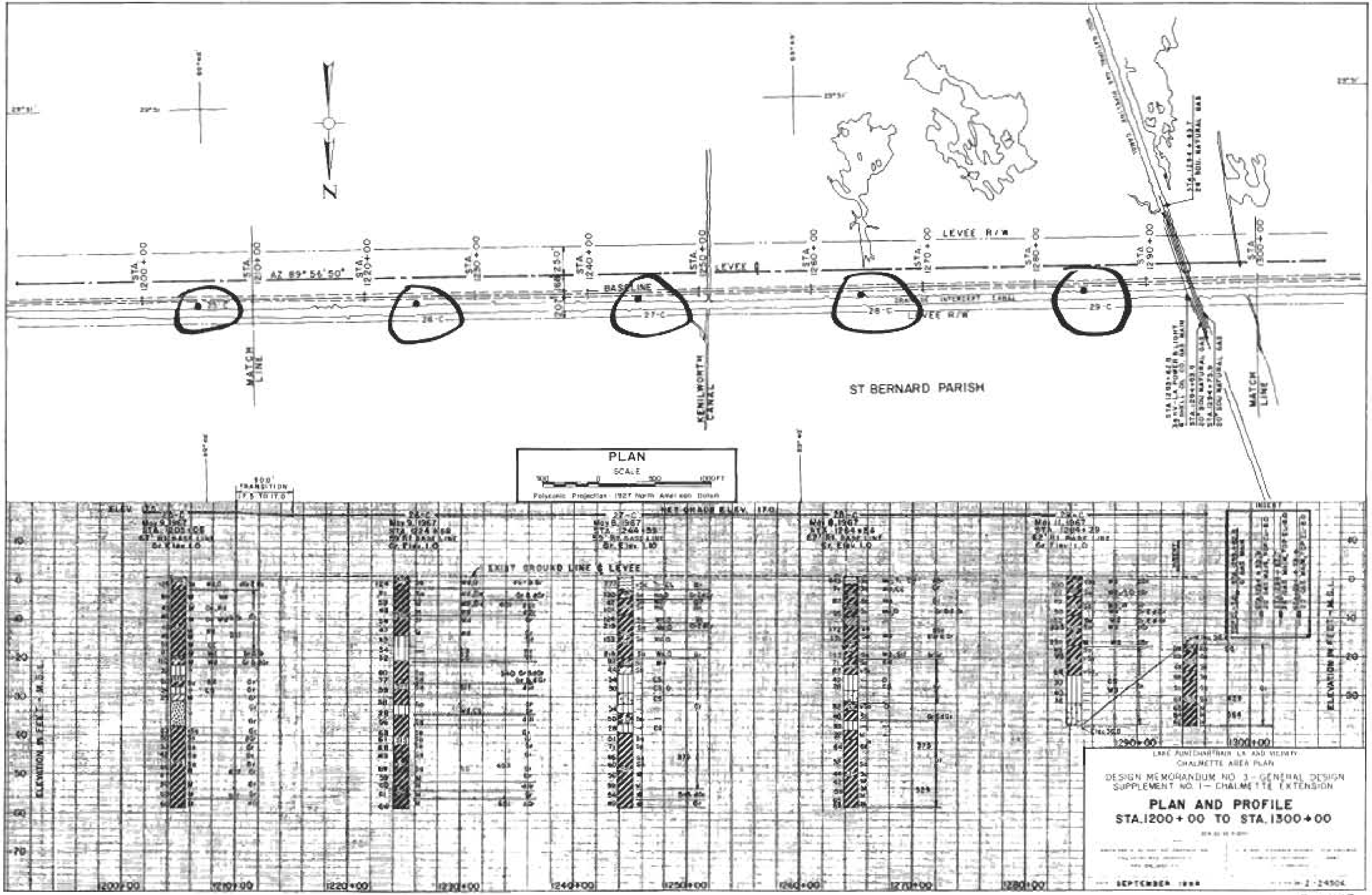

MR-GO ℄
STA. 1010+00
STA 1001+40.59=
STA 1001+25.85 CS
BASELINE
90°
94°30'
AZ 25° 42' 30"
LEVEE R/W
STA 999+87.52=
STA 1004+61.19 CS
MATCH LINE
STA. 1042+90
CRESENT PIPELINE CO.
14" ∅ OIL PIPELINE
STA. 1042+40
CREOLE GAS PIPELINES
NOTE: SEE PLATE 33 FOR BORING DATA
LEVEE R/W
MR-GO ℄
BASELINE
AZ 300° 12' 30"
LEVEE R/W
MR-GO R/W
LEVEE ℄
MR-GO ℄
STA. 980+00
ST. BERNARD PARISH
PLAN
SCALE
500 0 500 1000 FT.
Polyconic Projection - 1927 North American Datum
NET GRADE ELEV. 17.5
EXIST. GROUND LINE
INSET
LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN
DESIGN MEMORANDUM NO. 3 — GENERAL DESIGN
SUPPLEMENT NO. 1 — CHALMETTE EXTENSION
PLAN AND PROFILE
STA. 1000+00 TO STA. 1100+00
SEPTEMBER 1966
H-2-24306

PLATE 5



ST BERNARD PARISH WATER DISTRICT NO. 2, 10" ϕ WATER MAIN THIS AREA SEE PLATE 63 STA 1119+95
NOTE: FOR GAP CLOSURE STRUCTURE SEE PLATE 66
NOTE: SEE PLATE No. 36 FOR BORING DATA.
STA 1137+58.33+
STA 1138+23.08 CS
BASELINE CURVE DATA
STA 1163+63.94+
STA 1165+75.72 CS
LEVEE R/W
BASELINE
VERRET
ST BERNARD PARISH
MATCH LINE
N
PLAN
SCALE
Polyconic Projection—1927 North American Datum
NET GRADE ELEV 17.5
EXIST. GROUND LINE ℄ LEVEE
ELEVATION IN FEET—M.S.L.
1100+00
1110+00
1120+00
1130+00
1140+00
1150+00
1160+00
1170+00
1180+00
1190+00
1200+00
LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN
DESIGN MEMORANDUM NO. 3 — GENERAL DESIGN
SUPPLEMENT NO. 1 — CHALMETTE EXTENSION
PLAN AND PROFILE
STA.1100+00 TO STA. 1200+00
SEPTEMBER 1966

PLATE 6



PLAN
SCALE
Polyconic Projection - 1927 North American Datum
ST BERNARD PARISH
KENILWORTH CANAL
MATCH LINE
LEVEE R/W
BASELINE
AZ 89° 56' 50"
STA. 1200+00
STA. 1210+00
STA. 1220+00
STA. 1230+00
STA. 1240+00
STA. 1250+00
STA. 1260+00
STA. 1270+00
STA. 1280+00
STA. 1290+00
STA. 1300+00
25-C
26-C
27-C
28-C
29-C
EXIST GROUND LINE & LEVEE
NET GRADE ELEV. 17.0
ELEVATION IN FEET - M.S.L.
1200+00
1210+00
1220+00
1230+00
1240+00
1250+00
1260+00
1270+00
1280+00
1290+00
1300+00
INSERT
LAKE PONTCHARTRAIN LA. AND VICINITY
CHALMETTE AREA PLAN
DESIGN MEMORANDUM NO. 3 - GENERAL DESIGN
SUPPLEMENT NO. 1 - CHALMETTE EXTENSION
PLAN AND PROFILE
STA. 1200+00 TO STA. 1300+00
SEPTEMBER 1968

PLATE 7

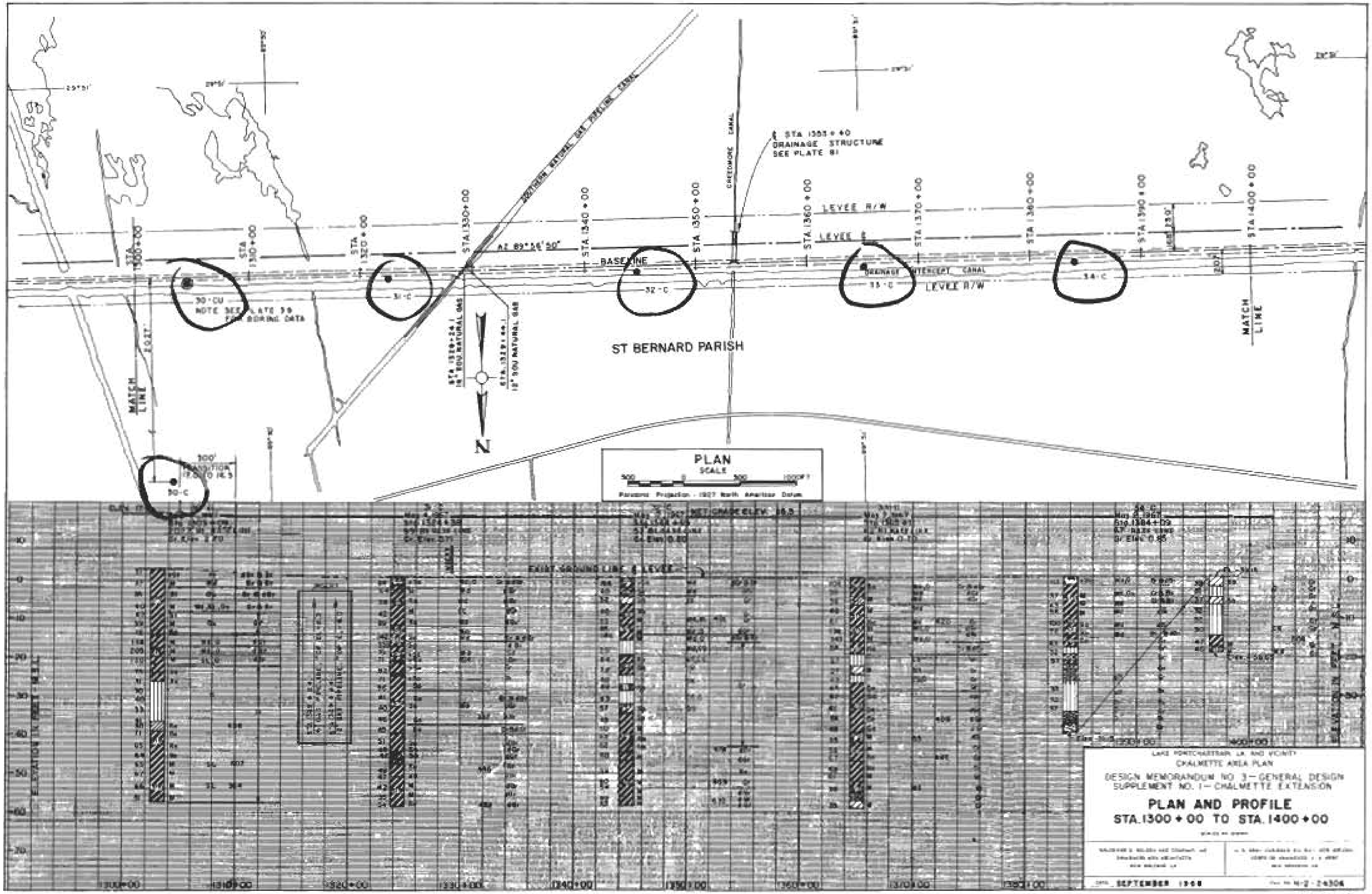
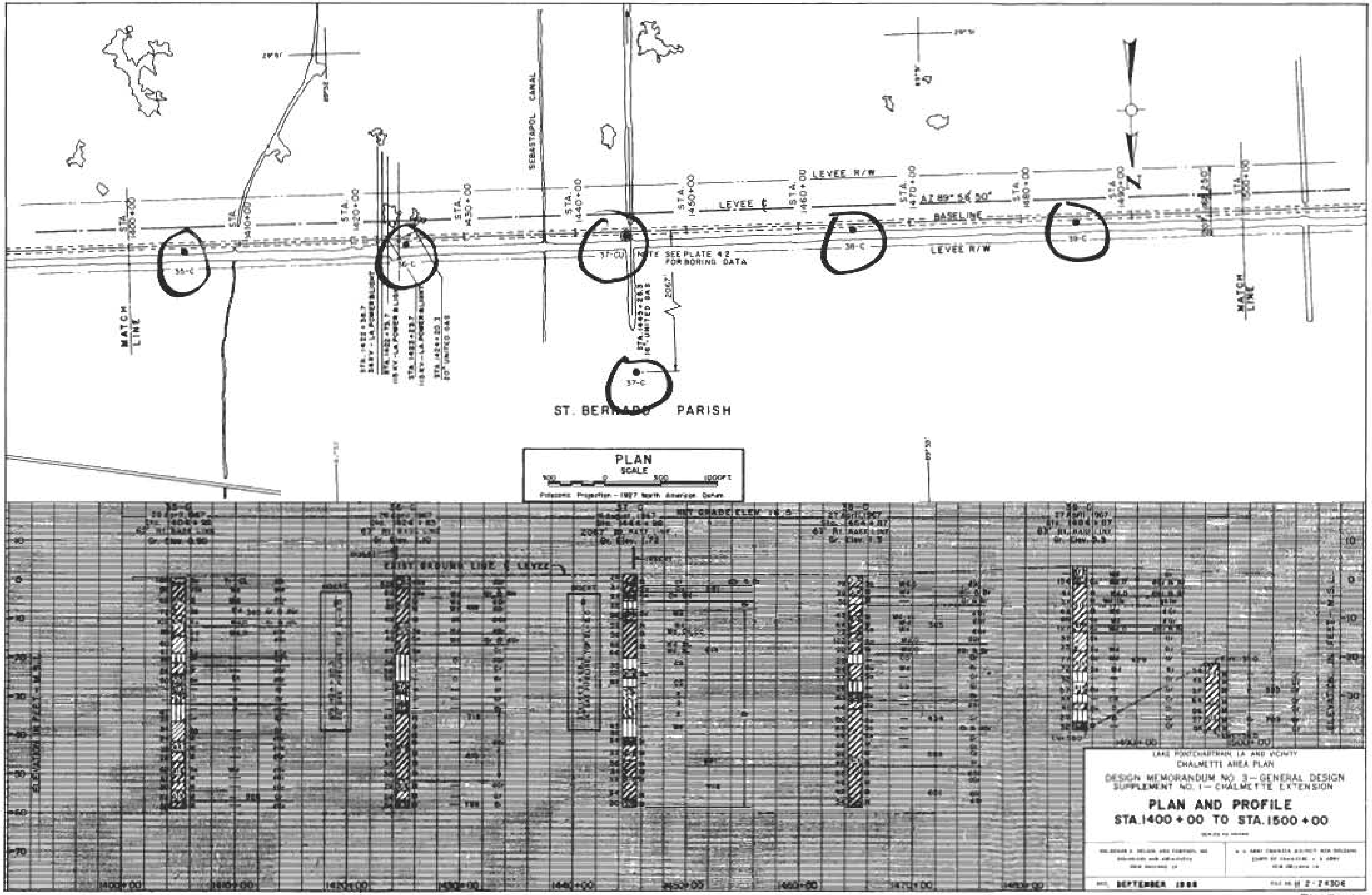

STA 1300+00
STA 1310+00
STA 1320+00
STA 1330+00
STA 1340+00
STA 1350+00
STA 1360+00
STA 1370+00
STA 1380+00
STA 1390+00
STA 1400+00
LEVEE R/W
LEVEE ℄
BASELINE
DRAINAGE INTERCEPT CANAL
LEVEE R/W
CREEDMORE CANAL
℄ STA 1353+40
DRAINAGE STRUCTURE
SEE PLATE 81
SOUTHERN NATURAL GAS PIPELINE CANAL
AZ 89°36'50"
30-CU
NOTE SEE PLATE 39 FOR BORING DATA
31-C
32-C
33-C
34-C
30-C
MATCH LINE
MATCH LINE
ST BERNARD PARISH
N
PLAN
SCALE
500 0 500 1000 FT
Polyconic Projection - 1927 North American Datum
EXIST. GROUND LINE & LEVEE
NET GRADE ELEV. 16.5
ELEVATION IN FEET M.S.L.
1300+00
1310+00
1320+00
1330+00
1340+00
1350+00
1360+00
1370+00
1380+00
1390+00
1400+00
LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN
DESIGN MEMORANDUM NO. 3 — GENERAL DESIGN
SUPPLEMENT NO. 1 — CHALMETTE EXTENSION
PLAN AND PROFILE
STA. 1300+00 TO STA. 1400+00
SEPTEMBER 1968
H-2-24306

PLATE 8



LEVEE R/W
LEVEE ℄
BASELINE
AZ 89° 56' 50"
SEBASTAPOL CANAL
MATCH LINE
MATCH LINE
NOTE SEE PLATE 42 FOR BORING DATA
ST. BERNARDO PARISH
PLAN
SCALE
EXIST GROUND LINE ℄ LEVEE
ELEVATION IN FEET - M.S.L.
LAKE PONTCHARTRAIN, LA AND VICINITY
CHALMETTE AREA PLAN
DESIGN MEMORANDUM NO. 3 — GENERAL DESIGN
SUPPLEMENT NO. 1 — CHALMETTE EXTENSION
PLAN AND PROFILE
STA. 1400 + 00 TO STA. 1500 + 00
SEPTEMBER 1966

PLATE 9

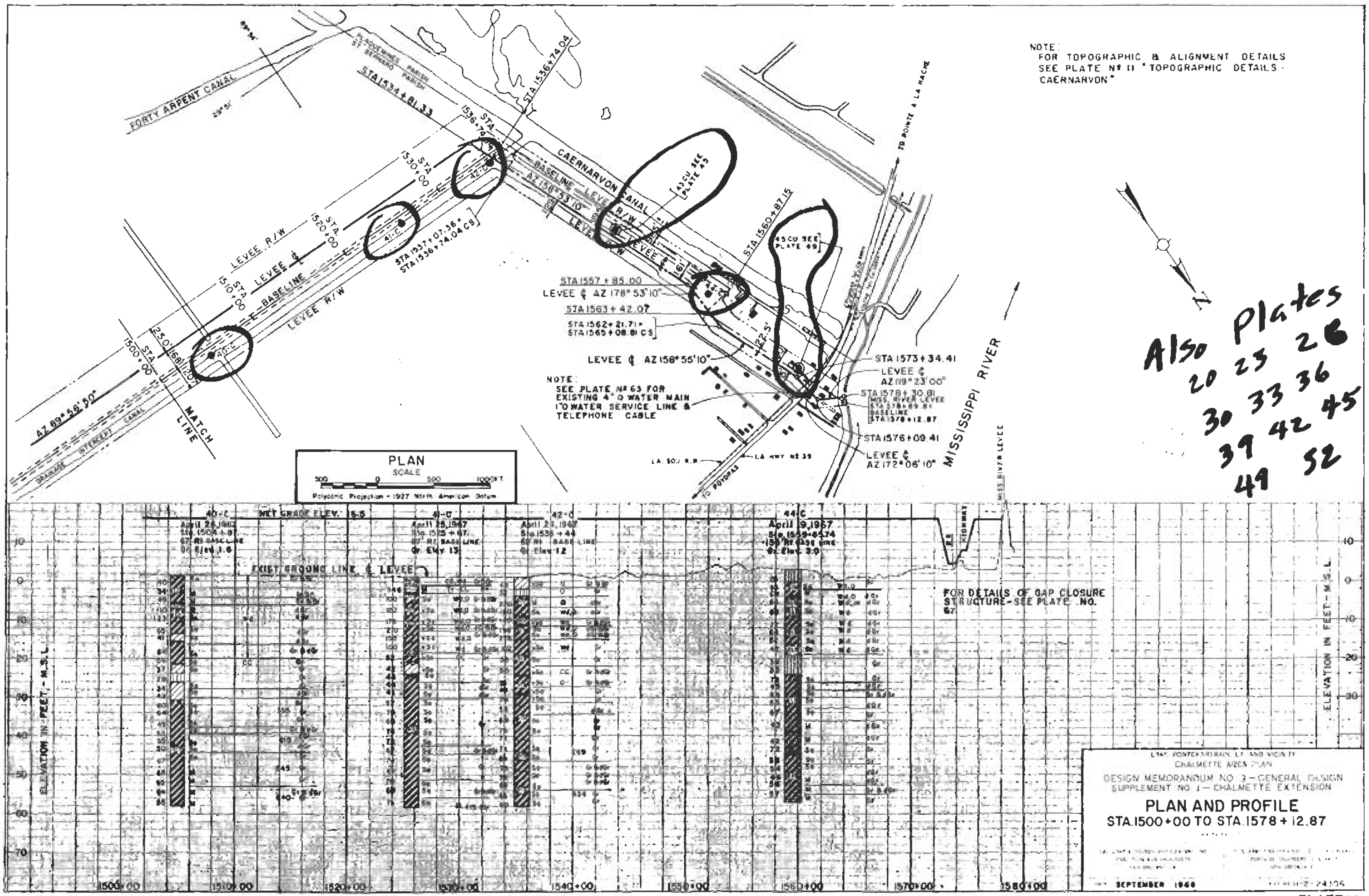

NOTE: FOR TOPOGRAPHIC & ALIGNMENT DETAILS SEE PLATE Nº 11 "TOPOGRAPHIC DETAILS - CAERNARVON"
FORTY ARPENT CANAL
PLAQUEMINES PARISH
ST BERNARD PARISH
STA 1534+81.33
STA 1536+74.04
CAERNARVON CANAL
BASELINE
LEVEE R/W
LEVEE ℄
AZ 158°33'10"
STA 1537+07.36 = STA 1536+74.04 C.S.
AZ 89°56'50"
MATCH LINE
DRAINAGE INTERCEPT CANAL
STA 1557+85.00
LEVEE ℄ AZ 178°53'10"
STA 1563+42.07
STA 1562+21.71= STA 1565+08.81 C.S.
LEVEE ℄ AZ 158°55'10"
STA 1560+87.15
STA 1573+34.41
LEVEE ℄ AZ 119°23'00"
STA 1578+30.81
STA 1576+09.41
LEVEE ℄ AZ 172°06'10"
NOTE: SEE PLATE Nº 63 FOR EXISTING 4" Ø WATER MAIN 1" Ø WATER SERVICE LINE & TELEPHONE CABLE
TO POINTE A LA HACHE
TO POYDRAS
LA. HWY Nº 39
MISSISSIPPI RIVER
PLAN
SCALE
500 0 500 1000 FT.
Polyconic Projection - 1927 North American Datum
Also Plates 20 23 26 30 33 36 39 42 45 49 52
NET GRADE ELEV. 16.5
EXIST. GROUND LINE ℄ LEVEE
April 24, 1967
April 25, 1967
April 21, 1967
April 19, 1967
FOR DETAILS OF GAP CLOSURE STRUCTURE - SEE PLATE NO. 67
ELEVATION IN FEET - M.S.L.
1500+00
1510+00
1520+00
1530+00
1540+00
1550+00
1560+00
1570+00
1580+00
LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN
DESIGN MEMORANDUM NO. 3 - GENERAL DESIGN
SUPPLEMENT NO. 1 - CHALMETTE EXTENSION
PLAN AND PROFILE
STA.1500+00 TO STA.1578+12.87
SEPTEMBER 1968

PLATE 10

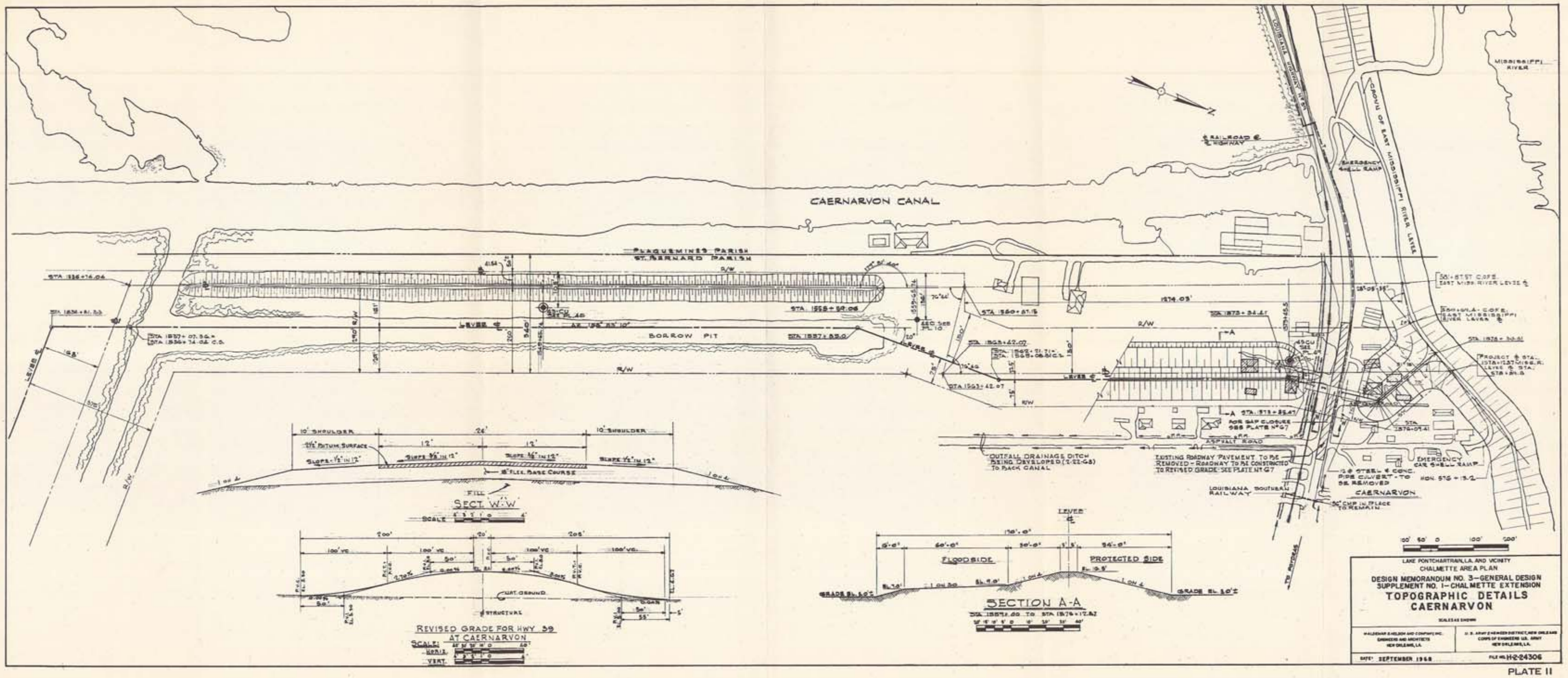
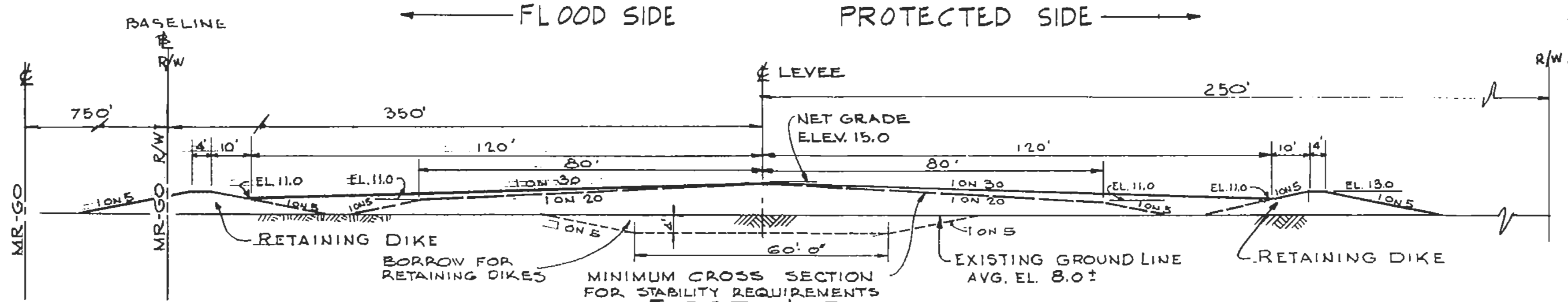
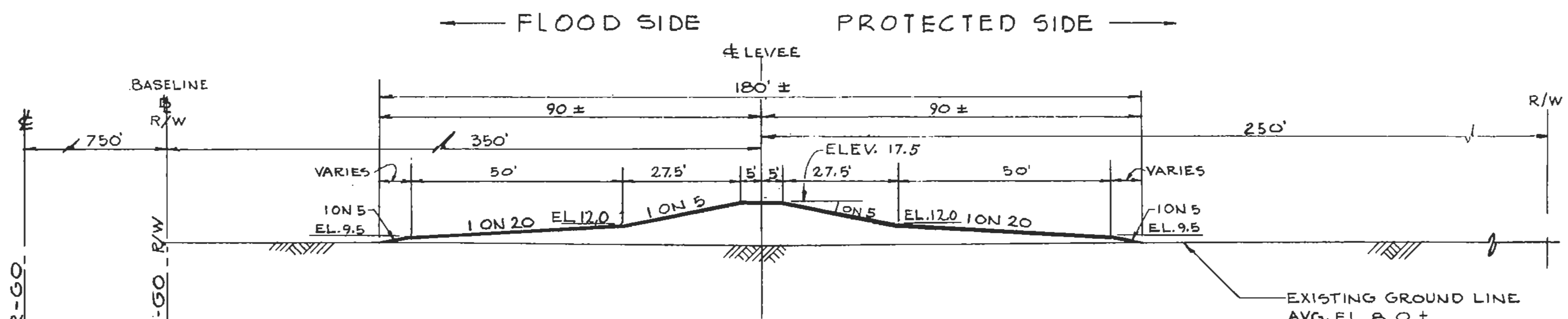

CAERNARVON CANAL
PLAQUEMINES PARISH
ST. BERNARD PARISH
BORROW PIT
SECT. W-W
REVISED GRADE FOR HWY 39
AT CAERNARVON
SECTION A-A
FLOODSIDE
PROTECTED SIDE
CAERNARVON
LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN
DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION
TOPOGRAPHIC DETAILS
CAERNARVON
DATE: SEPTEMBER 1968
FILE NO. H-2-24306

PLATE 11



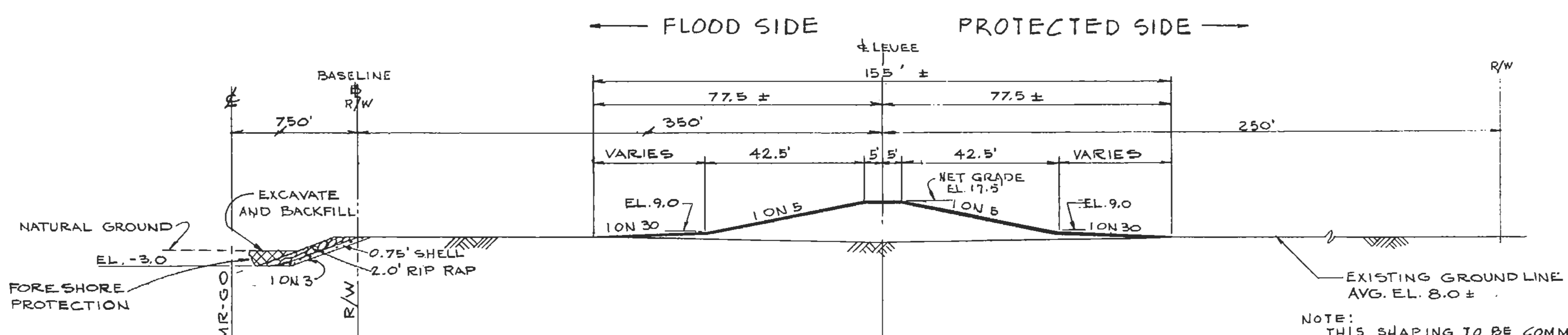
FIRST LIFT

(HYDRAULIC FILL FROM MR-GO BORROW)



FIRST SHAPING

NOTE:
THIS SHAPING TO BE COMMENCED 6 MONTHS AFTER COMPLETION OF FIRST LIFT.



FINAL SHAPING

NOTE:
THIS SHAPING TO BE COMMENCED 4 YEARS AFTER COMPLETION OF FIRST SHAPING.

NOTE:
SEE TABLE THIS PLATE FOR RIP-RAP SPECIFICATIONS

RIPRAP		
WEIGHT OF PIECES IN LBS.		PERCENT OF TOTAL WEIGHT
TYPE A 24" LAYERS	TYPE B 18" LAYERS	
800 - 1400	350 - 600	15
400 - 800	200 - 350	20
150 - 400	60 - 200	25
35 - 150	15 - 60	25
LESS THAN 35	LESS THAN 15	15
TYPE C 12" LAYERS		
75 - 150		NOT MORE THAN 10
25 - 75		50
6 - 25		30
UNDER 6		NOT MORE THAN 15

THE LEAST DIMENSION OF ANY STONE SHALL NOT BE LESS THAN ONE-THIRD ITS GREATEST DIMENSION

NOTE:
STATIONING REFERS TO ℄ STATIONS.
STATION LIMITS SHOWN ARE APPROXIMATE.
EXCESS MATERIAL, NECESSARY FOR GRADING BEYOND 5 YEAR REQUIREMENTS, SHALL BE STORED AS BERM ON FLOOD SIDE.
SECTIONS SHOWN INDICATE CONDITIONS 5 YEARS OR LESS AFTER START OF CONSTRUCTION. ANY DESIGN REQUIRED SUBSEQUENT TO THIS PERIOD WILL BE BASED ON UNDISTURBED BORINGS TAKEN AT THAT TIME.

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

DESIGN SECTIONS

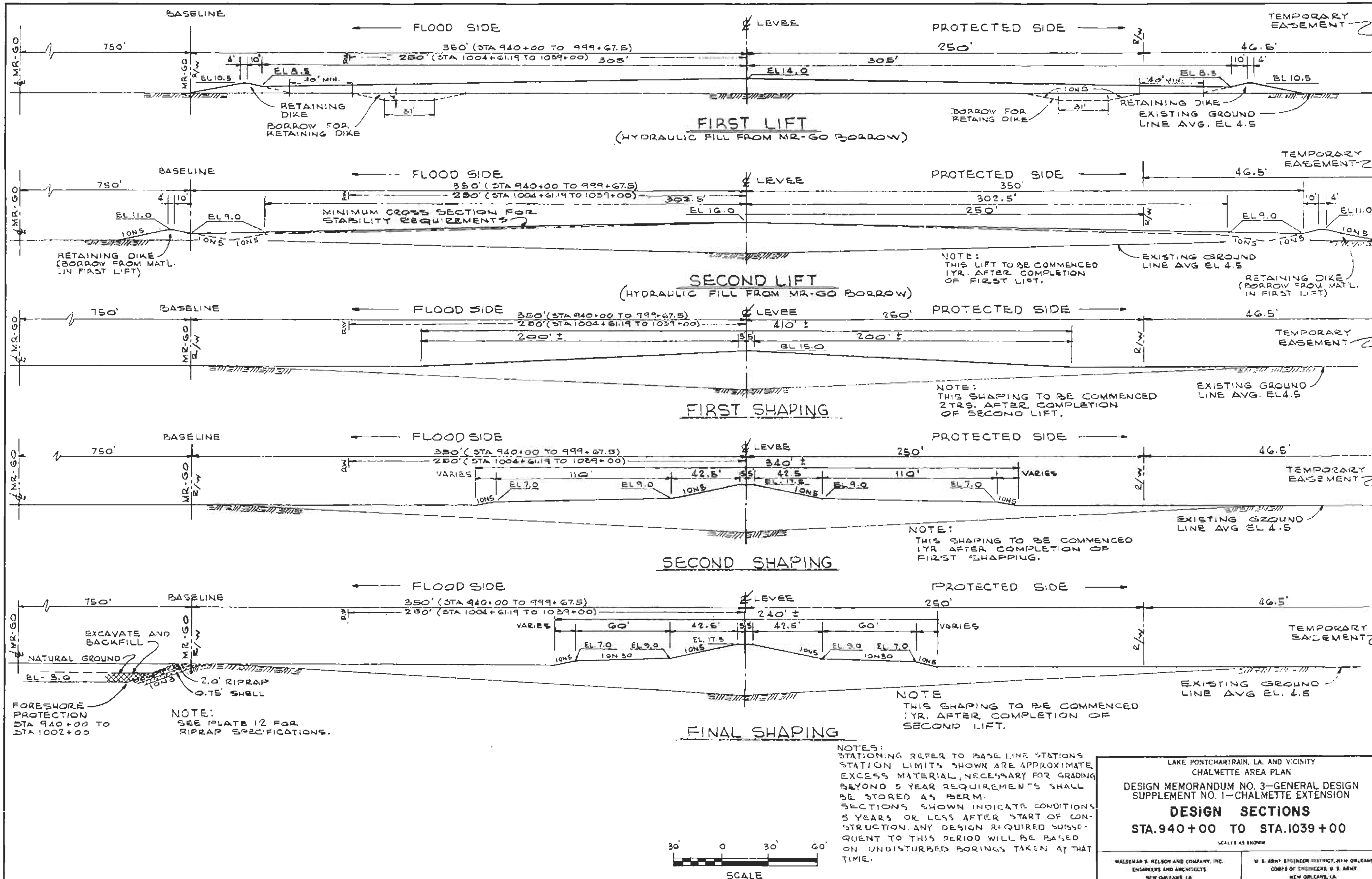
STA. 770+00 TO STA. 940+00

SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC.
ENGINEERS AND ARCHITECTS
NEW ORLEANS, LA.

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

DATE: SEPTEMBER 1968 FILE NO. H-2-24306



NOTES:
STATIONING REFER TO BASE LINE STATIONS
STATION LIMITS SHOWN ARE APPROXIMATE.
EXCESS MATERIAL, NECESSARY FOR GRADING BEYOND 5 YEAR REQUIREMENTS SHALL BE STORED AS BERM.
SECTIONS SHOWN INDICATE CONDITIONS 5 YEARS OR LESS AFTER START OF CONSTRUCTION. ANY DESIGN REQUIRED SUBSEQUENT TO THIS PERIOD WILL BE BASED ON UNDISTURBED BORINGS TAKEN AT THAT TIME.

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

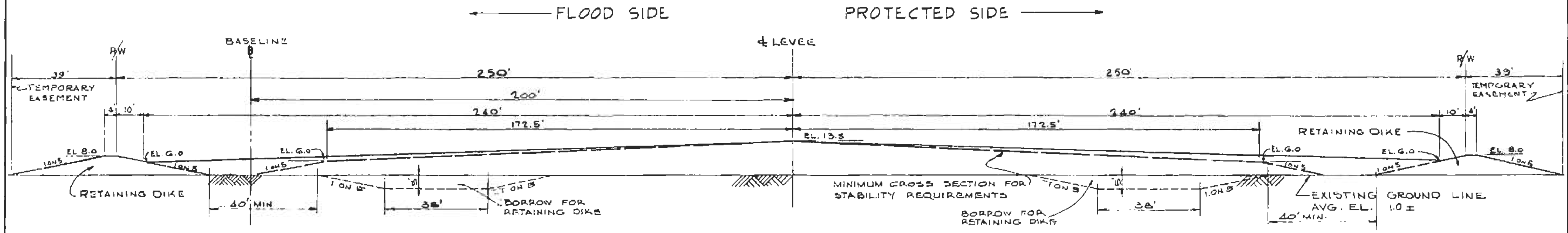
DESIGN SECTIONS

STA. 940+00 TO STA. 1039+00

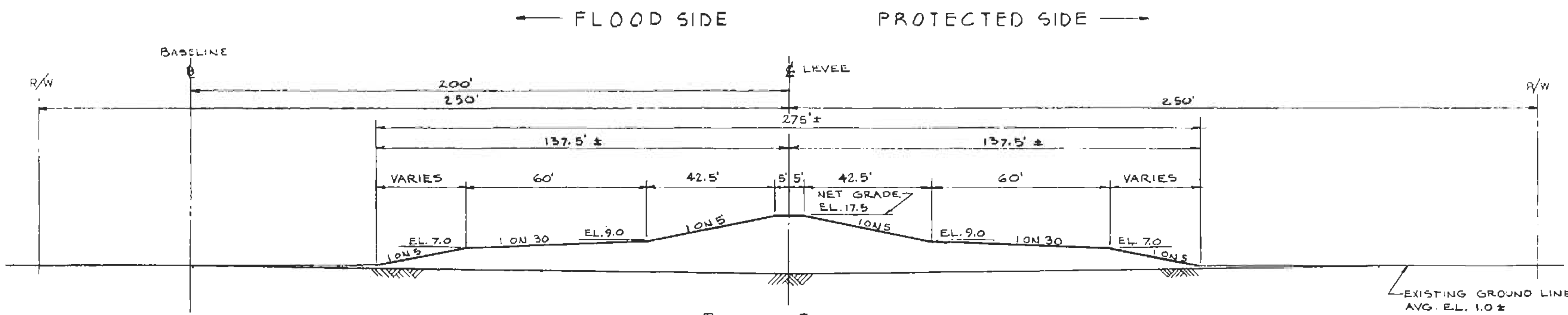
SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC. ENGINEERS AND ARCHITECTS NEW ORLEANS, LA.	U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS, U. S. ARMY NEW ORLEANS, LA.
DATE: SEPTEMBER 1968	FILE NO. H-2-24306

PLATE 13



FIRST LIFT
(HYDRAULIC FILL FROM MR-GO BORROW)



FINAL SHAPING

NOTE: THIS SHAPING TO BE COMMENCED 1 YEAR AFTER COMPLETION OF FIRST LIFT.

NOTES:
- SECTIONS SHOWN INDICATE CONDITIONS 5 YEARS OR LESS AFTER START OF CONSTRUCTION ANY DESIGN REQUIRED SUBSEQUENT TO THIS PERIOD WILL BE BASED ON UNDISTURBED BORINGS TAKEN AT THAT TIME
- STATIONING REFERS TO ℄ STATIONS
- STATION LIMITS SHOWN ARE APPROXIMATE.
- EXCESS MATERIAL, NECESSARY FOR GRADING BEYOND 5 YEAR REQUIREMENTS, SHALL BE STOCKED AS BERMS

SCALE

LAKE PONTCHARTRAIN, LA AND VICINITY
CHALMETTE AREA PLAN

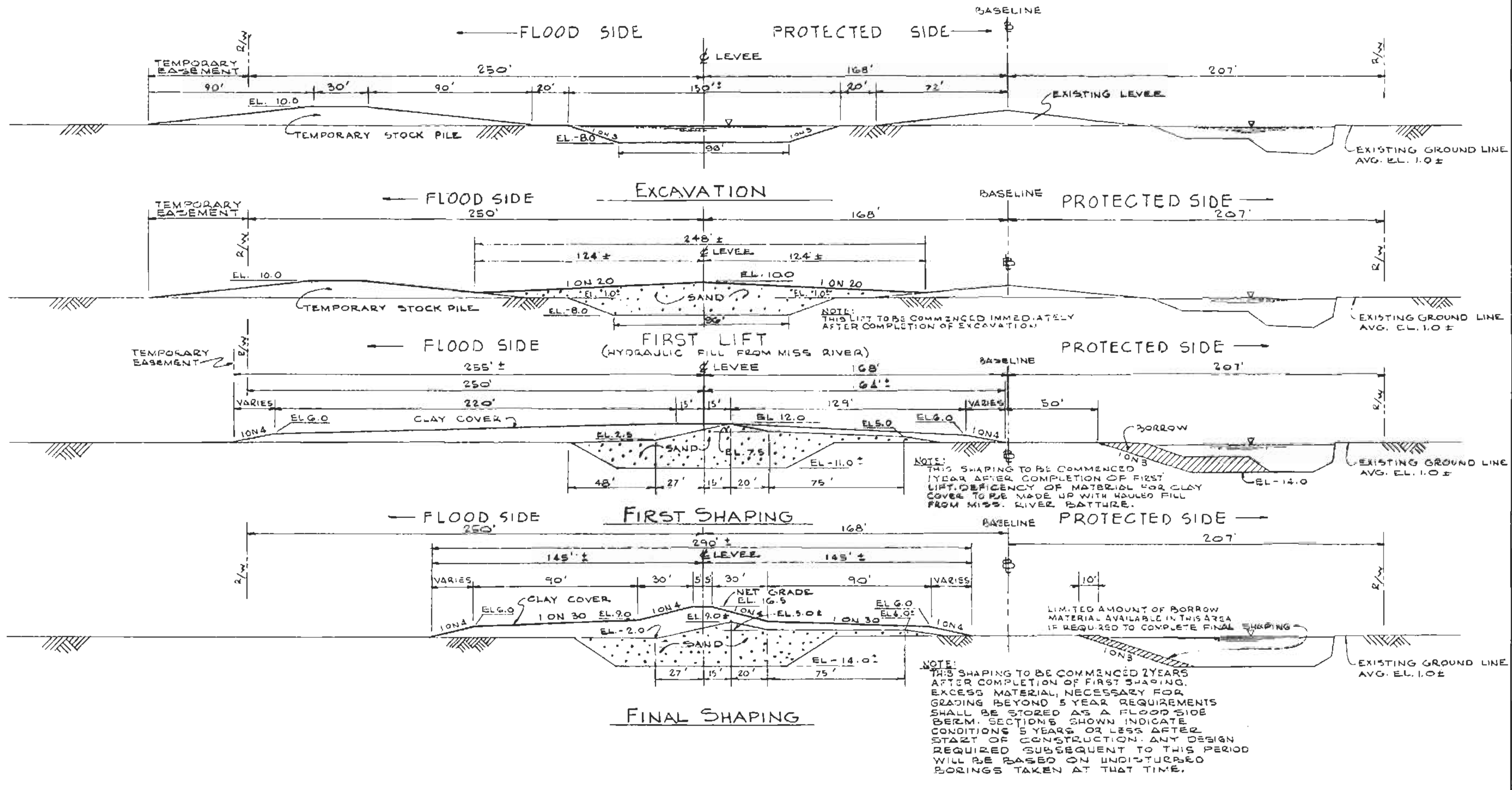
DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

DESIGN SECTIONS

STA. 1041+00 TO STA. 1118+35

SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC. ENGINEERS AND ARCHITECTS NEW ORLEANS, LA.	U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS, U. S. ARMY NEW ORLEANS, LA.
DATE: SEPTEMBER 1966	FILE NO. H-2-24306



NOTE:
STATIONING REFERS TO ℄ STATIONS
STATION LIMITS SHOWN ARE APPROXIMATE

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

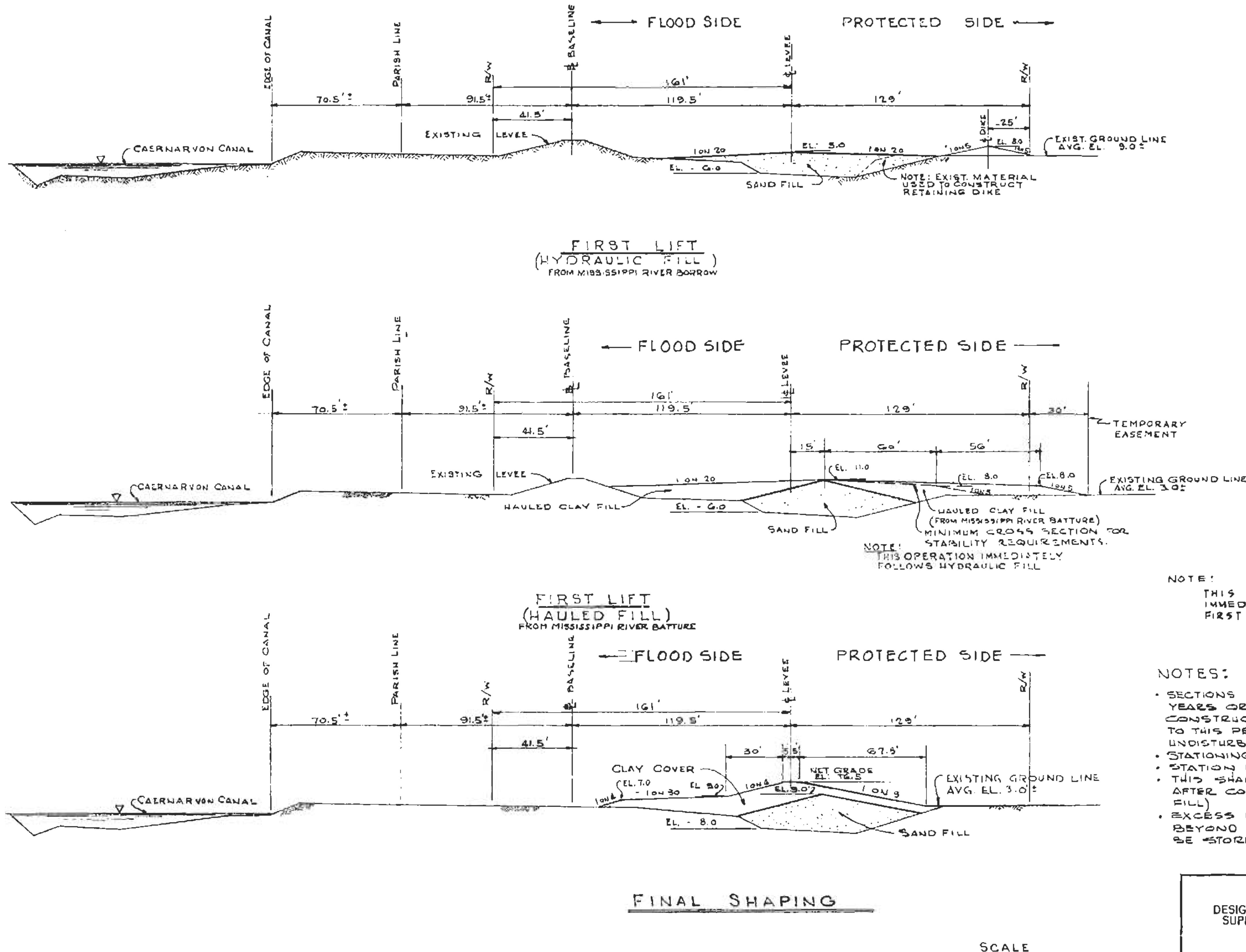
DESIGN SECTIONS

STA. 1120+90 TO STA. 1535+40

SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC. ENGINEERS AND ARCHITECTS NEW ORLEANS, LA.	U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS, U. S. ARMY NEW ORLEANS, LA.
DATE SEPTEMBER 1968	FILE NO. H-2-24306

PLATE 15



NOTE:
THIS LIFT SHAPING TO BE COMMENCED IMMEDIATELY AFTER COMPLETION OF FIRST LIFT (HYDRAULIC FILL)

NOTES:
- SECTIONS SHOWN INDICATE CONDITIONS 5 YEARS OR LESS AFTER START OF CONSTRUCTION, ANY DESIGN SUBSEQUENT TO THIS PERIOD WILL BE BASED ON UNDISTURBED BORINGS TAKEN AT THAT TIME.
- STATIONING REFERS TO ℄ STATIONS.
- STATION LIMITS ARE APPROXIMATE.
- THIS SHAPING TO BE COMMENCED 2 YEARS AFTER COMPLETION OF FIRST LIFT (HAULED FILL)
- EXCESS MATERIAL NECESSARY FOR GRADING BEYOND 5 YEAR REQUIREMENTS SHALL BE STORED AS BERM ON FLOOD SIDE.

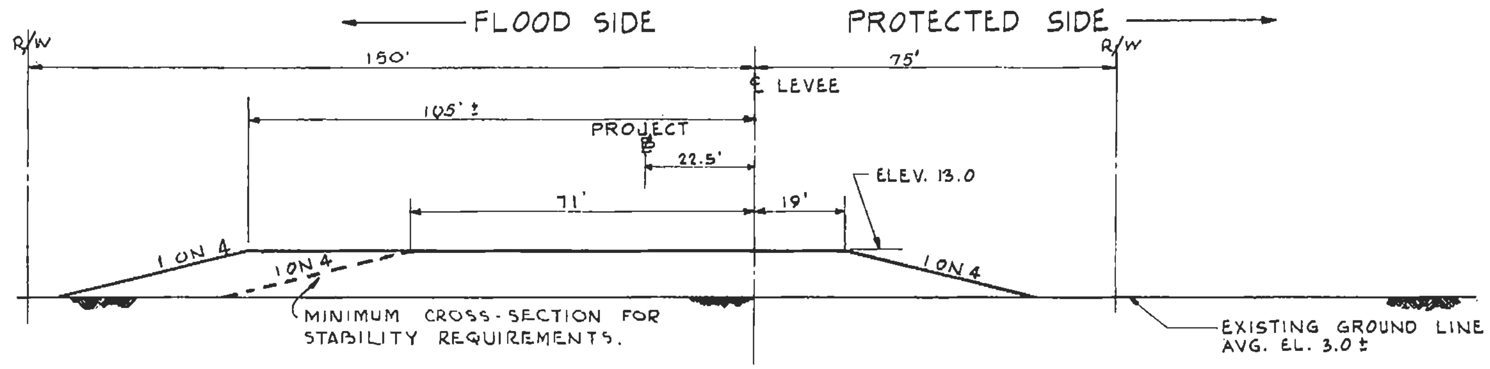
LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN
DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

DESIGN SECTIONS
STA. 1537 + 00 TO STA. 1559 + 00

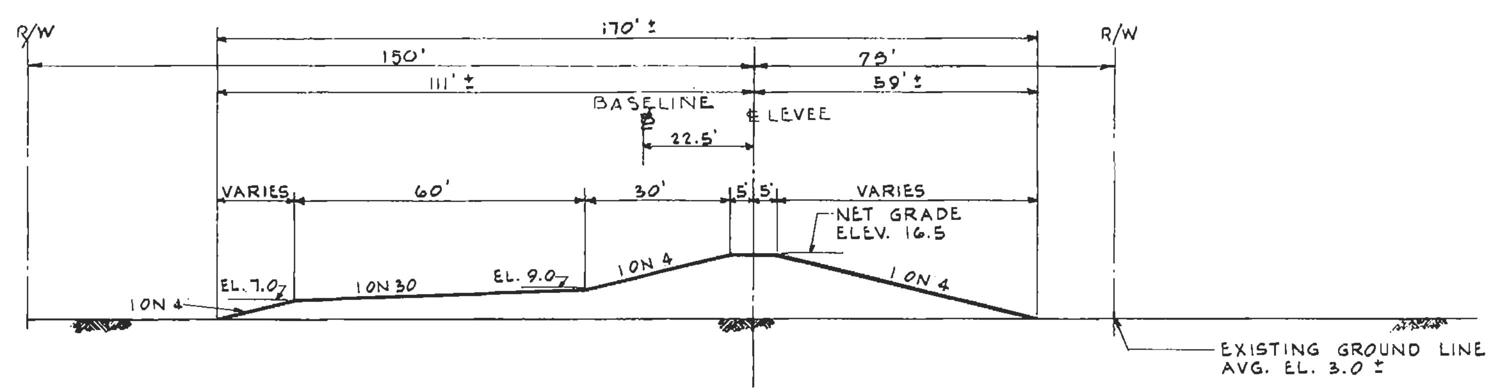
SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC. ENGINEERS AND ARCHITECTS NEW ORLEANS, LA. | U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS, U. S. ARMY NEW ORLEANS, LA.

DATE SEPTEMBER 1968 | FILE NO. H-2-24306



FIRST LIFT
(HAULED FILL FROM MISSISSIPPI RIVER BATTURE)



FINAL SHAPING

NOTE:
THIS SHAPING TO BE COMMENCED 1 YEAR AFTER COMPLETION OF FIRST LIFT.

NOTES:
- SECTIONS SHOWN INDICATE CONDITIONS 5 YEARS OR LESS AFTER START OF CONSTRUCTION. ANY DESIGN REQUIRED SUBSEQUENT TO THIS PERIOD WILL BE BASED ON UNDISTURBED BORINGS TAKEN AT THAT TIME.
- STATIONING REFERS TO ℄ STATIONS
- STATION LIMITS SHOWN ARE APPROXIMATE
- EXCESS MATERIAL, NECESSARY FOR GRADING BEYOND 5 YEAR REQUIREMENTS, SHALL BE STORED AS BERMS ON FLOOD SIDE.

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

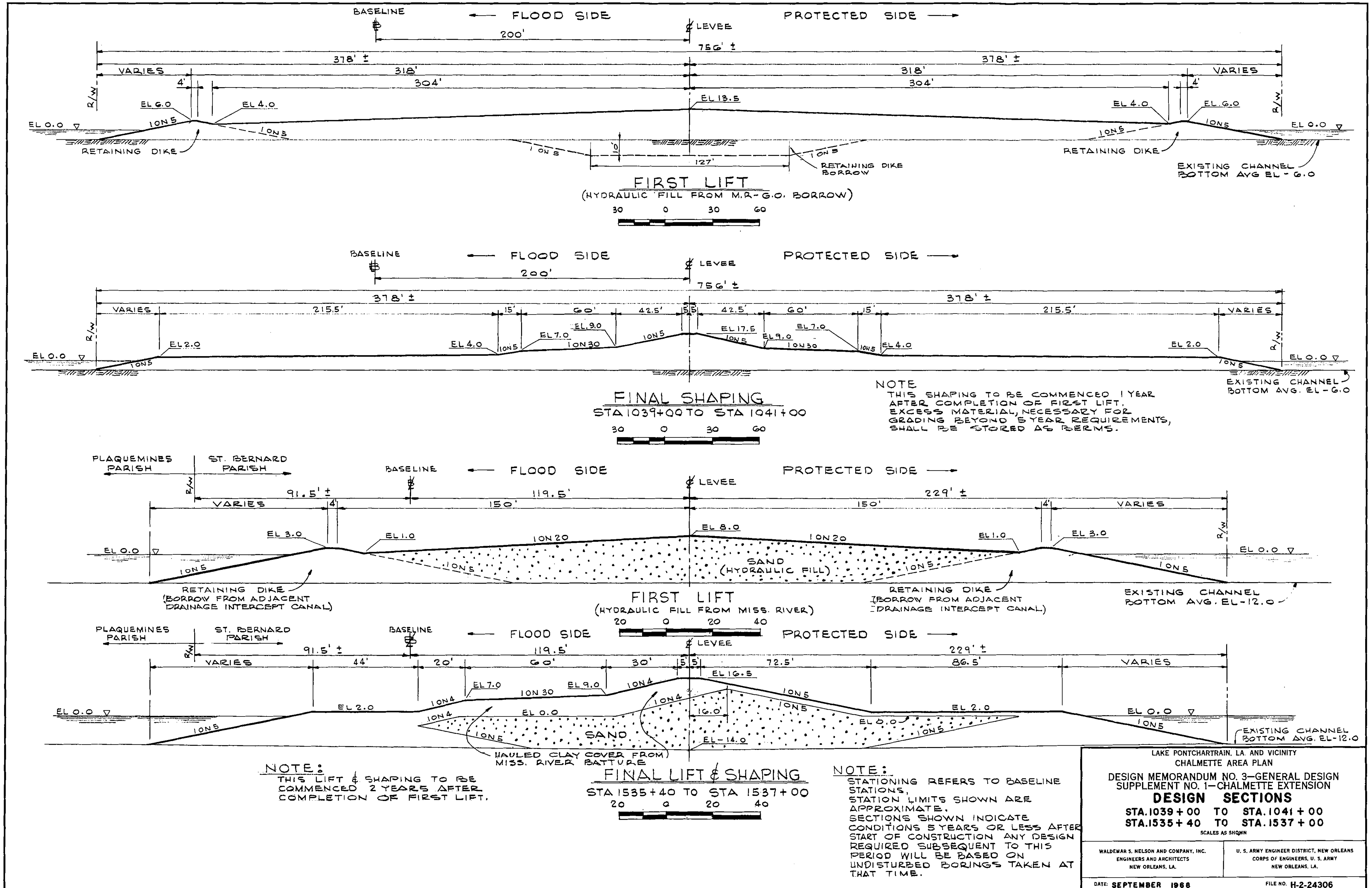
DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

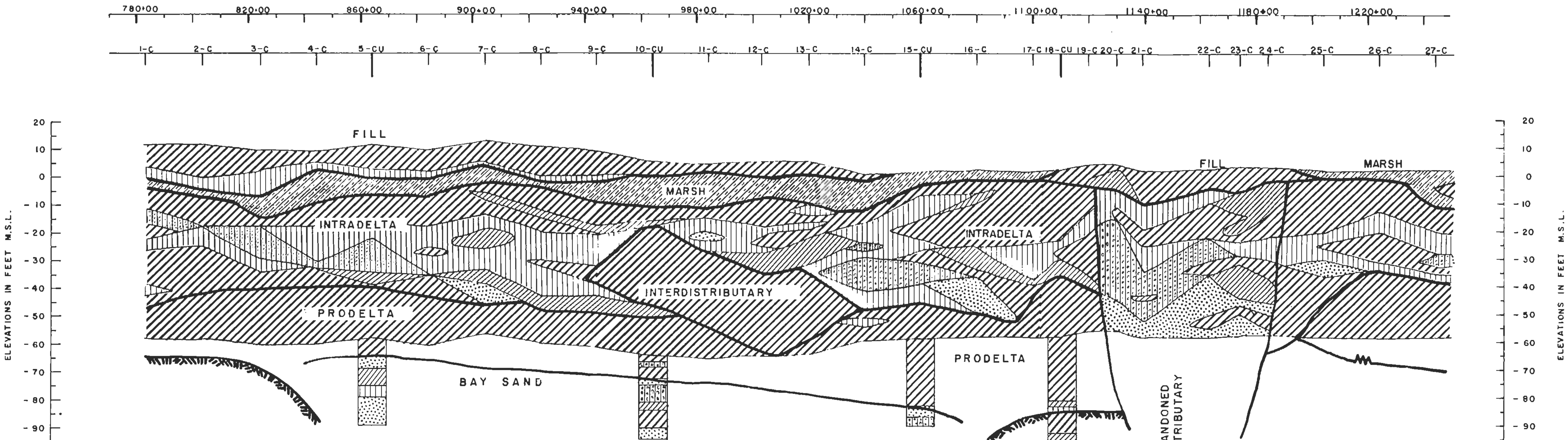
DESIGN SECTIONS

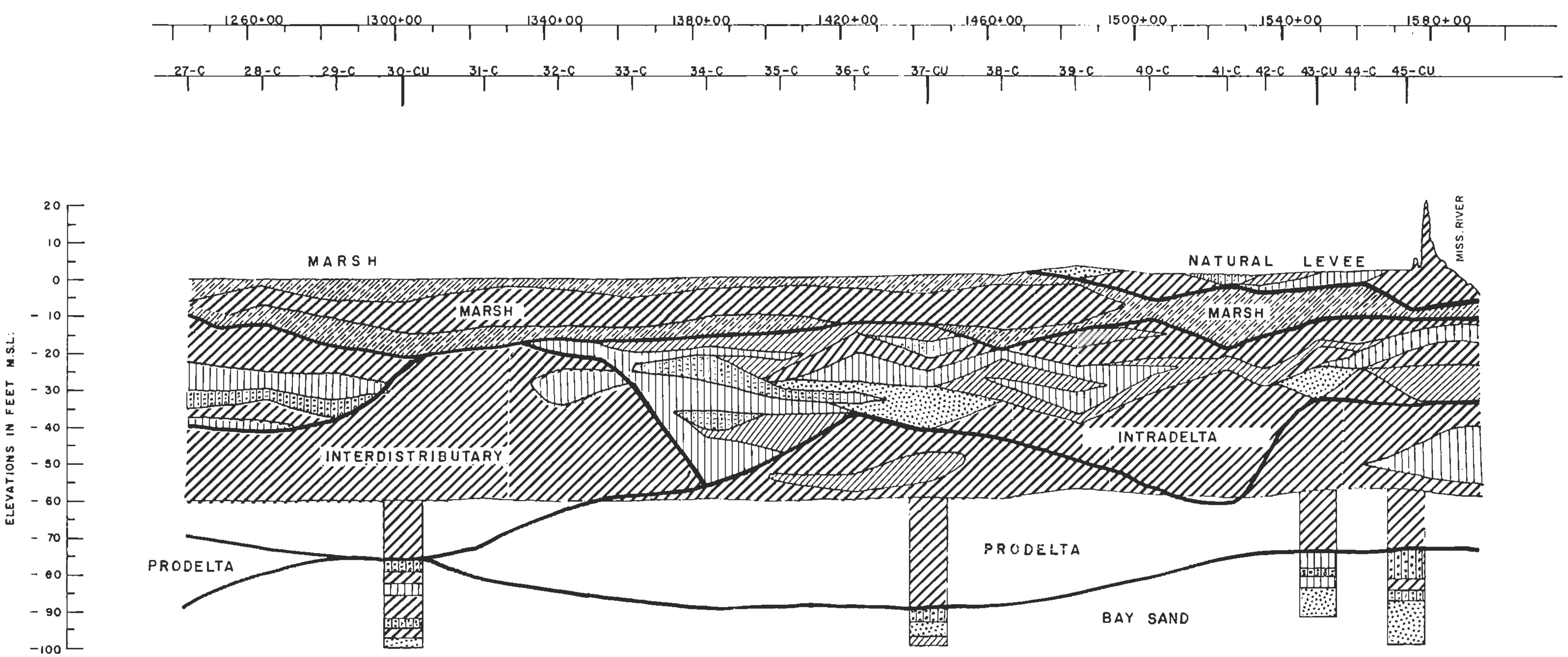
STA. 1559 + 00 TO STA. 1578 + 12

SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC. ENGINEERS AND ARCHITECTS NEW ORLEANS, LA.	U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS, U. S. ARMY NEW ORLEANS, LA.
DATE: SEPTEMBER 1968	FILE NO. H-2-24306


BASELINE
← FLOOD SIDE
℄ LEVEE
PROTECTED SIDE →
200'
756' ±
378' ±
378' ±
VARIES
318'
318'
VARIES
4'
304'
304'
4'
R/W
EL 6.0
EL 4.0
EL 13.5
EL 4.0
EL 6.0
EL 0.0
1 ON 5
1 ON 5
10'
127'
RETAINING DIKE
RETAINING DIKE BORROW
EXISTING CHANNEL BOTTOM AVG EL - 6.0
FIRST LIFT
(HYDRAULIC FILL FROM M.R-G.O. BORROW)
30 0 30 60
BASELINE
← FLOOD SIDE
℄ LEVEE
PROTECTED SIDE →
200'
756' ±
378' ±
378' ±
VARIES
215.5'
15'
60'
42.5'
5
5
42.5'
60'
15'
215.5'
VARIES
EL 2.0
EL 4.0
EL 7.0
EL 9.0
EL 17.5
EL 9.0
EL 7.0
EL 4.0
EL 2.0
EL 0.0
1 ON 5
1 ON 30
EXISTING CHANNEL BOTTOM AVG. EL - 6.0
FINAL SHAPING
STA 1039+00 TO STA 1041+00
30 0 30 60
NOTE
THIS SHAPING TO BE COMMENCED 1 YEAR AFTER COMPLETION OF FIRST LIFT. EXCESS MATERIAL, NECESSARY FOR GRADING BEYOND 5 YEAR REQUIREMENTS, SHALL BE STORED AS BERMS.
PLAQUEMINES PARISH
ST. BERNARD PARISH
BASELINE
← FLOOD SIDE
℄ LEVEE
PROTECTED SIDE →
91.5' ±
119.5'
229' ±
VARIES
4'
150'
150'
4'
VARIES
EL 3.0
EL 1.0
EL 8.0
EL 1.0
EL 3.0
EL 0.0
1 ON 20
1 ON 5
SAND (HYDRAULIC FILL)
RETAINING DIKE (BORROW FROM ADJACENT DRAINAGE INTERCEPT CANAL)
EXISTING CHANNEL BOTTOM AVG. EL-12.0
FIRST LIFT
(HYDRAULIC FILL FROM MISS. RIVER)
20 0 20 40
PLAQUEMINES PARISH
ST. BERNARD PARISH
BASELINE
← FLOOD SIDE
℄ LEVEE
PROTECTED SIDE →
91.5' ±
119.5'
229' ±
VARIES
44'
20'
60'
30'
5
5
72.5'
86.5'
VARIES
EL 7.0
EL 9.0
EL 16.5
EL 2.0
EL 0.0
EL 2.0
EL 0.0
EL 0.0
EL -14.0
1 ON 4
1 ON 30
1 ON 5
16.0'
SAND
HAULED CLAY COVER FROM MISS. RIVER BATTURE
EXISTING CHANNEL BOTTOM AVG. EL-12.0
NOTE:
THIS LIFT & SHAPING TO BE COMMENCED 2 YEARS AFTER COMPLETION OF FIRST LIFT.
FINAL LIFT & SHAPING
STA 1535+40 TO STA 1537+00
20 0 20 40
NOTE:
STATIONING REFERS TO BASELINE STATIONS.
STATION LIMITS SHOWN ARE APPROXIMATE.
SECTIONS SHOWN INDICATE CONDITIONS 5 YEARS OR LESS AFTER START OF CONSTRUCTION ANY DESIGN REQUIRED SUBSEQUENT TO THIS PERIOD WILL BE BASED ON UNDISTURBED BORINGS TAKEN AT THAT TIME.
LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN
DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION
DESIGN SECTIONS
STA. 1039 + 00 TO STA. 1041 + 00
STA. 1535 + 40 TO STA. 1537 + 00
SCALES AS SHOWN
WALDEMAR S. NELSON AND COMPANY, INC.
ENGINEERS AND ARCHITECTS
NEW ORLEANS, LA.
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS, U. S. ARMY
NEW ORLEANS, LA.
DATE: SEPTEMBER 1968
FILE NO. H-2-24306





L E G E N D

FILL (medium clays w/areas silt & sand, roots, wood)

NATURAL LEVEE (soft to stiff clays w/lenses & layers of silt)

MARSH (very soft organic clays w/peat)

INTERDISTRIBUTARY (very soft to soft clays w/ lenses, & layers of silt & sand)

INTRADELTA (soft to medium clays w/sand & silt layers)

PRODELTA (medium to stiff clays w/ silt lenses)

BAY SAND (silt & sand w/ lenses & layers of clay & shell fragments)

APPROX. TOP OF PLEISTOCENE

ABANDONED DISTRIBUTARY (silt, silty sands w/clay layers)

NOTE:

FOR SOIL BORING LEGEND SEE PLATE A. DETAILS OF GENERAL PURPOSE BORINGS (DESIGNATED AS 1-C, 2-C ETC.) ARE SHOW ON PLATES 2-10 INCLUSIVE. DETAILS OF UNDISTURBED BORING (DESIGNATED AS 5-CU, 10-CU ETC.) ARE SHOWN ON PLATES 20 - 51 INCLUSIVE.

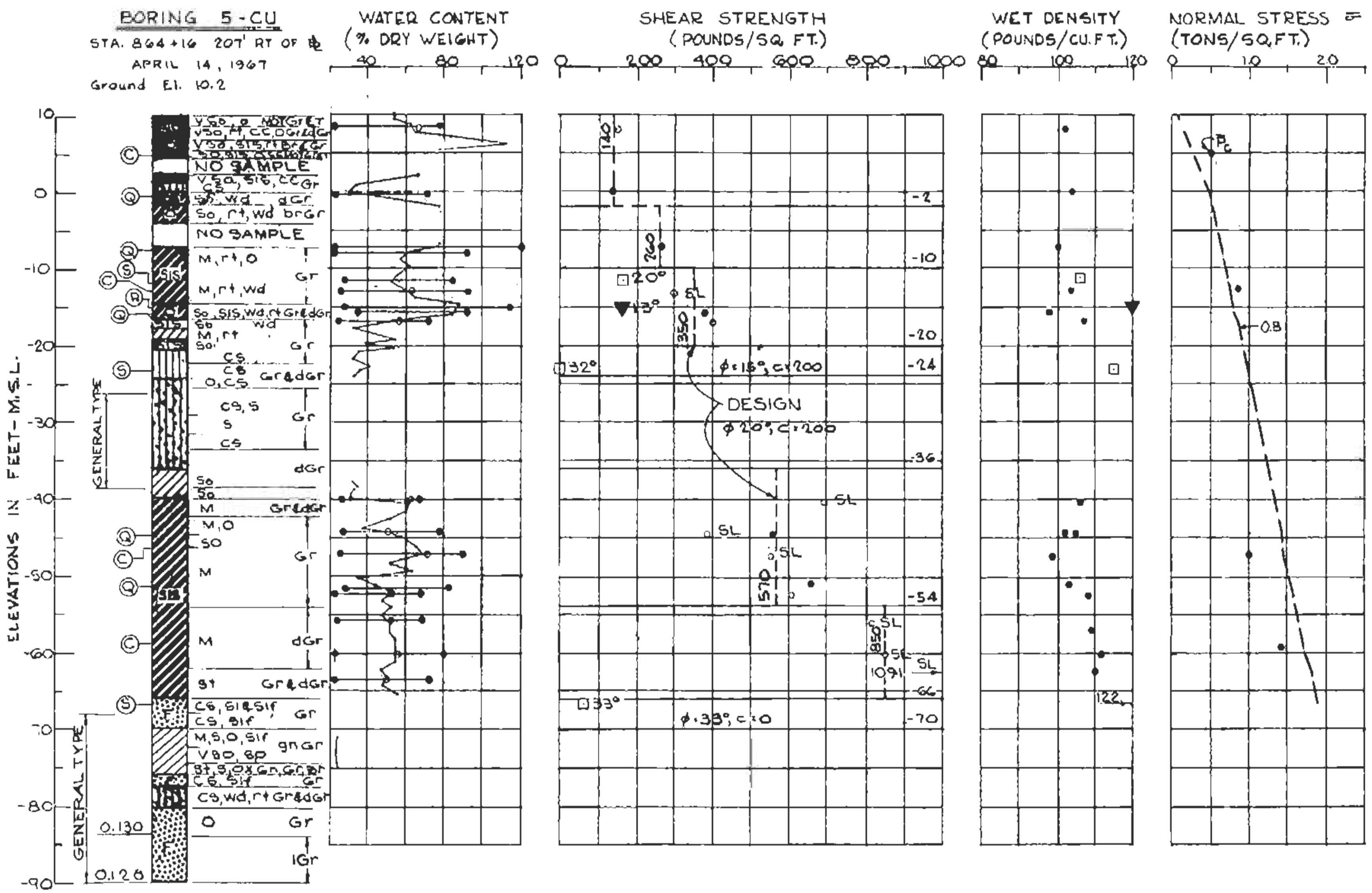
LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

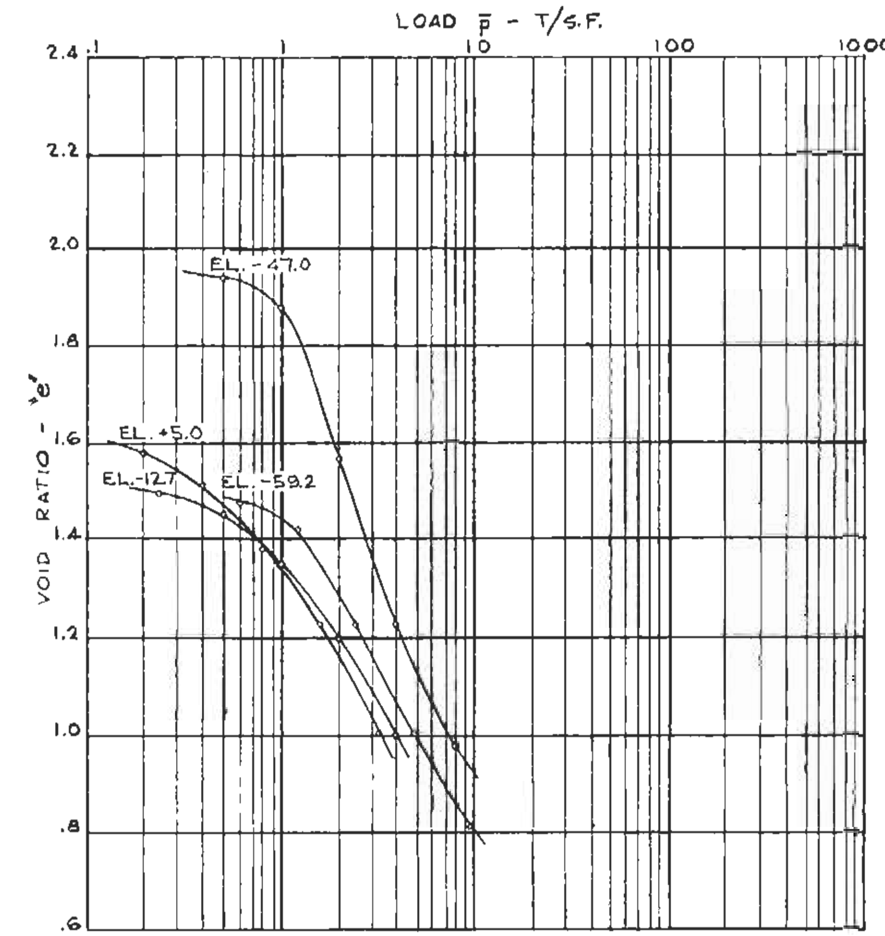
DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

GENERALIZED SOIL AND GEOLOGIC PROFILE

SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC. ENGINEERS AND ARCHITECTS NEW ORLEANS, LA.	U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS, U. S. ARMY NEW ORLEANS, LA.
DATE: SEPTEMBER 1968	FILE NO. H-2-24306



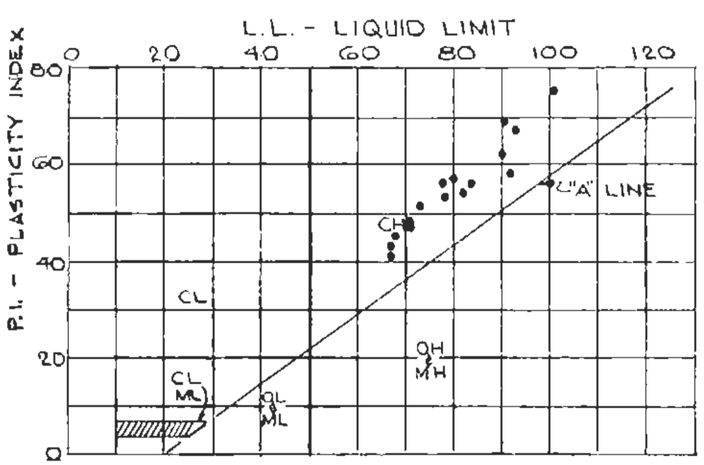


CONSOLIDATION DATA

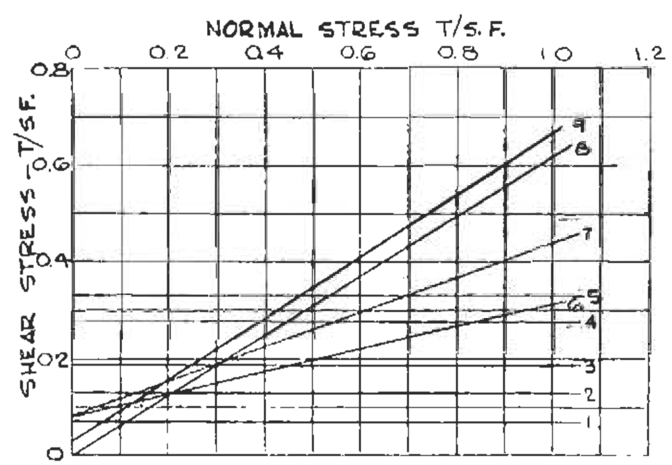
ENVELOPE		TYPE	STRENGTH		CLASS
NO.	EL.		Ø°	C, T.S.F.	
1	-0.11	Q	0	0.07	CH
2	-7.31			0.13	CH
3	-15.71			0.19	CH
4	-45.21			0.28	CH
5	-51.81		0	0.33	CH
6	-15.11	R	13	0.08	CH
7	-11.81	S	20	0.08	CH
8	-23.31		32	0.00	SM
9	-67.11		33	0.03	SM

GENERAL NOTES

- ○ UC - UNCONFINED COMPRESSION SHEAR
- ● Ⓠ - UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR
- ▲Ⓡ - CONSOLIDATED UNDRAINED TRIAXIAL SHEAR
- ⊡Ⓢ - CONSOLIDATED DRAINED DIRECT SHEAR
- Ⓒ - CONSOLIDATION TEST
- W - NATURAL WATER CONTENT
- L.L - LIQUID LIMIT
- P.L - PLASTIC LIMIT
- c - UNIT COHESION
- φ - ANGLE OF FRICTION
- γ - UNIT WEIGHT OF SOIL-WATER SYSTEM
- σ̄ - NORMAL STRESS
- O.B. - OVERBURDEN
- P_c - PRECONSOLIDATION PRESSURE
- e - VOID RATIO
- Cc - COMPRESSION INDEX
- SL - SLICKENSIDES



PLASTICITY CHART



SHEAR STRENGTH DATA

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

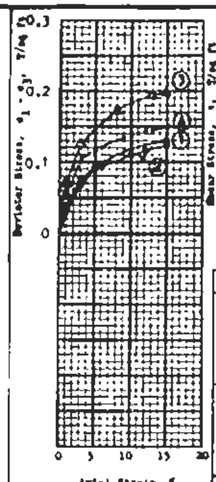
DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

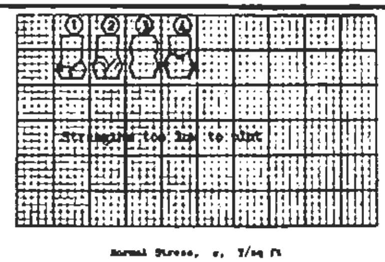
UNDISTURBED BORING 5-CU
TEST DATA

SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC. ENGINEERS AND ARCHITECTS NEW ORLEANS, LA.	U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS, U. S. ARMY NEW ORLEANS, LA.
DATE SEPTEMBER 1966	FILE NO. H-2-24306

Triaxial Compression Test Report — Boring 5-CU, Sample 3-C2





Test No.			①	②	③	④
Initial	Water content	w_o	55.0 %	52.9 %	56.7 %	62.4 %
	Void ratio	e_o	1.48	1.41	1.53	1.66
	Saturation	S_o	98.8 %	99.8 %	98.6 %	100 %
	Dry density, lb/cu ft	γ_d	67.0	68.8	65.6	62.3
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	1.5	3.0	3.0
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.13	0.12	0.20	0.15
Time to failure, min		t_f	62	23	24	23
Rate of strain, percent/min			0.24	0.65	0.65	0.65
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.38	1.40	1.39	1.38
Initial height, in.		H_o	3.00	3.00	3.00	3.00

Shear Strength Parameters
φ = 0 °
tan φ = 0
c = 0.07 T/sq ft

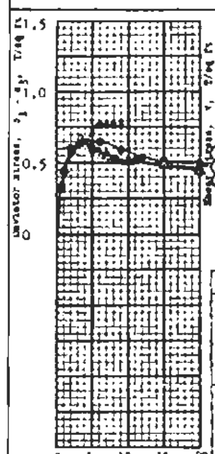
Method of saturation ______

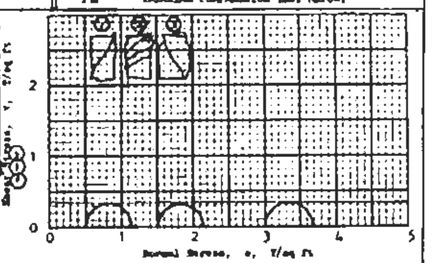
[ ] Controlled stress
[x] Controlled strain

Type of test Q — Type of specimen UNDISTURBED
Classification SILTY CLAY (CH), gray, w/horizontal and diagonal veins of *
LL 71 — PL 23 — PI 48 — G_s 2.66
Remarks * silt, contains decayed vegetation.

Project LAKE PONTCHARTRAIN AND VICINITY
HURRICANE PROTECTION
Area CHALMETTE LEVEE EXTENSION
Boring No. 5-CU — Sample No. 3-C2
Depth 10.3 — Date 3 June, 1967
FH TRIAXIAL COMPRESSION TEST REPORT

Triaxial Compression Test Report — Boring 5-CU, Sample 18-C





Test No.			1	2	3	
Initial	Water content	w_o	58.4 %	59.2 %	59.1 %	%
	Void ratio	e_o	1.51	1.53	1.56	
	Saturation	S_o	100+ %	100+ %	100+ %	%
	Dry density, lb/cu ft	γ_d	65.7	65.2	65.0	
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	1.5	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.64	0.65	0.67	
Time to failure, min		t_f	18	24	18	
Rate of strain, percent/min			0.19	0.18	0.18	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.39	1.39	1.39	
Initial height, in.		H_o	3.00	3.00	3.00	

Shear Strength Parameters
φ = 0 °
tan φ = 0
c = 0.33 T/sq ft

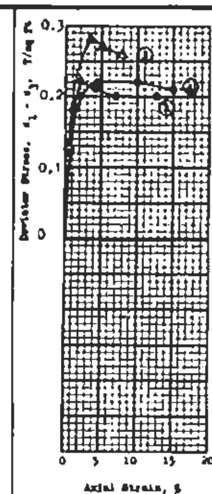
Method of saturation ______

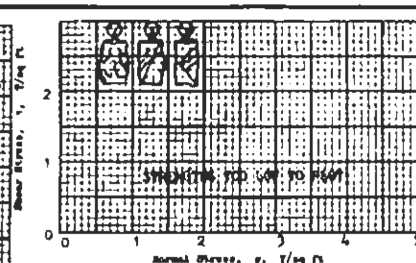
[ ] Controlled stress
[x] Controlled strain

Type of test Q — Type of specimen UNDISTURBED
Classification CLAY (CH), gray, homogeneous
LL 82 — PL 28 — PI 54 — G_s 2.64
Remarks ______

Project LAKE PONTCHARTRAIN AND VICINITY
HURRICANE PROTECTION
Area CHALMETTE EXTENSION
Boring No. 5-CU — Sample No. 18-C
Depth 62.0 — Date 17 JUNE 1967
TRIAXIAL COMPRESSION TEST REPORT

Triaxial Compression Test Report — Boring 5-CU, Sample 5-A





Test No.			1	2	3	
Initial	Water content	w_o	82.1 %	82.1 %	80.2 %	%
	Void ratio	e_o	2.25	2.26	2.17	
	Saturation	S_o	98.3 %	98.1 %	99.6 %	%
	Dry density, lb/cu ft	γ_d	51.8	57.7	53.1	
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	1.5	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.22	0.22	0.28	
Time to failure, min		t_f	18	13	19	
Rate of strain, percent/min			0.26	0.15	0.17	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.39	1.39	1.39	
Initial height, in.		H_o	3.00	3.00	3.00	

Shear Strength Parameters
φ = 0 °
tan φ = 0
c = 0.13 T/sq ft

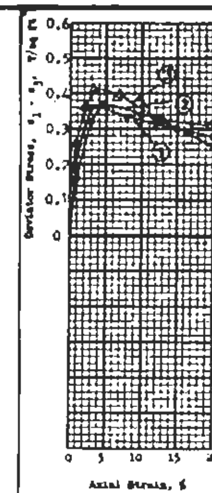
Method of saturation ______

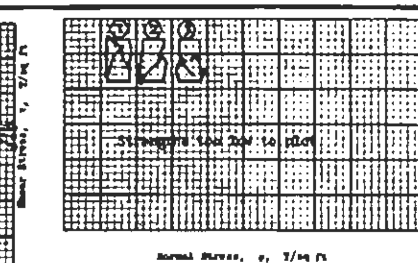
[ ] Controlled stress
[x] Controlled strain

Type of test Q — Type of specimen UNDISTURBED
Classification CLAY (CH), w/decayed vegetation and roots, gray
LL 119 — PL 31 — PI 88 — G_s 2.70
Remarks ______

Project LAKE PONTCHARTRAIN AND VICINITY
HURRICANE PROTECTION
Area CHALMETTE LEVEE EXTENSION
Boring No. 5-CU — Sample No. 5-A
Depth 17.5 — Date 3 JUNE 1967
FH TRIAXIAL COMPRESSION TEST REPORT

Triaxial Compression Test Report — Boring 5-CU, Sample 7-B





Test No.			①	②	③	
Initial	Water content	w_o	77.8 %	74.0 %	71.3 %	%
	Void ratio	e_o	2.06	2.01	1.94	
	Saturation	S_o	100 %	99.0 %	98.9 %	%
	Dry density, lb/cu ft	γ_d	54.8	55.8	57.2	
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	1.5	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.37	0.36	0.41	
Time to failure, min		t_f	9	17	15	
Rate of strain, percent/min			0.50	0.20	0.22	
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 = 0 °
tan φ = 0
c = 0.19 T/sq ft

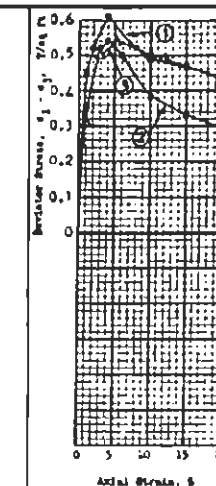
Method of saturation ______

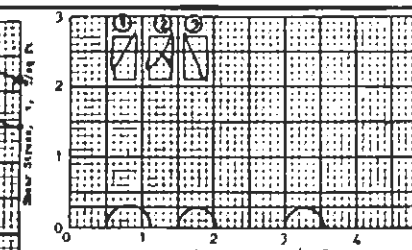
[ ] Controlled stress
[x] Controlled strain

Type of test Q — Type of specimen UNDISTURBED
Classification CLAY (CH), gray, contains roots and decayed vegetation
LL 92 — PL 34 — PI 58 — G_s 2.69
Remarks ______

Project LAKE PONTCHARTRAIN AND VICINITY
HURRICANE PROTECTION
Area CHALMETTE LEVEE EXTENSION
Boring No. 5-CU — Sample No. 7-B
Depth 25.9 — Date 10 June, 1967
FH TRIAXIAL COMPRESSION TEST REPORT

Triaxial Compression Test Report — Boring 5-CU, Sample 16-D





Test No.			①	②	③	
Initial	Water content	w_o	63.4 %	63.1 %	63.4 %	%
	Void ratio	e_o	1.72	1.72	1.72	
	Saturation	S_o	99.9 %	99.4 %	99.9 %	%
	Dry density, lb/cu ft	γ_d	62.3	62.2	62.1	
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	1.5	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.61	0.54	0.54	
Time to failure, min		t_f	13	19	24	
Rate of strain, percent/min			0.31	0.21	0.22	
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	

Shear Strength Parameters
φ = 0 °
tan φ = 0
c = 0.28 T/sq ft

Method of saturation ______

[ ] Controlled stress
[x] Controlled strain

Type of test Q — Type of specimen UNDISTURBED
Classification CLAY (CH), gray, homogeneous
LL 90 — PL 28 — PI 62 — G_s 2.71
Remarks ______

Project LAKE PONTCHARTRAIN AND VICINITY
HURRICANE PROTECTION
Area CHALMETTE LEVEE EXTENSION
Boring No. 5-CU — Sample No. 16-D
Depth 55.4 — Date 17 June, 1967
FH TRIAXIAL COMPRESSION TEST REPORT

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN
DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

UNDISTURBED BORING 5-CU-"Q" TEST DATA

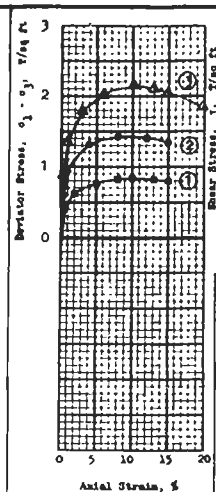
SCALES AS SHOWN

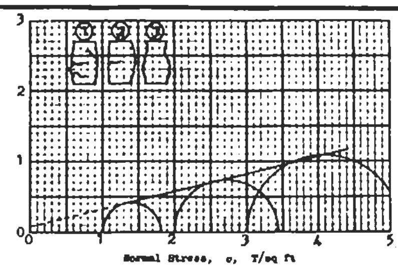
WALDEMAR S. NELSON AND COMPANY, INC.
ENGINEERS AND ARCHITECTS
NEW ORLEANS, LA.

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

DATE: SEPTEMBER 1968 — FILE NO. H-2-24306

Triaxial Compression Test Report — Boring 5-CU, Sample 7-A





Shear Strength Parameters

φ = 13°

tan φ = 0.231

c = 0.08 T/sq ft

Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Test No.			①	②	③	
Initial	Water content	w_o	84.9 %	83.1 %	83.0 %	%
	Void ratio	e_o	2.28	2.22	2.21	
	Saturation	S_o	99.0 %	99.6 %	100+ %	%
	Dry density, lb/cu ft	γ_d	50.7	51.6	51.7	
Before Shear	Water content	w_c	60.9 %	58.6 %	52.8 %	%
	Void ratio	e_c	1.81	1.52	1.32	
	Saturation	S_c	89.5 %	100+ %	100+ %	%
	Final back pressure, PSI	u_o	40	40	40	
	Dry Density lbs/cu. ft.	γ_d	59.1	66.0	71.6	
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	1.0	2.0	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.83	1.43	2.15	
Time to failure, min		t_f	91	69	78	
Rate of strain, percent/min			0.11	0.12	0.13	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.39	1.39	1.39	
Initial height, in.		H_o	3.00	3.00	3.00	

Type of test: R | Type of specimen: UNDISTURBED

Classification: CLAY (CH), gray, contains a few pieces of rotten wood

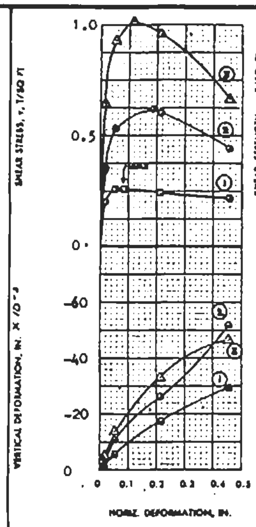
LL 114 | PL 28 | PI 86 | G_s 2.66

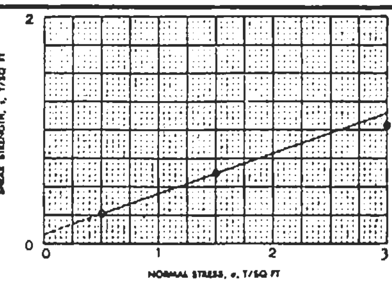
Remarks: * Pore pressure response indicated 100% saturation

Project: LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION
Area: CHALMETTE LEVEE EXTENSION
Boring No. 5-CU | Sample No. 7-A
Depth 25.3 | Date 9 June, 1967

BH — TRIAXIAL COMPRESSION TEST REPORT

Direct Shear Test Report — Boring 5-CU, Sample 6-B





SHEAR STRENGTH PARAMETERS

φ' = 20°

TAN φ' = 0.364

c' = 0.08 T/SQ FT

☐ CONTROLLED STRESS
☒ CONTROLLED STRAIN

TEST NO.			1	2	3	
INITIAL	WATER CONTENT	w_o	54.8 %	52.1 %	51.9 %	%
	VOID RATIO	e_o	1.50	1.46	1.48	
	SATURATION	S_o	100+ %	97.8 %	96.1 %	%
	DRY DENSITY, LB/CU FT	γ_d	68.3	69.6	69.1	
VOID RATIO AFTER CONSOLIDATION		e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN		t_{50}	< 1	< 1	2	
FINAL	WATER CONTENT	w_f	50.3 %	43.1 %	39.3 %	%
	VOID RATIO	e_f				
	SATURATION	S_f	%	%	%	%
NORMAL STRESS, T/SQ FT		σ	0.5	1.5	3.0	
MAXIMUM SHEAR STRESS, T/SQ FT		τ_{max}	0.26	0.62	1.04	
ACTUAL TIME TO FAILURE, MIN		t_f	540	1140	720	
RATE OF STRAIN, IN./MIN			.00016	.00016	.00016	
ULTIMATE SHEAR STRESS, T/SQ FT		τ_{ult}				

TYPE OF SPECIMEN: UNDISTURBED | 3.01 IN. SQUARE | 0.465 IN. THICK

CLASSIFICATION: CLAY (CH), gray, contains organic matter

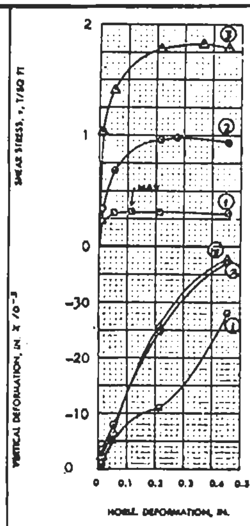
LL 84 | PL 28 | PI 56 | G_s 2.74

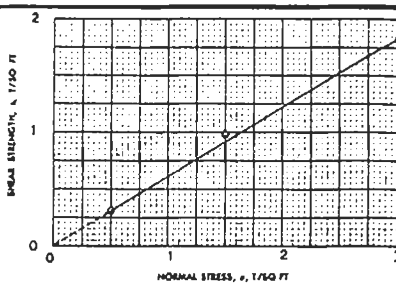
REMARKS ______

PROJECT: LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION PROJECT
AREA: CHALMETTE LEVEE EXTENSION
BORING NO. 5-CU | SAMPLE NO. 6-B
DEPTH 22.0 | DATE 7 JUNE 1967

GDA — DIRECT SHEAR TEST REPORT

Direct Shear Test Report — Boring 5-CU, Sample 9-A2





SHEAR STRENGTH PARAMETERS

φ' = 32°

TAN φ' = 0.625

c' = 0 T/SQ FT

☐ CONTROLLED STRESS
☒ CONTROLLED STRAIN

TEST NO.			1	2	3	
INITIAL	WATER CONTENT	w_o	35.7 %	35.3 %	40.4 %	%
	VOID RATIO	e_o	0.980	0.970	1.04	
	SATURATION	S_o	97.3 %	97.2 %	100+ %	%
	DRY DENSITY, LB/CU FT	γ_d	84.2	84.6	81.6	
VOID RATIO AFTER CONSOLIDATION		e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN		t_{50}	1	1	1	
FINAL	WATER CONTENT	w_f	34.1 %	34.5 %	33.4 %	%
	VOID RATIO	e_f				
	SATURATION	S_f	%	%	%	%
NORMAL STRESS, T/SQ FT		σ	0.5	1.5	3.0	
MAXIMUM SHEAR STRESS, T/SQ FT		τ_{max}	0.31	0.98	1.83	
ACTUAL TIME TO FAILURE, MIN		t_f	750	1680	2220	
RATE OF STRAIN, IN./MIN			.00016	.00016	.00016	
ULTIMATE SHEAR STRESS, T/SQ FT		τ_{ult}				

TYPE OF SPECIMEN: UNDISTURBED | 3.01 IN. SQUARE | 0.465 IN. THICK

CLASSIFICATION: SILTY SAND (SM), gray, homogeneous

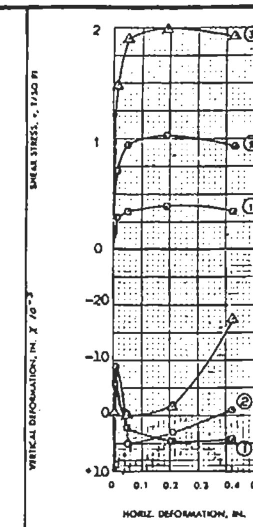
LL — | PL — | PI — | G_s 2.67

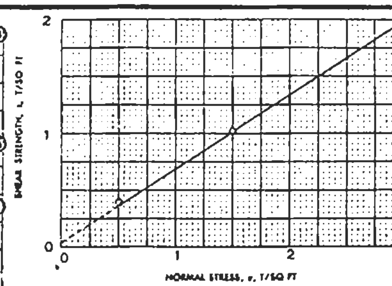
REMARKS ______

PROJECT: LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION PROJECT
AREA: CHALMETTE LEVEE EXTENSION
BORING NO. 5-CU | SAMPLE NO. 9-A2
DEPTH 33.5 | DATE 7 JUNE 1967

GDA — DIRECT SHEAR TEST REPORT

Direct Shear Test Report — Boring 5-CU, Sample 22-B





SHEAR STRENGTH PARAMETERS

φ = 33°

TAN φ' = 0.649

c' = 0.03 T/SQ FT

☐ CONTROLLED STRESS
☒ CONTROLLED STRAIN

TEST NO.			1	2	3	
INITIAL	WATER CONTENT	w_o	26.1 %	25.7 %	26.5 %	%
	VOID RATIO	e_o	0.685	0.690	0.729	
	SATURATION	S_o	100+ %	98.3 %	96.0 %	%
	DRY DENSITY, LB/CU FT	γ_d	97.8	97.5	95.3	
VOID RATIO AFTER CONSOLIDATION		e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN		t_{50}	< 1	< 1	< 1	
FINAL	WATER CONTENT	w_f	26.2 %	25.5 %	26.1 %	%
	VOID RATIO	e_f				
	SATURATION	S_f	%	%	%	%
NORMAL STRESS, T/SQ FT		σ	0.5	1.5	3.0	
MAXIMUM SHEAR STRESS, T/SQ FT		τ_{max}	0.39	1.02	1.99	
ACTUAL TIME TO FAILURE, MIN		t_f	1200	1200	1200	
RATE OF STRAIN, IN./MIN			.00016	.00016	.00016	
ULTIMATE SHEAR STRESS, T/SQ FT		τ_{ult}				

TYPE OF SPECIMEN: UNDISTURBED | 3.01 IN. SQUARE | 0.465 IN. THICK

CLASSIFICATION: SILTY SAND (SM), gray, homogeneous

LL — | PL — | PI — | G_s 2.64

REMARKS ______

PROJECT: LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION
AREA: CHALMETTE LEVEE EXTENSION
BORING NO. 5-CU | SAMPLE NO. 22-B
DEPTH 77.3 | DATE 9 JUNE 1967

GOA — DIRECT SHEAR TEST REPORT

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

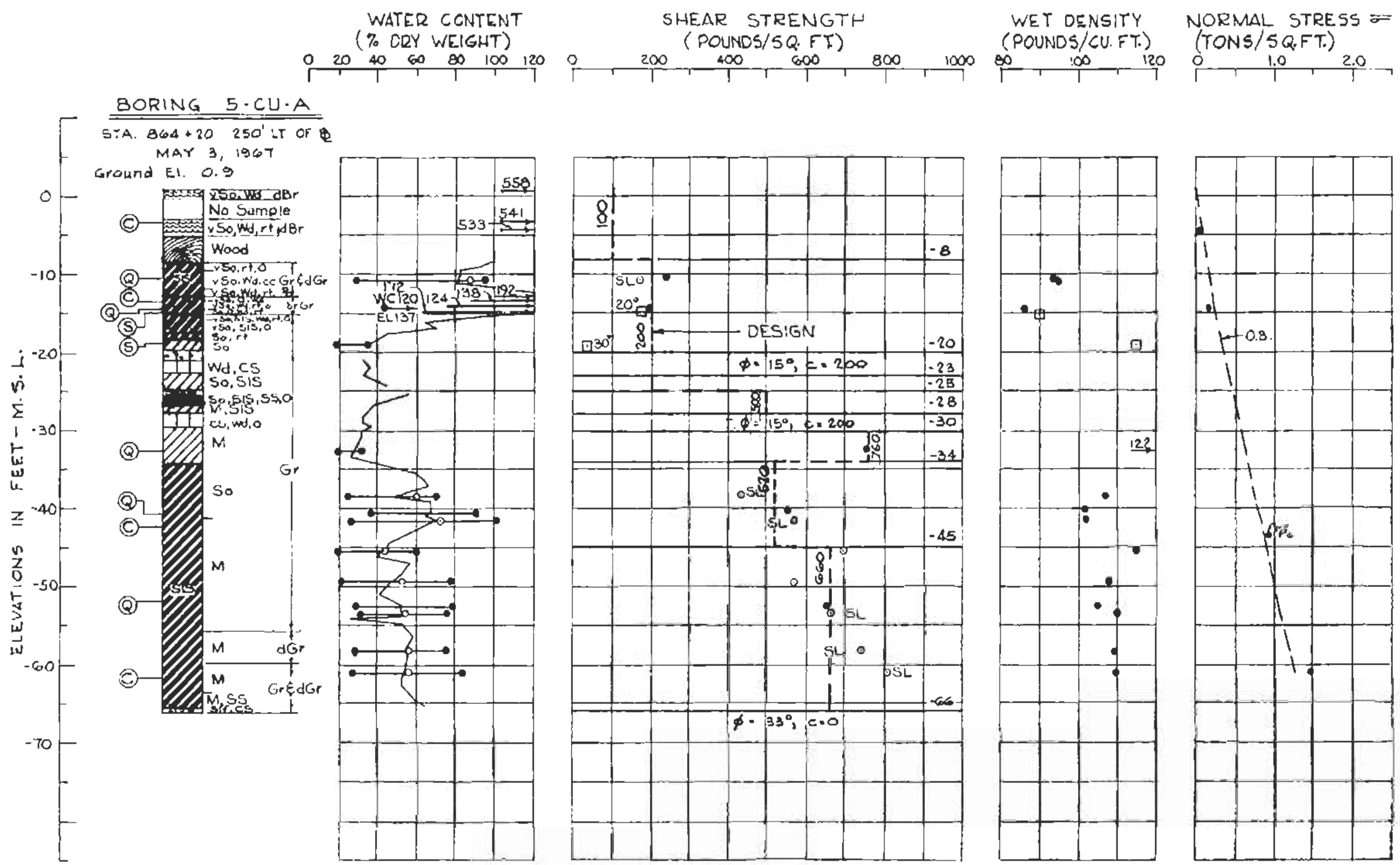
UNDISTURBED BORING 5-CU-"R"&"S" TEST DATA

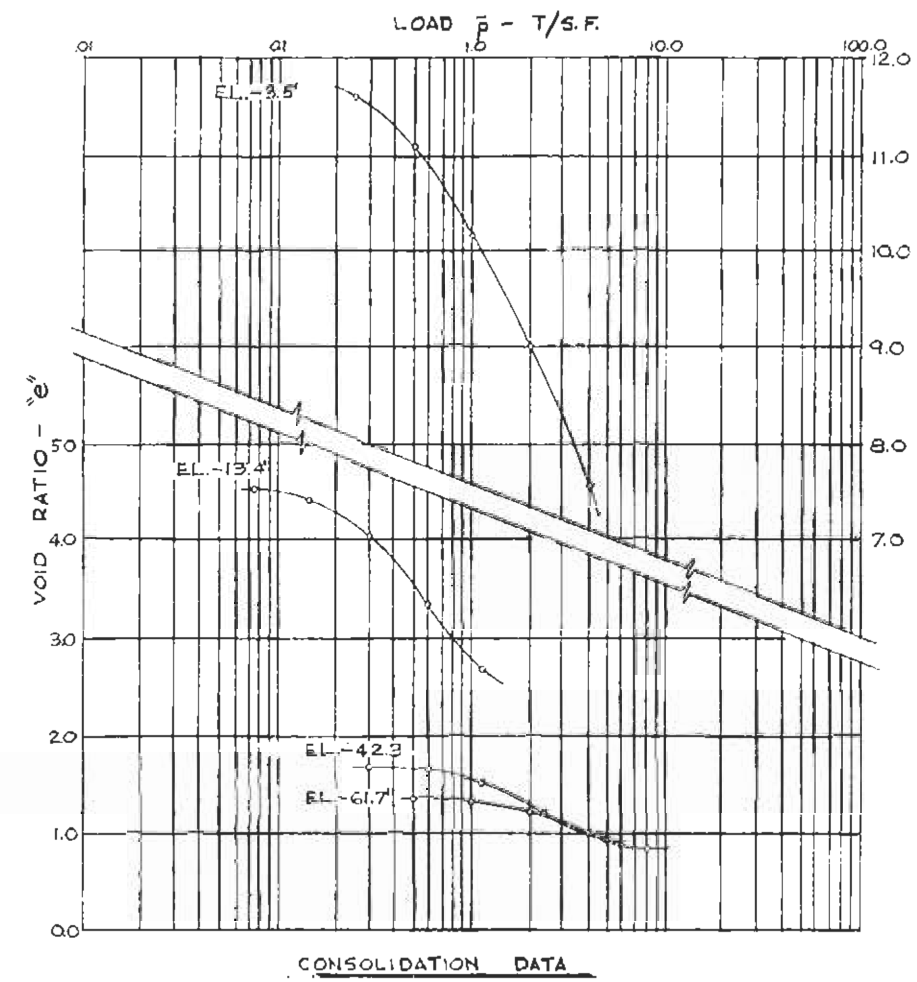
SCALES AS SHOWN

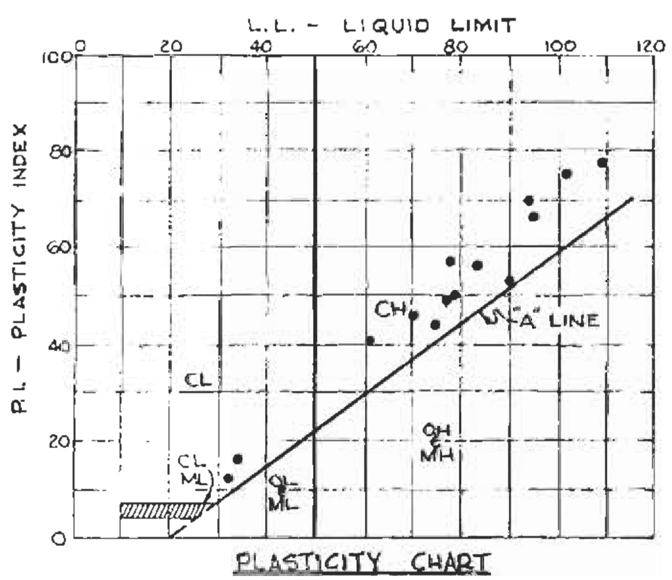
WALDEMAR S. NELSON AND COMPANY, INC.
ENGINEERS AND ARCHITECTS
NEW ORLEANS, LA.

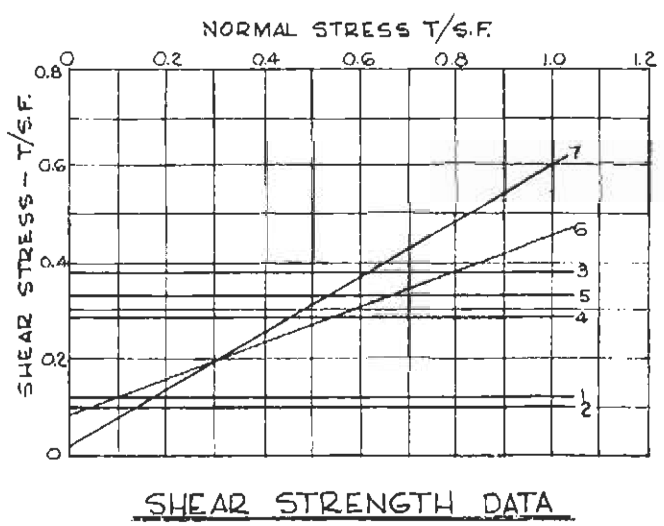
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS, U. S. ARMY
NEW ORLEANS, LA.

DATE: SEPTEMBER 1968 | FILE NO. H-2-24306









ENVELOPE		TYPE	STRENGTH		CLASS
NO.	EL.		ϕ°	(T/S.F.)	
1	-10.5	Q	0	0.12	CH
2	-14.4			0.10	CH
3	-32.6			0.38	CL
4	-40.4			0.28	CH
5	-52.4		0	0.33	CH
6	-15.0	S	20	0.09	CH
7	-19.0		30	0.02	CL

LAKE PONTCHARTRAIN, LA AND VICINITY
CHALMETTE AREA PLAN

DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

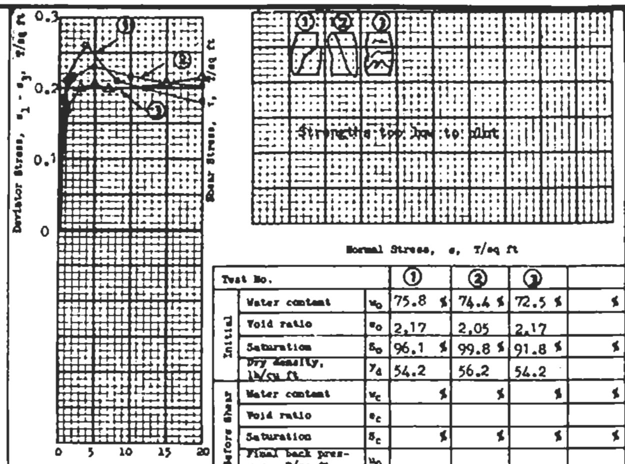
UNDISTURBED BORING 5-CU-A
TEST DATA

SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC.
ENGINEERS AND ARCHITECTS
NEW ORLEANS, LA.

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

DATE SEPTEMBER 1968 FILE NO. H-2-24306

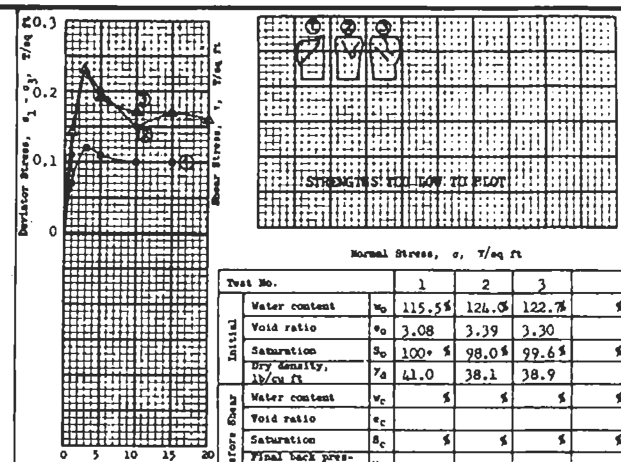


Test No.		①	②	③	
Initial – Water content	w_o	75.8 %	74.4 %	72.5 %	%
Initial – Void ratio	e_o	2.17	2.05	2.17	
Initial – Saturation	S_o	96.1 %	99.8 %	91.8 %	%
Initial – Dry density, lb/cu ft	γ_d	54.2	56.2	54.2	
Before Shear – Water content	w_c	%	%	%	%
Before Shear – Void ratio	e_c				
Before Shear – Saturation	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	0.5	1.5	3.0	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.26	0.23	0.20	
Time to failure, min	t_f	16	20	22	
Rate of strain, percent/min		0.23	0.25	0.22	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.39	1.38	1.39	
Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters
φ = 0 °
tan φ = 0
c = 0.12 T/sq ft
Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED
Classification CLAY (CH), Grey, w/ a few roots and lumps of clay (CL)
LL 94 | PL 29 | PI 65 | G_s 2.75
Remarks ______
Project LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION
Area CHALMETTE LEVEE EXTENSION
Boring No. 5-CU-A | Sample No. 3-C
Depth 11.4 | Date 17 June, 1967
RAA TRIAXIAL COMPRESSION TEST REPORT

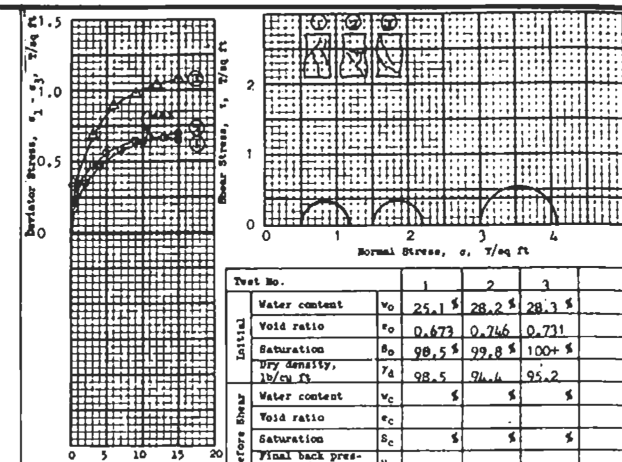


Test No.		1	2	3	
Initial – Water content	w_o	115.5 %	124.0 %	122.7 %	%
Initial – Void ratio	e_o	3.08	3.39	3.30	
Initial – Saturation	S_o	100+ %	98.0 %	99.6 %	%
Initial – Dry density, lb/cu ft	γ_d	41.0	38.1	38.9	
Before Shear – Water content	w_c	%	%	%	%
Before Shear – Void ratio	e_c				
Before Shear – 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	0.5	1.5	3.0	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.12	0.23	0.23	
Time to failure, min	t_f	4	20	18	
Rate of strain, percent/min		0.67	0.14	0.15	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.39	1.38	1.39	
Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters
φ = 0 °
tan φ = 0
c = 0.10 T/sq ft
Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED
Classification CLAY (CH), gray, w/ few 1/8" rootlets and two ½" rotten wood *
LL 137 | PL 43 | PI 94 | G_s 2.68
Remarks * pockets
Project LAKE PONTCHARTRAIN & VICINITY HURRICANE PROTECTION
Area CHALMETTE LEVEE EXTENSION
Boring No. 5-CU-A | Sample No. 4-C
Depth 15.3 | Date 17 JUNE 1967
JMS TRIAXIAL COMPRESSION TEST REPORT

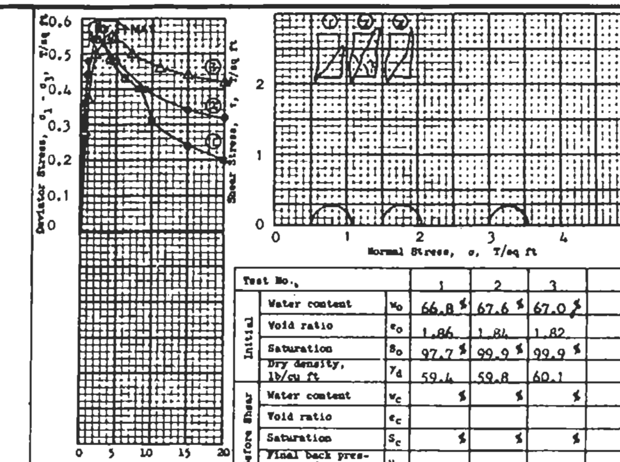


Test No.		1	2	3	
Initial – Water content	w_o	25.1 %	28.2 %	28.3 %	%
Initial – Void ratio	e_o	0.673	0.746	0.731	
Initial – Saturation	S_o	98.5 %	99.8 %	100+ %	%
Initial – Dry density, lb/cu ft	γ_d	98.5	94.4	95.2	
Before Shear – Water content	w_c	%	%	%	%
Before Shear – Void ratio	e_c				
Before Shear – 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	0.5	1.5	3.0	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.67	0.69	1.08	
Time to failure, min	t_f	12	17	16	
Rate of strain, percent/min		0.88	0.88	0.94	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.39	1.39	1.39	
Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters
φ = 0 °
tan φ = 0
c = 0.38 T/sq ft
Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED
Classification SANDY CLAY (CL), gray, w/ a very small amount of silt
LL 32 | PL 20 | PI 12 | G_s 2.64
Remarks ______
Project LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION
Area CHALMETTE LEVEE EXTENSION
Boring No. 5-CU-A | Sample No. 9-A
Depth 33.5 | Date 23 JUNE 1967
RAA TRIAXIAL COMPRESSION TEST REPORT

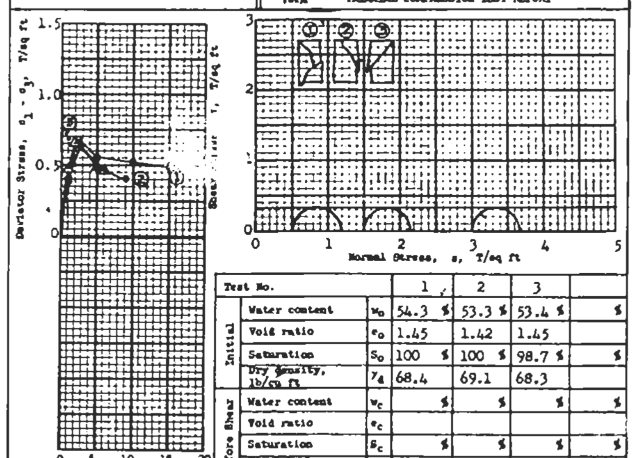


Test No.		1	2	3	
Initial – Water content	w_o	66.8 %	67.6 %	67.0 %	%
Initial – Void ratio	e_o	1.86	1.84	1.82	
Initial – Saturation	S_o	97.7 %	99.9 %	99.9 %	%
Initial – Dry density, lb/cu ft	γ_d	59.4	59.8	60.1	
Before Shear – Water content	w_c	%	%	%	%
Before Shear – Void ratio	e_c				
Before Shear – Saturation	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	0.5	1.5	3.0	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.57	0.54	0.54	
Time to failure, min	t_f	14	10	20	
Rate of strain, percent/min		0.17	0.16	0.18	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.40	1.39	1.40	
Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters
φ = 0 °
tan φ = 0
c = 0.28 T/sq ft
Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED
Classification CLAY (CH), gray, homogeneous
LL 90 | PL 37 | PI 53 | G_s 2.72
Remarks ______
Project LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION
Area CHALMETTE LEVEE EXTENSION
Boring No. 5-CU-A | Sample No. 12-A
Depth 41.5 | Date 23 JUNE 1967
RAA TRIAXIAL COMPRESSION TEST REPORT



Test No.		1	2	3	
Initial – Water content	w_o	54.3 %	53.3 %	53.4 %	%
Initial – Void ratio	e_o	1.45	1.42	1.45	
Initial – Saturation	S_o	100 %	100 %	98.7 %	%
Initial – Dry density, lb/cu ft	γ_d	68.4	69.1	68.3	
Before Shear – Water content	w_c	%	%	%	%
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	0.5	1.5	3.0	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.68	0.63	0.66	
Time to failure, min	t_f	7	22	20	
Rate of strain, percent/min		0.36	0.12	0.10	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.38	1.38	1.37	
Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters
φ = 0 °
tan φ = 0
c = 0.33 T/sq ft
Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED
Classification CLAY (CH), gray, homogeneous
LL 79 | PL 29 | PI 50 | G_s 2.68
Remarks ______
Project LAKE PONTCHARTRAIN & VICINITY HURRICANE PROTECTION
Area CHALMETTE LEVEE EXTENSION
Boring No. 5-CU-A | Sample No. 15-A
Depth 53.3 | Date 24 JUNE 1967
JMS TRIAXIAL COMPRESSION TEST REPORT

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN
DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

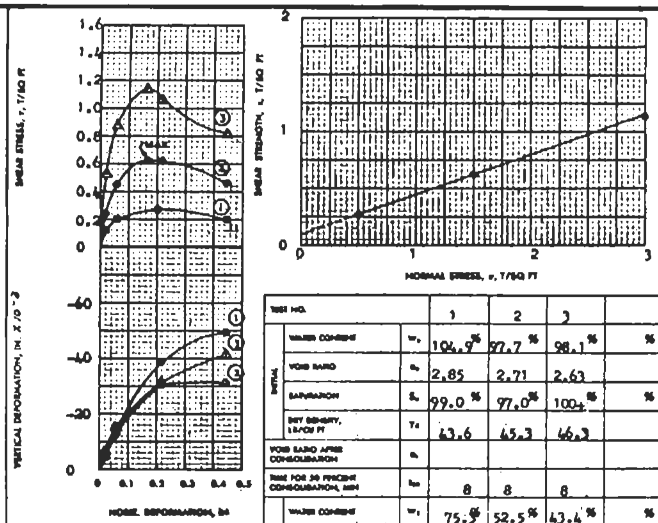
UNDISTURBED BORING 5-CU-A-"Q" TEST DATA

SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC.
ENGINEERS AND ARCHITECTS
NEW ORLEANS, LA.

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

DATE: SEPTEMBER 1968 | FILE NO. H-2-24306



SHEAR STRENGTH PARAMETERS

φ' = 20°

TAN φ' = 0.364

c' = 0.09 T/SQ FT

☐ CONTROLLED STRESS

☒ CONTROLLED STRAIN

TEST NO.			1	2	3	
INITIAL	WATER CONTENT	w_o	104.9 %	97.7 %	98.1 %	%
	VOID RATIO	e_o	2.85	2.71	2.63	
	SATURATION	S_o	99.0 %	97.0 %	100+ %	%
	DRY DENSITY, LB/CU FT	γ_d	43.6	45.3	46.3	
VOID RATIO AFTER CONSOLIDATION		e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN		t_{50}	8	8	8	
FINAL	WATER CONTENT	w_f	75.5 %	52.5 %	43.4 %	%
	VOID RATIO	e_f				
	SATURATION	S_f	%	%	%	%
NORMAL STRESS, T/SQ FT		σ	0.5	1.5	3.0	
MAXIMUM SHEAR STRESS, T/SQ FT		τ_{max}	0.27	0.62	1.14	
ACTUAL TIME TO FAILURE, MIN		t_f	1230	1020	990	
RATE OF STRAIN, IN./MIN			.00016	.00016	.00016	
ULTIMATE SHEAR STRESS, T/SQ FT		τ_{ult}				

TYPE OF SPECIMEN UNDISTURBED — 3.01 IN. SQUARE — 0.465 (#1) 0.626 (#2&3) IN. THICK

CLASSIFICATION CLAY (CH), gray, w/organic matter

LL 109 — PL 32 — PI 77 — G_s 2.69

REMARKS

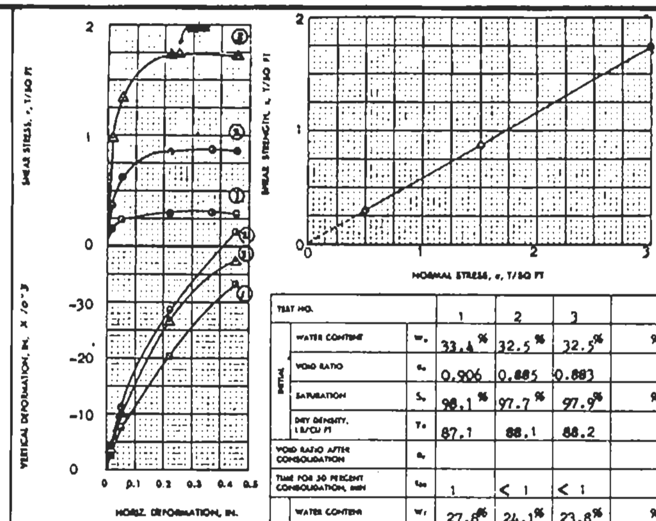
PROJECT LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION

AREA CHALMETTE LEVEE EXTENSION

BORING NO. 5-CU-A — SAMPLE NO. 4-D

DEPTH 15.9 — DATE 9 JUNE 1967

GDA — DIRECT SHEAR TEST REPORT



SHEAR STRENGTH PARAMETERS

φ' = 30°

TAN φ' = 0.577

c' = 0.02 T/SQ FT

☐ CONTROLLED STRESS

☒ CONTROLLED STRAIN

TEST NO.			1	2	3	
INITIAL	WATER CONTENT	w_o	33.4 %	32.5 %	32.5 %	%
	VOID RATIO	e_o	0.906	0.885	0.883	
	SATURATION	S_o	98.1 %	97.7 %	97.9 %	%
	DRY DENSITY, LB/CU FT	γ_d	87.1	88.1	88.2	
VOID RATIO AFTER CONSOLIDATION		e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN		t_{50}	1	< 1	< 1	
FINAL	WATER CONTENT	w_f	27.8 %	24.1 %	23.8 %	%
	VOID RATIO	e_f				
	SATURATION	S_f	%	%	%	%
NORMAL STRESS, T/SQ FT		σ	0.5	1.5	3.0	
MAXIMUM SHEAR STRESS, T/SQ FT		τ_{max}	0.30	0.87	1.74	
ACTUAL TIME TO FAILURE, MIN		t_f	2340	2340	1620	
RATE OF STRAIN, IN./MIN			.00015	.00015	.00015	
ULTIMATE SHEAR STRESS, T/SQ FT		τ_{ult}				

TYPE OF SPECIMEN UNDISTURBED — 3.01 IN. SQUARE — 0.465 IN. THICK

CLASSIFICATION SILTY CLAY (CL), gray, homogeneous

LL 34 — PL 18 — PI 16 — G_s 2.66

REMARKS

PROJECT LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION

AREA CHALMETTE LEVEE EXTENSION

BORING NO. 5-CU-A — SAMPLE NO. 5-D

DEPTH 19.9 — DATE 11 JUNE 1967

GDA — DIRECT SHEAR TEST REPORT

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

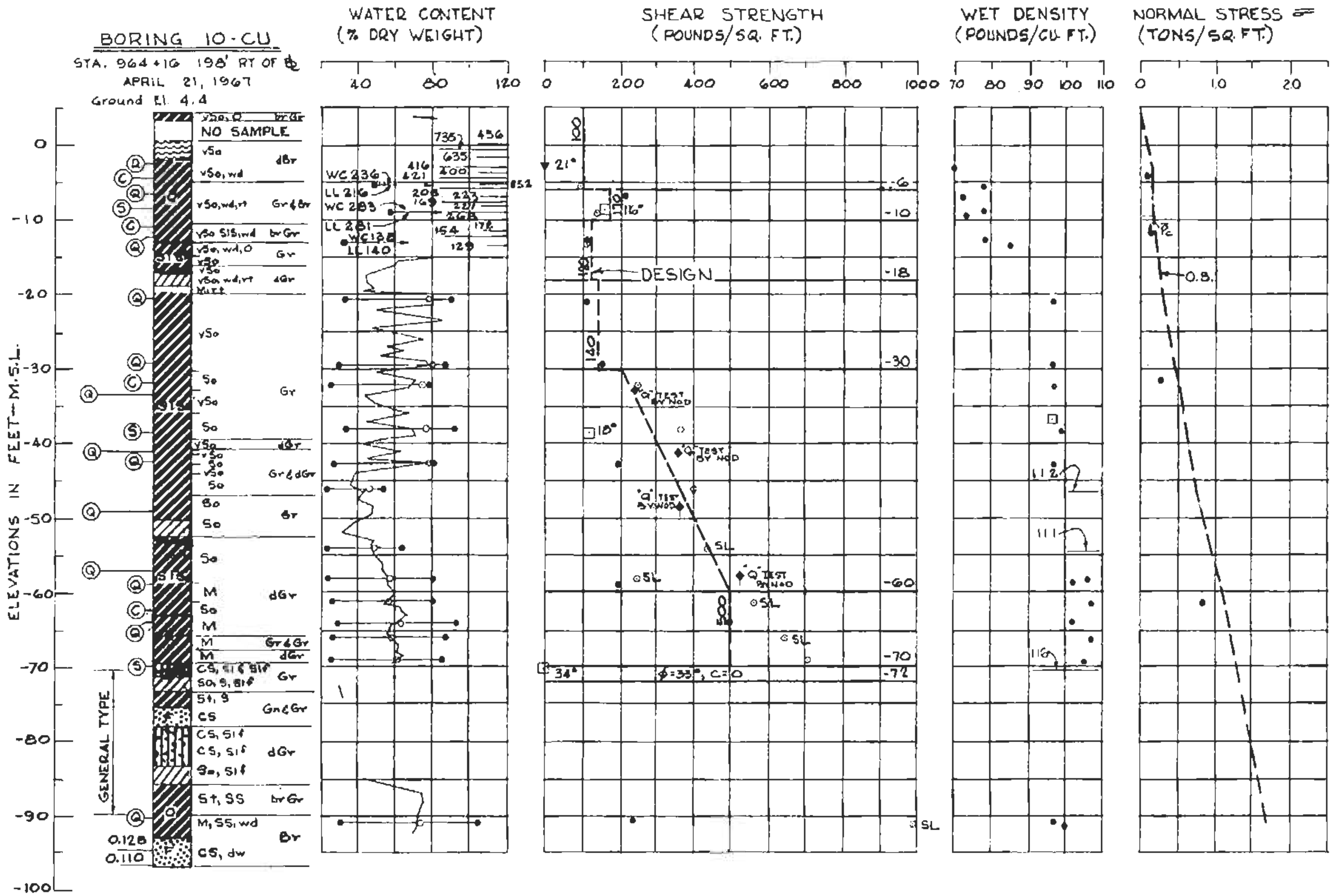
UNDISTURBED BORING 5-CU-A-"S" TEST DATA

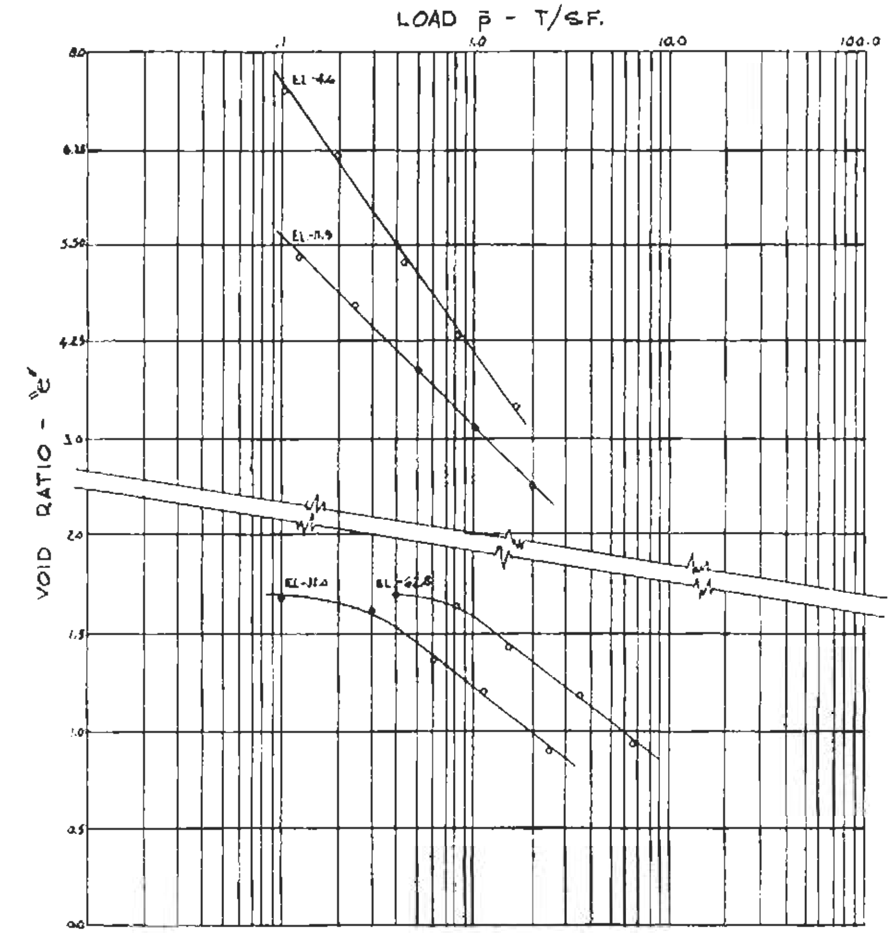
SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC. ENGINEERS AND ARCHITECTS NEW ORLEANS, LA.

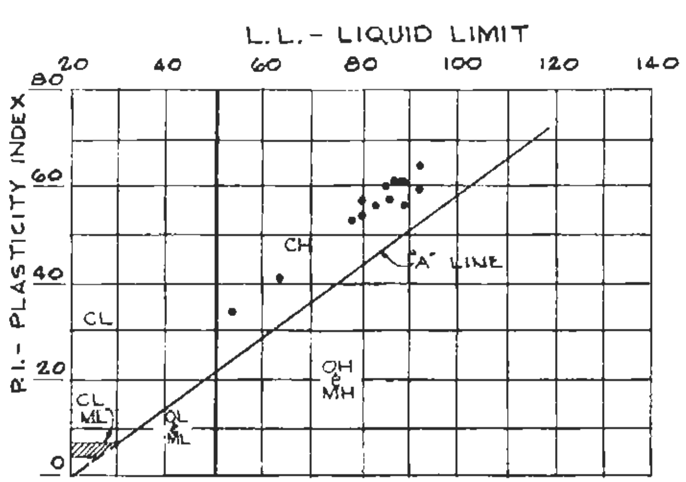
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS, U. S. ARMY NEW ORLEANS, LA.

DATE SEPTEMBER 1968 — FILE NO. H-2-24306

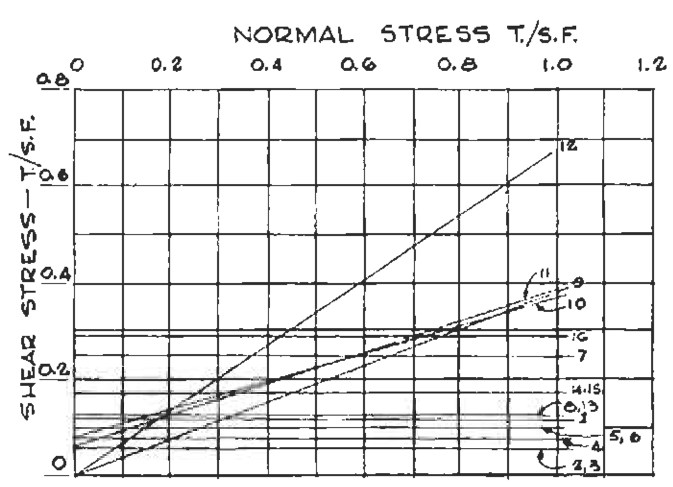




CONSOLIDATION DATA



PLASTICITY CHART



SHEAR STRENGTH DATA

ENVELOPE		TYPE	STRENGTH		CLASS
NO.	EL.		φ°	c (T/SF)	
1	-6.57	Q	0	0.11	CHO
2	-12.47			0.06	CH
3	-20.47			0.06	CH
4	-29.37			0.08	CH
5	-42.57			0.10	CH
6	-58.87			0.10	CH
7	-63.87			0.25	CH
8	-90.57		0	0.12	CH
9	-2.57	R	21	0.00	CHO
10	-8.57	S	16	0.08	CH
11	-38.57		18	0.06	CH
12	-70.07		34	0.00	SM
13	-37.8	Q	0	0.12	CH
14	-41.4		1	0.18	CH
15	-48.9		0	0.18	CH
16	-57.5		2	0.26	CH

LAKE PONTCHARTRAIN, LA AND VICINITY
CHALMETTE AREA PLAN

DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

UNDISTURBED BORING 10-CU
TEST DATA

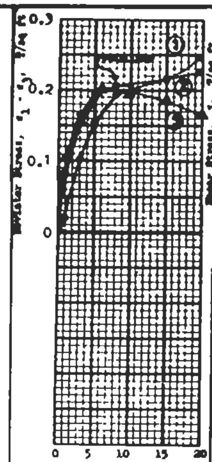
SCALES AS SHOWN

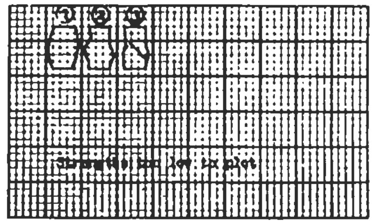
WALDEMAR S. NELSON AND COMPANY, INC.
ENGINEERS AND ARCHITECTS
NEW ORLEANS, LA.

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

DATE SEPTEMBER 1968 FILE NO. H-2-24306

Triaxial Compression Test Report — Boring 10-CU, Sample 3-D





Test No.			①	②	③	
Initial	Water content	w_o	226.3 %	244.8 %	231.6 %	%
	Void ratio	e_o	5.60	5.97	5.75	
	Saturation	S_o	97.0 %	98.2 %	96.7 %	%
	Dry density, lb/cu ft	γ_d	22.7	21.5	22.2	
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	1.5	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.21	0.23 *	0.20	
Time to failure, min		t_f	8	22	6	
Rate of strain, percent/min			1.04	0.90	1.03	
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	

Shear Strength Parameters
φ = 0 °
tan φ = 0
c = 0.11 T/sq ft

Method of saturation ______

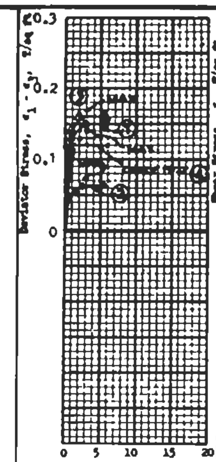
☐ Controlled stress
☒ Controlled strain

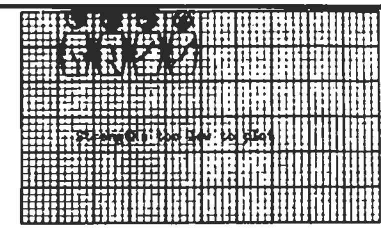
Type of test: Q — Type of specimen: UNDISTURBED
Classification: CLAY (OH), brown, w/ decayed wood and roots
LL 263 — PL 77 — PI 186 — G_s 2.40

Remarks: *Deviator stress at 15% AXIAL STRAIN

Project: LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION
Area: CHALMETTE LEVEE EXTENSION
Boring No. 10-CU — Sample No. 3-D
Depth 11.0 — Date 24 June, 1967
ESS — TRIAXIAL COMPRESSION TEST REPORT

Triaxial Compression Test Report — Boring 10-CU, Sample 5-B





Test No.			①	②	③	④
Initial	Water content	w_o	144.0 %	148.6 %	142.3 %	143.6 %
	Void ratio	e_o	3.85	3.96	3.79	3.87
	Saturation	S_o	96.5 %	96.8 %	96.9 %	95.7 %
	Dry density, lb/cu ft	γ_d	33.2	32.5	33.6	33.1
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	1.5	3.0	1.5
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.15	0.06	0.16	0.12
Time to failure, min		t_f	19	19	18	9
Rate of strain, percent/min			0.16	0.12	0.11	0.13
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.39	1.38	1.40	1.39
Initial height, in.		H_o	3.00	3.00	3.00	3.00

Shear Strength Parameters
φ = 0 °
tan φ = 0
c = 0.06 T/sq ft

Method of saturation ______

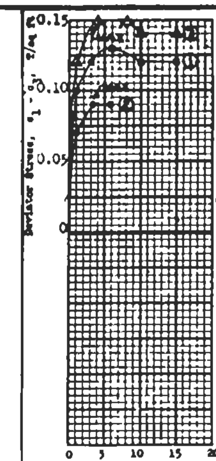
☐ Controlled stress
☒ Controlled strain

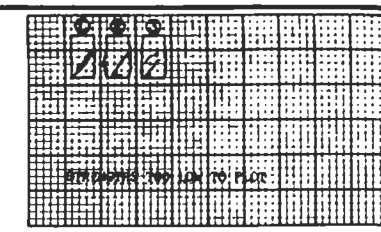
Type of test: Q — Type of specimen: UNDISTURBED
Classification: CLAY (CH), gray, w/decayed organic matter
LL 160 — PL 35 — PI 124 — G_s 2.58

Remarks:

Project: LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION
Area: CHALMETTE LEVEE EXTENSION
Boring No. 10-CU — Sample No. 5-B
Depth 16.9' — Date 24 June, 1967
RAA — TRIAXIAL COMPRESSION TEST REPORT

Triaxial Compression Test Report — Boring 10-CU, Sample 7-B





Test No.			1	2	3	
Initial	Water content	w_o	90.1 %	89.3 %	92.1 %	%
	Void ratio	e_o	2.46	2.44	2.47	
	Saturation	S_o	100 %	99.9 %	100+ %	%
	Dry density, lb/cu ft	γ_d	49.2	49.5	49.1	
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	1.5	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.13	0.09	0.15	
Time to failure, min		t_f	19	37	12	
Rate of strain, percent/min			0.32	0.09	0.33	
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	

Shear Strength Parameters
φ = 0 °
tan φ = 0
c = 0.06 T/sq ft

Method of saturation ______

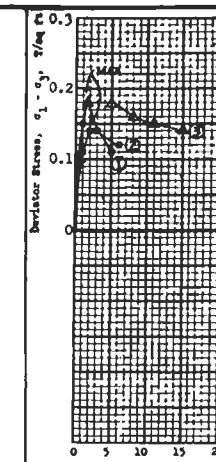
☐ Controlled stress
☒ Controlled strain

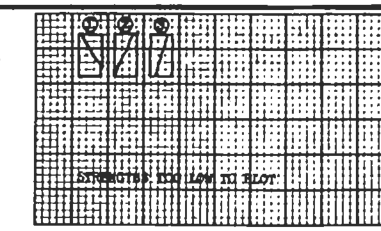
Type of test: Q — Type of specimen: UNDISTURBED
Classification: CLAY (CH), gray, homogeneous
LL 89 — PL 33 — PI 56 — G_s 2.73

Remarks:

Project: LAKE PONTCHARTRAIN & VICINITY HURRICANE PROTECTION
Area: CHALMETTE LEVEE EXTENSION
Boring No. 10-CU — Sample No. 7-B
Depth 24.9 — Date 5 JULY 1967
RAA — TRIAXIAL COMPRESSION TEST REPORT

Triaxial Compression Test Report — Boring 10-CU, Sample 9-C





Test No.			1	2	3	
Initial	Water content	w_o	79.5 %	79.1 %	78.2 %	%
	Void ratio	e_o	2.22	2.14	2.16	
	Saturation	S_o	98.5 %	100+ %	99.6 %	%
	Dry density, lb/cu ft	γ_d	53.4	54.6	54.3	
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	1.5	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.14	0.18	0.18	
Time to failure, min		t_f	22	23	14	
Rate of strain, percent/min			0.09	0.07	0.11	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.37	1.38	1.38	
Initial height, in.		H_o	3.00	3.00	3.00	

Shear Strength Parameters
φ = 0 °
tan φ = 0
c = 0.08 T/sq ft

Method of saturation ______

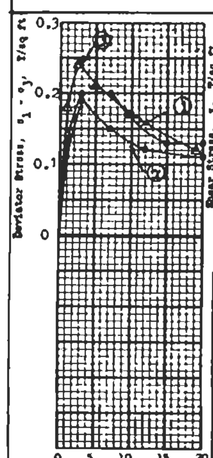
☐ Controlled stress
☒ Controlled strain

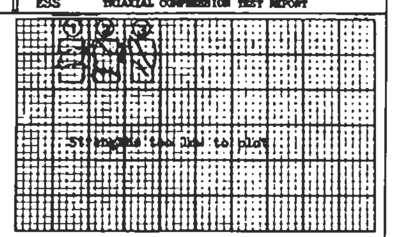
Type of test: Q — Type of specimen: UNDISTURBED
Classification: CLAY (CH), gray, homogeneous
LL 86 — PL 29 — PI 57 — G_s 2.75

Remarks:

Project: LAKE PONTCHARTRAIN & VICINITY HURRICANE PROTECTION
Area: CHALMETTE LEVEE EXTENSION
Boring No. 10-CU — Sample No. 9-C
Depth 33.8 — Date 24 JUNE 1967
JMS — TRIAXIAL COMPRESSION TEST REPORT

Triaxial Compression Test Report — Boring 10-CU, Sample 12-D





Test No.			①	②	③	
Initial	Water content	w_o	78.4 %	74.3 %	75.9 %	%
	Void ratio	e_o	2.18	2.02	2.13	
	Saturation	S_o	99.2 %	100 %	98.3 %	%
	Dry density, lb/cu ft	γ_d	54.1	57.0	55.0	
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	1.5	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.20	0.19	0.24	
Time to failure, min		t_f	7	18	16	
Rate of strain, percent/min			0.42	0.16	0.16	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.38	1.39	1.39	
Initial height, in.		H_o	3.00	3.00	3.00	

Shear Strength Parameters
φ = 0 °
tan φ = 0
c = 0.10 T/sq ft

Method of saturation ______

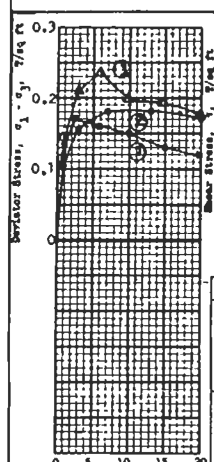
☐ Controlled stress
☒ Controlled strain

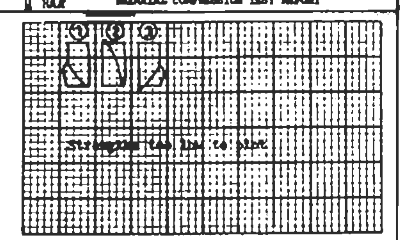
Type of test: Q — Type of specimen: UNDISTURBED
Classification: CLAY (CH), gray, homogeneous
LL 80 — PL 26 — PI 54 — G_s 2.76

Remarks:

Project: LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION
Area: CHALMETTE LEVEE EXTENSION
Boring No. 10-CU — Sample No. 12-D
Depth 47.0 — Date 26 June, 1967
RAA — TRIAXIAL COMPRESSION TEST REPORT

Triaxial Compression Test Report — Boring 10-CU, Sample 16-D





Test No.			①	②	③	
Initial	Water content	w_o	57.1 %	56.7 %	57.0 %	%
	Void ratio	e_o	1.64	1.62	1.64	
	Saturation	S_o	95.7 %	96.3 %	95.6 %	%
	Dry density, lb/cu ft	γ_d	65.1	65.6	65.1	
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	1.5	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.17	0.18	0.24	
Time to failure, min		t_f	14	37	32	
Rate of strain, percent/min			0.18	0.19	0.19	
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 = 0.10 T/sq ft

Method of saturation ______

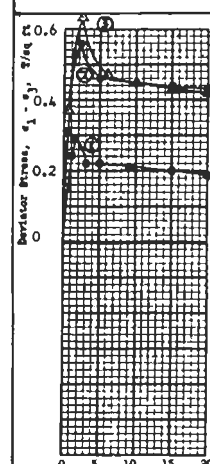
☐ Controlled stress
☒ Controlled strain

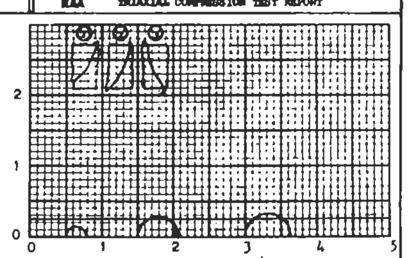
Type of test: Q — Type of specimen: UNDISTURBED
Classification: CLAY (CH), gray, w/ iron oxide discolorations
LL 83 — PL 27 — PI 56 — G_s 2.75

Remarks:

Project: LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION
Area: CHALMETTE LEVEE EXTENSION
Boring No. 10-CU — Sample No. 16-D
Depth 63.3 — Date 27 June, 1967
RAA — TRIAXIAL COMPRESSION TEST REPORT

Triaxial Compression Test Report — Boring 10-CU, Sample 18-A





Test No.			1	2	3	
Initial	Water content	w_o	62.3 %	61.9 %	62.1 %	%
	Void ratio	e_o	1.70	1.72	1.71	
	Saturation	S_o	100 %	98.2 %	99.1 %	%
	Dry density, lb/cu ft	γ_d	63.1	63.0	62.9	
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	1.5	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.29	0.56	0.63	
Time to failure, min		t_f	12	16	14	
Rate of strain, percent/min			0.12	0.13	0.17	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.39	1.39	1.38	
Initial height, in.		H_o	3.00	3.00	3.00	

Shear Strength Parameters
φ = 0 °
tan φ = 0
c = 0.25 T/sq ft

Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test: Q — Type of specimen: UNDISTURBED
Classification: CLAY (CH), dark gray with tan spots
LL 92 — PL 28 — PI 64 — G_s 2.73

Remarks: Insufficient material for check test

Project: LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION
Area: CHALMETTE LEVEE EXTENSION
Boring No. 10-CU — Sample No. 18-A
Depth 68.3 — Date 28 JUNE 1967
RAA — TRIAXIAL COMPRESSION TEST REPORT

LAKE PONTCHARTRAIN, LA AND VICINITY
CHALMETTE AREA PLAN

DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

UNDISTURBED BORING 10-CU-"Q" TEST DATA

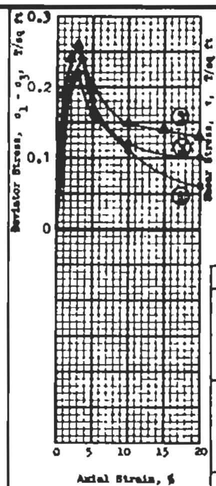
SCALES AS SHOWN

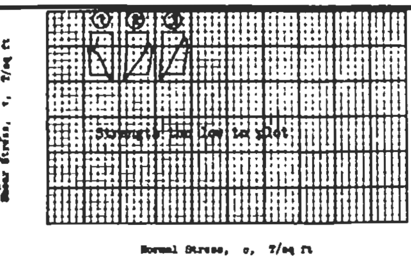
WALDEMAR S. NELSON AND COMPANY, INC. ENGINEERS AND ARCHITECTS NEW ORLEANS, LA.

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

DATE: SEPTEMBER 1968 — FILE NO. H-2-24306

PLATE 27





Test No.			1	2	3	
Initial	Water content	w_o	69.8 %	66.4 %	67.9 %	%
	Void ratio	e_o	1.91	1.80	1.86	
	Saturation	S_o	96.4 %	97.4 %	96.4 %	%
	Dry density, lb/cu ft	γ_d	56.6	58.8	57.7	
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	1.5	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.22	0.24	0.26	
Time to failure, min		t_f	15	18	14	
Rate of strain, percent/min			0.20	0.20	0.21	
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 = 0.12 T/sq ft

Method of saturation ______

☐ Controlled stress

☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED

Classification CLAY (CH), gray, contains sand silt lenses & organic matter

LL 89 | PL 28 | PI 61 | G_s 2.64

Remarks

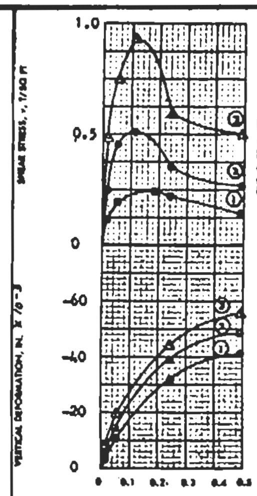
Project LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION

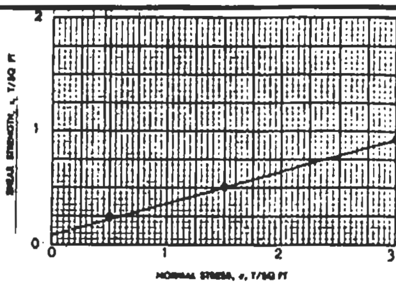
Area CHALMETTE LEVEE EXTENSION

Boring No. 10-CU | Sample No. 28A

Depth 95.0 | Date 29 June, 1967

RAA TRIAXIAL COMPRESSION TEST REPORT





TEST NO.			1	2	3	
INITIAL	WATER CONTENT	w_o	239.7 %	218.0 %	226.9 %	%
	VOID RATIO	e_o	5.70	5.16	5.38	
	SATURATION	S_o	98.0 %	98.4 %	98.3 %	%
	DRY DENSITY, LB/CU FT	γ_d	21.7	23.6	22.8	
VOID RATIO AFTER CONSOLIDATION		e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN		t_{50}	8	11	26	
FINAL	WATER CONTENT	w_f	144.2 %	96.6 %	82.1 %	%
	VOID RATIO	e_f				
	SATURATION	S_f	%	%	%	%
NORMAL STRESS, T/SQ FT		σ	0.5	1.5	3.0	
MAXIMUM SHEAR STRESS, T/SQ FT		τ_{max}	0.24	0.51	0.93	
ACTUAL TIME TO FAILURE, MIN		t_f	870	690	690	
RATE OF STRAIN, IN./MIN			.00017	.00017	.00017	
ULTIMATE SHEAR STRESS, T/SQ FT		τ_{ult}				

SHEAR STRENGTH PARAMETERS

φ' = 16 °

tan φ' = 0.287

c' = 0.08 T/SQ FT

☐ CONTROLLED STRESS

☒ CONTROLLED STRAIN

TYPE OF SPECIMEN UNDISTURBED | IN. SQUARE | IN. THICK

CLASSIFICATION CLAY (CH), gray, w/organic matter

LL 277 | PL 71 | PI 206 | G_s 2.33

REMARKS

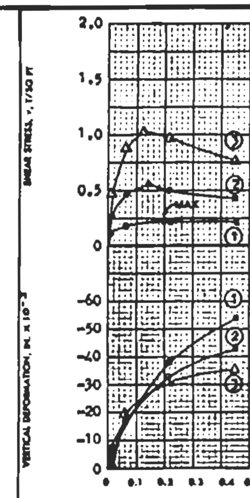
PROJECT LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION

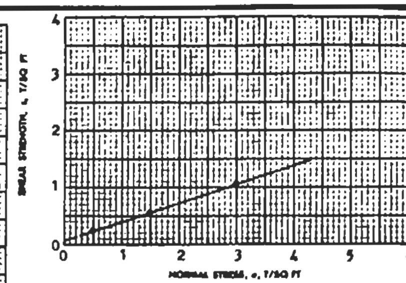
AREA CHALMETTE LEVEE EXTENSION

BORING NO. 10-CU | SAMPLE NO. 4-B

DEPTH 13.0 | DATE 11 JUNE 1967

GDA DIRECT SHEAR TEST REPORT





TEST NO.			①	②	③	
INITIAL	WATER CONTENT	w_o	74.6 %	74.5 %	74.1 %	%
	VOID RATIO	e_o	2.06	2.05	2.06	
	SATURATION	S_o	98.1 %	98.5 %	97.5 %	%
	DRY DENSITY, LB/CU FT	γ_d	55.3	55.4	55.3	
VOID RATIO AFTER CONSOLIDATION		e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN		t_{50}	<1	6	6	
FINAL	WATER CONTENT	w_f	63.8 %	51.5 %	46.3 %	%
	VOID RATIO	e_f				
	SATURATION	S_f	%	%	%	%
NORMAL STRESS, T/SQ FT		σ	0.5	1.5	3.0	
MAXIMUM SHEAR STRESS, T/SQ FT		τ_{max}	0.23	0.55	1.04	
ACTUAL TIME TO FAILURE, MIN		t_f	1260	930	810	
RATE OF STRAIN, IN./MIN			.00016	.00016	.00016	
ULTIMATE SHEAR STRESS, T/SQ FT		τ_{ult}				

SHEAR STRENGTH PARAMETERS

φ' = 18 °

tan φ' = 0.325

c' = 0.06 T/SQ FT

☐ CONTROLLED STRESS

☒ CONTROLLED STRAIN

TYPE OF SPECIMEN UNDISTURBED | 3.01 IN. SQUARE | 0.465 IN. THICK

CLASSIFICATION CLAY (CH), gray, homogeneous

LL 88 | PL 27 | PI 61 | G_s 2.71

REMARKS

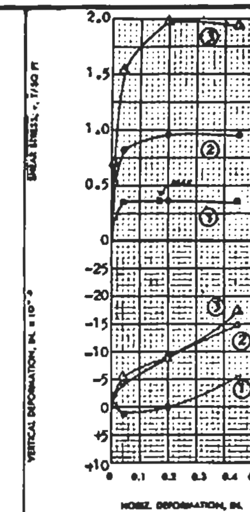
PROJECT LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION

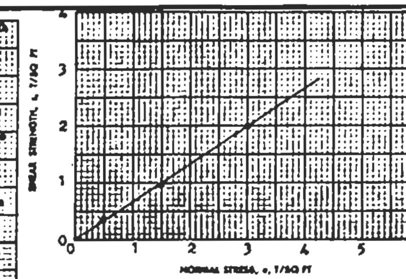
AREA CHALMETTE LEVEE EXTENSION

BORING NO. 10-CU | SAMPLE NO. 11-D

DEPTH 43.0 | DATE 13 June, 1967

GDA DIRECT SHEAR TEST REPORT





TEST NO.			①	②	③	
INITIAL	WATER CONTENT	w_o	25.9 %	26.7 %	26.4 %	%
	VOID RATIO	e_o	0.769	0.787	0.796	
	SATURATION	S_o	89.2 %	89.9 %	87.9 %	%
	DRY DENSITY, LB/CU FT	γ_d	93.5	92.6	92.1	
VOID RATIO AFTER CONSOLIDATION		e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN		t_{50}	<1	<1	<1	
FINAL	WATER CONTENT	w_f	28.1 %	26.8 %	25.8 %	%
	VOID RATIO	e_f				
	SATURATION	S_f	%	%	%	%
NORMAL STRESS, T/SQ FT		σ	0.5	1.5	3.0	
MAXIMUM SHEAR STRESS, T/SQ FT		τ_{max}	0.36	0.96	1.99	
ACTUAL TIME TO FAILURE, MIN		t_f	1200	1380	1380	
RATE OF STRAIN, IN./MIN			.00016	.00016	.00016	
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 | 3.01 IN. SQUARE | 0.465 IN. THICK

CLASSIFICATION SILTY SAND (SM), gray, contains small shells

LL — | PL — | PI — | G_s 2.65

REMARKS

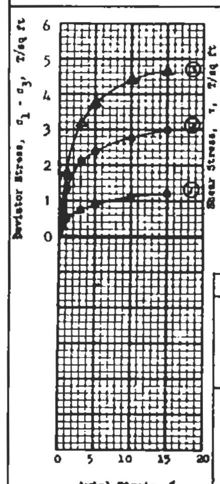
PROJECT LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION

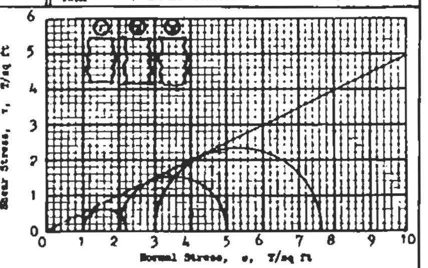
AREA CHALMETTE LEVEE EXTENSION

BORING NO. 10-CU | SAMPLE NO. 19-D

DEPTH 74.5 | DATE 13 June, 1967

GDA DIRECT SHEAR TEST REPORT





Test No.			1	2	3	
Initial	Water content	w_o	382.2 %	391.0 %	410.5 %	%
	Void ratio	e_o	8.30	8.57	8.92	
	Saturation	S_o	98.1 %	97.2 %	98.0 %	%
	Dry density, lb/cu ft	γ_d	14.3	13.9	13.4	
Before Shear	Water content	w_c	188.8 %	157.7 %	145.0 %	%
	Void ratio	e_c	3.04	2.12	1.70	
	Saturation	S_c	100+ %	100+ %	100+ %	%
	Final back pressure, T/sq ft	u_o	80	80	80	
	Dry density, lb/cu ft	γ_d	32.9 %	42.6 %	49.2 %	%
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	1.0	2.0	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	1.20	2.98	4.63	
Time to failure, min		t_f	108	99	93	
Rate of strain, percent/min			0.14	0.15	0.16	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.39	1.39	1.39	
Initial height, in.		H_o	3.00	3.00	3.00	

Shear Strength Parameters

φ = 21 °

tan φ = 0.384

c = 0 T/sq ft

Method of saturation BP

☐ Controlled stress

☒ Controlled strain

Type of test R | Type of specimen UNDISTURBED

Classification CLAY (OH), brown, contains grass

LL 405 | PL 133 | PI 272 | G_s 2.13

Remarks

Project LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION

Area CHALMETTE LEVEE EXTENSION

Boring No. 10-CU | Sample No. 2-D

Depth 7.0 | Date 10 JUNE 1967

PJR TRIAXIAL COMPRESSION TEST REPORT

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

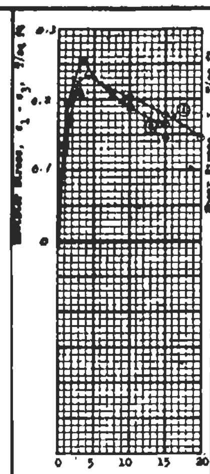
UNDISTURBED BORING 10-CU-"Q","R" & "S" TEST DATA

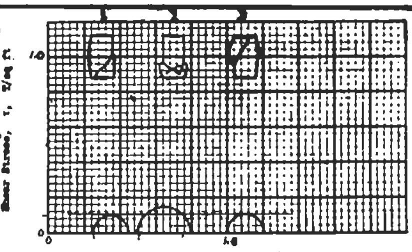
SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC.
ENGINEERS AND ARCHITECTS
NEW ORLEANS, LA.

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

DATE: SEPTEMBER 1988 | FILE NO. H-2-24306





Shear Strength Parameters

φ = 0°
tan φ = 0
c = 0.18 T/sq ft

Method of saturation ______

☐ Controlled stress
☒ Controlled strain

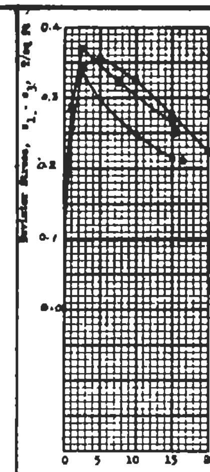
Test No.			①	②	③	
Initial	Water content	w_o	74.69%	76.59%	71.83%	%
	Void ratio	e_o	2.05	2.12	1.98	
	Saturation	S_o	100.0%	96.6%	95.8%	%
	Dry density, lb/cu ft	γ_d	55.74	54.44	57.01	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_o				
Final	Water content	w_f	%	%	%	%
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	0.25	0.50	1.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.23	0.26	0.21	
Time to failure, min		t_f	31	22	23	
Rate of strain, percent/min			0.63	0.67	0.65	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$	.1778	.1623	.1485	
Initial diameter, in.		D_o	1.42	1.42	1.41	
Initial height, in.		H_o	3.00	3.00	3.00	

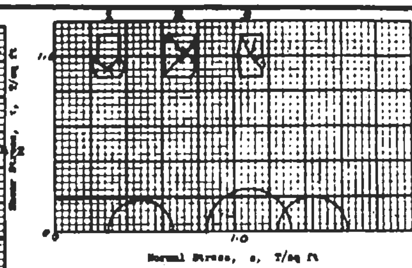
Type of test Q | Type of specimen UNDISTURBED
Classification So(Gr)CH4; Lns & lyrs. silt; org. strks.
LL | PL | PI | | G_s 2.7191

Remarks

TESTING SECTION
NOD

Project LAKE PONTCHARTRAIN & VIC. - CHALMETTE LEVEE EXTENSION
Area Sta. 970+00; 450' Rt. of MRGO B/L
Boring No. 10-CU | Sample No. 10-B
Depth El -32.8 | Date 2 JAN. 68
JER TRIAXIAL COMPRESSION TEST REPORT





Shear Strength Parameters

φ = 1.0°
tan φ = .017
c = 0.18 T/sq ft

Method of saturation ______

☐ Controlled stress
☒ Controlled strain

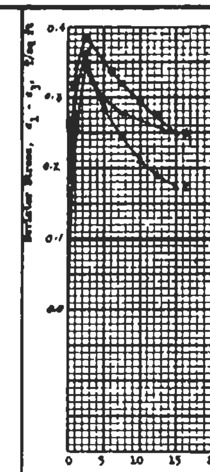
Test No.			1	2	3	
Initial	Water content	w_o	65.64%	69.88%	66.47%	%
	Void ratio	e_o	1.21	1.20	2.01	
	Saturation	S_o	100.0%	100.0%	100.0%	%
	Dry density, lb/cu ft	γ_d	50.93	63.80	66.36	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_o				
Final	Water content	w_f	%	%	%	%
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	0.5	0.86	1.25	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.34	0.36	0.37	
Time to failure, min		t_f	22	29	29	
Rate of strain, percent/min						
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o				
Initial height, in.		H_o	3.00	3.00	3.00	

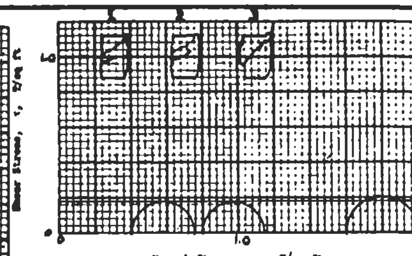
Type of test Q | Type of specimen UNDISTURBED
Classification So(Gr & dGr)CH4; Lns & thin lyrs silt
LL | PL | PI | | G_s 2.7120

Remarks

TESTING SECTION
NOD

Project LAKE PONTCHARTRAIN & VIC. CHALMETTE LEVEE EXTENSION
Area Sta. 970+00; 450' Rt. of MRGO B/L
Boring No. 10-CU | Sample No. 12-C
Depth El -41.4 | Date 2 JAN 68
JER TRIAXIAL COMPRESSION TEST REPORT





Shear Strength Parameters

φ = 0°
tan φ = 0
c = 0.18 T/sq ft

Method of saturation ______

☐ Controlled stress
☒ Controlled strain

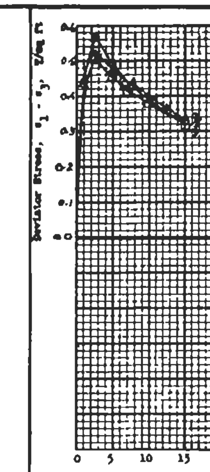
Test No.			1	2	3	
Initial	Water content	w_o	39.72%	46.95%	46.51%	%
	Void ratio	e_o	2.26	2.06	1.94	
	Saturation	S_o	49.2%	59.1%	64.6%	%
	Dry density, lb/cu ft	γ_d	51.63	56.08	57.31	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_o				
Final	Water content	w_f	%	%	%	%
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	0.4	0.8	1.60	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.36	0.35	0.39	
Time to failure, min		t_f	29	22	22	
Rate of strain, percent/min						
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.41	1.41	1.41	
Initial height, in.		H_o	3.00	3.00	3.00	

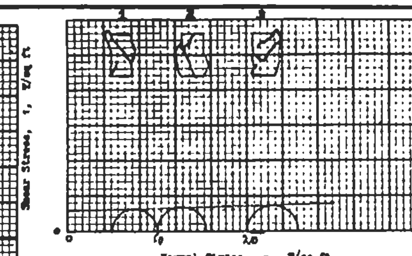
Type of test Q | Type of specimen UNDISTURBED
Classification So(Gr)CH3; Lns & Lyrs silt; org. stks.
LL | PL | PI | | G_s 2.7040

Remarks

TESTING SECTION
NOD

Project LAKE PONTCHARTRAIN & VIC. CHALMETTE LEVEE EXTENSION
Area Sta. 970+00; 450' Rt. of MRGO B/L
Boring No. 10-CU | Sample No. 14-B
Depth El -48.9 | Date 2 JAN. 68
JER TRIAXIAL COMPRESSION TEST REPORT





Shear Strength Parameters

φ = 2.0°
tan φ = .035
c = 0.26 T/sq ft

Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Test No.			1	2	3	
Initial	Water content	w_o	57.32%	56.57%	56.17%	%
	Void ratio	e_o	1.92	2.19	2.32	
	Saturation	S_o	88.25%	84.0%	84.90%	%
	Dry density, lb/cu ft	γ_d	57.9	53.10	50.9	
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	1.0	2.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.53	0.57	0.51	
Time to failure, min		t_f	23	22	23	
Rate of strain, percent/min						
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.41	1.41	1.41	
Initial height, in.		H_o	3.00	3.00	3.00	

Type of test Q | Type of specimen UNDISTURBED
Classification So(dGr)CH3; few lns silt; spks. dw.
LL | PL | PI | | G_s 2.7082

Remarks

TESTING SECTION
NOD

Project LAKE PONTCHARTRAIN & VIC. CHALMETTE LEVEE EXTENSION
Area Sta. 970+00; 450' Rt. of MRGO B/L
Boring No. 10-CU | Sample No. 16-C
Depth El -57.5 | Date
JER TRIAXIAL COMPRESSION TEST REPORT

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

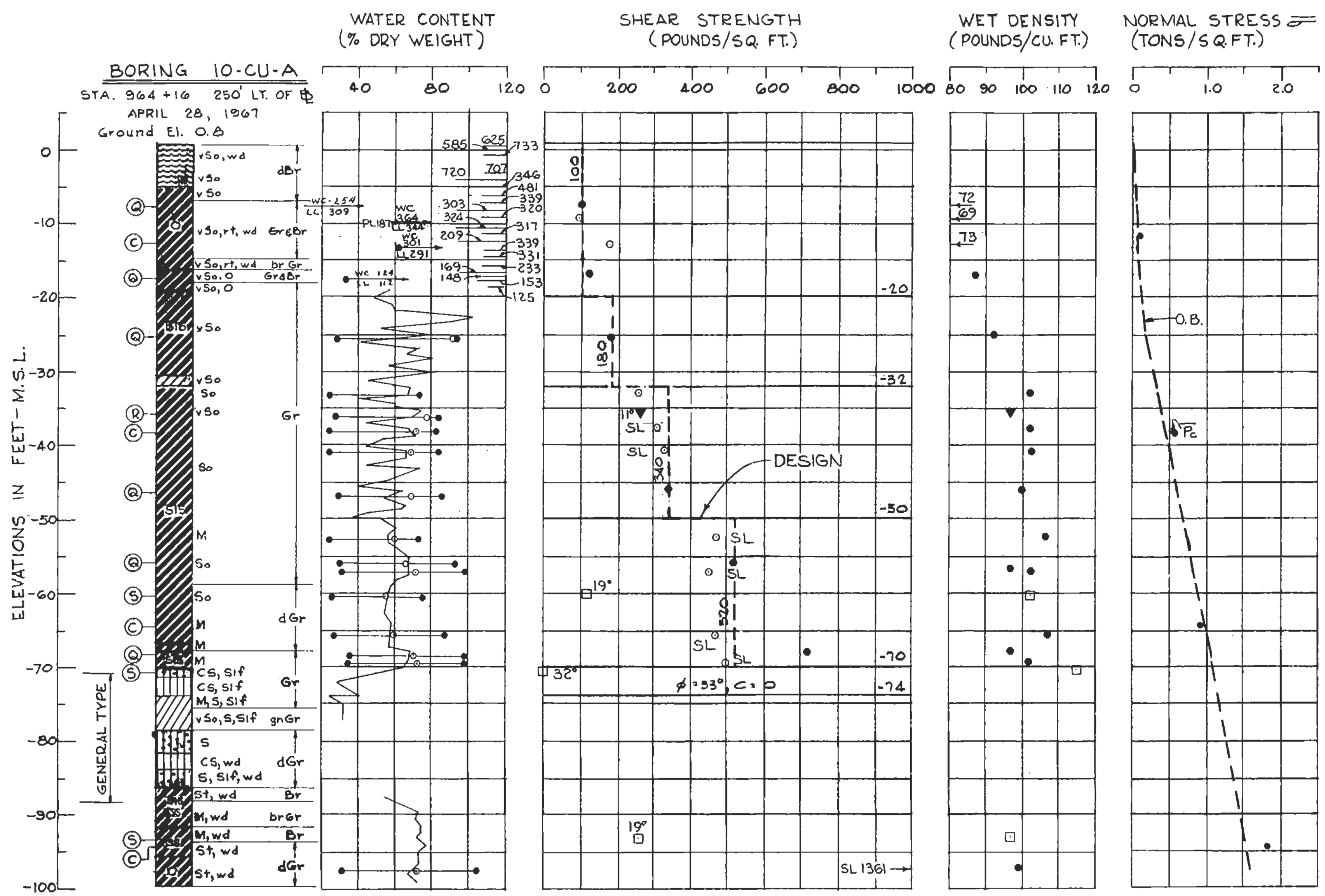
UNDISTURBED BORING 10-CU-"Q" TEST DATA

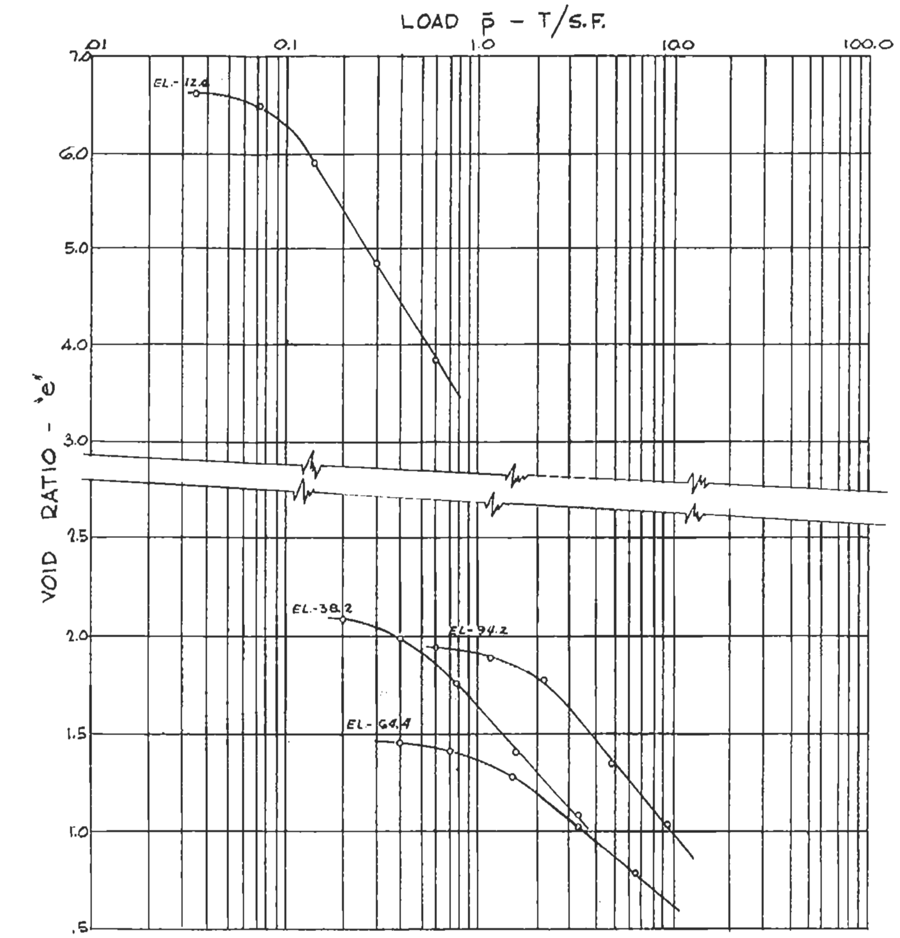
SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC.
ENGINEERS AND ARCHITECTS
NEW ORLEANS, LA.

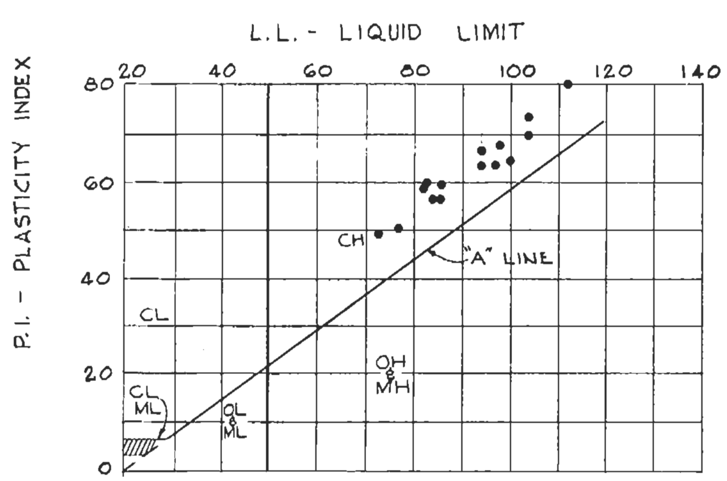
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS, U. S. ARMY
NEW ORLEANS, LA.

DATE: SEPTEMBER 1966 | FILE NO. H-2-24306

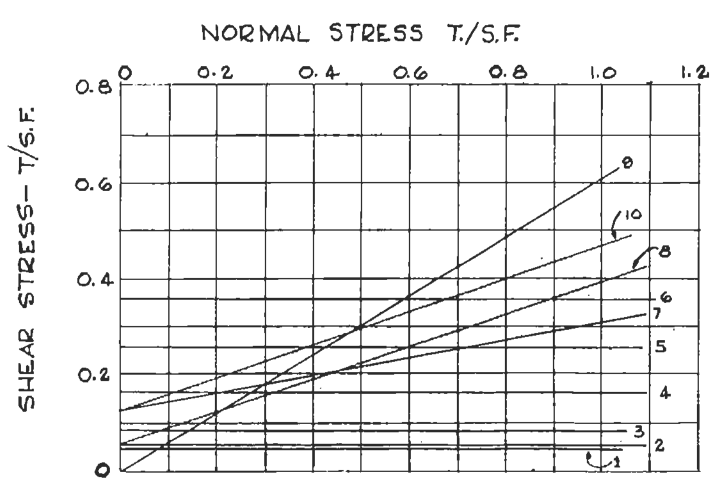




CONSOLIDATION DATA



PLASTICITY CHART



SHEAR STRENGTH DATA

ENVELOPE NO.	EL.	TYPE	STRENGTH φ°	(T.S.F.)	CLASS
1	-7.59	Q	0	0.05	CHO
2	-17.09			0.06	CH
3	-25.19			0.09	CH
4	-46.09			0.17	CH
5	-55.69			0.26	CH
6	-68.19		0	0.36	CH
7	-35.59	R	11	0.13	CH
8	-60.19	S	19	0.06	CH
9	-70.39		32	0.00	SM
10	-93.19		19	0.13	CH

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN
DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

UNDISTURBED BORING 10-CU-A
TEST DATA

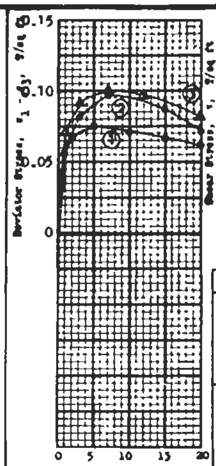
SCALES AS SHOWN

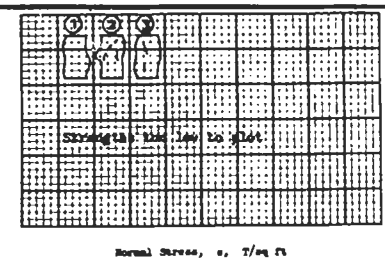
WALDEMAR S. NELSON AND COMPANY, INC.
ENGINEERS AND ARCHITECTS
NEW ORLEANS, LA.

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

DATE: SEPTEMBER 1968 | FILE NO. H-2-24306

Triaxial Compression Test Report — Boring 10-CU-A, Sample 3-A





Test No.			①	②	③	
Initial	Water content	w_o	242.4 %	258.7 %	261.5 %	%
	Void ratio	e_o	6.24	6.60	6.63	
	Saturation	S_o	96.0 %	96.8 %	97.4 %	%
	Dry density, lb/cu ft	γ_d	21.3	20.3	20.2	
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	1.5	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.08	0.10	0.10	
Time to failure, min		t_f	22	32	30	
Rate of strain, percent/min			0.23	0.22	0.23	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.39	1.39	1.39	
Initial height, in.		H_o	3.00	3.00	3.00	

Shear Strength Parameters
ϕ = 0°
tan ϕ = 0
c = 0.05 T/sq ft

Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED

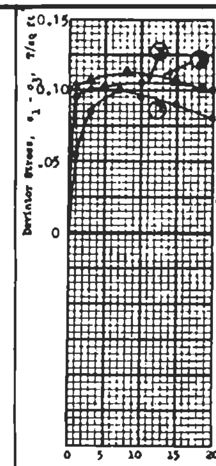
Classification CLAY (OH), dark brown, contains fibrous organic matter

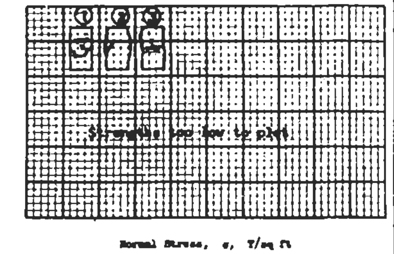
LL 309 | PL 107 | PI 202 | G_s 2.47

Remarks ______

Project LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION
Area CHALMETTE LEVEE EXTENSION
Boring No. 10-CU-A | Sample No. 3-A
Depth 8.4 | Date 30 June, 1967
RAA TRIAXIAL COMPRESSION TEST REPORT

Triaxial Compression Test Report — Boring 10-CU-A, Sample 5-C





Test No.			①	②	③	
Initial	Water content	w_o	123.2 %	120.1 %	125.3 %	%
	Void ratio	e_o	3.38	3.37	3.39	
	Saturation	S_o	97.7 %	97.3 %	99.1 %	%
	Dry density, lb/cu ft	γ_d	38.2	38.8	38.7	
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	1.5	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.10	0.11	0.12	
Time to failure, min		t_f	21	44	32	
Rate of strain, percent/min			0.33	0.23	0.25	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.40	1.40	1.39	
Initial height, in.		H_o	3.00	3.00	3.00	

Shear Strength Parameters
ϕ = 0°
tan ϕ = 0
c = 0.06 T/sq ft

Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED

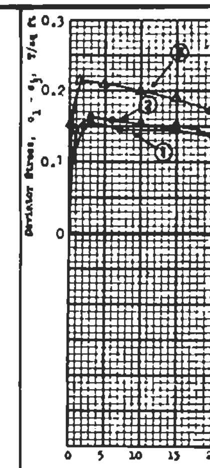
Classification CLAY (CH), Gray, homogeneous

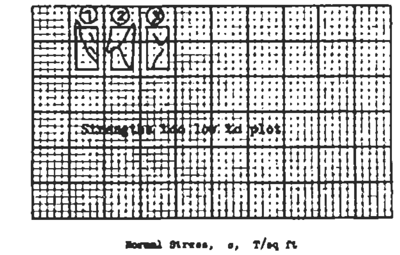
LL 112 | PL 32 | PI 80 | G_s 2.68

Remarks ______

Project LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION
Area CHALMETTE LEVEE EXTENSION
Boring No. 10-CU-A | Sample No. 5-C
Depth 17.9 | Date 3 July, 1967
RAA TRIAXIAL COMPRESSION TEST REPORT

Triaxial Compression Test Report — Boring 10-CU-A, Sample 7-C





Test No.			①	②	③	
Initial	Water content	w_o	91.8 %	93.7 %	93.4 %	%
	Void ratio	e_o	2.52	2.61	2.59	
	Saturation	S_o	99.5 %	98.0 %	98.4 %	%
	Dry density, lb/cu ft	γ_d	48.4	47.2	47.5	
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	1.5	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.16	0.16	0.21	
Time to failure, min		t_f	9	10	5	
Rate of strain, percent/min			0.33	0.31	0.32	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.40	1.39	1.39	
Initial height, in.		H_o	3.00	3.00	3.00	

Shear Strength Parameters
ϕ = 0°
tan ϕ = 0
c = 0.09 T/sq ft

Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED

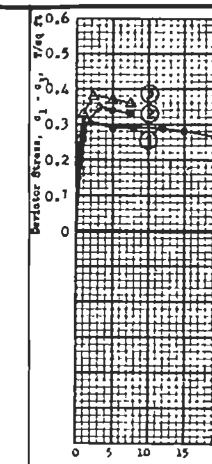
Classification CLAY (CH), gray, discolored by ferrous oxide

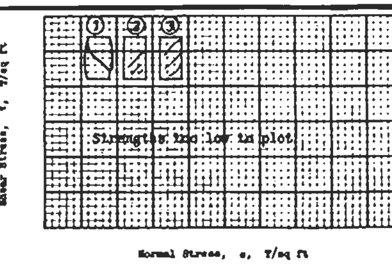
LL 94 | PL 28 | PI 66 | G_s 2.73

Remarks ______

Project LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION
Area CHALMETTE LEVEE EXTENSION
Boring No. 10-CU-A | Sample No. 7-C
Depth 26.0 | Date 3 July, 1967
RAA TRIAXIAL COMPRESSION TEST REPORT

Triaxial Compression Test Report — Boring 10-CU-A, Sample 12-D





Test No.			1	2	3	
Initial	Water content	w_o	70.8 %	69.6 %	70.1 %	%
	Void ratio	e_o	1.88	1.88	1.89	
	Saturation	S_o	100 %	100 %	100 %	%
	Dry density, lb/cu ft	γ_d	58.7	58.8	58.6	
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	1.5	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.31	0.35	0.38	
Time to failure, min		t_f	3	18	13	
Rate of strain, percent/min			0.51	0.18	0.19	
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 = 0°
tan ϕ = 0
c = 0.17 T/sq ft

Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED

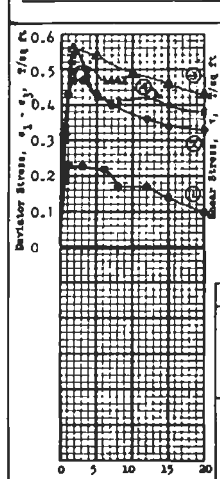
Classification CLAY (CH), gray, homogeneous

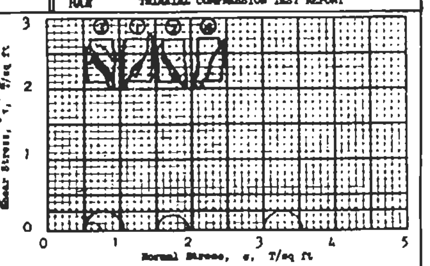
LL 86 | PL 30 | PI 56 | G_s 2.71

Remarks ______

Project LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION
Area CHALMETTE LEVEE EXTENSION
Boring No. 10-CU-A | Sample No. 12-D
Depth 46.9 | Date 6 July, 1967
RAA TRIAXIAL COMPRESSION TEST REPORT

Triaxial Compression Test Report — Boring 10-CU-A, Sample 15-B





Test No.			1	2	3	4
Initial	Water content	w_o	70.3 %	67.4 %	68.1 %	63.8 %
	Void ratio	e_o	1.93	1.86	1.91	1.74
	Saturation	S_o	98.9 %	98.4 %	97.1 %	99.7 %
	Dry density, lb/cu ft	γ_d	57.9	59.3	58.4	61.9
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	1.5	3.0	0.5
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.23	0.47	0.56	0.55
Time to failure, min		t_f	5	12	14	10
Rate of strain, percent/min			0.20	0.14	0.13	0.23
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.39	1.39	1.40	1.39
Initial height, in.		H_o	3.00	3.00	3.00	3.00

Shear Strength Parameters
ϕ = 0°
tan ϕ = 0
c = 0.26 T/sq ft

Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED

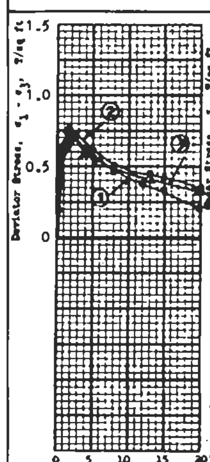
Classification CLAY (CH), gray, fissured

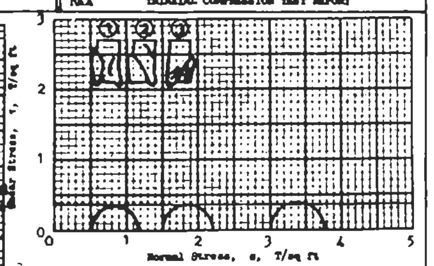
LL 94 | PL 31 | PI 63 | G_s 2.72

Remarks ______

Project LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION
Area CHALMETTE LEVEE EXTENSION
Boring No. 10-CU-A | Sample No. 15-B
Depth 56.5 | Date 6 JULY 1967
RAA TRIAXIAL COMPRESSION TEST REPORT

Triaxial Compression Test Report — Boring 10-CU-A, Sample 18-B





Test No.			①	②	③	
Initial	Water content	w_o	70.7 %	71.2 %	70.1 %	%
	Void ratio	e_o	1.95	1.96	1.93	
	Saturation	S_o	99.0 %	99.2 %	99.2 %	%
	Dry density, lb/cu ft	γ_d	57.8	57.5	58.1	
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	1.5	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.70	0.72	0.76	
Time to failure, min		t_f	16	20	14	
Rate of strain, percent/min			0.13	0.13	0.13	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.39	1.39	1.39	
Initial height, in.		H_o	3.00	3.00	3.00	

Shear Strength Parameters
ϕ = 0°
tan ϕ = 0
c = 0.36 T/sq ft

Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED

Classification CLAY (CH), gray, homogeneous

LL 100 | PL 36 | PI 64 | G_s 2.73

Remarks ______

Project LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION
Area CHALMETTE LEVEE EXTENSION
Boring No. 10-CU-A | Sample No. 18-B
Depth 69.0 | Date 10 July, 1967
RAA TRIAXIAL COMPRESSION TEST REPORT

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

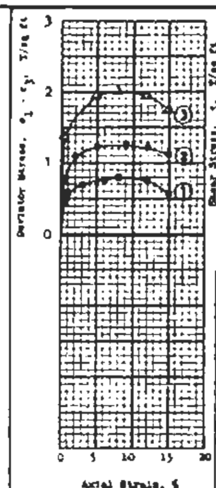
UNDISTURBED BORING 10-CU-A-"Q" TEST DATA

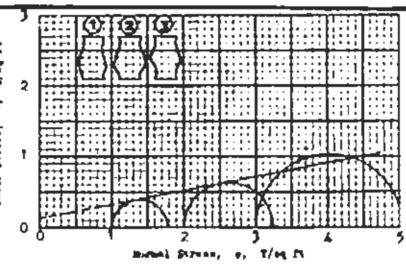
SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC.
ENGINEERS AND ARCHITECTS
NEW ORLEANS, LA.

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

DATE: SEPTEMBER 1968 | FILE NO. H-2-24306





Shear Strength Parameters

φ = 11 °

tan φ = 0.194

c = 0.13 T/sq ft

Method of saturation BP

[ ] Controlled stress

[X] Controlled strain

Test No.			1	2	3	
Initial	Water content	w_o	76.5 %	76.3 %	77.6 %	%
	Void ratio	e_o	2.05	1.99	2.04	
	Saturation	S_o	100 %	100+ %	100 %	%
	Dry density, lb/cu ft	γ_d	54.9	56.0	55.1	
Before Shear	Water content	w_c	57.7 %	49.3 %	44.3 %	%
	Void ratio	e_c	1.55	1.18	0.978	
	Saturation	S_c	99.8 %	100+ %	100+ %	%
	Final back pressure, PSI	u_b	30	30	30	
	Dry Density lbs/cu.ft.	γ_d	65.6	76.6	84.6	
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	1.0	2.0	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.79	1.25	2.03	
Time to failure, min		t_f	84	75	106	
Rate of strain, percent/min			0.10	0.12	0.08	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$	0.58	1.13	1.75	
Initial diameter, in.		D_o	1.39	1.37	1.37	
Initial height, in.		H_o	3.00	3.00	3.00	

Type of test R — Type of specimen UNDISTURBED

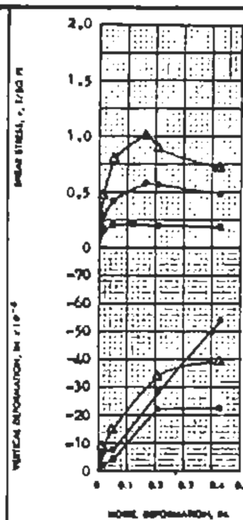
Classification CLAY (CH), gray, fissured

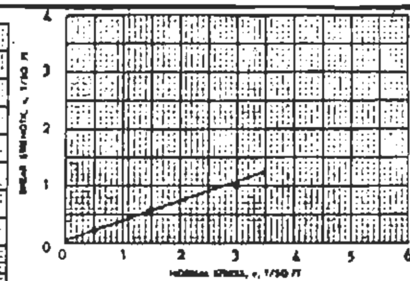
LL 84 — PL 28 — PI 56 — G_s 2.68

Remarks

Project	LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION
Area	CHALMETTE LEVEE EXTENSION
Boring No. 10-CU-A	Sample No. 10-E
Depth 36.4	Date 10 June,1967

SH — TRIAXIAL COMPRESSION TEST REPORT





SHEAR STRENGTH PARAMETERS

φ' = 19°

tan φ' = 0.344

c' = 0.06 T/SQ FT

[ ] CONTROLLED STRESS

[X] CONTROLLED STRAIN

TEST NO.			1	2	3	
Initial	WATER CONTENT	w_o	55.9%	56.0%	56.2%	%
	VOID RATIO	e_o	1.47	1.48	1.48	
	SATURATION	S_o	100+%	100+%	100+%	%
	DRY DENSITY, LB/CU FT	γ_d	67.2	66.8	66.8	
VOID RATIO AFTER CONSOLIDATION		e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN		t_{50}	2	5	6	
Final	WATER CONTENT	w_f	54.1%	44.9%	39.4%	%
	VOID RATIO	e_f				
	SATURATION	S_f	%	%	%	%
NORMAL STRESS, T/SQ FT		σ	0.5	1.5	3.0	
MAXIMUM SHEAR STRESS, T/SQ FT		τ_{max}	0.22	0.58	1.01	
ACTUAL TIME TO FAILURE, MIN		t_f	780	1050	1050	
RATE OF STRAIN, IN/MIN			.00016	.00016	.00016	
ULTIMATE SHEAR STRESS, T/SQ FT		τ_{ult}				

TYPE OF SPECIMEN UNDISTURBED — 3.01 IN. SQUARE — 0.465 IN. THICK

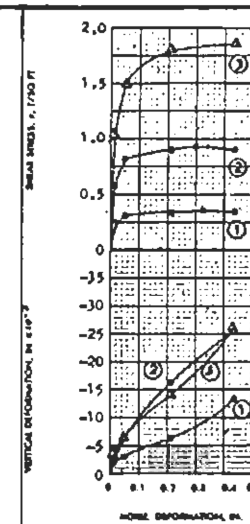
CLASSIFICATION CLAY (CH), gray, homogeneous

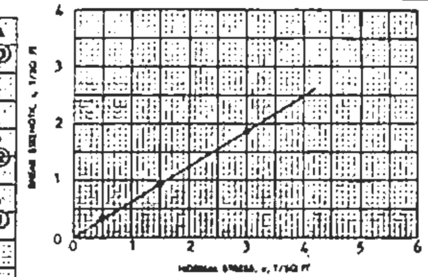
LL 77 — PL 27 — PI 50 — G_s 2.66

REMARKS

PROJECT	LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION
AREA	CHALMETTE LEVEE EXTENSION
BORING NO. 10 CU-A	SAMPLE NO. 16-B
DEPTH 61.0	DATE 15 June,1967

GDE — DIRECT SHEAR TEST REPORT





SHEAR STRENGTH PARAMETERS

φ' = 32°

tan φ' = 0.625

c' = 0 T/SQ FT

[ ] CONTROLLED STRESS

[X] CONTROLLED STRAIN

TEST NO.			①	②	③	
Initial	WATER CONTENT	w_o	24.2%	24.1%	23.6%	%
	VOID RATIO	e_o	0.699	0.753	0.701	
	SATURATION	S_o	91.4%	84.5%	88.9%	%
	DRY DENSITY, LB/CU FT	γ_d	97.0	94.0	96.9	
VOID RATIO AFTER CONSOLIDATION		e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN		t_{50}	<1	<1	<1	
Final	WATER CONTENT	w_f	25.7%	26.0%	25.2%	%
	VOID RATIO	e_f				
	SATURATION	S_f	%	%	%	%
NORMAL STRESS, T/SQ FT		σ	0.5	1.5	3.0	
MAXIMUM SHEAR STRESS, T/SQ FT		τ_{max}	0.36	0.93	1.86	
ACTUAL TIME TO FAILURE, MIN		t_f	2040	1860	2640	
RATE OF STRAIN, IN/MIN			.00016	.00016	.00016	
ULTIMATE SHEAR STRESS, T/SQ FT		τ_{ult}				

TYPE OF SPECIMEN UNDISTURBED — 3.01 IN. SQUARE — 0.465 IN. THICK

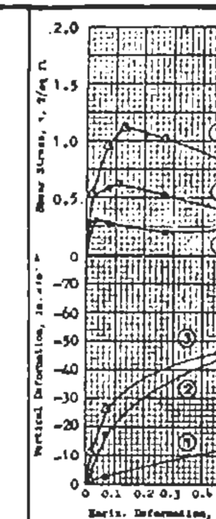
CLASSIFICATION SILTY SAND (SM), gray, contains small shells

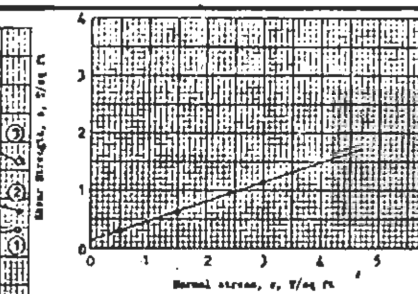
LL — — PL — — PI — — G_s 2.64

REMARKS

PROJECT	LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION
AREA	CHALMETTE LEVEE EXTENSION
BORING NO. 10-CU-A	SAMPLE NO. 18-D2
DEPTH 71.2	DATE 15 June,1967

GDE — DIRECT SHEAR TEST REPORT





Shear Strength Parameters

φ' = 19 °

tan φ' = 0.344

c' = 0.13 T/sq ft

[ ] Controlled stress

[X] Controlled strain

Test No.			①	②	③	
Initial	Water content	w_o	68.8 %	66.6 %	64.0 %	%
	Void ratio	e_o	1.93	1.85	1.76	
	Saturation	S_o	94.8 %	95.8 %	96.7 %	%
	Dry density, lb/cu ft	γ_d	56.7	58.2	60.2	
Void ratio after consolidation		e_c				
Time for 50 percent consolidation, min		t_{50}	2	<1	2	
Final	Water content	w_f	77.7 %	56.0 %	52.1 %	%
	Void ratio	e_f				
	Saturation	S_f	%	%	%	%
Normal stress, T/sq ft		σ	0.5	1.5	3.0	
Maximum shear stress, T/sq ft		τ_{max}	0.30	0.62	1.12	
Actual time to failure, min		t_f	180	720	840	
Rate of strain, in./min			.00016	.00016	.00016	
Ultimate shear stress, T/sq ft		τ_{ult}				

Type of specimen UNDISTURBED — 3.01 in. square — 0.465 in. thick

Classification CLAY (CH), gray, contains pockets of sand

LL 104 — PL 35 — PI 69 — G_s 2.66

Remarks

Project	LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION
Area	CHALMETTE LEVEE EXTENSION
Boring No. 10-CU-A	Sample No. 27-B
Depth 94.0	Date 17 June,1967

GDE — DIRECT SHEAR TEST REPORT

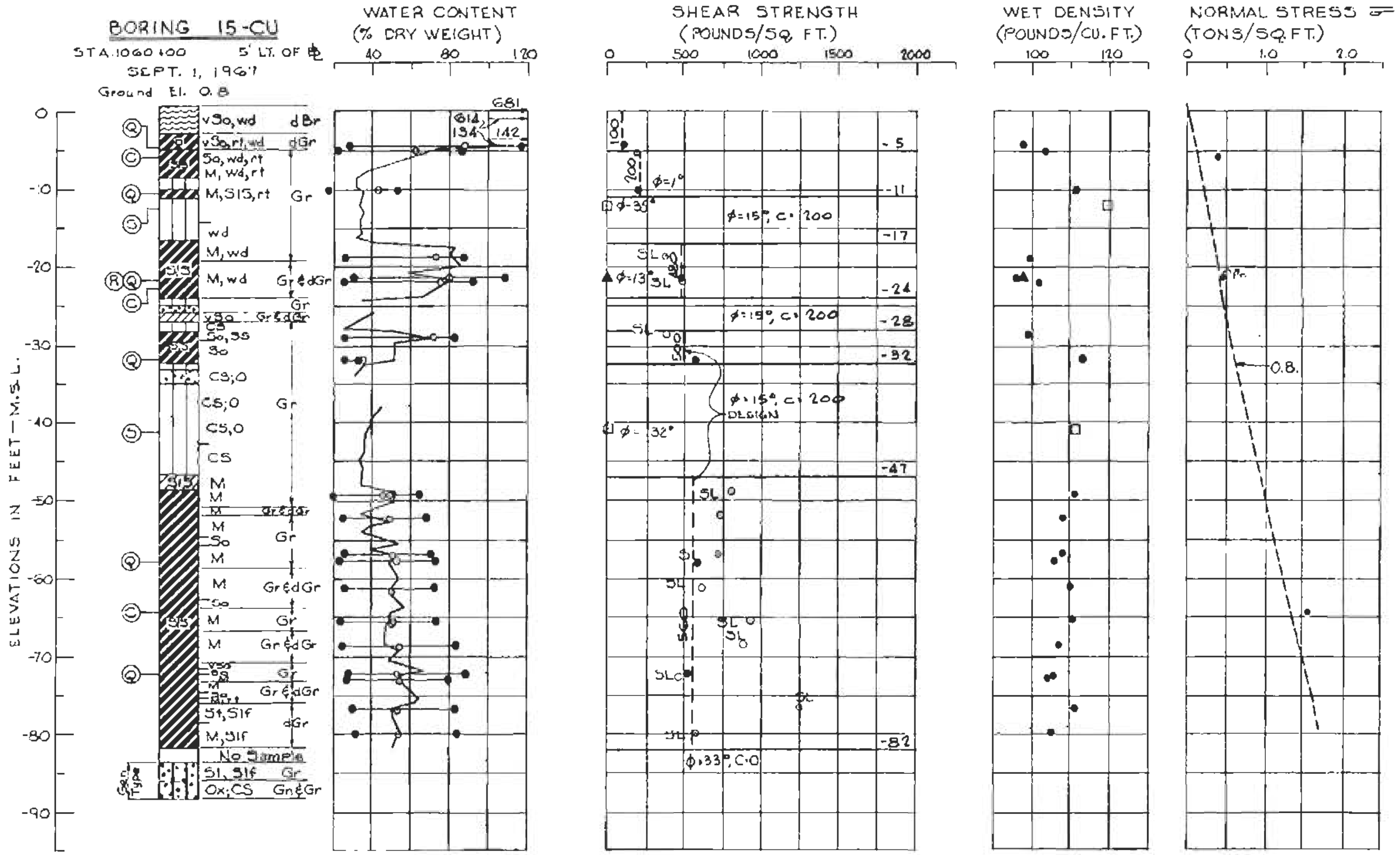
LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

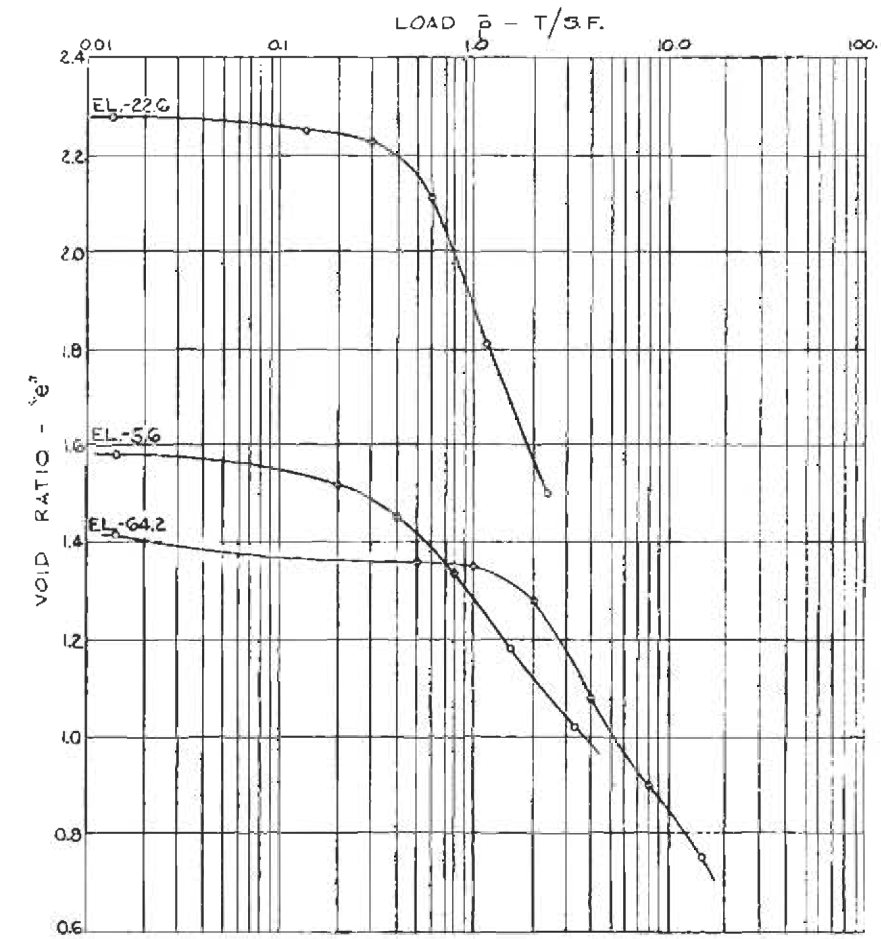
DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

UNDISTURBED BORING 10-CU-A-"R"&"S" TEST DATA

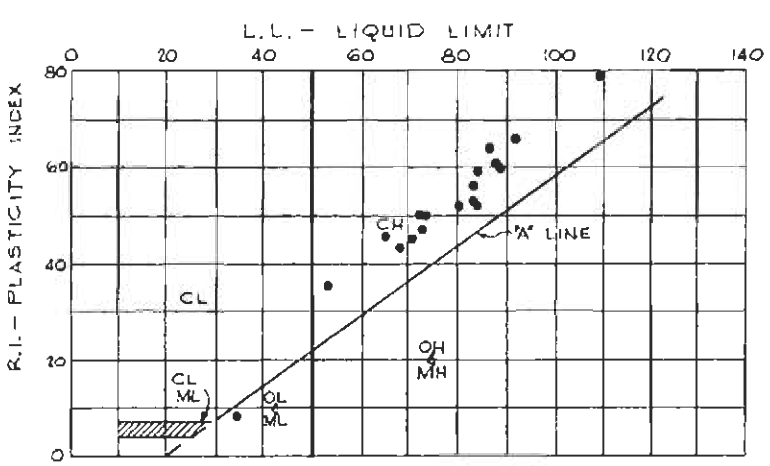
SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC. ENGINEERS AND ARCHITECTS NEW ORLEANS, LA.	U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS, U. S. ARMY NEW ORLEANS, LA.
DATE SEPTEMBER 1966	FILE NO. H-2-24306

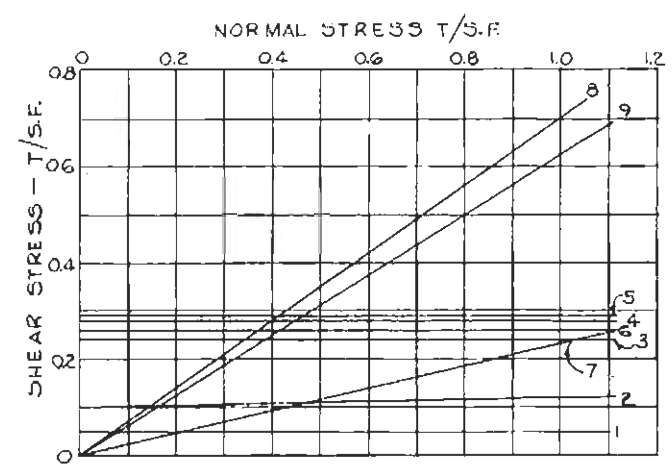




CONSOLIDATION DATA



PLASTICITY CHART



SHEAR STRENGTH DATA

ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH ϕ°	STRENGTH C (TSF)	CLASS
1	-4.3	Q	0	0.05	CH
2	-10.1		1	0.10	CH
3	-21.4		0	0.24	CH
4	-31.9		0	0.28	SM
5	-57.9		0	0.29	CH
6	-72.1		0	0.26	CH
7	-21.4	R	13	0	CH
8	-12.2	S	35	0	ML
9	-41.0		32	0	ML

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

UNDISTURBED BORING 15-CU TEST DATA

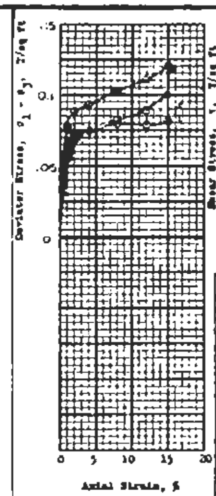
SCALES AS SHOWN

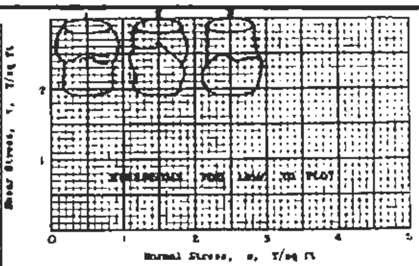
WALDEMAR S. NELSON AND COMPANY, INC
ENGINEERS AND ARCHITECTS
NEW ORLEANS, LA.

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

DATE SEPTEMBER 1968 FILE NO. H-2-24306

Triaxial Compression Test Report — Boring 15-CU, Sample 2-B





Test No.		1	2	3	
Initial: Water content	w_o	92.7 %	81.0 %	69.6 %	%
Initial: Void ratio	e_o	2.40	2.08	1.94	
Initial: Saturation	S_o	100 %	100+ %	100+ %	%
Initial: Dry density, lb/cu ft	γ_d	47.5	51.5	55.0	
Before Shear: Water content	w_c	%	%	%	%
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	0.50	1.50	3.00	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.08	0.10	0.12	
Time to failure, min	t_f	16	16	16	
Rate of strain, percent/min		0.97	0.97	0.97	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.41	1.41	1.41	
Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters

ϕ = 0°

tan ϕ = 0

c = 0.05 T/sq ft

Method of saturation ______

☐ Controlled stress
☑ Controlled strain

Type of test: Q | Type of specimen: UNDISTURBED

Classification: GRAY CLAY (CH), W/ WOOD & ROOT FRAGMENTS

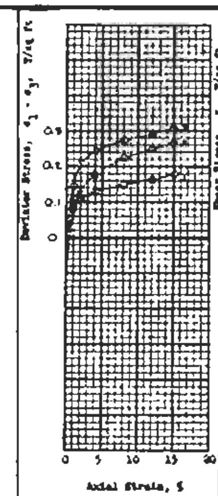
LL 117 | PL 26 | PI 89 | G_s 2.59

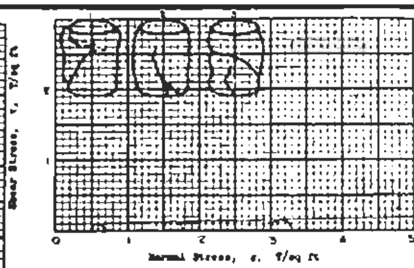
Remarks ______

Project: LAKE PONTCHARTRAIN & VIC. HURRICANE PROTECTION
Area: CHALMETTE LEVEE EXTENSION
Boring No. 15-CU | Sample No. 2-B
Depth, ft 5.1 | Date 10/3/67

TRIAXIAL COMPRESSION TEST REPORT

Triaxial Compression Test Report — Boring 15-CU, Sample 5-D





Test No.		1	2	3	
Initial: Water content	w_o	45.7 %	42.4 %	41.1 %	%
Initial: Void ratio	e_o	1.25	1.13	1.10	
Initial: Saturation	S_o	98.5 %	100+ %	100+ %	%
Initial: Dry density, lb/cu ft	γ_d	74.6	76.7	79.5	
Before Shear: Water content	w_c	%	%	%	%
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	0.50	1.50	3.00	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.16	0.27	0.31	
Time to failure, min	t_f	16	16	16	
Rate of strain, percent/min		0.97	0.97	0.97	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.41	1.41	1.41	
Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters

ϕ = 1°

tan ϕ = 0.018

c = 0.10 T/sq ft

Method of saturation ______

☐ Controlled stress
☑ Controlled strain

Type of test: Q | Type of specimen: UNDISTURBED

Classification: GRAY CLAY (CH), SLIGHTLY SILTY W/ ROOTS

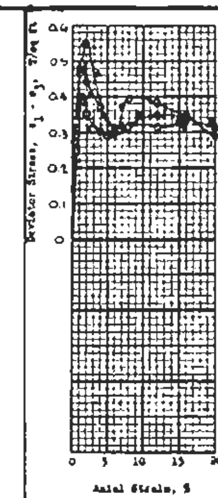
LL 53 | PL 18 | PI 35 | G_s 2.69

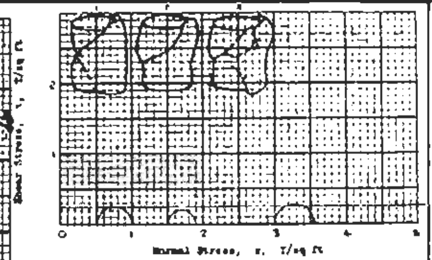
Remarks ______

Project: LAKE PONTCHARTRAIN & VIC. HURRICANE PROTECTION
Area: CHALMETTE LEVEE EXTENSION
Boring No. 15-CU | Sample No. 5-D
Depth, ft 10.9 | Date 10/4/67

TRIAXIAL COMPRESSION TEST REPORT

Triaxial Compression Test Report — Boring 15-CU, Sample 6-C





Test No.		1	2	3	
Initial: Water content	w_o	79.3 %	79.5 %	80.0 %	%
Initial: Void ratio	e_o	2.26	2.24	2.22	
Initial: Saturation	S_o	97.2 %	97.4 %	97.1 %	%
Initial: Dry density, lb/cu ft	γ_d	52.6	53.0	51.5	
Before Shear: Water content	w_c	%	%	%	%
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	0.50	1.50	3.00	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.49	0.50	0.55	
Time to failure, min	t_f	2	8	20	
Rate of strain, percent/min		0.97	0.16	0.09	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.41	1.41	1.41	
Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters

ϕ = 0°

tan ϕ = 0

c = 0.26 T/sq ft

Method of saturation ______

☐ Controlled stress
☑ Controlled strain

Type of test: Q | Type of specimen: UNDISTURBED

Classification: GRAY CLAY (CH) Contains a small amount of Organic Matter

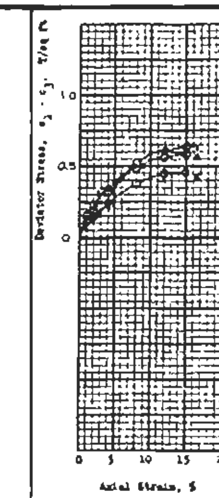
LL 109 | PL 30 | PI 79 | G_s 2.75

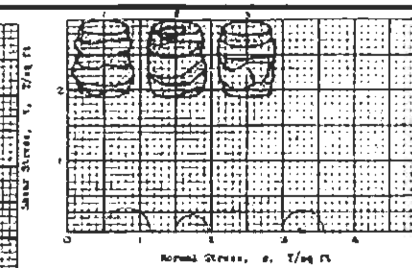
Remarks ______

Project: LAKE PONTCHARTRAIN & VIC. HURRICANE PROTECTION
Area: CHALMETTE LEVEE EXTENSION
Boring No. 15-CU | Sample No. 6-C
Depth, ft 22.2 | Date 10/4 & 10/5/67

TRIAXIAL COMPRESSION TEST REPORT

Triaxial Compression Test Report — Boring 15-CU, Sample 9-B





Test No.		1	2	3	
Initial: Water content	w_o	35.5 %	36.2 %	36.4 %	%
Initial: Void ratio	e_o	0.997	1.03	1.03	
Initial: Saturation	S_o	96.4 %	96.3 %	94.7 %	%
Initial: Dry density, lb/cu ft	γ_d	83.8	82.3	82.6	
Before Shear: Water content	w_c	%	%	%	%
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	0.50	1.50	3.00	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.04	0.46	0.50	
Time to failure, min	t_f	16	16	16	
Rate of strain, percent/min		0.97	0.97	0.97	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.41	1.41	1.41	
Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters

ϕ = 0°

tan ϕ = 0

c = 0.28 T/sq ft

Method of saturation ______

☐ Controlled stress
☑ Controlled strain

Type of test: Q | Type of specimen: UNDISTURBED

Classification: GRAY SILTY FINE SAND (SM), W/ SILTY CLAY & CLAY SEAMS

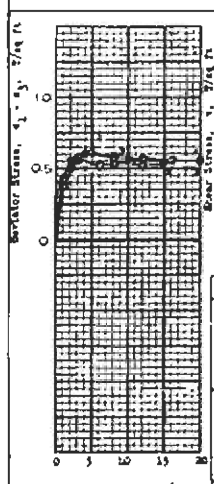
LL 34 | PL 26 | PI 8 | G_s 2.68

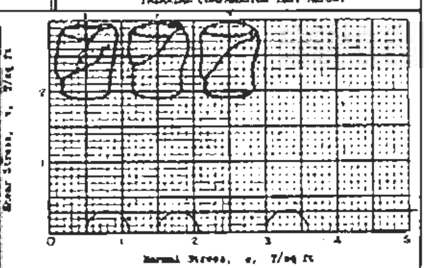
Remarks ______

Project: LAKE PONTCHARTRAIN & VIC. HURRICANE PROTECTION
Area: CHALMETTE LEVEE EXTENSION
Boring No. 15-CU | Sample No. 9-B
Depth, ft 37.7 | Date 10/8/67

TRIAXIAL COMPRESSION TEST REPORT

Triaxial Compression Test Report — Boring 15-CU, Sample 15-D





Test No.		1	2	3	
Initial: Water content	w_o	52.9 %	53.3 %	53.0 %	%
Initial: Void ratio	e_o	1.46	1.46	1.46	
Initial: Saturation	S_o	98.9 %	99.7 %	100 %	%
Initial: Dry density, lb/cu ft	γ_d	60.3	60.2	60.5	
Before Shear: Water content	w_c	%	%	%	%
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	0.50	1.50	3.00	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.60	0.56	0.61	
Time to failure, min	t_f	5	12	28	
Rate of strain, percent/min		0.93	0.26	0.18	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.41	1.41	1.41	
Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters

ϕ = 0°

tan ϕ = 0

c = 0.29 T/sq ft

Method of saturation ______

☐ Controlled stress
☑ Controlled strain

Type of test: Q | Type of specimen: UNDISTURBED

Classification: GRAY CLAY (CH), HOMOGENEOUS

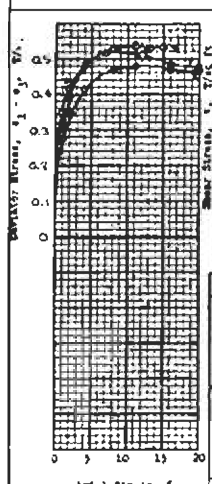
LL 73 | PL 23 | PI 50 | G_s 2.73

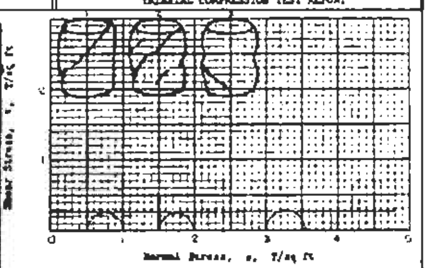
Remarks ______

Project: LAKE PONTCHARTRAIN & VIC. HURRICANE PROTECTION
Area: CHALMETTE LEVEE EXTENSION
Boring No. 15-CU | Sample No. 15-D
Depth, ft 58.7 | Date 10/5 & 10/6/67

TRIAXIAL COMPRESSION TEST REPORT

Triaxial Compression Test Report — Boring 15-CU, Sample 18-B





Test No.		1	2	3	
Initial: Water content	w_o	53.0 %	55.8 %	53.5 %	%
Initial: Void ratio	e_o	1.49	1.50	1.54	
Initial: Saturation	S_o	93.8 %	94.8 %	95.5 %	%
Initial: Dry density, lb/cu ft	γ_d	69.0	68.7	67.9	
Before Shear: Water content	w_c	%	%	%	%
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	0.50	1.50	3.00	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.52	0.48	0.54	
Time to failure, min	t_f	25	29	18	
Rate of strain, percent/min		0.29	0.19	0.43	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.41	1.41	1.41	
Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters

ϕ = 0°

tan ϕ = 0

c = 0.26 T/sq ft

Method of saturation ______

☐ Controlled stress
☑ Controlled strain

Type of test: Q | Type of specimen: UNDISTURBED

Classification: GRAY CLAY (CH), HOMOGENEOUS

LL 88 | PL 28 | PI 60 | G_s 2.75

Remarks ______

Project: LAKE PONTCHARTRAIN & VIC. HURRICANE PROTECTION
Area: CHALMETTE LEVEE EXTENSION
Boring No. 15-CU | Sample No. 18-B
Depth, ft 72.9 | Date 10/6/67

TRIAXIAL COMPRESSION TEST REPORT

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

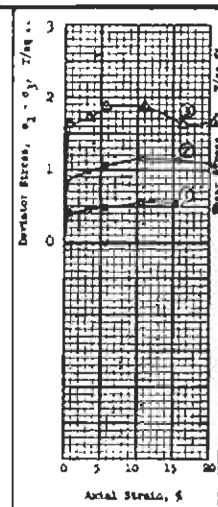
UNDISTURBED BORING 15-CU-"Q" TEST DATA

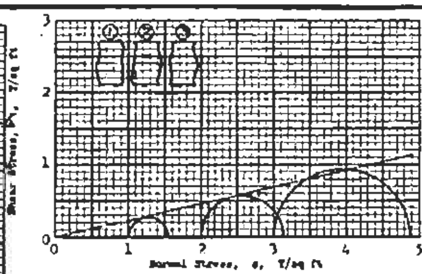
SCALED AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC.
ENGINEERS AND ARCHITECTS
NEW ORLEANS, LA

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

DATE SEPTEMBER 1968 | FILE NO. H-2-24306





Normal Stress, σ, T/sq ft

Test No.			1	2	3	
Initial	Water content	w_o	79.3 %	71.6 %	64.1 %	%
	Void ratio	e_o	2.22	1.98	1.80	
	Saturation	S_o	98.5 %	99.7 %	98.1 %	%
	Dry density, lb/cu ft	γ_d	55.4	57.6	61.4	
Before Shear	Water content	w_c	65.1 %	50.0 %	40.1 %	%
	Void ratio	e_c	1.92	1.45	1.11	
	Saturation	S_c	93.2*%	95.1*%	99.4 %	%
	Final back pressure, psi	u_o	40	40	40	
	Dry Density lb/cu ft	γ_d	58.8	70.2	81.4	
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	1.0	2.0	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.56	1.15	1.88	
Time to failure, min		t_f	86	82	45	
Rate of strain, percent/min			0.12	0.13	0.13	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.37	1.37	1.37	
Initial height, in.		H_o	3.00	3.00	3.00	

Axial Strain, %

Shear Strength Parameters

φ = 13 °

tan φ = 0.231

c = 0 T/sq ft

Method of saturation BP

☐ Controlled stress

☒ Controlled strain

Type of test R | Type of specimen UNDISTURBED

Classification CLAY (CH), gray, contains a small amount of organic matter

LL — | PL — | PI — | G_s 2.75 Ex = 0

Remarks * Pore pressure indicated 100% saturation

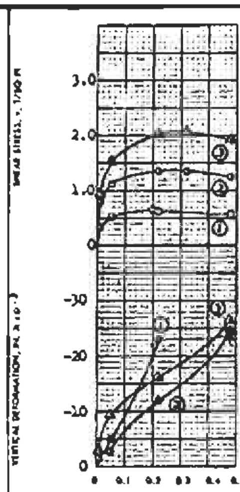
Project LAKE PONTCHARTRAIN & VIC. HURRICANE PROTECTION

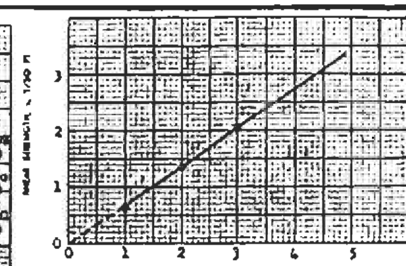
Area CHALMETTE LEVEE EXTENSION

Boring No. 15-CU | Sample No. 6-C

Depth, ft 22.2 | Date 12 OCTOBER 1967

SH TRIAXIAL COMPRESSION TEST REPORT





Normal stress, σ, T/sq ft

Test No.			1	2	3	
Initial	Water content	w_o	32.7 %	33.1 %	32.4 %	%
	Void ratio	e_o	0.896	0.875	0.850	
	Saturation	S_o	98.5 %	100+ %	100+ %	%
	Dry density, lb/cu ft	γ_d	88.9	89.9	91.1	
Void ratio after consolidation		e_c				
Time for 50 percent consolidation, min		t_{50}	<1	<1	<1	
Final	Water content	w_f	29.4 %	27.4 %	27.4 %	%
	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}	0.64	1.37	2.06	
Actual time to failure, min		t_f	1200	1860	1860	
Rate of strain, in./min			.00018	.00018	.00018	
Ultimate shear stress, T/sq ft		τ_{ult}				

Horiz. deformation, in

Shear strength parameters

φ' = 35°

tan φ' = 0.700

c' = 0.0 T/sq ft

☐ Controlled stress

☒ Controlled strain

Type of specimen UNDISTURBED | 3.00 in square | 0.562 in thick

Classification SILT (ML), gray

LL — | PL — | PI — | G_s 2.70

Remarks

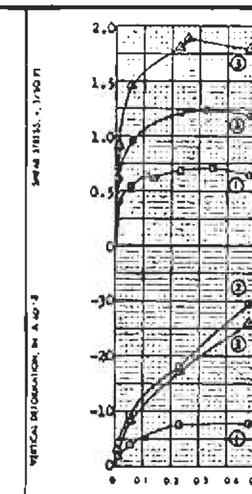
Project LAKE PONTCHARTRAIN & VIC. HURRICANE PROTECTION

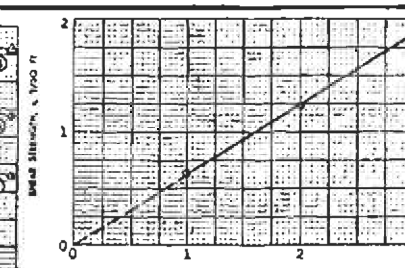
Area CHALMETTE LEVEE EXTENSION

Boring No. 15CU | Sample No. 4 B

Depth, ft 13.0 | Date 2 Oct. 1967

B.W.G. DIRECT SHEAR TEST REPORT





Normal stress, σ, T/sq ft

Test No.			1	2	3	
Initial	Water content	w_o	35.3 %	35.7 %	34.6 %	%
	Void ratio	e_o	1.025	1.038	1.038	
	Saturation	S_o	92.0 %	91.8 %	89.0 %	%
	Dry density, lb/cu ft	γ_d	82.3	81.8	81.8	
Void ratio after consolidation		e_c				
Time for 50 percent consolidation, min		t_{50}	<1	<1	<1	
Final	Water content	w_f	33.4 %	33.9 %	34.7 %	%
	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	1.24	1.89	
Actual time to failure, min		t_f	660	1860	1500	
Rate of strain, in./min			.00017	.00017	.00017	
Ultimate shear stress, T/sq ft		τ_{ult}				

Horiz. deformation, in

Shear strength parameters

φ' = 32°

tan φ' = 0.625

c' = 0.0 T/sq ft

☐ Controlled stress

☒ Controlled strain

Type of specimen UNDISTURBED | 3.00 in square | 0.562 in thick

Classification SANDY SILT (ML), gray

LL — | PL — | PI — | G_s 2.67

Remarks

Project LAKE PONTCHARTRAIN & VIC. HURRICANE PROTECTION

Area CHALMETTE LEVEE EXTENSION

Boring No. 15-CU | Sample No. 11C

Depth, ft 41.8 | Date 29 Sept. 1967

B.W.G. DIRECT SHEAR TEST REPORT

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

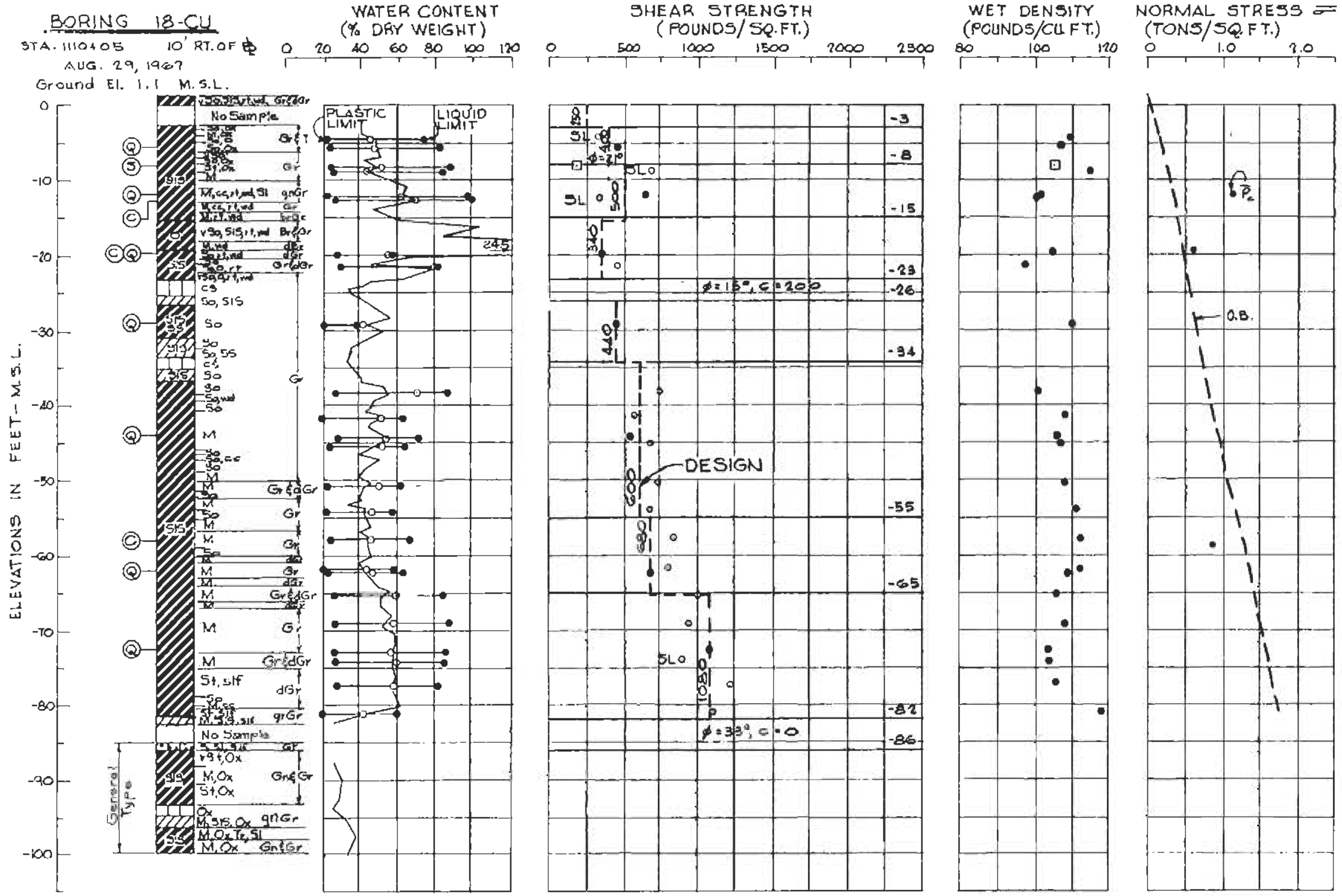
UNDISTURBED BORING 15-CU-"R"&"S" TEST DATA

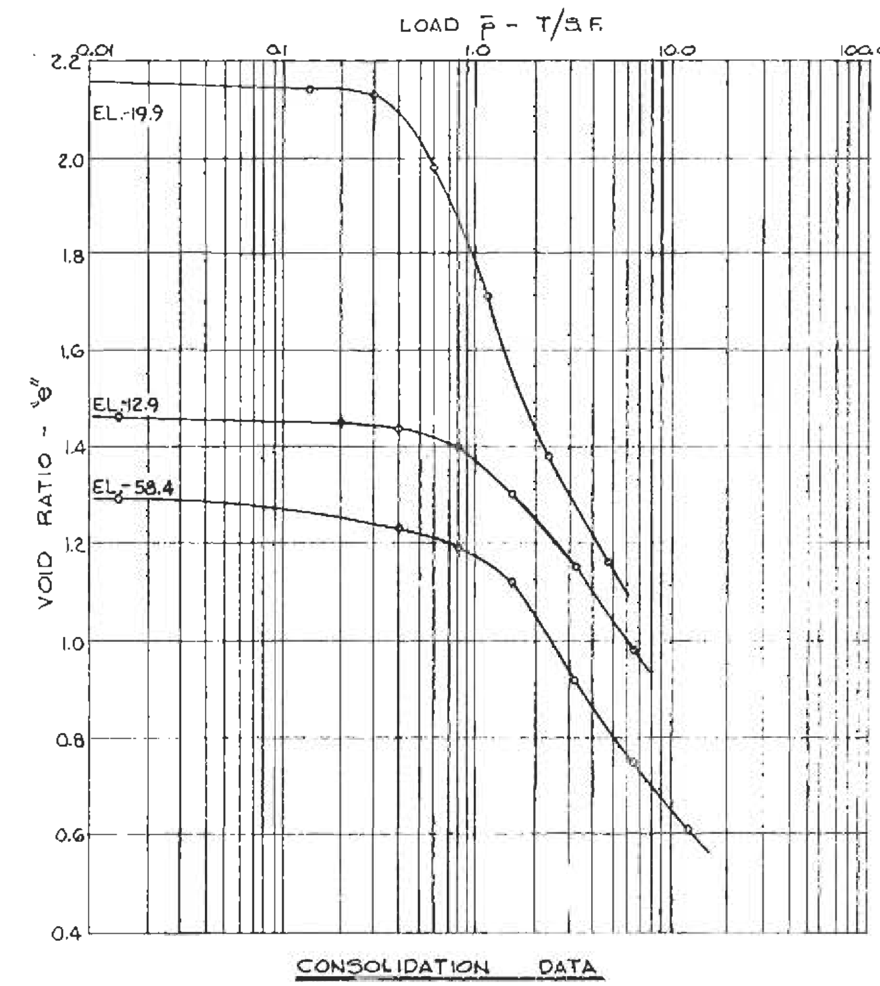
SCALES AS SHOWN

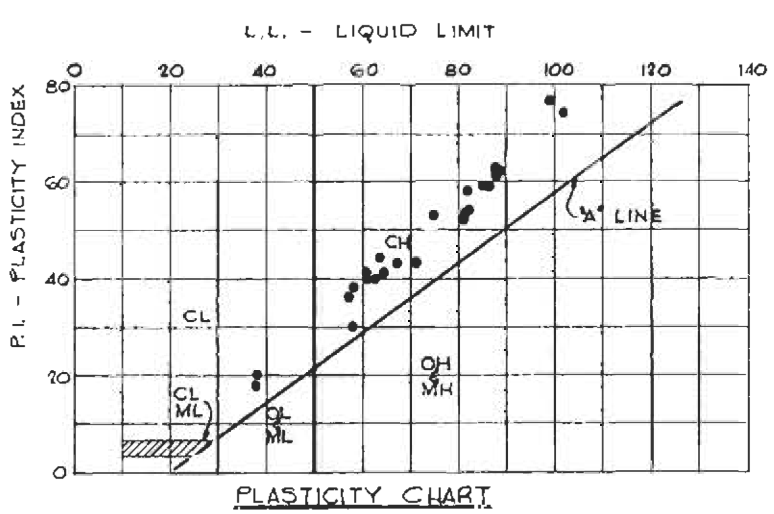
WALDEMAR S. NELSON AND COMPANY INC
ENGINEERS AND ARCHITECTS
NEW ORLEANS LA

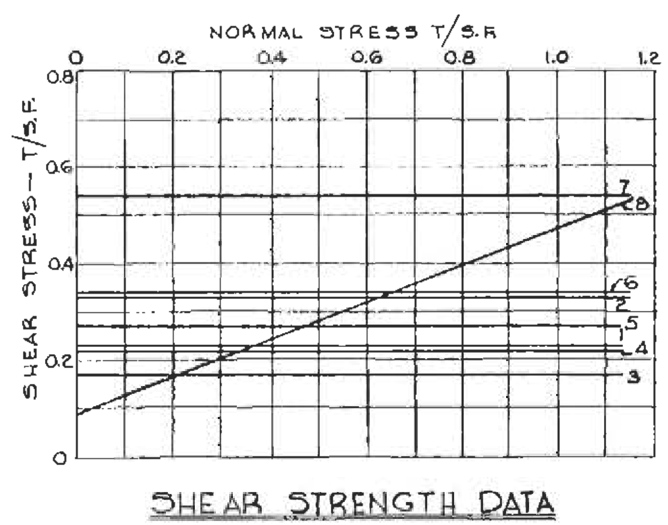
U. S. ARMY ENGINEER DISTRICT NEW ORLEANS
CORPS OF ENGINEERS, U. S. ARMY
NEW ORLEANS, LA

DATE SEPTEMBER 1968 | FILE NO. H-2-24306









ENVELOPE		TYPE	STRENGTH		CLASS
NO.	EL.		φ°	C T.S.F.	
1	-5.6	Q	0	0.23	CH
2	-12.0			0.33	CH
3	-19.9			0.17	CH
4	-29.3			0.22	CH
5	-44.3			0.27	CH
6	-62.3			0.34	CH
7	-72.9			0.54	CH
8	-8.3	S	21	0.09	CH

LAKE PONTCHARTRAIN, LA AND VICINITY
CHALMETTE AREA PLAN

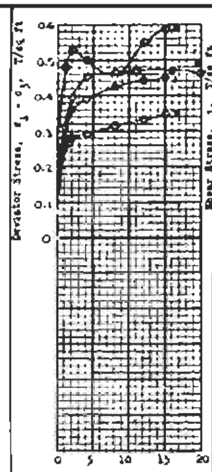
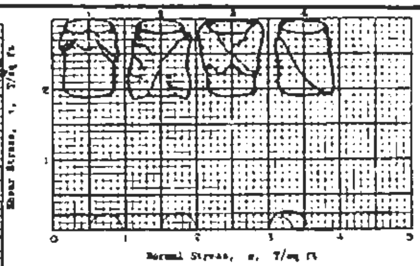
DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

UNDISTURBED BORING 18-CU
TEST DATA

SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC. ENGINEERS AND ARCHITECTS NEW ORLEANS, LA	U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS, U. S. ARMY NEW ORLEANS, LA
DATE SEPTEMBER 1968	FILE NO. H-2-24306

Triaxial Compression Test Report — Boring 18-CU, Sample 2-D

Test No.		1	2	3	4
Initial — Water content	w_o	47.8 %	50.0 %	47.6 %	46.3 %
Initial — Void ratio	e_o	1.37	1.18	1.32	1.12
Initial — Saturation	S_o	94.6 %	98.2 %	97.7 %	96.1 %
Initial — Dry density, lb/cu ft	γ_d	71.4	71.2	73.0	72.9
Before Shear — Water content	w_c	%	%	%	%
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	0.50	1.50	3.00	3.00
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.45	0.43	0.36	0.51
Time to failure, min	t_f	32	12	24	16
Rate of strain, percent/min		0.47	0.96	0.63	0.97
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.41	1.41	1.41	1.41
Initial height, in.	H_o	3.00	3.00	3.00	3.00

Axial Strain, %

Shear Strength Parameters
ϕ = 0 °
tan ϕ = 0
c = 0.53 T/sq ft

Method of saturation ______

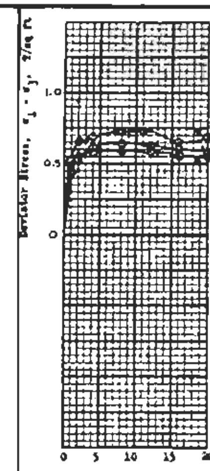
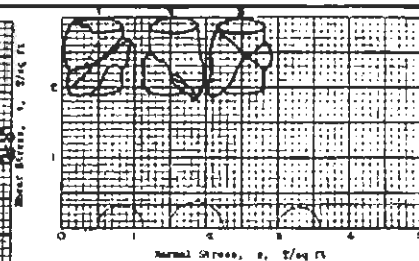
☐ Controlled stress
☑ Controlled strain

Type of test Q | Type of specimen UNDISTURBED
Classification GRAY AND TAN CLAY (CH), CRUMBLY STRUCTURE
LL 82 | PL 24 | PI 58 | G_s 2.71

Remarks

Project LAKE PONTCHARTRAIN & VIC.
HURRICANE PROTECTION
Area CHALMETTE LEVEE EXTENSION
Boring No. 18-CU | Sample No. 2-D
Depth 6.7 | Date 10/6/67
TRIAXIAL COMPRESSION TEST REPORT

Triaxial Compression Test Report — Boring 18-CU, Sample 4-B

Test No.		1	2	3	
Initial — Water content	w_o	61.1 %	60.3 %	60.1 %	%
Initial — Void ratio	e_o	1.69	1.66	1.64	
Initial — Saturation	S_o	96.2 %	97.8 %	98.5 %	%
Initial — Dry density, lb/cu ft	γ_d	61.8	62.3	63.0	
Before Shear — Water content	w_c	%	%	%	%
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	0.50	1.50	3.00	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.65	0.73	0.60	
Time to failure, min	t_f	15	24	16	
Rate of strain, percent/min		0.62	0.61	0.63	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.41	1.41	1.41	
Initial height, in.	H_o	3.00	3.00	3.00	

Axial Strain, %

Shear Strength Parameters
ϕ = 0 °
tan ϕ = 0
c = 0.33 T/sq ft

Method of saturation ______

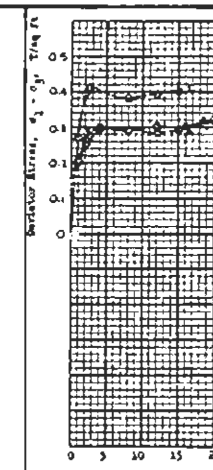
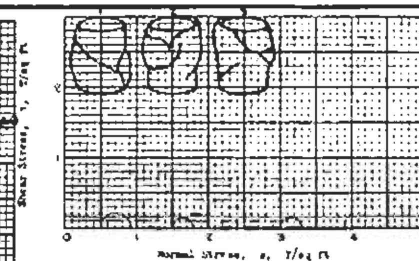
☐ Controlled stress
☑ Controlled strain

Type of test Q | Type of specimen UNDISTURBED
Classification GRAY CLAY (CH), W/ MANY SMALL TAN SAND POCKETS, ORG. MAT. & ROOTS
LL 99 | PL 22 | PI 77 | G_s 2.64

Remarks

Project LAKE PONTCHARTRAIN & VIC.
HURRICANE PROTECTION
Area CHALMETTE LEVEE EXTENSION
Boring No. 18-CU | Sample No. 4-B
Depth 13.1 | Date 10/7 & 10/9/67
TRIAXIAL COMPRESSION TEST REPORT

Triaxial Compression Test Report — Boring 18-CU, Sample 6-B

Test No.		1	2	3	
Initial — Water content	w_o	55.6 %	55.2 %	55.6 %	%
Initial — Void ratio	e_o	1.48	1.46	1.51	
Initial — Saturation	S_o	100+ %	100+ %	100+ %	%
Initial — Dry density, lb/cu ft	γ_d	67.1	68.4	66.0	
Before Shear — Water content	w_c	%	%	%	%
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	0.50	1.50	3.00	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.41	0.30	0.32	
Time to failure, min	t_f	3	14	35	
Rate of strain, percent/min		0.90	0.19	0.09	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.41	1.41	1.41	
Initial height, in.	H_o	3.00	3.00	3.00	

Axial Strain, %

Shear Strength Parameters
ϕ = 0 °
tan ϕ = 0
c = 0.17 T/sq ft

Method of saturation ______

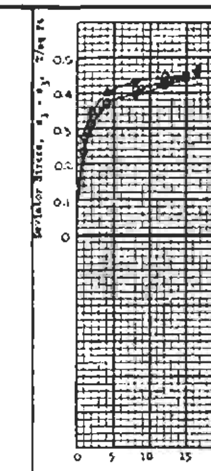
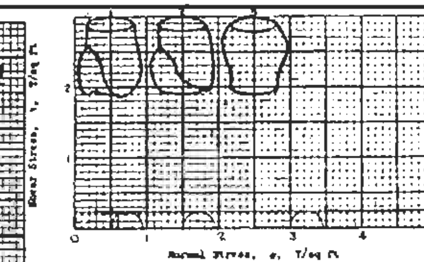
☐ Controlled stress
☑ Controlled strain

Type of test Q | Type of specimen UNDISTURBED
Classification GRAY CLAY (CH), W/ SMALL ROOTS
LL 58 | PL 28 | PI 30 | G_s 2.69

Remarks

Project LAKE PONTCHARTRAIN & VIC.
HURRICANE PROTECTION
Area CHALMETTE LEVEE EXTENSION
Boring No. 18-CU | Sample No. 6-B
Depth 21.0 | Date 10/5/67
TRIAXIAL COMPRESSION TEST REPORT

Triaxial Compression Test Report — Boring 18-CU, Sample 8-B

Test No.		1	2	3	
Initial — Water content	w_o	41.4 %	42.7 %	41.8 %	%
Initial — Void ratio	e_o	1.12	1.24	1.14	
Initial — Saturation	S_o	99.1 %	92.3 %	98.3 %	%
Initial — Dry density, lb/cu ft	γ_d	78.6	74.5	78.3	
Before Shear — Water content	w_c	%	%	%	%
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	0.50	1.50	3.00	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.44	0.44	0.45	
Time to failure, min	t_f	16	16	16	
Rate of strain, percent/min		0.96	0.97	0.97	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.41	1.41	1.41	
Initial height, in.	H_o	3.00	3.00	3.00	

Axial Strain, %

Shear Strength Parameters
ϕ = 0 °
tan ϕ = 0
c = 0.22 T/sq ft

Method of saturation ______

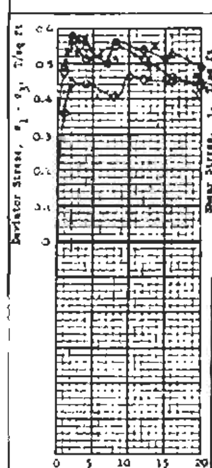
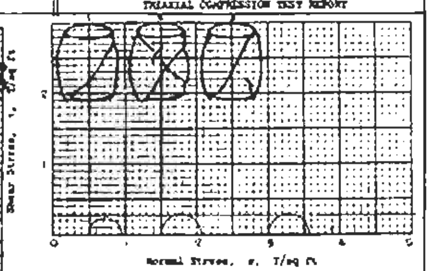
☐ Controlled stress
☐ Controlled strain

Type of test Q | Type of specimen UNDISTURBED
Classification GRAY CLAY (CH), & GRAY FINE SAND, (SC.), IN ALTERNATING THIN LAYERS
LL 38 | PL 20 | PI 18 | G_s 2.68

Remarks

Project LAKE PONTCHARTRAIN & VIC.
HURRICANE PROTECTION
Area CHALMETTE LEVEE EXTENSION
Boring No. 18-CU | Sample No. 8-B
Depth 30.4 | Date 10/9/67
TRIAXIAL COMPRESSION TEST REPORT

Triaxial Compression Test Report — Boring 18-CU, Sample 12-A

Test No.		1	2	3	
Initial — Water content	w_o	54.5 %	57.1 %	53.5 %	%
Initial — Void ratio	e_o	1.49	1.49	1.47	
Initial — Saturation	S_o	99.5 %	99.5 %	99.0 %	%
Initial — Dry density, lb/cu ft	γ_d	68.2	69.6	68.7	
Before Shear — Water content	w_c	%	%	%	%
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	0.50	1.50	3.00	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.46	0.57	0.58	
Time to failure, min	t_f	35	18	18	
Rate of strain, percent/min		0.39	0.11	0.11	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.41	1.41	1.41	
Initial height, in.	H_o	3.00	3.00	3.00	

Axial Strain, %

Shear Strength Parameters
ϕ = 0 °
tan ϕ = 0
c = 0.27 T/sq ft

Method of saturation ______

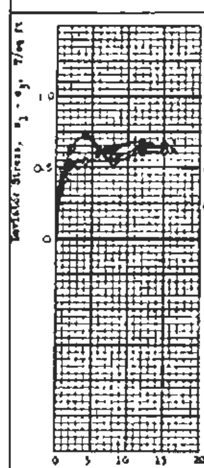
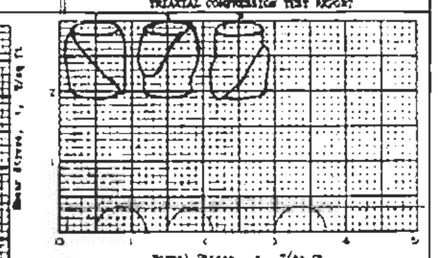
☐ Controlled stress
☑ Controlled strain

Type of test Q | Type of specimen UNDISTURBED
Classification GRAY CLAY (CH) HOMOGENEOUS
LL 71 | PL 28 | PI 43 | G_s 2.72

Remarks

Project LAKE PONTCHARTRAIN & VIC.
HURRICANE PROTECTION
Area CHALMETTE LEVEE EXTENSION
Boring No. 18-CU | Sample No. 12-A
Depth 45.4 | Date 10/10/67
TRIAXIAL COMPRESSION TEST REPORT

Triaxial Compression Test Report — Boring 18-CU, Sample 16-D

Test No.		1	2	3	
Initial — Water content	w_o	46.6 %	46.4 %	47.2 %	%
Initial — Void ratio	e_o	1.28	1.28	1.27	
Initial — Saturation	S_o	98.7 %	98.2 %	100+ %	%
Initial — Dry density, lb/cu ft	γ_d	74.1	74.3	74.3	
Before Shear — Water content	w_c	%	%	%	%
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	0.50	1.50	3.00	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.78	0.68	0.71	
Time to failure, min	t_f	11	52	16	
Rate of strain, percent/min		0.45	0.19	0.46	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.41	1.41	1.41	
Initial height, in.	H_o	3.00	3.00	3.00	

Axial Strain, %

Shear Strength Parameters
ϕ = 0 °
tan ϕ = 0
c = 0.34 T/sq ft

Method of saturation ______

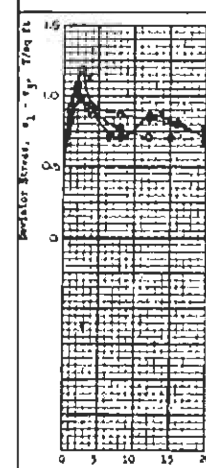
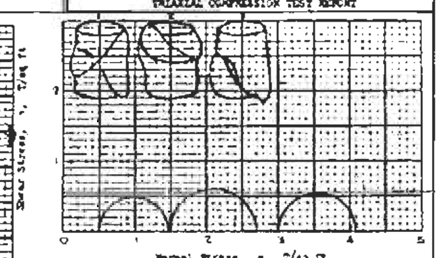
☐ Controlled stress
☑ Controlled strain

Type of test Q | Type of specimen UNDISTURBED
Classification GRAY CLAY (CH), W/ SILT SEAMS
LL 63 | PL 23 | PI 40 | G_s 2.71

Remarks

Project LAKE PONTCHARTRAIN & VIC.
HURRICANE PROTECTION
Area CHALMETTE LEVEE EXTENSION
Boring No. 18-CU | Sample No. 16-D
Depth 63.4 | Date 10/11/67
TRIAXIAL COMPRESSION TEST REPORT

Triaxial Compression Test Report — Boring 18-CU, Sample 19-B

Test No.		1	2	3	
Initial — Water content	w_o	56.1 %	56.5 %	58.0 %	%
Initial — Void ratio	e_o	1.53	1.56	1.59	
Initial — Saturation	S_o	100+ %	98.9 %	99.6 %	%
Initial — Dry density, lb/cu ft	γ_d	67.3	66.7	65.7	
Before Shear — Water content	w_c	%	%	%	%
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	0.50	1.50	3.00	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.99	1.19	1.07	
Time to failure, min	t_f	10	12	14	
Rate of strain, percent/min		0.43	0.23	0.15	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.41	1.41	1.41	
Initial height, in.	H_o	3.00	3.00	3.00	

Axial Strain, %

Shear Strength Parameters
ϕ = 0 °
tan ϕ = 0
c = 0.54 T/sq ft

Method of saturation ______

☐ Controlled stress
☑ Controlled strain

Type of test Q | Type of specimen UNDISTURBED
Classification GRAY CLAY (CH), W/ TAN VERT. SILT PARTINGS
LL 86 | PL 27 | PI 59 | G_s 2.73

Remarks

Project LAKE PONTCHARTRAIN & VIC.
HURRICANE PROTECTION
Area CHALMETTE LEVEE EXTENSION
Boring No. 18-CU | Sample No. 19-B
Depth 74.0 | Date 10/11 & 10/14/67
TRIAXIAL COMPRESSION TEST REPORT

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

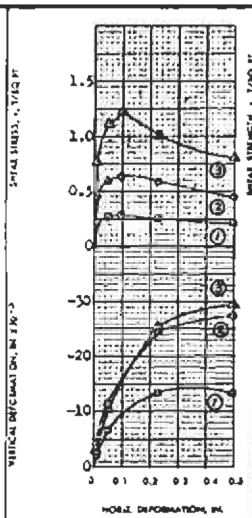
UNDISTURBED BORING 18-CU-"Q" TEST DATA

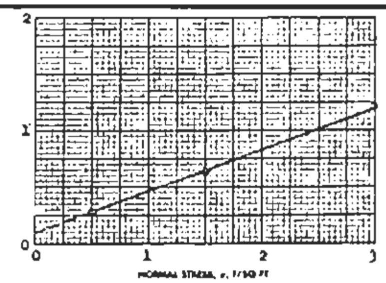
SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC.
ENGINEERS AND ARCHITECTS
NEW ORLEANS, LA.

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

DATE SEPTEMBER 1968 | FILE NO. H-2-24306





SHEAR STRENGTH PARAMETERS

φ = 21°

tan φ = 0.384

c = 0.09 T/SQ FT

☐ CONTROLLED STRESS

☒ CONTROLLED STRAIN

TEST NO.			1	2	3	
INITIAL	WATER CONTENT	w_o	53.6%	52.4%	48.1%	%
	VOID RATIO	e_o	1.466	1.434	1.390	
	SATURATION	S_o	99.1%	99.0%	93.8%	%
	DRY DENSITY, LB/CU FT	γ_d	68.6	69.5	70.8	
VOID RATIO AFTER CONSOLIDATION		e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN		t_{50}	<1	<1	2.0	
FINAL	WATER CONTENT	w_f	50.5%	44.8%	40.2%	%
	VOID RATIO	e_f				
	SATURATION	S_f	%	%	%	%
NORMAL STRESS, T/SQ FT		σ	0.5	1.5	3.0	
MAXIMUM SHEAR STRESS, T/SQ FT		τ_{max}	0.28	0.64	1.22	
ACTUAL TIME TO FAILURE, MIN		t_f	570	570	600	
RATE OF STRAIN, IN./MIN			.00018	.00018	.00018	
ULTIMATE SHEAR STRESS, T/SQ FT		τ_{ult}				

TYPE OF SPECIMEN	UNDISTURBED	3.00 IN. SQUARE	0.560 IN. THICK
CLASSIFICATION	CLAY (CH), grey, homogeneous		
LL 88	PL 25	PI 63	G_s 2.71

REMARKS

PROJECT	LAKE PONTCHARTRAIN & VIC. HURRICANE PROTECTION
AREA	CHALMETTE LEVEE EXTENSION
BORING NO. 18-CU	SAMPLE NO. 3-B
DEPTH, FT 9.4	DATE
W.J.H.	DIRECT SHEAR TEST REPORT

LAKE PONTCHARTRAIN, LA. AND VICINITY

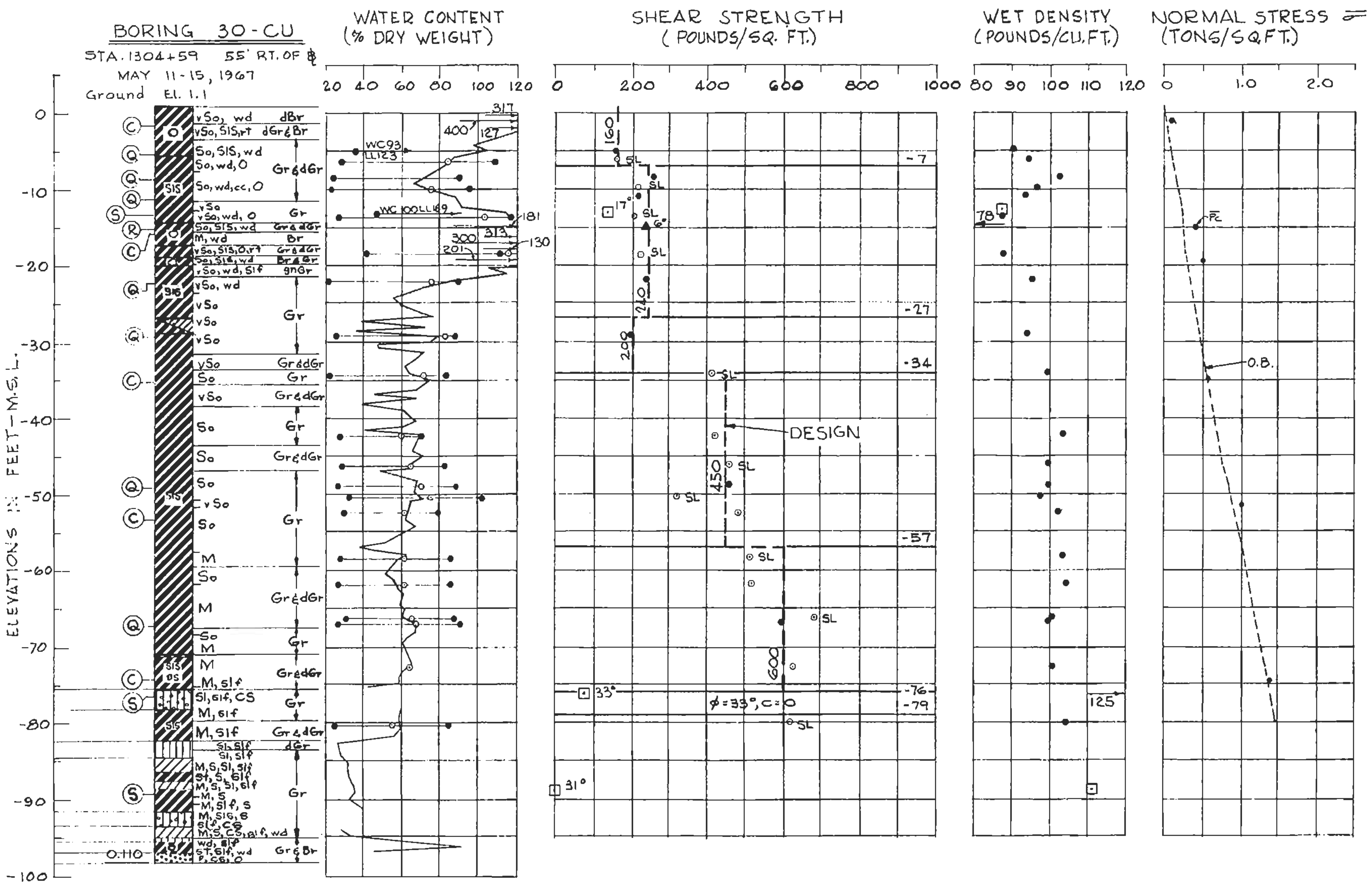
CHALMETTE AREA PLAN

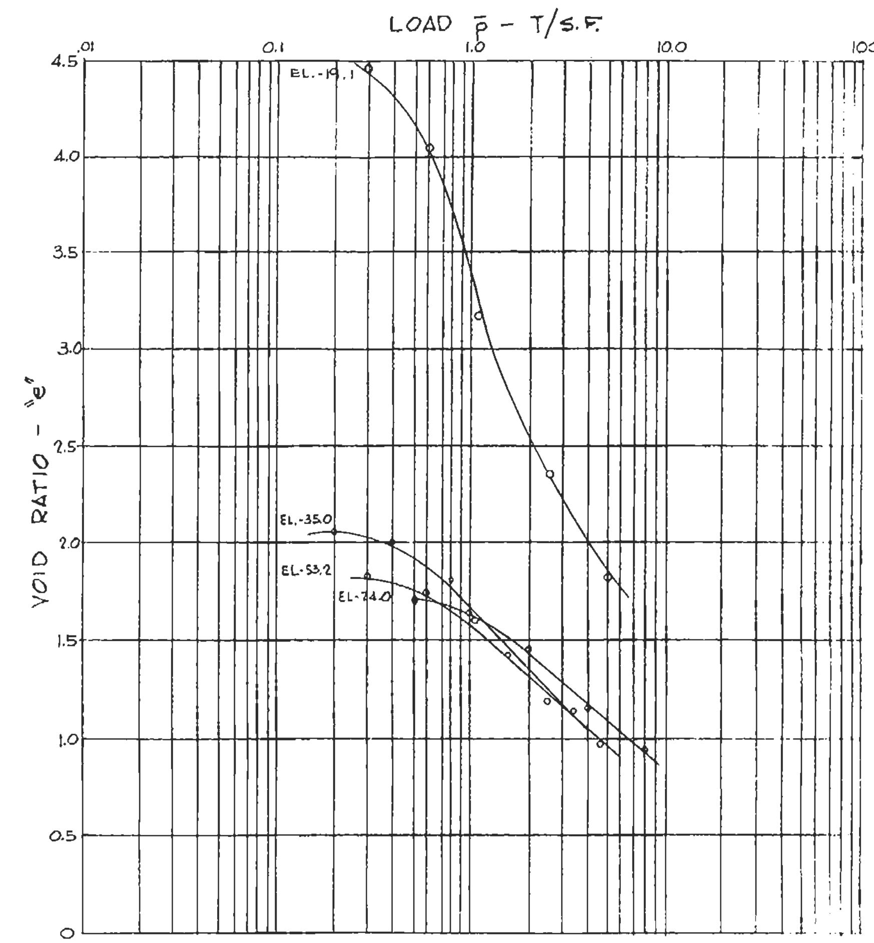
DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

UNDISTURBED BORING 18-CU-"S" TEST DATA

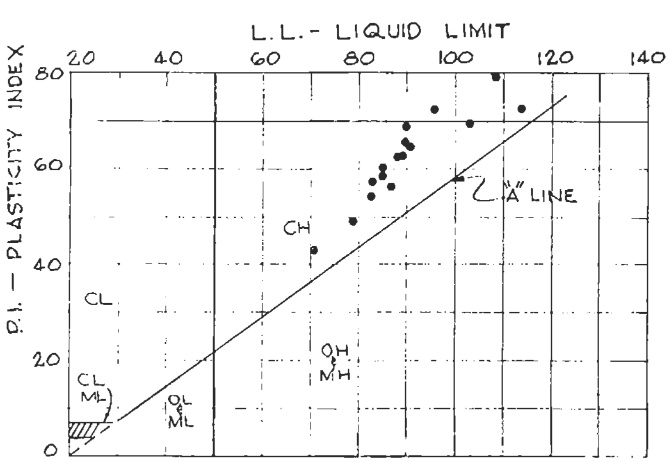
SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC. ENGINEERS AND ARCHITECTS NEW ORLEANS, LA.	U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS, U.S. ARMY NEW ORLEANS, LA.
DATE SEPTEMBER 1966	FILE NO. H-2-24306

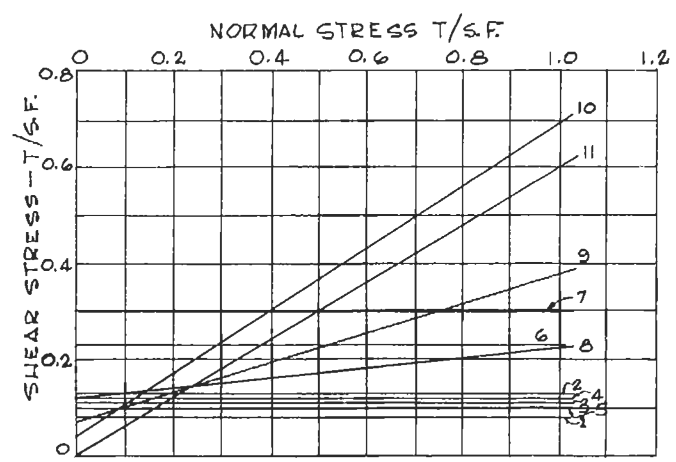




CONSOLIDATION DATA



PLASTICITY CHART



SHEAR STRENGTH DATA

ENVELOPE NO.	EL.	TYPE	STRENGTH φ°	STRENGTH c (T/SF)	CLASS
1	-5.0	Q	0	0.08	CH
2	-8.4			0.13	CH
3	-11.0			0.11	CH
4	-21.9			0.12	CH
5	-29.2			0.10	CH
6	-48.9			0.23	CH
7	-67.0		0	0.30	CH
8	-14.9	R	6	0.12	CH
9	-13.1		17	0.07	CH
10	-76.4	S	33	0.04	SM
11	-89.1		31	0	CL

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

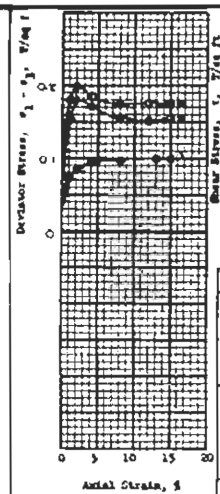
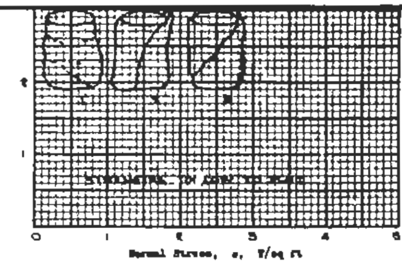
UNDISTURBED BORING 30-CU
TEST DATA

SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC. ENGINEERS AND ARCHITECTS NEW ORLEANS, LA.

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

DATE: SEPTEMBER 1968 FILE NO. H-2-24306

Test No.			1	2	3	
Initial	Water content	w_o	111.3 %	95.8 %	91.2 %	%
	Void ratio	e_o	3.06	2.64	2.51	
	Saturation	S_o	98.6 %	97.8 %	98.5 %	%
	Dry density, lb/cu ft	γ_d	41.7	46.5	48.2	
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	0.50	1.50	3.00	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.10	0.20	0.18	
Time to failure, min		t_f	14	2	4	
Rate of strain, percent/min			0.96	0.85	0.43	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.41	1.41	1.41	
Initial height, in.		H_o	3.00	3.00	3.00	

Shear Strength Parameters

ϕ = 0 °

tan ϕ = 0

c = 0.08 T/sq ft

Method of saturation ______

☐ Controlled stress
☑ Controlled strain

Type of test Q | Type of specimen UNDISTURBED

Classification GRAY CLAY (CH), W/ ORGANIC MATTER

LL 123 | PL 36 | PI 87 | G_s 2.71

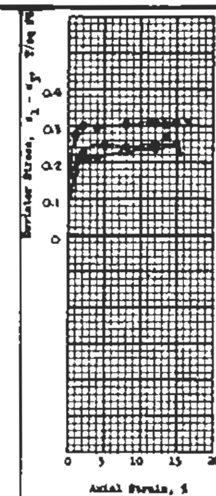
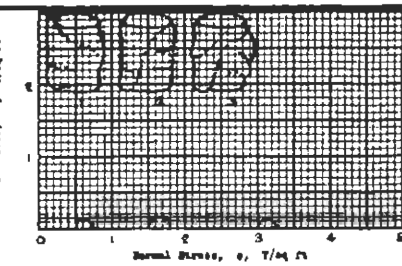
Remarks: Triaxial Compression Test Report

Project LAKE PONTCHARTRAIN & VIC. CHALMETTE LEVEE EXT.

Area

Boring No. 30-CU | Sample No. 2-B

Depth El −5.0 | Date 7/25/67

Test No.			1	2	3	
Initial	Water content	w_o	64.7 %	60.3 %	63.5 %	%
	Void ratio	e_o	1.83	1.57	1.73	
	Saturation	S_o	100+ %	100+ %	100+ %	%
	Dry density, lb/cu ft	γ_d	61.2	66.5	62.5	
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	0.50	1.50	3.00	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.25	0.30	0.25	
Time to failure, min		t_f	52	2	8	
Rate of strain, percent/min			0.20	0.96	0.67	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.41	1.41	1.41	
Initial height, in.		H_o	3.00	3.00	3.00	

Shear Strength Parameters

ϕ = 0 °

tan ϕ = 0

c = 0.13 T/sq ft

Method of saturation ______

☐ Controlled stress
☑ Controlled strain

Type of test Q | Type of specimen UNDISTURBED

Classification GRAY CLAY (CH), W/ ORGANIC MATTER

LL 90 | PL 25 | PI 65 | G_s 2.73

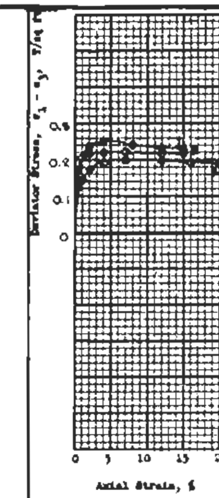
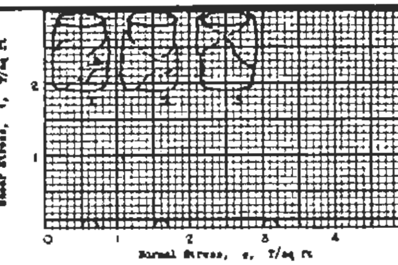
Remarks: Triaxial Compression Test Report

Project LAKE PONTCHARTRAIN & VIC. CHALMETTE LEVEE EXT.

Area

Boring No. 30-CU | Sample No. 3-A

Depth El −8.4 | Date 7/26/67

Test No.			1	2	3	
Initial	Water content	w_o	87.8 %	89.2 %	85.4 %	%
	Void ratio	e_o	2.40	2.46	2.39	
	Saturation	S_o	99.9 %	99.0 %	97.5 %	%
	Dry density, lb/cu ft	γ_d	50.2	49.3	50.8	
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	0.50	1.50	3.00	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.26	0.20	0.23	
Time to failure, min		t_f	9	15	16	
Rate of strain, percent/min			0.47	0.48	0.48	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.41	1.41	1.41	
Initial height, in.		H_o	3.00	3.00	3.00	

Shear Strength Parameters

ϕ = 0 °

tan ϕ = 0

c = 0.11 T/sq ft

Method of saturation ______

☐ Controlled stress
☑ Controlled strain

Type of test Q | Type of specimen UNDISTURBED

Classification GRAY CLAY (CH), W/ ORGANIC MATTER

LL —— | PL —— | PI —— | G_s 2.73

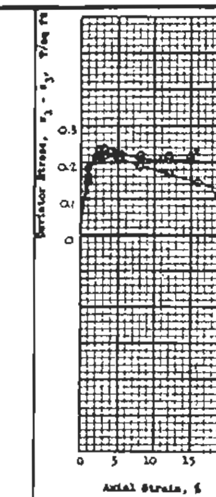
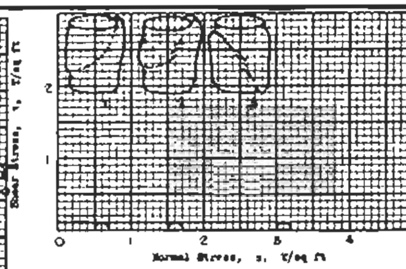
Remarks: Triaxial Compression Test Report

Project LAKE PONTCHARTRAIN & VIC. CHALMETTE LEVEE EXT.

Area

Boring No. 30-CU | Sample No. 3-D

Depth El −11.0 | Date 7/26/67

Test No.			1	2	3	
Initial	Water content	w_o	81.0 %	80.5 %	82.0 %	%
	Void ratio	e_o	2.14	2.18	2.18	
	Saturation	S_o	100+ %	100+ %	100+ %	%
	Dry density, lb/cu ft	γ_d	53.4	53.1	52.8	
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	0.50	1.50	3.00	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.22	0.24	0.24	
Time to failure, min		t_f	4	16	14	
Rate of strain, percent/min			0.86	0.19	0.19	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.41	1.41	1.41	
Initial height, in.		H_o	3.00	3.00	3.00	

Shear Strength Parameters

ϕ = 0 °

tan ϕ = 0

c = 0.12 T/sq ft

Method of saturation ______

☐ Controlled stress
☑ Controlled strain

Type of test Q | Type of specimen UNDISTURBED

Classification GRAY CLAY (CH) homogeneous

LL 90 | PL 22 | PI 68 | G_s 2.69

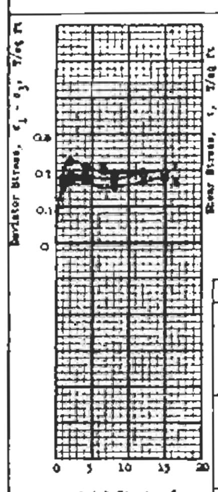
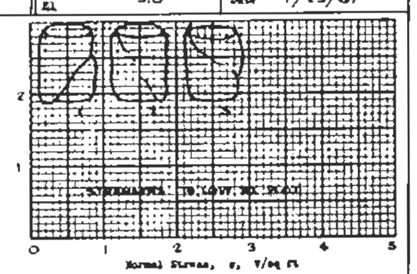
Remarks: Triaxial Compression Test Report

Project LAKE PONTCHARTRAIN & VIC. CHALMETTE LEVEE EXT.

Area

Boring No. 30-CU | Sample No. 6-C

Depth El −21.9 | Date 7/26 & 7/27/67

Test No.			1	2	3	
Initial	Water content	w_o	84.2 %	84.2 %	84.0 %	%
	Void ratio	e_o	2.28	2.28	2.27	
	Saturation	S_o	100+ %	100+ %	100+ %	%
	Dry density, lb/cu ft	γ_d	51.5	51.6	51.8	
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	0.60	1.50	3.00	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.19	0.23	0.18	
Time to failure, min		t_f	10	18	19	
Rate of strain, percent/min			0.17	0.13	0.12	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.41	1.41	1.41	
Initial height, in.		H_o	3.00	3.00	3.00	

Shear Strength Parameters

ϕ = 0 °

tan ϕ = 0

c = 0.10 T/sq ft

Method of saturation ______

☐ Controlled stress
☑ Controlled strain

Type of test Q | Type of specimen UNDISTURBED

Classification GRAY CLAY (CH), homogeneous

LL 88 | PL 28 | PI 62 | G_s 2.71

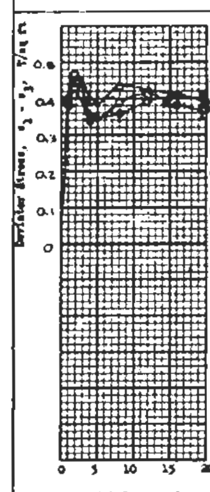
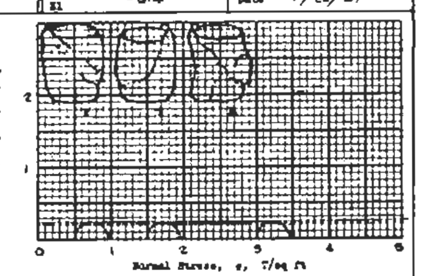
Remarks: Triaxial Compression Test Report

Project LAKE PONTCHARTRAIN & VIC. CHALMETTE LEVEE EXT.

Area

Boring No. 30-CU | Sample No. 8-B

Depth El −29.2 | Date 7/27/67

Test No.			1	2	3	
Initial	Water content	w_o	69.8 %	70.1 %	71.7 %	%
	Void ratio	e_o	1.85	1.87	1.90	
	Saturation	S_o	100+ %	100+ %	100+ %	%
	Dry density, lb/cu ft	γ_d	60.3	59.0	58.4	
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	0.60	1.50	3.00	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.45	0.48	0.47	
Time to failure, min		t_f	12	15	15	
Rate of strain, percent/min			0.17	0.11	0.11	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.41	1.41	1.41	
Initial height, in.		H_o	3.00	3.00	3.00	

Shear Strength Parameters

ϕ = 0 °

tan ϕ = 0

c = 0.23 T/sq ft

Method of saturation ______

☐ Controlled stress
☑ Controlled strain

Type of test Q | Type of specimen UNDISTURBED

Classification GRAY CLAY (CH), homogeneous

LL 89 | PL 27 | PI 62 | G_s 2.71

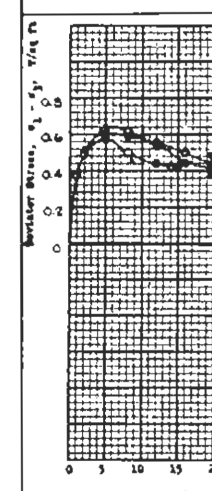
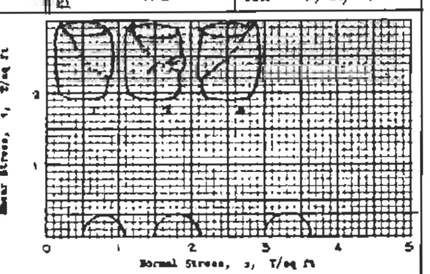
Remarks: Triaxial Compression Test Report

Project LAKE PONTCHARTRAIN & VIC. CHALMETTE LEVEE EXT.

Area

Boring No. 30-CU | Sample No. 12-B

Depth El −46.5 | Date 7/27/67

Test No.			1	2	3	
Initial	Water content	w_o	87.7 %	87.6 %	87.8 %	%
	Void ratio	e_o	1.86	1.86	1.89	
	Saturation	S_o	99.4 %	99.2 %	97.9 %	%
	Dry density, lb/cu ft	γ_d	59.6	59.5	58.9	
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	0.50	1.50	3.00	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.60	0.61	0.68	
Time to failure, min		t_f	19	18	19	
Rate of strain, percent/min			0.27	0.28	0.26	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.41	1.41	1.41	
Initial height, in.		H_o	3.00	3.00	3.00	

Shear Strength Parameters

ϕ = 0 °

tan ϕ = 0

c = 0.30 T/sq ft

Method of saturation ______

☐ Controlled stress
☑ Controlled strain

Type of test Q | Type of specimen UNDISTURBED

Classification GRAY CLAY (CH), homogeneous

LL 91 | PL 27 | PI 64 | G_s 2.73

Remarks: Triaxial Compression Test Report

Project LAKE PONTCHARTRAIN & VIC. CHALMETTE LEVEE EXT.

Area

Boring No. 30-CU | Sample No. 17-D

Depth El −67.0 | Date 7/28/67

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

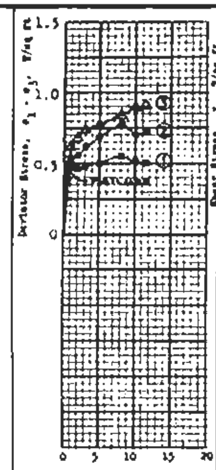
UNDISTURBED BORING 30-CU-"Q" TEST DATA

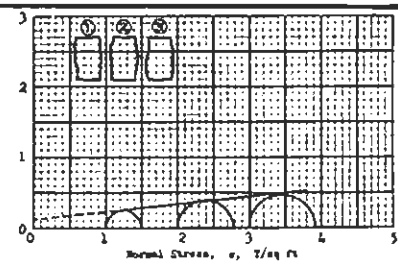
SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY INC.
ENGINEERS AND ARCHITECTS
NEW ORLEANS, LA.

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

DATE SEPTEMBER 1966 | FILE NO. H-2-24306





Test No.			1	2	3	
Initial	Water content	w_o	181.2%	193.8%	186.6%	%
	Void ratio	e_o	4.61	4.96	4.78	
	Saturation	S_o	98.3%	97.7%	97.6%	%
	Dry density, lb/cu ft	γ_d	27.8	26.2	27.0	
Before Shear	Water content	w_c	122.5%	114.9%	100.2%	%
	Void ratio	e_c	2.65	2.43	2.00	
	Saturation	S_c	100+ %	100+ %	100+ %	%
	Final back pressure, PSI	u_o	60	60	60	
	Dry Density lb/cu ft	γ_d	42.8	45.5	52.0	
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	1.0	2.0	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.50	0.78	0.90	
Time to failure, min		t_f	33	267	384	
Rate of strain, percent/min			0.03	0.03	0.03	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.40	1.39	1.39	
Initial height, in.		H_o	3.00	3.00	3.00	

Shear Strength Parameters

φ = 6°

tan φ = 0.105

c = 0.12 T/sq ft

Method of saturation BP

[ ] Controlled stress

[X] Controlled strain

Type of test R — Type of specimen UNDISTURBED

Classification CLAY (CH), gray, w/organic matter

LL -- | PL -- | PI -- | G_s 2.50 FROM Consol

Remarks

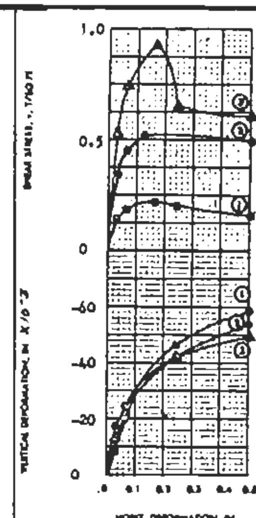
Project LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION

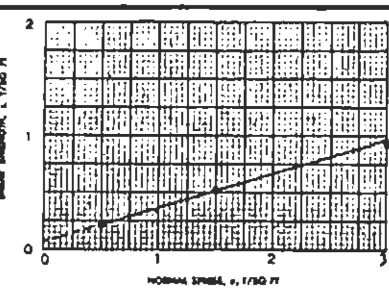
Area CHALMETTE LEVEE EXTENSION

Boring No. 30-CU — Sample No. 4-D

El. - 14.9 — Date 23 JUNE 1967

JL — TRIAXIAL COMPRESSION TEST REPORT





TEST NO.			1	2	3	
Initial	WATER CONTENT	w_o	99.0%	100.9%	100.0%	%
	VOID RATIO	e_o	2.68	2.70	2.66	
	SATURATION	S_o	96.0%	97.2%	97.7%	%
	DRY DENSITY, LB/CU FT	γ_d	44.1	43.8	44.4	
VOID RATIO AFTER CONSOLIDATION		e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN		t_{50}	1	2	6	
Final	WATER CONTENT	w_f	82.1%	65.4%	51.9%	%
	VOID RATIO	e_f				
	SATURATION	S_f	%	%	%	%
NORMAL STRESS, T/SQ FT		σ	0.5	1.5	3.0	
MAXIMUM SHEAR STRESS, T/SQ FT		τ_{max}	0.22	0.52	0.93	
ACTUAL TIME TO FAILURE, MIN		t_f	900	690	900	
RATE OF STRAIN, IN./MIN			.00018	.00018	.00018	
ULTIMATE SHEAR STRESS, T/SQ FT		τ_{ult}				

SHEAR STRENGTH PARAMETERS

φ' = 17°

tan φ' = 0.306

c' = .07 T/SQ FT

[ ] CONTROLLED STRESS

[X] CONTROLLED STRAIN

TYPE OF SPECIMEN UNDISTURBED — 3.01 IN. SQUARE — 0.665 (1), 0.626 (2) (3) IN. THICK

CLASSIFICATION CLAY, (CH), GRAY, WITH ORGANIC MATTER

LL 189 | PL 47 | PI 142 | G_s 2.60

REMARKS

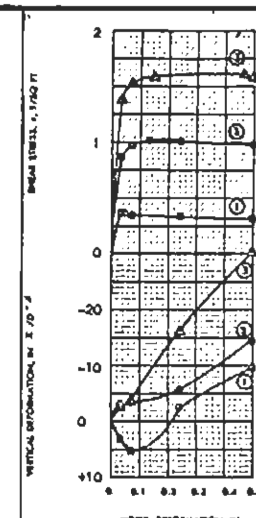
PROJECT LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION PROJECT

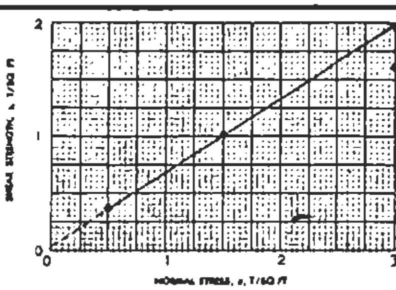
AREA CHALMETTE LEVEE EXTENSION

BORING NO. 30-CU — SAMPLE NO. 4-B

EL. - 13.1 — DATE 17 JULY 1967

WJH & BMG — DIRECT SHEAR TEST REPORT





TEST NO.			1	2	3	
Initial	WATER CONTENT	w_o	25.9%	26.8%	26.6%	%
	VOID RATIO	e_o	0.720	0.646	0.647	
	SATURATION	S_o	94.4%	100+%	100+%	%
	DRY DENSITY, LB/CU FT	γ_d	96.0	100.9	100.8	
VOID RATIO AFTER CONSOLIDATION		e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN		t_{50}	<1	<1	<1	
Final	WATER CONTENT	w_f	26.2%	25.8%	25.8%	%
	VOID RATIO	e_f				
	SATURATION	S_f	%	%	%	%
NORMAL STRESS, T/SQ FT		σ	0.5	1.5	3.0	
MAXIMUM SHEAR STRESS, T/SQ FT		τ_{max}	0.37	1.01	1.61	
ACTUAL TIME TO FAILURE, MIN		t_f	240	690	2580	
RATE OF STRAIN, IN./MIN			.00017	.00017	.00017	
ULTIMATE SHEAR STRESS, T/SQ FT		τ_{ult}				

SHEAR STRENGTH PARAMETERS

φ' = 33°

tan φ' = 0.649

c' = 0.04 T/SQ FT

[ ] CONTROLLED STRESS

[X] CONTROLLED STRAIN

TYPE OF SPECIMEN UNDISTURBED — 3.01 IN. SQUARE — 0.465 IN. THICK

CLASSIFICATION SILTY SAND (SM), GRAY WITH SHELLS

LL —— | PL —— | PI —— | G_s 2.66

REMARKS

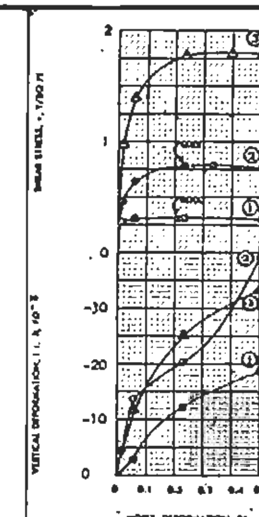
PROJECT LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION PROJECT

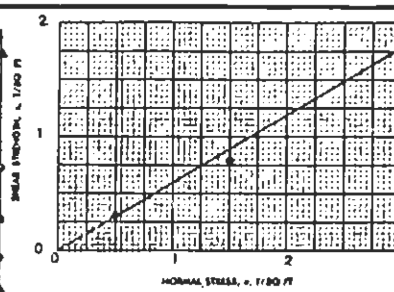
AREA CHALMETTE LEVEE EXTENSION

BORING NO. 30-CU — SAMPLE NO. 20-A

EL. - 76.4 — DATE 17 JULY 1967

WJH & BMG — DIRECT SHEAR TEST REPORT





TEST NO.			1	2	3	
Initial	WATER CONTENT	w_o	37.2%	38.4%	39.4%	%
	VOID RATIO	e_o	1.06	1.15	1.06	
	SATURATION	S_o	95.1%	90.5%	100+%	%
	DRY DENSITY, LB/CU FT	γ_d	82.1	78.7	82.1	
VOID RATIO AFTER CONSOLIDATION		e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN		t_{50}	<1	<1	<1	
Final	WATER CONTENT	w_f	34.7%	34.2%	27.9%	%
	VOID RATIO	e_f				
	SATURATION	S_f	%	%	%	%
NORMAL STRESS, T/SQ FT		σ	0.5	1.5	3.0	
MAXIMUM SHEAR STRESS, T/SQ FT		τ_{max}	0.31	0.78	1.80	
ACTUAL TIME TO FAILURE, MIN		t_f	1200	1860	2220	
RATE OF STRAIN, IN./MIN			.00018	.00018	.00018	
ULTIMATE SHEAR STRESS, T/SQ FT		τ_{ult}				

SHEAR STRENGTH PARAMETERS

φ' = 31°

tan φ' = 0.601

c' = 0 T/SQ FT

[ ] CONTROLLED STRESS

[X] CONTROLLED STRAIN

TYPE OF SPECIMEN UNDISTURBED — 3.01 IN. SQUARE — 0.465 IN. THICK

CLASSIFICATION SILTY CLAY (CL), GRAY, WITH TRACES OF SHELL AND SAND

LL —— | PL —— | PI —— | G_s 2.71

REMARKS

PROJECT LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION PROJECT

AREA CHALMETTE LEVEE EXTENSION

BORING NO. 30-CU — SAMPLE NO. 23-B

EL. -89.1 — DATE 19 JULY 1967

WJH & BMG — DIRECT SHEAR TEST REPORT

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

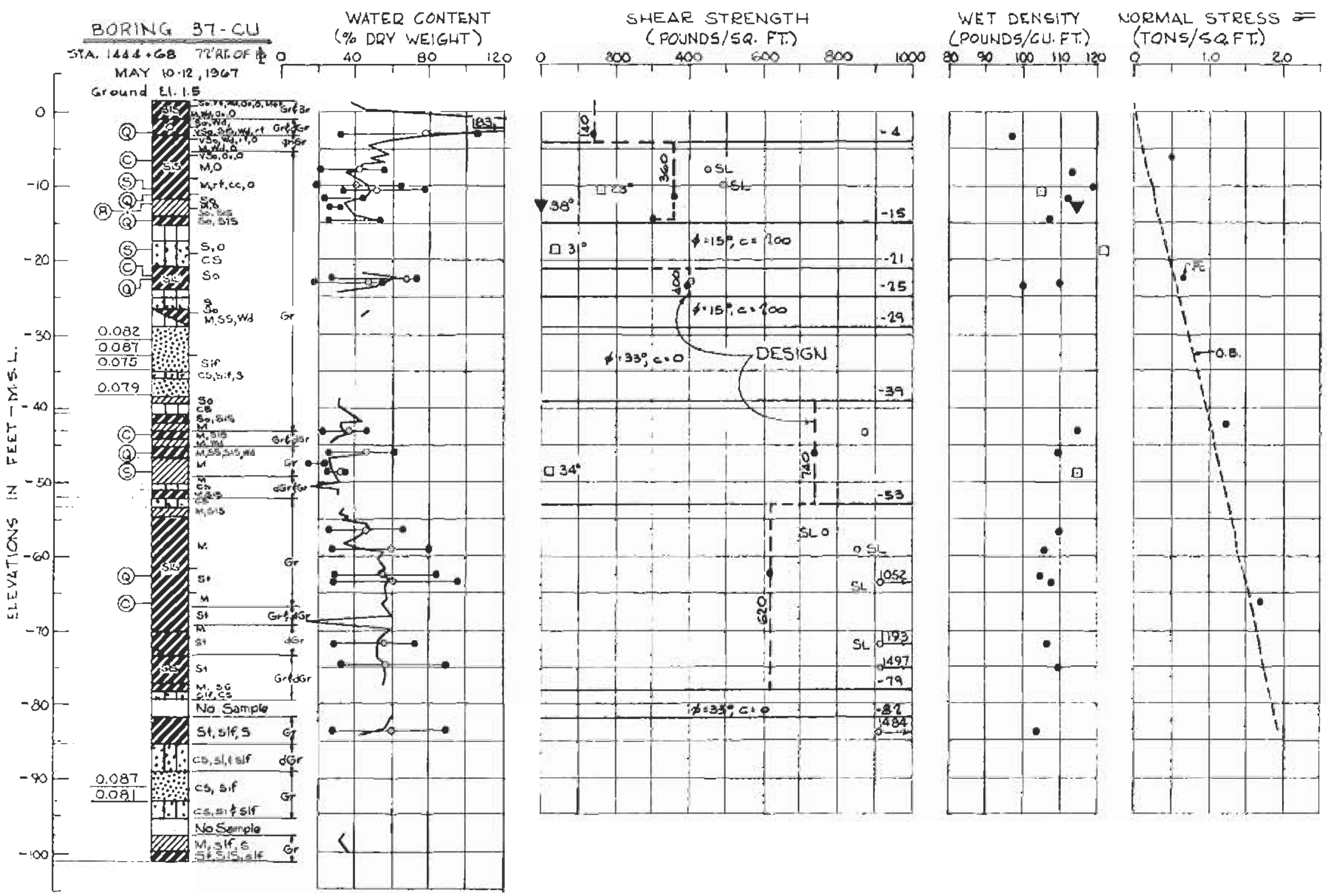
UNDISTURBED BORING 30-CU-"R" & "S" TEST DATA

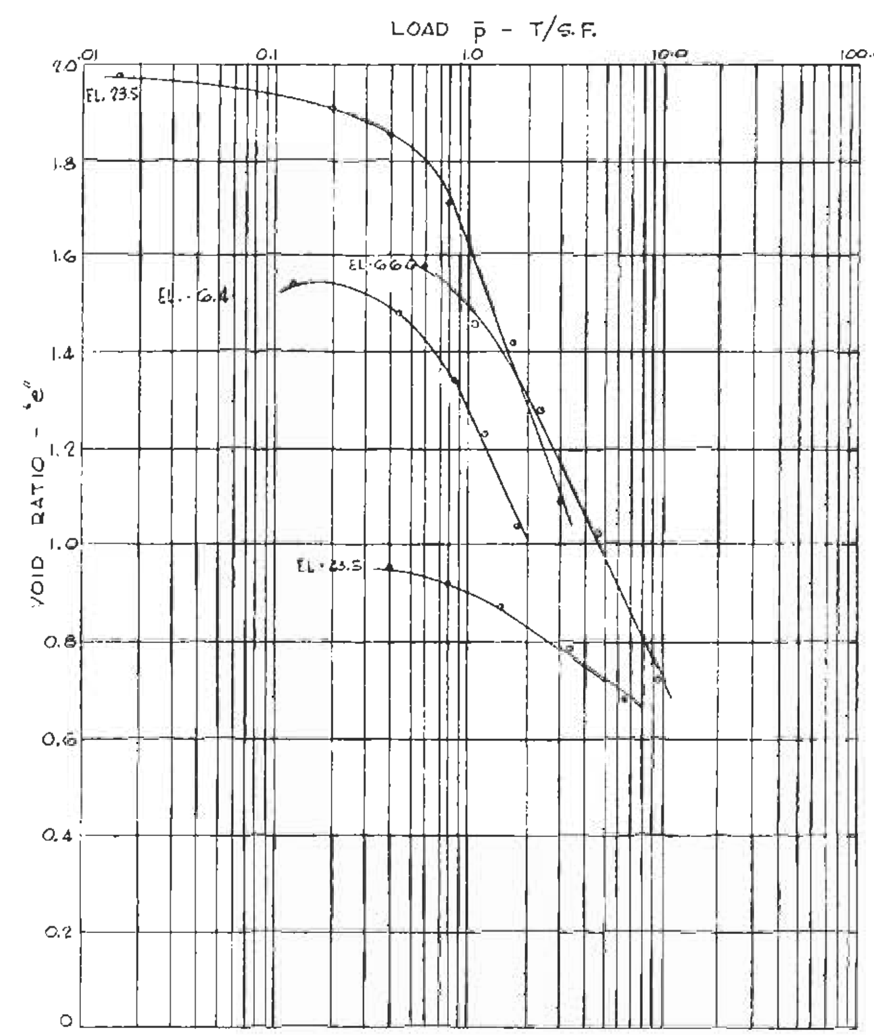
SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC. ENGINEERS AND ARCHITECTS NEW ORLEANS, LA.

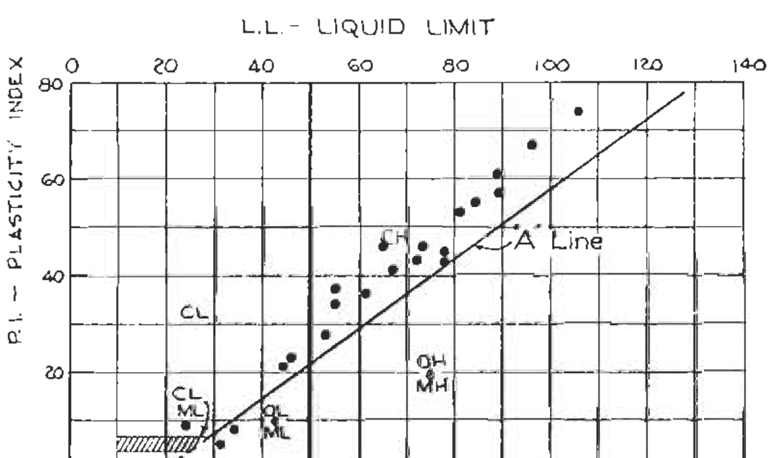
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS, U. S. ARMY NEW ORLEANS, LA.

DATE SEPTEMBER 1968 — FILE NO. H-2-24306

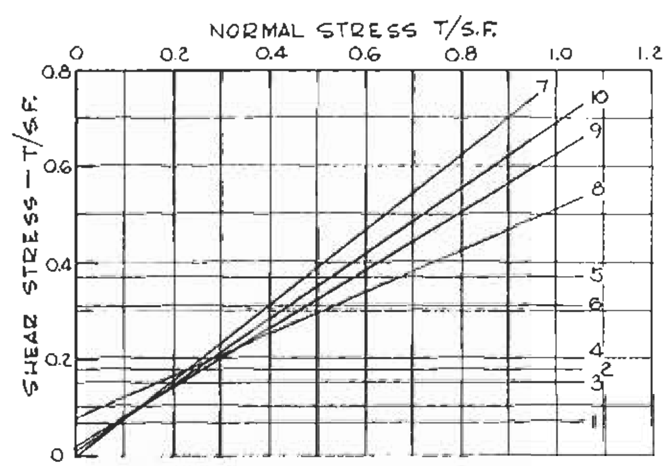




CONSOLIDATION DATA



PLASTICITY CHART



SHEAR STRENGTH DATA

ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH $\phi°$	STRENGTH c (+SF)	CLASS
1	-2.8	Q	0	0.07	CHO
2	-11.4			0.18	CL
3	-14.6			0.15	CH
4	-22.5			0.20	CH
5	-46.5			0.37	CH
6	-62.4		0	0.31	CH
7	-12.4	R	38	0	ML
8	-10.5	S	23	0.08	CH
9	-18.6		31	0.02	SM
10	-48.4		34	0.01	CL

LAKE PONTCHARTRAIN, LA AND VICINITY
CHALMETTE AREA PLAN

DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

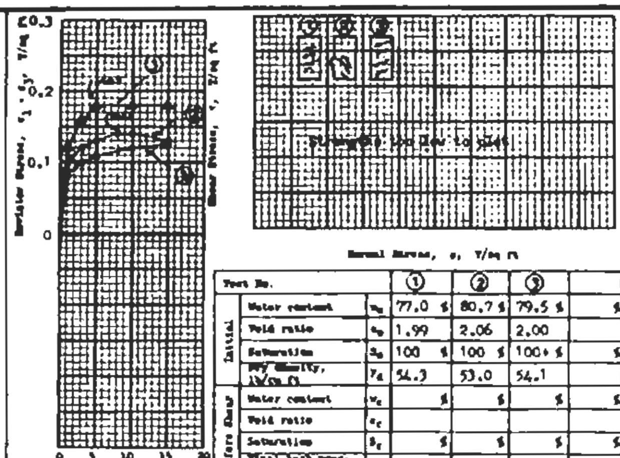
UNDISTURBED BORING 37-CU TEST DATA

SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC.
ENGINEERS AND ARCHITECTS
NEW ORLEANS, LA

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

DATE SEPTEMBER 1968 | FILE NO. H-2-24306



Shear Strength Parameters

φ = 0 °

tan φ = 0

c = 0.07 T/sq ft

Method of saturation ______

[ ] Controlled stress
[X] Controlled strain

Test No.			①	②	③	
Initial	Water content	w_o	77.0 %	80.7 %	79.5 %	%
	Void ratio	e_o	1.99	2.06	2.00	
	Saturation	S_o	100 %	100 %	100+ %	%
	Dry density, lb/cu ft	γ_d	54.3	53.0	54.1	
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	1.5	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.12	0.14	0.18	
Time to failure, min		t_f	16	8	5	
Rate of strain, percent/min			0.96	1.01	0.95	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.38	1.39	1.39	
Initial height, in.		H_o	3.00	3.00	3.00	

Type of test Q | Type of specimen UNDISTURBED

Classification CLAY (CH), gray, mixed w/decayed organic matter

LL 106 | PL 32 | PI 74 | G_s 2.60

Remarks ______

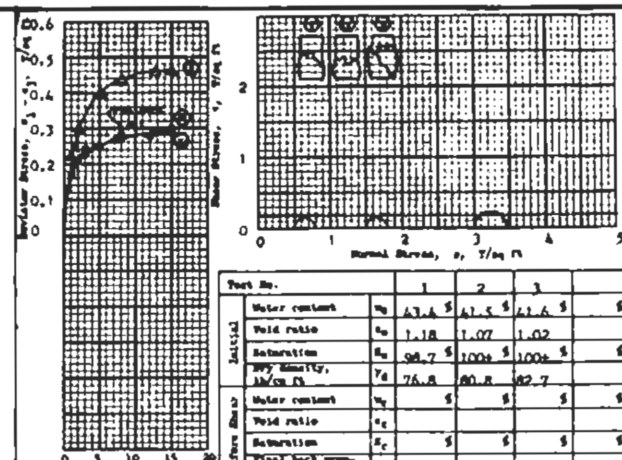
Project LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION

Area CHALMETTE LEVEE EXTENSION

Boring No. 37-CU | Sample No. 2-B

Depth 4.3 | Date 11 July, 1967

RAA TRIAXIAL COMPRESSION TEST REPORT



Shear Strength Parameters

φ = 0 °

tan φ = 0

c = 0.18 T/sq ft

Method of saturation ______

[ ] Controlled stress
[X] Controlled strain

Test No.			1	2	3	
Initial	Water content	w_o	43.4 %	41.5 %	41.6 %	%
	Void ratio	e_o	1.18	1.07	1.02	
	Saturation	S_o	98.7 %	100+ %	100+ %	%
	Dry density, lb/cu ft	γ_d	76.8	80.8	82.7	
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	1.5	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.28	0.30	0.46	
Time to failure, min		t_f	8	16	14	
Rate of strain, percent/min			1.0	0.94	0.94	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.37	1.39	1.40	
Initial height, in.		H_o	3.00	3.00	3.00	

Type of test Q | Type of specimen UNDISTURBED

Classification SILTY CLAY (CL), gray, w/decayed organic matter, fissured

LL 44 | PL 23 | PI 21 | G_s 2.68

Remarks ______

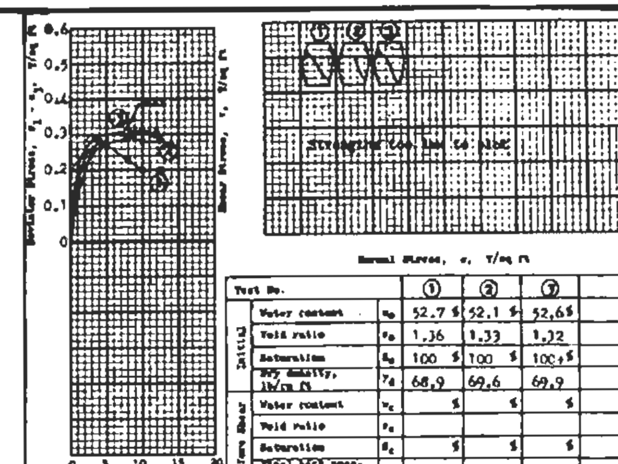
Project LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION

Area CHALMETTE LEVEE EXTENSION

Boring No. 37-CU | Sample No. 4-C

Depth 12.9 | Date 12 JULY 1967

RAA TRIAXIAL COMPRESSION TEST REPORT



Shear Strength Parameters

φ = 0 °

tan φ = 0

c = 0.15 T/sq ft

Method of saturation ______

[ ] Controlled stress
[X] Controlled strain

Test No.			①	②	③	
Initial	Water content	w_o	52.7 %	52.1 %	52.6 %	%
	Void ratio	e_o	1.36	1.33	1.32	
	Saturation	S_o	100 %	100 %	100+ %	%
	Dry density, lb/cu ft	γ_d	68.9	69.6	69.9	
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	1.5	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.28	0.29	0.31	
Time to failure, min		t_f	19	35	36	
Rate of strain, percent/min			0.21	0.23	0.22	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.38	1.37	1.37	
Initial height, in.		H_o	3.00	3.00	3.00	

Type of test Q | Type of specimen UNDISTURBED

Classification CLAY (CH), gray, w/very thin silt layers

LL 53 | PL 25 | PI 28 | G_s 2.60

Remarks ______

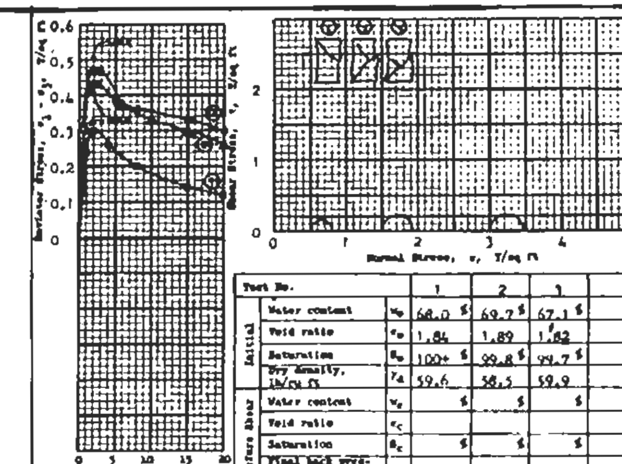
Project LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION

Area CHALMETTE LEVEE EXTENSION

Boring No. 37-CU | Sample No. 5-B_2

Depth 16.1 | Date 11 July, 1967

ESS TRIAXIAL COMPRESSION TEST REPORT



Shear Strength Parameters

φ = 0 °

tan φ = 0

c = 0.20 T/sq ft

Method of saturation ______

[ ] Controlled stress
[X] Controlled strain

Test No.			1	2	3	
Initial	Water content	w_o	68.0 %	69.7 %	67.1 %	%
	Void ratio	e_o	1.84	1.89	1.82	
	Saturation	S_o	100+ %	99.8 %	99.7 %	%
	Dry density, lb/cu ft	γ_d	59.6	58.5	59.9	
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	1.5	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.30	0.43	0.42	
Time to failure, min		t_f	7	10	14	
Rate of strain, percent/min			0.22	0.17	0.13	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.39	1.39	1.39	
Initial height, in.		H_o	3.00	3.00	3.00	

Type of test Q | Type of specimen UNDISTURBED

Classification CLAY (CH), Gray, fissured, contains sand pockets approx.* thic

LL 73 | PL 27 | PI 46 | G_s 2.71

Remarks * ¼" in diameter

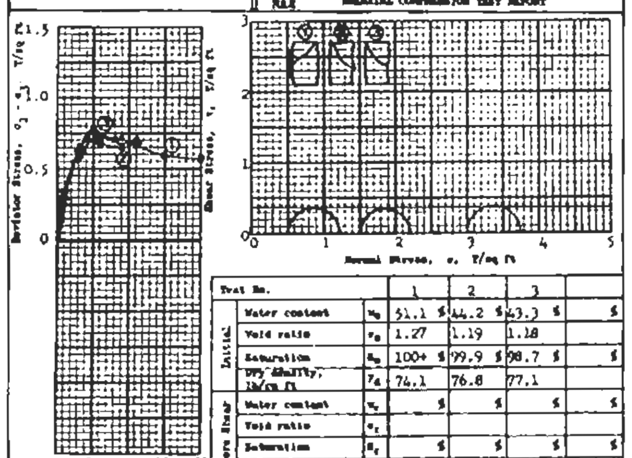
Project LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION

Area CHALMETTE LEVEE EXTENSION

Boring No. 37-CU | Sample No. 7-B

Depth 24.0 | Date 13 JULY 1967

RAA TRIAXIAL COMPRESSION TEST REPORT



Shear Strength Parameters

φ = 0 °

tan φ = 0

c = 0.37 T/sq ft

Method of saturation ______

[ ] Controlled stress
[X] Controlled strain

Test No.			1	2	3	
Initial	Water content	w_o	51.1 %	44.2 %	43.3 %	%
	Void ratio	e_o	1.27	1.19	1.18	
	Saturation	S_o	100+ %	99.9 %	98.7 %	%
	Dry density, lb/cu ft	γ_d	74.1	76.8	77.1	
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	1.5	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.72	0.71	0.77	
Time to failure, min		t_f	13	20	31	
Rate of strain, percent/min			0.41	0.20	0.16	
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 Q | Type of specimen COMPACTED

Classification CLAY (CH), gray, w/sandy silt (ML) lenses

LL 61 | PL 25 | PI 36 | G_s 2.69

Remarks Lower portion of sample was gray clayey silt (ML)

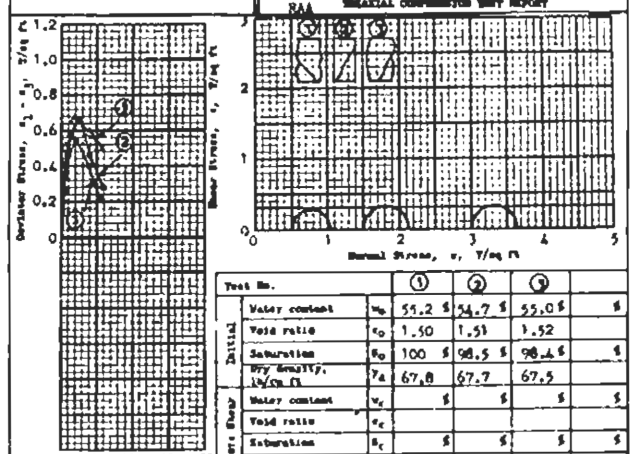
Project LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION

Area CHALMETTE LEVEE EXTENSION

Boring No. 37-CU | Sample No. 13B_1

Depth 47.7 | Date 31 AUGUST 1967

FAM TRIAXIAL COMPRESSION TEST REPORT



Shear Strength Parameters

φ = 0 °

tan φ = 0

c = 0.31 T/sq ft

Method of saturation ______

[ ] Controlled strain
[X] Controlled strain

Test No.			①	②	③	
Initial	Water content	w_o	55.2 %	54.7 %	55.0 %	%
	Void ratio	e_o	1.50	1.51	1.52	
	Saturation	S_o	100 %	98.5 %	98.4 %	%
	Dry density, lb/cu ft	γ_d	67.8	67.7	67.5	
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	1.5	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.54	0.66	0.66	
Time to failure, min		t_f	18	25	30	
Rate of strain, percent/min			0.11	0.10	0.07	
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	

Type of test Q | Type of specimen UNDISTURBED

Classification CLAY (CH), gray, homogeneous

LL 84 | PL 29 | PI 55 | G_s 2.72

Remarks ______

Project LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION

Area CHALMETTE LEVEE EXTENSION

Boring No. 37-CU | Sample No. 17-B

Depth 63.9 | Date 7 July, 1967

ESS TRIAXIAL COMPRESSION TEST REPORT

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

UNDISTURBED BORING 37-CU-"Q" TEST DATA

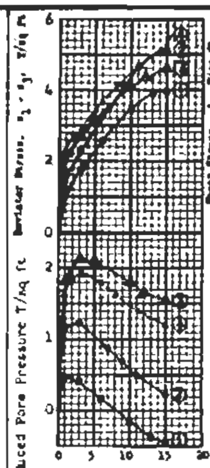
SCALES AS SHOWN

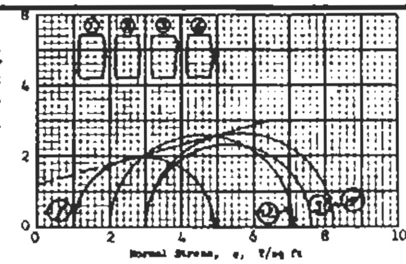
WALDEMAR S. NELSON AND COMPANY, INC.
ENGINEERS AND ARCHITECTS
NEW ORLEANS, LA.

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

DATE SEPTEMBER 1968 | FILE NO. H-2-24306

Triaxial Compression Test Report — Boring 37-CU, Sample 4-D





Shear Strength Parameters **

φ = 18°

tan φ = [illegible]

c = [illegible] T/sq ft

Method of saturation BP

☐ Controlled stress
☒ Controlled strain

Test No.			1	2	3	4
Initial	Water content	w_o	34.8 %	34.7 %	37.1 %	33.9 %
Initial	Void ratio	e_o	0.904	0.889	0.955	0.910
Initial	Saturation	S_o	100+ %	100+ %	100+ %	100+ %
Initial	Dry density, lb/cu ft	γ_d	88.2	88.9	85.9	87.9
Before Shear	Water content	w_c	29.9 %	28.5 %	27.4 %	27.9 %
Before Shear	Void ratio	e_c	0.810	0.798	0.822	0.845
Before Shear	Saturation	S_c	99.3 %	*96.1 %	*89.7 %	*88.8 %
Before Shear	Final back pressure, PSI	u_o	60	60	60	70
Before Shear	Dry density lb/cu ft	γ_d	92.8	93.4	91.8	91.0
Before Shear	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	1.0	2.0	3.0	3.0
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	3.97	5.10	4.60	5.24
Time to failure, min		t_f	125	150	125	125
Rate of strain, percent/min			0.12	0.10	0.12	0.12
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.38	1.36	1.36	1.37
Initial height, in.		H_o	3.00	3.00	3.00	3.00

Type of test R | Type of specimen UNDISTURBED

Classification SILT (ML), gray, homogeneous

LL 31 | PL 26 | PI 5 | G_s 2.69

Remarks * Pore pressure response indicated 100% saturation
** See attached plot for effective values

Project LAKE PONTCHARTRAIN & VICINITY HURRICANE PROTECTION

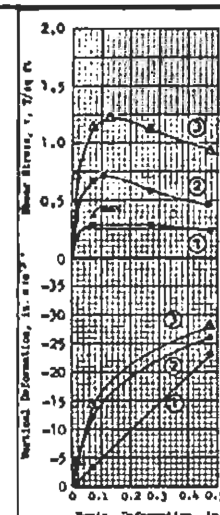
Area CHALMETTE LEVEE EXTENSION

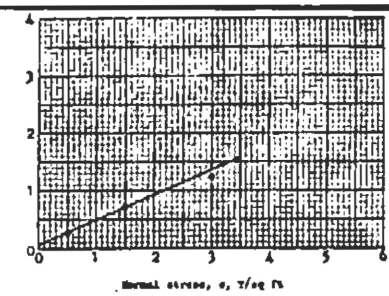
Boring No. 37-CU | Sample No. 4-D

Depth 13.9 | Date 14 JUNE 1967

JL TRIAXIAL COMPRESSION TEST REPORT

Direct Shear Test Report — Boring 37-CU, Sample 4-B





Shear Strength Parameters

φ' = 23°

tan φ' = 0.424

c' = 0.08 T/sq ft

☐ Controlled stress
☒ Controlled strain

Test No.			①	②	③	
Initial	Water content	w_o	52.1 %	51.4 %	52.1 %	%
Initial	Void ratio	e_o	1.44	1.42	1.43	
Initial	Saturation	S_o	98.0 %	98.0 %	98.7 %	%
Initial	Dry density, lb/cu ft	γ_d	69.3	69.9	69.5	
Void ratio after consolidation		e_c				
Time for 50 percent consolidation, min		t_{50}		1		
Final	Water content	w_f	50.4 %	43.0 %	37.8 %	%
Final	Void ratio	e_f				
Final	Saturation	S_f	%	%	%	%
Normal stress, T/sq ft		σ	0.5	1.5	3.0	
Maximum shear stress, T/sq ft		τ_{max}	0.29	0.71	1.23	
Actual time to failure, min		t_f	480	690	840	
Rate of strain, in./min			.00016	.00016	.00016	
Ultimate shear stress, T/sq ft		τ_{ult}				

Type of specimen UNDISTURBED | 3.01 in. square | 0.465 in. thick

Classification SILTY CLAY (CH), gray, contains trace of organic matter

LL 78 | PL 33 | PI 45 | G_s 2.71

Remarks

Project LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION

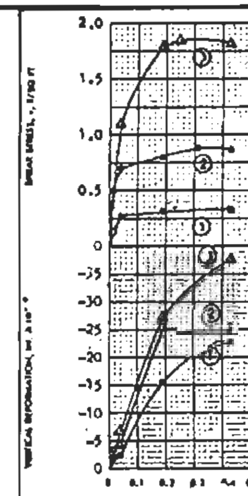
Area CHALMETTE LEVEE EXTENSION

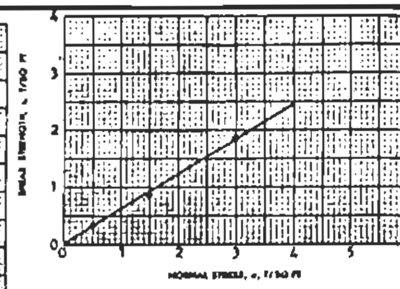
Boring No. 37-CU | Sample No. 4-B

Depth 12.0 | Date 17 June, 1967

CDE DIRECT SHEAR TEST REPORT

Direct Shear Test Report — Boring 37-CU, Sample 6-B





Shear Strength Parameters

φ = 31°

tan φ = 0.601

c = 0.02 T/sq ft

☐ Controlled stress
☒ Controlled strain

Test No.			①	②	③	
Initial	Water content	w_o	27.8%	31.4%	29.9%	%
Initial	Void ratio	e_o	0.760	0.820	0.814	
Initial	Saturation	S_o	97.7%	100%	98.1%	%
Initial	Dry density, lb/cu ft	γ_d	94.7	91.6	91.9	
Void ratio after consolidation		e_c				
Time for 50 percent consolidation, min		t_{50}	<1	<1	<1	
Final	Water content	w_f	27.2%	27.8%	26.2%	%
Final	Void ratio	e_f				
Final	Saturation	S_f	%	%	%	%
Normal stress, T/sq ft		σ	0.5	1.5	3.0	
Maximum shear stress, T/sq ft		τ_{max}	0.33	0.88	1.85	
Actual time to failure, min		t_f	2700	1980	1620	
Rate of strain, in./min			.00016	.00016	.00016	
Ultimate shear stress, T/sq ft		τ_{ult}				

Type of specimen UNDISTURBED | 3.01 in. square | 0.465 in. thick

Classification SILTY SAND (SM), gray, contains seams of clay

LL — | PL — | PI — | G_s 2.67

Remarks

Project LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION

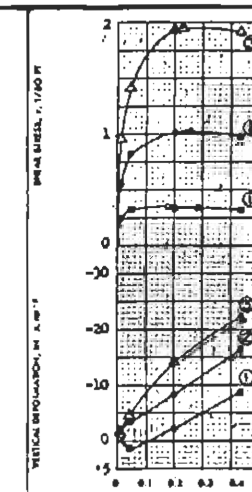
Area CHALMETTE LEVEE EXTENSION

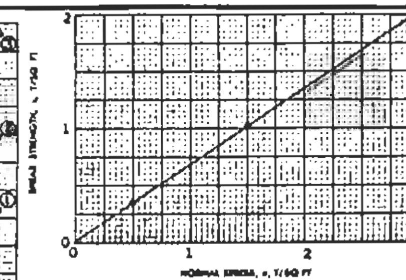
Boring No. 37-CU | Sample No. 6-B

Depth 20.1 | Date 19 June, 1967

CDK DIRECT SHEAR TEST REPORT

Direct Shear Test Report — Boring 37-CU, Sample 13-D





Shear Strength Parameters

φ = 24°

tan φ = 0.476

c = 0.01 T/sq ft

☐ Controlled stress
☒ Controlled strain

Test No.			1	2	3	
Initial	Water content	w_o	33.7%	32.2%	32.6%	%
Initial	Void ratio	e_o	0.941	0.919	0.948	
Initial	Saturation	S_o	96.3%	94.2%	92.5%	%
Initial	Dry density, lb/cu ft	γ_d	86.5	87.5	86.2	
Void ratio after consolidation		e_c				
Time for 50 percent consolidation, min		t_{50}	<1	<1	<1	
Final	Water content	w_f	32.0%	31.1%	30.0%	%
Final	Void ratio	e_f				
Final	Saturation	S_f	%	%	%	%
Normal stress, T/sq ft		σ	0.5	1.5	3.0	
Maximum shear stress, T/sq ft		τ_{max}	0.35	1.02	1.95	
Actual time to failure, min		t_f	1200	1680	1500	
Rate of strain, in./min			.00016	.00016	.00016	
Ultimate shear stress, T/sq ft		τ_{ult}				

Type of specimen UNDISTURBED | 3.01 in. square | 0.465 in. thick

Classification SANDY SILT (ML), gray, homogeneous

LL 34 | PL 26 | PI 8 | G_s 2.69

Remarks

Project LAKE PONTCHARTRAIN & VICINITY HURRICANE PROTECTION

Area CHALMETTE LEVEE EXTENSION

Boring No. 37-CU | Sample No. 13-D

Depth 49.9 | Date 21 JUNE 1967

GDA DIRECT SHEAR TEST REPORT

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

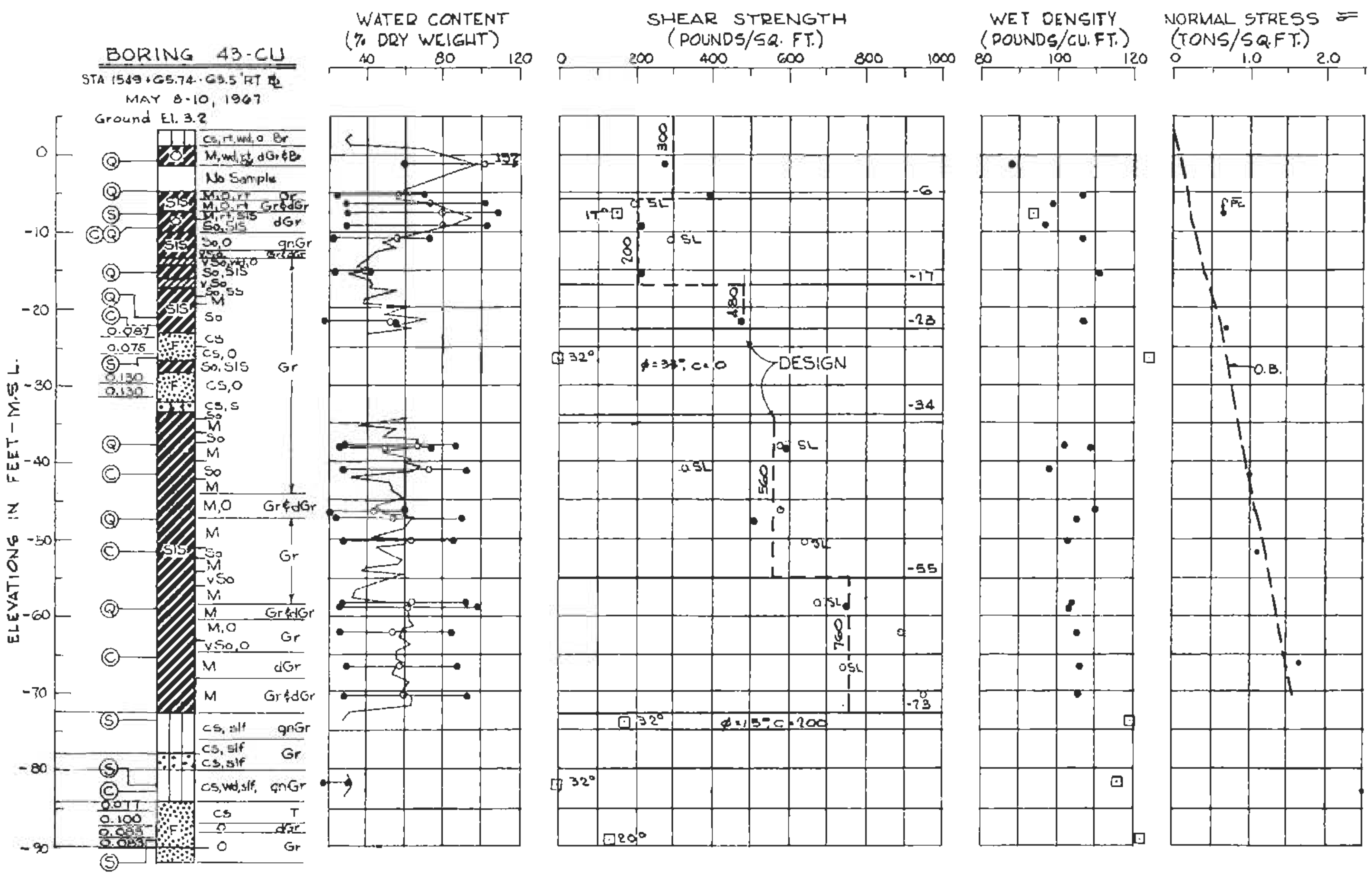
DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

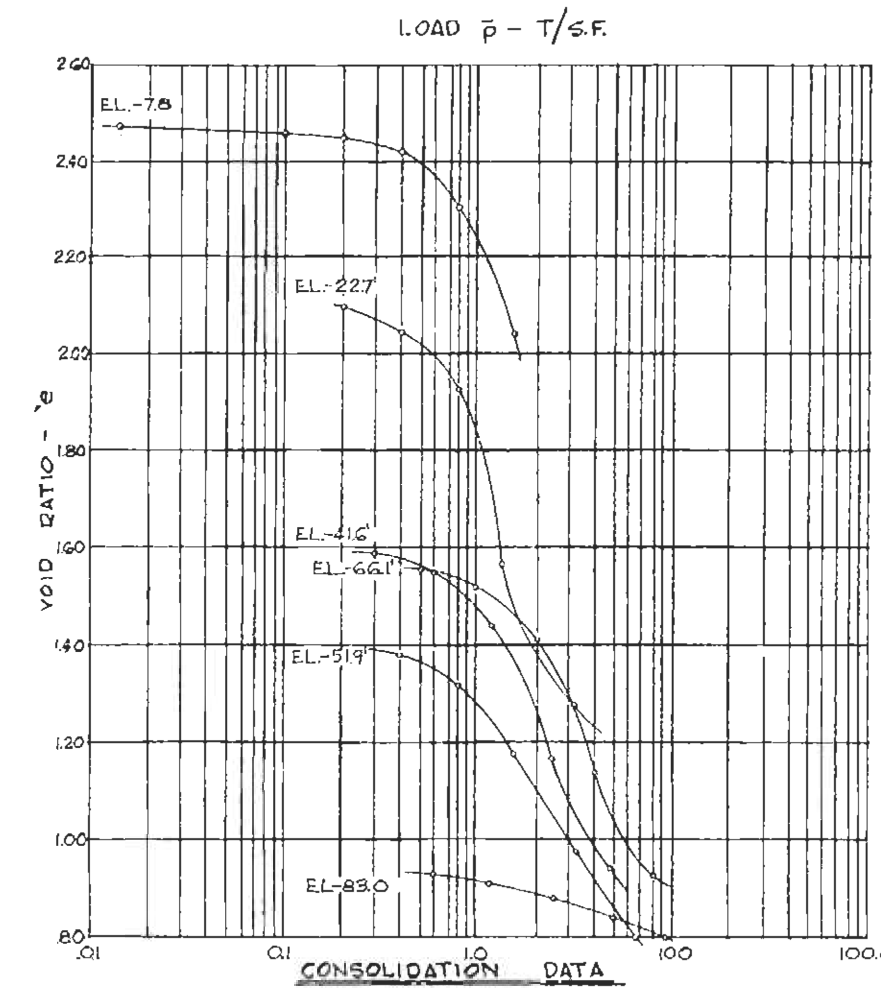
UNDISTURBED BORING 37-CU-"R" & "S" TEST DATA

SCALES AS SHOWN

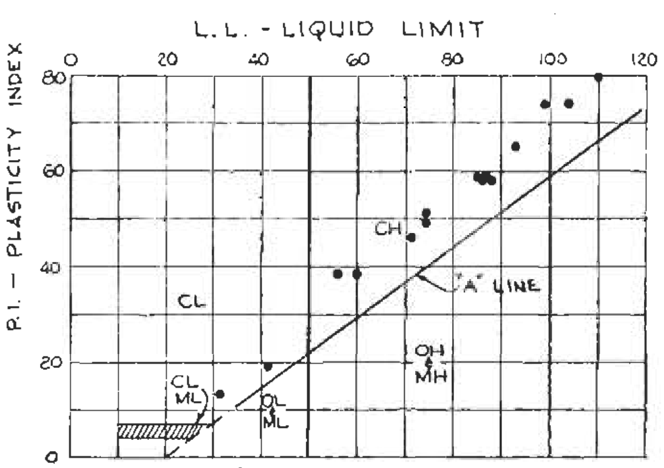
WALDEMAR S. NELSON AND COMPANY, INC. ENGINEERS AND ARCHITECTS NEW ORLEANS, LA. | U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS, U. S. ARMY NEW ORLEANS, LA.

DATE: SEPTEMBER 1968 | FILE NO. H-2-24306

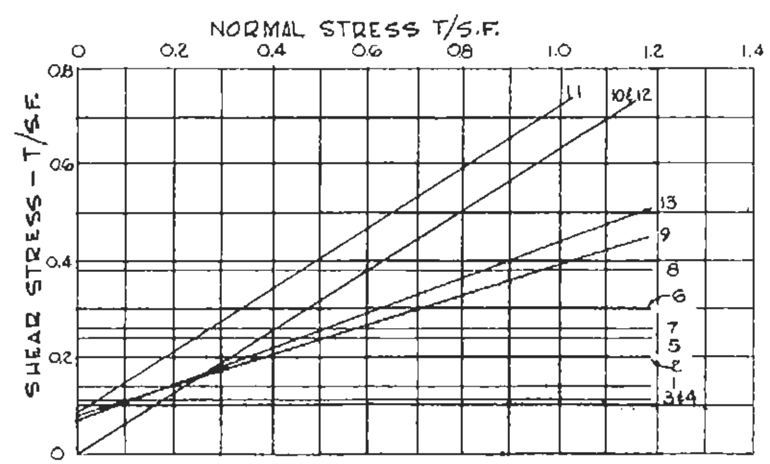




CONSOLIDATION DATA



PLASTICITY CHART



SHEAR STRENGTH DATA

ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH $\phi°$	STRENGTH (T/SF)	CLASS
1	-1.3	Q	0	0.14	CHO
2	-5.3			0.20	CH
3	-9.3			0.11	CH
4	-15.6			0.11	CL
5	-21.7			0.24	CH
6	-38.3			0.30	CH
7	-47.8			0.26	CH
8	-59.1		0	0.38	CH
9	-7.8	S	17	0.08	CH
10	-26.6		32	0	SP
11	-74.1		32	0.09	SM
12	-82.1		32	0	ML
13	-89.6		20	0.07	SM

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

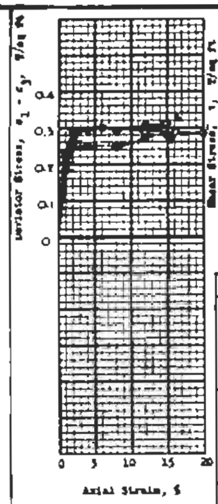
UNDISTURBED BORING 43-CU
TEST DATA

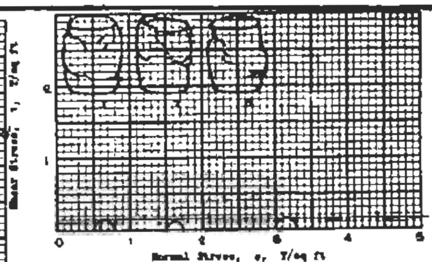
SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC.
ENGINEERS AND ARCHITECTS
NEW ORLEANS, LA.

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

DATE SEPTEMBER 1968 | FILE NO. H-2-24306





Test No.		1	2	3	
Initial – Water content	w_o	107.5%	106.0%	116.0%	%
Initial – Void ratio	e_o	2.59	2.58	2.91	
Initial – Saturation	S_o	100+ %	99.4 %	96.5 %	%
Initial – Dry density, lb/cu ft	γ_d	42.1	42.2	38.6	
Before Shear – Water content	w_c	%	%	%	%
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	0.50	1.50	3.00	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.30	0.23	0.32	
Time to failure, min	t_f	21	5	16	
Rate of strain, percent/min		0.29	0.39	0.97	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.41	1.41	1.41	
Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters

φ = 0°

tan φ = 0

c = 0.14 T/sq ft

Method of saturation ______

☐ Controlled stress

☑ Controlled strain

Type of test Q | Type of specimen UNDISTURBED

Classification GRAY CLAY (CH), W/ ORGANIC MATTER

LL 152 | PL 50 | PI 102 | G_s 2.42

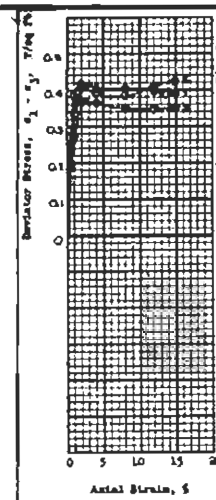
Remarks Triaxial Compression Test Report

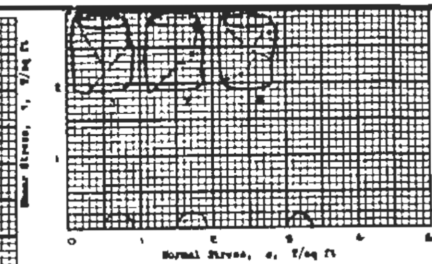
Project LAKE PONTCHARTRAIN & VIC. CHALMETTE LEVEE EXT.

Area

Boring No. 43-CU | Sample No. 2-A

Depth El -1.3 | Date 7/28/67





Test No.		1	2	3	
Initial – Water content	w_o	48.6 %	49.8 %	52.3 %	%
Initial – Void ratio	e_o	1.31	1.35	1.46	
Initial – Saturation	S_o	100+ %	99.1 %	97.4 %	%
Initial – Dry density, lb/cu ft	γ_d	73.6	72.3	68.8	
Before Shear – Water content	w_c	%	%	%	%
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	0.50	1.50	3.00	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.41	0.41	0.37	
Time to failure, min	t_f	9	12	9	
Rate of strain, percent/min		0.86	0.19	0.27	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.41	1.41	1.41	
Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters

φ = 0°

tan φ = 0

c = 0.20 T/sq ft

Method of saturation ______

☐ Controlled stress

☑ Controlled strain

Type of test Q | Type of specimen UNDISTURBED

Classification GRAY CLAY (CH), W/ ORGANIC MATTER

LL 71 | PL 25 | PI 46 | G_s 2.72

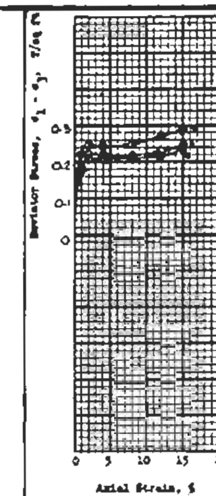
Remarks Triaxial Compression Test Report

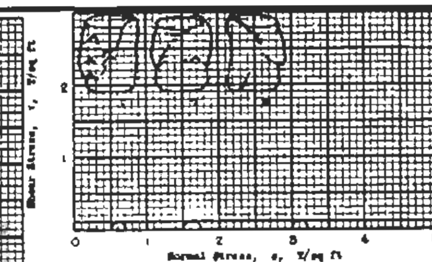
Project LAKE PONTCHARTRAIN & VIC. CHALMETTE LEVEE EXT

Area

Boring No. 43-CU | Sample No. 3-A

Depth El -5.3 | Date 7/28/67





Test No.		1	2	3	
Initial – Water content	w_o	78.1 %	76.2 %	85.3 %	%
Initial – Void ratio	e_o	2.06	2.01	2.22	
Initial – Saturation	S_o	100+ %	100+ %	100+ %	%
Initial – Dry density, lb/cu ft	γ_d	54.5	65.1	51.6	
Before Shear – Water content	w_c	%	%	%	%
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	0.50	1.50	3.00	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.22	0.25	0.21	
Time to failure, min	t_f	5	3	1	
Rate of strain, percent/min		0.39	0.67	0.97	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.41	1.41	1.41	
Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters

φ = 0°

tan φ = 0

c = 0.11 T/sq ft

Method of saturation ______

☐ Controlled stress

☑ Controlled strain

Type of test Q | Type of specimen UNDISTURBED

Classification GRAY CLAY (CH) homogeneous

LL 104 | PL 30 | PI 74 | G_s 2.66

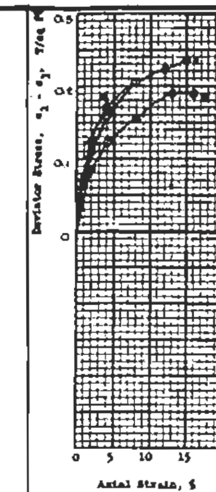
Remarks Triaxial Compression Test Report

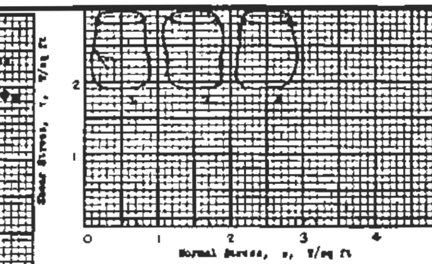
Project LAKE PONTCHARTRAIN & VIC. CHALMETTE LEVEE EXT.

Area

Boring No. 43-CU | Sample No. 4-A

Depth El -9.3 | Date 7/28 & 7/29/67





Test No.		1	2	3	
Initial – Water content	w_o	42.4 %	43.4 %	45.0 %	%
Initial – Void ratio	e_o	1.14	1.16	1.18	
Initial – Saturation	S_o	100+ %	100+ %	100+ %	%
Initial – Dry density, lb/cu ft	γ_d	78.3	77.8	76.9	
Before Shear – Water content	w_c	%	%	%	%
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	0.50	1.50	3.00	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.24	0.23	0.20	
Time to failure, min	t_f	16	16	14	
Rate of strain, percent/min		0.97	0.97	0.96	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.41	1.41	1.41	
Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters

φ = 0°

tan φ = 0

c = 0.11 T/sq ft

Method of saturation ______

☐ Controlled stress

☑ Controlled strain

Type of test Q | Type of specimen UNDISTURBED

Classification GRAY SILTY CLAY (CL) homogeneous

LL 41 | PL 22 | PI 19 | G_s 2.69

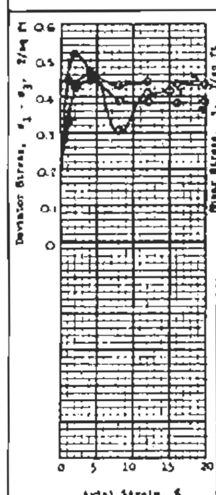
Remarks Triaxial Compression Test Report

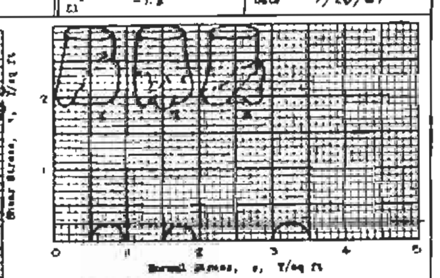
Project LAKE PONTCHARTRAIN & VIC. CHALMETTE LEVEE EXT.

Area

Boring No. 43-CU | Sample No. 5-D

Depth El -15.6 | Date 7/29/67





Test No.		1	2	3	
Initial – Water content	w_o	52.1 %	54.2 %	52.4 %	%
Initial – Void ratio	e_o	1.38	1.46	1.40	
Initial – Saturation	S_o	100+ %	99.9 %	100+ %	%
Initial – Dry density, lb/cu ft	γ_d	70.6	68.4	70.0	
Before Shear – Water content	w_c	%	%	%	%
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	0.50	1.50	3.00	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.46	0.45	0.52	
Time to failure, min	t_f	4	4	14	
Rate of strain, percent/min		0.86	0.86	0.17	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.41	1.41	1.41	
Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters

φ = 0°

tan φ = 0

c = 0.24 T/sq ft

Method of saturation ______

☐ Controlled stress

☑ Controlled strain

Type of test Q | Type of specimen UNDISTURBED

Classification GRAY CLAY (CH), W/ FREQUENT SILT SEAMS

LL 56 | PL 18 | PI 38 | G_s 2.69

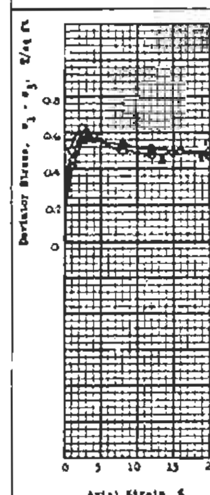
Remarks Triaxial Compression Test Report

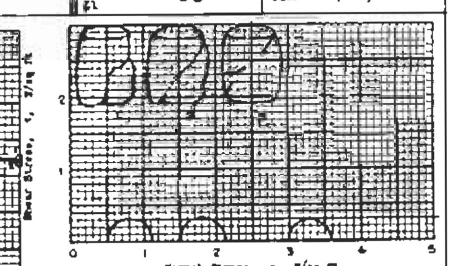
Project LAKE PONTCHARTRAIN & VIC. CHALMETTE LEVEE EXT.

Area

Boring No. 43-CU | Sample No. 7-B

Depth El -21.7 | Date 7/31/67





Test No.		1	2	3	
Initial – Water content	w_o	47.5 %	45.6 %	49.0 %	%
Initial – Void ratio	e_o	1.28	1.25	1.30	
Initial – Saturation	S_o	99.4 %	98.1 %	100+ %	%
Initial – Dry density, lb/cu ft	γ_d	73.7	74.6	75.1	
Before Shear – Water content	w_c	%	%	%	%
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	0.50	1.50	3.00	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.63	0.59	0.67	
Time to failure, min	t_f	9	16	19	
Rate of strain, percent/min		0.76	0.17	0.17	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.41	1.41	1.41	
Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters

φ = 0°

tan φ = 0

c = 0.30 T/sq ft

Method of saturation ______

☐ Controlled stress

☑ Controlled strain

Type of test Q | Type of specimen UNDISTURBED

Classification GRAY CLAY (CH), W/ SILT SEAMS

LL 74 | PL 25 | PI 49 | G_s 2.69

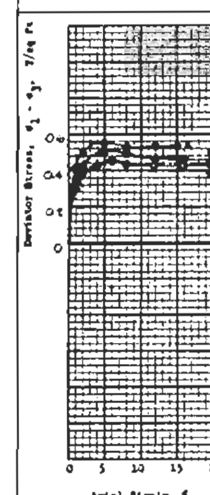
Remarks Triaxial Compression Test Report

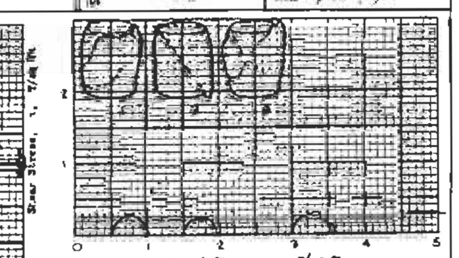
Project LAKE PONTCHARTRAIN & VIC. CHALMETTE LEVEE EXT

Area

Boring No. 43-CU | Sample No. 11-B

Depth El -38.3 | Date 7/31/67





Test No.		1	2	3	
Initial – Water content	w_o	54.0 %	54.4 %	53.6 %	%
Initial – Void ratio	e_o	1.47	1.48	1.48	
Initial – Saturation	S_o	99.6 %	99.6 %	98.1 %	%
Initial – Dry density, lb/cu ft	γ_d	68.5	68.2	68.2	
Before Shear – Water content	w_c	%	%	%	%
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	0.50	1.50	3.00	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.51	0.49	0.56	
Time to failure, min	t_f	18	21	14	
Rate of strain, percent/min		0.30	0.49	0.94	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.41	1.41	1.41	
Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters

φ = 0°

tan φ = 0

c = 0.26 T/sq ft

Method of saturation ______

☐ Controlled stress

☑ Controlled strain

Type of test Q | Type of specimen UNDISTURBED

Classification GRAY CLAY (CH), W/ SILT SEAMS

LL 90 | PL 24 | PI 66 | G_s 2.71

Remarks Triaxial Compression Test Report

Project LAKE PONTCHARTRAIN & VIC. CHALMETTE LEVEE EXT.

Area

Boring No. 43-CU | Sample No. 13-D

Depth El -47.8 | Date 7/31/67 & 8/1/67

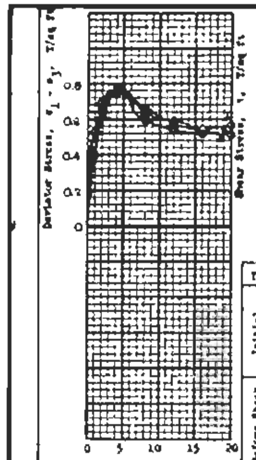
LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

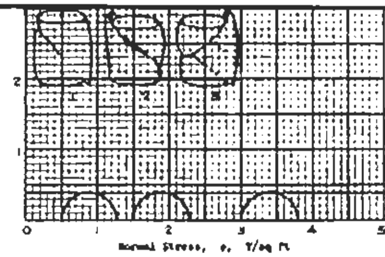
DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

UNDISTURBED BORING 43-CU-"Q" TEST DATA

SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC. ENGINEERS AND ARCHITECTS NEW ORLEANS, LA.	U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS, U. S. ARMY NEW ORLEANS, LA.
DATE SEPTEMBER 1968	FILE NO. H-2-24306





Shear Strength Parameters

φ = 0°

tan φ = 0

c = 0.30 T/sq ft

Method of saturation ______

☐ Controlled stress
☑ Controlled strain

Test No.			1	2	3	
Initial	Water content	w_o	61.2 %	61.8 %	60.9 %	%
	Void ratio	e_o	1.68	1.70	1.68	
	Saturation	S_o	100+ %	100 %	99.7 %	%
	Dry density, lb/cu ft	γ_d	64.0	63.6	64.1	
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	0.50	1.50	3.00	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.75	0.77	0.76	
Time to failure, min		t_f	16	15	15	
Rate of strain, percent/min			0.27	0.27	0.27	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.41	1.41	1.41	
Initial height, in.		H_o	3.00	3.00	3.00	

Type of test Q | Type of specimen UNDISTURBED

Classification GRAY CLAY (CH), W/ SILT SEAMS

LL 99 | PL 25 | PI 74 | | G_s 2.75

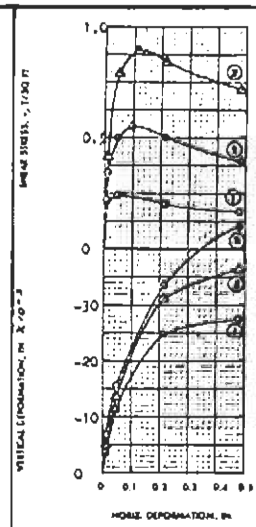
Remarks: Triaxial Compression Test Report

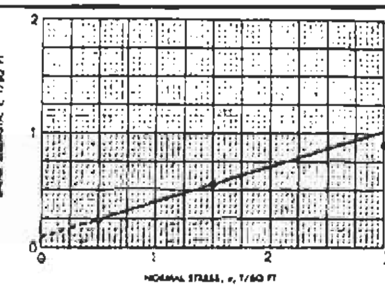
Project LAKE PONTCHARTRAIN & VIC. CHALMETTE LEVEE EXT.

Area

Boring No. 43-CU | Sample No. 16-C

Depth El -52.1 | Date 8/1/67





SHEAR STRENGTH PARAMETERS

φ' = 17°

tan φ' = 0.306

c' = 0.08 T/SQ FT

☐ CONTROLLED STRESS
☒ CONTROLLED STRAIN

TEST NO.			1	2	3	
INITIAL	WATER CONTENT	w_o	83.6 %	82.7 %	76.9 %	%
	VOID RATIO	e_o	2.41	2.31	2.13	
	SATURATION	S_o	95.7 %	98.8 %	99.6 %	%
	DRY DENSITY, LB/CU FT	γ_d	50.5	52.1	55.0	
VOID RATIO AFTER CONSOLIDATION		e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN		t_{50}	<1	4	4	
FINAL	WATER CONTENT	w_f	78.0 %	54.8 %	62.6 %	%
	VOID RATIO	e_f				
	SATURATION	S_f	%	%	%	%
NORMAL STRESS, T/SQ FT		σ	0.5	1.5	3.0	
MAXIMUM SHEAR STRESS, T/SQ FT		τ_{max}	0.24	0.55	0.89	
ACTUAL TIME TO FAILURE, MIN		t_f	360	660	750	
RATE OF STRAIN, IN./MIN			.00012	.00017	.00017	
ULTIMATE SHEAR STRESS, T/SQ FT		τ_{ult}				

TYPE OF SPECIMEN UNDISTURBED | 3.01 IN. SQUARE | 0.465 IN. THICK

CLASSIFICATION CLAY (CH), GRAY, HOMOGENEOUS

LL ——— | PL ——— | PI ——— | | G_s 2.76 From Consol

REMARKS ______

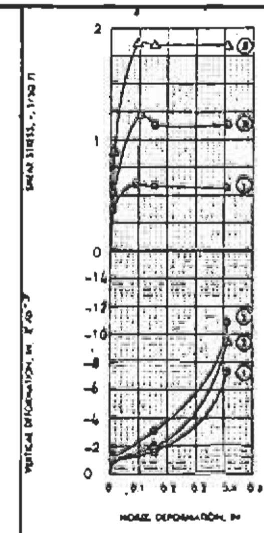
PROJECT LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION PROJECT

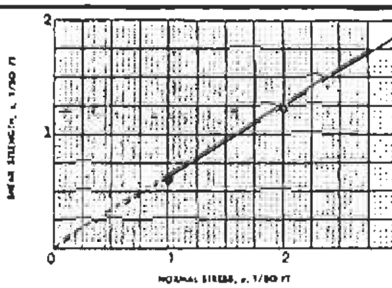
AREA CHALMETTE LEVEE EXTENSION

BORING NO. 43-CU | SAMPLE NO. 1-D

EL. -7.8 | DATE 19 JULY 1967

WJH & BMG — DIRECT SHEAR TEST REPORT





SHEAR STRENGTH PARAMETERS

φ' = 32°

tan φ' = 0.625

c' = 0 T/SQ FT

☐ CONTROLLED STRESS
☒ CONTROLLED STRAIN

TEST NO.			1	2	3	
INITIAL	WATER CONTENT	w_o	20.7 %	21.1 %	20.6 %	%
	VOID RATIO	e_o	0.612	0.625	0.632	
	SATURATION	S_o	90.3 %	90.1 %	87.0 %	%
	DRY DENSITY, LB/CU FT	γ_d	103.6	102.6	102.1	
VOID RATIO AFTER CONSOLIDATION		e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN		t_{50}	<1	<1	<1	
FINAL	WATER CONTENT	w_f	17.2 %	19.5 %	19.6 %	%
	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}	0.59	1.22	1.87	
ACTUAL TIME TO FAILURE, MIN		t_f	630	690	630	
RATE OF STRAIN, IN./MIN			.00015	.00015	.00015	
ULTIMATE SHEAR STRESS, T/SQ FT		τ_{ult}				

TYPE OF SPECIMEN UNDISTURBED | 3.01 IN. SQUARE | 0.465 IN. THICK

CLASSIFICATION SILTY SAND (SM), GRAY

LL ——— | PL ——— | PI ——— | | G_s 2.67

REMARKS ______

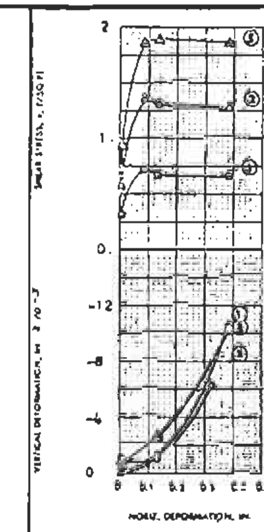
PROJECT LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION

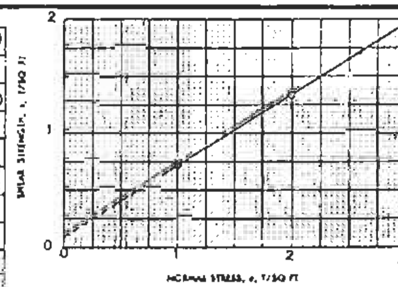
AREA CHALMETTE LEVEE EXTENSION

BORING NO. 43-CU | SAMPLE NO. 8-C

EL. -26.6 | DATE 25 JULY 1967

GDA — DIRECT SHEAR TEST REPORT





SHEAR STRENGTH PARAMETERS

φ' = 32°

tan φ' = 0.625

c' = 0.09 T/SQ FT

☐ CONTROLLED STRESS
☒ CONTROLLED STRAIN

TEST NO.			1	2	3	
INITIAL	WATER CONTENT	w_o	29.4 %	29.6 %	29.9 %	%
	VOID RATIO	e_o	0.807	0.805	0.824	
	SATURATION	S_o	97.6 %	98.5 %	97.2 %	%
	DRY DENSITY, LB/CU FT	γ_d	92.6	92.7	91.7	
VOID RATIO AFTER CONSOLIDATION		e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN		t_{50}	< 1	< 1	< 1	
FINAL	WATER CONTENT	w_f	26.4 %	26.4 %	26.1 %	%
	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}	0.72	1.34	1.90	
ACTUAL TIME TO FAILURE, MIN		t_f	630	630	630	
RATE OF STRAIN, IN./MIN			.00014	.00014	.00014	
ULTIMATE SHEAR STRESS, T/SQ FT		τ_{ult}				

TYPE OF SPECIMEN UNDISTURBED | 3.01 IN. SQUARE | 0.465 IN. THICK

CLASSIFICATION SILTY SAND (SM), GRAY, WITH SMALL SHELLS

LL ——— | PL ——— | PI ——— | | G_s 2.68

REMARKS ______

PROJECT LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION

AREA CHALMETTE LEVEE EXTENSION

BORING NO. 43-CU | SAMPLE NO. 20-B

EL. -74.1 | DATE 29 JULY 1967

GDA — DIRECT SHEAR TEST REPORT

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

UNDISTURBED BORING 43-CU-"Q"&"S" TEST DATA

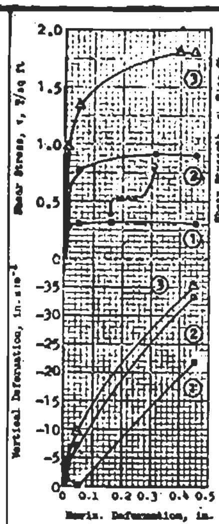
SCALES AS SHOWN

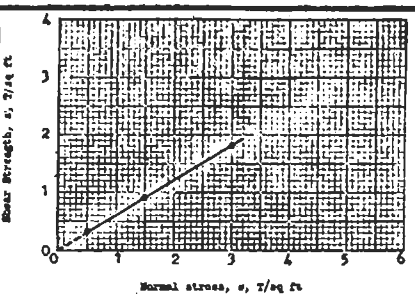
WALDEMAR S. NELSON AND COMPANY, INC. ENGINEERS AND ARCHITECTS NEW ORLEANS, LA.

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

DATE SEPTEMBER 1968 | FILE NO. H-2-24306

PLATE 47





Shear Strength Parameters

φ' = 32 °

tan φ' = 0.625

c' = 0 T/sq ft

☐ Controlled stress

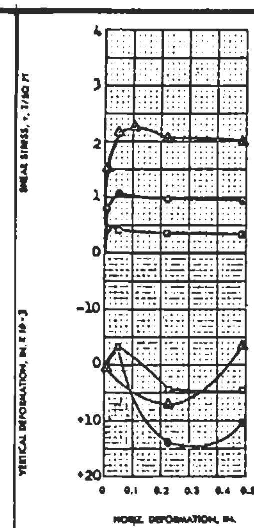
☒ Controlled strain

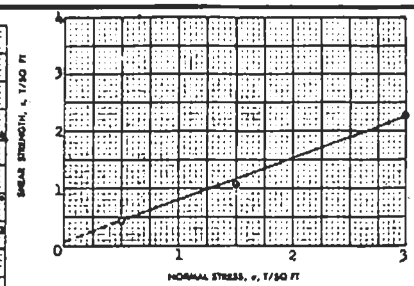
Test No.			①	②	③	
Initial	Water content	w_o	30.8 %	30.5 %	30.0 %	%
	Void ratio	e_o	0.881	0.852	0.862	
	Saturation	S_o	93.3 %	95.6 %	92.9 %	%
	Dry density, lb/cu ft	γ_d	88.6	90.0	89.5	
Void ratio after consolidation		e_c				
Time for 50 percent consolidation, min		t_{50}	<1	<1	<1	
Final	Water content	w_f	31.1 %	29.2 %	28.3 %	%
	Void ratio	e_f				
	Saturation	S_f	%	%	%	%
Normal stress, T/sq ft		σ	0.5	1.5	3.0	
Maximum shear stress, T/sq ft		τ_{max}	0.32	0.91	1.82	
Actual time to failure, min		t_f	1440	2880	3600	
Rate of strain, in./min			.00011	.00011	.00011	
Ultimate shear stress, T/sq ft		τ_{ult}				

Type of specimen	UNDISTURBED		3.01 in. square	0.465 in. thick
Classification	SANDY SILT (ML), tan, contains shells			
LL 31	PL 18	PI 13		G_s 2.67

Remarks

Project	LAKE PONTCHARTRAIN AND VICINITY
	HURRICANE PROTECTION
Area	CHALMETTEE LEVEE EXTENSION
Boring No. 43-CU	Sample No. 22-B
El. -82.1	Date 21 July, 1967
WJH	DIRECT SHEAR TEST REPORT





SHEAR STRENGTH PARAMETERS

φ' = 20°

TAN φ' = 0.364

c' = 0.07 T/SQ FT

☐ CONTROLLED STRESS

☒ CONTROLLED STRAIN

TEST NO.			1	2	3	
INITIAL	WATER CONTENT	w_o	23.7 %	22.9 %	22.6 %	%
	VOID RATIO	e_o	0.739	0.700	0.692	
	SATURATION	S_o	86.9 %	88.6 %	88.5 %	%
	DRY DENSITY, LB/CU FT	γ_d	97.3	99.5	100.0	
VOID RATIO AFTER CONSOLIDATION		e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN		t_{50}	<1	<1	<1	
FINAL	WATER CONTENT	w_f	25.7 %	23.8 %	23.5 %	%
	VOID RATIO	e_f				
	SATURATION	S_f	%	%	%	%
NORMAL STRESS, T/SQ FT		σ	0.5	1.5	3.0	
MAXIMUM SHEAR STRESS, T/SQ FT		τ_{max}	0.42	1.09	2.26	
ACTUAL TIME TO FAILURE, MIN		t_f	.00018	.00018	.00018	
RATE OF STRAIN, IN./MIN			150	360	660	
ULTIMATE SHEAR STRESS, T/SQ FT		τ_{ult}				

TYPE OF SPECIMEN	UNDISTURBED		3.01 IN. SQUARE	0.465 IN. THICK
CLASSIFICATION	SILTY SAND (SM), GRAY			
LL ———	PL ———	PI ———		G_s 2.65

REMARKS

PROJECT	LAKE PONTCHARTRAIN & VICINITY
	HURRICAN PROTECTION PROJECT
AREA	CHALMETTE LEVEE EXTENSION
BORING NO. 43-CU	SAMPLE NO. 24-B
EL. -89.6	DATE 24 JULY 1967
WJH	DIRECT SHEAR TEST REPORT

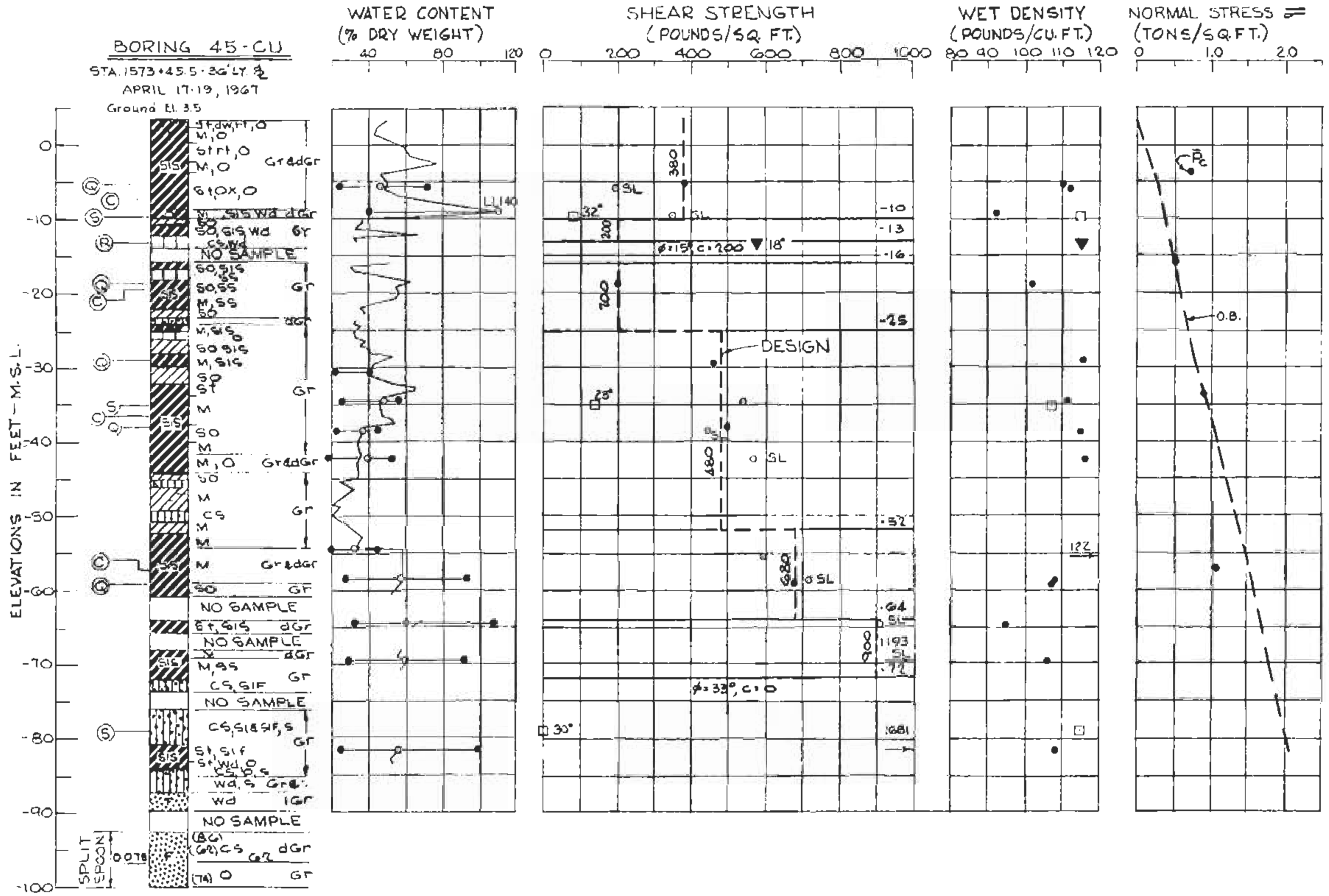
LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

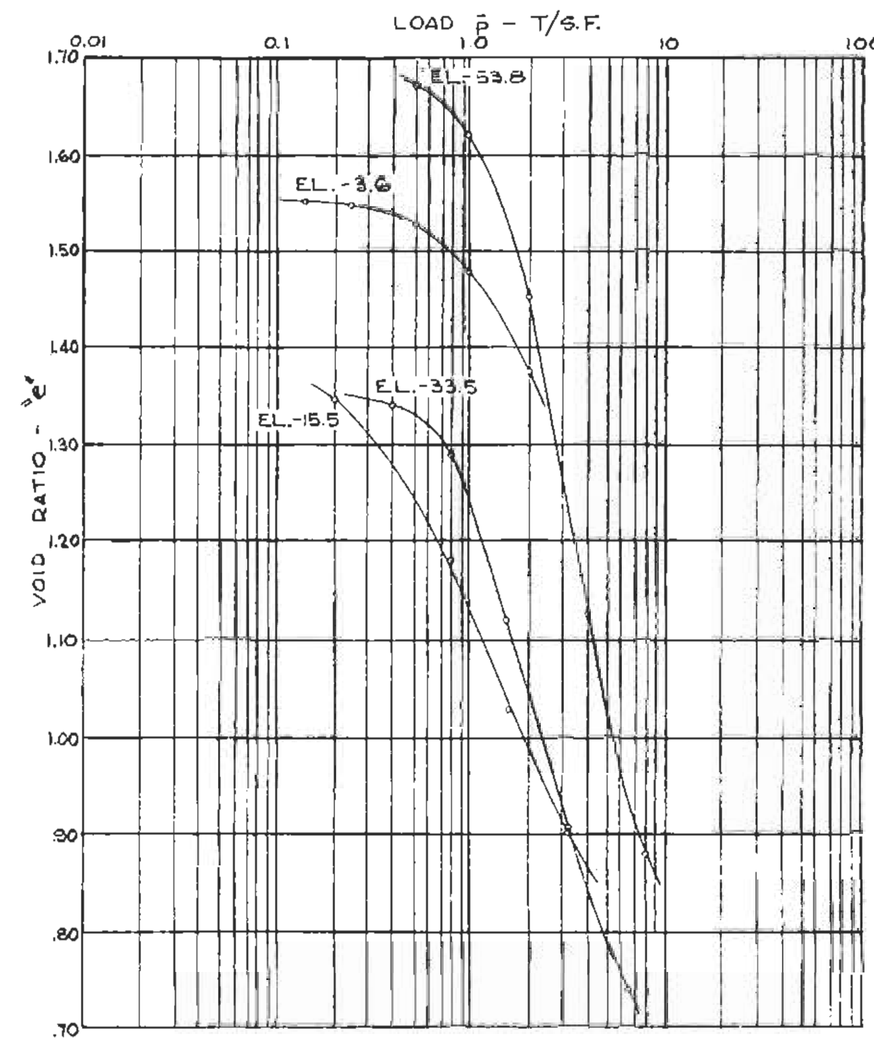
DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

UNDISTURBED BORING 43-CU-"S" TEST DATA

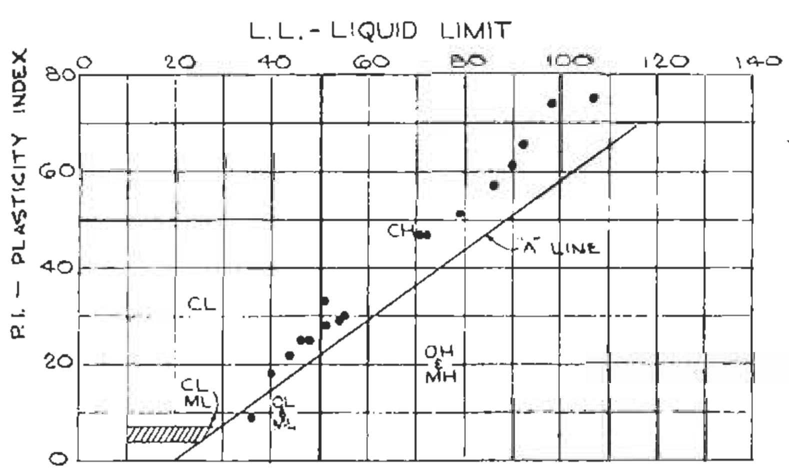
SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC. ENGINEERS AND ARCHITECTS NEW ORLEANS, LA.	U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS, U. S. ARMY NEW ORLEANS, LA.
DATE SEPTEMBER 1968	FILE NO. H-2-24306

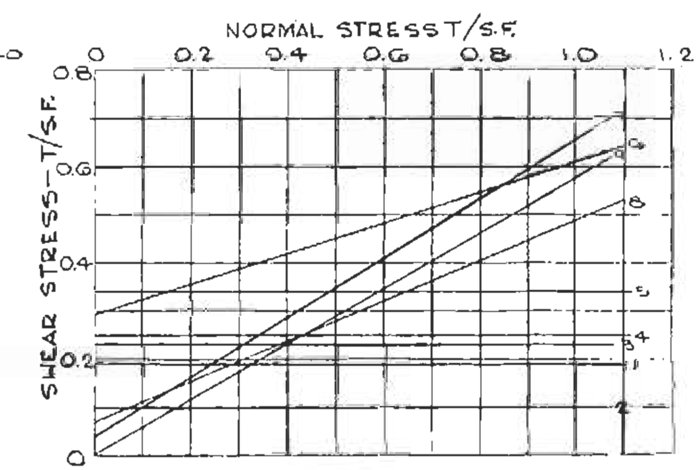




CONSOLIDATION DATA



PLASTICITY CHART



SHEAR STRENGTH DATA

ENVELOPE NO.	ENVELOPE EL.	TYPE	STRENGTH φ°	STRENGTH c (T/SF)	CLASS
1	-5.1	Q	0	0.19	CH
2	-18.3			0.10	CH
3	-28.9			0.23	CH
4	-37.8			0.25	CL
5	-59.1		0	0.34	CH
6	-13.1	R	18	0.29	ML
7	-9.5	S	32	0.04	ML
8	-34.8		23	0.00	CH
9	-78.4		30	0.00	SM

LAKE PONTCHARTRAIN, LA AND VICINITY
CHALMETTE AREA PLAN

DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

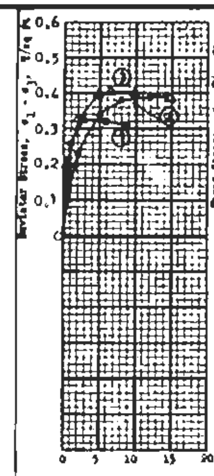
UNDISTURBED BORING 45-CU
TEST DATA

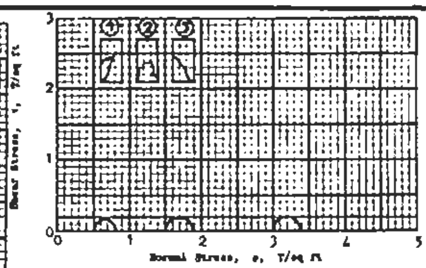
SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC.
ENGINEERS AND ARCHITECTS
NEW ORLEANS, LA.

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

DATE SEPTEMBER 1966 | FILE NO. H-2-24306





Test No.			①	②	③	
Initial	Water content	w_o	42.0 %	42.5 %	42.8 %	%
	Void ratio	e_o	1.22	1.19	1.24	
	Saturation	S_o	93.6 %	97.1 %	93.9 %	%
	Dry density, lb/cu ft	γ_d	76.6	77.5	75.8	
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	1.5	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.33	0.40	0.41	
Time to failure, min		t_f	11	16	14	
Rate of strain, percent/min			0.24	0.90	0.48	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.39	1.38	1.40	
Initial height, in.		H_o	3.00	3.00	3.00	

Shear Strength Parameters

φ = 0 °

tan φ = 0

c = 0.19 T/sq ft

Method of saturation ______

☐ Controlled stress

☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED

Classification CLAY (CH), gray, fissured

LL 72 | PL 25 | PI 47 | G_s 2.72

Remarks ______

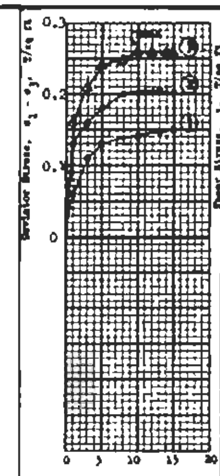
Project LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION

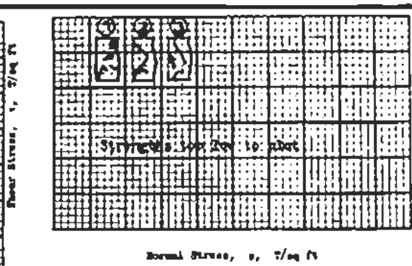
Area CHALMETTE LEVEE EXTENSION

Boring No. 45-CU | Sample No. 3-B

Depth 8.6 | Date 12 July,1967

RAA TRIAXIAL COMPRESSION TEST REPORT





Test No.			①	②	③	
Initial	Water content	w_o	70.3 %	72.4 %	75.5 %	%
	Void ratio	e_o	1.90	1.95	2.04	
	Saturation	S_o	100 %	100 %	100 %	%
	Dry density, lb/cu ft	γ_d	58.4	57.4	55.7	
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	1.5	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.15	0.20	0.26	
Time to failure, min		t_f	32	16	13	
Rate of strain, percent/min			0.51	0.80	0.78	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.39	1.39	1.38	
Initial height, in.		H_o	3.00	3.00	3.00	

Shear Strength Parameters

φ = 0 °

tan φ = 0

c = 0.10 T/sq ft

Method of saturation ______

☐ Controlled stress

☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED

Classification CLAY (CH), gray, contains sand silt lenses

LL 79 | PL 28 | PI 51 | G_s 2.71

Remarks ______

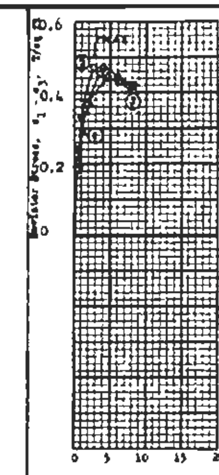
Project LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION

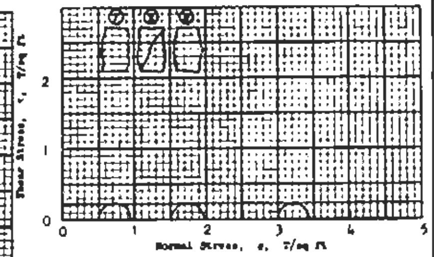
Area CHALMETTE LEVEE EXTENSION

Boring No. 45-CU | Sample No. 6-C2

Depth 21.8 | Date 13 July,1967

RAA TRIAXIAL COMPRESSION TEST REPORT





Test No.			1	2	3	
Initial	Water content	w_o	50.7 %	51.6 %	52.6 %	%
	Void ratio	e_o	1.50	1.43	1.46	
	Saturation	S_o	94.8 %	98.0 %	98.2 %	%
	Dry density, lb/cu ft	γ_d	67.8	69.7	68.9	
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	1.5	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.45	0.47	0.44	
Time to failure, min		t_f	16	13	23	
Rate of strain, percent/min			0.21	0.20	0.20	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.38	1.39	1.39	
Initial height, in.		H_o	3.00	3.00	3.00	

Shear Strength Parameters

φ = 0 °

tan φ = 0

c = 0.23 T/sq ft

Method of saturation ______

☐ Controlled stress

☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED

Classification CLAY (CH), gray, w/few layers of sandy silt

LL 54 | PL 25 | PI 29 | G_s 2.71

Remarks ______

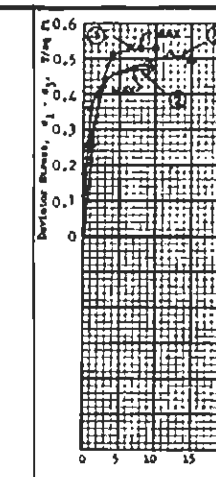
Project LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION

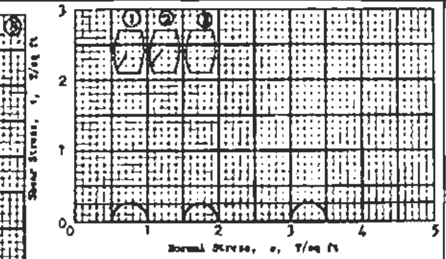
Area CHALMETTE LEVEE EXTENSION

Boring No. 45-CU | Sample No. 9-B1

Depth 32.4 | Date 13 JULY 1967

ESS TRIAXIAL COMPRESSION TEST REPORT





Test No.			①	②	③	
Initial	Water content	w_o	37.7 %	38.3 %	37.6 %	%
	Void ratio	e_o	1.03	1.03	1.00	
	Saturation	S_o	98.4 %	100 %	100 %	%
	Dry density, lb/cu ft	γ_d	82.8	82.8	83.8	
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	1.5	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.52	0.47	0.51	
Time to failure, min		t_f	31	26	32	
Rate of strain, percent/min			0.26	0.27	0.38	
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	

Shear Strength Parameters

φ = 0 °

tan φ = 0

c = 0.25 T/sq ft

Method of saturation ______

☐ Controlled stress

☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED

Classification SILTY CLAY (CL), gray, homogeneous

LL 46 | PL 21 | PI 25 | G_s 2.69

Remarks ______

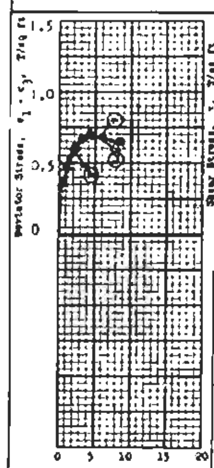
Project LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION

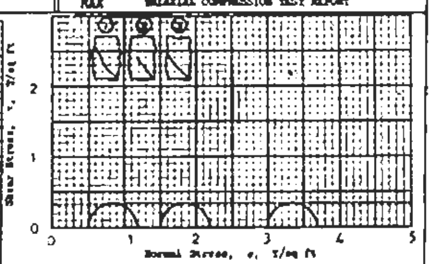
Area CHALMETTE LEVEE EXTENSION

Boring No. 45-CU | Sample No. 11C1

Depth 41.3 | Date 13 July,1967

ESS TRIAXIAL COMPRESSION TEST REPORT





Test No.			1	2	3	
Initial	Water content	w_o	57.3 %	56.0 %	57.5 %	%
	Void ratio	e_o	1.61	1.59	1.62	
	Saturation	S_o	98.2 %	97.2 %	98.0 %	%
	Dry density, lb/cu ft	γ_d	66.1	66.4	65.8	
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	1.5	2.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.69	0.68	0.69	
Time to failure, min		t_f	18	21	21	
Rate of strain, percent/min			0.24	0.21	0.19	
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 = 0 °

tan φ = 0

c = 0.34 T/sq ft

Method of saturation ______

☐ Controlled stress

☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED

Classification CLAY (CH) gray, w/few oxidized fissures

LL 86 | PL 29 | PI 57 | G_s 2.76

Remarks ______

Project LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION

Area CHALMETTE LEVEE EXTENSION

Boring No. 45-CU | Sample No. 16-D

Depth 62.6 | Date 12 JULY 1967

ESS TRIAXIAL COMPRESSION TEST REPORT

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

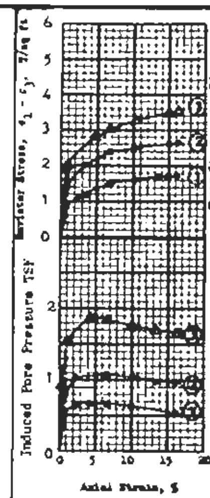
UNDISTURBED BORING 45-CU-"Q" TEST DATA

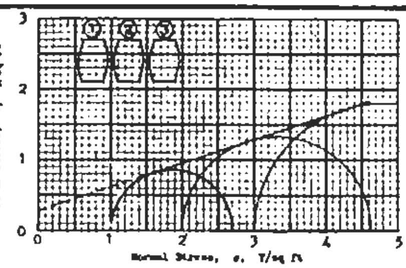
SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC.
ENGINEERS AND ARCHITECTS
NEW ORLEANS, LA.

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

DATE SEPTEMBER 1968 | FILE NO. H-2-24306





Shear Strength Parameters**

φ = 18°

tan φ = 0.325

c = 0.29 T/sq ft

Method of saturation BP

☐ Controlled stress
☒ Controlled strain

Test No.			①	②	③	
Initial	Water content	w_o	37.2 %	36.4 %	34.2 %	%
	Void ratio	e_o	0.981	0.956	0.899	
	Saturation	S_o	100 %	100 %	100 %	%
	Dry density, lb/cu ft	γ_d	80.5	84.6	87.1	
Before Shear	Water content	w_c	32.4 %	29.3 %	27.0 %	%
	Void ratio	e_c	0.876	0.816	0.745	
	Saturation	S_c	98.0 %	95.2*%	96.0*%	%
	Final back pressure, PSI	u_o	38	78	58	
	Dry Density lbs/cu.ft.		88.2	91.1	94.8	
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	1.0	2.0	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	1.70	2.60	3.49	
Time to failure, min		t_f	146	144	144	
Rate of strain, percent/min			0.11	0.11	0.11	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.35	1.35	1.36	
Initial height, in.		H_o	3.00	3.00	3.00	

Type of test R — Type of specimen UNDISTURBED

Classification CLAYEY SILT (ML), gray, contains decayed roots

LL — PL — PI — G_s 2.65

Remarks *Pore Pressure Response indicated 100% Saturation. **See attached plot for effective values. ***Deviator stress at 15.0% axial strain.

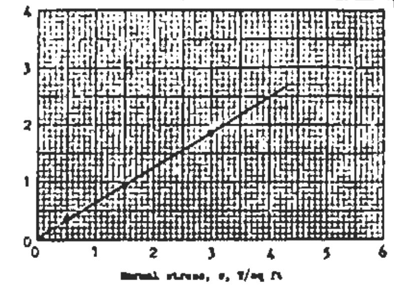
Project LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION

Area CHALMETTE LEVEE EXTENSION

Boring No. 45-CU — Sample No. 5-B

Depth 16.6 — Date 10 June, 1967

TES — TRIAXIAL COMPRESSION TEST REPORT



Shear Strength Parameters

φ' = 32°

tan φ' = 0.625

c' = 0.04 T/sq ft

☐ Controlled stress
☒ Controlled strain

Test No.			①	②	③	
Initial	Water content	w_o	40.2 %	39.3 %	40.7 %	%
	Void ratio	e_o	1.04	1.04	1.05	
	Saturation	S_o	100+ %	100+ %	100+ %	%
	Dry density, lb/cu ft	γ_d	81.8	81.8	81.6	
Void ratio after consolidation		e_c				
Time for 50 percent consolidation, min		t_{50}	<1	<1	<1	
Final	Water content	w_f	32.1 %	31.4 %	29.7 %	%
	Void ratio	e_f				
	Saturation	S_f	%	%	%	%
Normal stress, T/sq ft		σ	0.5	1.5	3.0	
Maximum shear stress, T/sq ft		τ_{max}	0.35	0.98	1.94	
Actual time to failure, min		t_f	1200	1860	2220	
Rate of strain, in./min			.00016	.00016	.00016	
Ultimate shear stress, T/sq ft		τ_{ult}				

Type of specimen UNDISTURBED — 3.01 in. square — 0.465 in. thick

Classification CLAYEY SILT (ML), gray, homogeneous

LL 36 PL 27 PI 9 G_s 2.68

Remarks

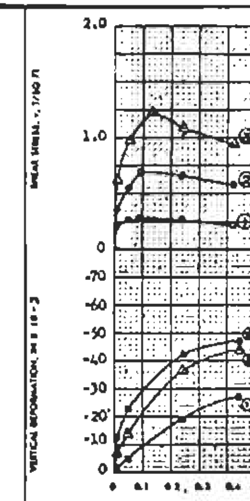
Project LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION

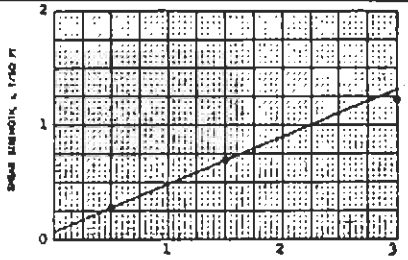
Area CHALMETTE LEVEE EXTENSION

Boring No. 45-CU — Sample No. 4-C_1

Depth 13.0 — Date 21 June, 1967

GDA — DIRECT SHEAR TEST REPORT





SHEAR STRENGTH PARAMETERS

φ' = 23°

tan φ' = 0.424

c' = 0.07 T/SQ FT

☐ CONTROLLED STRESS
☒ CONTROLLED STRAIN

TEST NO.			1	2	3	
INITIAL	WATER CONTENT	w_o	47.2%	45.4%	47.1%	%
	VOID RATIO	e_o	1.34	1.30	1.38	
	SATURATION	S_o	95.4%	94.6%	92.5%	%
	DRY DENSITY, LB/CU FT	γ_d	72.2	73.5	71.2	
VOID RATIO AFTER CONSOLIDATION		e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN		t_{50}	1	1	2	
FINAL	WATER CONTENT	w_f	45.8%	38.2%	35.1%	%
	VOID RATIO	e_f				
	SATURATION	S_f	%	%	%	%
NORMAL STRESS, T/SQ FT		σ	0.5	1.5	3.0	
MAXIMUM SHEAR STRESS, T/SQ FT		τ_{max}	0.27	0.69	1.22	
ACTUAL TIME TO FAILURE, MIN		t_f	570	930	870	
RATE OF STRAIN, IN./MIN			.00016	.00016	.00016	
ULTIMATE SHEAR STRESS, T/SQ FT		τ_{ult}				

TYPE OF SPECIMEN UNDISTURBED — 3.01 IN. SQUARE — 0.465 IN. THICK

CLASSIFICATION CLAY (CH), GRAY, CONTAINS SILT STRATIFIED

LL 51 PL 23 PI 28 G_s 2.71

REMARKS

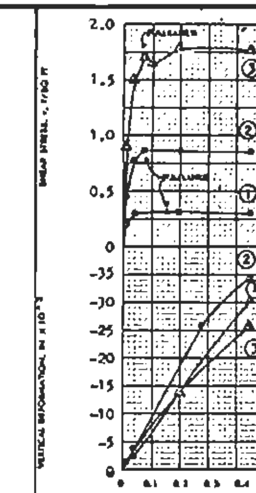
PROJECT LAKE PONTCHARTRAIN AND VICINITY CHALMETTE LEVEE EXTENSION

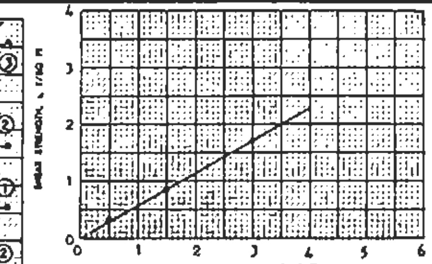
AREA

BORING NO. 45-CU — SAMPLE NO. 10-D

DEPTH 38.3 — DATE 23 June 1967

GDA — DIRECT SHEAR TEST REPORT





SHEAR STRENGTH PARAMETERS

φ' = 30°

tan φ' = 0.577

c' = 0 T/SQ FT

☐ CONTROLLED STRESS
☒ CONTROLLED STRAIN

TEST NO.			①	②	③	
INITIAL	WATER CONTENT	w_o	32.1 %	33.8%	32.6%	%
	VOID RATIO	e_o	0.945	0.939	0.912	
	SATURATION	S_o	91.0 %	96.5%	95.8%	%
	DRY DENSITY, LB/CU FT	γ_d	86.0	86.3	87.5	
VOID RATIO AFTER CONSOLIDATION		e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN		t_{50}	<1	<1	<1	
FINAL	WATER CONTENT	w_f	35.3 %	31.6%	30.0%	%
	VOID RATIO	e_f				
	SATURATION	S_f	%	%	%	%
NORMAL STRESS, T/SQ FT		σ	0.5	1.5	3.0	
MAXIMUM SHEAR STRESS, T/SQ FT		τ_{max}	0.32	0.86	1.71	
ACTUAL TIME TO FAILURE, MIN		t_f	1020	510	510	
RATE OF STRAIN, IN./MIN			.00016	.00016	.00016	
ULTIMATE SHEAR STRESS, T/SQ FT		τ_{ult}				

TYPE OF SPECIMEN UNDISTURBED — 3.01 IN. SQUARE — 0.465 IN. THICK

CLASSIFICATION SILTY SAND (SM), gray, contains seams of clay

LL — PL — PI — G_s 2.68

REMARKS

PROJECT LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION

AREA CHALMETTE LEVEE EXTENSION

BORING NO. 45-CU — SAMPLE NO. 21-D

DEPTH 82.3 — DATE 19 June, 1967

GDA — DIRECT SHEAR TEST REPORT

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

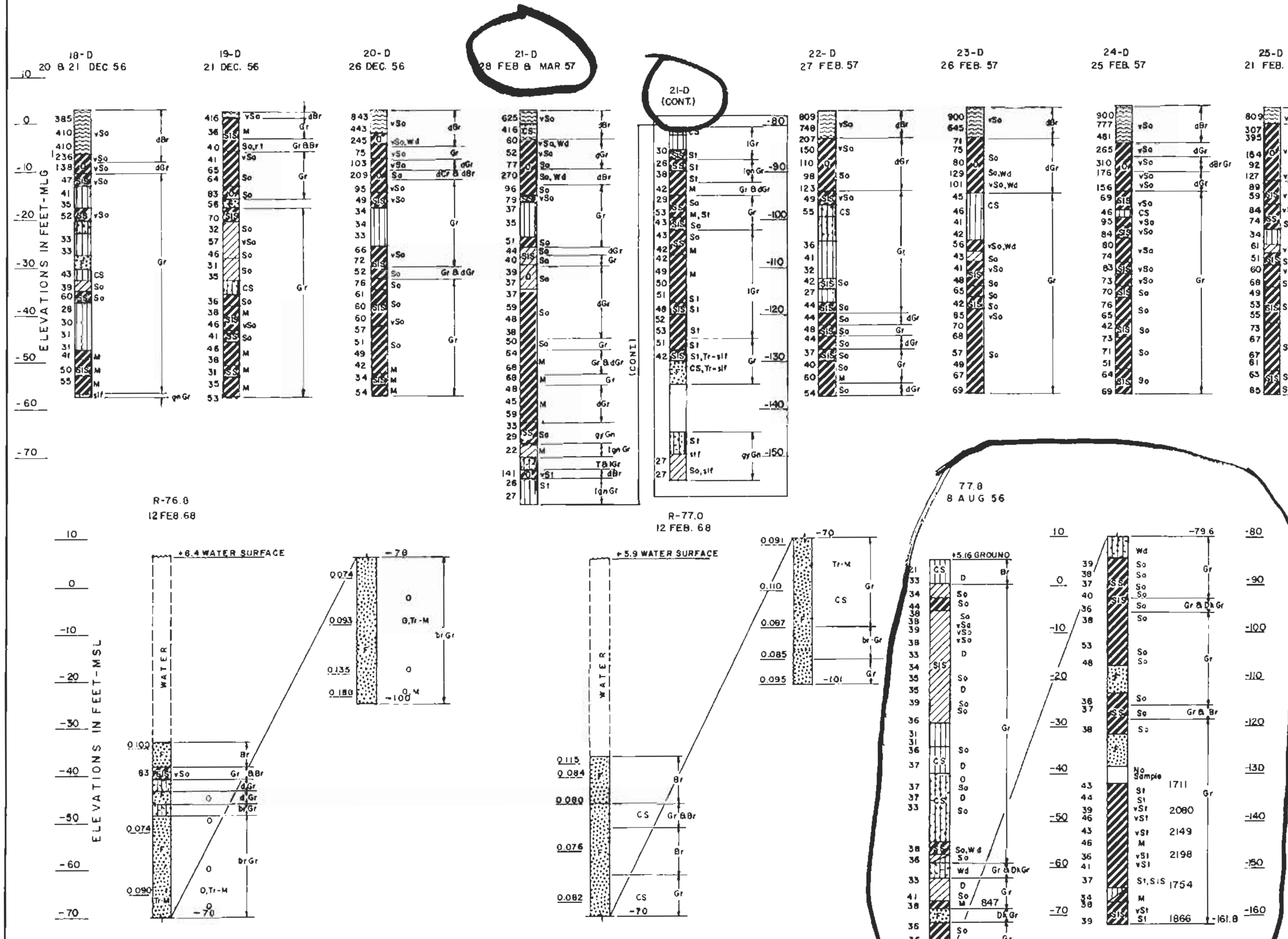
UNDISTURBED BORING 45-CU -"R"&"S"
TEST DATA

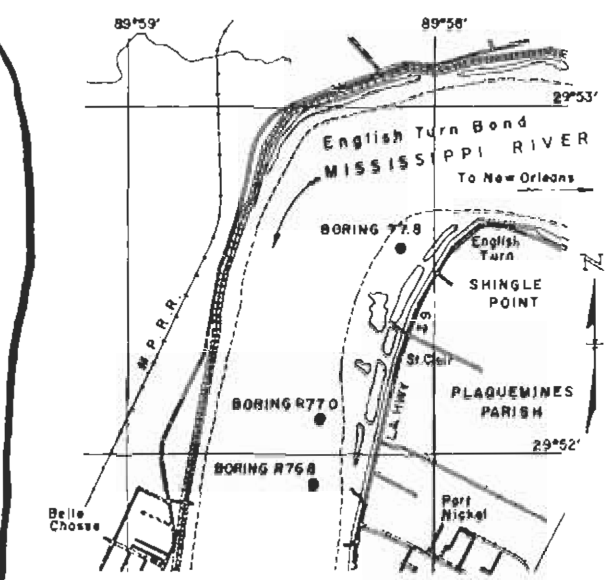
SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC.
ENGINEERS AND ARCHITECTS
NEW ORLEANS, LA.

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

DATE SEPTEMBER 1968 — FILE NO. H-2-24306





BORROW AREA LOCATION PLAN

NOTES

1.-ELEVATIONS REFER TO MEAN LOW GULF DATUM (MLG) FOR BORINGS 18-D THRU 27-D.

2.-FOR LOCATION OF BORINGS 18-D THRU 27-D SEE PLATES 2 THRU 4.

3.-ELEVATIONS REFER TO MEAN SEA LEVEL DATUM (MSL) FOR BORINGS R-76.8, R-77.0, & 77.8.

4.-FOR LOCATION OF BORINGS (R-76.8 — R-77.0 — 77.8) SEE LOCATION PLAN THIS PLATE.

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

MR-GO & MISS. RIVER BORROW
BORING LOGS

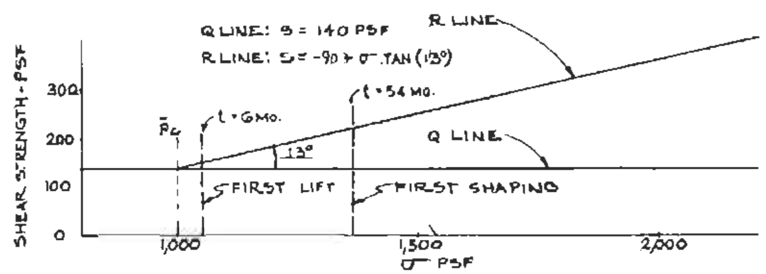
SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC.
ENGINEERS AND ARCHITECTS
NEW ORLEANS, LA.

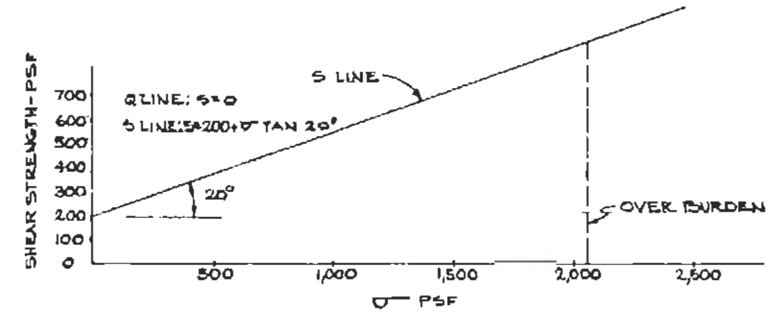
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS, U. S. ARMY
NEW ORLEANS, LA.

DATE SEPTEMBER 1966

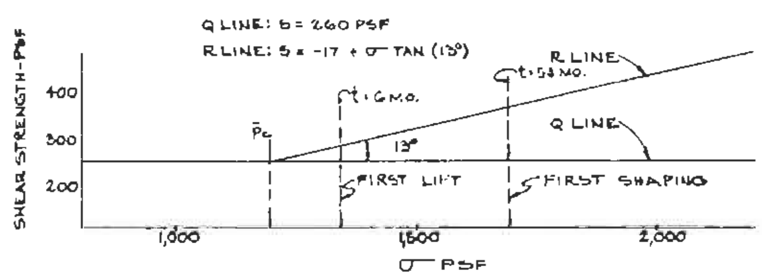
FILE NO. H-2-24306



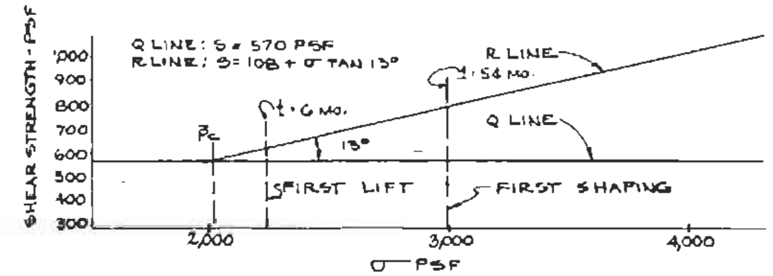
STRATUM 1 (CH)
(SURFACE TO EL. -2)



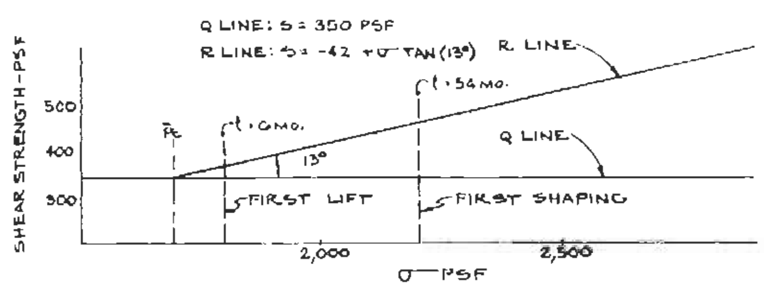
STRATUM 5 (SM)
(EL. -24 TO -36)



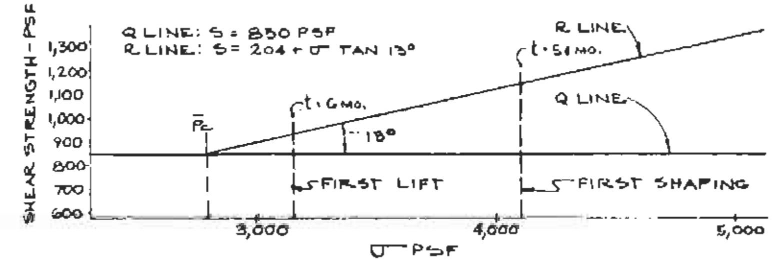
STRATUM 2 (CH)
(EL. -2 TO EL. -10)



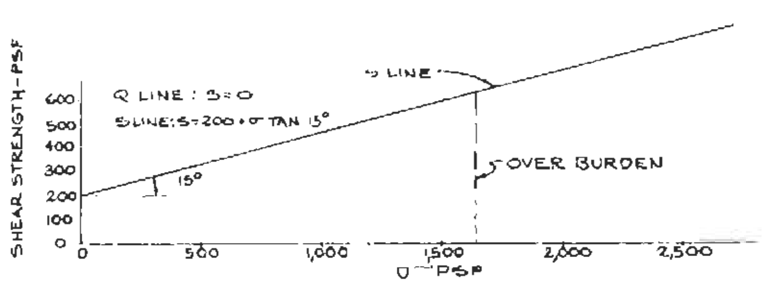
STRATUM 6 (CH)
(EL. -36 TO EL. -54)



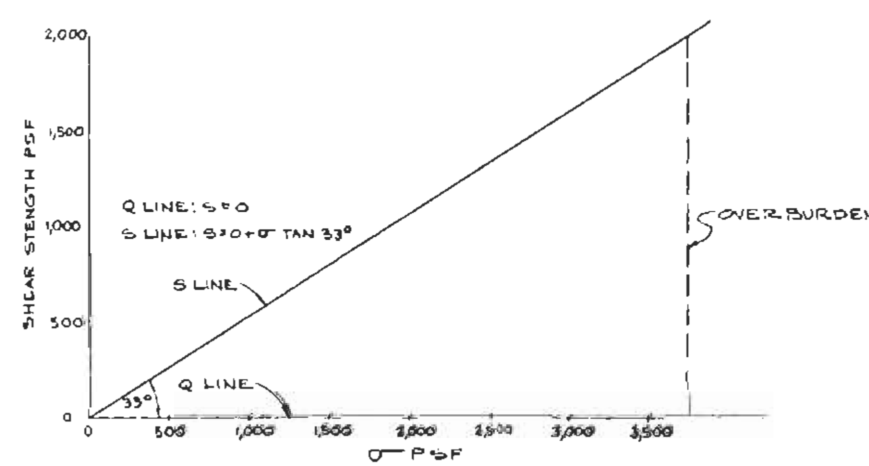
STRATUM 3 (CH)
(EL. -10 TO -20)



STRATUM 7 (CH)
EL. -54 TO EL. -66



STRATUM 4 (ML)
(EL. -20 TO -24)



STRATUM 8 (SP-F)
(EL. -66 TO EL. -70)

NOTES:
ELEVATIONS IN FEET M.S.L.
SEE BORINGS No. S-CU- PL 20 FOR DESIGN TEST DATA

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

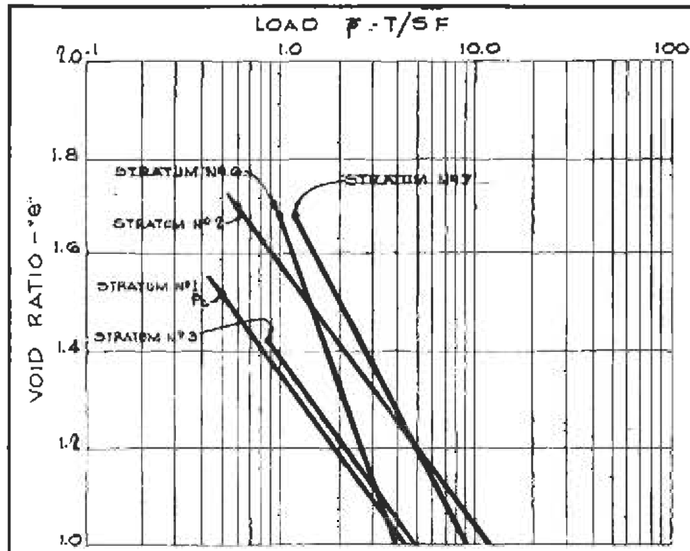
DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

(R) STRENGTH DESIGN DATA - I

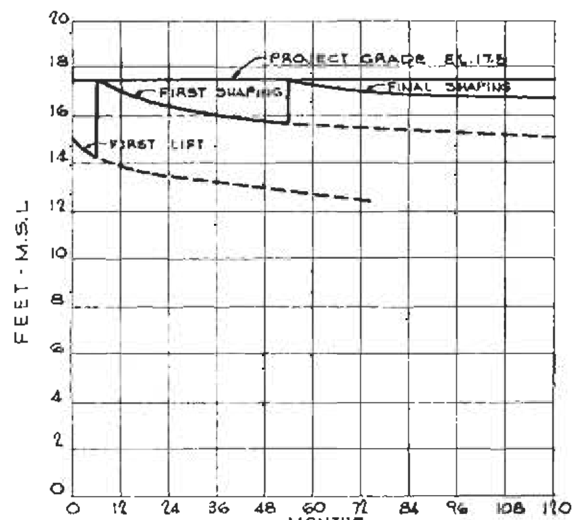
STA. 770 + 00 TO STA. 940 + 00

SCALES AS SHOWN

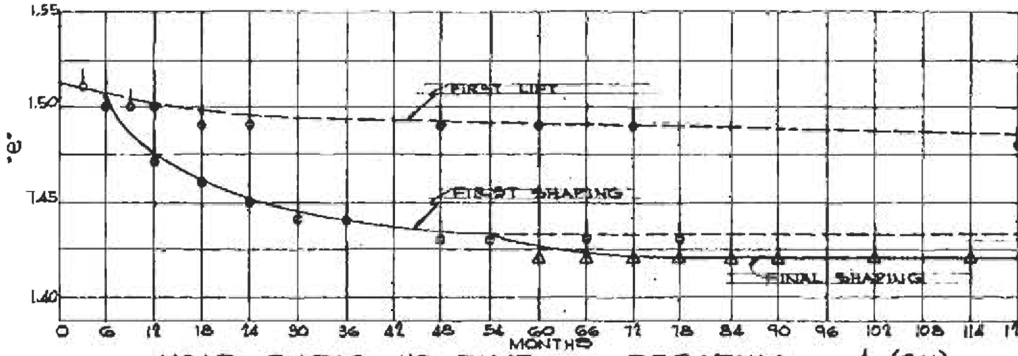
DATE SEPTEMBER 1968 — FILE NO. H-2-24306



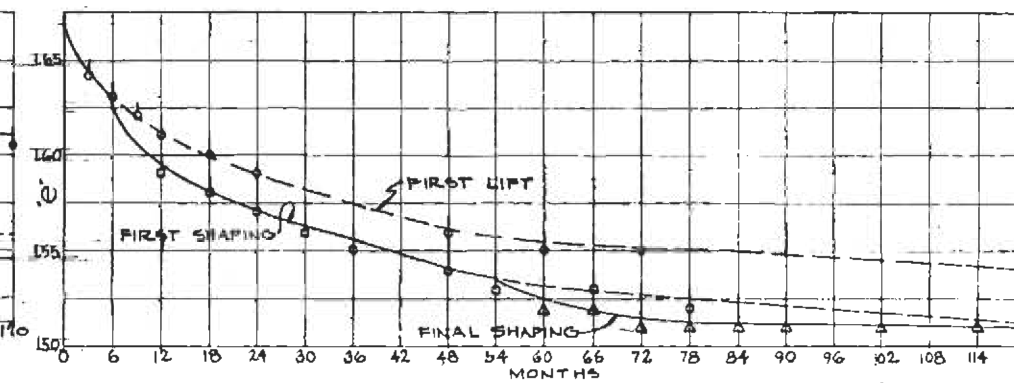
CONSOLIDATION DATA



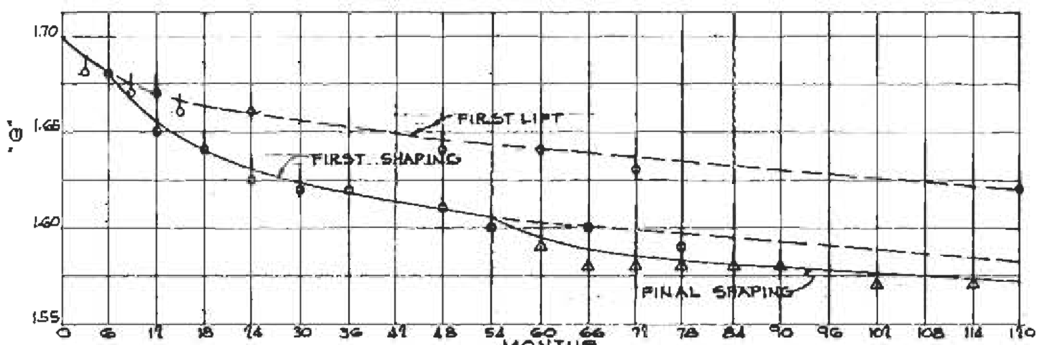
ELEVATION AT LEVEE ℄ VS. TIME



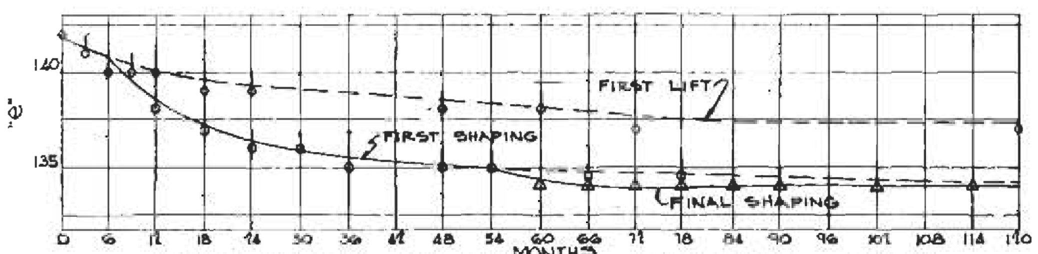
VOID RATIO VS. TIME — STRATUM 1 (CH)



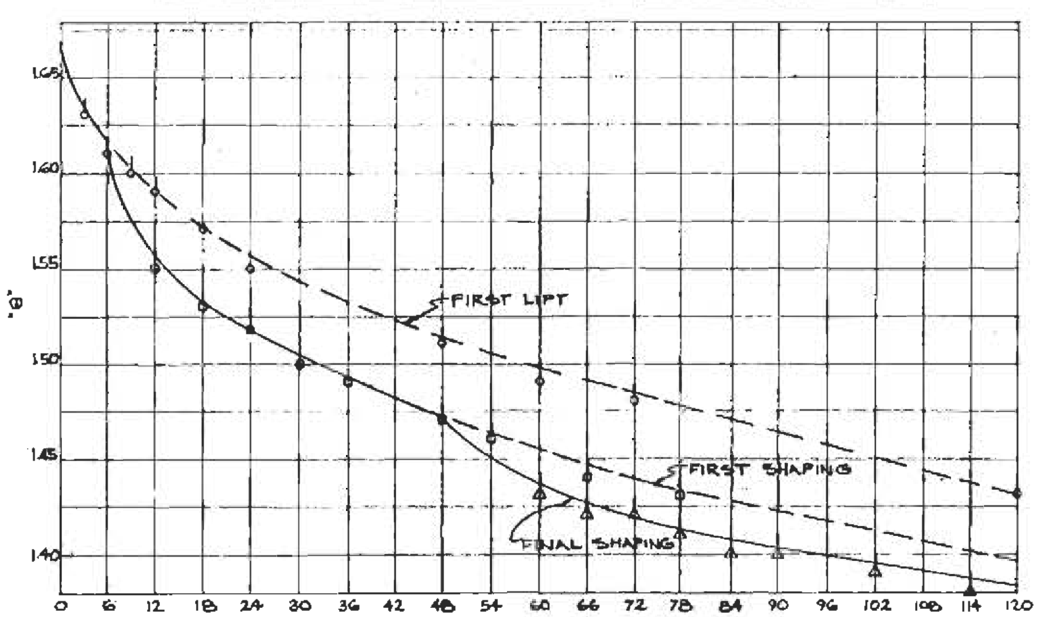
VOID RATIO VS. TIME — STRATUM 7 (CH)



VOID RATIO VS. TIME — STRATUM 2 (CH)



VOID RATIO VS. TIME — STRATUM 3 (CH)



VOID RATIO VS TIME — STRATUM 6 (CH)

NOTE:
SEE BORING Nº 5-CU-PL. 20 FOR DESIGN TEST DATA.

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

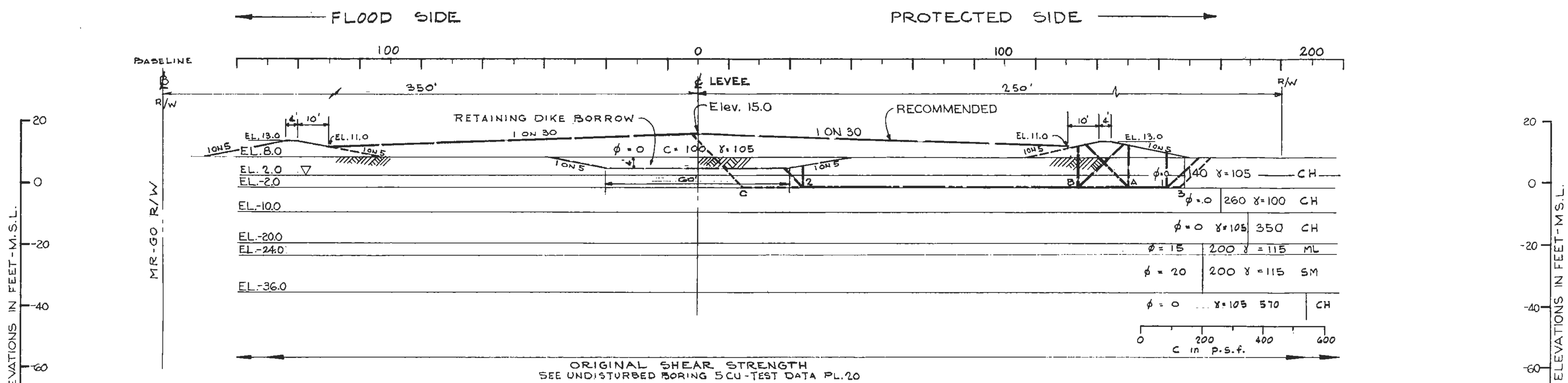
DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

(R) STRENGTH DESIGN DATA - 2

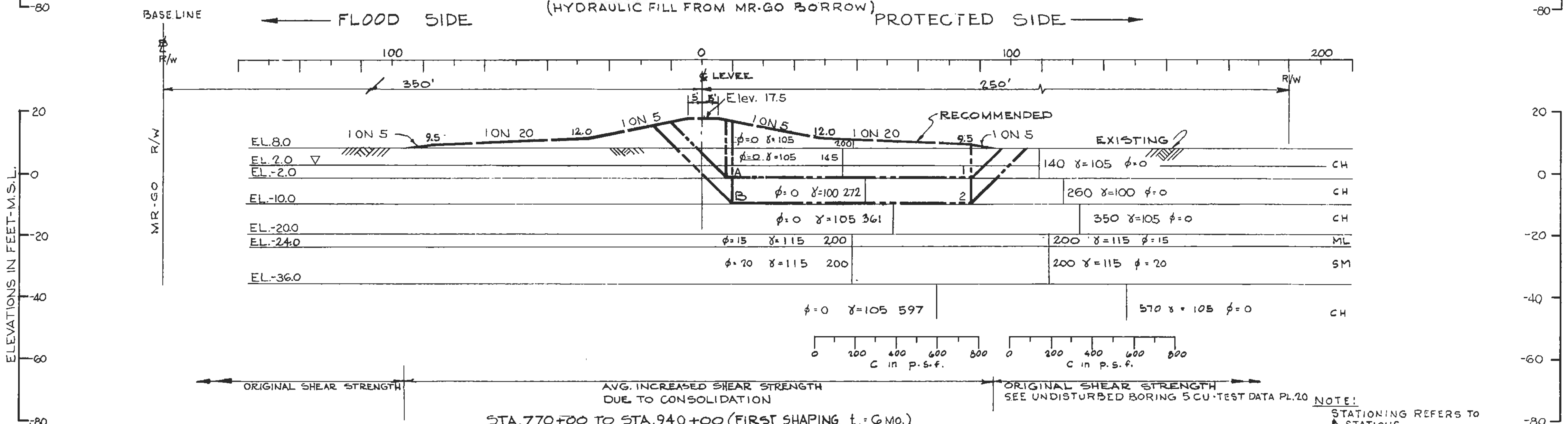
STA. 770 + 00 TO STA. 940 + 00

SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC. ENGINEERS AND ARCHITECTS NEW ORLEANS, LA.	U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS, U. S. ARMY NEW ORLEANS, LA.
DATE: SEPTEMBER 1968	FILE NO. H-2-24305



STA. 770+00 TO STA. 940+00 (FIRST LIFT t=0)
(HYDRAULIC FILL FROM MR-GO BORROW)



STA. 770+00 TO STA. 940+00 (FIRST SHAPING t = 6 MO.)

NOTE:
STATIONING REFERS TO ℄ STATIONS
STATION LIMITS SHOWN ARE APPROXIMATE
SEE PL. 12 FOR DESIGN SECTIONS.

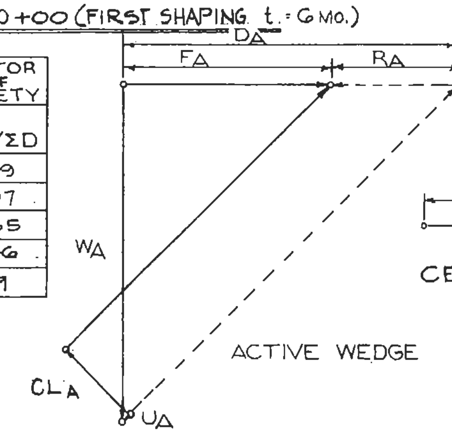
SECTION	FAILURE SURFACE			DRIVING FORCES			RESISTING FORCES				FACTOR OF SAFETY
	NO.		EL.	+D_A	-D_P	ΣD	+R_A	+R_B	+R_P	ΣR	ΣR/ΣD
FIRST LIFT	A	1	-1.9	10,983	5,645	5,338	3,652	1,512	2,772	7,936	1.49
	B	2	-1.9	10,983	1,916	9,067	3,652	12,572	1,652	17,876	1.97
	C	3	-1.9	14,578	5,206	9,372	4,162	19,775	2,772	26,709	2.85
FIRST SHAPING	A	1	-1.9	19,323	5,398	13,925	6,271	11,121	2,871	20,263	1.46
	B	2	-9.9	37,781	16,918	20,863	10,277	19,992	7,109	37,378	1.79

LEVEE STABILITY CALCULATIONS

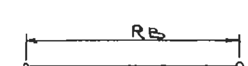
SURFACE: A-1

FS WITH RESPECT TO SHEAR STRENGTH

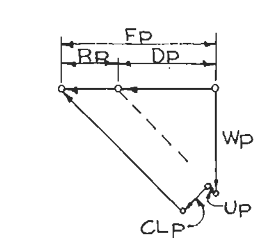
$$\frac{R_A + R_B + R_P}{D_A - D_P} = \frac{20,263}{13,925} = 1.46$$



VECTOR DIAGRAM
(Method of planes)



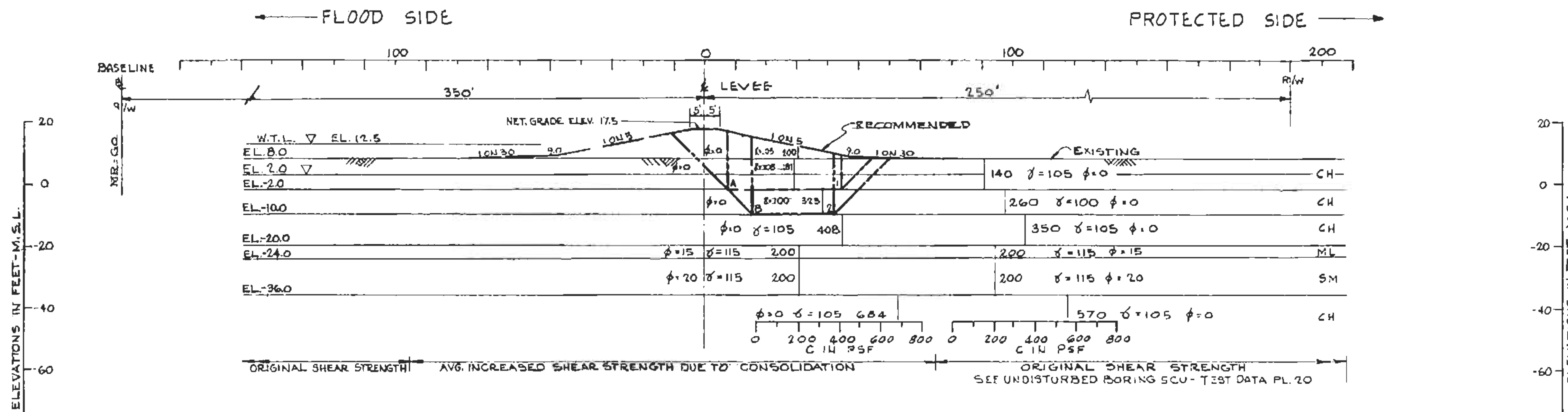
CENTRAL BLOCK



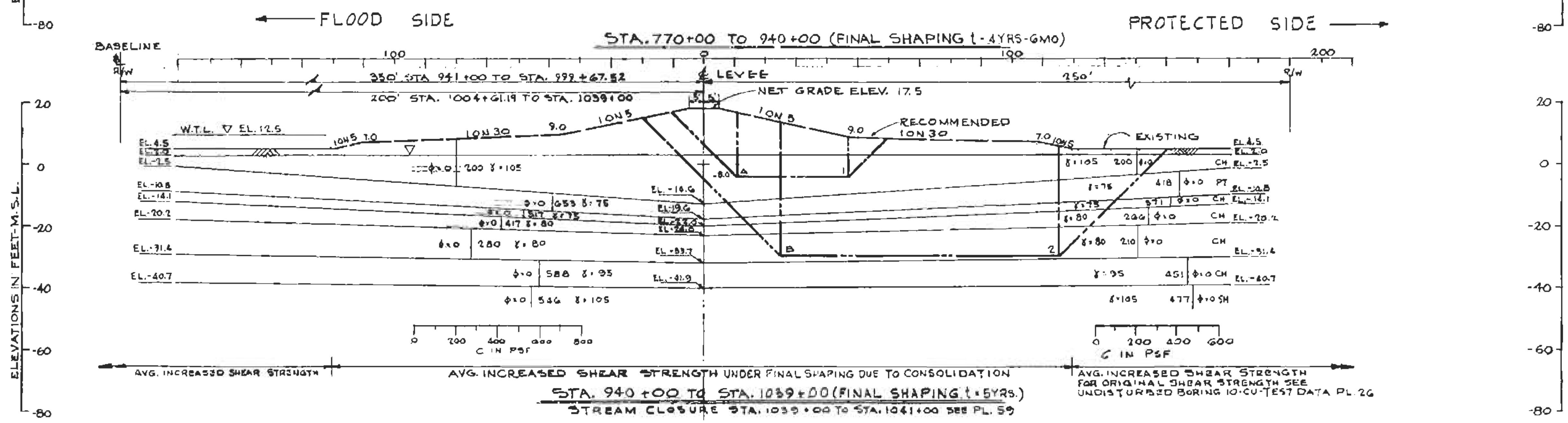
PASSIVE WEDGE

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN
DESIGN MEMORANDUM NO. 5—DETAIL DESIGN
BAYOUS BIENVENUE AND DUPRE CONTROL STRUCTURES
(Q)(R) STABILITY ANALYSIS
STA. 770+00 TO STA. 940+00
SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC. ENGINEERS AND ARCHITECTS NEW ORLEANS, LA.	U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS, U. S. ARMY NEW ORLEANS, LA.
DATE: SEPTEMBER 1968	FILE NO. H-2-24147



STA. 770+00 TO 940+00 (FINAL SHAPING t - 4 YRS-6MO)



STA. 940+00 TO STA. 1039+00 (FINAL SHAPING t - 5YRS.)

STREAM CLOSURE STA. 1039+00 TO STA. 1041+00 SEE PL. 59

NOTE:
STATIONING REFERS TO ℄ STATIONS
STATION LIMITS SHOWN ARE APPROXIMATE

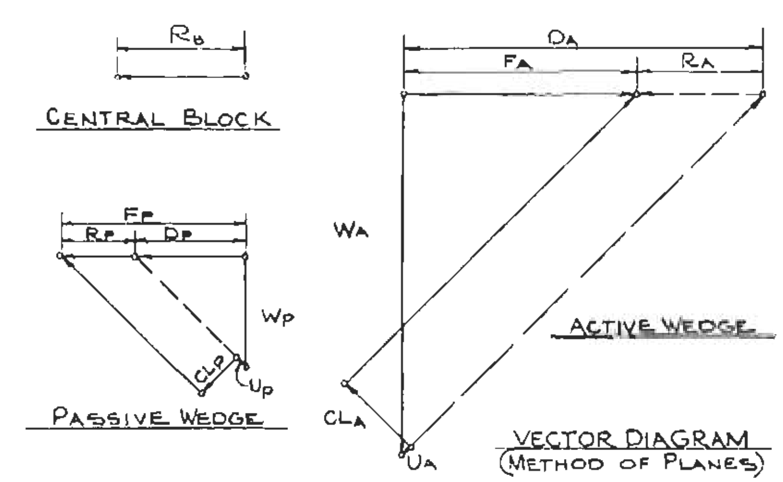
SECTION	FAILURE SURFACE			DRIVING FORCES			RESISTING FORCES				FACTOR OF SAFETY
	NO.		EL	$+D_A$	$-D_P$	ΣD	$+R_A$	$+R_B$	$+R_P$	ΣR	$\Sigma R/\Sigma D$
770+00 TO 940+00	A	1	-1.9	19,323	6240	13,083	6,984	6,507	3,884	17,375	1.33
	B	2	-9.9	37,579	18,691	18,888	12,123	8,112	8,957	29,192	1.55
940+00 TO 1039+00	A	1	-8.0	32,875	15,065	17,810	9,800	5,783	6,633	22,216	1.25
	B	2	-31.3	113,090	58,153	54,937	26,694	24,752	20,174	71,620	1.30

LEVEE STABILITY CALCULATIONS

SURFACE: A-1

FS WITH RESPECT TO SHEAR STRENGTH

$$\frac{R_A + R_B + R_P}{D_A - D_P} = \frac{17,375}{13,083} = 1.33$$



SEE PLATE 12 AND PLATE 13 FOR DESIGN SECTIONS

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN
DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

(R) STABILITY ANALYSIS

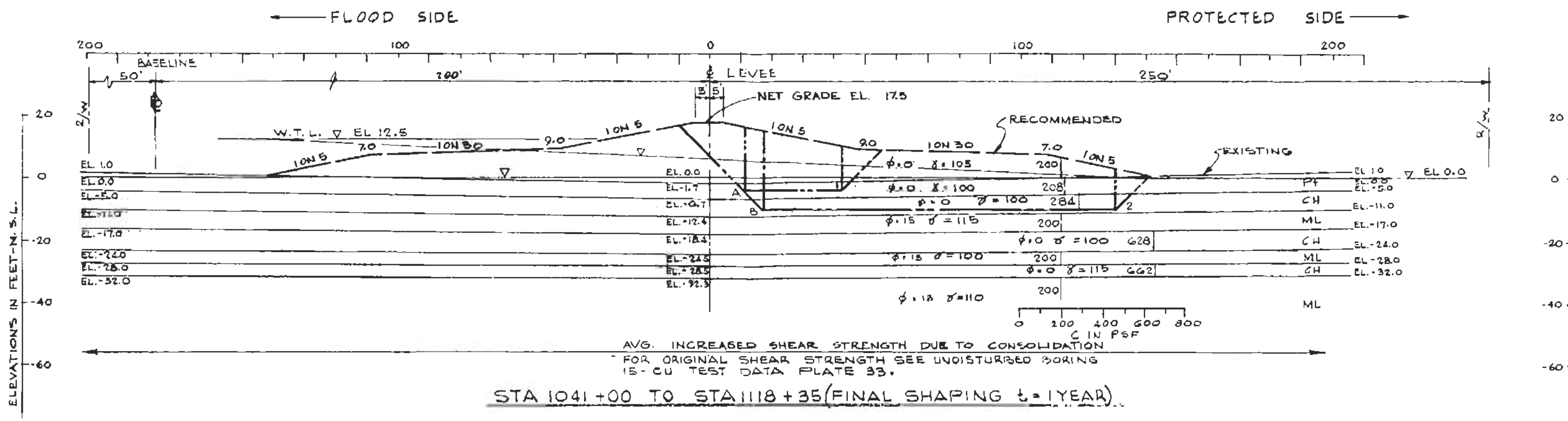
STA. 770+00 TO STA. 1039+00

SCALES AS SHOWN

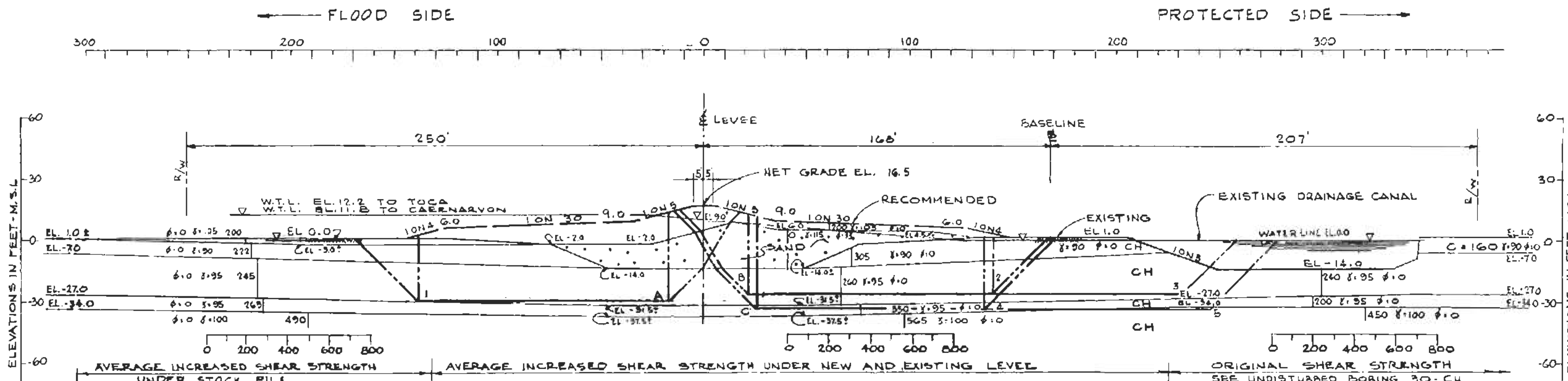
WALDEMAR S. NELSON AND COMPANY, INC. ENGINEERS AND ARCHITECTS NEW ORLEANS, LA.

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

DATE SEPTEMBER 1966 FILE NO. H-2-24306



STA 1041+00 TO STA 1118+35 (FINAL SHAPING t = 1 YEAR)



STA. 1120+90 TO STA. 1535+40 (FINAL SHAPING t = 3 YEARS)

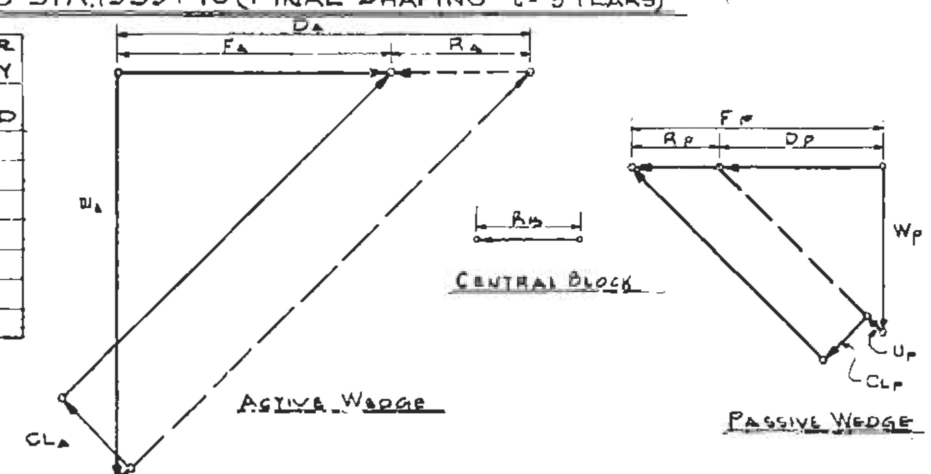
SECTION	FAILURE SURFACE		DRIVING FORCES			RESISTING FORCES				FACTOR OF SAFETY
	NO	EL	$+D_A$	$-D_P$	ΣD	$+R_A$	$+R_B$	$+R_P$	ΣR	$\Sigma R/\Sigma D$
1041+00 TO 1118+35	A 1	-4.9	25,569	10,398	15,171	8,614	6,230	5,525	20,369	1.34
	B 2	-10.9	40,192	8,013	32,179	11,765	31,439	5,764	48,968	1.52
1120+90 TO 1535+40	A 1	-29.9	112,020	45,664	66,356	39,371	30,905	14,440	84,716	1.28
	B 2	-26.9	98,578	36,089	62,489	31,877	31,363	15,466	78,706	1.26
	B 3	-26.9	98,593	27,162	71,431	31,738	54,657	6,972	93,367	1.31
	C 4	-33.9	130,475	57,644	72,831	35,326	38,859	19,956	94,141	1.29
	C 5	-33.9	130,475	42,260	88,215	35,326	74,096	8,831	118,253	1.34

LEVEE STABILITY CALCULATIONS

SURFACE : A-1

FS WITH RESPECT TO SHEAR STRENGTH

$$\frac{R_A + R_B + R_P}{D_A - D_P} = \frac{20,369}{15,171} = 1.34$$



NOTE:
- STATIONING REFERS TO ℄ STATIONS
- STATION LIMITS ARE APPROXIMATE.
- SEE PLATE 14 AND PLATE 15 FOR DESIGN SECTION
- GAP CLOSURE STRUCTURE STA. 1118+40.41 TO STA. 1120+95.41 SEE PLATE 66

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

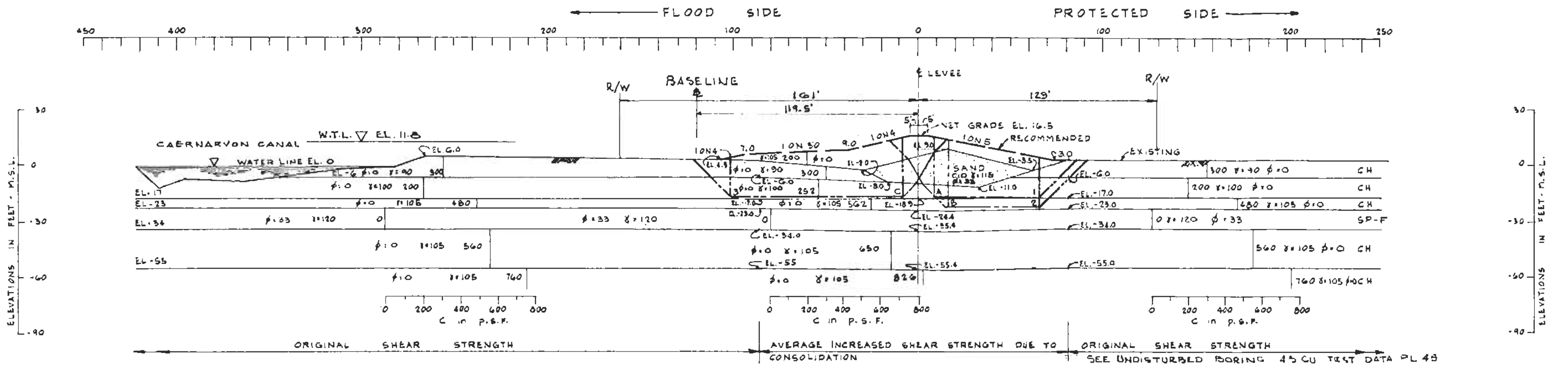
(R) STABILITY ANALYSIS
STA. 1041+00 TO STA. 1535+40

SCALES AS SHOWN

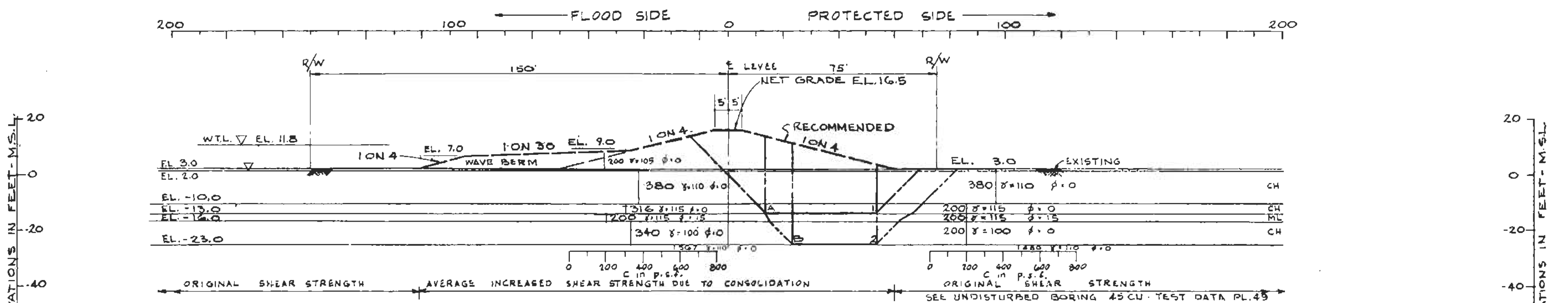
WALDEMAR S. NELSON AND COMPANY, INC.
ENGINEERS AND ARCHITECTS
NEW ORLEANS, LA.

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

DATE SEPTEMBER 1966 FILE NO. H-2-24308



STA. 1537 + 00 TO 1559 + 00 (FINAL SHAPING t = 2 YRS.)



STA. 1559 + 00 TO 1578 + 12 (FINAL SHAPING t = 1 YR)

(STRUCTURE SITE EXPECTED - SEE PL 67)

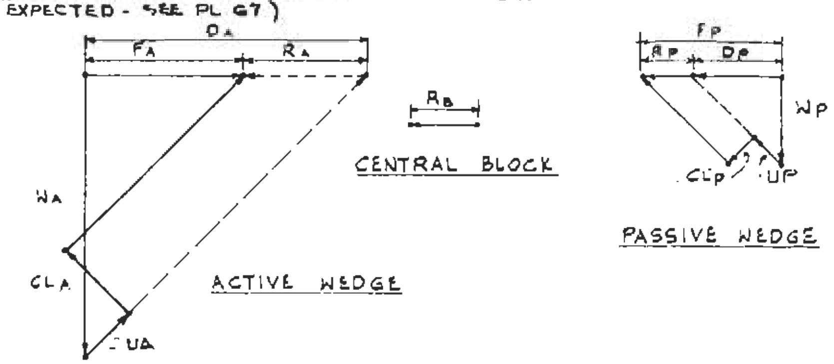
SECTION	FAILURE SURFACE		DRIVING FORCES			RESISTING FORCES				FACTOR OF SAFETY
	NO	EL	$+D_A$	$-D_P$	ΣD	$+R_A$	$+R_B$	$+R_P$	ΣR	$\Sigma R/\Sigma D$
1537+00 TO 1559+00	A 1	-16.9	58,789	19,857	38,932	25,421	13,927	10,893	50,241	1.29
	B 2	-22.9	81,567	33,398	48,169	30,963	27,125	17,347	75,435	1.57
	C 3	-16.9	59,024	21,277	37,747	26,696	22,870	10,641	60,207	1.60
1559+00 TO 1578+12	A 1	-12.9	43,352	14,241	29,091	16,618	11,360	11,713	39,686	1.36
	B 2	-22.9	75,944	21,277	38,982	24,703	10,006	17,326	52,035	1.33

LEVEE STABILITY CALCULATIONS

SURFACE A-1

F.S. WITH RESPECT TO SHEAR STRENGTH

$$\frac{R_A + R_B + R_P}{D_A - D_P} = \frac{50,241}{38,932} = 1.29$$



VECTOR DIAGRAM
(METHOD OF PLANES)

NOTE:
STATIONING REFERS TO ℄ STATIONS.
STATION LIMITS SHOWN ARE APPROXIMATE
SEE PL. 16 AND PL. 17 FOR DESIGN SECTION

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN
DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION
(R) STABILITY ANALYSIS
STA. 1537+00 TO STA. 1578+12

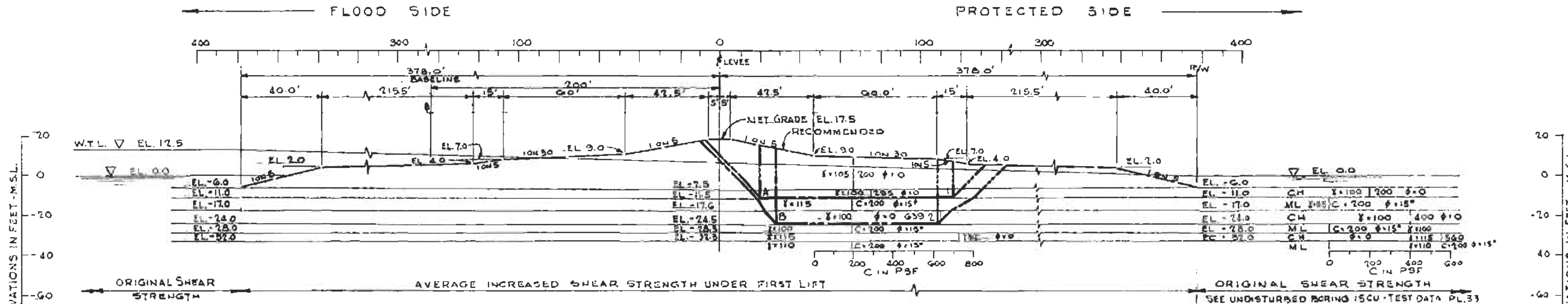
SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC. ENGINEERS AND ARCHITECTS NEW ORLEANS, LA.

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

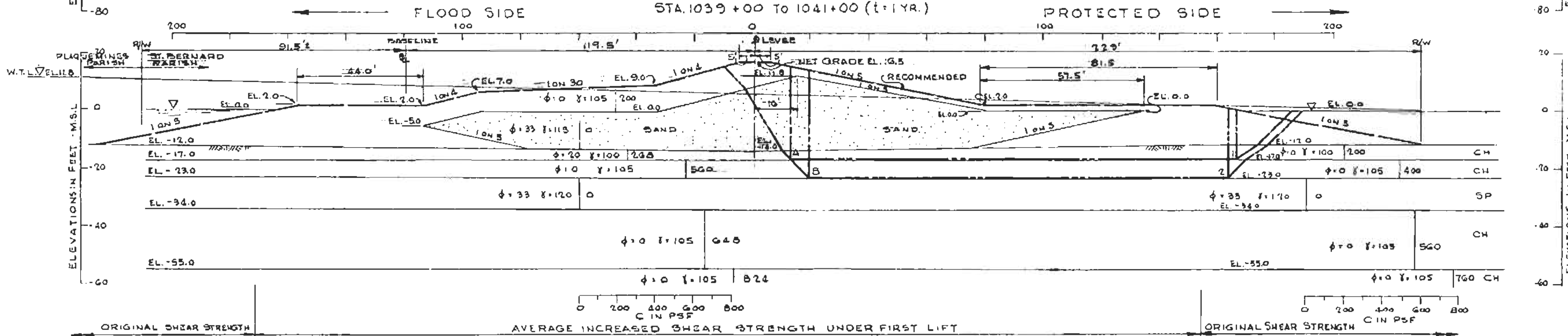
DATE SEPTEMBER 1968

FILE NO. H-2-24306



STREAM CLOSURE

STA. 1039+00 TO 1041+00 (t = 1 YR.)



STREAM CLOSURE

STA. 1535+40 TO STA. 1537+00 (t = 2 YRS.)

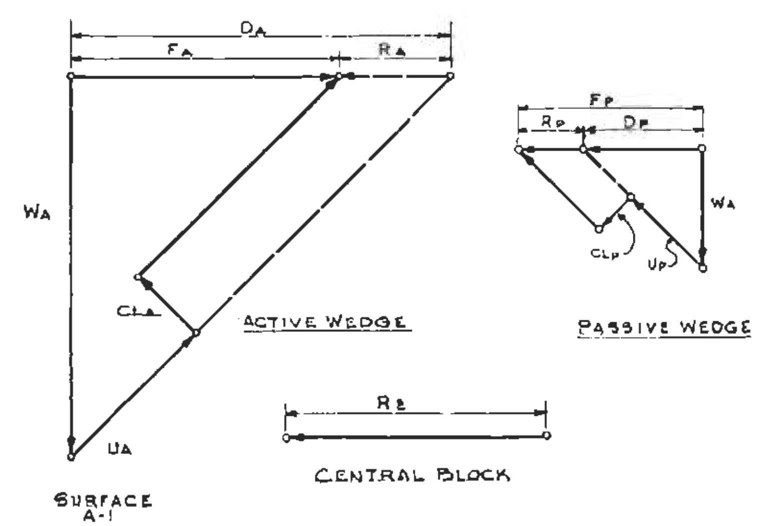
SECTION	FAILURE SURFACE		DRIVING FORCES			RESISTING FORCES				FACTOR OF SAFETY
	NO	EL	$+D_A$	$-D_P$	ΣD	$+R_A$	$+R_B$	$+R_P$	ΣR	$\Sigma R / \Sigma D$
1039+00 TO 1041+00	A1	-10.9	39,555	12,051	27,504	11,729	27,068	6,604	45,401	1.65
	B2	-23.9	82,255	41,496	40,759	26,059	52,332	21,436	99,827	2.45
1535+40 TO 1537+00	A1	-16.9	60,579	13,375	47,204	30,076	41,674	4,302	76,052	1.61
	B2	-54.9	83,694	25,083	58,611	36,673	83,238	10,842	130,753	2.23

LEVEE STABILITY CALCULATIONS

SURFACE A-1

FACTOR OF SAFETY WITH RESPECT TO SHEAR STRENGTH

$$\frac{R_A + R_B + R_P}{D_A + D_P} = \frac{45,401}{27,504} = 1.65$$



VECTOR DIAGRAM
(METHOD OF PLANES)

NOTES:

STATIONING REFERS TO ℄ STATIONS.
STATION LIMITS SHOWN ARE APPROXIMATE.
SEE PL. 18 FOR DESIGN SECTIONS.
SECTIONS SHOWN INDICATE CONDITIONS FOR 5 YEARS OR LESS AFTER START OF CONSTRUCTION.
ANY DESIGN REQUIRED SUBSEQUENT TO THIS PERIOD WILL BE BASED ON UNDISTURBED BORINGS TAKEN AT THAT TIME.

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

(R) STABILITY ANALYSIS

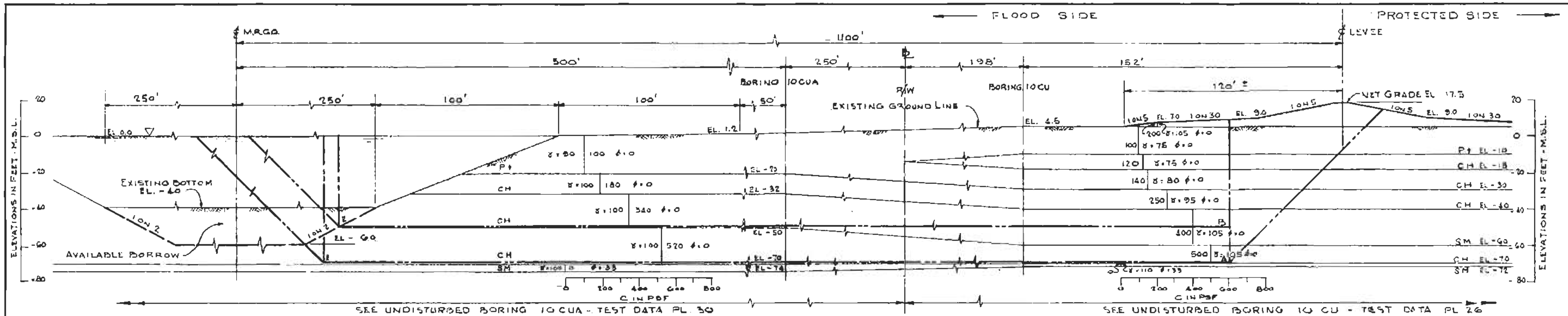
STREAM CLOSURES

SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC.
ENGINEERS AND ARCHITECTS
NEW ORLEANS, LA.

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

DATE SEPTEMBER 1966 | FILE NO. H-2-24306



NOTE:
SEE PLATE No. 52 FOR GENERAL BORINGS ALONG ℄ M.R.G.O.

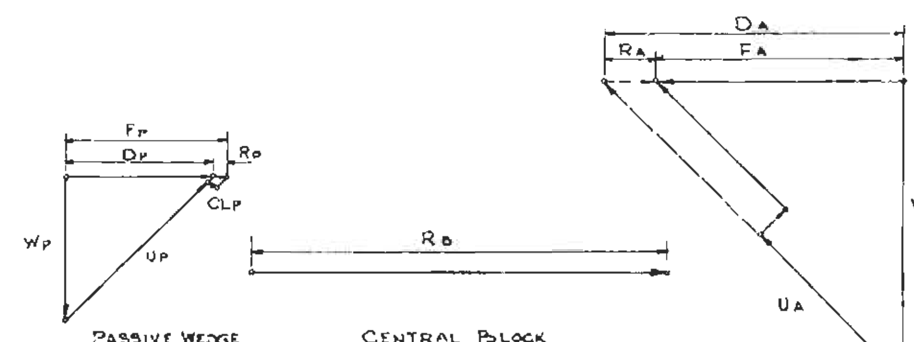
SECTION	FAILURE SURFACE			DRIVING FORCES			RESISTING FORCES				FACTOR OF SAFETY
	NO		EL.	$+D_A$	$-D_P$	ΣD	$+R_A$	$+R_B$	$+R_P$	ΣR	$\Sigma R / \Sigma D$
MR-GO	A	1	-69.9	302,636	155,031	147,605	41,343	421,648	10,296	473,287	3.21
BORROW	B	2	-69.9	178,956	77,688	101,268	23,547	300,515	0	324,062	3.20

LEVEE STABILITY CALCULATIONS

SURFACE A-1

F.S. WITH RESPECT TO SHEAR STRENGTH

$$\frac{R_A + R_B + R_P}{D_A - D_P} \quad \frac{473,287}{147,605} = 3.21$$



VECTOR DIAGRAM
(METHOD OF PLANES)

LAKE PONTCHARTRAIN, LA AND VICINITY
CHALMETTE AREA PLAN

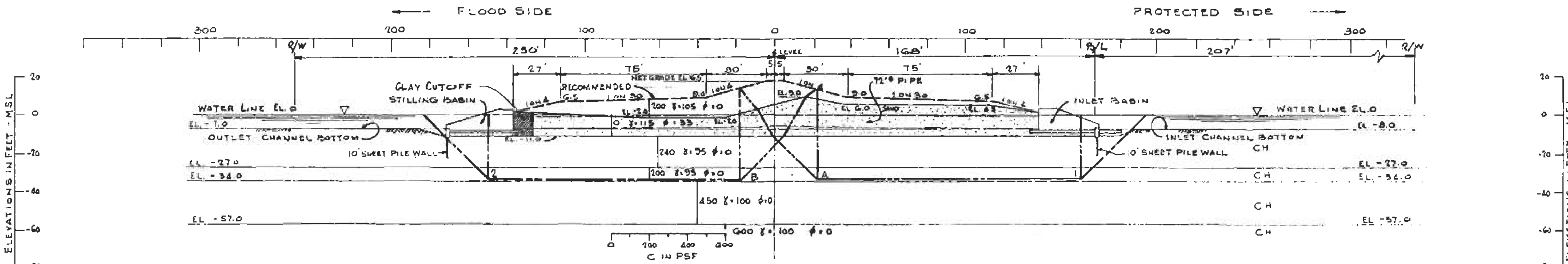
DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

(Q) STABILITY ANALYSIS

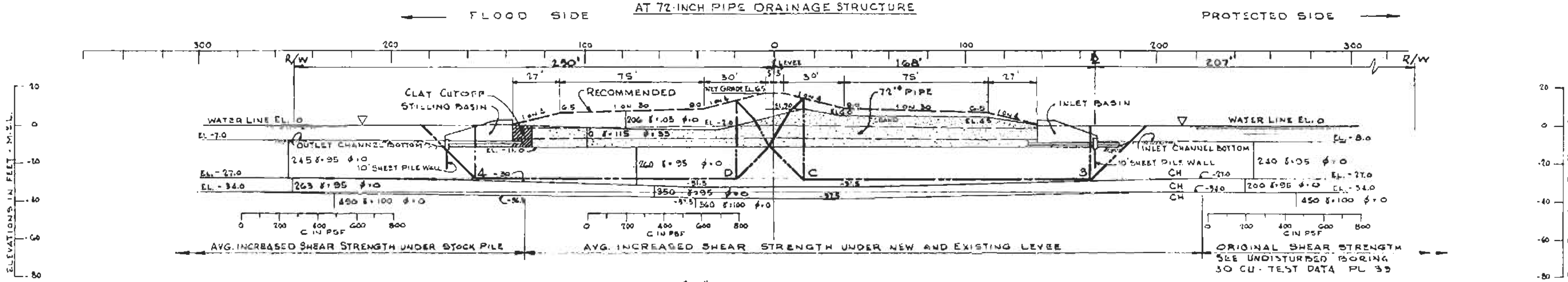
MR - GO BORROW

SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC. ENGINEERS AND ARCHITECTS NEW ORLEANS, LA	U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS, U. S. ARMY NEW ORLEANS, LA
DATE SEPTEMBER 1966	FILE NO. H-2-24306



"Q" STABILITY
AT 72-INCH PIPE DRAINAGE STRUCTURE



"R" STABILITY
AT 72-INCH PIPE DRAINAGE STRUCTURE

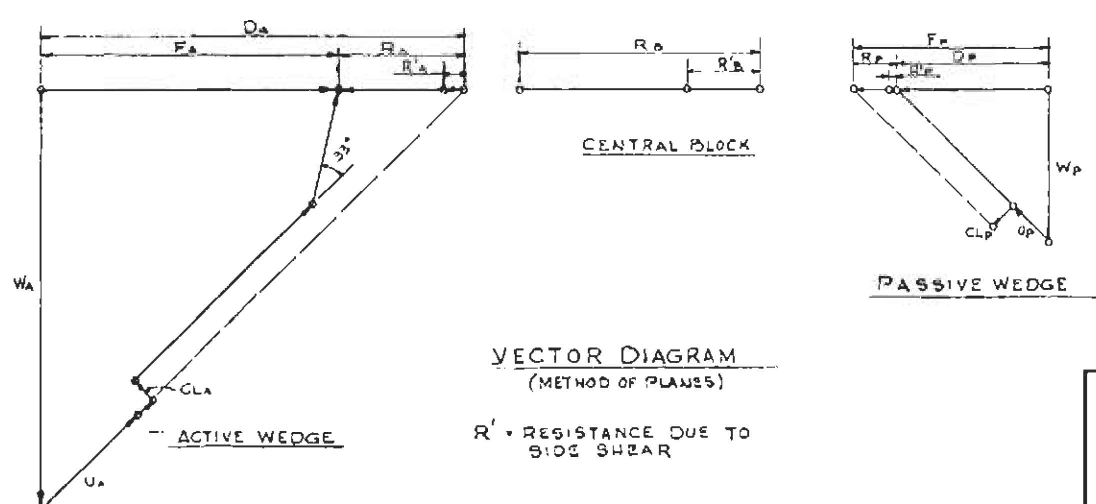
FAILURE SURFACE		F.S. CONVENTIONAL STABILITY	F.S. MASS STABILITY	
			50' WIDTH	170' WIDTH
Q-TEST DATA	A-1	0.91	2.09	1.24
	B-2	0.90	2.04	1.22
R-TEST DATA	C-3	1.16	2.52	1.59
	D-4	1.12	2.28	1.44

FAILURE SURFACE		DRIVING FORCES			RESISTING FORCES				FACTOR OF SAFETY
NO.	EL.	$+D_A$	$-D_P$	ΣD	$+R_A$	$+R_B$	$+R_P$	ΣR	$\Sigma R / \Sigma D$
A-1	-33.9	131,400	48,104	83,296	38,965	51,760	12,608	103,333	1.24

LEVEE STABILITY CALCULATIONS
SURFACE A-1

F.S. WITH RESPECT TO SHEAR STRENGTH

$$\frac{R_A + R_B + R_P}{D_A - D_P} = \frac{103,333}{83,296} = 1.24$$



VECTOR DIAGRAM
(METHOD OF PLANES)

R' = RESISTANCE DUE TO SIDE SHEAR

NOTE:
SEE PLATE Nº 81 FOR PLAN AND DETAILS

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN
DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

STABILITY ANALYSIS
DRAINAGE STRUCTURE

SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC. ENGINEERS AND ARCHITECTS NEW ORLEANS, LA.

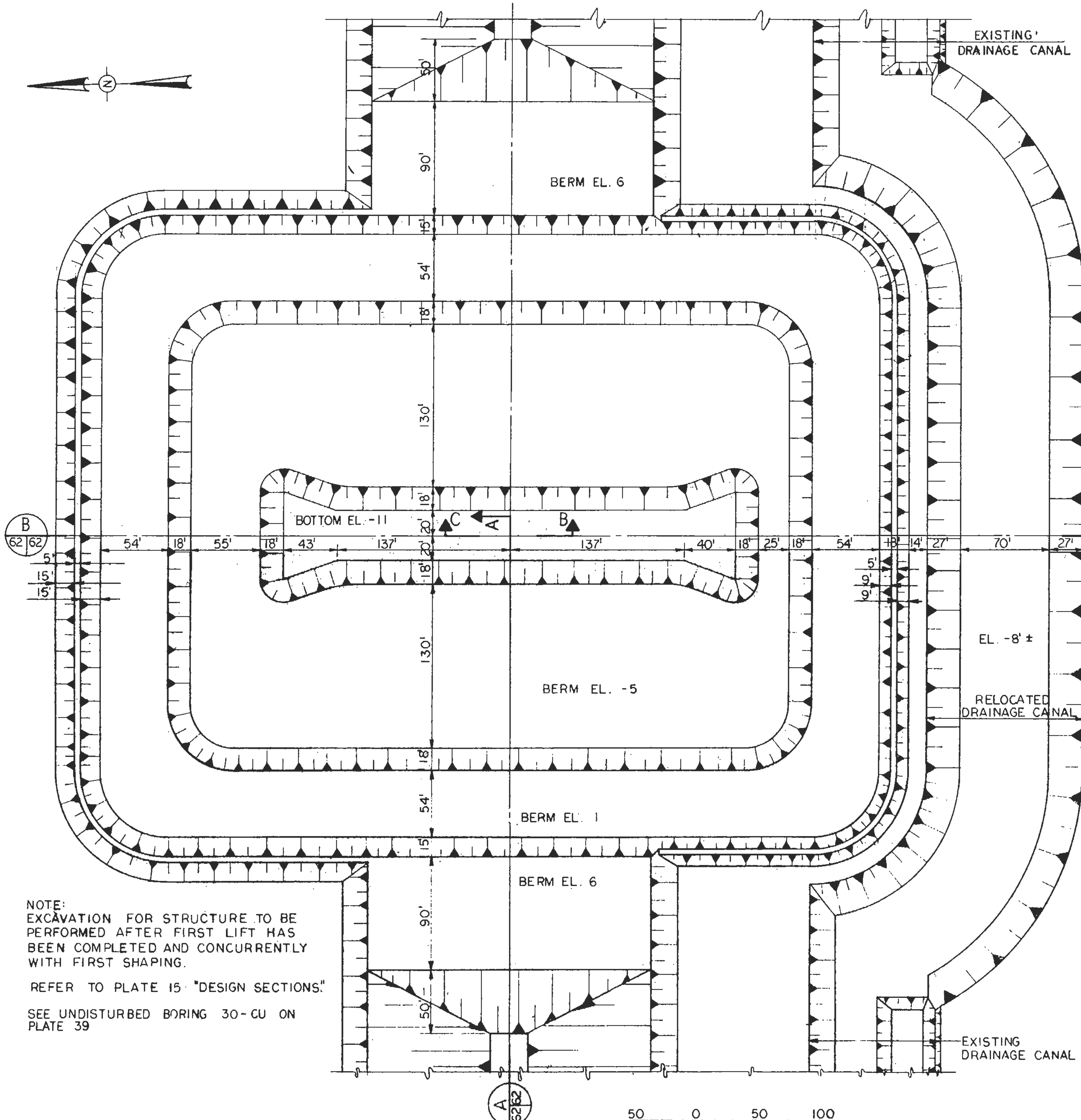
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS, U. S. ARMY NEW ORLEANS, LA.

DATE SEPTEMBER 1968

FILE NO. H-2-24306

STABILITY CALCULATIONS

	FAILURE SURFACE			DRIVING FORCES			RESISTING FORCES				FACTOR OF SAFETY
		NO.	EL.	$+D_A$	$-D_P$	ΣD	$+R_A$	$+R_B$	$+R_P$	ΣR	$\Sigma R/\Sigma D$
A	A B	1 2	-33.9 -27.1	112,796 42,624	25,071 12,561	87,725 30,063	29,742 12,915	71,068 31,857	10,440 7,720	111,250 52,492	1.27 1.75
B	A B	1 2	-33.9 -26.9	66,528 35,370	25,432 12,446	41,096 22,924	14,546 11,472	27,307 19,488	10,440 7,632	52,293 38,592	1.27 1.68
C	A B	1 2	-27.1 -32.9	36,020 57,591	12,705 23,144	23,315 34,447	12,045 14,920	10,160 19,040	7,720 10,040	29,925 44,000	1.28 1.28

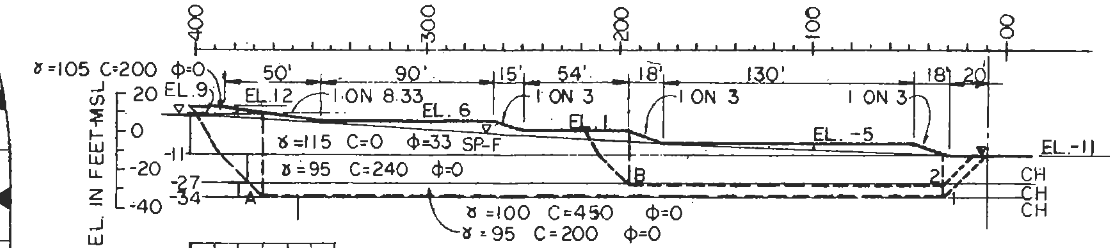


NOTE:
EXCAVATION FOR STRUCTURE TO BE PERFORMED AFTER FIRST LIFT HAS BEEN COMPLETED AND CONCURRENTLY WITH FIRST SHAPING.

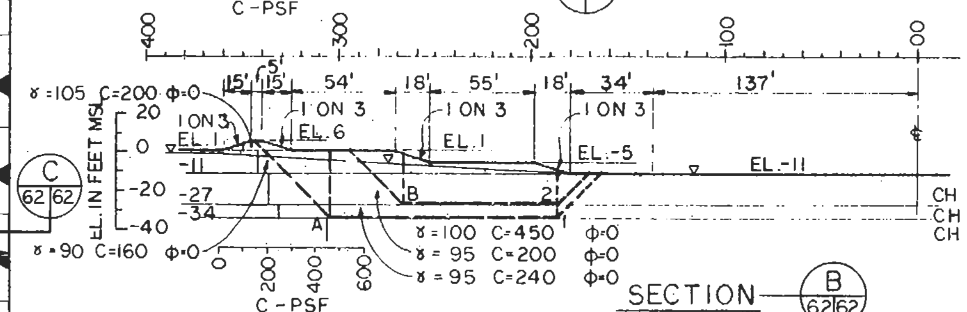
REFER TO PLATE 15 "DESIGN SECTIONS."

SEE UNDISTURBED BORING 30-CU ON PLATE 39

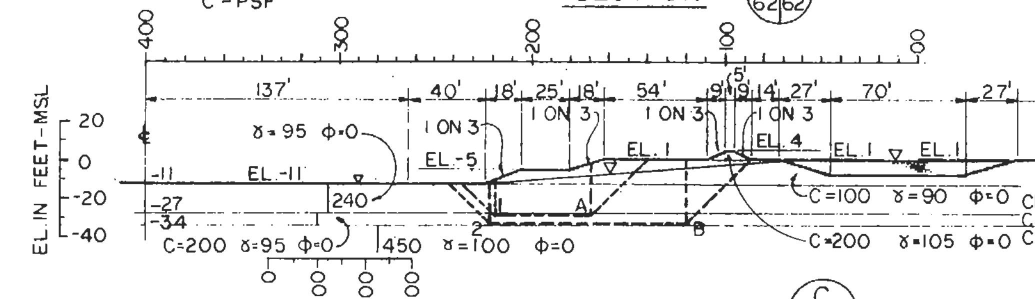
SCALE



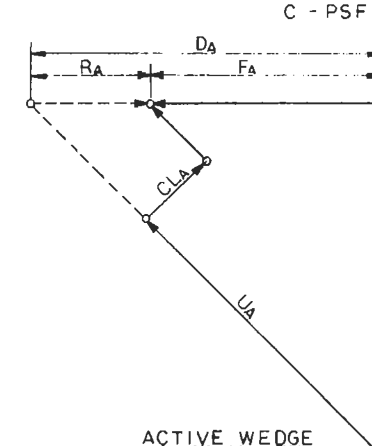
SECTION (A 62/62)



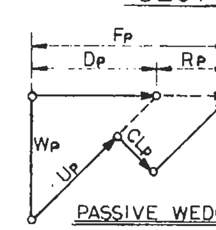
SECTION (B 62/62)



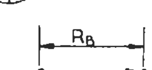
SECTION (C 62/62)



ACTIVE WEDGE
SECTION C
SURFACE A-1



PASSIVE WEDGE
SECTION C
SURFACE A-1



CENTRAL BLOCK
SECTION C
SURFACE A-1

F.S. WITH RESPECT TO SHEAR STRENGTH

$$\frac{R_A + R_P + R_B}{D_A - D_P} = \frac{29925}{23315} = 1.28$$

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

(Q) STABILITY ANALYSIS
DRAINAGE STRUCTURE EXCAVATION

SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC. ENGINEERS AND ARCHITECTS NEW ORLEANS, LA.	U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS, U. S. ARMY NEW ORLEANS, LA.
DATE SEPTEMBER 1968	FILE NO. H-2-24306

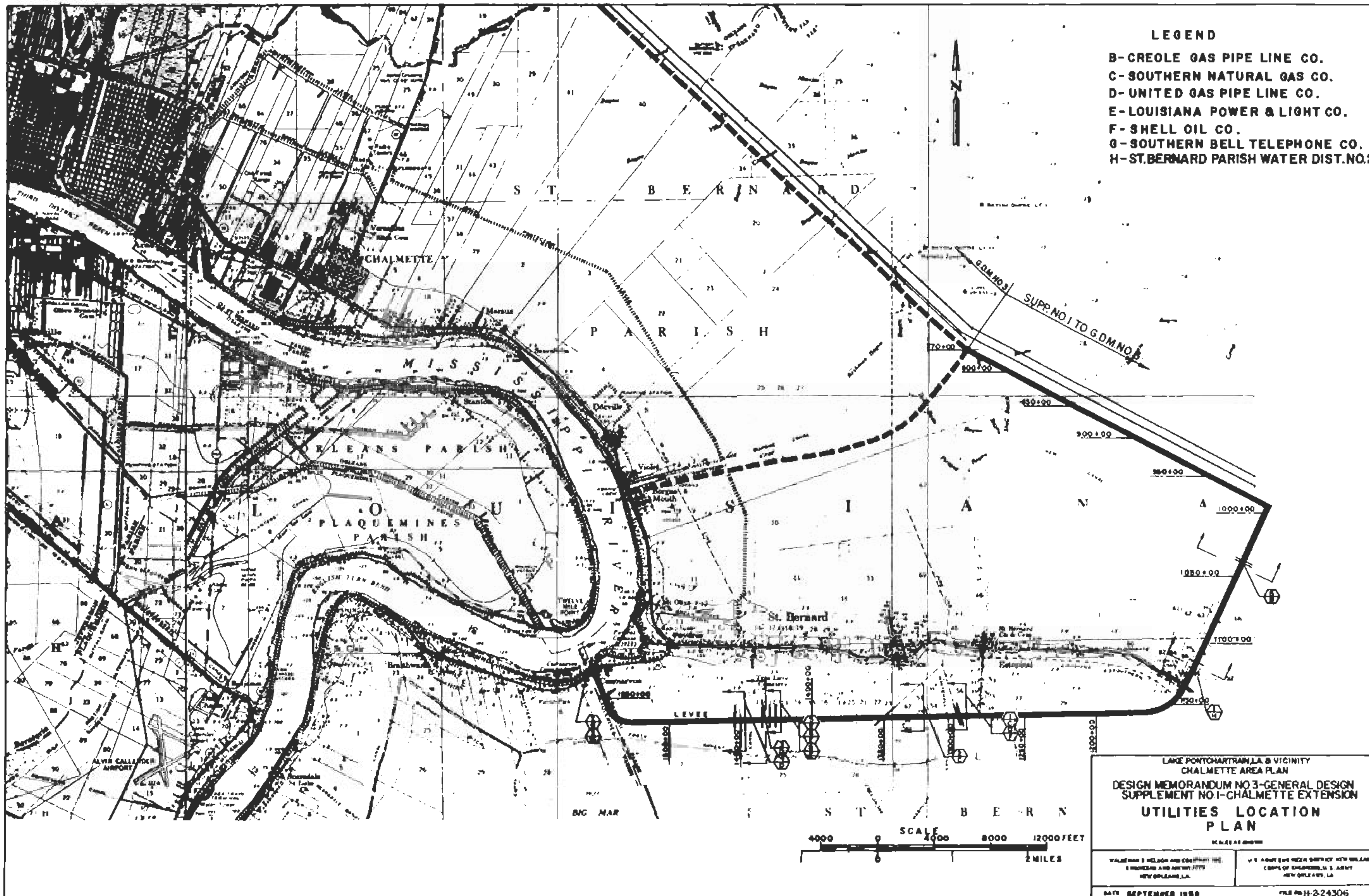
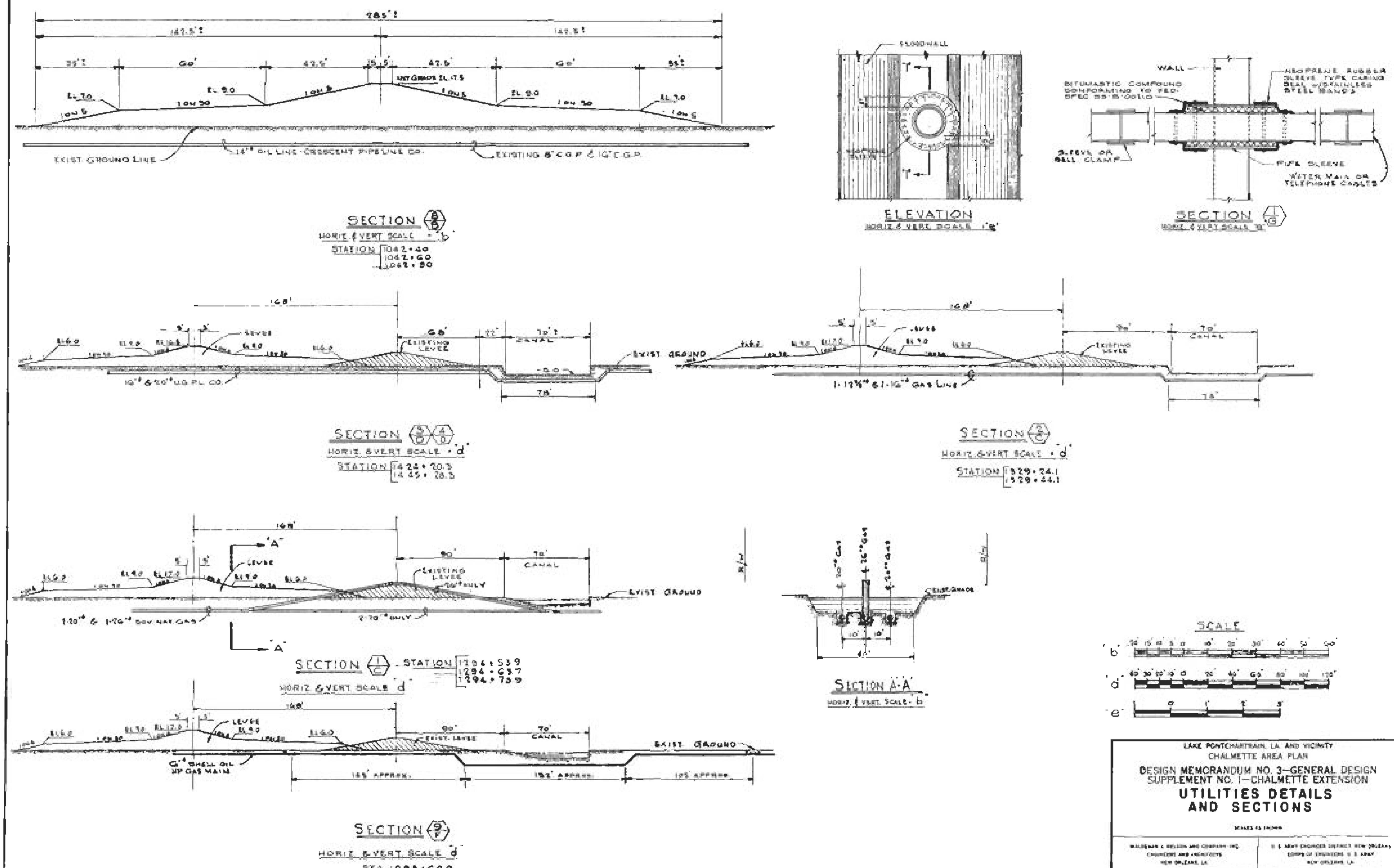

LEGEND
B-CREOLE GAS PIPE LINE CO.
C-SOUTHERN NATURAL GAS CO.
D-UNITED GAS PIPE LINE CO.
E-LOUISIANA POWER & LIGHT CO.
F-SHELL OIL CO.
G-SOUTHERN BELL TELEPHONE CO.
H-ST.BERNARD PARISH WATER DIST.NO.2
N
ST. BERNARD PARISH
ORLEANS PARISH
PLAQUEMINES PARISH
LOUISIANA
MISSISSIPPI RIVER
CHALMETTE
St. Bernard
LEVEE
G.D.M. NO.3
SUPP. NO.1 TO G.D.M. NO.3
770+00
800+00
850+00
900+00
950+00
1000+00
1050+00
1100+00
BIG MAR
ALVIN CALLENDER AIRPORT
SCALE
4000 0 4000 8000 12000 FEET
2 MILES
LAKE PONTCHARTRAIN, LA. & VICINITY
CHALMETTE AREA PLAN
DESIGN MEMORANDUM NO.3-GENERAL DESIGN
SUPPLEMENT NO.1-CHALMETTE EXTENSION
UTILITIES LOCATION
PLAN
H-2-24306

PLATE 63



LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

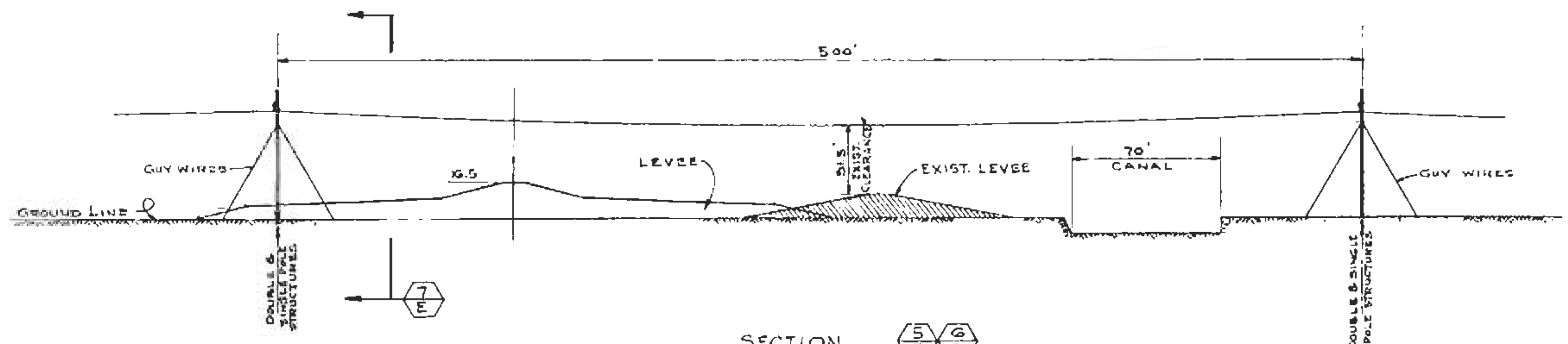
DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

UTILITIES DETAILS AND SECTIONS

SCALES AS SHOWN

DATE SEPTEMBER 1966

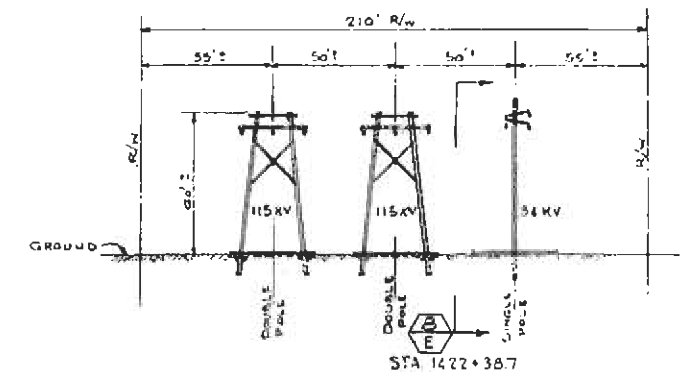
FILE NO. H-2-24306



SECTION 5/E 6/E

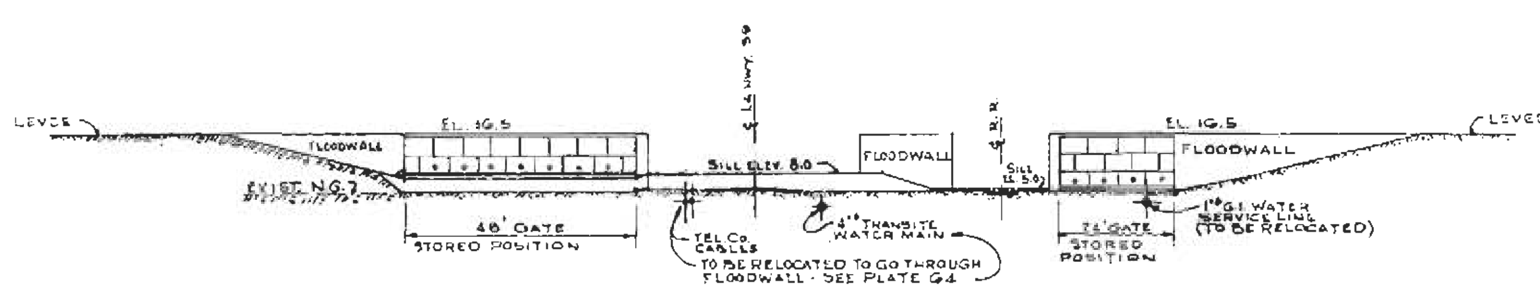
HORIZ. & VERT. SCALE "d"

STATION: 1422 + 73.7
1423 + 25.7



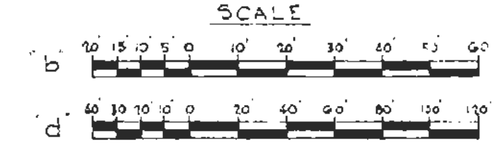
SECTION 7/E

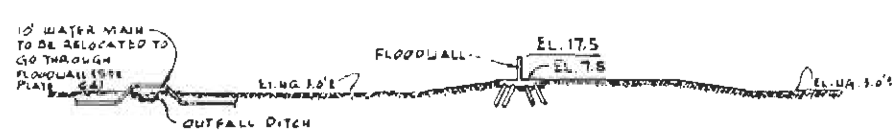
HORIZ. & VERT. SCALE "d"



SECTION 7/G 2/H

HORIZ. & VERT. SCALE "b"





SECTION 1/H

HORIZ. & VERT. SCALE "d"

STATION 1119 + 95.0

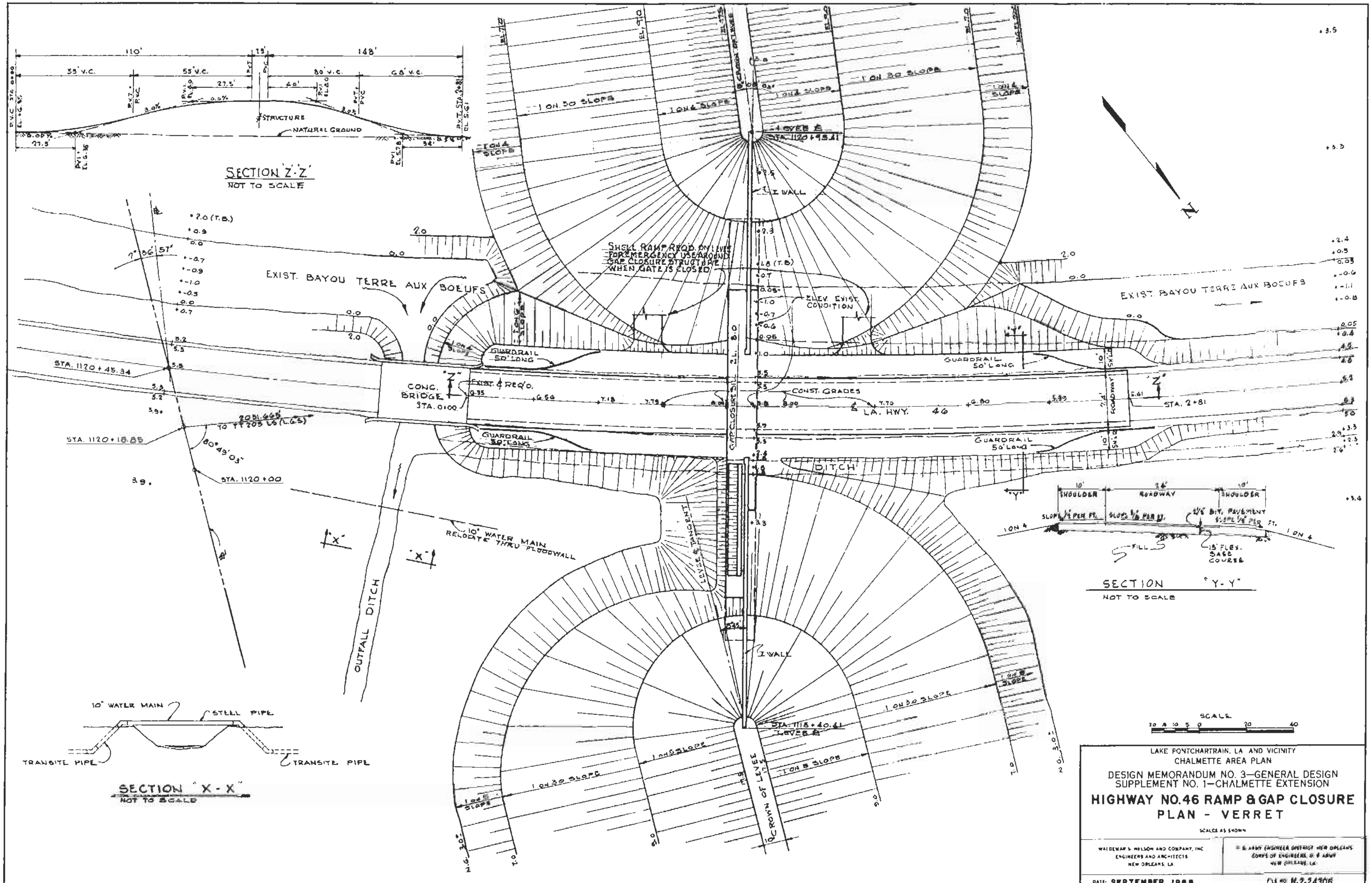
LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

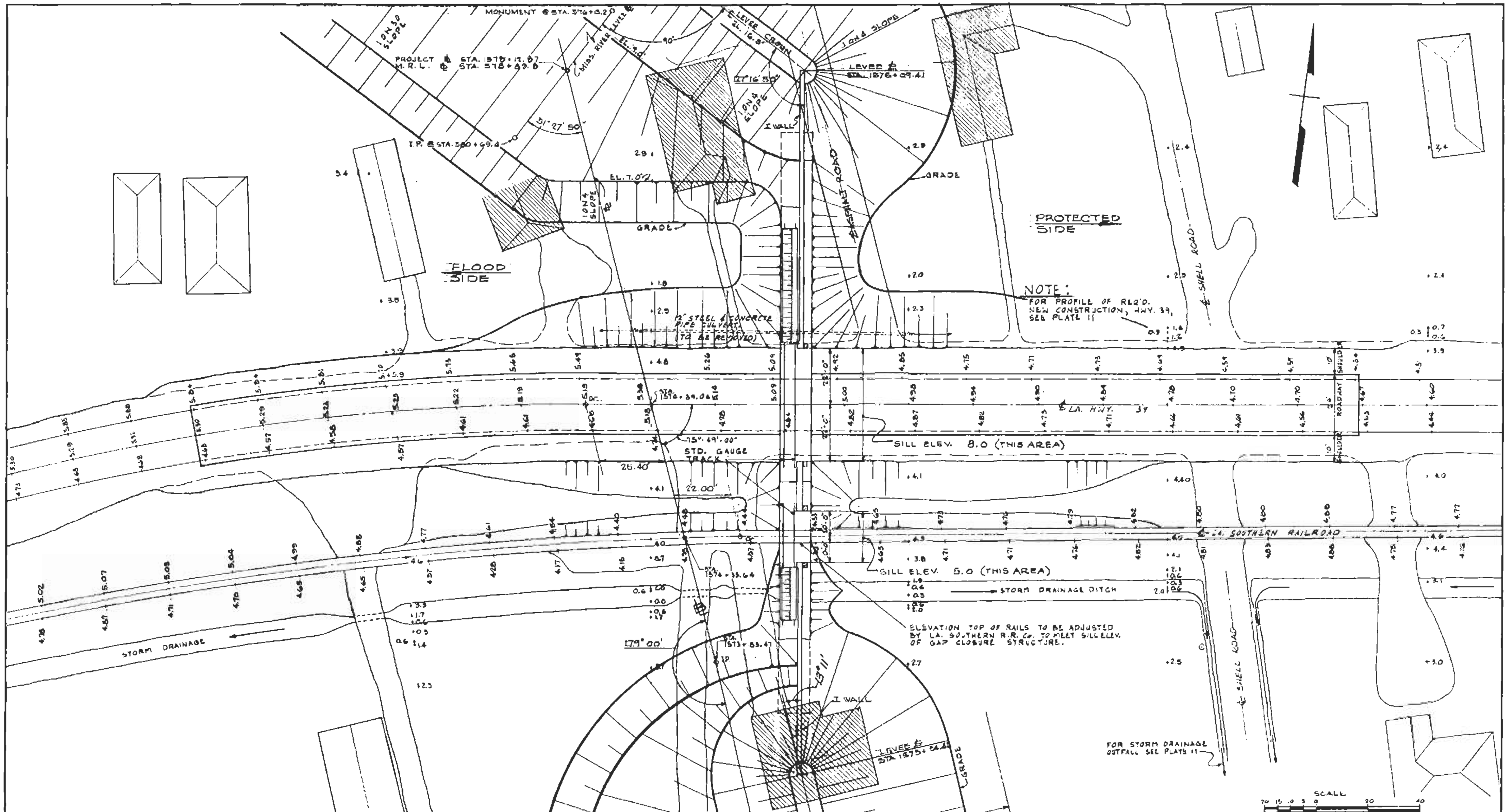
DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

UTILITIES DETAILS AND SECTIONS

SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY INC. ENGINEERS AND ARCHITECTS NEW ORLEANS, LA.	U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS, U. S. ARMY NEW ORLEANS, LA.
DATE SEPTEMBER 1968	FILE NO. H-2-24306


SECTION 'Z-Z'
NOT TO SCALE
110'
148'
55' V.C.
55' V.C.
80' V.C.
68' V.C.
STRUCTURE
NATURAL GROUND
EXIST. BAYOU TERRE AUX BOEUFS
CONC. BRIDGE STA. 0+00
STA. 1120+45.34
STA. 1120+18.85
STA. 1120+00
GUARDRAIL 50' LONG
CONST. GRADES
LA. HWY. 46
STA. 2+81
DITCH
OUTFALL DITCH
10" WATER MAIN RELOCATE THRU FLOODWALL
SHELL RAMP REQ'D. ON LEVEE FOR EMERGENCY USE AROUND GAP CLOSURE STRUCTURE WHEN GATE IS CLOSED
ELEV. EXIST. CONDITION
I WALL
1 ON 30 SLOPE
1 ON 4 SLOPE
1 ON 5 SLOPE
1 ON 8 SLOPE
STA. 1120+93.41 LEVEE ℄
STA. 1118+40.41 LEVEE ℄
CROWN OF LEVEE
SECTION "Y-Y"
NOT TO SCALE
SHOULDER
ROADWAY
SHOULDER
FILL
SECTION "X-X"
NOT TO SCALE
10" WATER MAIN
STEEL PIPE
TRANSITE PIPE
TRANSITE PIPE
SCALE
LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN
DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION
HIGHWAY NO. 46 RAMP & GAP CLOSURE
PLAN - VERRET
SCALE AS SHOWN
WALDEMAR S. NELSON AND COMPANY, INC.
ENGINEERS AND ARCHITECTS
NEW ORLEANS, LA.
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS, U.S. ARMY
NEW ORLEANS, LA.
DATE: SEPTEMBER 1968
FILE NO. H-2-24306



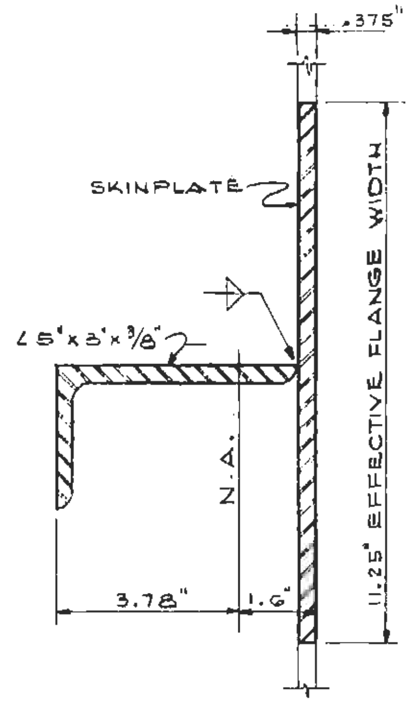
LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

HIGHWAY NO.39 & RAILROAD GAP CLOSURE PLAN — CAERNARVON

SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC. ENGINEERS AND ARCHITECTS NEW ORLEANS, LA.	U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS, U. S. ARMY NEW ORLEANS, LA.
DATE: SEPTEMBER 1966	FILE NO. H-2-24306



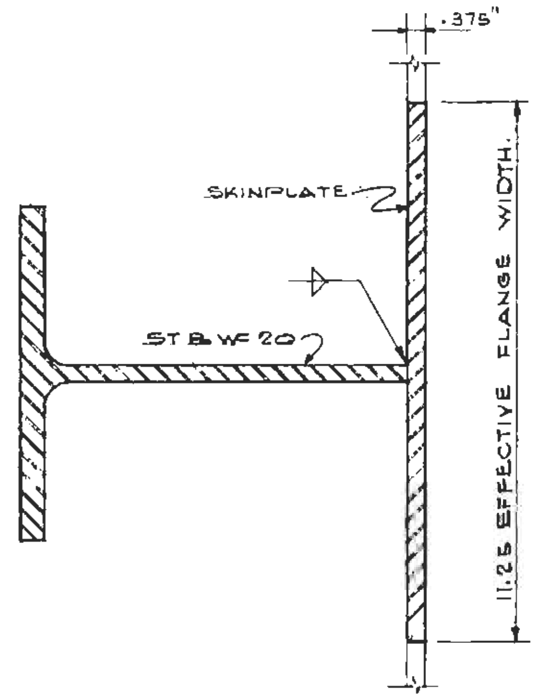
$I = 28.18 \ IN.^4$
$MIN. S = 7.46 \ IN^3$
$A = 7.08 \ IN^2$

$M_{MAX.} = 9.63 \ ^I/K$

$fb_{MAX.} = \frac{9.63 \times 12}{7.46} = 15.5 \ KSI < 24.0 \ KSI$ OK

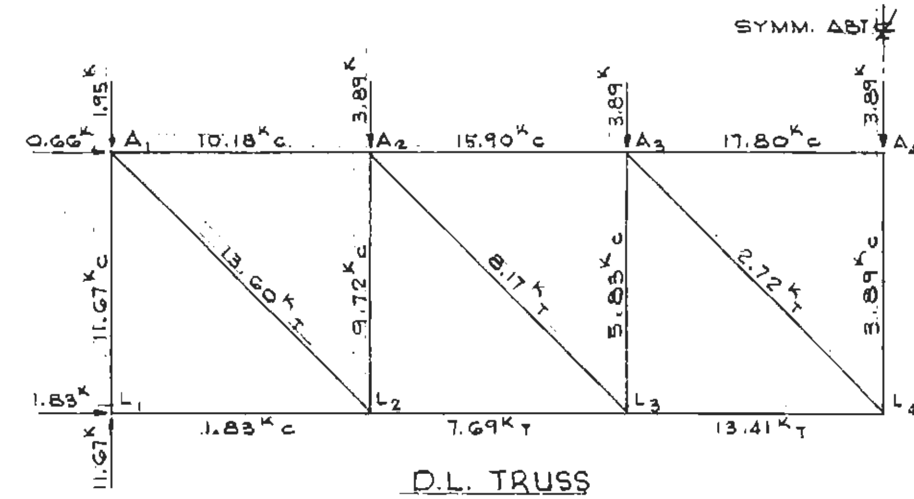
$V_{MAX.} = \frac{13.0}{7.08} = 1.84 \ KSI$

HORIZONTAL RIB



$I = 130.83 \ IN^4$
$MIN. \ S_x = 31.0 \ IN^3$
$Fb = \frac{3.95(12)}{31.0} = 1.53 \ KSI < 24.0 \ KSI$

VERTICAL RIB



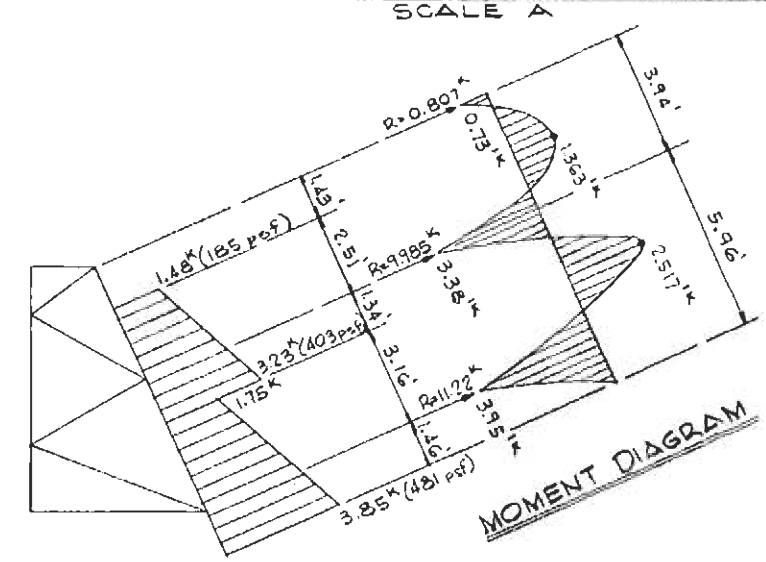
D.L. TRUSS

NOTE
MEMBERS L_1-L_2, L_2-L_3, L_3-L_4 DESIGNED ON PLATE 69. THESE MEMBERS ARE IN COMBINED STRESS DUE TO VERTICAL TRUSS & BOTTOM TRUSS.

VERTICAL TRUSS
SCALE A

DESIGN OF MEMBERS
A_1-L_2, A_2-L_3, A_3-L_4
$P = 13.60 \ ^K T$
$F_a = 24 \ KSI$
$A = \frac{13.6}{24} = 0.57 \ IN^2$
USE 4" ϕ PIPE $A = 3.17 \ IN^2$

DESIGN OF MEMBERS
A_1-L_1, A_2-L_2, A_3-L_3, A_4-L_4
$P = 11.67 \ ^K C$
$L = 8.17'$
TRY ST 4 WF 8.5 $A = 2.50 \ IN^2$, $r = 1.13 \ IN.$
$\frac{KL}{r} = \frac{(1)(8.17)(12)}{1.13} = 87.0$
$F_a = 16.0 \ KSI$
$f_a = \frac{11.67}{2.50} = 4.67 \ KSI < F_a$
USE ST 4 WF 8.5



LOADING DIAGRAM

COMPUTATION OF WAVE LOAD
REFERENCE: U.S. ARMY COSTAL ENGINEERING RESEARCH CENTER, TECHNICAL REPORT NO. 4. "SHORE PROTECTION PLANNING AND DESIGN."

P_m = DYNAMIC $\quad d_b = 1.3(H_b) = 6.5'$
P_s = STATIC $\quad h_c = 0.7(H_b) = 3.5'$
$W = 62.4 \ ^\#/ft^3 \quad d = 4.2'$
$H_b = 5.0'$

$P_m = \frac{WC^2}{2g} = \frac{W d_b}{2} \quad P_s = W(\phi + h_c)$

$P_m = \frac{62.4(6.5)}{2} \quad P_s = 62.4(4.2 + 3.5)$

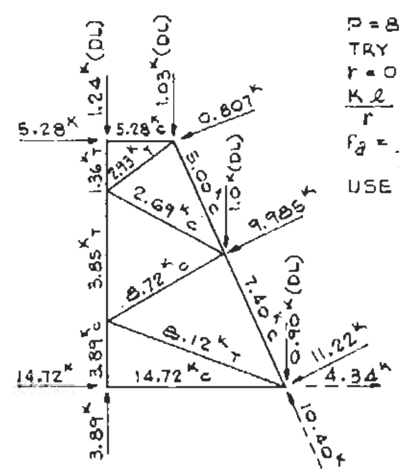
$P_s = 481 \ psf$

$P_m = 203 \ psf.$

REDUCE DYNAMIC PRESSURE DUE TO EFFECT OF FACE SLOPE ON WAVE PRESSURE.
$P_m' = P_m \ Sin^2 \theta$
$= P_m \ Sin^2 \ 114° - 40'$
$P_m' = 203(0.9090)^2$
$P_m' = 168 \ psf$
REVOLVE P_m' NORMAL TO SKIN ℞
$P_{m'\perp} = \frac{P_m'}{Sin \ 114°\text{-}40'} = \frac{168}{0.9090}$
$P_{m'\perp} = 185 \ psf$

MAX. LOAD = 481 #/FT.
3/8" SKINPLATE
$S = 1/6 \times 12 \times (3/8)^2 = 0.28 \ IN^3$
$M_{MAX.} = \frac{481 \times \ell^2 \times 12}{12} = 4.81 \ \ell^2 \ IN.^\#$
$\frac{481 \ \ell^2}{0.281} = 26{,}500$
$\ell = 3.94'$
USE 3'-0" SPAN

SKIN PLATE DESIGN



$P = 8.72 \ ^K c \quad \ell = 4.20'$
TRY 2½" ϕ PIPE
$r = 0.95 \quad A = 1.70 \ IN.^2$
$\frac{K\ell}{r} = 53 \quad F_a = 19.9 \ KSI$
$f_a = \frac{P}{A} = \frac{8.72}{1.70} = 5.13^{KSI} < 19.9 \ KSI$
USE 2½" ϕ PIPE ALL DIAGONALS

VERTICAL SUPPORT BENTS
SCALE 'A'

NOTE
THE DESIGN OF THE TWO 48 FOOT CLOSURES AT CAERNARVON & VERRET IS BASED ON THE STRESS ANALYSIS AND DESIGN FOR THE GATE FOR HIGHWAY 46 AT VERRET.

SCALE
SCALE 'A' 1' ½ 0 1' 2' 3' 4'

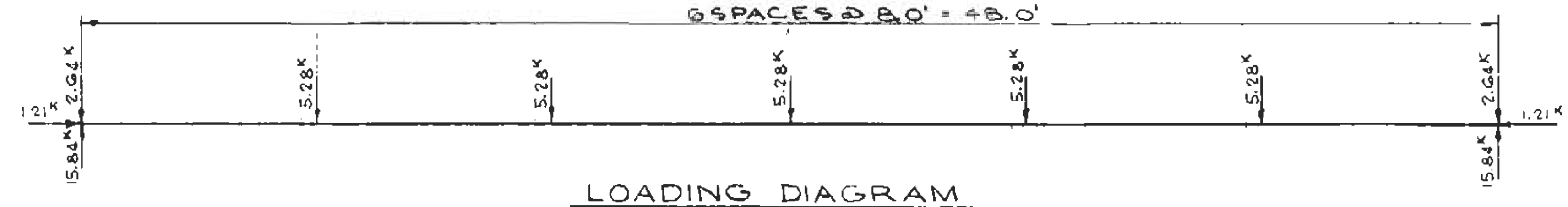
LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN
DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

STRESS ANALYSIS & DESIGN-I

SCALES AS SHOWN

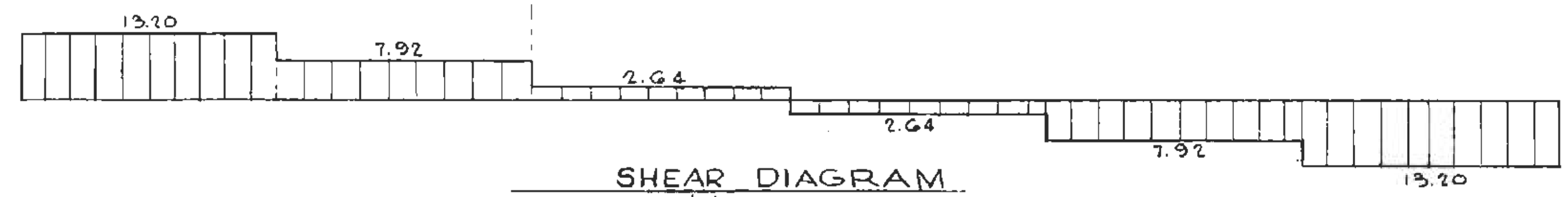
WALDEMAR S. NELSON AND COMPANY, INC. ENGINEERS AND ARCHITECTS NEW ORLEANS LA. | U. S. ARMY ENGINEER DISTRICT NEW ORLEANS CORPS OF ENGINEERS U. S. ARMY NEW ORLEANS LA.

DATE SEPTEMBER 1969 FILE NO. H-2-24306

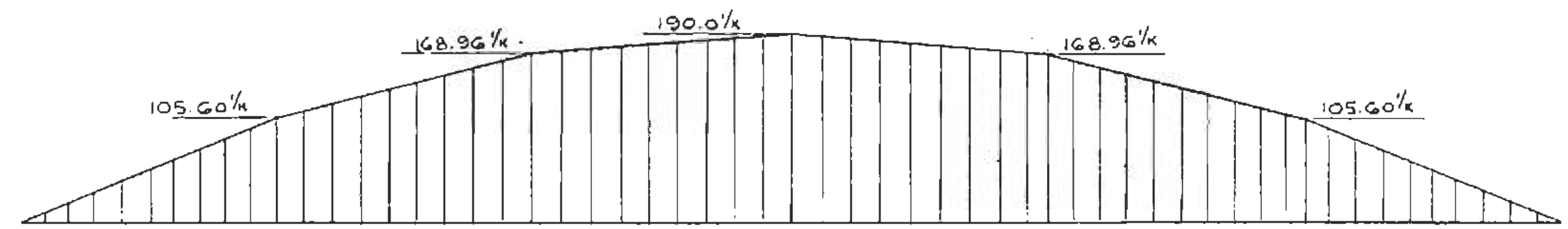


LOADING DIAGRAM
SCALE: 1" = 3'

P = 17.14 K C
TRY 24 WF 100
S_x = 248.9 in³
$f_b = \frac{190 \times 12}{248.9}$ = 9.20 KSI < 26.5 KSI
USE 24 WF 100

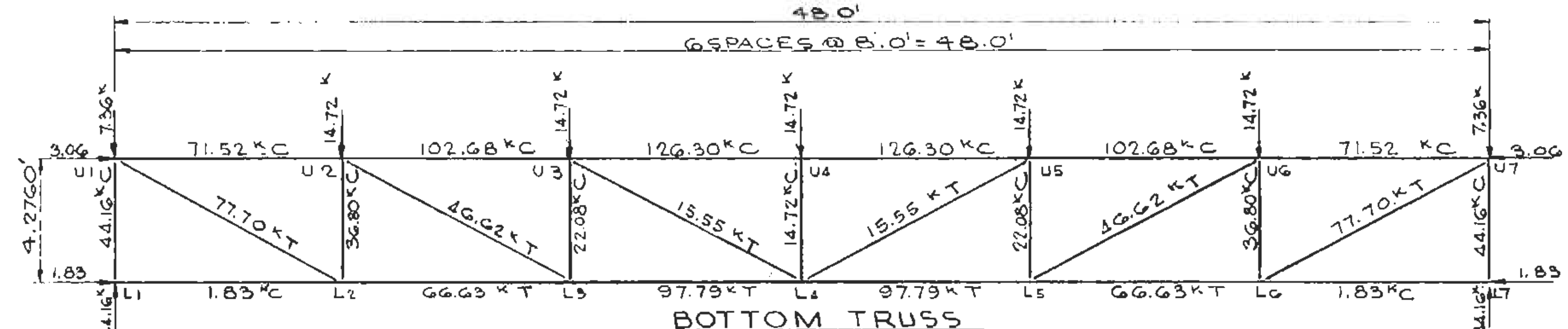


SHEAR DIAGRAM
SCALE: 'A' HORIZ.
'C' VERT.

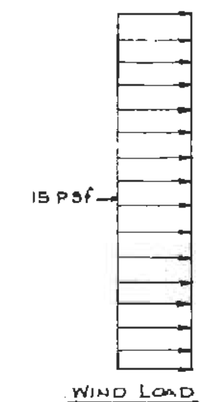


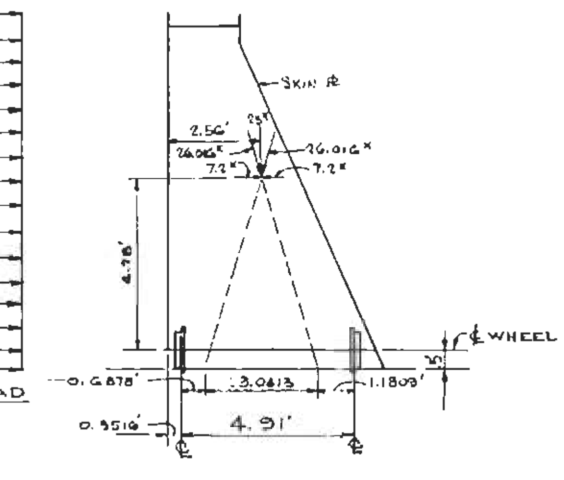
MOMENT DIAGRAM
SCALE: 'A' HORIZ.
'D' VERT.

TOP GIRDER

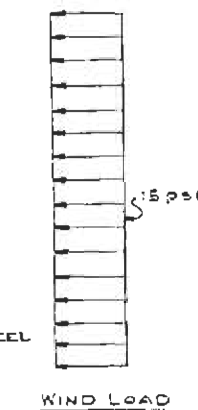


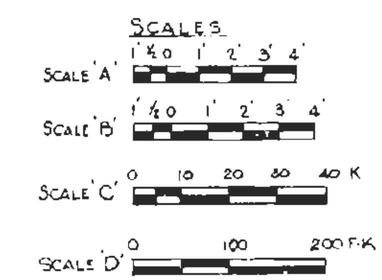
BOTTOM TRUSS
SCALE: 'A'





STABILITY DIAGRAM
SCALE: 'B'





DESIGN OF MEMBERS – U1-U2, U2-U3, U3-U4, U4-U5, U5-U6, U6-U7

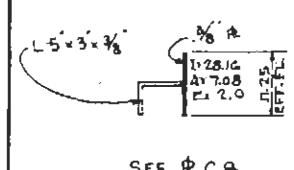
P = 126.30 K C ℓ = 8' = 96"
TRY 12 WF 40 r = 1.94
$\frac{K\ell}{r} = \frac{96}{1.94} = 49.5$
Fa = 20.42 KSI
$fa = \frac{P}{A} = \frac{126.30\,K}{11.77}$ = 10.73 KSI ∴ OK
USE 12 WF 40

DESIGN OF MEMBERS – L1-L2, L2-L3, L3-L4, L4-L5, L5-L6, L6-L7

P_1 = 97.79 K T P_2 = 13.41 K T
F_a = 24.0 KSI
$A = \frac{97.79}{24} + \frac{13.41}{24}$ = 4.63 IN²
USE 10 WF 29 A = 8.53 IN²
(NOTE: THESE MEMBERS ARE IN COMBINED STRESSES FROM BOTTOM TRUSS ℄ VERTICAL TRUSS)

DESIGN OF DIAGONAL U1-L2, U7-L6

P = 77.7 K T
F_a = 24.0 KSI
$A = \frac{P}{F_a} = \frac{77.7\,K}{24.0\,KSI}$ = 3.24 IN²
USE 6" Φ STD. PIPE



SEE ℞ 68

DESIGN OF MEMBERS – L1-U1 & L7-U7

P = 44.16 K C
$\frac{K\ell}{r} = \frac{(1)(4.3)(12)}{2.0} = 26$ ∴ Fa = 22.4
$A = \frac{44.16}{22.4}$ = 1.97 in²
USE 3/8" ℞ WITH L 5"×3"×3/8" A = 7.08 in²

DESIGN OF MEMBERS – U2-L2, U3-L3, U4-L4, U5-L5, U6-L6, U7-L7

P = 36.80 K C ℓ = 4.28' = 51.36"
TRY 4" Φ PIPE r = 1.51" A = 4.3 IN²
$\frac{K\ell}{r} = \frac{59.53}{1.51}$ = 39.4 Fa = 21.36 KSI
$fa = \frac{P}{A} = \frac{36.80}{3.17}$ = 11.61 KSI < Fa ∴ OK
USE 4" Φ STD. PIPE

DESIGN OF DIAGONALS U2-L3, U3-L4, U5-L4, U6-L5

P = 46.62 K T
F_a = 24.0 KSI
$A = \frac{P}{F_a} = \frac{46.62}{24.0}$ = 1.94 IN²
USE 4" Φ STD PIPE A = 3.17

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN
DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

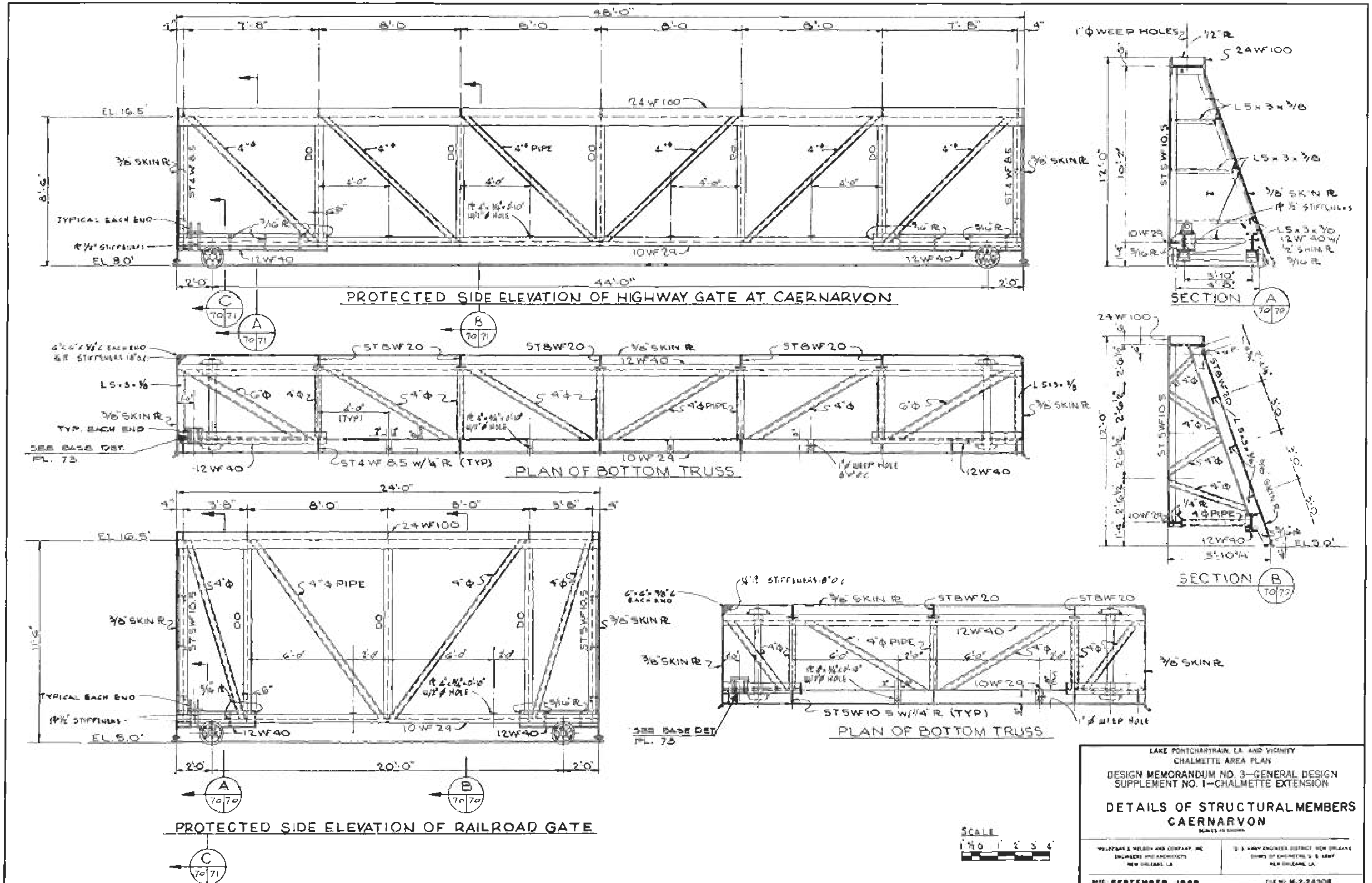
STRESS ANALYSIS & DESIGN - 2

SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC.
ENGINEERS AND ARCHITECTS
NEW ORLEANS, LA.

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

DATE SEPTEMBER 1968
FILE NO. H-2-24306



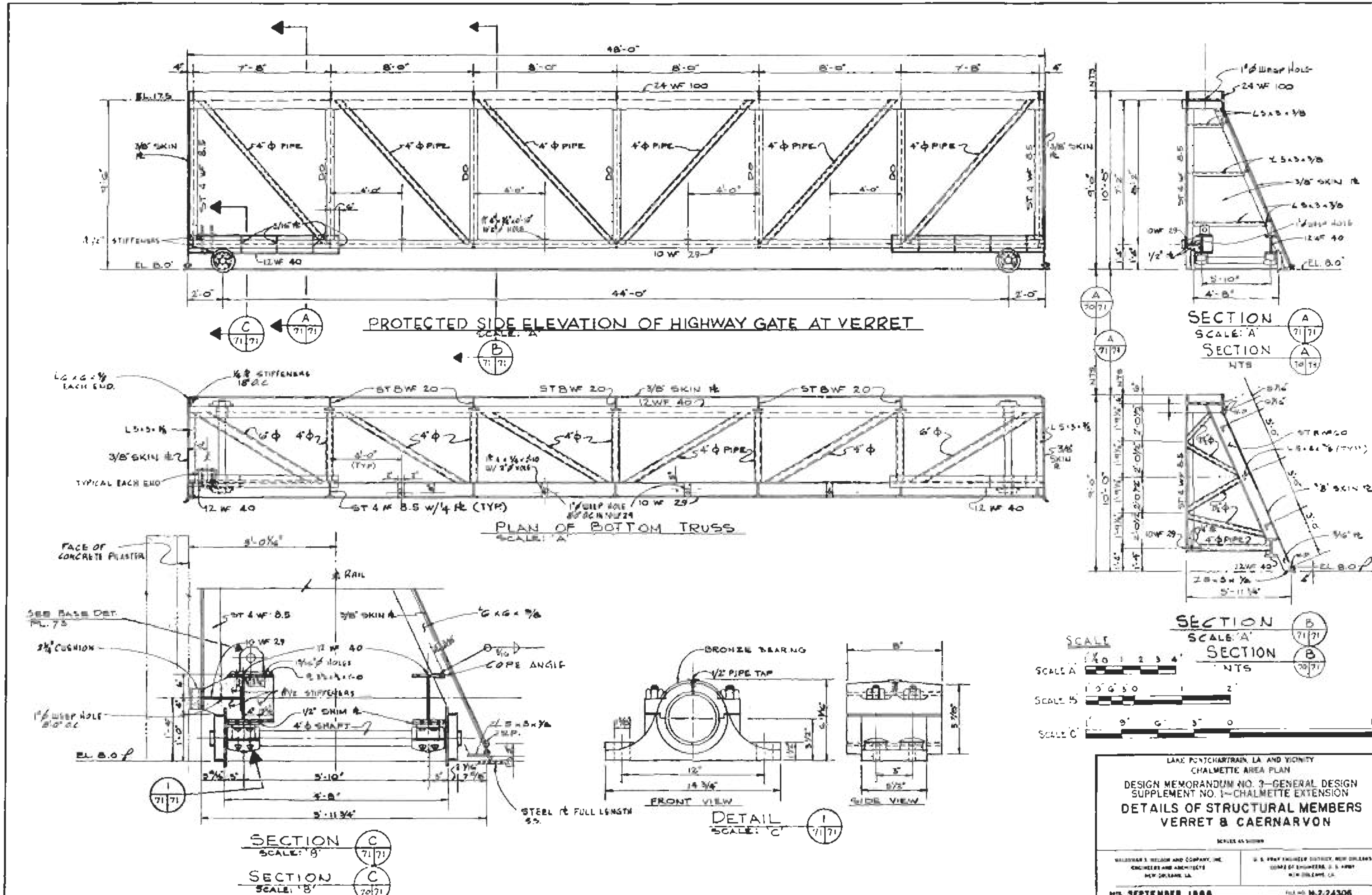
LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN
DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

DETAILS OF STRUCTURAL MEMBERS
CAERNARVON

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

DATE: SEPTEMBER 1966

FILE NO. H-2-24308



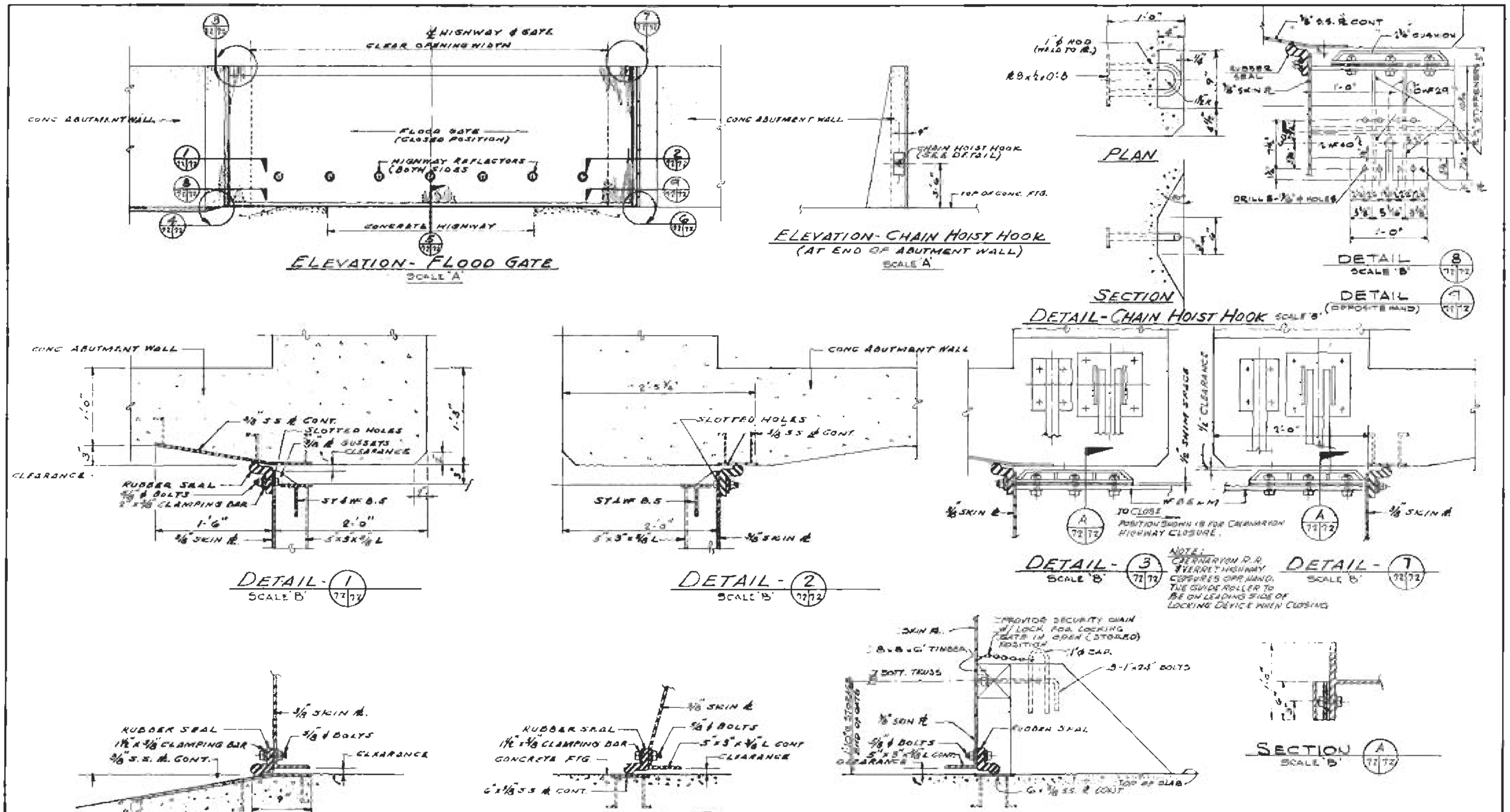
LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

DETAILS OF STRUCTURAL MEMBERS
VERRET & CAERNARVON

SEPTEMBER [illegible]

FILE NO. H-2-24306



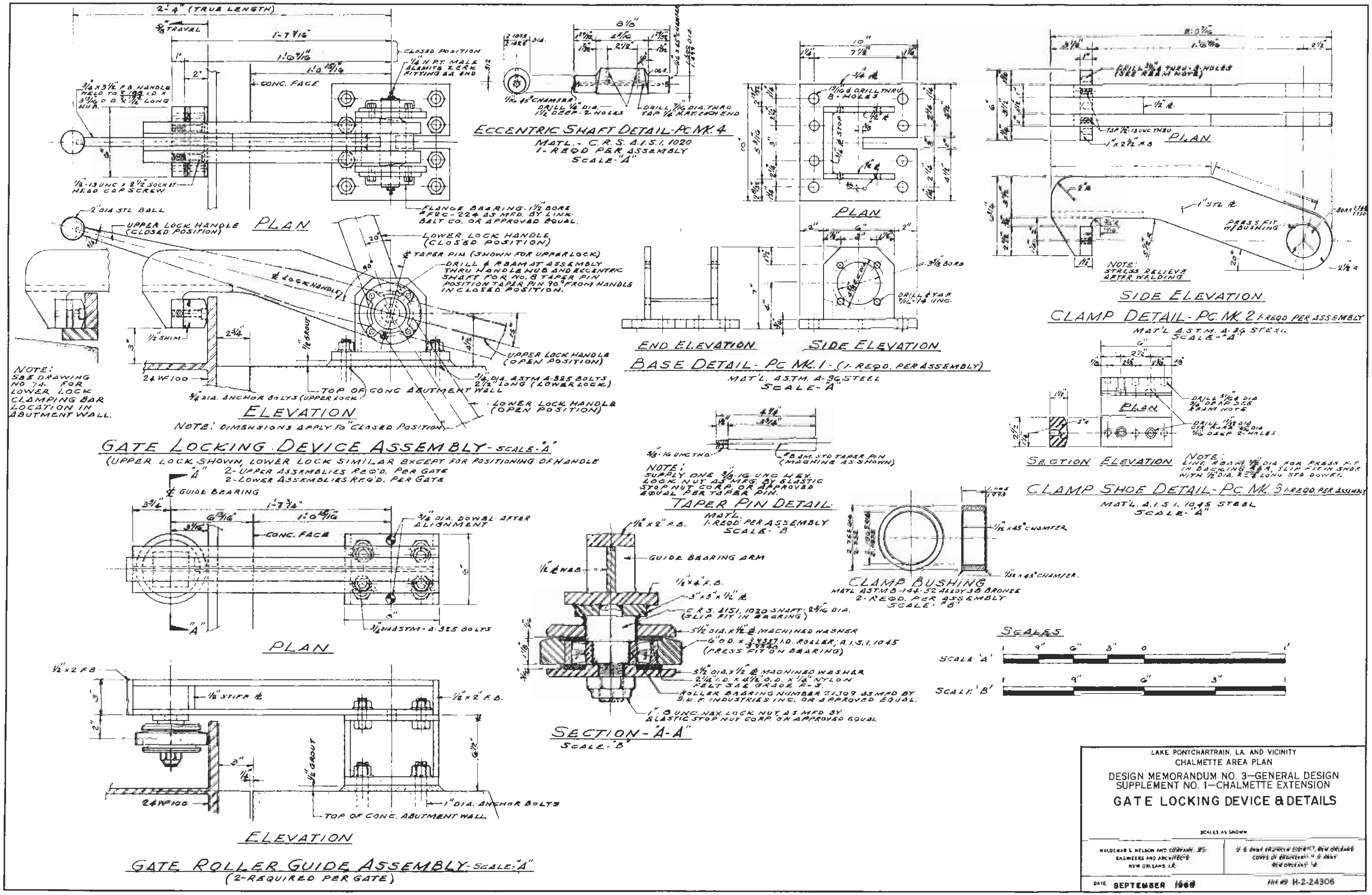
LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

DETAILS - SEALS & SEAL PLATES

SCALES AS SHOWN

DATE SEPTEMBER 1968 | FILE NO. H-2-24306



LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

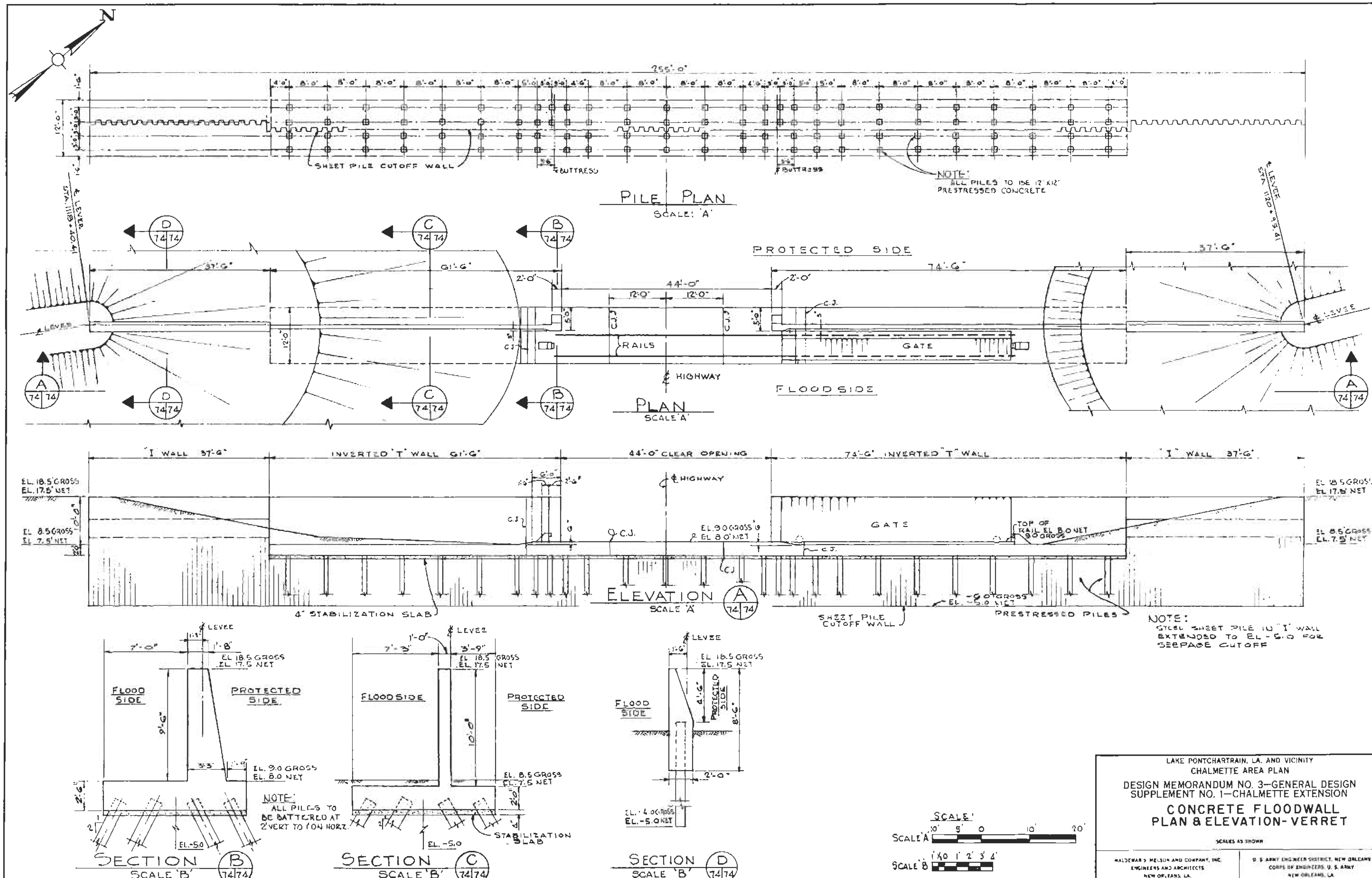
GATE LOCKING DEVICE & DETAILS

SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC.
ENGINEERS AND ARCHITECTS
NEW ORLEANS, LA.

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

DATE SEPTEMBER 1968 FILE NO. H-2-24306



LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

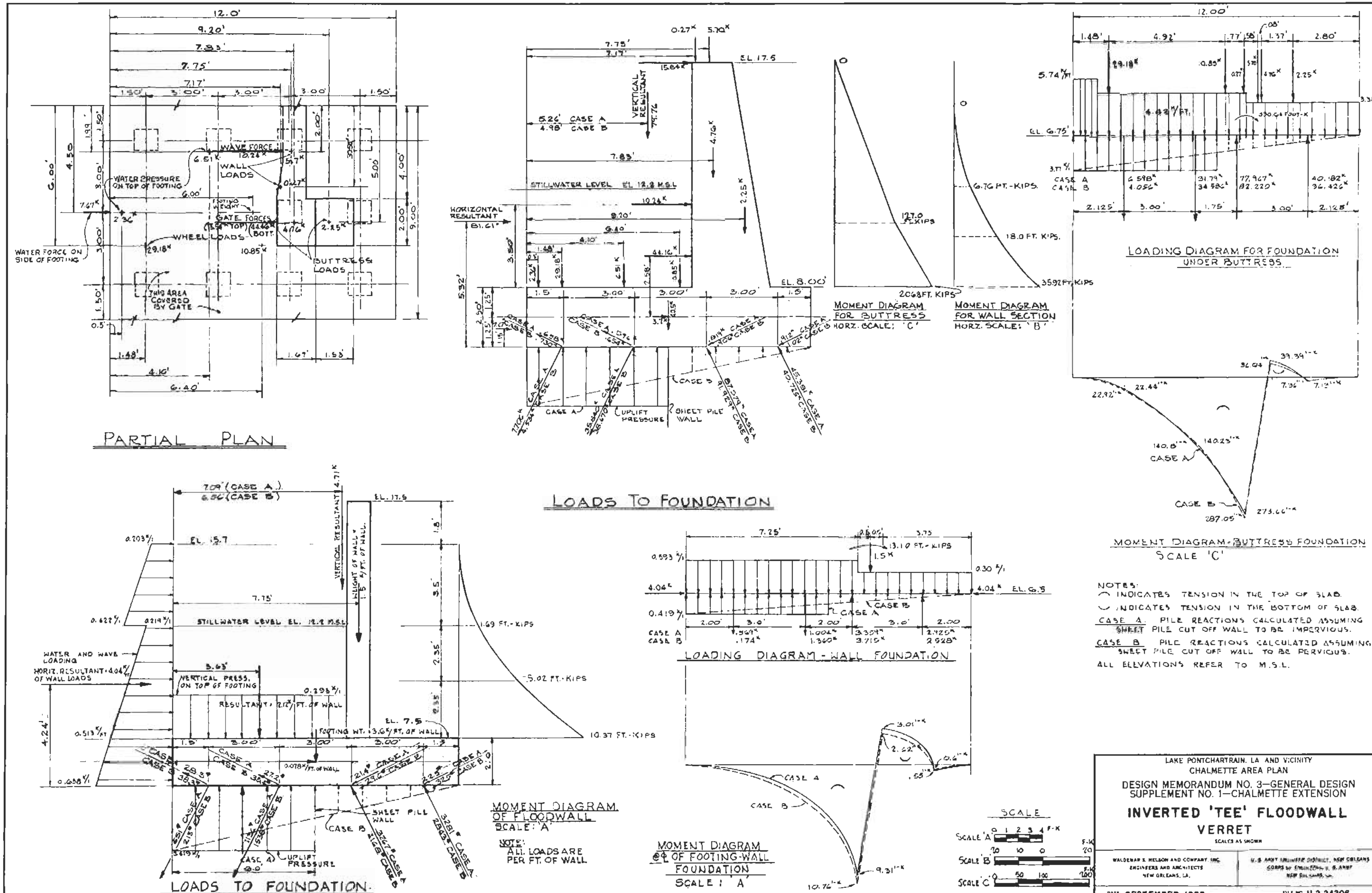
CONCRETE FLOODWALL PLAN & ELEVATION- VERRET

SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC.
ENGINEERS AND ARCHITECTS
NEW ORLEANS, LA.

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

DATE SEPTEMBER 1968 FILE NO. H-2-24306



NOTES:

⌒ INDICATES TENSION IN THE TOP OF SLAB.

⌣ INDICATES TENSION IN THE BOTTOM OF SLAB.

CASE A. PILE REACTIONS CALCULATED ASSUMING SHEET PILE CUT OFF WALL TO BE IMPERVIOUS.

CASE B. PILE REACTIONS CALCULATED ASSUMING SHEET PILE CUT OFF WALL TO BE PERVIOUS.

ALL ELEVATIONS REFER TO M.S.L.

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

INVERTED 'TEE' FLOODWALL

VERRET

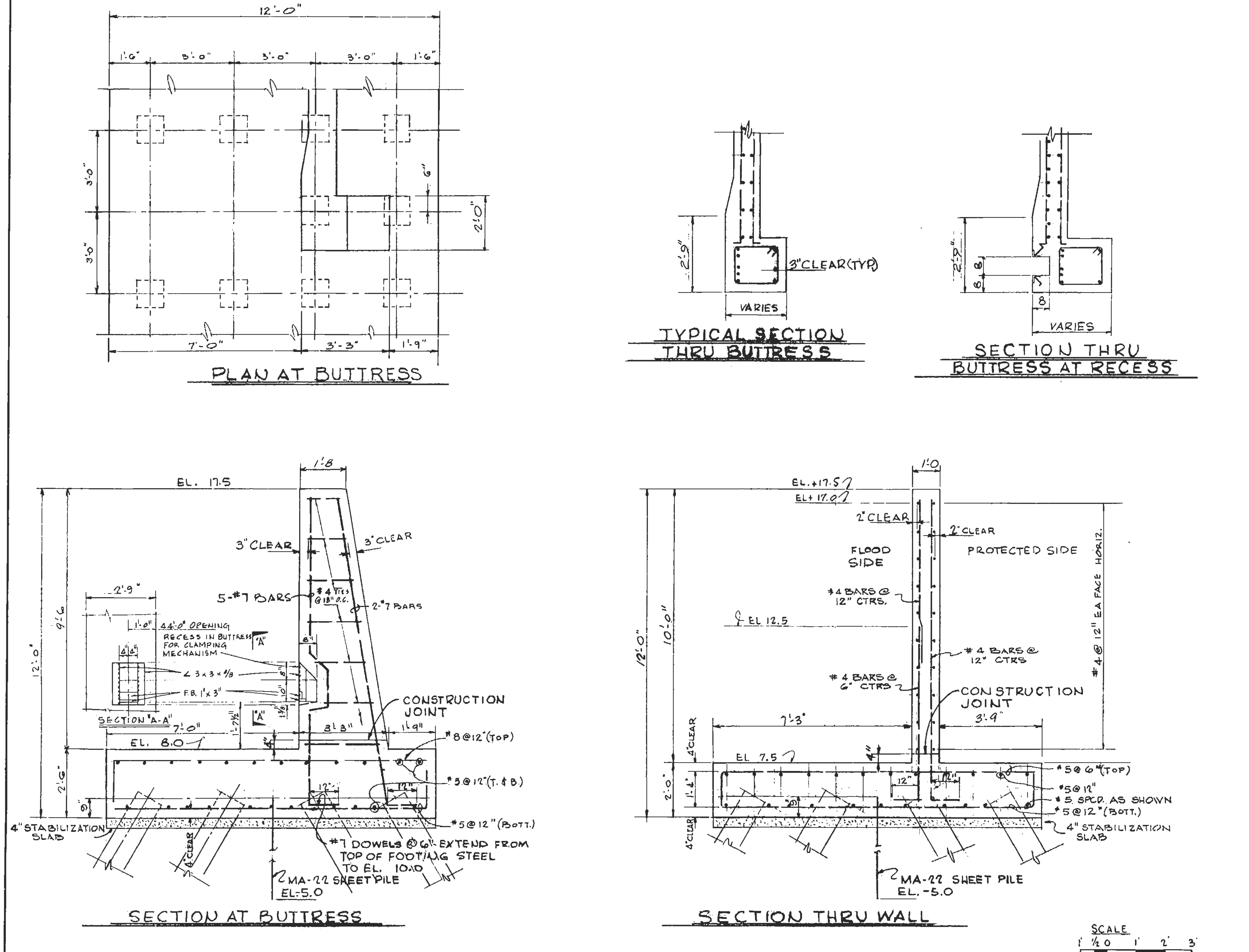
SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC. ENGINEERS AND ARCHITECTS NEW ORLEANS, LA.

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

DATE: SEPTEMBER 1968

FILE NO. H-2-24306



NOTE:
ELEVATIONS ARE IN FEET M.S.L.

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN
DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

INVERTED "TEE" FLOODWALL
SECTIONS & DETAILS - VERRET

SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC. ENGINEERS AND ARCHITECTS NEW ORLEANS, LA.	U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS, U. S. ARMY NEW ORLEANS, LA.
DATE: SEPTEMBER 1968	FILE NO. H-2-24306

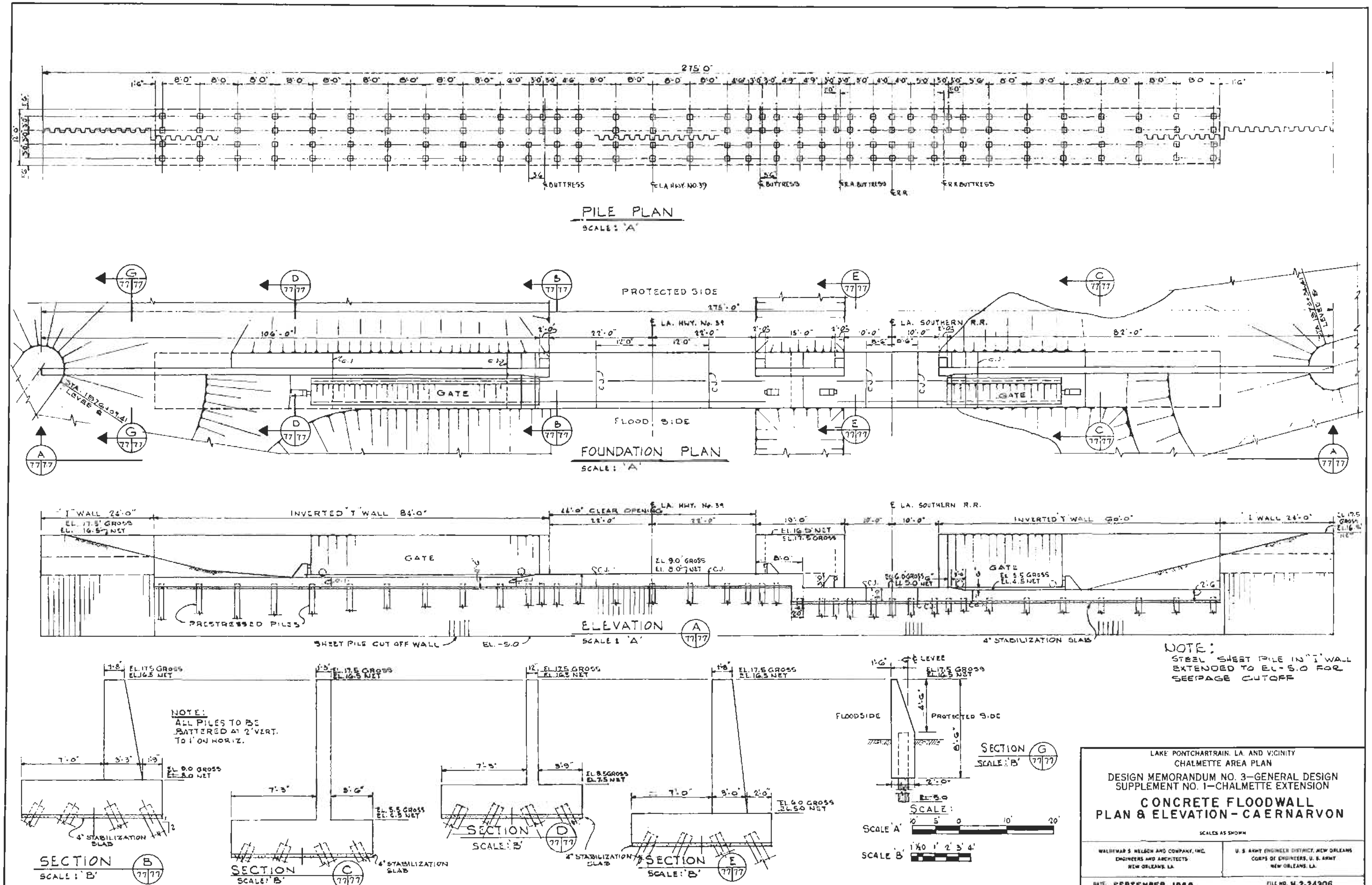
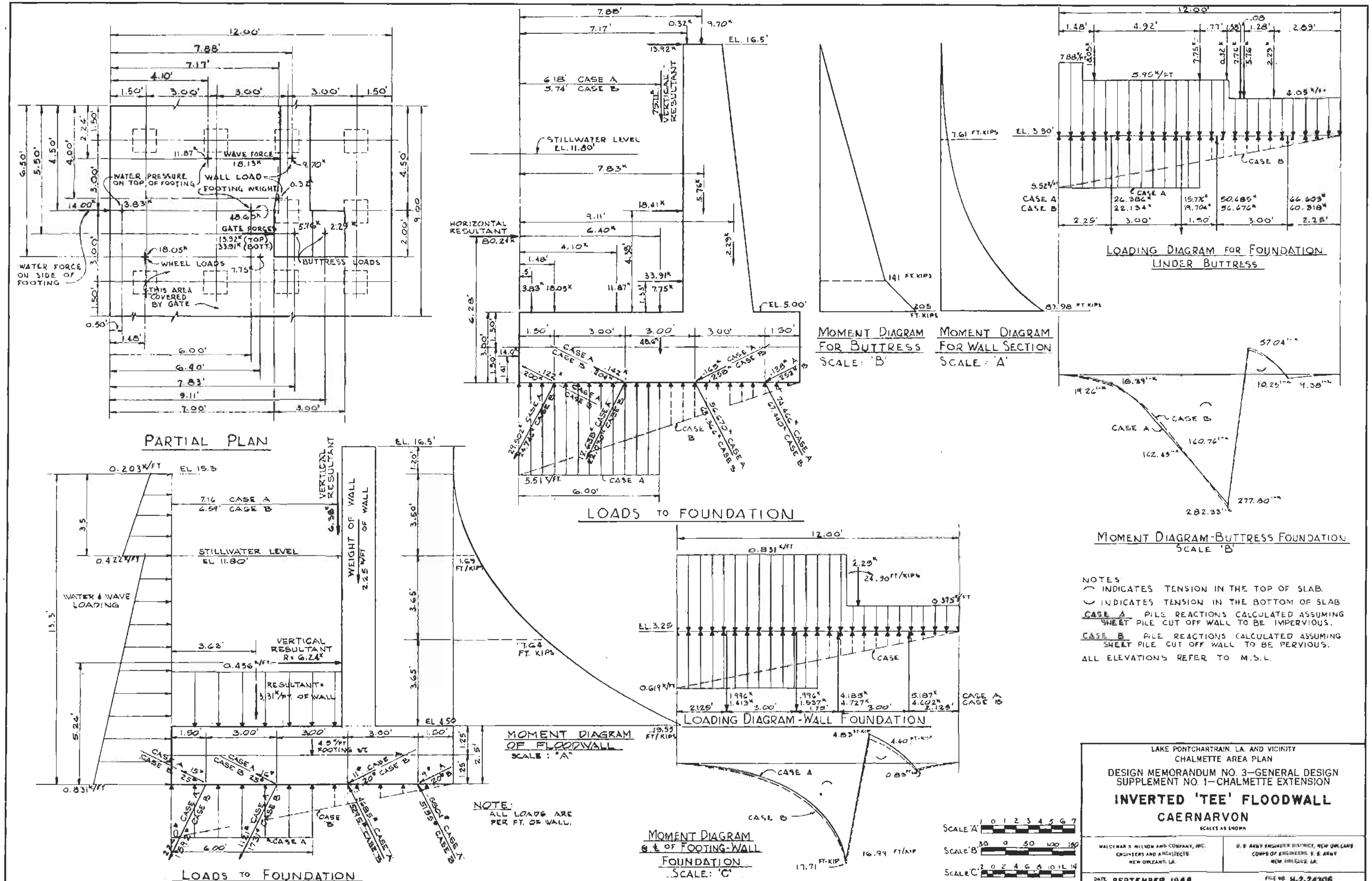

PILE PLAN
SCALE: 'A'
FOUNDATION PLAN
SCALE: 'A'
PROTECTED SIDE
FLOOD SIDE
GATE
LA. HWY. No. 39
LA. SOUTHERN R.R.
ELEVATION
SCALE: 'A'
INVERTED 'T' WALL 84'-0"
INVERTED 'T' WALL 90'-0"
'I' WALL 24'-0"
PRESTRESSED PILES
SHEET PILE CUT OFF WALL
4" STABILIZATION SLAB
NOTE:
STEEL SHEET PILE IN "I" WALL EXTENDED TO EL-5.0 FOR SEEPAGE CUTOFF
NOTE:
ALL PILES TO BE BATTERED AT 2' VERT. TO 1' ON HORIZ.
SECTION B
SCALE: 'B'
SECTION C
SCALE: 'B'
SECTION D
SCALE: 'B'
SECTION E
SCALE: 'B'
SECTION G
SCALE: 'B'
FLOODSIDE
PROTECTED SIDE
SCALE:
SCALE 'A'
SCALE 'B'
LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN
DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION
CONCRETE FLOODWALL
PLAN & ELEVATION - CAERNARVON
SCALES AS SHOWN
WALDEMAR S. NELSON AND COMPANY, INC.
ENGINEERS AND ARCHITECTS
NEW ORLEANS, LA.
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS, U. S. ARMY
NEW ORLEANS, LA.
DATE SEPTEMBER 1969
FILE NO. H-2-24306

PLATE 77



LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN
DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

INVERTED 'TEE' FLOODWALL

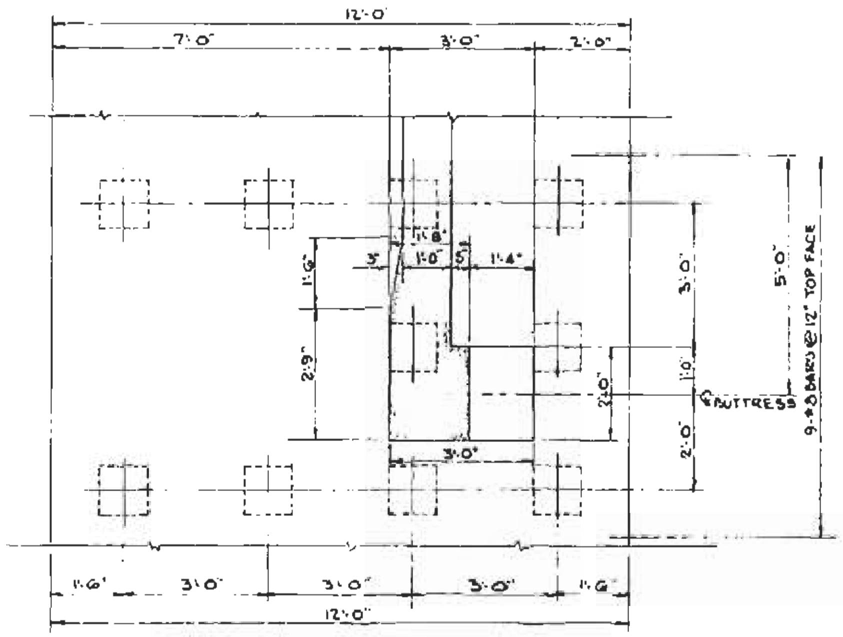
CAERNARVON

SCALES AS SHOWN

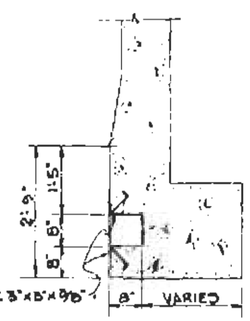
WALDEMAR S. NELSON AND COMPANY, INC. ENGINEERS AND ARCHITECTS NEW ORLEANS, LA.

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

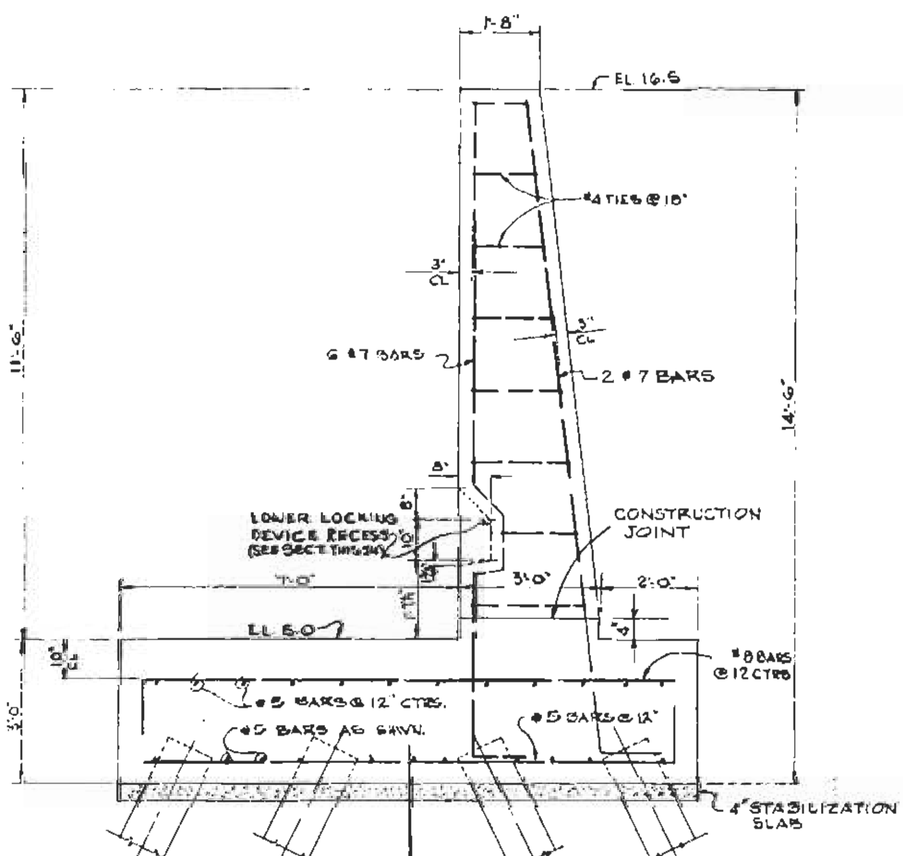
DATE SEPTEMBER 1966 | FILE NO. H-2-24306



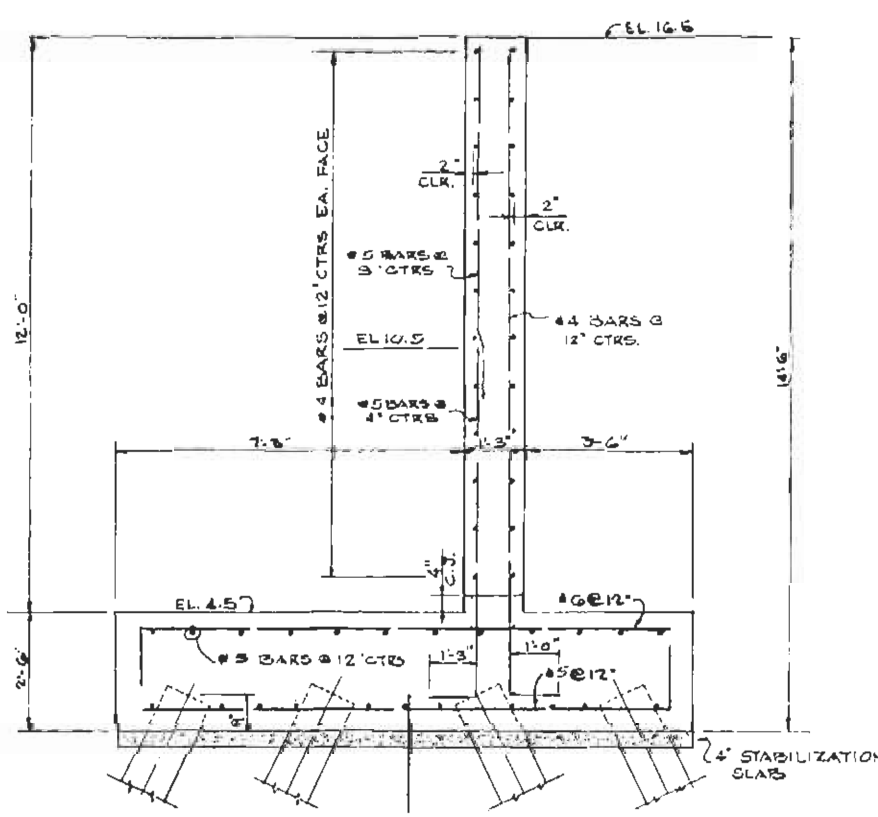
PLAN AT BUTTRESS



SECTION THRU BUTTRESS
AT LOCKING DEVICE RECESS



SECTION AT BUTTRESS



SECTION THRU WALL

SCALE

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

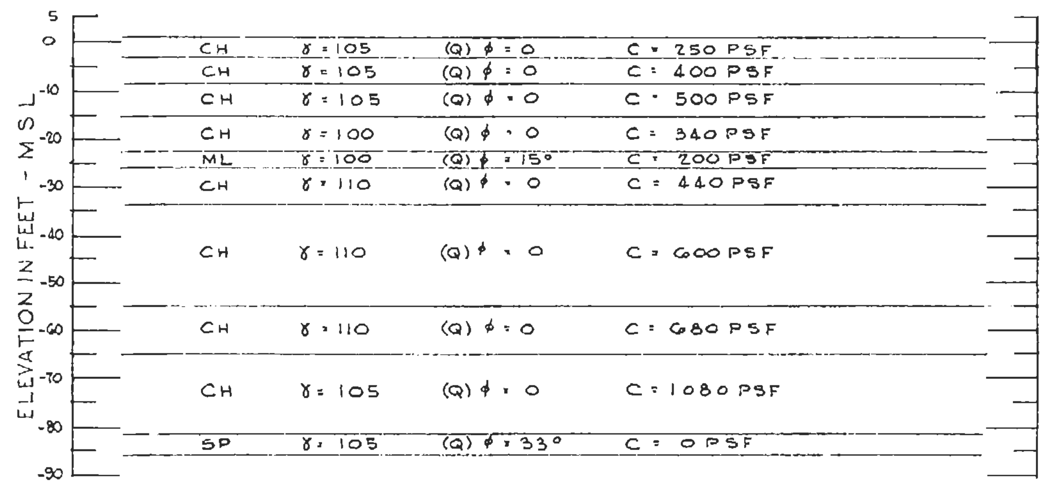
DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

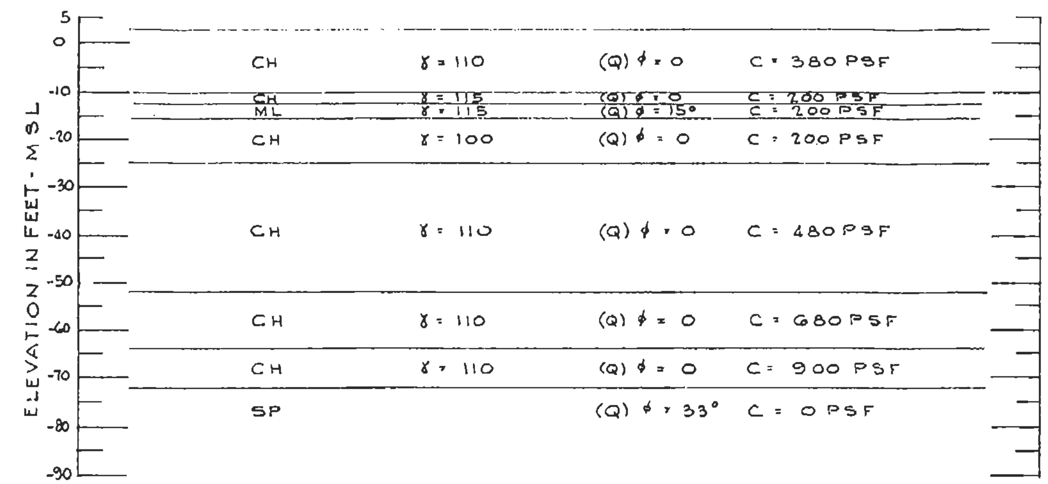
INVERTED "TEE" FLOODWALL
SECTIONS & DETAILS - CAERNARVON

SCALE: AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC. ENGINEERS AND ARCHITECTS NEW ORLEANS, LA.	U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS, U. S. ARMY NEW ORLEANS, LA.
DATE SEPTEMBER 1966	FILE NO. H-2-24306

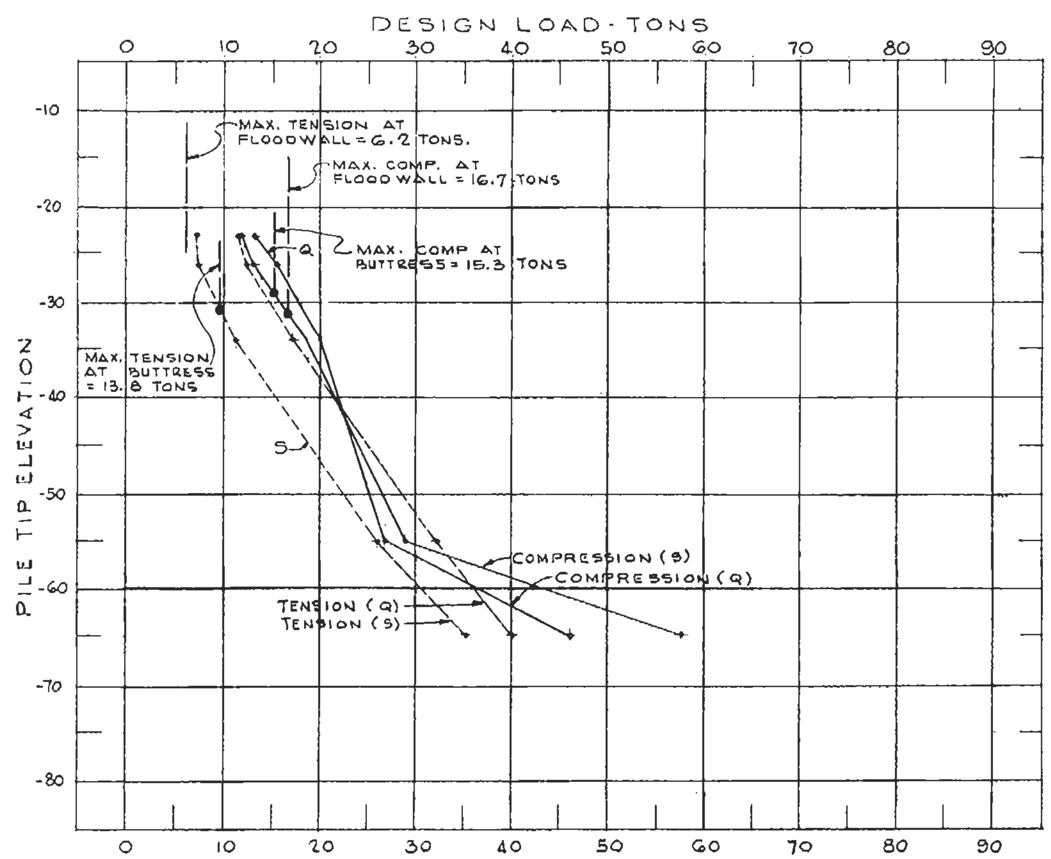
PLATE 79

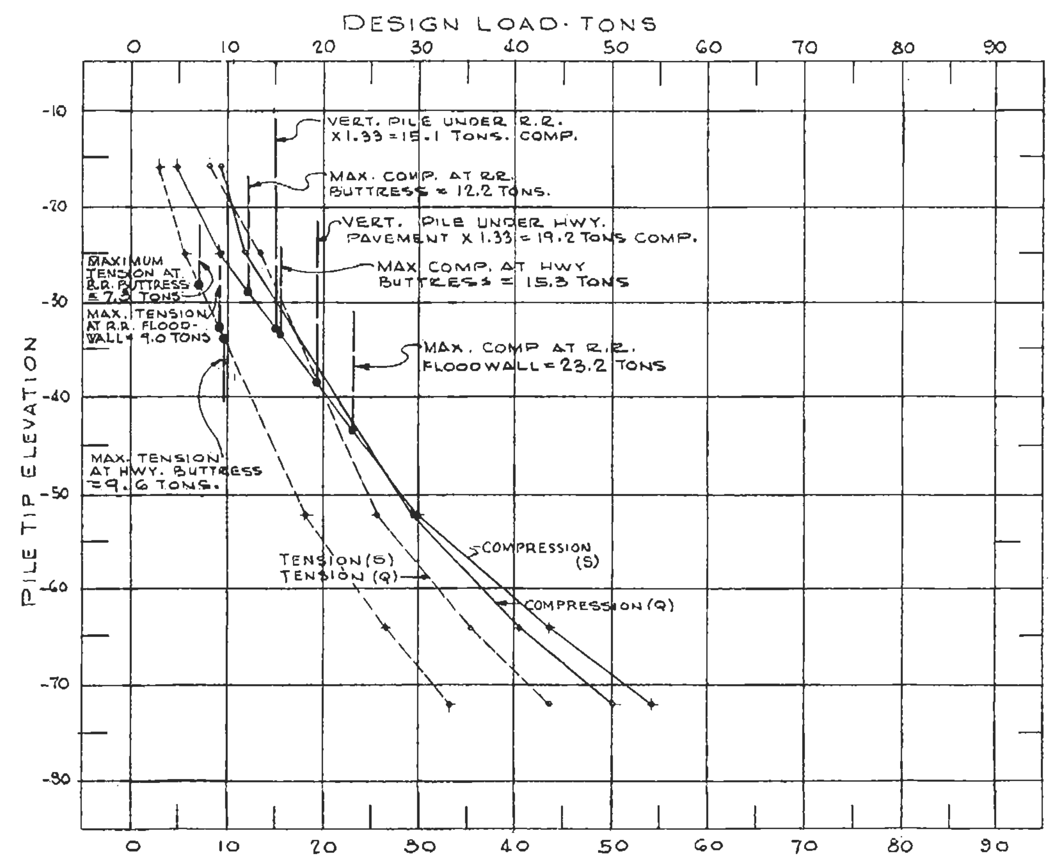




VERRET - GAP CLOSURE
12"×12" PRESTRESSED CONCRETE PILE
(BORING No. 18 - CU)

CAERNARVON - GAP CLOSURE
12"×12" PRESTRESSED CONCRETE PILE
(BORING No. 45 - CU)





DESIGN LOAD VS TIP ELEVATION

SHEAR STRENGTH DESIGN DATA

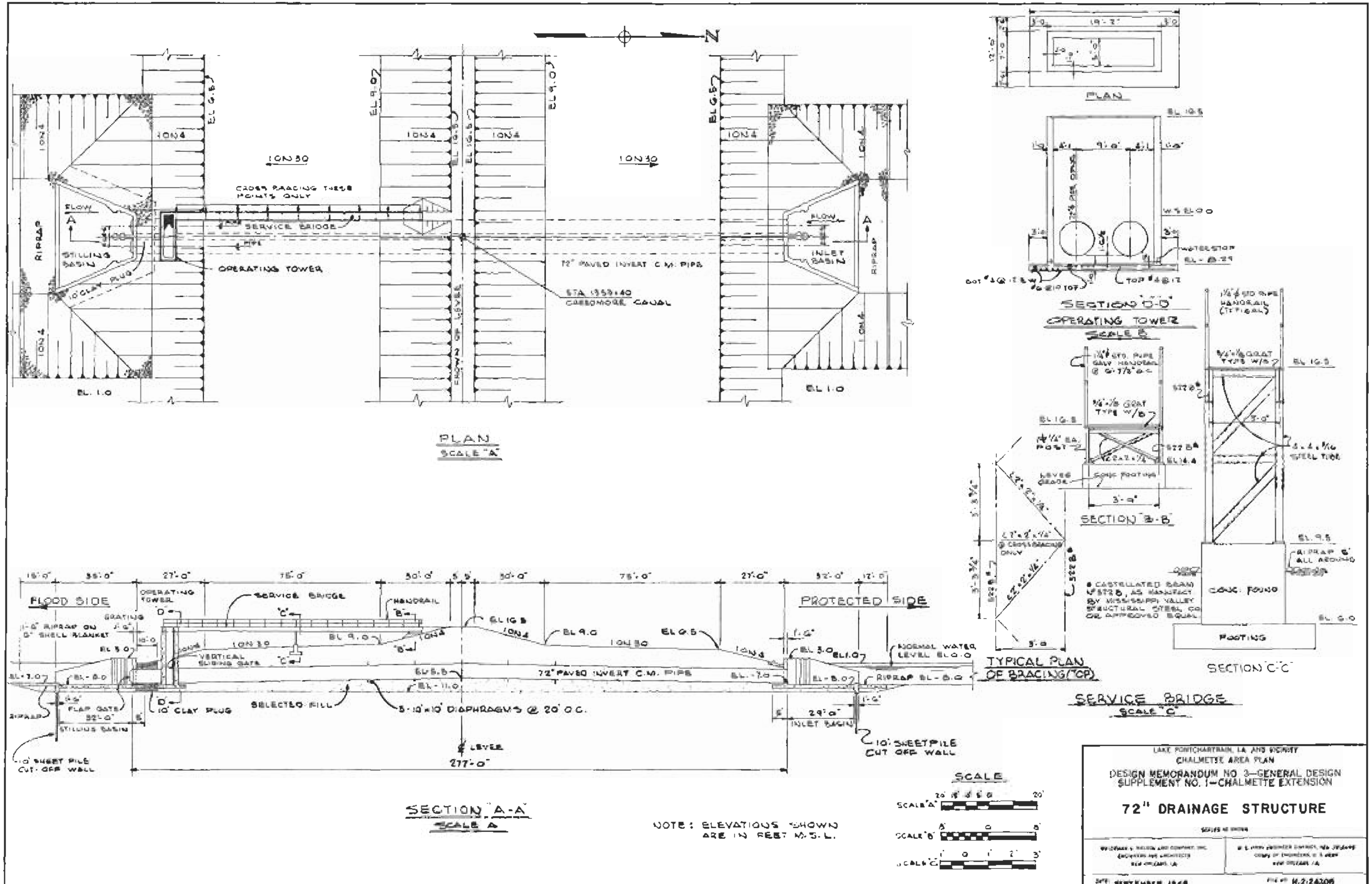
APPLIED FACTORS OF SAFETY 1.75 IN COMPRESSION & 2.0 IN TENSION.
APPLIED CONJUGATE STRESS RATIOS - K: 1.00 IN COMPRESSION & 0.7 IN TENSION.
(S) STRENGTH IN CLAYS: $\phi = 23°$, C = O, (Q) & (S) STRENGTH IN SANDS: $\phi = 33°$, C = O.
(S) STRENGTH IN SILTS: $\phi = 33°$, C = O.
(Q) STRENGTH IN CLAYS & SILTS ARE AS SHOWN IN SOIL SECTIONS.
DESIGN LOADS INCREASED BY 1/3 FOR GROUP 2 LOADINGS.

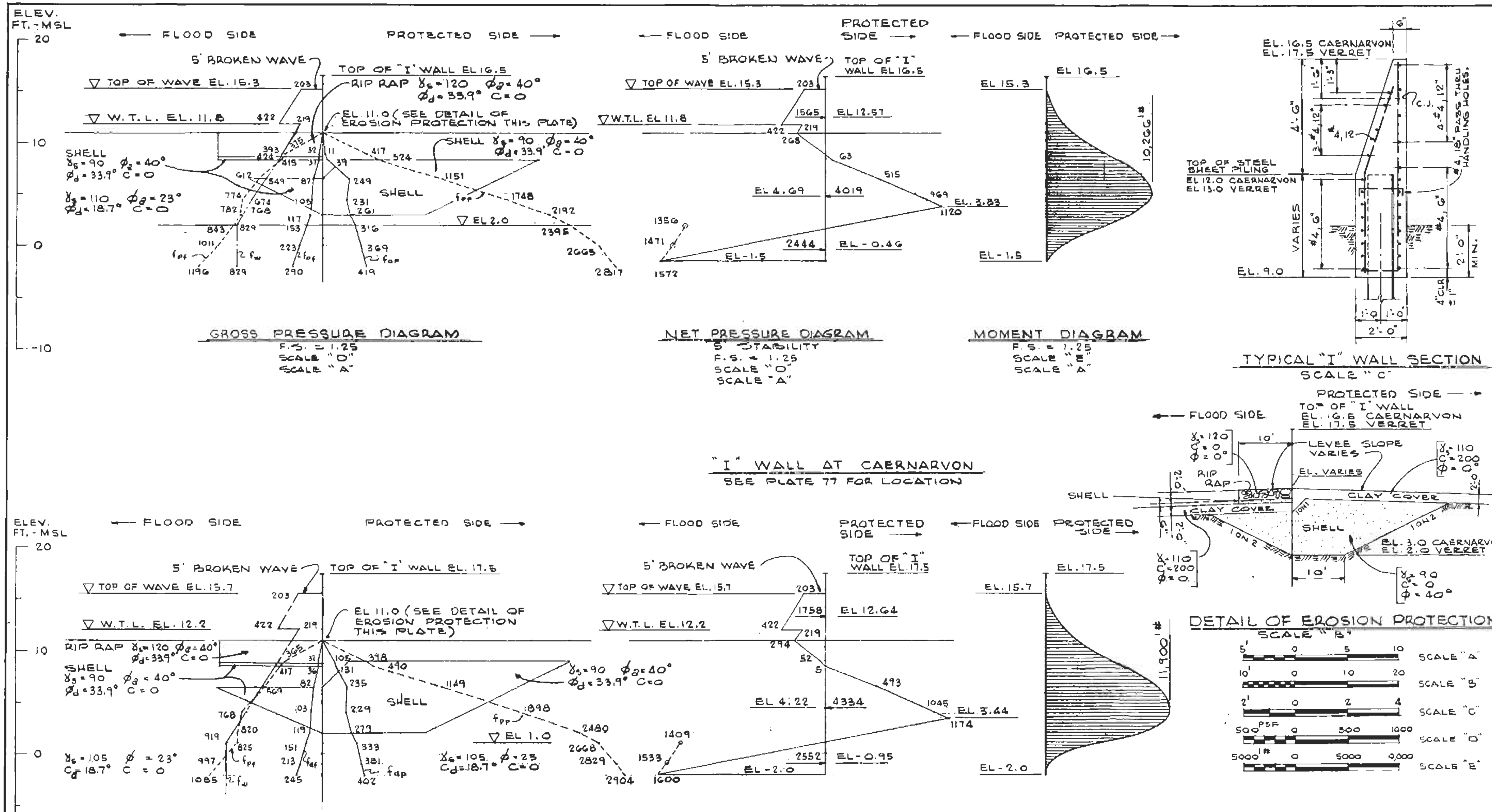
LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN
DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

PILE DESIGN LOAD VS TIP ELEVATION

SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC. ENGINEERS AND ARCHITECTS NEW ORLEANS, LA.	U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS, U. S. ARMY NEW ORLEANS, LA.
DATE: SEPTEMBER 1968	FILE NO. H-2-24306


N
PLAN
SCALE "A"
1 ON 30
1 ON 4
EL 6.5
EL 9.0
EL 16.5
EL. 1.0
RIPRAP
FLOW
STILLING BASIN
10' CLAY PLUG
CROSS BRACING THESE POINTS ONLY
SERVICE BRIDGE
PIPE
OPERATING TOWER
72" PAVED INVERT C.M. PIPE
STA 1359+40 CARSONIORE CANAL
FRONT OF LEVEE
INLET BASIN
SECTION "A-A"
SCALE A
FLOOD SIDE
PROTECTED SIDE
OPERATING TOWER
SERVICE BRIDGE
HANDRAIL
GRATING
1'-6" RIPRAP ON 6" SHELL BLANKET
VERTICAL SLIDING GATE
FLAP GATE
STILLING BASIN
10' CLAY PLUG
SELECTED FILL
5-10'x10' DIAPHRAGMS @ 20' O.C.
℄ LEVEE
277'-0"
NORMAL WATER LEVEL EL. 0.0
RIPRAP EL -6.0
INLET BASIN
10' SHEET PILE CUT OFF WALL
NOTE: ELEVATIONS SHOWN ARE IN FEET M.S.L.
PLAN
SECTION "D-D"
OPERATING TOWER
SCALE B
SECTION "B-B"
TYPICAL PLAN OF BRACING (TOP)
SECTION "C-C"
SERVICE BRIDGE
SCALE "C"
CONC. FOUND.
FOOTING
SCALE
SCALE "A"
SCALE "B"
SCALE "C"
LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN
DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION
72" DRAINAGE STRUCTURE
SEPTEMBER 1968
H-2-24306



LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN
DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

"I" WALL STABILITY AND DETAILS

SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC.
ENGINEERS AND ARCHITECTS
NEW ORLEANS, LA.

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

DATE SEPTEMBER 1966 — FILE NO. H-2-24306

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			Sl		SHELLS
NO SAMPLE					

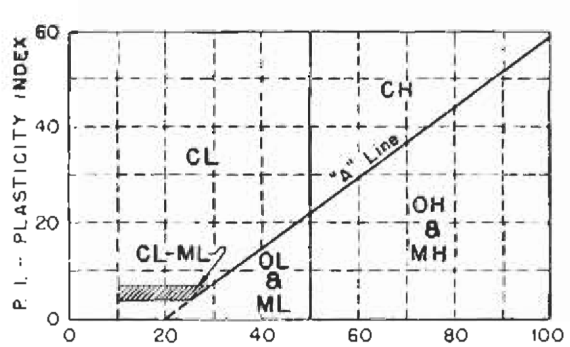
NOTE: Soils possessing characteristics of two groups are designated by combinations of group symbols

DESCRIPTIVE SYMBOLS

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	brGr
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



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 subsurface 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
2	6-8-64	SYMBOL FW, NOTE REVISED	ORAL FROM LMVCE 5 JUNE 1964
1	9-17-63	1ST PAR OF GENERAL NOTES REVISED	LMVD 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, LA. AND VICINITY
CHALMETTE AREA PLAN
DESIGN MEMORANDUM NO. 3-GENERAL DESIGN
SUPPLEMENT NO. 1-CHALMETTE EXTENSION

APPENDIX A

REPORT ON MODIFICATION OF CHALMETTE AREA PLAN TO INCLUDE LARGER AREA

St Bernard

LMNED-PR 29 November 1966

SUBJECT: Lake Pontchartrain, Louisiana and Vicinity - Modification of the Chalmette Area Plan to Include Larger Area

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

1. Reference is made to the following:

a. Flood Control Act of 1965 authorizing subject project.

b. Project document for subject project (H.Doc. 231/89th Congress).

c. Design Memorandum No. 3, General Design for Lake Pontchartrain, La. and Vicinity, Chalmette Area Plan, submitted 1 November 1966.

d. Flood Control Act of 1962 authorizing hurricane protection for the Mississippi River Delta Area at and below New Orleans, Louisiana, and Reach E, Violet to Verret, in particular.

e. Project document for Mississippi River Delta at and below New Orleans, La. (New Orleans to Venice, La.) (H.Doc. 550/87th Congress).

f. Resolution adopted 8 May 1964 by the House Public Works Committee authorizing a restudy of hurricane protection in St. Bernard Parish.

g. Paragraph 2 of 1st Ind file LMVED-PR dated 25 February 1966 to NOD letter of 21 February 1966 subject "Review of St. Bernard Parish, Louisiana - Plan of Survey."

h. Paragraph 9.b. of ER 1110-2-1150 dated 1 July 1966.

2. Hurricane protection for the Chalmette area was authorized as an item of the "Lake Pontchartrain, Louisiana and Vicinity," project by the Flood Control Act of 1965 (page 5 of PL 89-298) "...substantially in accordance with the recommendations of the Chief of Engineers in House Document Numbered 231, Eighty-Ninth Congress, 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...."

3. The recommendations of the Board as stated in paragraph 4 of the report are as follows:

> "Subject to re-examination of the levee alignment in the preconstruction stage with a view to protecting additional lands, and to certain requirements of local cooperation, the Board recommends authorization for construction of the improvements, essentially as planned by the reporting officers, provided...."

The Chief of Engineers concurred in the recommendations of the Board subject to certain modifications pertaining to the Rigolets lock as a result of a change in the interest rates.

4. The present plan of improvement for the Chalmette area is shown in Design Memorandum No. 3, General Design (reference 1.c.). This plan, also shown on the attached map, provides for protection of the Chalmette area against a standard project hurricane (described in paragraph 14 of the DM) having an estimated frequency of about once in 200 years.

5. Protection for the Reach E area, Violet to Verret, against a hurricane having a frequency of about once in 100 years was authorized as a feature of the project "New Orleans to Venice, La.," by the Flood Control Act of 1962. The plan of improvement provided for raising existing back levees from the Mississippi River at Violet to the highway at Verret (see attached map).

6. St. Bernard Parish interests were dissatisfied with this plan and secured authorization for a restudy (reference 1.f.) which was initiated in FY 1966 and is being continued in FY 1967. At the public hearing in Chalmette on 15 December 1965, the Parish Police Jury, State of Louisiana, Department of Public Works, and others requested hurricane protection for a much larger area in St. Bernard Parish including the settlements of Caernarvon, Reggio, Delacroix, Yscloskey, and Hopedale. The locations of the levees proposed by the sponsors at the public hearing are shown on the attached map.

7. Afeer preliminary examination of the requested levee alignment, previous studies, and damages caused by hurricane "Betsy" (9 September 1965), it was deemed advisable to move the levee about halfway between the requested location and the highway from Poydras to Verret because of better levee construction conditions (Reach A-B on the inclosed map). The area thus deleted from the proposed protected area is entirely undeveloped marsh in which only minor enhancement benefits would be

obtained from hurricane protection. It was also deemed advisable to consider the initial plan as protection for the Poydras to Verret area which, if added to the Chalmette area, would eliminate the need for the return levee between the Mississippi River-Gulf Outlet spoil bank and the Mississippi River levee at Violet, a very expensive section of levee to construct and maintain (see reference 1.c.). The remainder of the requested levees would be considered as increments thereto. The plan of survey recommending this approach was submitted 21 February 1966 and approved 25 February 1966 (see reference 1.g.).

8. Initial studies of the additional protection requested for St. Bernard Parish have been essentially completed. Maximum utilization has been made of the data developed during preparation of the design memorandum for the Chalmette area. The levee sections and estimated construction requirements and unit prices for comparable areas in the Chalmette plan have been used for cost estimates. Hydraulic studies have been made to estimate levee grades. Field reconnaissance and hydraulic studies have been made for benefit estimates.

9. The net levee grade for the Chalmette area plan levee along the spoil banks of the Mississippi River-Gulf Outlet gulfward of Paris Road is 17.5 feet m.s.l. (plates 10 through 15 of design memorandum, reference 1.c.). Hydraulic studies have been made and levee grades established for the additional area under study as follows: along the entire spoil bank, 17.5 feet m.s.l.; Caernarvon to the highway at Verret, 16.5 feet; Verret to spoil bank, 17.5 feet; and Verret to Reggio, and thence along Bayou LaLoutre to the Mississippi River-Gulf Outlet spoil bank, 17.0 feet. Levees to these grades would provide the same degree of protection for the entire area as that under the existing Chalmette area plan.

10. The estimated cost of modifying the Chalmette area plan to include the settlements of Caernarvon, Poydras, and Verret (by levees A, B, C, D) in the protected area is as shown below. A detailed estimate of the costs is inclosed.

Item	Estimated cost
Levee construction	$ 9,548,500
Foreshore protection along MR-GO	703,000
Drainage structure	146,000
Relocations	
Highway crossings(2)	93,800
Pipelines(7)	295,000
Subtotal	$10,786,300
Contingencies (20%+)	2,157,700
Subtotal	$12,944,000
Engineering and design	776,000
Supervision and administration	1,099,000
Total construction cost	$14,819,000
Rights-of-way	537,000
Total estimated cost of additional levees	$15,356,000(1)
Less levee from Bayou Lawler (Point D) to Violet made unnecessary	7,212,000(2)
Total increased cost for additional protection	$ 8,144,000(1)

(1) Includes $966,000 for foreshore protection along Mississippi River-Gulf Outlet, Reach C-D on the inclosed map.
(2) Section IV, pages 52-53 of D.M. reference 1.c.

11. The estimated annual charges based on the increased costs in the preceding paragraph, a 100-year life, and an interest rate of 3-1/8% are:

Item		Amount
Interest		$255,000
Amortization		12,000
Maintenance and operation		
16 miles levee @ $5,000/mile	80,000	
Less: maintenance levee--Bayou Lawler to Violet(par. 65 D.M. ref. 1)	42,000	
Increased levee maintenance		38,000
Increased annual charges		$305,000

12. The benefits from the additional protection are estimated at $359,200 average annually, consisting of $13,100 crop, $178,600 non-crop, and $167,500 land enhancement. A detailed computation of the benefits is inclosed.

13. Based on annual charges in paragraph 11 and annual benefits in paragraph 12, the benefit-cost ratio for the protection of the additional area is 1.2.

14. Consideration was given to extending the protection eastward and southward of Verret generally as requested by the local sponsors and shown on the attached map. However, these studies indicate protection for a larger area cannot be justified in the foreseeable future. The length of levee required would be relatively large in relation to the levee eliminated and the increased area protected. The area is sparsely inhabited and the improvements are of low value. Reconnaissance scope studies show that the estimated incremental first costs and annual charges for extending the hurricane protection from the Poydras-Verret area to include Yscloskey (excludes Hopedale and Delacroix), generally as shown on the inclosed map (levees B, E, F, I, C), are $18,000,000 and $670,000, respectively. The estimated incremental first costs and annual charges for extending the hurricane protection from Verret to Hopedale (levees F, G, H, I) are $28,000,000 and $1,000,000, respectively. The average annual benefits for extending the hurricane protection from Verret to Hopedale are only $195,000 (exclusive of Delacroix) ($5,000 crop, $140,000 non-crop, and $50,000 land enhancement). In view of the very small benefit-cost ratio for the area from Verret to Yscloskey (less than 0.2), no studies were made of the levees along Bayou Terre aux Boeufs to include Delacroix in the protected area.

15. A survey of the highway from Poydras to Verret shows the controlling elevation to be about 5 feet mean sea level. Over two miles of the highway have a controlling elevation of less than 6.0 feet m.s.l. Hurricane "Betsy" produced stillwater elevations in excess of 10.0 feet m.s.l. in the Poydras-Verret-Hopedale area. The protection to be provided under the authorized project "Reach E" is obviously inadequate for a residential area. In recognization of this, the State of Louisiana, Department of Public Works, at the request of the Board of Commissioners of the Lake Borgne Levee District, has recently (about 1 November 1966) initiated the construction of a small levee to elevation 10.0 feet m.s.l. (by dragline) from Caernarvon to Verret generally along the alignment proposed herein and shown on the attached map. The alignment and levee section have been examined in this office. The work being accomplished, unless enlarged and raised, will soon settle

29 Nov 66
Blair/kn/364
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until it would provide only a small amount of additional protection. However, it will be of substantial value in expediting the construction of the levee to the full grade and section recommended herein. Local interests should be given credit for the work accomplished on their Caernarvon to Verret levee.

16. It is recommended that the presently approved plan of hurricane protection for the Chalmette area contained in the general design memorandum (reference 1.c.) be modified under the authority quoted in paragraphs 2 and 3 to provide for the construction of the levee from Caernarvon via Verret and the Mississippi River-Gulf Outlet spoil bank to the approved plan levee at Bayou Lawler (Point D) generally along the alignment shown on the attached map and for the elimination of the levee in the approved plan from Bayou Lawler to Violet (Section IV in reference 1.c.). This modification will increase the total estimated cost of the Chalmette area plan from $29,552,200 to $37,697,000, which includes $4,337,400 for foreshore protection along the Mississippi River-Gulf Outlet)(an increase of $966,000). The estimated Federal cost will be increased from $21,697,952 to $27,689,000 and the estimated non-Federal cost from $7,854,236 to $10,008,000.

17. It is further recommended that, when the modification in the authorized plan is approved, this District be authorized to proceed with work necessary to prepare a supplement to the general design memorandum for the Chalmette area (reference 1.c.) on the modified plan.

Chaney

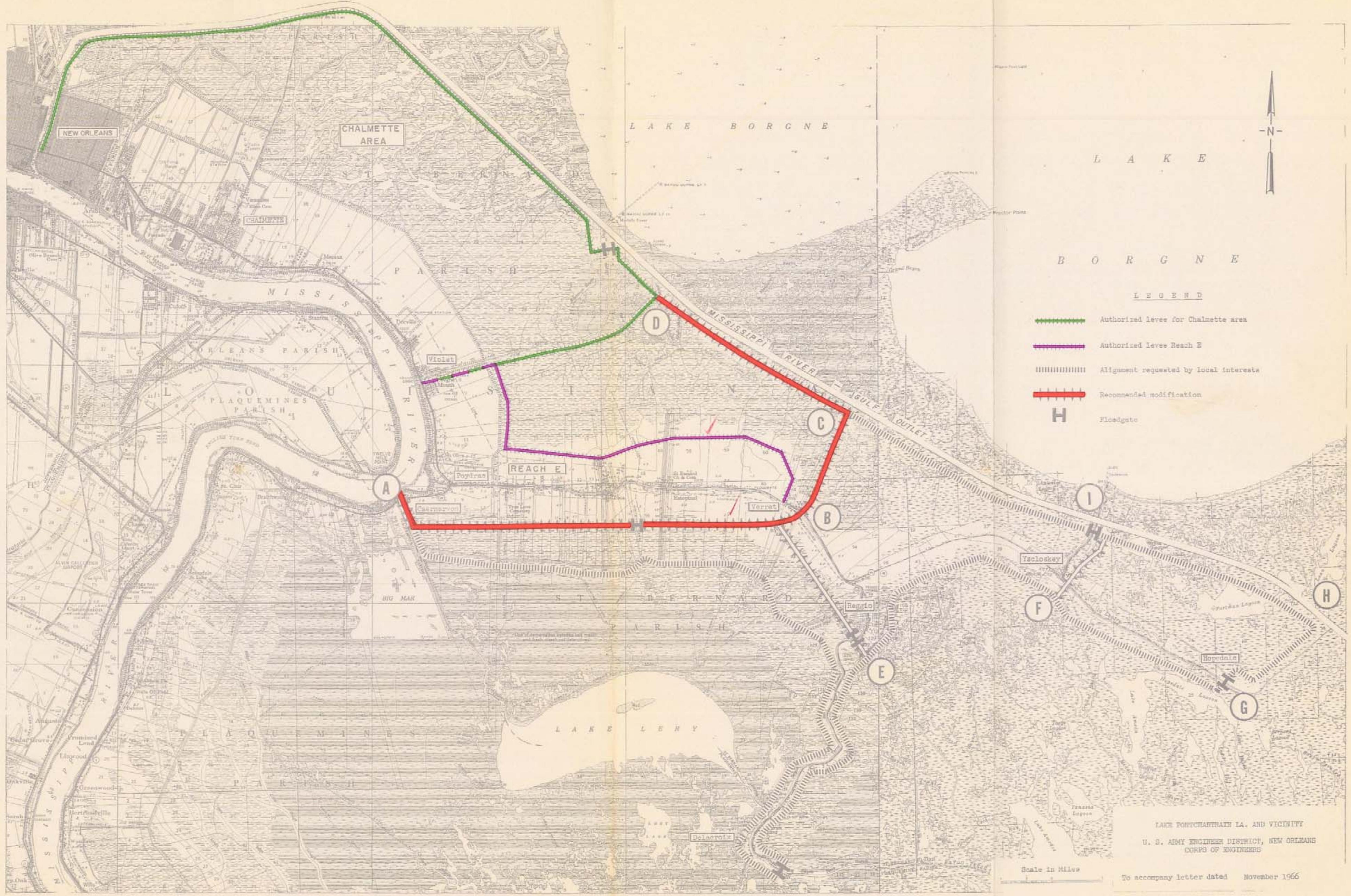
WDM
Mask

Hudson

4 Incl (quint)
1. Map
2. Cost est.
3. Benefit est.
4. Apportionment of costs

THOMAS J. BOWEN
Colonel, CE
District Engineer

Exe Ofc



NEW ORLEANS
CHALMETTE AREA
CHALMETTE
ST. BERNARD PARISH
ORLEANS PARISH
PLAQUEMINES PARISH
LOUISIANA
MISSISSIPPI RIVER
MISSISSIPPI RIVER GULF OUTLET
LAKE BORGNE
REACH E
Violet
Poydras
Caernarvon
Verret
Yscloskey
Reggio
Hopedale
Delacroix
BIG MAR
LAKE LERY
A
B
C
D
E
F
G
H
I
N
LEGEND
Authorized levee for Chalmette area
Authorized levee Reach E
Alignment requested by local interests
Recommended modification
Floodgate
LAKE PONTCHARTRAIN LA. AND VICINITY
U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
Scale in Miles
To accompany letter dated November 1966

DETAILED ESTIMATED FIRST COST
FOR
ADDING POYDRAS-VERRET AREA TO THE
CHALMETTE AREA PLAN

1. ESTIMATES OF FIRST COSTS

The estimates of first cost for the plan of improvement for the Poydras to Verret area, based on October 1966 prices, are as follows:

a. REACH A-B.

Estimated first cost

Cost acct. No.	Item	Quantity	Unit cost	Estimated cost
	FEDERAL CONSTRUCTION			
11	Levees and floodwalls			
	Levee			
	Hydraulic fill	8,212,000 cu.yd.	$ 0.60	$4,927,200
	Shape up	1,026,000 cu.yd.	0.40	410,400
	Cast fill for dikes	385,000 cu.yd.	0.30	115,500
	Haul fill for levee	313,000 cu.yd.	1.50	469,500
	Seeding	264 acre	75.00	19,800
	Subtotal			$5,942,400
	Contingencies (20%)			1,188,600
	Subtotal			$7,131,000
15	Floodway control and diversion structures			
	Drainage structure	job		$ 146,000
	Contingencies (20%)			29,000
	Subtotal			$ 175,000
30	Engineering and design (6%)			$ 438,000
31	Supervision and administration (8%)			620,000
	Total estimated Federal construction first cost			$8,364,000

Incl 2

a. REACH A-B (cont'd)

Cost acct. No.	Item	Quantity	Unit cost	Estimated cost
	RELOCATIONS			
02.3	Relocation of pipelines			
	3-20" gas pipeline	L.S.		$ 161,000
	2-16" gas pipeline	L.S.		86,000
	1-12" gas pipeline	L.S.		32,000
	1-6" gas pipeline	L.S.		16,000
	Subtotal			$ 295,000
	Contingencies (20%)			59,000
	Subtotal			$ 354,000
02.1	Relocation of roads			
	La.Hwy.39 (Caernarvon)			
	Earthfill	26,200 cu.yd.	$ 1.50	$ 39,300
	Asphalt ramp	630 ft.	12.00	7,600
	Subtotal			$ 46,900
	Contingencies (20%)			9,100
	Subtotal			$ 56,000
30	Engineering and design (6%)			25,000
31	Supervision and administration (8%)			35,000
	Total estimated cost of relocations			$ 470,000
01	Lands and damages			
	Fee area	928 acres		$ 269,000
	Improvements			20,000
	Severance			10,000
	Contingencies (15%)			45,000
	Acquisition costs (83 tracts)			17,000
	Total cost for rights-of-way			$ 361,000
	TOTAL ESTIMATED COST FOR REACH A-B			$9,195,000

b. BEACH B-C.

Estimated first cost

Cost acct. No.	Item	Quantity	Unit cost	Estimated cost
	FEDERAL CONSTRUCTION			
11	Levees and floodwalls			
	Levee			
	Hydraulic fill	3,032,000 cu.yd.	$ 0.60	$1,819,200
	Shape up	379,000 cu.yd.	0.40	151,600
	Cast fill for dikes	142,000 cu.yd.	0.30	42,600
	Haul fill for levee	313,000 cu.yd.	2.50	782,500
	Seeding	140 acre	75.00	10,500
	Subtotal			$2,806,400
	Contingencies (20%)			561,600
	Subtotal			$3,368,000
30	Engineering and design (6%)			$ 202,000
31	Supervision and administration (8%)			285,000
	Total estimated Federal construction first cost			$3,855,000
	RELOCATIONS			
02.1	Relocations			
	La.Hwy. 46 (Verret)			
	Earthfill	26,200 cu.yd.	$ 1.50	$ 39,300
	Asphalt ramp	630 ft.	12.00	7,600
	Subtotal			$ 46,900
	Contingencies (20%)			9,100
	Subtotal			$ 56,000
30	Engineering and design (6%)			4,000
31	Supervision and administration (8%)			5,000
	Total estimated first cost for relocations			$ 65,000
01	Lands and damages			
	Fee area	306 acres		$ 85,000
	Improvements			3,000
	Severances			5,000
	Contingencies (15%)			14,000
	Acquisition costs			1,000
	Total costs for rights-of-way			$ 108,000
	TOTAL COST FOR BEACH B-C			$4,028,000

c. REACH C-D.

Estimated first cost

Cost acct. No.	Item	Quantity	Unit cost	Estimated cost
	FEDERAL CONSTRUCTION			
11	Levees and floodwalls			
	Levee			
	Hydraulic fill	1,198,000 cu.yd.	$ 0.60	$ 718,800
	Shape up	150,000 cu.yd.	0.40	60,000
	Cast fill for dikes	56,000 cu.yd.	0.30	16,800
	Seeding	54 acres	75.00	4,100
	Subtotal			$ 799,700
	Contingencies (20%)			160,300
	Subtotal			$ 960,000
30	Engineering and design (6%)			57,000
31	Supervision and administration (8%)			82,000
	Total estimated cost of levee			$1,099,000
11	Foreshore protection along MR-GO			
	Excavation & backfill	121,000 cu.yd.	1.00	121,000
	Riprap	54,000 ton	10.00	540,000
	Shell	12,000 cu.yd.	3.50	42,000
	Subtotal			$ 703,000
	Contingencies (20%)			141,000
	Subtotal			$ 844,000
30	Engineering and design (6%)			50,000
31	Supervision and administration (8%)			72,000
	Total estimated costs for foreshore protection			$ 966,000
	Total estimated Federal construction cost			$2,065,000
01	Lands and damages			
	Fee area	116 acres		$ 58,000
	Improvements			None
	Severance			None
	Contingencies (15%)			9,000
	Acquisition costs			1,000
	Total estimated costs for rights-of-way			$ 68,000
	TOTAL ESTIMATED COST REACH C-D			$2,133,000

d. Summary.

	A-B	B-C	C-D	Total
Federal construction	$8,364,000	$3,855,000	$2,065,000	$14,284,000
Relocations	470,000	65,000	None	535,000
Lands & damages	361,000	108,000	68,000	537,000
Total	$9,195,000	$4,028,000	$2,133,000	$15,356,000

ESTIMATE OF BENEFITS
FOR
POYDRAS-VERRET AREA

DESCRIPTION

The study area is rural in nature and is characterized by several small communities located along the highways which traverse the area. Along La. State Highway 39 are the settlements of Violet, Poydras, and Caernarvon. St. Bernard, Toca, Estopinal, and Verret are situated along La. State Highway 46. Estimated total population (1960 census) is 3,100 representing a growth rate of approximately 34% in the last decade. Improvements are generally located on high ground along the alluvial banks of the Mississippi River and Bayou Terre aux Boeufs, a former distributary of the Mississippi River at Poydras.

ECONOMIC DEVELOPMENT

Railway transportation is provided by the Louisiana Southern Railroad track (Southern Railway System) running along the west side of La. State Highway 39 and south of La. State Highway 46 as far east as the community of Toca. The Mississippi River-Gulf Outlet, a tidewater channel deep enough to accommodate seagoing vessels, borders on the northeastern boundary of the study area; to the north, Bayou Dupre and connecting Lake Borgne Canal afford a shallow navigation channel for smaller boats.

Economic activity in the area is primarily agricultural with truck crops and the production of beef cattle predominating. One industrial natural gas plant and one petroleum plant are in operation at Toca; no mineral production exists at this time. A few small, local business establishments are scattered along the highways. A large part of the income enjoyed by residents is derived outside of the area; primary sources include business and industrial establishments in metropolitan New Orleans, nearby oil production facilities, commercial fishing, sport fishing services, and fur trapping.

Development within the area has shown consistent gains over the past 25 years despite inadequate flood protection; its geographic position within the Greater New Orleans area indicates sustained future growth.

EXTENT AND CHARACTER OF FLOODED AREA

Within the project area are some 17,900 acres of land subject to inundation, including 3,800 acres cleared, 9,500 acres woods, and 4,600 acres marshland. About 6,300 acres lying north of La. State Highway 46 receive some protection from flooding as a result of the Bayou Terre aux Boeufs alluvial ridge to the south and a protection levee up to +8 feet above mean sea level to the north. Nearly all improvements in the

Incl 3

area are residential, with a few small commercial businesses and two industrial plants. These improvements are generally located on the alluvial ridges at elevation +5 feet to +10 feet above mean sea level. Agricultural production is based primarily on small farm truck crop production and the raising of beef cattle.

The present estimated land value within the project area is $16,750,000 and the improvements are valued at $18,050,000 for a total valuation of $34,800,000. Annual value of agricultural production, under flood-free conditions, is about $250,000.

Due to the extreme peril to life and property in the area because of possible tidal overflow, it becomes necessary for a mass evacuation whenever there is an indication of approaching hurricanes or severe tropical disturbances. Highway and railway access is subject to disruption during these periods.

FLOOD DAMAGES

As a result of hurricane tidal overflows, damages are sustained by residences, house trailers, small business establishments, two industries, schools, churches, utilities, highways, and the railroad. Additional losses are suffered to truck crops, pastures, drowned livestock, fowl, and wildlife. Mass evacuation costs, flood fighting costs, business and personal income losses are also incurred.

Flood damages determined during surveys following hurricanes "Flossy" (September 1956) and "Betsy" (September 1965) were adjusted to reflect present conditions and used as a basis for developing stage-damage curves for agricultural and non-agricultural damages. In turn, average annual damages were determined by combining stage-damage and stage-frequency curves to obtain damage-probability curves.

Under present conditions, average annual losses within the project area are estimated at $13,100 crop and $119,600 non-crop for a total of $132,700.

Analysis of the growth trend for the metropolitan New Orleans area indicates continued growth for the next 50 years in this region. It was assumed that future improvements would take place in proportion to population increases and that the population within the study area would double by the end of a 50-year period and remain constant thereafter. No increase for agricultural production was assumed. On this basis of future development, average annual damages discounted for a 50-year growth and 100-year project life are estimated to be $13,100 crop and $178,600 non-crop for a total of $191,700.

ESTIMATES OF BENEFITS

Protection of the area from storms up to SPH frequency (about 200 years) will be afforded by the proposed works. Residual damages with the improvement are considered to be negligible; therefore, average annual flood damages prevented are estimated to be $13,100 crop and $178,600 non-crop or a total of $191,700.

The present appraised value of lands in the study area are estimated at $16,750,000; with protection from tidal overflow the value is anticipated to approximate $20,100,000 or an increase of $3,350,000. Annual value of land enhancement is estimated (at a 5 percent interest rate) to be $167,500.

Total average annual benefits attributable to the proposed project are $359,200, composed of $191,700 flood damage prevented and $167,500 enhancements.

Apportionment of Increased First Costs
for
Poydras to Verret Area

Project first cost	
Increased first cost (including riprap foreshore protection along MR-GO)	$ 8,144,000
Less foreshore protection	966,000
Total cost for additional levees	$ 7,178,000

Apportionment of costs

Item	Federal	Non-Federal
Levees	$ 5,024,600(70%)	$ 2,153,400 (30%)
Foreshore protection	966,000(100%)	-
Total incremental cost	$ 5,990,600	$ 2,153,400
Existing plan (cost from p. 40 of ref. 1.c.)	$21,697,952	$ 7,854,236
Total for modified project	$27,688,552	$10,007,636
Round to	$27,689,000	$10,008,000
Cost for lands & relocations	(orig. project)	3,968,755
	modification)	1,072,000
		$ 5,040,755 *
Contribution required for modified project		$ 4,966,881
Round to		$ 4,967,000

*This is in error in that it includes $1,393,400 for lands & damages and relocations (MR-GO to Violet) which will be eliminated under the modification. Correct total should be $3,647,355.

Incl A

LMVED-TD (NOD 29 Nov 66) 1st Ind
SUBJECT: Lake Pontchartrain, Louisiana and Vicinity - Modification of the Chalmette Area Plan to Include Larger Area

DA, Lower Miss. Valley Div, CE, Vicksburg, Miss. 39180 13 Dec 66

TO: Chief of Engineers, ATTN: ENGCW-V/ENGCW-E

1. The recommendations of the District Engineer in paras 16 and 17 of basic communication are concurred in, subject to the comments below. General Design Memorandum No. 3 (reference 1c) was forwarded to OCE by our 1st Ind, LMVED-TD, dated 1 Dec 66, on NOD letter, dated 1 Nov 66, subject: Lake Pontchartrain, La. and Vicinity, General Design Memorandum No. 3, Chalmette Area Plan.

2. Para 1f, basic letter. In connection with studies being made in response to referenced resolution, present indications are that the part of the area below Verret will probably have a very low B/C ratio.

3. Para 16, basic fletter. The estimate of $29,552,200 is that shown in General Design Memorandum No. 3 and has not been approved in a Project Cost Estimate (PB-3). The estimate of $37,697,000 should be designated as approximate in view of the comment in para 5 below.

4. Incl 1. a. Location of drainage structure should be shown.

b. Upon approval of enlarged Chalmette Area, consideration should be given to locating the east-west portion of levee A-E approximately 2,000 feet north of the recommended alignment in order to provide a slightly better foundation and to place the levee on somewhat higher ground.

5. Incl 2. It should be noted that levee fill volumes and costs are based on data furnished in General Design Memorandum No. 3. As pointed out in para 5 of our 1st Ind dated 1 Dec 66, cited in para 1 above, the data and analyses presented in the GDM are not completely adequate to permit the levee to be constructed in stages to final grade without additional studies. As a result, at this time we do not actually know the volume of levee fill required to construct the levee to an ultimate grade taking into account all future settlement and displacement. Thus, the cost estimate for the levee is based on the best information available at this time.

6. Incl 4. Upon approval of the modified plan, local interests should be apprised of the plan including the increase in required

LMVED-TD (NOD 29 Nov 66) 1st Ind 13 Dec 66
SUBJECT: Lake Pontchartrain, Louisiana and Vicinity - Modification of the Chalmette Area Plan to Include Larger Area

non-Federal contribution and their views discussed in the proposed supplement to the general design memorandum.

FOR THE DIVISION ENGINEER:

4 Incl (quad)
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A. J. DAVIS
Chief, Engineering Division

Copy furnished:
NOD, ATTN: LMNED-PR

ENGCW-EZ 2nd Ind Mr. Hanscomb/jh/55104
SUBJECT: Lake Pontchartrain, Louisiana and Vicinity - Modification of the Chalmette Area Plan to Include Larger Area

DA, CofEngrs, Washington, D.C. 20315, 31 January 1967

TO: Division Engineer, Lower Mississippi Valley Division

1. References:

a. 2nd Indorsement, ENGCW-EZ, 27 October 1966, on letter LMNED-PP, 18 August 1966, subject: "Lake Pontchartrain, Louisiana and Vicinity, Design Memorandum No. 1, Hydrology and Hydraulic Analysis, Part I - Chalmette."

b. 2nd Indorsement, ENGCW-EZ, 31 January 1967 on letter LMNED-PP, 1 November 1966, subject: "Lake Pontchartrain, Louisiana and Vicinity, General Design Memorandum No. 3, Chalmette Area Plan."

2. The modification recommended by the District Engineer in paragraph 16 of the basic letter is approved subject to the comments of the Division Engineer, the comments in OCE 2nd indorsement referenced in paragraph 1a above, and the following additional comment.

3. Since the modification involves a significant increase in the project cost, the Appropriations Committees of Congress will have to be notified by this office. For this purpose the views of local interests on the plan and the increase in the non-Federal contribution is necessary. It is requested that the modification be discussed with local interests and this office be advised of the results thereof.

4. Cost for Reach 2, shown in orange on Inclosure No. 1, should be stated in the supplement mentioned below, since the levee ABCD will replace this authorized levee as well as that shown in green.

5. Preparation of the supplement recommended in paragraph 17 of the basic letter is approved.

FOR THE CHIEF OF ENGINEERS:

wd incl

DANIEL D. HALL
Major, Corps of Engineers
Assistant Director of Civil Works
for Mississippi Valley

VF
SKR
MSG
WMF

LMVED-TD (NOD 29 Nov 66) 3d Ind
SUBJECT: Lake Pontchartrain, Louisiana and Vicinity - Modification of the Chalmette Area Plan to Include Larger Area

DA, Lower Miss. Valley Div, CE, Vicksburg, Miss. 39180 9 Feb 67

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

1. Referred to note approval, subject to comments of 1st and 2d Indorsements.

2. Early action should be taken in regard to para 3, 2d Ind so that OCE may be furnished required information prior to impending Appropriations Hearings. In addition to a statement setting forth the views of local interests on the proposed modification and the increase in local costs, the submittal should clearly show that the modification of the Chalmette Area levee plan will obviate the need for the "Reach E" feature of the New Orleans to Venice hurricane protection project at a saving of $__________ to that project. Furthermore, the modified levee plan will eliminate the Bayou Lawler to Violet segment of the Chalmette Area as now planned at a saving of $__________. This proposed addition to the Chalmette Area will provide protection to all areas in St. Bernard Parish that can be economically justified at this time.

FOR THE DIVISION ENGINEER:

A. J. DAVIS
Chief, Engineering Division

23 Feb 67
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LMNED-PP (NOD 29 Nov 66) 4th Ind
SUBJECT: Lake Pontchartrain, Louisiana and Vicinity - Modification of the Chalmette Area Plan to Include Larger Area

DA, New Orleans District, CE, New Orleans, La. 70160 23 Feb 67

TO: Division Engineer, Lower Miss. Valley, CE, ATTN: LMVED-TD

1. In accordance with paragraph 3 of the 2d Indorsement, the State of Louisiana, Department of Public Works, which was designated by the Governor of Louisiana on 2 November 1965 as "...the agency to coordinate the efforts of local interests and to see that the local commitments are carried out promptly....," was requested to comment on the acceptability of the subject modification to local interests and their willingness to provide an additional local contribution therefor of approximately $2,150,000, inclusive of the value of lands, damages, relocations, and a cash contribution (or equivalent work) amounting to ~~$1,080,000~~. A copy of our telegraphic request is inclosed.
$2,470,000

2. By letter dated 13 February 1967, the Department of Public Works concurred in the modification and gave assurance that "...the requirements made of local interests will be carried out by the appropriate local governmental units." A copy of this response is inclosed.

3. The modified Chalmette Area Plan will extend hurricane protection to all areas in St. Bernard Parish for which such protection can be economically justified at this time. Since the entire Reach "E" feature of the "New Orleans to Venice, La.," project is located within the protected area of the modified Chalmette Area Plan, construction of this plan will, in addition to producing other benefits, generate all of the benefits realizable through construction of the Reach "E" feature, thus obviating the need for construction of the feature at a saving of $1,316,000 ($921,900 Federal, $394,100 non-Federal, based on PB-3 approved 2 June 1966). In addition, the return levee along Bayou Dupre, a segment of the Chalmette Area Plan as originally authorized, is not required with the modified plan, and its elimination results in an additional saving of $7,212,000 ($5,048,400 Federal and $2,163,600 non-Federal, based on DM No. 3, 1 November 1966).

Mask

2 Incl (dupe)
5. NOD telegram LMNED-PP-6, 7 Feb 67
6. DPW ltr dtd 13 Feb 67

THOMAS J. BOWEN
Colonel, CE
District Engineer

Hudson

Exe Ofc

67-265

LMVED-TD (NOD 29 Nov 66) 5th Ind
SUBJECT: Lake Pontchartrain, Louisiana and Vicinity - Modification of the Chalmette Area Plan to Include Larger Area

DA, Lower Miss. Valley Div, CE, Vicksburg, Miss. 39180 27 Feb 67

TO: Chief of Engineers, ATTN: ENGCW-EZ

Information requested by OCE 2d Ind is forwarded for your information. To avoid misinterpretation of the last sentence of para 3, 4th Ind, and to correct minor discrepancies, a summary of costs rounded to nearest $1,000 is furnished below.

Cost of Modifying Chalmette Area Plan

Total Const. Cost	$14,819,000
Right of Way	537,000
Total Cost	$15,356,000
Less Levee Violet to Point D	7,212,000
Total Cost of Modifying Plan	$ 8,144,000

Cost of Chalmette Area Plan as Modified

Total Cost of Modified Plan	$37,697,000
Previous Estimate	29,553,000
Increase	$ 8,144,000
Federal Cost of Modified Plan	$27,689,000
Previous Estimate	21,698,000
Increase	$ 5,991,000
Non-Federal Cost of Modified Plan	$10,008,000
Previous Estimate	7,854,000
Increase	$ 2,154,000

Additional Saving

Elimination of Reach E of New Orleans to Venice Hurricane Protection Project

Total Savings	$ 1,316,000
Federal Cost	$ 922,000
Non-Federal Cost	$ 394,000

FOR THE DIVISION ENGINEER:

2 Incl
Dupe ~~cy~~ wd

GEORGE B. DAVIS
Acting Chief, Engineering Division

Copy furnished:
NOD, ATTN: LMNED-PP

Rec'd NOD
5/5/67

ENGCW-EZ (LMNED-PR, 29 Nov 66) 6th Ind
SUBJECT: Lake Pontchartrain, Louisiana and Vicinity - Modification of the Chalmette Area Plan to Include Larger Area

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

TO: Division Engineer, Lower Mississippi Valley Division

1. Reference is made to letter, LMVED-A, 21 March 1966, subject: "Hurricane Protection - Lake Ponchartrain and Vicinity - Chalmette Area" and 1st indorsement, ENGCW-OM, 15 April 1966 thereon.

2. The construction costs presented in the 4th and 5th indorsements and in the GDM (DM #3) include costs for riprap foreshore protection along the Mississippi River - Gulf Outlet reach of the project. 1st indorsement ENGCW-OM, 15 April 1966, referenced in paragraph 1 above, directed that these costs be charged to the navigation project (MR-GO) as a Federal cost for wave protection. These costs, including the modified plan, are in excess of $4,000,000. The estimated costs should be adjusted by the District and revised estimates submitted to OCE, together with draft of letters to Congressional Committees. Since the riprap should be included in the Gulf Outlet (MR-GO) project, the necessary revisions to the design memorandum for the Gulf Outlet project should be made, or a supplement be prepared, and furnished OCE.

FOR THE CHIEF OF ENGINEERS:

wd incl

WENDELL E. JOHNSON
Chief, Engineering Division
Civil Works

LMVED-TD (NOD 29 Nov 66) 7th Ind
SUBJECT: Lake Pontchartrain, Louisiana and Vicinity - Modification of the Chalmette Area Plan to Include Larger Area

DA, Lower Miss. Valley Div, CE, Vicksburg, Miss. 39180 2 May 67

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

1. Referred for necessary action.

2. The question of charging the cost of riprap protection along the GIWW has been submitted to OCE by letter, LMVBC, SUBJECT: Hurricane Protection, Lake Pontchartrain and Vicinity, 24 Apr 67 for guidance. You will be advised when a decision is reached.

FOR THE ACTING DIVISION ENGINEER:

George B. Davis
GEORGE B. DAVIS
Acting Chief, Engineering Division

LMNED-PP (NOD 29 Nov 66) 8th Ind
SUBJECT: Lake Pontchartrain, Louisiana and Vicinity - Modification of The Chalmette Area Plan to Include Larger Area

DA, New Orleans District. CE, New Orleans, La. 70160 14 Jul 67

TO: Division Engineer, Lower Miss. Valley, CE, ATTN: LMVED-TD & LMVBC

1. In addition to the prior elements of this chain, reference is made to LMVBC letter dated 24 April 1967, subject "Hurricane Protection - Lake Pontchartrain and Vicinity," and 1st through 3d Indorsements thereto.

2. Forwarded herewith are the following:

a. Draft of proposed letter from the Chief of Engineers to the Special Assistant to the Secretary of the Army for Civil Functions explaining the inclusion of foreshore protection costs in the "Mississippi River-Gulf Outlet, La.," project.

b. Draft of proposed letter from the Special Assistant to the Director, Bureau of the Budget, transmitting a draft of proposed letters to the Public Works and Appropriations Committees of the United States Congress notifying them of the increase in cost of the "Mississippi River-Gulf Outlet, La.," project as a result of including foreshore protection in the plan of improvement, and requesting information as to whether there is any objection by the Bureau to the submission of the proposed letters to the respective committees.

c. Draft of proposed letter to the Committees.

3. Design for a portion of the foreshore protection has been covered in the general design memorandum (No. 3) for the Chalmette Area Plan. Inasmuch as the foreshore protection is more or less integral to and must be coordinated with the levee construction, it is planned to cover the design of the remaining foreshore protection in the general design memorandum for the Lake Pontchartrain Barrier Plan (No. 2) and in Supplement No. 1 to the general design memorandum for the Chalmette Area Plan. In addition a very brief letter-type supplement to the general design memorandum for the Mississippi River-Gulf Outlet (MR-GO) will be prepared and submitted for approval. This supplement, which will present the bases for inclusion of foreshore protection in the MR-GO project, the location of such protection, and a revised cost estimate for the overall project, will be prepared and submitted for approval after the notification of the Congressional Committees has been effected.

13 Jul 67
Chatry/kn/239
14 Jul 67

LMNED-PP (NOD 29 Nov 66) 8th Ind (contd)
SUBJECT: Lake Pontchartrain, Louisiana and Vicinity - Modification of the Chalmette Area Plan to Include Larger Area

4. Approval of the course of action outlined in paragraph 3. above is recommended.

3 Incl (dupe)
7, 8, & 9 as listed

GEORGE H. HUDSON
Acting District Engineer

Mask

Hudson

67-877

LMVED-TD (NOD 29 Nov 66) 9th Ind
SUBJECT: Lake Pontchartrain, Louisiana and Vicinity - Modification of the Chalmette Area Plan to Include Larger Area

DA, Lower Miss. Valley Div, CE, Vicksburg, Miss. 39180 14 Aug 67

TO: Chief of Engineers, ATTN: ENGCW-EZ

1. In our opinion the drafts of letters as prepared by the New Orleans District, mentioned in paragraph 2, 8th Ind, are not fully responsive to the request of the Chief of Engineers in his 2d and 6th Ind. Actually there are 3 projects being modified under the discretionary authority of the Chief of Engineers. Modification of the Chalmette Area affects both the Lake Pontchartrain and Vicinity project and the New Orleans to Venice project. Modification of the Mississippi River-Gulf Outlet project includes levee protection affecting the Lake Pontchartrain and Vicinity project. In addition the New Orleans to Venice project is being modified because of need to change net levee grade and construct levees on modified alignments. Thus, it is our opinion that each of these projects should be covered separately but concurrently. For this reason we are forwarding for each of the three projects the following:

a. Draft of proposed letter from the Chief of Engineers to the Special Assistant to the Secretary of the Army for Civil Functions.

b. Draft of proposed letter from the Special Assistant to the Director, Bureau of the Budget.

c. Draft of proposed letter to the Committees.

2. The course of action outlined in paragraph 3 of 8th Ind is concurred in except we recommend proceeding with preparation of the supplement to the general design memorandum for the Mississippi River-Gulf Outlet project without waiting for notification of the Congressional Committee.

ACTING
FOR THE/DIVISION ENGINEER:

A. J. DAVIS
Chief, Engineering Division

9 Incl (dupe)
wd Incl 7, 8, and 9
Added: 10 thru 18, as listed

Copy furnished:
NOD, ATTN: LMNED-PP

ENGCW-EZ (LMNED-PR, 29 Nov 66)   10th Ind
SUBJECT: Lake Pontchartrain, Louisiana and Vicinity - Modification of the Chalmette Area Plan to Include Larger Area

DA, CofEngrs, Washington, D. C., 20315, 16 November 1967

TO: Division Engineer, Lower Mississippi Valley Division

1. The action indicated in paragraph 2 of the 9th indorsement is satisfactory.

2. It is proposed to notify the Committees of Congress at an early date of the modifications of the projects, indicated in paragraph 1 of the 9th indorsement, which are considered to be within the descretionary authority of the Chief of Engineers.

FOR THE CHIEF OF ENGINEERS:

Homer B. Willis

wd Incls

WENDELL E. JOHNSON
Chief, Engineering Division
Civil Works

LMVED-TD (NOD 29 Nov 66) 11th Ind
SUBJECT: Lake Pontchartrain, Louisiana and Vicinity - Modification of the Chalmette Area Plan to Include Larger Area

DA, Lower Miss. Valley Div, CE, Vicksburg, Miss. 39180 22 Nov 67

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

Referred to note approval of action indicated in 9th Indorsement.

FOR THE DIVISION ENGINEER:

George B. Davis
for A. J. DAVIS
Chief, Engineering Division

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN
DESIGN MEMORANDUM NO. 3-GENERAL DESIGN
SUPPLEMENT NO. 1-CHALMETTE EXTENSION

APPENDIX B

HYDRAULIC ANALYSIS AND DESIGN
INTERIOR DRAINAGE

APPENDIX B
HYDRAULIC ANALYSIS AND DESIGN-INTERIOR DRAINAGE

1. General. The area covered in this appendix is that part of the Chalmette Supplemental area south of Highway 39 from Caernarvon to Poydras and Highway 46 from Poydras to Verret. The ccontributing drainage area of 4,280 acres is generally rural in nature. Runoff from the area will drain through corrugated metal pipes placed under the new levee. The pipes will be equipped with flap gates to permit outflow of storm drainage and to prevent backflow of tide water into the protected area and with vertical lift gates to insure closure in the event of failure of the flap gates.

2. Culvert hydraulics. The Manning formula, assuming an "n" value of 0.021, was used for the determination of friction losses in the corrugated metal pipe culverts with asphalt paved inverts. In the derivation of the rating curve for the drainage structure, an entrance loss of 20 per cent of the difference in velocity heads was used. Head losses for a discharge of 250 cfs are as follows:

Entrance and exit losses	0.36
Friction loss	0.63
Total loss	0.99

The velocity for this condition is 4.42 f.p.s. These values applied in the formula $Q=CA\ (2gh)^{0.5}$ result in a discharge coefficient of 0.56 for the structure under normal conditions with the outlet submerged and operating under various heads. The rating curve derived by use of the preceding formula is shown on plate B-1.

3. Infiltration and runoff. Runoff data for the area is not available. An infiltration rate of 0.10 inch per hour was used for the area. The unit hydrograph was used to determine hourly inflows from the design storm.

4. Synthetic hydrographs. The inflow hydrograph, for the structure design storm, was synthesized with the use of an infiltration rate of 0.10 inch per hour and values contained in U.S. Weather Bureau Technical Paper No. 40, "Rainfall Frequency Atlas of the United States", published in 1961. This inflow hydrograph is shown on plate B-3 and pertinent data are shown in table B-1. Curves showing rainfall-duration-frequencies and distribution of rainfall for the structure design storm are shown on plate B-1.

5. Design criteria. a. General. The drainage structure was designed to have sufficient capacity to dispose of inflows from high intensity storms occurring in connection with an average elevation of about 1.0 at the upper end of the outfall channel. Since some of the lands at and above elevations 3.0 have been devoted to residential development, the maximum elevation of the sump pool for the structure design storm was established at about 2.5. This will allow about one-half foot of drainage slope between the sump and residential areas. For the occurrence of the structure design storm, the drainage structure will have sufficient capacity to provide about three inches of runoff below elevation 2.5 within 24-hours after cessation of inflow from the design storm. The remaining lands above elevation 2.0 will be devoted to agricultural use. With the occurrence of the 24-hour, 5-year storm at the average gulf-side elevation of 1.0, the drainage structure was designed to have sufficient capacity to limit overlow of the agricultural lands to about 10 hours.

b. Structure design storm. The design storm chosen was a storm with a freqency of 25-years and a duration of 24-hours. The storm was assumed to occur coincidently with a tide elevation of 0.3 in Lake Lery on the floodside of the levee.

c. Inflow, outflow, and sump pool hydrographs for the structure resulting from the design storm are shown on plate B-3. Other pertinent data are provided in table B-1

d. A 100-year storm for 24 hours duration was used in the stilling basin design for the drainage structure with a maximum discharge of 333 c.f.s. For the stilling basin discharge of 333 c.f.s. the maximum velocity over the end sill will be about 0.9 f.p.s. Velocities of this magnitude occur only during times when the tide in Lake Lery is at or below 0.30 and the sump pool is at its maximum elevation of 2.75.

6. Location and capacity of outlet. The location and capacity of the outlet was selected so that sufficient capacity would be provided to dispose of inflows from high intensity storms without detrimental effects on agricultural or residential areas. The two 72 inch diameter pipes selected limit the time of ponding above elevation 2.0 to a period of 50 hours for the 25-year storm and 10 hours for the 5-year storm, thus providing drainage in a reasonable length of time without detrimental effects.

7. Other plans considered. In order to determine the minimum

cost to provide an adequate outflow structure, various schemes were investigated during the preliminary analysis. Ponding conditions were studied for a single structure with two 72 inch pipes and a single structure with four 72 inch pipes. An additional study was made with two 72 inch pipes at the third points of the area thus providing two outlets with two 72 inch pipes at each outlet. It was found that the maximum ponding elevations reached and the time of ponding above elevation 2.0 did not differ to any great extent between the four 72 inch pipes located centrally, as compared to the above mentioned third points location. Therefore, the additional cost for intake and outlet structures and for outlet channel improvements necessary when two structures were used could not be justified.

8. Drainage structure. a. Approach channel. The approach channel will be approximately 78 feet from the existing borrow canal to the concrete paved portion of the intake. The invert elevation of the channel will be -8.0 with a bottom width of 47 feet and channel slopes of 1 on 4. Although velocities in the approach channel will be low, a 12 foot section adjacent to the concrete intake will be riprapped to protect the structure from turbulence and eddy conditions. Water will enter the approach channel from the existing borrow canal which is in effect a collector canal for the entire area to be drained. This collector canal averages 10 feet deep and 85 feet wide. Since the approach channel is centrally located, flows in the collector canal will reach a maximum of 150 c.f.s. from each direction totaling to the maximum flow of 300 c.f.s (25-year storm) through the structure. Under these maximum flow conditions, the total head loss in the collector canal from the extreme upstream ends to the junction with the approach channel will be approximately .03 feet. The existing borrow canal has ample capacity to serve as a collector canal. Velocities will average below 0.2 f.p.s.

b. Intake. The intake section has a paved invert at elevation -8.0 flared sloping wing walls, and a head wall. The maximum average velocity for the structure design discharge of 300 c.f.s. will be about 0.7 f.p.s. at the beginning of the pavement.

c. Conduit. The conduit will consist of two 72 inch corrugated metal pipes, with paved inverts with inlet invert elevation of -7.0 feet, outlet invert elevation of -7.0 and a total length of approximately 277 feet. The maximum velocity for the structure design discharge is about 5.3 f.p.s.

d. Operating tower. The operating tower will be located on the floodside of the levee (see plate No. 81) and will contain two 72 inch vertical lift gates operated by a portable gasoline power unit. Provisions will be made for manual operation in event of failure of the power unit. The operating platform elevation of 16.5 feet will provide about 4 feet of freeboard above the peak still water level.

e. Stilling basin. The stilling basin will consist of a headwall, flared sloping wing walls and a paved invert. Provision will be made for the use of stop logs for dewatering of each conduit separately. For the stilling basin discharge of 333 c.f.s. the maximum velocity over the end sill will be about 0.9 f.p.s.

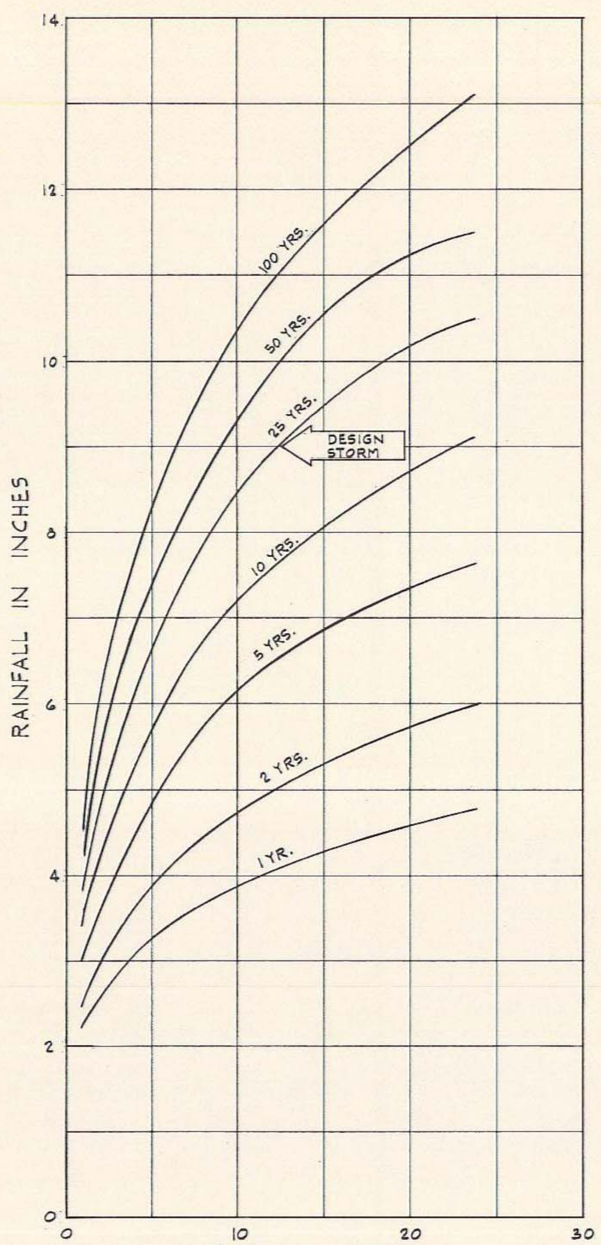
f. Outlet channel. Creedmore Canal has been selected as the outlet channel. This selection was based upon its central location as well as economic considerations. The selection of this canal reduces to a minimum the quantity of excavation required to provide a direct outflow to Lake Lery. Some improvement of Creedmore Canal between the drainage structure and Lake Lery will be required. A minimum cross section equivalent to a top width of approximately 72 feet at elevation 0.00, and a bottom width of approximately 40 at an invert elevation of -8.00 will be required. This minimum canal section will carry the maximum flow of 300 c.f.s. discharged from the drainage structure together with an estimated flow of 77 c.f.s. of runoff tributary to Creedmore Canal. Under these flow conditions, the head loss will be about .7 feet between the drainage structure and Lake Lery. This is in accord with design criteria of water surface elevation of 1.0 at discharge of drainage structure and 0.30 in Lake Lery.

TABLE B-1
STRUCTURE AND DRAINAGE AREA
PERTINENT DATA

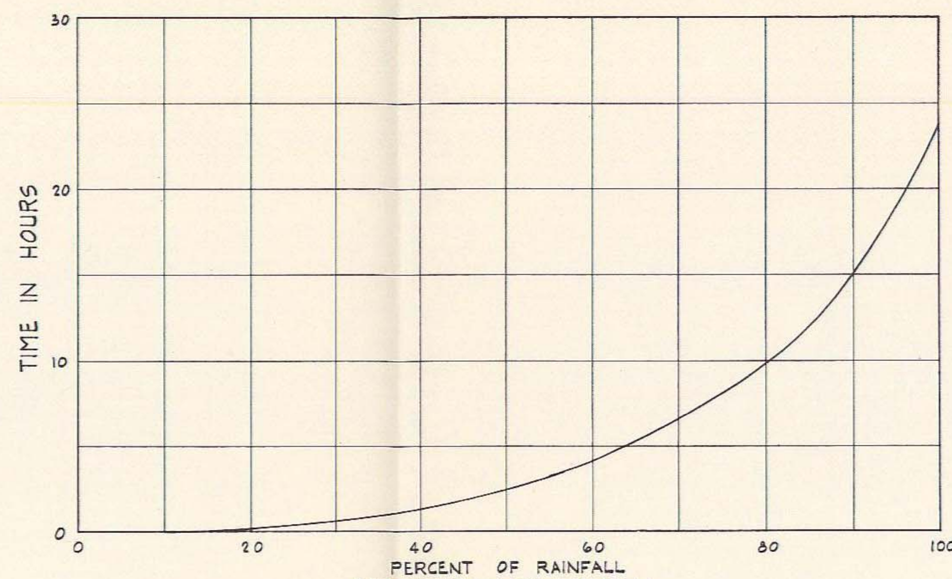
	25-Yr. - 24-Hr. Storm
Rainfall, inches	10.5
Rainfall, excess, inches	8.1
Maximum hourly rainfall, inches	3.7
Maximum inflow, c.f.s.	3,379
Maximum outflow, c.f.s.	300
Maximum sump stage, feet, MSL	2.41
Maximum velocity, f.p.s.	5.3

PERTINENT DATA (cont'd)

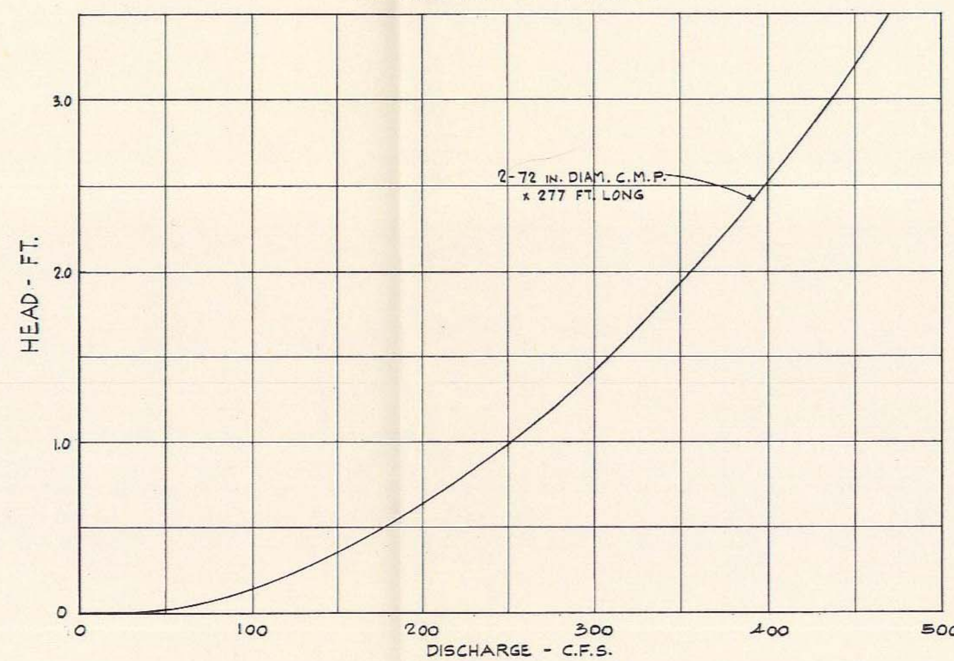
	25-Yr. - 24-Hr. Storm
Storage below peak sump elevation available 24 hours after cessation of runoff, inches of runoff	2.1
Drainage area, acres	4,280
Time of concentration, hrs.	8
Assumed tide elevation at discharge end of structure feet, MSL	1.0
Maximum differential head, feet	1.41
Maximum reverse head, feet	11
Time sump stage above 2.0 feet, MSL, Hrs.	50



RAINFALL - DURATION
FREQUENCY CURVES



DISTRIBUTION OF RAINFALL



DISCHARGE CURVE
SUBMERGED OUTLET

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

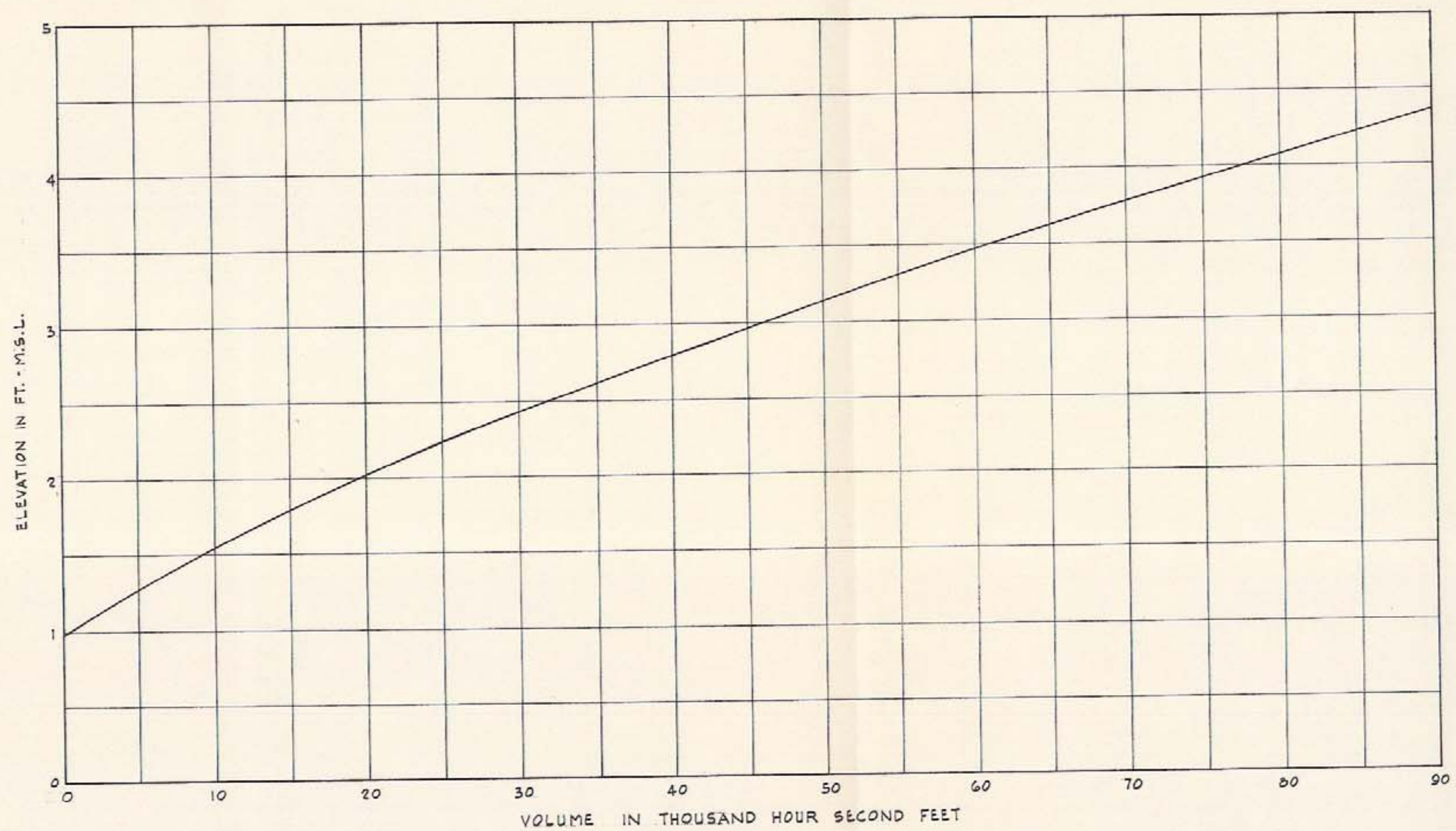
DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

HYDRAULIC DATA - I

SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC. ENGINEERS AND ARCHITECTS NEW ORLEANS, LA.	U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS, U. S. ARMY NEW ORLEANS, LA.
DATE: SEPTEMBER 1968	FILE NO. H-2-24306

PLATE B-1



STORAGE CURVE

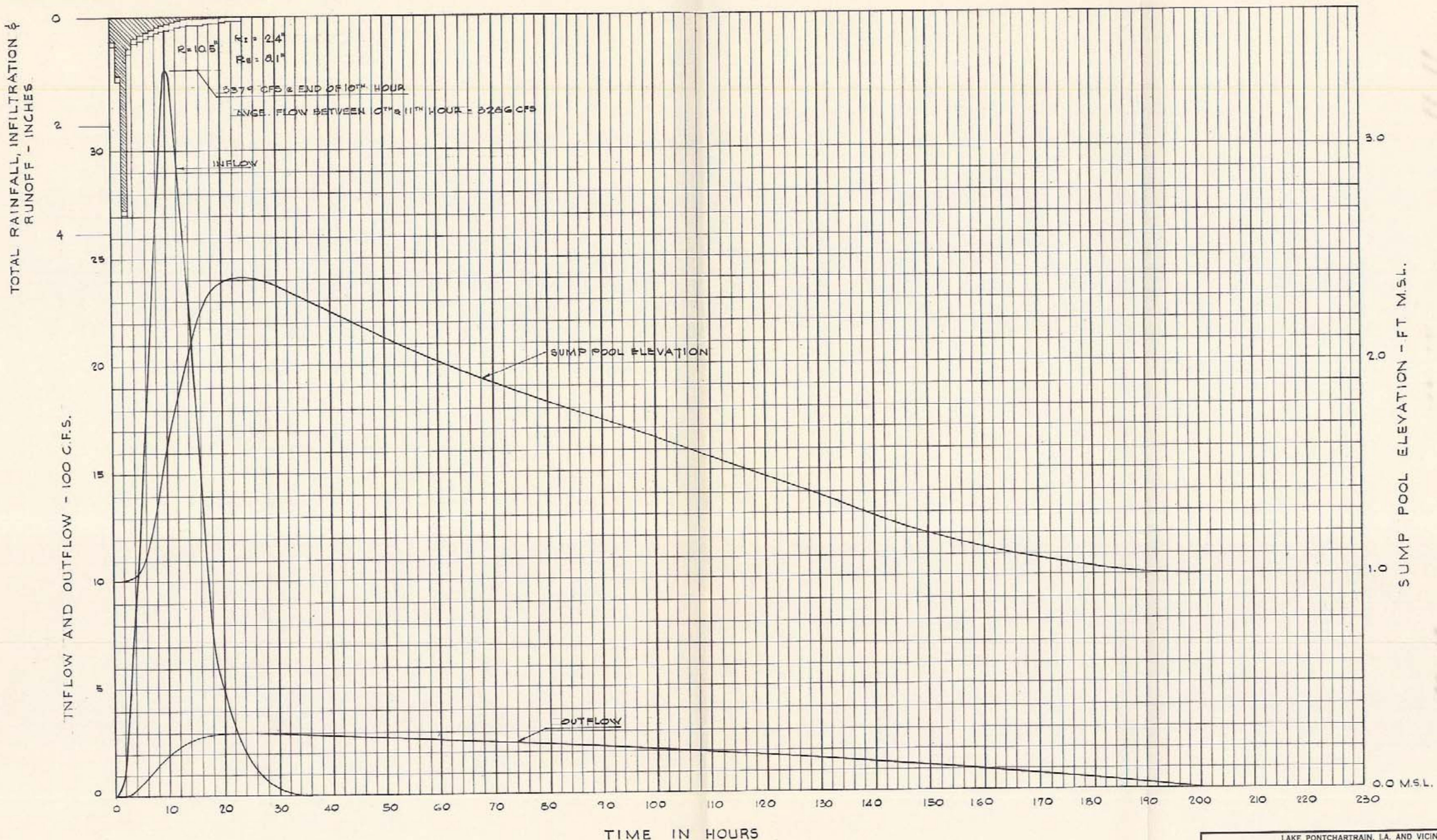
LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN
DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

HYDRAULIC DATA – 2

SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC. ENGINEERS AND ARCHITECTS NEW ORLEANS, LA.	U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS, U. S. ARMY NEW ORLEANS, LA.
DATE: SEPTEMBER 1968	FILE NO. H-2-24306

PLATE B-2



STRUCTURE DESIGN STORM

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN

DESIGN MEMORANDUM NO. 3—GENERAL DESIGN
SUPPLEMENT NO. 1—CHALMETTE EXTENSION

DRAINAGE STRUCTURE
DESIGN DATA

SCALES AS SHOWN

WALDEMAR S. NELSON AND COMPANY, INC. ENGINEERS AND ARCHITECTS NEW ORLEANS, LA.	U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS, U. S. ARMY NEW ORLEANS, LA.
DATE: SEPTEMBER 1968	FILE NO. H-2-24306

PLATE B-3

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN
DESIGN MEMORANDUM NO. 3-GENERAL DESIGN
SUPPLEMENT NO. 1-CHALMETTE EXTENSION

APPENDIX C

CORRESPONDENCE RELATIVE TO COORDINATION WITH OTHER AGENCIES

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

November 23, 1966

District Engineer
U. S. Army, Corps of Engineers
New Orleans, Louisiana

Dear Sir:

Your letter of September 23, 1966, presented the proposals under consideration for possible modification of plans for Hurricane Study Area II, Reach E, St. Bernard Parish, Louisiana. Our comments on these modifications, submitted in accordance with the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), have been prepared in cooperation with the Louisiana Wild Life and Fisheries Commission.

The modified plan, which has been proposed by local interests, provides for enclosing a larger area extending along the Mississippi River-Gulf Outlet navigation channel from Violet to the vicinity of Hopedale. The Corps of Engineers' alternate plan encompasses a smaller area, extending generally from Violet to Verret. The authorized and proposed levee alignment ties to the protective works for the Chalmette area plan of the project for Lake Pontchartrain and Vicinity, Louisiana. Such modifications of the authorized project are depicted on plate 1.

The Bureau provided you with a letter, dated September 26, 1960, relative to your original plan for Hurricane Study Area II. The project as proposed at that time would have had no significant effect on fish and wildlife resources which are of considerable value. The area in question is important both because of the habitat it furnishes and the contribution it makes to nearby estuarine areas.

Our study of the modified plan indicates that under either proposal the existing brackish water circulatory system will be essentially maintained. It does not, therefore, appear that the modified hurricane levee alignments will directly affect fish and wildlife resources to any great extent. Both plans will indirectly damage these resources by hastening urbanization and industrialization of valuable marshes through providing basic features for further flood protection and reclamation.

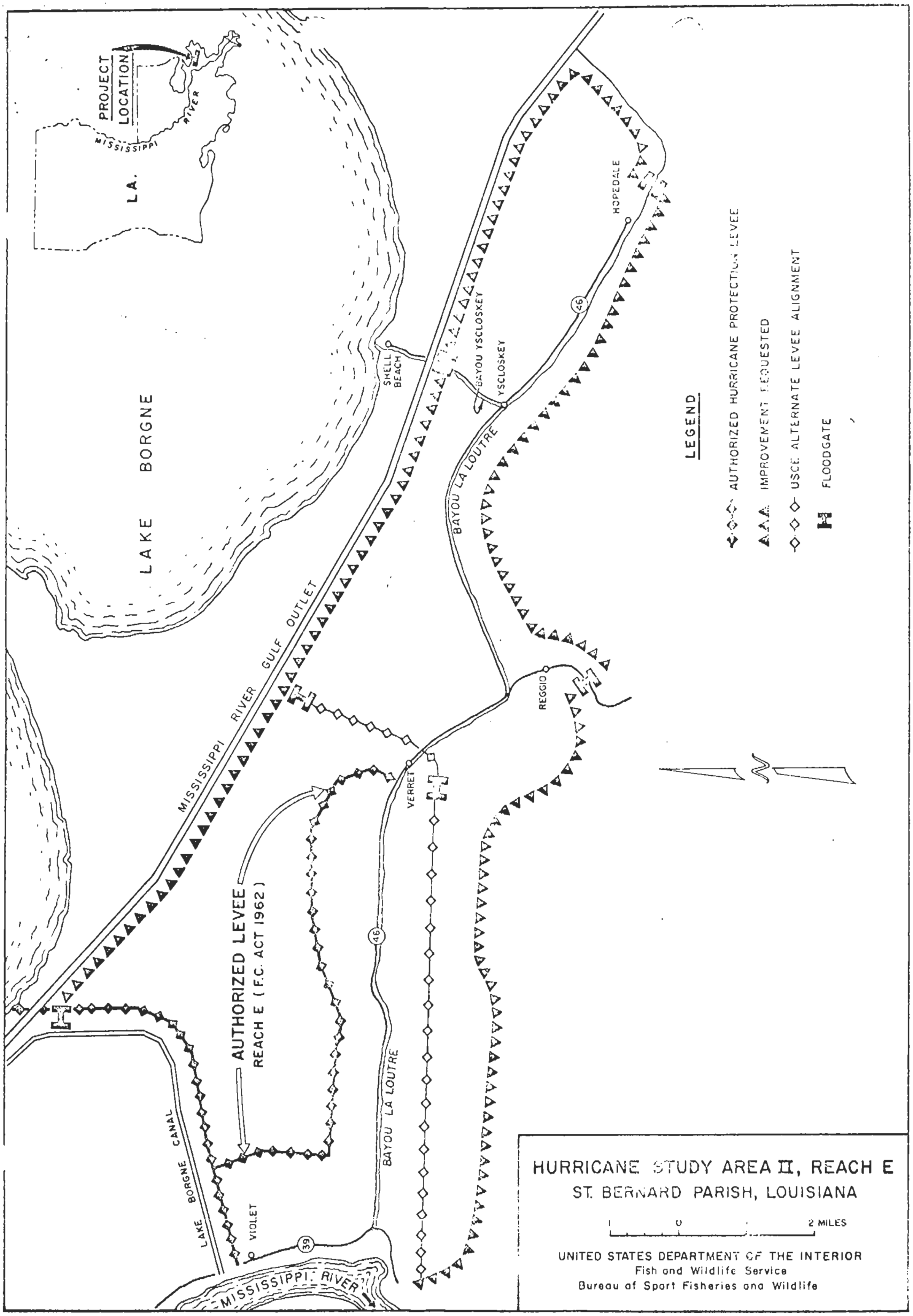
Should major changes or alterations in project plans be considered, the Bureau requests the opportunity for further review in the interest of fish and wildlife conservation. Early notice of such planning will aid in appropriate scheduling of any additional study or comment which may be required.

This report has been reviewed and concurred in by the Bureau of Commercial Fisheries and the Louisiana Wild Life and Fisheries Commission. Please note the comments in the attached copy of Director Glasgow's letter.

Sincerely yours,

W. L. Towns
Acting Regional Director

Attachments 2



HURRICANE STUDY AREA II, REACH E
ST. BERNARD PARISH, LOUISIANA

UNITED STATES DEPARTMENT OF THE INTERIOR
Fish and Wildlife Service
Bureau of Sport Fisheries and Wildlife

PLATE 1

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

Engr Div

November 14, 1967

Your Ref: LMNED-PP

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

Dear Colonel Brown:

Reference is made to your letter of October 5, 1967 requesting our comments on the Chalmette Area Plan of the "Lake Pontchartrain, Louisiana and Vicinity", hurricane protection project as modified.

This levee alignment modification with the floodgate structure does not change the water quality control comments of the original project as stated in Mr. Keith S. Krause's letter of December 10, 1963 to the Chief of Engineers. A copy of this letter is enclosed for your information.

We have also reviewed this project with its modifications 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 provide and operate sanitation facilities that will adequately treat or dispose of domestic wastes to conform with Federal or local health regulations.

b. All contractors should take precautions during the construction of this project in the handling and storage of hazardous materials to prevent accidental spillages which would result in substantial harm to fish or shellfish.

c. All contractors should perform dredging and construction operations in a manner that will reduce turbidity and siltation to the lowest practicable level.

This project should also be coordinated with the Louisiana Stream Control Commission in addition to the Louisiana State Department of Health.

The opportunity to review this report is appreciated. If we can be of further assistance, please contact us.

Sincerely yours,

WILLIAM C. GALEGAR
Regional Director

Enclosure

cc: Louisiana State Department of Health
Louisiana Stream Control Commission

DEC 10 1963

Lieutenant General Walter K. Wilson, Jr.
Chief of Engineers
Department of the Army
Washington 25, D. C.

Dear General Wilson:

This is in reply to General MacDonnell's letter of September 10, 1963, requesting comments on the U. S. Army Engineers' Report on Lake Pontchartrain, Louisiana and Vicinity.

The proposed improvements are not expected to have any adverse effects on water supply, water quality control, or vector control.

It is recommended that cooperation with the Louisiana State Department of Health be continued as this project is developed.

The opportunity to review this report is appreciated. We stand ready to supply further consultation on your request.

Sincerely yours,

Keith S. Krause
Chief, Technical Services Branch
Division of Water Supply and
Pollution Control

cc: Regional Office, Dallas (3)
CDC, Atlanta, Ga. (2)
SEC, Cincinnati, Ohio

STATE OF LOUISIANA
STREAM CONTROL COMMISSION
P. O. DRAWER FC
UNIVERSITY STATION
BATON ROUGE, LOUISIANA 70803

November 28, 1967

Department of the Army
New Orleans District, Corps of Engineers
Post Office Box 60267
New Orleans, Louisiana 70160

Attention: Col. Thomas J. Bowen

Gentlemen:

After review of the Chalmette Area Plan, as modified, we wish to comment as follows:

(1) Existing pollution of the waters of Bayou Bienvenue due to the storm water discharge from the City of New Orleans are not likely to be affected in any manner by this construction.

(2) The discharge of waste water from other points within the area to be protected are minor and can be controlled at the source.

(3) We assume that the proposed floodgates will be open at all times except when danger from flooding is eminent.

Very truly yours,

Robert A. Lafleur
Executive Secretary

RAL/fbr

Engr

Louisiana State
Department of Health

LOUISIANA STATE OFFICE BUILDING
P. O. BOX 60630
New Orleans, La. 70160

ANDREW HEDMEG, M. D., M. P. H.
STATE HEALTH OFFICER

March 22, 1968

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

Re: Modified Alignment of Protection Levee Lake Pontchartrain, La. and Vicinity, Chalmette Area Plan

Dear Colonel Bowen:

Receipt of your letter of November 21, 1968 7, and telegram this date is acknowledged.

Please be advised that we have no comments on or objections to the proposed modification of levee alignment in the above noted project.

Very truly yours,

James F. Coerver, Chief
Water Supply and Sewerage Section

JFC:sb

cc: Mr. William C. Galegar
Mr. Robert Lafleur

LOUISIANA WILD LIFE AND FISHERIES COMMISSION
CAPITOL STATION
BATON ROUGE, LOUISIANA 70804

November 9, 1966

Mr. James R. Fielding
Assistant Regional Director
Bureau of Sport Fisheries and Wildlife
Peachtree-Seventh Building
Atlanta, Georgia

Dear Mr. Fielding

Reference is made to your letter dated October 14, 1966 and enclosed report on the Hurricane Study Area II, Reach E, St. Bernard Parish, Louisiana.

My staff has reviewed your proposed report and is in general agreement with its contents. We realize that the project will hasten urbanization and industrialization of valuable marshes; however, we feel that the following comments might be appropriate:

In conjunction with the alternate plan the requested improvements from Hopedale, Shell Beach, Ycloskey, Reggio, Caernarvon and fronting the South side of the Gulf Outlet would give even better wildlife potentials. The requested improvement plan merely shows floodgates on Bayou LaLoutre, Bayou Yscloskey, Bayou Terre Bouet and Violet Canal. This would mean that the only drainage in the Shell Beach, Yscloskey, Hopedale area would be from two to three existing culverts on Highway 46 between Yscloskey and Hopedale. If this marsh were to be managed properly, additional drainage controls might become necessary. As this segment is now subject to tidal fluctuations from the access canal 3/4 mile south of the Gulf Outlet, a levee system as requested could result in an impoundment. We do not recommend this.

We presume that the floodgates would remain open at all times, with the exception of times of hurricane warnings. This is not indicated in the enclosed plat.

The opportunity to review and comment on this project is appreciated.

Sincerely

Leslie L. Glasgow

Leslie L. Glasgow, Director
La. Wild Life and Fisheries Comm.

LLG/pc

LAKE PONTCHARTRAIN, LA. AND VICINITY
CHALMETTE AREA PLAN
DESIGN MEMORANDUM NO. 3-GENERAL DESIGN
SUPPLEMENT NO. 1-CHALMETTE EXTENSION

APPENDIX D

ANALYSIS OF BATTER PILE FOUNDATION

TO DETERMINE THE PILE REACTIONS UNDER THE INVERTED "T" FLOODWALL AT VERRET AND CAERNARVON AN ANALYSIS WAS MADE USING THE PROCEDURE PRESENTED BY A. HRENNIKOFF IN THE TRANSACTIONS OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS VOLUME 115, 1950 TITLED "ANALYSIS OF PILE FOUNDATIONS WITH BATTER PILES" THE METHOD CONSIDERS BOTH THE AXIAL AND LATERAL RESISTANCE OF THE PILES. THE ELASTIC PROPERTIES OF THE PILE AND THE LATERAL RESISTANCE OF THE SOIL IS USED. WHEN A PILE FOUNDATION IS LOADED DISPLACEMENTS AND ROTATIONS OF THE FOOTING TAKE PLACE. THE DISPLACEMENTS AND ROTATIONS ARE FOUND BY SOLVING SIMULTANEOUS EQUATION FOR EQUILIBRIUM BETWEEN THE EXTERNAL FORCES AND THE PILE LOADS. THE EQUATIONS ARE AS FOLLOWS:

$$X_x \Delta_x + X_y \Delta_y + X_\alpha \alpha + X = 0$$

$$X_y \Delta_x + Y_y \Delta_y + Y_\alpha \alpha + Y = 0$$

$$X_\alpha \Delta_x + Y_\alpha \Delta_y + M_\alpha \alpha + M = 0$$

HRENNIKOFF HAS DERIVED EXPRESSIONS FOR THE DISPLACEMENT AND ROTATION COEFFICIENTS IN TERMS OF THE PILE MOVEMENTS. HE HAS ALSO SHOWN THAT CERTAIN RATIOS CAN BE IGNORED WITHOUT INTRODUCING SERIOUS ERRORS. THESE COEFFICENTS CAN BE EXPRESSED AS FOLLOWS:

$$X'_x = \frac{X_x}{n} = -\sum_g \left[N(\cos^2\phi + r_1 \sin^2\phi) \right]$$

$$Y'_x = \frac{X_Y}{n} = \frac{Y_x}{n} = -\frac{1}{2}(1-r_1)\sum_g (N \sin 2\phi)$$

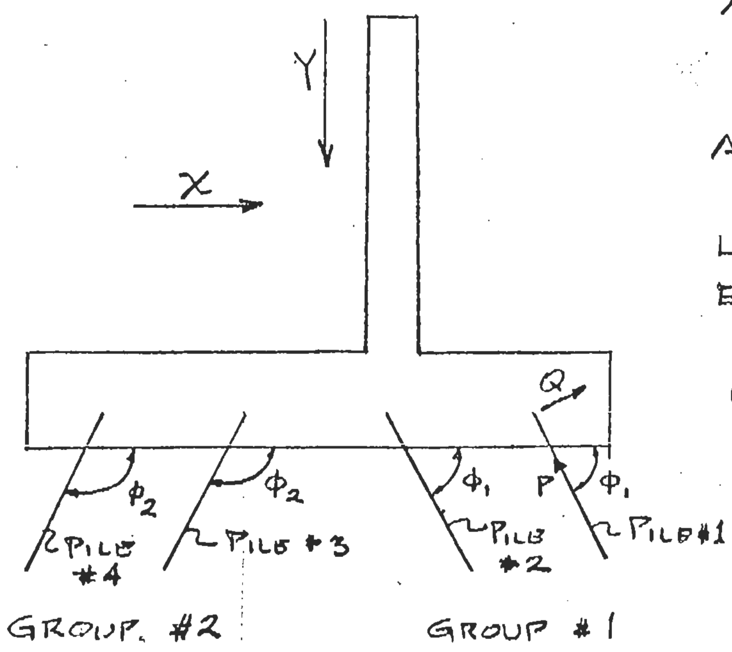
$$Y'_Y = \frac{Y_Y}{n} = -\sum_g \left[N(\sin^2\phi + r_1 \cos^2\phi) \right]$$

$$M'_x = \frac{M_x}{n} = \frac{X_\alpha}{n} = -\frac{1}{2}(1-r_1)\sum_g (N\bar{x} \sin 2\phi)$$

$$M'_Y = \frac{M_Y}{n} = \frac{Y_\alpha}{n} = -\sum \left[(\sin^2\phi + r_1 \cos^2\phi) N \bar{x} \right]$$

$$M'_\alpha = \frac{M_\alpha}{n} = -\sum_g \left[(\sin^2\phi + r_1 \cos^2\phi) \sum_N (x^2) \right]$$

THE FOLLOWING SKETCH WILL BE USED TO HELP DEFINE THE ABOVE TERMS.



$$n = \frac{2AE}{L}$$

A = CROSS-SECTIONAL AREA OF PILE
L = LENGTH OF PILE
E = MODULUS OF ELASTICITY

β = A COEFFICIENT

$$\beta = \sqrt[4]{\frac{K}{4EI}}$$

K = A SOIL COEFFICIENT

I = MOMENT OF INERTIA OF PILE

$$t_\delta = \frac{K}{2B}$$ (FOR PINNED END PILES)

$$r_1 = \frac{t_\delta}{n}$$

x = DISTANCE FROM ORIGIN TO A PILE

$\bar{x}$ = DISTANCE FROM ORIGIN TO THE CENTROID OF A PILE GROUP

g = THE NUMBER OF PILE GROUPS

N = THE NUMBER OF PILES IN A PARTICULAR GROUP

TO ANALYSE A PILE GROUP THE 3 GENERAL EQUATION SHOWN BEFORE WERE RE-WRITTEN AS FOLLOWS:

$$X'_x \Delta'_x + Y'_x \Delta'_Y + M'_x \alpha' + X = 0$$

$$Y'_x \Delta'_x + Y'_y \Delta'_Y + M'_Y \alpha' + Y = 0$$

$$M'_x \Delta'_x + M'_Y \Delta'_Y + M'_\alpha \alpha' + M = 0$$

WHERE

$$\Delta'_x = n \Delta_x$$
$$\Delta'_Y = n \Delta_Y$$
$$\alpha' = n \alpha$$

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USING THE EXPRESSIONS DEVELOPED X'_y, Y'_x, Y'_y, M'_x, M'_y, AND M'_α WERE DETERMINED. THIS WAS DONE BY PROGRAMMING THE GENERAL EXPRESSIONS FOR THE I.B.M. 1130 COMPUTER. ONCE THESE VALUES WERE DETERMINED, THE EXTERNAL FORCES X, Y, AND M WERE ENTERED INTO THE COMPUTER TO SOLVE THE SIMULTANEOUS EQUATIONS FOR Δ'_x, Δ'_y, AND α'. ONCE THESE VALUES HAVE BEEN FOUND THE PILE LOADS CAN BE DETERMINED AS SHOWN BY THE FOLLOWING EQUATION DEVELOPED BY HRENNIKOFF:

$$P_1 = \delta'_1 = \Delta'_x \cos\phi_1 + \Delta'_y \sin\phi_1 + \alpha' x_1 \sin\phi_1$$

P_1 = THE AXIAL FORCE IN PILE # 1

$$Q_1 = -r_1 \delta'_1 = -r_1 \left(\Delta'_x \sin\phi_1 - \Delta'_y \cos\phi_1 - \alpha' x_1 \cos\phi_1\right)$$

Q_1 = THE FORCE PERPENDICULAR TO AXIS OF PILE # 1

THESE GENERAL EXPRESSIONS WERE ALSO PROGRAMMED FOR THE I.B.M. 1130 COMPUTER. THE FOLLOWING SHEETS SHOW THE RESULTS OF APPLYING THE ABOVE EQUATIONS TO THE FLOODWALLS AT VERRET AND CAERNARVON.

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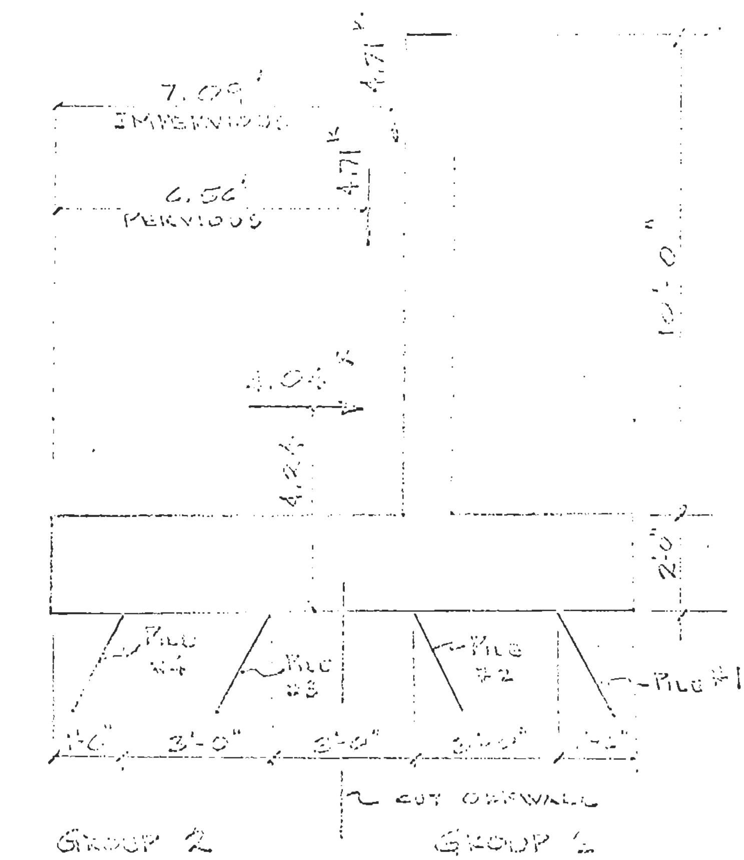
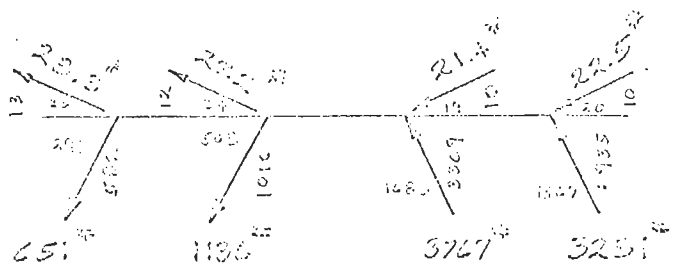
BY [illegible] DATE ____ SUBJECT [illegible] SHEET NO. [illegible] OF [illegible]
CHKD. BY ____ DATE ____ [illegible] JOB NO. [illegible]

VERRET FLOODWALL





PILES – 12" [illegible] PRESTRESSED
CONCRETE [illegible], L = 45'
E = 4, [illegible]
SOIL CONSTANTS
q_u = 300 P.S.F.
K = 178 [illegible]

CASE 1 SHEET PILE
CUTOFF WALL ASSUMED
IMPERVIOUS.
ΣF_x = 4.04 K/FT OF WALL
ΣF_y = 4.7 K
ΣM = 267.2 "-K

PILE REACTION BY
HRENNIKOFF
PILE #1 = 3251 #/FT OF WALL
PILE #2 = 3767 #/FT
PILE #3 = 1136 #/FT
PILE #4 = 651 #/FT

"Q" FORCE AT PILE HEAD
PILE #1 = 22.5 #/FT OF WALL
PILE #2 = 21.4 #/FT
PILE #3 = 27.2 #/FT
PILE #4 = 28.3 #/FT

USING 8'-0" PILE SPACING MAX PILE COMP = 15.07 TONS
MAX PILE UPLIFT = 4.54 TONS

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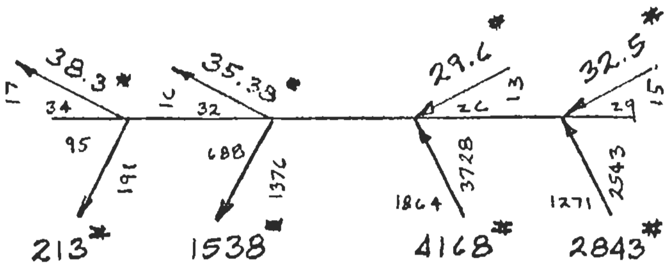
CHKD. BY ______ DATE ______ VERRET & CAERNARVON FLOODWALL JOB NO. 67019

VERRET FLOODWALL

CASE 2 SHEET PILE CUTOFF WALL ASSUMED PERVIOUS

$\Sigma F_x = 4.04$ K/FT. OF WALL
$\Sigma F_Y = 4.71$ K/FT
$\Sigma M = 237.2$ '-K



PILE REACTIONS BY HRENNIKOFF
PILE #1 = 2843 #/FT OF WALL
#2 = 4168 #/FT
#3 = -1538 #/FT
#4 = -213 #/FT

"Q" FORCES AT PILE HEAD
PILE #1 = 32.5 #/FT OF WALL
#2 = 29.6 #/FT
#3 = 35.4 #/FT
#4 = 38.3 #/FT

8'-0" SPACING MAX COMP = 16.67 TONS
MAX TEN = 6.15 TONS

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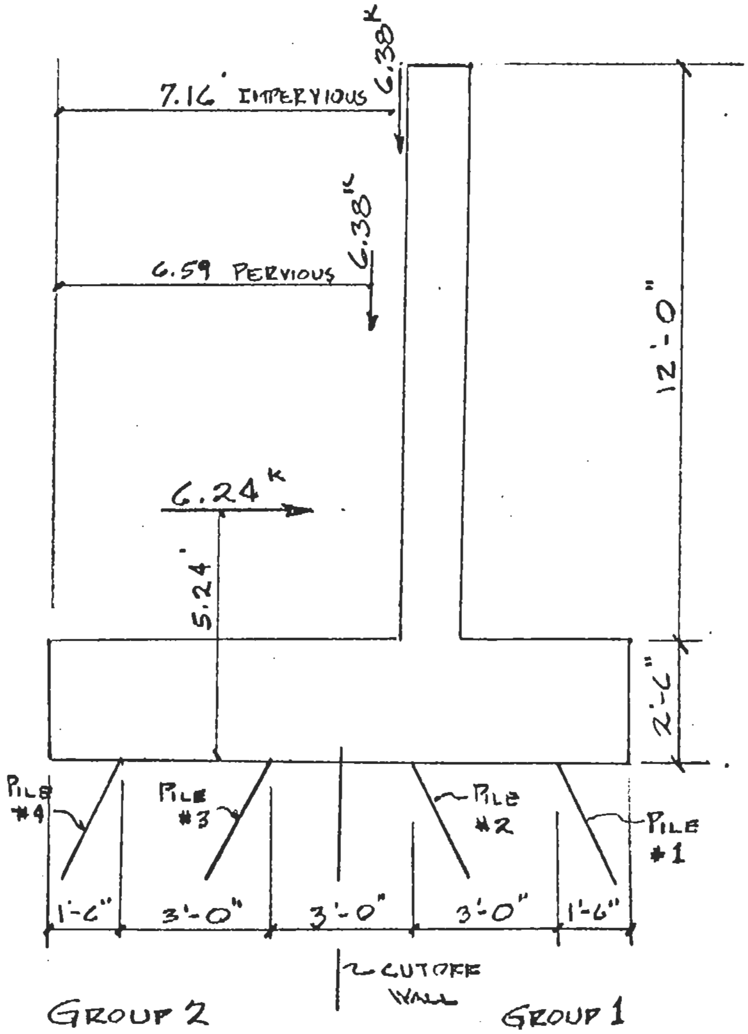
CHKD. BY ____ DATE ____ VERRET & CAERNARVON FLOODWALL JOB NO. 67019

CAERNARVON FLOODWALL

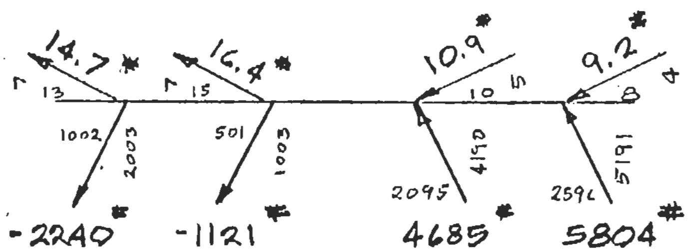


PILES - 12" ϕ PRESTRESSED CONCRETE $A = 144^{\square''}$, $L = 45'$
$E = 4,300,000$ P.S.I.
SOIL CONSTANT
$q_u = 500$ P.S.F
$K = 111$ P.S.I.

CASE 1 SHEET PILE CUTOFF ASSUMED IMPERVIOUS
$\Sigma F_x = 6.24\ ^K/_{FT}$ OF WALL
$\Sigma F_y = 6.38\ ^K/_{FT}$
$\Sigma M = 481.2\ ^{''-K}/_{FT}$

PILE REACTIONS BY HRENNIKOFF
PILE #1 = 5804 #/FT OF WALL
#2 = 4685 #/FT
#3 = -1121 #/FT
#4 = -2240 #/FT

"Q" FORCE AT PILE HEAD
PILE #1 = 9.2 #/FT OF WALL
#2 = 10.9 #/FT
#3 = 16.4 #/FT
#4 = 14.7 #/FT.

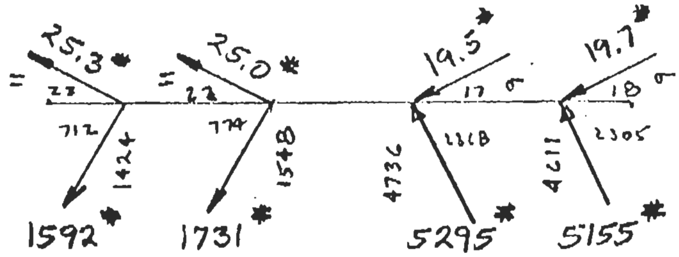


USING 8'-0" SPACING MAX COMP = 23.22 TONS
MAX TEN. = 8.96 TONS

CAERNARVON FLOODWALL

CASE 2 SHEET PILE CUTOFF WALL ASSUMED PERVIOUS

$\Sigma F_x = 6.24$ k/FT OF WALL
$\Sigma F_y = 6.38$ k/FT
$\Sigma M = 437.54$ ''-k/FT



PILE REACTIONS BY HRENNIKOFF

PILE #1 = 5155 #/FT OF WALL
#2 = 5295 #/FT
#3 = -1731 #/FT
#4 = -1592 #/FT

"Q" FORCE AT PILE HEAD

PILE #1 = 19.7 #/FT OF WALL
#2 = 19.5 #/FT
#3 = 25.0 #/FT
#4 = 25.3 #/FT

8'-0" SPACING MAX COMP 21.18 TONS
MAX TEN. 6.92 TONS

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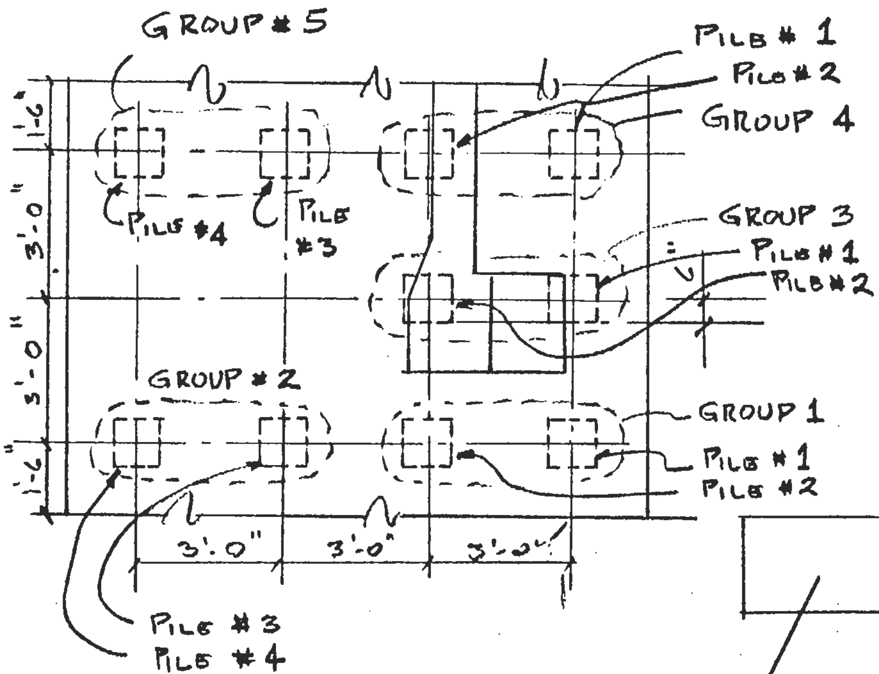
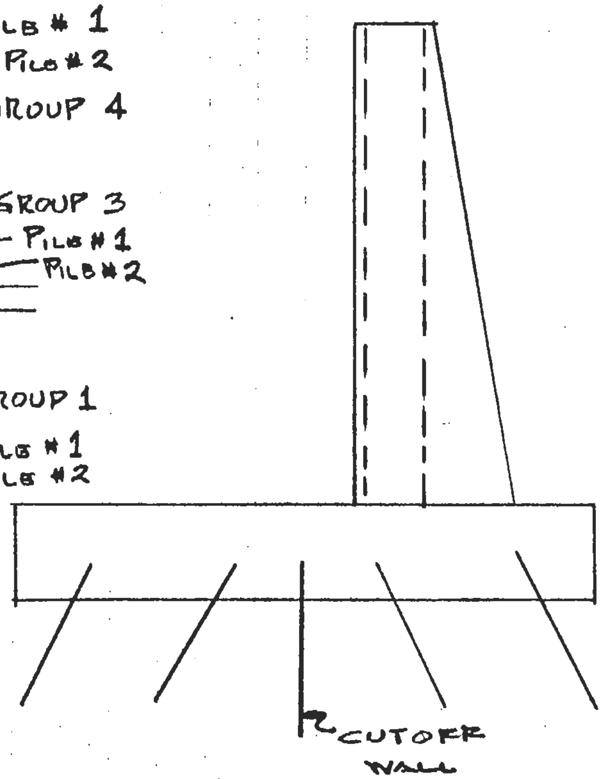
CHKD. BY ______ DATE ______ VERRET & CAERNARVON FLOODWALL JOB NO. 67019

SINCE OPENINGS ARE REQUIRED IN THE FLOODWALL FOR THE HIGHWAY TO PASS THROUGH IT IS NECESSARY TO HAVE A CLOSURE STRUCTURE TO FILL THIS GAP DURING HURRICANE OR FLOOD PERIODS. THE CLOSURE STRUCTURE PRODUCES REACTION WHICH MUST BE RESISTED BY ABUTMENTS AT THE END OF THE WALL. THE PILES UNDER THE ABUTMENTS WERE ALSO ANALYZED BY THE HRENNIKOFF METHOD. IN THE CASE OF THE ABUTMENT A GROUP ACTION WAS ASSUMED RATHER THAN A PER FOOT OF WALL ANALYSIS AS WAS USED ON THE FLOODWALL ITSELF. THE FOLLOWING SKETCH SHOWS THE GROUP USED.





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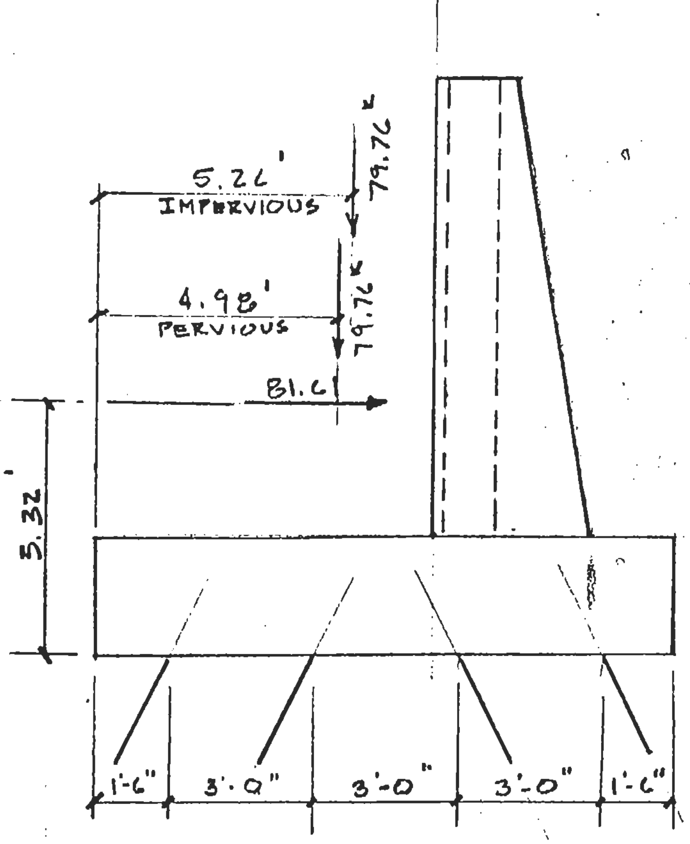
VERRET ABUTMENT



PILES - 12"φ PRESTRESSED CONCRETE A = 144 □", L = 45'
E = 4,300,000 , I = 1728 IN⁴
SOIL CONSTANT
K = 178

<u>CASE 1</u> SHEET PILE CUTOFF WALL ASSUMED IMPERVIOUS

$\Sigma F_x = 81.61^k$

$\Sigma F_y = 79.76^k$

$\Sigma M = 4501.71^{''-k}$

PILE REACTIONS BY HRENNIKOFF

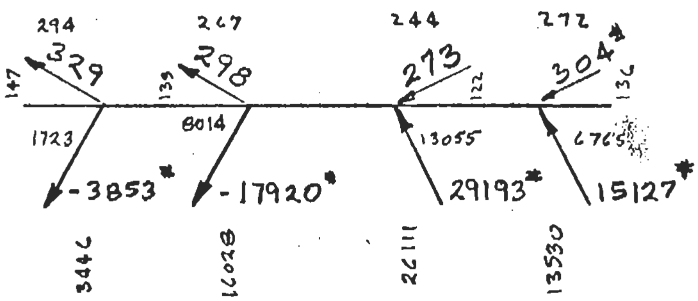
GROUP 1
PILE #1 = 15127# Q = -304#
#2 = 29193# = -273#

GROUP 2
PILE #3 = -17920# Q = -298#
#4 = -3853# Q = -329#

GROUP 3
PILE #1 = 15127# Q = -304#
#2 = 29193 Q = -273#

GROUP 4
PILE #1 = 15127# Q = -304#
#2 = 29193# Q = -273#

GROUP 5
PILE #3 = -17920 Q = -298#
#4 = -3853 Q = -329#



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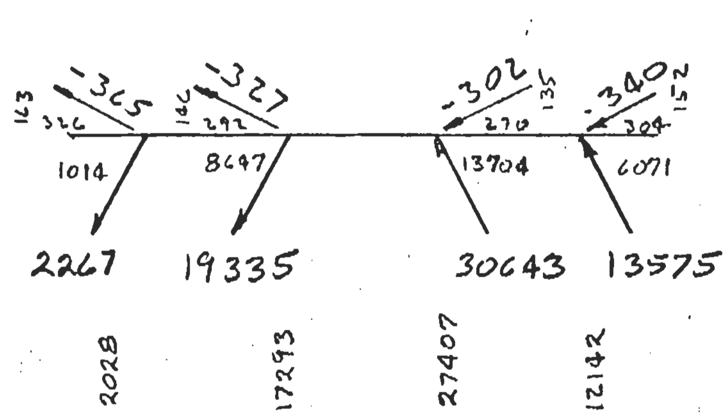
VERRET ABUTMENT

CASE 2 SHEET PILE CUTOFF WALL ASSUMED PERVIOUS

$\Sigma F_x = 81.61^k$

$\Sigma F_y = 79.76^k$

$\Sigma M = 4233.76$ ''-k



PILE REACTIONS BY HRENNIKOFF

GROUP 1
PILE 1 = 13575 Q = -340
2 = 30643 Q = -302

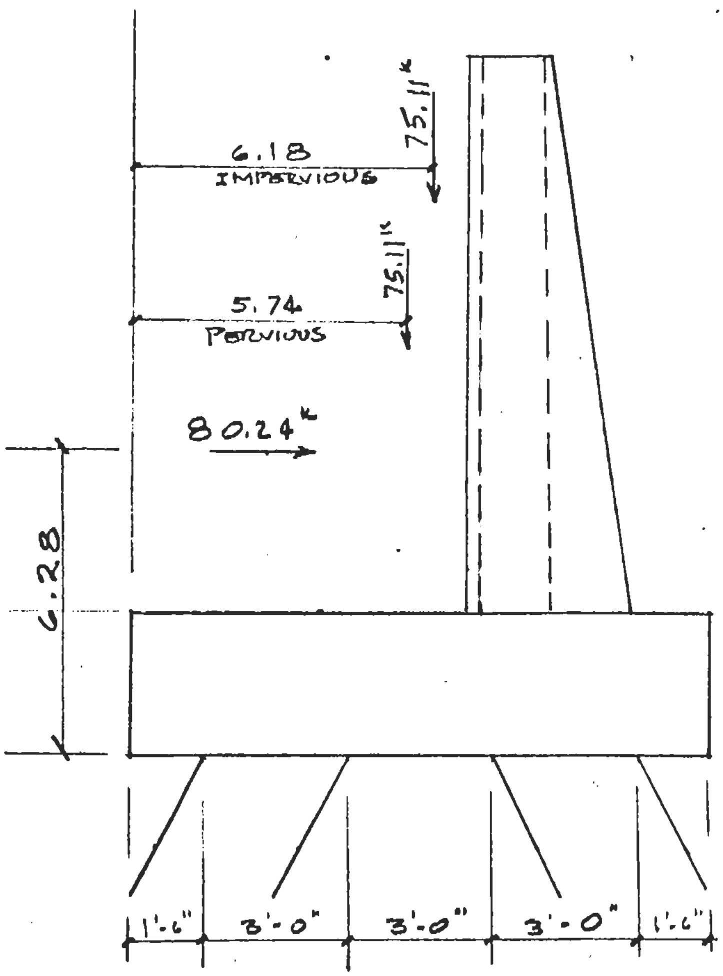
GROUP 2
PILE 3 = -19335 Q = -327
4 = -2267 Q = -365

GROUP 3
PILE 1 = 13575 Q = -340
2 = 30643 Q = -302

GROUP 4
PILE 1 = 13575 Q = -340
2 = 30643 Q = -302

GROUP 5
PILE 3 = -19335 Q = -327
4 = -2267 Q = -365

CAERNARVON ABUTMENT



PILES - 12" ϕ PRESTRESSED
CONCRETE A = 144 □" L = 45'
E = 4,300,000 I = 1728
SOIL CONSTANT
K = 111 K.S.I.

CASE 1 SHEET PILE
CUTOFF WALL ASSUMED
IMPERVIOUS

$\Sigma F_x = 80.24^k$

$\Sigma F_y = 75.11^k$

$\Sigma M = 6209.12^{\prime\prime-k}$

PILE REACTIONS BY
HRENNIKOFF

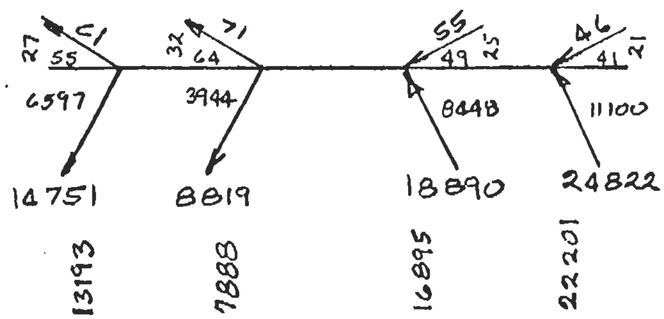
GROUP 1
PILE #1 = 24822 Q = -46
#2 = 18890 Q = -55

GROUP 2
PILE #3 = -8819 Q = -71
#4 = -14751 Q = -61

GROUP 3
PILE #1 = 24822 Q = -46
#2 = 18890 Q = -55

GROUP 4
PILE #1 = 24822 Q = -46
#2 = 18890 Q = -55

GROUP 5
PILE #3 = -8819 Q = -71
#4 = -14751 Q = -61



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CHKD. BY ______ DATE ______ JOB NO. 67019

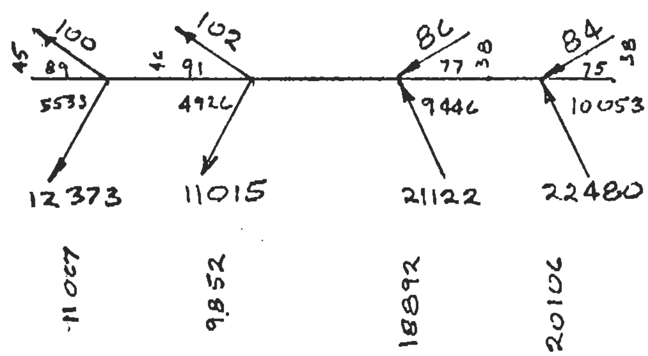
CAERNARVON ABUTMENT

CASE 2 SHEET PILE CUTOFF WALL ASSUMED PERVIOUS

$\Sigma F_x = 80.24^k$

$\Sigma F_y = 75.11^k$

$\Sigma M = 5812.54^{\text{'-k}}$



PILE REACTIONS BY HRENNIKOFF

GROUP 1
PILE 1 = 22480 Q = -84
2 = 21122 Q = -86

GROUP 2
PILE 3 = -11015 Q = -102
4 = -12373 Q = -100

GROUP 3
PILE 1 = 22480 Q = -84
2 = 21122 Q = -86

GROUP 4
PILE 1 = 22480 Q = -84
2 = 21122 Q = -86

GROUP 5
PILE 3 = -11015 Q = -102
4 = -12373 Q = -100

HORIZONTAL FORCE

$\frac{1}{2}(.638)(10.2) + .203(3.5) + .078$

4.04 K/FT OF WALL

VERRET & CAERNARVON WALL (10' & 9')

DESIGN WALL FOR $M = 10.37^{1-K}$, GROUP II LOAD

1/3 INCREASE IN STRESS ALLOWED. (SEE P. 75)

$$d_{Mom.} = \sqrt{\frac{M}{Kb}} = \sqrt{\frac{10.37}{1.33(.152)(1.)}} = 7.15''$$

GOVERNS

$$d_{SHEAR} = \frac{V}{v\,b} = \frac{2.82}{.060(1.33)(12)} = 2.94''$$

USE WALL WITH T = 12"

$d \approx 9''$

$$A_s = \frac{M}{a} = \frac{10.33}{1.33(1.44)(9.5)} = .57\ \square''/FT.$$

CAERNARVON WALL 12'-0" SECTION

DESIGN WALL FOR $M = 19.55^{1-K}$ (GROUP II LOAD).

$$d_{MOM} = \sqrt{\frac{M}{Kb}} = \sqrt{\frac{19.55}{1.33(.152)(1)}} = 9.83''$$

GOVERNS

$$d_{SHEAR} = \frac{V}{v\,b} = \frac{4.36}{.06(1.33)(12)} = 4.55''$$

USE WALL WITH T = 1'-3" THIS AREA

$d \approx 11''$

$$A_s = \frac{19.55}{1.33(1.44)(11)} = 0.93\ \square''/FT.$$

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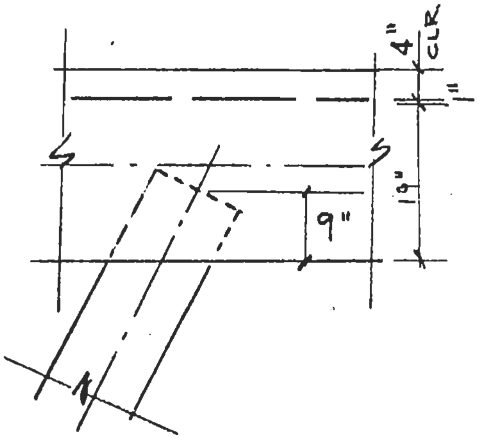
FOOTING DESIGN

VERRET $M = 10.76^{1-K}$ GROUP II LOADING



$$d = \sqrt{\frac{10.76}{1.33(.152)(1)}} = 7.30 < 19.0" \text{ PROVIDED O.K.}$$

$$A_s = \frac{10.76}{1.33(1.44)(19)} = .30^{\square"}/\text{FT}$$

CAERNARVON

$M = 17.71^{1-K}$ GROUP II LOADING

$$d = \sqrt{\frac{17.71}{1.33(.152)(1)}} = 9.36" < 25" \text{ PROVIDED O.K.}$$

$$A_s = \frac{17.71}{1.33(1.44)(25)} = 0.37^{\square"}/\text{FT}$$

DESIGN BUTTRESS FOR $M = 207^{1\text{-}K}$, GROUP II LOAD
A 1/3 INCREASE IN STRESS IS ALLOWED. (SEE PLATE 75 & 78)

$$d = \sqrt{\frac{M}{kb}} = \sqrt{\frac{207}{1.33(.152)(2)}} = 22.5''$$

$$d_{SHEAR} = \frac{V}{vb} = \frac{60.00}{.06(1.33)(24)} = 31'' \leftarrow \text{GOVERNS}$$

A BUTTRESS OF T = 3'-3" WAS USED
d = 35" O.K.

$$A_s = \frac{207}{1.33(1.44)(35)} = 3.09\ \square''$$

DESIGN FOOTING (SEE PLATE 75 & 78)
GROUP II LOADING 1/3 INCREASE IN STRESS
$M = 287.05^{1\text{-}K}$ VERRET $V = 98^K$ $b = 108''$

$M = 282.33^{1\text{-}K}$ CAERNARVON $V = 89^K$ $b = 108''$

VERRET

$$d = \sqrt{\frac{287}{1.33(.152)(9)}} = 12.56''$$

D = 2'-6"
d = 21" USED

$$d = \frac{98}{.06(1.33)(108)} = 11.37''$$

$$A_s = \frac{287}{1.33(1.44)(21)} = 7.14\ \square'' \quad .79\ \square''/FT$$

CAERNARVON

$$d = \sqrt{\frac{282}{1.33(.152)(9)}} = 12.45''$$

"D" = 36"
d = 24"
(LARGER "D" USED TO SUIT RAILROAD)

$$d = \frac{89}{.06(1.33)(108)} = 10.33$$

$$A_s = \frac{282}{1.33(1.44)(24)} = 6.14\ \square'' \quad .68\ \square''/FT$$