A 0002010

GEOTECHNICAL INVESTIGATION
ORLEANS LEVEE DISTRICT
SEABROOK FLOODWALL DISTRICT
OLB PROJECT NO. 2042-0320
NEW ORLEANS, LOUISIANA

FOR
THE BOARD OF LEVEE COMMISSIONERS
FOR THE ORLEANS LEVEE DISTRICT
NEW ORLEANS, LOUISIANA

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

DESIGN ENGINEERING, INC.
METAIRIE, LOUISIANA

6 AUGUST 1986

EUSTIS ENGINEERING
GEOTECHNICAL ENGINEERS
3011 28th Street • Metairie, Louisiana 70002 • 504-834-0157

EUSTIS ENGINEERING
GEOTECHNICAL ENGINEERS
3011 28th Street • Metairie, Louisiana 70002 • 504-834-0157

8 August 1986

Waldemar S. Nelson and Company, Inc.
Engineers and Architects
1200 St. Charles Avenue
New Orleans, Louisiana 70130

Attention Mr. Chip Muller

Gentlemen:

Geotechnical Investigation
Orleans Levee District
Seabrook Floodwall Extension
OLB Project No. 2042-0320
New Orleans, Louisiana

Transmitted is our engineering report covering a geotechnical investigation performed for the subject project.

Thank you for asking us to perform these services.

Yours very truly,

EUSTIS ENGINEERING

Lloyd A. Held, Jr.

GEOTECHNICAL INVESTIGATION
ORLEANS LEVEE DISTRICT
SEABROOK FLOODWALL DISTRICT
OLB PROJECT NO. 2042-0320
NEW ORLEANS, LOUISIANA

FOR
THE BOARD OF LEVEE COMMISSIONERS
FOR THE ORLEANS LEVEE DISTRICT
NEW ORLEANS, LOUISIANA

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

DESIGN ENGINEERING, INC.
METAIRIE, LOUISIANA

By
Eustis Engineering
Metairie, Louisiana

6 AUGUST 1986

TABLE OF CONTENTS

	Page
INTRODUCTION	1
SCOPE	2
SOIL BORINGS	2
LABORATORY TESTS	3
DESCRIPTION OF SUBSOIL CONDITIONS	4
Ground Water	4
FOUNDATION ANALYSIS	5
Furnished Information	5
Conditions and Methods	5
Results of Analyses	7
Pile Foundations	7
Levee Earth Embankment	10
Pressure Relief Wells	10

FIGURES 1 THROUGH 25

GEOTECHNICAL INVESTIGATION

ORLEANS LEVEE DISTRICT

SEABROOK FLOODWALL EXTENSION

OLB PROJECT NO. 2042-0320

NEW ORLEANS, LOUISIANA

INTRODUCTION

1. This report contains the results of a geotechnical investigation performed for the proposed Seabrook Floodwall Extension, OLB Project No. 2042-0320, to be located in New Orleans, Louisiana. The investigation was performed in accordance with Eustis Engineering's letter of proposal dated 6 August 1985 which was accepted on 21 August 1985 by Mr. Earl Magner, Chief Engineer for the Board of Levee Commissioners of the Orleans Levee District. The firms of Waldemar S. Nelson and Company, Inc. of New Orleans, Louisiana, and Design Engineering, Inc. of Metairie, Louisiana, are the Consulting Engineers for the project.

2. This report has been prepared in accordance with generally accepted geotechnical engineering practice for the exclusive use of the Board of Levee Commissioners of the Orleans Levee District and their representatives for specific application to the site of the proposed Seabrook Floodwall Extension located in New Orleans, Louisiana. In the event that any changes in the nature, design or location of the proposed floodwall extension are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and the conclusions of this report are modified or verified in writing.

3. The analyses and recommendations contained in this report are based in part on data obtained from the soil borings.

The nature and extent of variations that may exist away from the boring locations may not become evident until construction. If variations then appear, it will be necessary to re-evaluate the recommendations contained in this report.

SCOPE

4. The scope of the investigation included the drilling of soil borings at designated locations to determine subsoil conditions and stratifications and to obtain samples of the various strata encountered. Soil mechanics laboratory tests were performed on samples from the borings to evaluate their physical properties. Engineering analyses were made to determine ultimate pile load capacities, estimates of settlement, criteria for design of I-type floodwalls, and included slope stability and deep seated stability analyses.

SOIL BORINGS

5. A total of eight (8) undisturbed sample type soil test borings were drilled during the period 9 - 14 September 1985 at the locations shown on Figure 1. The borings were drilled with a truck mounted rotary type drill rig, each to a depth of 75 feet below the existing ground surface. Detailed descriptive logs of the individual borings are shown in both tabular and graphical form on Figures 2 through 9. All survey work to determine station numbers and ground surface elevations at the boring locations was performed by representatives of Waldemar S. Nelson and Company, Inc.

6. Undisturbed samples of all cohesive or semi-cohesive soils were obtained at close intervals or at a change in stratum using a 3-in. diameter (Borings 1, 3, 5 and 7) and a 5-in. diameter (Borings 2, 4, 6 and 8) Shelby tube sampling barrel. All samples were extruded in the field, inspected and visually classified by Eustis Engineering's soil technician.

Representative specimens were cut, placed in moisture proof containers, and sealed for preservation prior to laboratory testing.

7. Cohesionless soils were sampled during the performance of in situ Standard Penetration Tests. This test consists of driving a 2-in. diameter splitspoon sampler into the soil using blows of a 140-lb weight dropped 30 inches. The number of blows required to drive the sampler one foot after it is first seated six inches is shown on the individual boring logs under the column headed "Standard Penetration Test." Samples recovered from these tests were visually classified and placed in glass jars for preservation of their natural moisture content.

8. Four (4) auger type borings, designated Borings A-1 through A-4, were drilled on 27 September 1985. The borings were drilled with manually operated equipment, one to a depth of 8 feet and three to a depth of 10 feet below the existing ground surface. Samples were obtained at intervals of approximately 2 feet, visually classified and placed in glass jars for preservation of their natural moisture content. Detailed descriptive logs of these borings are shown in both tabular and graphical form on Figures 10 and 11.

LABORATORY TESTS

9. Soil mechanics laboratory tests consisting of natural water content, unit weight, and either unconfined compression or unconsolidated undrained triaxial compression shear were performed on a majority of the undisturbed samples from the 5-in. diameter borings. In addition, Atterberg liquid and plastic limit determinations were performed on selected representative samples. The results of all these tests are summarized and shown in tabular form on Figures 12 through 15.

10. Three-point unconsolidated undrained triaxial compression shear tests were performed on three selected samples and the results of these tests are shown in the form of indivi-

dual Triaxial Compression Test Reports on Figures 16 through 18. Also, grain size analyses were performed on seven selected samples of granular soils, and the results of these tests are shown graphically in the form of Grain Size Distribution Curves on Figures 19 through 22.

DESCRIPTION OF SUBSOIL CONDITIONS

11. The subsoils consist primarily of very loose to very dense gray fine sand from the ground surface to elevations ranging between -41 and -44 NGVD with some tan coloration extending a few feet below the ground surface due to past oxidation. This deposit is interrupted by a 1.5 to 10.5-ft thick continuous stratum of loose gray clayey sand or soft gray sandy clay generally located between el -10 and -23 NGVD. Above this stratum of clayey sand are relatively thin discontinuous layers of medium stiff dark gray or brown organic clay, loose gray clayey silt and soft to very stiff gray or tan and gray clay and silty clay.

12. Beginning at elevations ranging from -41 to -44 NGVD is a stratum of medium stiff to stiff gray clay that continues to elevations from -47.5 to -56 NGVD. Following this are strata of medium stiff to very stiff tan and gray or greenish-gray and tan clay and sandy clay and loose to medium dense clayey sand to elevations from -55 to -59.5 NGVD. Below this are strata of medium dense to very dense tan and gray sand and silty sand to elevations from -64.5 to -68.5 NGVD, where the borings terminate.

Ground Water

13. In order to monitor the ground water conditions, three (3) piezometers (designated P-1 through P-3) were installed on 26 September 1985 at the locations shown on Figure 1. A summary of piezometer installation data and readings obtained during the period 27 September to 14 October 1985 is shown on Figure 23.

The depth to ground water may vary with climatic conditions and/or the water level in Lake Pontchartrain or the Inner Harbor Navigation Canal. If important to construction, the depth to ground water should be determined by those responsible prior to initiation of the work.

FOUNDATION ANALYSIS

Furnished Information

14. Furnished information indicates that the proposed Seabrook Floodwall Extension project will include construction of three (3) gate monolith structures, approximately 857 linear feet of I-type floodwall and a new earth levee.

Conditions and Methods

15. For the purpose of the computations, the project was divided into ten (10) segments based on the type structure, ground surface configuration or subsoil conditions. The cross-section used for the analyses of each segment is shown on Figure 23 along with the subsoil stratification and soil parameters selected. Slope stability analyses, deep seated stability analyses, and pile capacity analyses were based on the "Q"-case soil shear strengths. Floodwall analyses were based on the "S"-case soil shear strengths. Seepage and settlement estimates were based on the appropriate soil parameters.

16. Slope stability analyses and deep seated analyses were performed using the Corps of Engineers' Method of Planes wherein the potential failure elevation is varied along with the location of active and passive wedges to determine the minimum factor of safety. For the deep seated stability analysis of the gate structures, a factor of safety of 1.3 was first applied to the estimated soil shear strengths.

17. Pile capacity analyses include support through skin friction and end bearing, where appropriate. The computations were based on piles driven without the aid of jetting or preboring, and, therefore k values of 1.0 and 0.8 were assigned for piles loaded in compression and tension, respectively. The computations were also based on stability analyses to determine at what point support from the subsoils would begin.

18. Floodwall analyses were performed using classical cantilever bulkhead methods wherein moments are summed about the toe of the sheetpiles to determine the required sheetpile penetration. In determining the required penetration, the following loading conditions and factors of safety were used at all locations:

(1) Headwater at the stillwater plus freeboard elevation, tailwater at elevation -2.0 NGVD and factor of safety equals 1.5;

(2) Headwater at the stillwater plus freeboard elevation, tailwater at ground surface and factor of safety equals 1.3.

In addition to these conditions between Stations 9+04 and 14+30, a third condition was checked based on headwater at the stillwater elevation, tailwater at ground surface, a dynamic wave force of 1706 plf and a factor of safety of 1.25. The dynamic wave force was computed from a diagram furnished by the Corps of Engineers and was applied at the centroid. All factors of safety were applied to the estimated soil shear strengths. Determination of the maximum bending moment and deflection was based on the critical condition of headwater at stillwater plus freeboard elevation and tailwater at ground surface. A factor of safety of 1.0 was applied to determine the maximum bending moment, therefore an adequate factor of safety must be included in the working stresses of the sheetpiles.

19. Seepage analyses to determine the exit gradient were performed using the Harr Method wherein the relationship of head,

sheetpile penetration and depth to an impervious layer is graphically represented. The factor of safety against "boiling" is the ratio of the critical gradient (I_c) to the estimated exit gradient (I_e) and a value of at least 8 is acceptable for sandy soils.

Results of Analyses

20. The results of all stability, floodwall, pile capacity and seepage analyses are summarized in tabular or graphical form on Figure 24. The results of stability and seepage analyses are summarized in tabular form along with typical computations. Floodwall analyses are summarized in tabular form along with typical pressure, shear and moment diagrams. Pile capacity analyses are summarized graphically in the form of "Ultimate Pile Load Capacity Versus Pile Tip Elevation" curves.

Pile Foundations

21. Allowable Pile Load Capacities. The values of ultimate pile load capacity obtained from the curves of Figure 24 apply to vertical piles. The actual capacity and horizontal component of batter piles can be estimated by assuming the vertical component is equal to the axial capacity of the vertical pile driven to the same tip elevation as the batter pile. For planning purposes, a factor of safety of 3 should be applied to the values obtained from the pile curves to determine the allowable pile load capacity. A factor of safety of 2 may be applied to the job piles when the design load has been verified by pile load tests. The estimated ultimate pile load capacities shown on Figure 24 are based on a soil-pile relationship. Therefore, the structural capacity of the pile and/or connections to transmit the loads must be determined by others.

22. Pile Capacity and Spacing of Groups. Compression piles not firmly seated in dense sand and all tension piles will derive their supporting capacity primarily through skin friction.

Therefore, the single pile load capacity of these piles must be reduced for the effect of group action when piles are driven in groups or clusters. The capacity of pile groups should be evaluated on the basis of group perimeter shear by the formula shown on Figure 25. The minimum center to center spacing between piles in a group should be determined by the formula shown on Figure 25 but should not be less than 3 feet.

23. Horizontal Subgrade Reaction. The modulus of horizontal subgrade reaction (k_h) in PCI should be determined for cohesive and granular soils by the following formula.

Cohesion Soils: $k_h = 40\ (C)\ (D)$

Granular Soils: $k_h = Z\ (C)\ (D)$

Z = Depth below existing ground surface in inches

C = 0.5 (cyclic loading) and C = 1.0 (initial loading)

D = Group effect reduction factor:

D	S
1.00	8B
0.85	7B
0.70	6B
0.55	5B
0.40	4B
0.25	3B

S = Pile spacing in direction of loading

B = Width of pile in direction of loading

24. Estimated Settlement. Foundations should be supported by 12-in. precast concrete piles driven to a tip embedment at or below el -25 NGVD. Settlement for these piles will be small and should not exceed 0.25 to 0.5 of an inch provided single rows of piles or small groups of six to eight piles per group are used. It is recommended that additional settlement analyses be performed if these criteria are not followed.

25. Pile Driving. Precast concrete piles should be driven with a single acting steam or air hammer delivering 24,375 ft-lb of energy per blow. The Engineering News Formula may be used as a guide to determine when sufficient resistance to penetration has been obtained when piles are seated in dense

sand, but should not be used when piles are seated in cohesive soils. Pile driving should terminate when a pile driving resistance of 75 blows per foot is encountered to avoid damage to the piles. 12"x12" OS

26. All adjacent structures should be inspected prior to pile driving and vibrations transmitted to these structures should be monitored during all pile driving operations. If vibrations are measured at a level which is sufficient to cause damage to adjacent structures, all pile driving operations should cease immediately. Close field supervision must be maintained by experienced and qualified personnel during installation of piles to insure that proper pile driving criteria and procedures are followed, accurate records are kept, and vibrations transmitted to adjacent structures are closely monitored during pile driving operations. Eustis Engineering is available to monitor vibrations during all pile driving operations and can provide consultations concerning the effect of vibrations on existing structures.

27. Test Piles and Pile Load Tests. It is recommended that at least one test pile of the type anticipated for final design be driven in each area to give a general indication of the expected driving resistance. The test piles should be driven with the same type of equipment and techniques that will be used to drive the job piles. The test pile will provide information regarding the expected driving resistances and vibrations that may be anticipated during the driving of the job piles. The test pile should be load tested to failure in accordance with the New Orleans Building Code in order to verify the estimated design load capacities shown on Figure 24. Eustis Engineering recommends that the load increments past the design load be one-half the increments recommended by the Code.

28. Eustis Engineering is available for discussions regarding the formulation of a test pile program, and can provide personnel for the logging of the test piles, application of the loads, and evaluation of the results of the load tests. We can

also log the driving of the job piles as well as evaluate the integrity of the job piles based on the driving logs.

what ABOUT CH

Levee Earth Embankment

29. It is recommended that site preparation, levee fill and compaction be accomplished in accordance with Department of the Army, Mississippi River Commission and Lower Mississippi Valley Division, Corps of Engineers Standard Specifications for Levee Construction. Levee fill should be a CL material as classified by the Unified Soil Classification System and should be compacted by semi-compaction methods. Material for levee fill should be compacted within a moisture content range of 18 percent minimum and 32 percent maximum. Considering the sandy nature of the subsoils, it is believed that settlement due to consolidation of the subsoils will be small and the greater majority will occur upon completion of construction. It is further estimated that settlement due to shrinkage of the levee fill material should not exceed 6 inches.

Pressure Relief Wells

30. In order to prevent a landside blowout or instability due to hydrostatic uplift in the surface and underlying sand strata during high water conditions, a system of relief wells should be installed between Station 0+00 and Station 7+15. The system of relief wells should be designed to maintain the hydrostatic head in these sand strata at or below the levee of the existing ground surface. A contractor experienced in this field should be selected to design and install the pressure relief system. Based on recent discussions with representatives of the Corps of Engineers, details of the present relief system located behind the existing floodwall are available to represen-

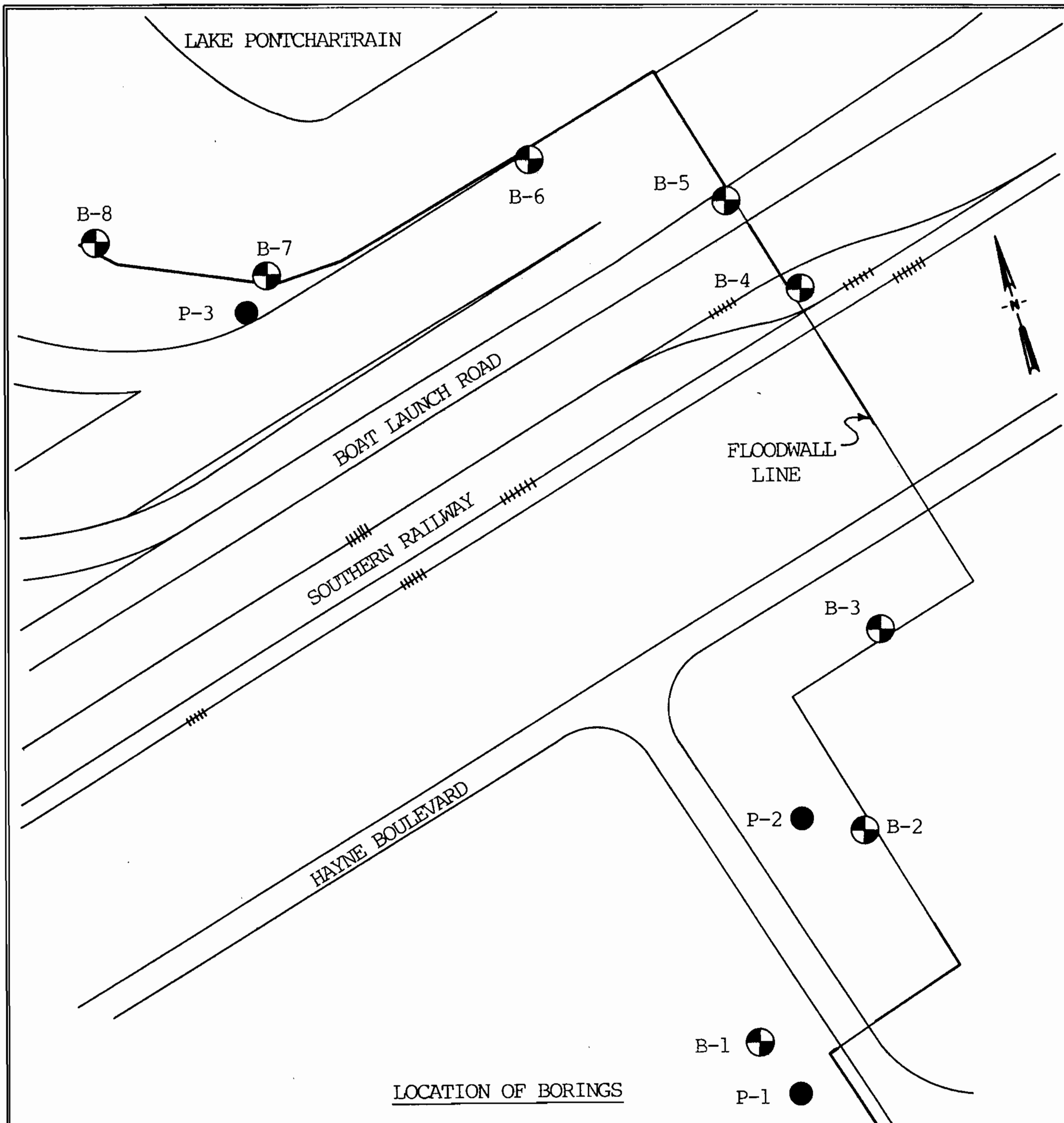
tatives of Waldemar S. Nelson for planning and estimating purposes.

EUSTIS ENGINEERING

Lloyd A. Held, Jr.

L. J. Napolitano:kdl

EE 9214



LOCATION OF BORINGS

Scale: 1" = 100'

Geotechnical Investigation
Orleans Levee District
Seabrook Floodwall Extension
OLB Project No. 2042-0320
New Orleans, Louisiana

For: The Board of Levee Commissioners of the Orleans Levee District

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

Design Engineering, Inc., Metairie, Louisiana

Fig. 1

EUSTIS ENGINEERING COMPANY
SOIL AND FOUNDATION CONSULTANTS
METAIRIE, LOUISIANA

LOG OF BORING

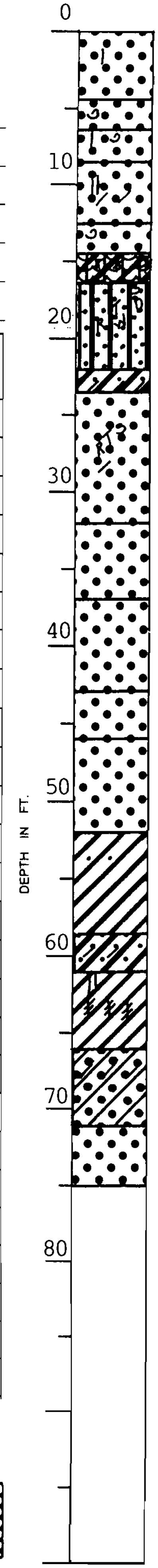
EUSTIS ENGINEERING COMPANY
SOIL AND FOUNDATION CONSULTANTS
METAIRIE, LA.

Name of Project: Orleans Levee District, Seabrook Floodwall Extension
OLB Project No. 2042-0320, New Orleans, Louisiana
For: The Board of Levee Commissioners of the Orleans Levee District
New Orleans, Louisiana

Boring No. 1 Soil Technician George Hardee Date 9 September 1985

Ground Elev. 8.4 Datum NGVD Gr. Water Depth See Text

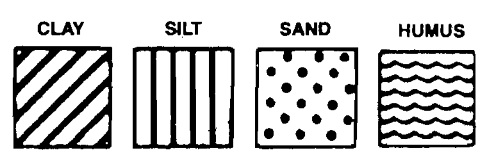
Sample No.	SAMPLE Depth — Feet From	SAMPLE Depth — Feet To	DEPTH STRATUM Feet From	DEPTH STRATUM Feet To	VISUAL CLASSIFICATION	*STANDARD PENETRATION TEST	
1	0.5	2.0	0.0		Loose tan fine sand w/silt	3	8
2	2.5	4.0		4.5	Ditto	2	6
3	4.5	6.0	4.5	6.5	Very loose tan fine sand w/shell fragments	1	4
4	6.5	8.0	6.5	8.5	Medium dense tan fine sand w/silt & shells	4	27
5	8.5	10.0	8.5		Medium dense tan & gray fine sand w/silt & clay pockets	6	18
6	10.5	12.0		12.5	Medium dense tan & gray fine sand	5	13
7	12.5	14.0	12.5	14.5	Loose gray fine sand w/shells	4	8
8	14.5	16.0	14.5	16.5	Medium stiff dark brown organic silty clay w/clayey silt layers	2	5
9	19.0	19.5	16.5		Loose gray sandy silt w/roots & wood layers		
10	20.0	21.5		22.0	Loose gray sandy silt	3	5
11	23.0	23.5	22.0	23.5	Soft gray sandy clay w/clay layers		
12	24.5	25.0	23.5		Very loose gray fine sand w/roots & trace of clay		
13	25.0	26.5			Very loose gray fine sand	1	3
14	28.5	30.0		32.0	Ditto	1	4
15	33.5	35.0	32.0	37.0	Medium dense gray fine sand	7	25
16	38.5	40.0	37.0	43.0	Dense gray fine sand	11	35
17	43.5	45.0	43.0	46.0	Very dense gray fine sand	16	50=10"
18	48.5	50.0	46.0	52.0	Dense gray fine sand	20	44
19	53.5	55.0	52.0		Medium stiff gray clay	2	7
20	57.0	57.5		58.5	Medium stiff gray clay w/sand pockets		



*Number in first column indicates number of blows of 140-lb. hammer dropped 30 in. required to seat 2-in. O. D. splitspoon sampler 6 in. Number in second column indicates number of blows of 140-lb. hammer dropped 30 in. required to drive 2-in. O. D. splitspoon sampler 1 ft. after seating 6 in.

WHILE THIS LOG OF BORING IS CONSIDERED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT ITS RESPECTIVE LOCATION ON THE DATE SHOWN, IT IS NOT WARRANTED THAT IT IS REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

Remarks: Boring located at Station 1+10



Predominant type shown heavy. Modifying type shown light.

Fig. 2
(Sheet #1)

LOG OF BORING

EUSTIS ENGINEERING COMPANY
SOIL AND FOUNDATION CONSULTANTS
METAIRIE, LA.

Name of Project: Orleans Levee District, Seabrook Floodwall Extension
OLB Project No. 2042-0320, New Orleans, Louisiana
For: The Board of Levee Commissioners of the Orleans Levee District
New Orleans, Louisiana

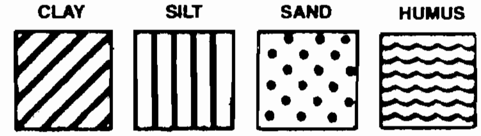
Boring No. 1 (Cont'd) Soil Technician George Hardee Date 9 September 1985
Ground Elev. 8.4 Datum NGVD Gr. Water Depth See Text

Sample No.	SAMPLE Depth — Feet From	SAMPLE Depth — Feet To	DEPTH STRATUM Feet From	DEPTH STRATUM Feet To	VISUAL CLASSIFICATION	*STANDARD PENETRATION TEST	
21	58.5	59.5	58.5	61.0	Very stiff greenish-gray & tan sandy		
					clay w/clay pockets		
22	63.5	64.5	61.0	66.0	Very stiff greenish-gray & tan clay		
					w/silt pockets & silty clay layers		
23	68.5	69.5	66.0	71.0	Medium dense tan & gray clayey sand		
					w/very stiff clay layers		
24	71.0	72.5	71.0		Medium dense tan & gray fine sand		
25	73.5	75.0		75.0	Ditto	6	26

*Number in first column indicates number of blows of 140-lb. hammer dropped 30 in. required to seat 2-in. O. D. splitspoon sampler 6 in. Number in second column indicates number of blows of 140-lb. hammer dropped 30 in. required to drive 2-in. O. D. splitspoon sampler 1 ft. after seating 6 in.

WHILE THIS LOG OF BORING IS CONSIDERED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT ITS RESPECTIVE LOCATION ON THE DATE SHOWN, IT IS NOT WARRANTED THAT IT IS REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

Remarks: Boring located at Station 1+10



Predominant type shown heavy. Modifying type shown light.

DEPTH IN FT.

Fig. 2 (Sheet #2)

LOG OF BORING

EUSTIS ENGINEERING COMPANY

SOIL AND FOUNDATION CONSULTANTS

METAIRIE, LA.

Name of Project: Orleans Levee District, Seabrook Floodwall Extension

OLB Project No. 2042-0320, New Orleans, Louisiana

For: The Board of Levee Commissioners of the Orleans Levee District

New Orleans, Louisiana

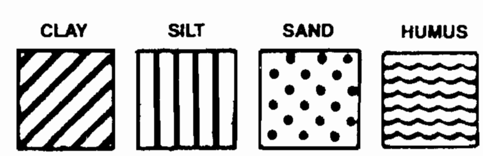
Boring No. 2 Soil Technician George Hardee Date 9-10 September 1985

Ground Elev. 8.4 Datum NGVD Gr. Water Depth See Text

Sample No.	SAMPLE Depth — Feet		DEPTH STRATUM Feet		VISUAL CLASSIFICATION	*STANDARD PENETRATION TEST	
	From	To	From	To			
1	0.5	2.0	0.0		Very loose tan fine sand w/silt	1	4
2	2.5	4.0			Ditto	1	5
3	4.5	6.0		7.0	Very loose tan fine sand w/clayey sand	1	3
					layers & organic matter		
4	6.5	8.0	7.0	8.5	Loose tan & gray fine sand w/shells	1	6
5	8.5	10.0	8.5		Medium dense gray fine sand w/shells	4	17
6	10.5	12.0		12.5	Ditto	4	14
7	12.5	14.0	12.5	14.0	Medium stiff gray clay w/trace of	3	7
					organic matter		
8	14.0	15.0	14.0	16.0	Loose gray shells		
9	16.5	17.5	16.0	18.0	Soft gray silty clay w/roots, organic		
					matter & sandy silt layers		
10	19.0	20.0	18.0	21.0	Soft gray clay w/roots, organic matter		
					& silt lenses		
11	21.5	22.5	21.0		Loose gray clayey sand w/roots & sand		
					pockets		
12	24.0	25.0		27.0	Loose gray clayey sand w/sand pockets		
13	29.5	31.0	27.0	31.5	Loose gray fine sand w/trace of clay	2	9
					& shell fragments		
14	32.0	33.5	31.5		Medium dense gray fine sand	4	16
15	34.5	36.0		37.5	Ditto	7	23
16	37.0	38.5	37.5	39.0	Dense gray fine sand	6	33
17	39.5	41.0	39.0	43.0	Medium dense gray fine sand w/shell	10	28
					fragments		
18	43.5	45.0	43.0	46.5	Very dense gray fine sand	13	50=10"
19	48.5	50.0	46.5	52.5	Dense gray fine sand w/shell fragments	6	35

*Number in first column indicates number of blows of 140-lb. hammer dropped 30 in. required to seat 2-in. O. D. splitspoon sampler 6 in. Number in second column indicates number of blows of 140-lb. hammer dropped 30 in. required to drive 2-in. O. D. splitspoon sampler 1 ft. after seating 6 in.

WHILE THIS LOG OF BORING IS CONSIDERED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT ITS RESPECTIVE LOCATION ON THE DATE SHOWN, IT IS NOT WARRANTED THAT IT IS REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.



Predominant type shown heavy. Modifying type shown light.

Remarks: Boring located at Station 3+25

NOTE: 5" Diameter Boring

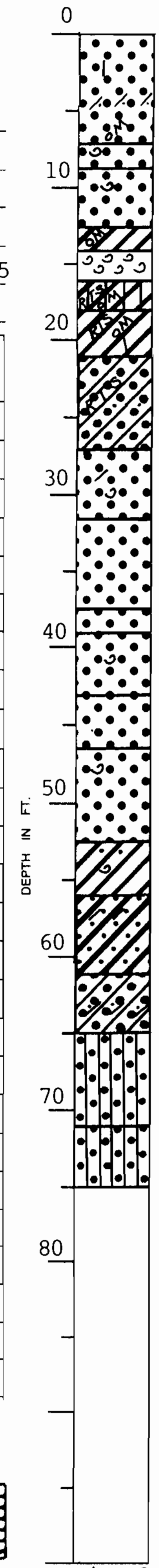


Fig. 3
(Sheet #1)

LOG OF BORING

EUSTIS ENGINEERING COMPANY

SOIL AND FOUNDATION CONSULTANTS

METAIRIE, LA.

Name of Project: Orleans Levee District, Seabrook Floodwall Extension

OLB Project No. 2042-0320, New Orleans, Louisiana

For: The Board of Levee Commissioners of the Orleans Levee District

New Orleans, Louisiana

Boring No. 2 (Cont'd) Soil Technician George Hardee Date 9-10 September 1985

Ground Elev. 8.4 Datum NGVD Gr. Water Depth See Text

Sample No.	SAMPLE Depth — Feet		DEPTH STRATUM Feet		VISUAL CLASSIFICATION	*STANDARD PENETRATION TEST	
	From	To	From	To			
20	53.5	55.0	52.5	56.0	Medium stiff gray clay w/sand pockets	2	6
					& shell fragments		
21	58.5	59.5	56.0	61.0	Very stiff greenish-gray & tan sandy		
					clay w/clay pockets		
22	63.5	64.5	61.0	65.0	Medium dense tan & gray clayey sand		
					w/sandy clay layers		
23	67.0	68.0	65.0		Medium dense tan & gray silty sand		
24	68.5	70.0		71.0	Ditto	8	26
25	73.5	75.0	71.0	75.0	Dense tan & gray silty sand	8	44

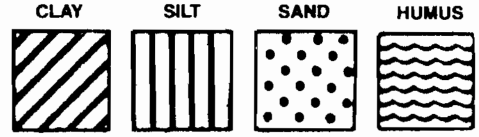
DEPTH IN FT.

*Number in first column indicates number of blows of 140-lb. hammer dropped 30 in. required to seat 2-in. O. D. splitspoon sampler 6 in. Number in second column indicates number of blows of 140-lb. hammer dropped 30 in. required to drive 2-in. O. D. splitspoon sampler 1 ft. after seating 6 in.

WHILE THIS LOG OF BORING IS CONSIDERED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT ITS RESPECTIVE LOCATION ON THE DATE SHOWN, IT IS NOT WARRANTED THAT IT IS REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

Remarks: Boring located at Station 3+25

NOTE: 5" Diameter Boring



Predominant type shown heavy. Modifying type shown light.

Fig. 3 (Sheet #2)

LOG OF BORING
EUSTIS ENGINEERING COMPANY
SOIL AND FOUNDATION CONSULTANTS
METAIRIE, LA.

Name of Project: Orleans Levee District, Seabrook Floodwall Extension
OLB Project No. 2042-0320, New Orleans, Louisiana
For: The Board of Levee Commissioners of the Orleans Levee District
New Orleans, Louisiana

Boring No. 3 Soil Technician George Hardee Date 10-11 September 1985

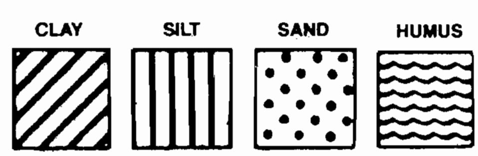
Ground Elev. 7.9 Datum NGVD Gr. Water Depth See Text

Sample No.	SAMPLE Depth — Feet		DEPTH STRATUM Feet		VISUAL CLASSIFICATION	*STANDARD PENETRATION TEST	
	From	To	From	To			
1	0.5	2.0	0.0		Loose tan & gray silty sand w/roots	2	7
2	2.5	4.0		4.0	Loose tan & gray silty sand	1	7
3	4.5	6.0	4.0		Medium dense tan & gray silty sand	3	23
4	6.5	8.0		8.5	Medium dense tan & gray silty sand	7	22
					w/shell fragments		
5	8.5	10.0	8.5		Medium dense gray fine sand w/shells	6	21
6	10.5	12.0		12.5	Ditto	4	14
7	12.5	14.0	12.5		Medium stiff dark gray organic clay	3	7
					w/sand layers		
8	15.0	16.0		16.0	Medium stiff dark gray organic clay		
					w/silty clay pockets & roots		
9	16.0	17.0	16.0		Loose gray fine sand w/organic matter,		
					shell layers & roots		
10	17.0	18.5		19.0	Loose gray fine sand	4	8
11	19.0	20.5	19.0		Very loose to loose gray clayey sand	2	3
12	22.0	22.5			Ditto		
13	24.5	25.0		26.0	Ditto		
14	28.5	29.5	26.0	30.0	Loose gray fine sand w/clay pockets		
15	30.0	31.5	30.0		Medium dense gray fine sand	3	14
16	32.0	33.5			Ditto	4	19
17	34.0	35.5		36.0	Medium dense gray fine sand w/shell	7	29
					fragments		
18	36.0	37.5	36.0	38.0	Dense gray fine sand	11	32
19	38.5	40.0	38.0	42.0	Medium dense gray fine sand w/shell	9	23
					fragments		
20	43.5	45.0	42.0	46.5	Very dense gray fine sand	15	50=9"

*Number in first column indicates number of blows of 140-lb. hammer dropped 30 in. required to seat 2-in. O. D. splitspoon sampler 6 in. Number in second column indicates number of blows of 140-lb. hammer dropped 30 in. required to drive 2-in. O. D. splitspoon sampler 1 ft. after seating 6 in.

WHILE THIS LOG OF BORING IS CONSIDERED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT ITS RESPECTIVE LOCATION ON THE DATE SHOWN, IT IS NOT WARRANTED THAT IT IS REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

Remarks: Boring located at Station 4+99



Predominant type shown heavy. Modifying type shown light.

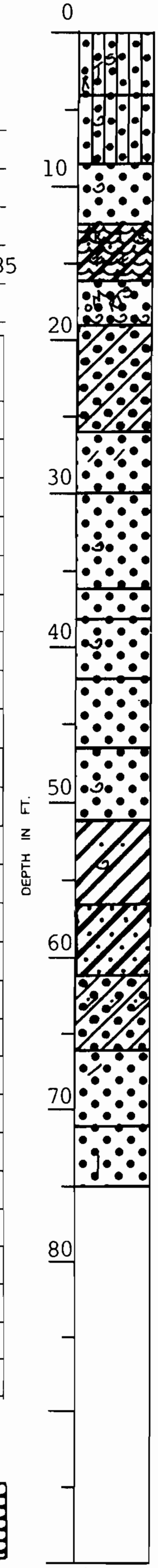


Fig. 4
(Sheet #1)

LOG OF BORING

EUSTIS ENGINEERING COMPANY

SOIL AND FOUNDATION CONSULTANTS

METAIRIE, LA.

Name of Project: Orleans Levee District, Seabrook Floodwall Extension

OLB Project No. 2042-0320, New Orleans, Louisiana

For: The Board of Levee Commissioners of the Orleans Levee District

New Orleans, Louisiana

Boring No. 3 (Cont'd) Soil Technician George Hardee Date 10-11 September 1985

Ground Elev. 7.9 Datum NGVD Gr. Water Depth See Text

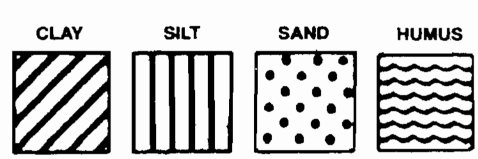
Sample No.	SAMPLE Depth — Feet		DEPTH STRATUM Feet		VISUAL CLASSIFICATION	*STANDARD PENETRATION TEST	
	From	To	From	To			
21	48.5	50.0	46.5	51.0	Medium dense gray fine sand w/shell fragments	7	27
22	53.5	54.5	51.0	56.5	Medium stiff gray clay w/sand pockets & shells		
23	58.5	59.5	56.5	61.0	Very stiff greenish-gray & tan sandy clay		
24	63.5	64.5	61.0	66.0	Loose gray & tan clayey sand w/sandy clay layers		
25	67.5	68.5	66.0		Medium dense gray fine sand w/trace of clay		
26	68.5	70.0		71.0	Medium dense gray fine sand	8	30
27	73.5	75.0	71.0	75.0	Dense tan fine sand w/silt	9	39

DEPTH IN FT.

*Number in first column indicates number of blows of 140-lb. hammer dropped 30 in. required to seat 2-in. O. D. splitspoon sampler 6 in. Number in second column indicates number of blows of 140-lb. hammer dropped 30 in. required to drive 2-in. O. D. splitspoon sampler 1 ft. after seating 6 in.

WHILE THIS LOG OF BORING IS CONSIDERED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT ITS RESPECTIVE LOCATION ON THE DATE SHOWN, IT IS NOT WARRANTED THAT IT IS REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

Remarks: Boring located at Station 4+99



Predominant type shown heavy. Modifying type shown light.

Fig. 4
(Sheet #2)

LOG OF BORING

EUSTIS ENGINEERING COMPANY

SOIL AND FOUNDATION CONSULTANTS

METAIRIE, LA.

Name of Project: Orleans Levee District, Seabrook Floodwall Extension

OLB Project No. 2042-0320, New Orleans, Louisiana

For: The Board of Levee Commissioners of the Orleans Levee District

New Orleans, Louisiana

Boring No. 4 Soil Technician George Hardee Date 12-13 September 1985

Ground Elev. 6.5 Datum NGVD Gr. Water Depth See Text

Sample No.	SAMPLE Depth — Feet From	SAMPLE Depth — Feet To	DEPTH STRATUM Feet From	DEPTH STRATUM Feet To	VISUAL CLASSIFICATION	*STANDARD PENETRATION TEST	
			0.0	1.5	Slag		
1	2.0	3.5	1.5	4.0	Loose tan & gray fine sand w/silt	2	6
2	4.0	5.5	4.0	6.0	Medium dense tan & gray fine sand	4	11
3	6.0	7.5	6.0	8.0	Very loose tan & gray fine sand	2	4
					w/gravel		
			8.0	8.5	Wood		
4	10.5	11.5	8.5		Loose gray clayey silt w/roots & silty		
					clay layers		
5	11.5	13.0			Loose gray clayey silt	3	6
6	13.5	15.0			Ditto	2	8
7	15.5	17.0		20.0	Loose gray clayey silt w/silty clay &	3	4
					sand layers		
8	21.0	22.0	20.0		Loose gray clayey sand w/clay pockets		
9	23.0	24.0		24.0	Loose gray clayey sand w/clay pockets		
					& sand layers		
10	24.0	25.5	24.0	26.0	Loose gray fine sand	1	6
11	26.5	28.0	26.0		Medium dense gray fine sand	3	13
12	28.5	30.0			Medium dense gray fine sand w/clay	1	12
					layers		
13	31.0	32.5			Medium dense gray fine sand	4	27
14	33.5	35.0			Ditto	5	28
15	38.5	40.0		44.0	Medium dense gray fine sand w/shell	12	22
					fragments		
16	43.5	45.0	44.0	47.5	Dense gray fine sand	8	37
17	48.5	50.0	47.5		Medium stiff gray clay	1	5
					(Continued)		

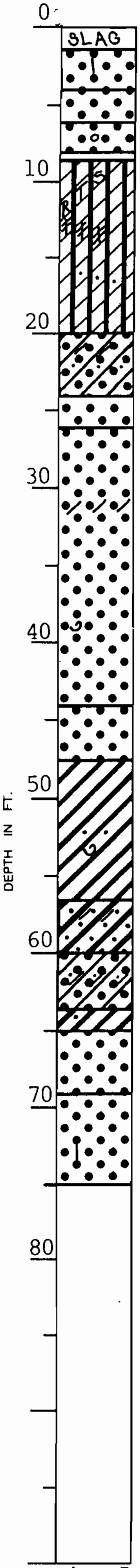


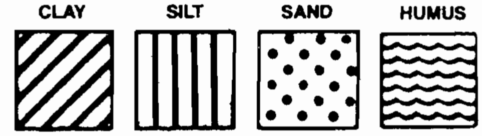
Fig. 5
(Sheet #1)

*Number in first column indicates number of blows of 140-lb. hammer dropped 30 in. required to seat 2-in. O. D. splitspoon sampler 6 in. Number in second column indicates number of blows of 140-lb. hammer dropped 30 in. required to drive 2-in. O. D. splitspoon sampler 1 ft. after seating 6 in.

WHILE THIS LOG OF BORING IS CONSIDERED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT ITS RESPECTIVE LOCATION ON THE DATE SHOWN, IT IS NOT WARRANTED THAT IT IS REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

Remarks: Boring located at Station 8+15

NOTE: 5" Diameter Boring



Predominant type shown heavy. Modifying type shown light.

LOG OF BORING

EUSTIS ENGINEERING COMPANY

SOIL AND FOUNDATION CONSULTANTS

METAIRIE, LA.

Name of Project: Orleans Levee District, Seabrook Floodwall Extension

OLB Project No. 2042-0320, New Orleans, Louisiana

For: The Board of Levee Commissioners of the Orleans Levee District

New Orleans, Louisiana

Boring No. 4 (Cont'd) Soil Technician George Hardee Date 12-13 September 1985

Ground Elev. 6.5 Datum NGVD Gr. Water Depth See Text

Sample No.	SAMPLE Depth — Feet From	SAMPLE Depth — Feet To	DEPTH STRATUM Feet From	DEPTH STRATUM Feet To	VISUAL CLASSIFICATION	*STANDARD PENETRATION TEST	
18	53.5	54.5		56.5	Medium stiff gray clay w/sand pockets & shell fragments		
19	58.5	59.5	56.5	60.0	Stiff to very stiff tan & gray sandy clay w/clay pockets		
20	62.0	63.0	60.0	63.5	Loose gray & tan clayey sand w/sandy clay layers		
21	63.5	64.5	63.5	65.0	Very stiff pink & gray clay w/sand lenses		
22	65.0	66.5	65.0	69.0	Medium dense tan & gray fine sand	3	17
23	68.5	70.0	69.0		Dense tan & gray fine sand	10	31
24	73.5	75.0		75.0	Dense tan & gray fine sand w/silt	12	47

DEPTH IN FT.

*Number in first column indicates number of blows of 140-lb. hammer dropped 30 in. required to seat 2-in. O. D. splitspoon sampler 6 in. Number in second column indicates number of blows of 140-lb. hammer dropped 30 in. required to drive 2-in. O. D. splitspoon sampler 1 ft. after seating 6 in.

WHILE THIS LOG OF BORING IS CONSIDERED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT ITS RESPECTIVE LOCATION ON THE DATE SHOWN, IT IS NOT WARRANTED THAT IT IS REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

CLAY SILT SAND HUMUS

Predominant type shown heavy. Modifying type shown light.

Remarks: Boring located at Station 8+15

NOTE: 5" Diameter Boring

LOG OF BORING

EUSTIS ENGINEERING COMPANY
SOIL AND FOUNDATION CONSULTANTS
METAIRIE, LA.

Name of Project: Orleans Levee District, Seabrook Floodwall Extension
OLB Project No. 2042-0320, New Orleans, Louisiana
For: The Board of Levee Commissioners of the Orleans Levee District
New Orleans, Louisiana

Boring No. 5 Soil Technician George Hardee Date 11 September 1985

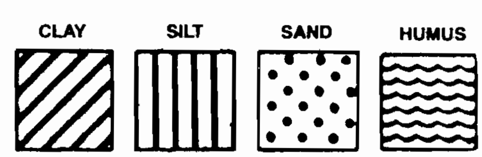
Ground Elev. 8.5 Datum NGVD Gr. Water Depth See Text

Sample No.	SAMPLE Depth — Feet From	SAMPLE Depth — Feet To	DEPTH STRATUM Feet From	DEPTH STRATUM Feet To	VISUAL CLASSIFICATION	*STANDARD PENETRATION TEST	
			0.0	0.5	Concrete		
1	1.0	2.5	0.5	2.5	Medium dense tan & gray fine sand	2	11
					w/silt & shells		
2	2.5	4.0	2.5		Dense tan & gray fine sand w/silt	9	44
					pockets & shells		
3	5.0	6.5		7.0	Dense tan & gray fine sand w/clay	5	31
					pockets		
4	7.0	8.5	7.0	9.0	Medium dense tan fine sand	4	13
5	9.0	10.5	9.0	11.0	Very loose gray silty sand w/clayey	1	3
					silt & clay layers		
6	11.0	12.5	11.0		Medium dense gray fine sand w/shells	4	20
7	13.0	14.5		15.0	Medium dense gray fine sand w/shells	2	11
					& clay layers		
8	15.0	16.5	15.0		Loose gray fine sand w/clay layers	4	7
9	17.0	18.5			Loose gray fine sand w/clay layers	3	5
					& organic matter		
10	19.0	20.5		23.0	Ditto	4	9
11	23.5	25.0	23.0		Very loose gray clayey sand	1	1
12	26.5	27.5			Very loose gray clayey sand w/clay		
					pockets		
13	29.0	30.0		31.0	Very loose gray clayey sand w/clay		
					pockets & roots		
14	33.5	34.5	31.0		Loose gray fine sand w/clay pockets		
15	35.0	36.5		37.0	Loose gray fine sand	1	6
16	37.0	38.5	37.0		Dense gray fine sand	7	31
17	39.5	41.0		42.0	Ditto	9	36

*Number in first column indicates number of blows of 140-lb. hammer dropped 30 in. required to seat 2-in. O. D. splitspoon sampler 6 in. Number in second column indicates number of blows of 140-lb. hammer dropped 30 in. required to drive 2-in. O. D. splitspoon sampler 1 ft. after seating 6 in.

WHILE THIS LOG OF BORING IS CONSIDERED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT ITS RESPECTIVE LOCATION ON THE DATE SHOWN, IT IS NOT WARRANTED THAT IT IS REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

Remarks: Boring located at Station 8+90



Predominant type shown heavy. Modifying type shown light.

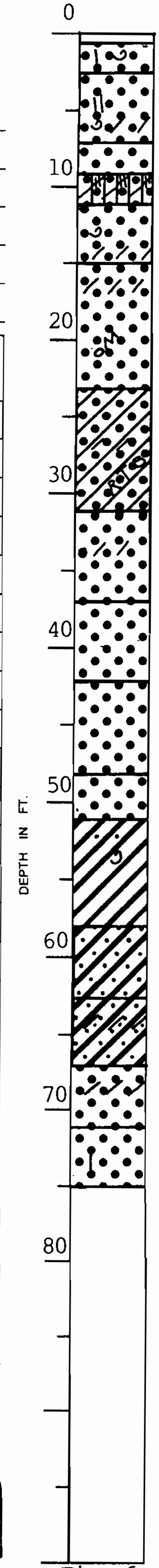


Fig. 6
(Sheet #1)

LOG OF BORING

EUSTIS ENGINEERING COMPANY
SOIL AND FOUNDATION CONSULTANTS
METAIRIE, LA.

Name of Project: Orleans Levee District, Seabrook Floodwall Extension
OLB Project No. 2042-0320, New Orleans, Louisiana

For: The Board of Levee Commissioners of the Orleans Levee District
New Orleans, Louisiana

Boring No. 5 (Cont'd) Soil Technician George Hardee Date 11 September 1985

Ground Elev. 8.5 Datum NGVD Gr. Water Depth See Text

Sample No.	SAMPLE Depth — Feet		DEPTH STRATUM Feet		VISUAL CLASSIFICATION	*STANDARD PENETRATION TEST	
	From	To	From	To			
18	43.5	45.0	42.0	48.0	Medium dense gray fine sand	5	22
19	48.5	50.0	48.0	51.0	Dense gray fine sand	8	35
20	53.5	54.5	51.0	58.0	Medium stiff gray clay w/sand pockets		
					& shell fragments		
21	58.5	59.5	58.0	62.5	Very stiff tan & gray sandy clay		
22	63.5	64.5	62.5	67.0	Medium stiff tan & gray sandy clay		
					w/clayey sand layers		
23	67.0	68.0	67.0		Medium dense tan & gray fine sand		
					w/clay layers		
24	68.5	70.0		71.0	Medium dense tan & gray fine sand	6	28
25	73.5	75.0	71.0	75.0	Dense tan fine sand w/silt	10	46

DEPTH IN FT.

*Number in first column indicates number of blows of 140-lb. hammer dropped 30 in. required to seat 2-in. O. D. splitspoon sampler 6 in. Number in second column indicates number of blows of 140-lb. hammer dropped 30 in. required to drive 2-in. O. D. splitspoon sampler 1 ft. after seating 6 in.

WHILE THIS LOG OF BORING IS CONSIDERED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT ITS RESPECTIVE LOCATION ON THE DATE SHOWN, IT IS NOT WARRANTED THAT IT IS REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

Remarks: Boring located at Station 8+90

CLAY SILT SAND HUMUS

Predominant type shown heavy. Modifying type shown light.

Fig. 6
(Sheet #2)

LOG OF BORING

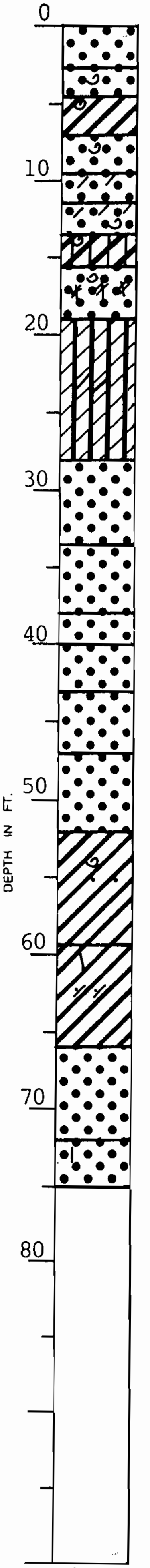
EUSTIS ENGINEERING COMPANY
SOIL AND FOUNDATION CONSULTANTS
METAIRIE, LA.

Name of Project: Orleans Levee District, Seabrook Floodwall Extension
OLB Project No. 2042-0320, New Orleans, Louisiana
For: The Board of Levee Commissioners of the Orleans Levee District
New Orleans, Louisiana

Boring No. 6 **Soil Technician** George Hardee **Date** 12 September 1985

Ground Elev. 9.4 **Datum** NGVD **Gr. Water Depth** See Text

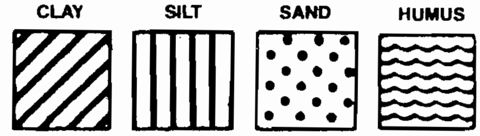
Sample No.	SAMPLE Depth — Feet From	SAMPLE Depth — Feet To	DEPTH STRATUM Feet From	DEPTH STRATUM Feet To	VISUAL CLASSIFICATION	*STANDARD PENETRATION TEST	
1	0.5	2.0	0.0	2.5	Loose tan fine sand	1	5
2	2.5	4.0	2.5	4.5	Medium dense tan fine sand w/shells	4	24
3	5.0	6.5	4.5	7.0	Medium stiff tan & gray clay w/shells	1	5
4	7.5	9.0	7.0	9.5	Medium dense tan fine sand w/shells	3	12
5	9.5	11.0	9.5	11.5	Loose tan fine sand w/clay pockets	1	6
6	11.5	13.0	11.5	13.5	Medium dense gray fine sand w/clay	6	14
					layers & shells		
7	14.0	15.0	13.5	15.5	Soft gray silty clay w/shells	1	2
8	16.5	17.5	15.5		Loose gray fine sand w/shells & silty		
					clay layers		
9	17.5	19.0		19.0	Loose gray fine sand w/shells	3	7
10	20.0	21.0	19.0		Loose gray clayey sand w/clay pockets		
11	23.0	24.0			Ditto		
12	27.0	28.0		28.0	Ditto		
13	29.0	30.5	28.0		Loose gray fine sand	1	5
14	31.5	33.0		33.5	Ditto	2	5
15	34.0	35.5	33.5		Medium dense gray fine sand	4	21
16	36.0	37.5		38.0	Ditto	4	22
17	38.0	39.5	38.0	40.0	Dense gray fine sand	7	36
18	40.0	41.5	40.0	43.0	Very dense gray fine sand	10	50=11"
19	43.5	45.0	43.0	47.0	Dense gray fine sand	14	31
20	48.5	50.0	47.0	52.0	Very dense gray fine sand	12	67
21	53.5	54.5	52.0		Medium stiff gray clay w/shell		
					fragments & sand pockets		
22	58.5	59.5		59.5	Ditto		
					(Continued)		



*Number in first column indicates number of blows of 140-lb. hammer dropped 30 in. required to seat 2-in. O. D. splitspoon sampler 6 in. Number in second column indicates number of blows of 140-lb. hammer dropped 30 in. required to drive 2-in. O. D. splitspoon sampler 1 ft. after seating 6 in.

WHILE THIS LOG OF BORING IS CONSIDERED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT ITS RESPECTIVE LOCATION ON THE DATE SHOWN, IT IS NOT WARRANTED THAT IT IS REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

Remarks: Boring located at Station 11+00
NOTE: 5" Diameter Boring



Predominant type shown heavy. Modifying type shown light.

Fig. 7
(Sheet #1)

LOG OF BORING

EUSTIS ENGINEERING COMPANY
SOIL AND FOUNDATION CONSULTANTS
METAIRIE, LA.

Name of Project: Orleans Levee District, Seabrook Floodwall Extension
OLB Project No. 2042-0320, New Orleans, Louisiana
For: The Board of Levee Commissioners of the Orleans Levee District
New Orleans, Louisiana

Boring No. 6 (Cont'd) Soil Technician George Hardee Date 12 September 1985
Ground Elev. 9.4 Datum NGVD Gr. Water Depth See Text

Sample No.	SAMPLE Depth — Feet		DEPTH STRATUM Feet		VISUAL CLASSIFICATION	*STANDARD PENETRATION TEST	
	From	To	From	To			
23	63.5	64.5	59.5	66.0	Very stiff greenish-gray & tan clay		
					w/silt & sandy clay pockets		
24	67.0	68.5	66.0		Dense tan & gray fine sand	7	37
25	70.0	71.5		72.0	Ditto	7	40
26	73.5	75.0	72.0	75.0	Very dense tan & gray fine sand w/silt	15	50=10"

DEPTH IN FT.

*Number in first column indicates number of blows of 140-lb. hammer dropped 30 in. required to seat 2-in. O. D. splitspoon sampler 6 in. Number in second column indicates number of blows of 140-lb. hammer dropped 30 in. required to drive 2-in. O. D. splitspoon sampler 1 ft. after seating 6 in.

WHILE THIS LOG OF BORING IS CONSIDERED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT ITS RESPECTIVE LOCATION ON THE DATE SHOWN, IT IS NOT WARRANTED THAT IT IS REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

Remarks: Boring located at Station 11+00
NOTE: 5" Diameter Boring

CLAY SILT SAND HUMUS

Predominant type shown heavy. Modifying type shown light.

Fig. 7
(Sheet #2)

LOG OF BORING

EUSTIS ENGINEERING COMPANY
SOIL AND FOUNDATION CONSULTANTS
METAIRIE, LA.

Name of Project: Orleans Levee District, Seabrook Floodwall Extension
OLB Project No. 2042-0320, New Orleans, Louisiana
For: The Board of Levee Commissioners of the Orleans Levee District
New Orleans, Louisiana

Boring No. 7 Soil Technician George Hardee Date 14 September 1985

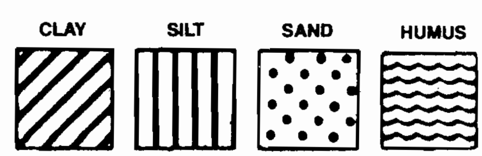
Ground Elev. 10.7 Datum NGVD Gr. Water Depth See Text

Sample No.	SAMPLE Depth — Feet		DEPTH STRATUM Feet		VISUAL CLASSIFICATION	*STANDARD PENETRATION TEST	
	From	To	From	To			
1	0.5	2.0	0.0	2.5	Medium dense tan fine sand w/shells & silt	6	11
2	2.5	4.0	2.5	4.0	Loose tan fine sand w/clay pockets & silt	2	7
3	4.0	5.5	4.0		Medium dense tan fine sand w/shells & clay pockets	20	28
4	6.0	7.5			Medium dense tan fine sand w/sandy clay layers	5	12
5	8.0	9.5		10.5	Medium dense tan fine sand	7	13
6	11.0	12.5	10.5	13.0	Soft gray silty clay w/organic matter & sand layers	1	3
7	13.0	14.5	13.0		Very loose gray silty sand w/shells	1	3
8	17.5	18.0		18.0	Very loose gray silty sand		
9	18.5	20.0	18.0		Medium dense gray fine sand w/silty clay layers	7	21
10	20.5	22.0		22.5	Ditto	8	10
11	22.5	24.0	22.5		Loose gray clayey sand w/clay pockets	2	3
12	25.0	26.0			Ditto		
13	26.0	27.0			Ditto		
14	29.0	30.0		30.5	Ditto		
15	31.0	32.5	30.5		Medium dense gray fine sand	4	10
16	33.5	35.0			Ditto	8	23
17	36.0	37.5			Ditto	11	27
18	38.5	40.0			Ditto	8	30
19	43.5	45.0			Ditto	8	30
20	48.5	50.0		53.5	Ditto	9	26

*Number in first column indicates number of blows of 140-lb. hammer dropped 30 in. required to seat 2-in. O. D. splitspoon sampler 6 in. Number in second column indicates number of blows of 140-lb. hammer dropped 30 in. required to drive 2-in. O. D. splitspoon sampler 1 ft. after seating 6 in.

WHILE THIS LOG OF BORING IS CONSIDERED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT ITS RESPECTIVE LOCATION ON THE DATE SHOWN, IT IS NOT WARRANTED THAT IT IS REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

Remarks: Boring located at Station 12+78.5



Predominant type shown heavy. Modifying type shown light.

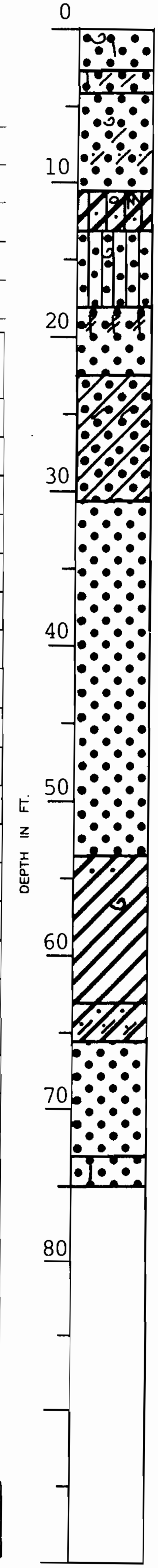


Fig. 8
(Sheet #1)

LOG OF BORING

EUSTIS ENGINEERING COMPANY
SOIL AND FOUNDATION CONSULTANTS
METAIRIE, LA.

Name of Project: Orleans Levee District, Seabrook Floodwall Extension
OLB Project No. 2042-0320, New Orleans, Louisiana
For: The Board of Levee Commissioners of the Orleans Levee District
New Orleans, Louisiana

Boring No. 7 (Cont'd) Soil Technician George Hardee Date 14 September 1985

Ground Elev. 10.7 Datum NGVD Gr. Water Depth See Text

Sample No.	SAMPLE Depth — Feet From	To	DEPTH STRATUM Feet From	To	VISUAL CLASSIFICATION	*STANDARD PENETRATION TEST	
21	53.5	55.0	53.5		Medium stiff gray clay	3	4
22	58.5	59.5		63.0	Medium stiff gray clay w/sand pockets		
					& shell fragments		
23	63.5	64.5	63.0	65.5	Stiff to very stiff greenish-gray &		
					tan clay w/sand pockets & sandy clay		
					layers		
24	66.5	68.0	65.5		Medium dense tan & gray fine sand	6	29
25	70.0	71.5		73.0	Ditto	8	26
26	73.5	75.0	73.0	75.0	Very dense tan fine sand w/silt	18	50=9"

DEPTH IN FT.

*Number in first column indicates number of blows of 140-lb. hammer dropped 30 in. required to seat 2-in. O. D. splitspoon sampler 6 in. Number in second column indicates number of blows of 140-lb. hammer dropped 30 in. required to drive 2-in. O. D. splitspoon sampler 1 ft. after seating 6 in.

WHILE THIS LOG OF BORING IS CONSIDERED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT ITS RESPECTIVE LOCATION ON THE DATE SHOWN, IT IS NOT WARRANTED THAT IT IS REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

Remarks: Boring located at Station 12+78.5

CLAY SILT SAND HUMUS

Predominant type shown heavy. Modifying type shown light.

Fig. 8
(Sheet #2)

LOG OF BORING

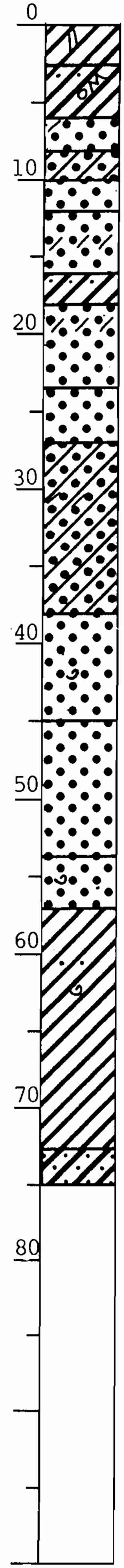
EUSTIS ENGINEERING COMPANY
SOIL AND FOUNDATION CONSULTANTS
METAIRIE, LA.

Name of Project: Orleans Levee District, Seabrook Floodwall Extension
OLB Project No. 2042-0320, New Orleans, Louisiana
For: The Board of Levee Commissioners of the Orleans Levee District
New Orleans, Louisiana

Boring No. 8 **Soil Technician** George Hardee **Date** 13-14 September 1985

Ground Elev. 15.3 **Datum** NGVD **Gr. Water Depth** See Text

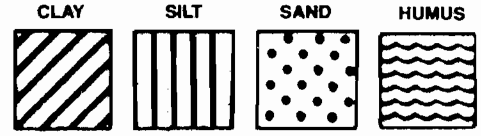
Sample No.	SAMPLE Depth — Feet From	SAMPLE Depth — Feet To	DEPTH STRATUM Feet From	DEPTH STRATUM Feet To	VISUAL CLASSIFICATION	*STANDARD PENETRATION TEST	
1	1.5	2.5	0.0	2.5	Very stiff tan & gray clay w/silt		
					pockets		
2	4.5	5.5	2.5	6.0	Stiff gray & tan clay w/sand pockets		
					& organic matter		
3	6.0	7.5	6.0	8.0	Medium dense tan fine sand w/trace of	9	24
					clay		
4	8.0	9.5	8.0	10.0	Medium dense tan clayey sand	4	17
5	10.0	11.5	10.0	12.0	Medium dense tan fine sand	5	12
6	12.0	13.5	12.0		Loose gray fine sand w/clay layers	3	8
7	14.0	15.5		16.0	Ditto	1	6
8	16.0	17.5	16.0	18.0	Soft gray clay w/sand layers	2	4
9	20.5	21.5	18.0		Loose gray fine sand w/clay layers		
10	21.5	23.0		23.5	Ditto	3	7
11	23.5	25.0	23.5		Medium dense gray fine sand	4	11
12	25.5	27.0		27.0	Ditto	4	10
13	27.0	28.5	27.0		Loose gray clayey sand	1	3
14	29.5	30.5			Loose gray clayey sand w/clay pockets		
15	32.0	33.0			Ditto		
16	33.5	35.0			Ditto	1	5
17	35.5	37.0		38.0	Ditto	2	3
18	38.5	40.0	38.0		Medium dense gray fine sand	4	19
19	43.5	45.0		45.0	Medium dense gray fine sand w/shells	9	30
20	48.5	50.0	45.0	53.5	Dense gray fine sand	11	38
21	53.5	55.0	53.5	57.0	Very dense gray fine sand w/shell	14	59=9"
					fragments		
					(Continued)		



*Number in first column indicates number of blows of 140-lb. hammer dropped 30 in. required to seat 2-in. O. D. splitspoon sampler 6 in. Number in second column indicates number of blows of 140-lb. hammer dropped 30 in. required to drive 2-in. O. D. splitspoon sampler 1 ft. after seating 6 in.

WHILE THIS LOG OF BORING IS CONSIDERED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT ITS RESPECTIVE LOCATION ON THE DATE SHOWN, IT IS NOT WARRANTED THAT IT IS REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

Remarks: Boring located at Station 14+30
NOTE: 5" Diameter Boring



Predominant type shown heavy. Modifying type shown light.

Fig. 9
(Sheet #1)

LOG OF BORING

EUSTIS ENGINEERING COMPANY
SOIL AND FOUNDATION CONSULTANTS
METAIRIE, LA.

Name of Project: Orleans Levee District, Seabrook Floodwall Extension
OLB Project No. 2042-0320, New Orleans, Louisiana
For: The Board of Levee Commissioners of the Orleans Levee District
New Orleans, Louisiana

Boring No. 8 (Cont'd) Soil Technician George Hardee Date 13-14 September 1985
Ground Elev. 15.3 Datum NGVD Gr. Water Depth See Text

Sample No.	SAMPLE Depth — Feet From	To	DEPTH STRATUM Feet From	To	VISUAL CLASSIFICATION	*STANDARD PENETRATION TEST	
22	58.5	60.0	57.0		Medium stiff gray clay w/sand pockets	2	5
					& shell fragments		
23	63.5	64.5			Ditto		
24	68.5	69.5		72.5	Ditto		
25	73.5	74.5	72.5	75.0	Medium stiff greenish-gray sandy clay		

DEPTH IN FT.

*Number in first column indicates number of blows of 140-lb. hammer dropped 30 in. required to seat 2-in. O. D. splitspoon sampler 6 in. Number in second column indicates number of blows of 140-lb. hammer dropped 30 in. required to drive 2-in. O. D. splitspoon sampler 1 ft. after seating 6 in.

WHILE THIS LOG OF BORING IS CONSIDERED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT ITS RESPECTIVE LOCATION ON THE DATE SHOWN, IT IS NOT WARRANTED THAT IT IS REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

Remarks: Boring located at Station 14+30
NOTE: 5" Diameter Boring

CLAY SILT SAND HUMUS

Predominant type shown heavy. Modifying type shown light.

Fig. 9
(Sheet #2)

LOG OF BORING

EUSTIS ENGINEERING COMPANY

SOIL AND FOUNDATION CONSULTANTS

METAIRIE, LA.

Name of Project: Orleans Levee District, Seabrook Floodwall Extension

OLB Project No. 2042-0320, New Orleans, Louisiana

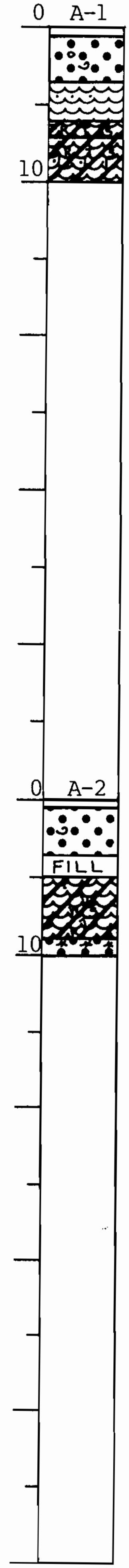
For: The Board of Levee Commissioners of the Orleans Levee District

New Orleans, Louisiana

Boring No. ______ Soil Technician R. Elkins Date 27 September 1985

Ground Elev. ______ Datum ______ Gr. Water Depth ______

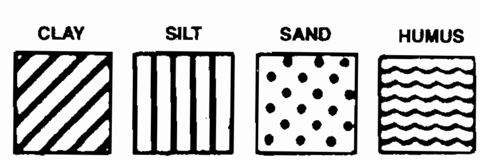
Sample No.	SAMPLE Depth — Feet		DEPTH STRATUM Feet		VISUAL CLASSIFICATION	*STANDARD PENETRATION TEST	
	From	To	From	To			
					AUGER BORING A-1		
			0.0	0.5	Asphalt		
1	1.5	2.0	0.5	3.5	Medium dense gray sand w/gravel &		
					shells		
2	3.5	4.0	3.5	6.0	Loose brown humus w/sand layers		
3	5.5	6.0	6.0	7.0	Loose brown organic clay w/roots &		
					sandy silt layers		
4	7.5	8.0	7.0		Very soft brown organic clay w/roots &		
					sandy silt layers		
5	9.5	10.0		10.0	Ditto		
					AUGER BORING A-2		
			0.0	0.42	Asphalt		
1	1.5	2.0	0.42	3.5	Medium dense gray sand w/few shell		
					fragments		
2	3.5	4.0	3.5	5.0	Miscellaneous fill - gray sand, gravel,		
					shells & oil odor		
3	5.5	6.0	5.0		Very soft brown organic clay w/sand,		
					wood & roots		
4	7.5	8.0		9.0	Ditto		
5	9.5	10.0	9.0	10.0	Loose gray sand w/organic clay layers		
					Borings located on ℄ of Hayne Boulevard		
					A-1, 50' west of wall line;		
					A-2, 50' east of wall line.		



*Number in first column indicates number of blows of 140-lb. hammer dropped 30 in. required to seat 2-in. O. D. splitspoon sampler 6 in. Number in second column indicates number of blows of 140-lb. hammer dropped 30 in. required to drive 2-in. O. D. splitspoon sampler 1 ft. after seating 6 in.

WHILE THIS LOG OF BORING IS CONSIDERED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT ITS RESPECTIVE LOCATION ON THE DATE SHOWN, IT IS NOT WARRANTED THAT IT IS REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

Remarks: ______



Predominant type shown heavy. Modifying type shown light.

Fig. 10

LOG OF BORING

EUSTIS ENGINEERING COMPANY

SOIL AND FOUNDATION CONSULTANTS

METAIRIE, LA.

Name of Project: Orleans Levee District, Seabrook Floodwall Extension

OLB Project No. 2042-0320, New Orleans, Louisiana

For: The Board of Levee Commissioners of the Orleans Levee District

New Orleans, Louisiana

Boring No. ______ Soil Technician R. Elkins Date 27 September 1985

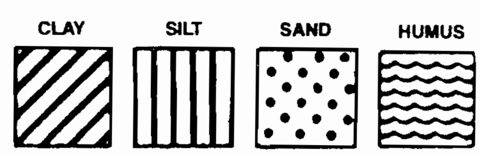
Ground Elev. ______ Datum ______ Gr. Water Depth ______

Sample No.	Sample Depth — Feet From	Sample Depth — Feet To	Depth Stratum Feet From	Depth Stratum Feet To	Visual Classification	*Standard Penetration Test	
					AUGER BORING A-3		
1	0.0	1.0	0.0	1.0	Very loose brown humus w/sand pockets &		
					roots		
2	1.5	2.0	1.0	3.5	Loose gray silty sand w/shell fragments		
3	3.5	4.0	3.5	4.0	Medium stiff gray & tan clay w/sand		
					pockets & roots		
4	5.5	6.0	4.0		Very soft brown humus w/sandy silt		
					layers & roots		
5	6.5	7.0		7.5	Ditto		
6	7.5	8.0	7.5	8.0	Medium dense gray sandy silt w/trace		
					of organic matter		
					AUGER BORING A-4		
1	0.0	1.0	0.0	1.0	Loose gray & brown sandy silt w/humus		
					& roots		
2	1.5	2.0	1.0	3.0	Very soft brown humus w/roots		
3	3.5	4.0	3.0	5.0	Very soft brown & gray humus w/wood &		
					sandy silt layers		
4	5.5	6.0	5.0		Very loose gray sandy silt w/wood		
5	7.5	8.0			Ditto		
6	9.5	10.0		10.0	Ditto		
					A-3 located 50' south of A-1;		
					A-4 located 50' north of A-2.		

*Number in first column indicates number of blows of 140-lb. hammer dropped 30 in. required to seat 2-in. O. D. splitspoon sampler 6 in. Number in second column indicates number of blows of 140-lb. hammer dropped 30 in. required to drive 2-in. O. D. splitspoon sampler 1 ft. after seating 6 in.

WHILE THIS LOG OF BORING IS CONSIDERED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT ITS RESPECTIVE LOCATION ON THE DATE SHOWN, IT IS NOT WARRANTED THAT IT IS REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

Remarks: ______



Predominant type shown heavy. Modifying type shown light.

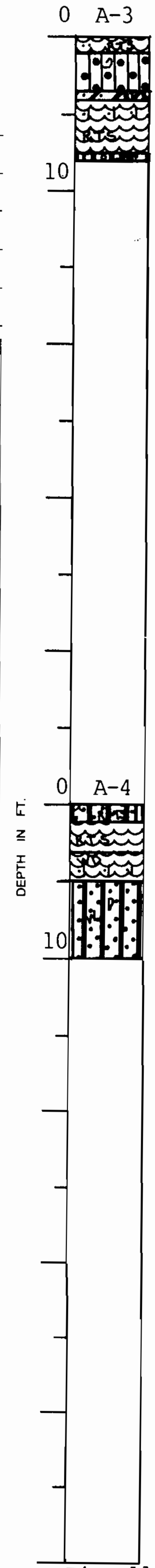


Fig. 11

Geotechnical Investigation
Orleans Levee District
Seabrook Floodwall Extension
OLB Project No. 2042-0320
New Orleans, Louisiana

For: The Board of Levee Commissioners of the Orleans Levee District
New Orleans, Louisiana

Waldemar S. Nelson and Company, Inc., Engineers and Architects,
New Orleans, Louisiana

Design Engineering, Inc., Metairie, Louisiana

SUMMARY OF LABORATORY TEST RESULTS

BORING 2

Sample No.	Depth in Feet	Classification	Water Content Percent	Density PCF Dry	Density PCF Wet	Unconfined Compressive Strength PSF	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI
7	12.5	Medium stiff gray clay w/trace of organic matter & silt	58.2	----	-----	----			
9	16.5	Loose gray clayey silt	43.4	74.0	106.1	505*			
10	19.0	Medium stiff brown organic clay w/roots	100.6	42.5	85.3	1495	111	28	83
20	53.5	Medium stiff gray clay w/sand pockets & shell fragments	42.1	----	-----	----			
21	58.5	Very stiff greenish-gray & tan sandy clay	21.3	103.4	125.5	4070			

*Unconsolidated Undrained Triaxial Compression Test - One Specimen; Confined at the approximate overburden pressure.

Fig. 12

Geotechnical Investigation
Orleans Levee District
Seabrook Floodwall Extension
OLB Project No. 2042-0320
New Orleans, Louisiana

For: The Board of Levee Commissioners of the Orleans Levee District
New Orleans, Louisiana

Waldemar S. Nelson and Company, Inc., Engineers and Architects,
New Orleans, Louisiana

Design Engineering, Inc., Metairie, Louisiana

SUMMARY OF LABORATORY TEST RESULTS

BORING 4

Sample No.	Depth in Feet	Classification	Water Content Percent	Density PCF Dry	Density PCF Wet	Unconfined Compressive Strength PSF	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI
18	53.5	Medium stiff gray fissured clay w/sand pockets	46.1	73.8	107.9	1890			
19	58.5	Very stiff gray & tan sandy clay	22.5	102.5	125.5	4160	50	19	31
21	63.5	Stiff pink & gray fissured clay w/sand pockets	37.7	83.1	114.5	2395			

Fig. 13

Geotechnical Investigation
Orleans Levee District
Seabrook Floodwall Extension
OLB Project No. 2042-0320
New Orleans, Louisiana

For: The Board of Levee Commissioners of the Orleans Levee District
New Orleans, Louisiana

Waldemar S. Nelson and Company, Inc., Engineers and Architects,
New Orleans, Louisiana

Design Engineering, Inc., Metairie, Louisiana

SUMMARY OF LABORATORY TEST RESULTS

BORING 6

Sample No.	Depth in Feet	Classification	Water Content Percent	Density PCF Dry	Density PCF Wet	Unconfined Compressive Strength PSF	Atterberg Limits LL	PL	PI
3	5.0	Medium stiff tan & gray clay w/shells & sand pockets	28.6	----	-----	----	64	22	42
7	14.0	Soft gray silty clay w/shells	36.9	----	-----	----			
21	53.5	Stiff gray fissured clay w/silt lenses				Ø=0°;c=1295*	94	28	66
22	58.5	Stiff gray clay with sand pockets & shells	48.7	73.2	108.8	2030			
23	63.5	Stiff greenish-gray fissured clay w/silt & sand pockets	36.6	84.2	115.0	2425			

*Unconsolidated Undrained Triaxial Compression Test - Multiple Stage;
Ø = Angle of Internal Friction; c = Cohesion in psf.

Fig. 14

Geotechnical Investigation
Orleans Levee District
Seabrook Floodwall Extension
OLB Project No. 2042-0320
New Orleans, Louisiana

For: The Board of Levee Commissioners of the Orleans Levee District
New Orleans, Louisiana

Waldemar S. Nelson and Company, Inc., Engineers and Architects,
New Orleans, Louisiana

Design Engineering, Inc., Metairie, Louisiana

SUMMARY OF LABORATORY TEST RESULTS

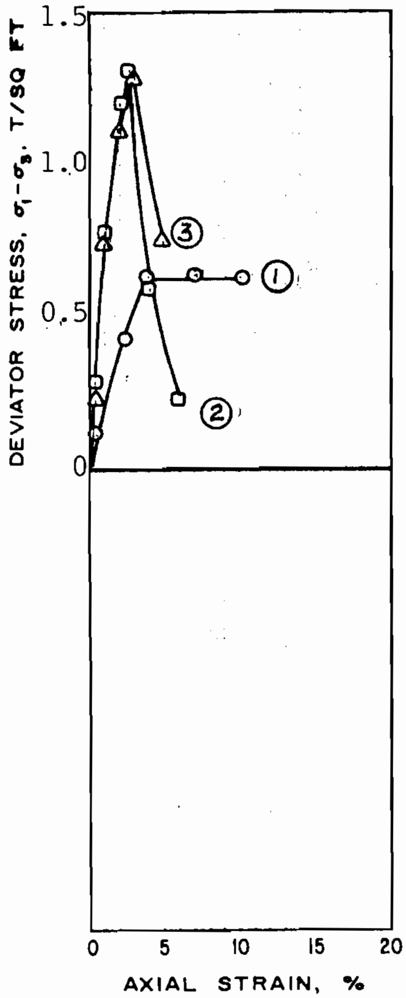
BORING 8

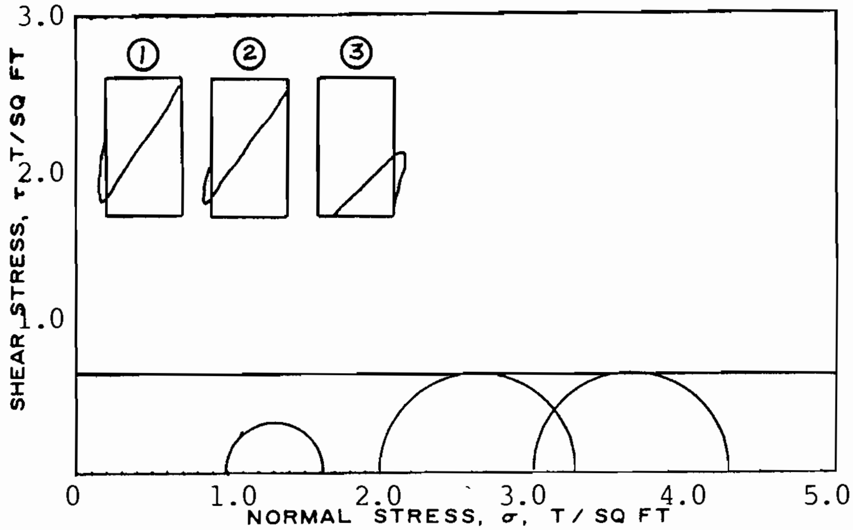
Sample No.	Depth in Feet	Classification	Water Content Percent	Density PCF Dry	Density PCF Wet	Unconfined Compressive Strength PSF	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI
1	1.5	Very stiff tan & gray clay w/sand pockets	21.3	100.7	122.7	4325			
2	4.5	Stiff gray & tan clay w/sand pockets	26.2	96.3	121.6	2405			
8	16.0	Soft gray clay with sand layers	52.5	----	-----	----			
14	29.5	Very loose gray silty sand w/clay pockets	----	----	-----	Ø=1°;c=230*			
23	63.5	Medium stiff gray clay w/sand pockets & decayed shell fragments	51.8	70.3	106.7	1290**			
24	68.5	Medium stiff gray silty clay w/shells				Ø=0°;c=865*	43		
25	73.5	Medium stiff gray sandy clay	20.0	106.9	128.3	1820			

*Unconsolidated Undrained Triaxial Compression Test - Multiple Stage;
Ø = Angle of Internal Friction; c = Cohesion in psf.

**Unconsolidated Undrained Triaxial Compression Test - One Specimen;
Confined at the approximate overburden pressure.

Fig. 15





TEST NO.			1	2	3	
INITIAL	WATER CONTENT %	w_o	61.3	64.7	65.6	
	VOID RATIO	e_o	1.68	1.77	1.78	
	SATURATION %	S_o	100	100	100	
	DRY DENSITY, LB/CU FT	γ_d	63.8	61.8	61.5	
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	61.3	64.7	65.6	
	VOID RATIO	e_f	1.68	1.77	1.78	
MINOR PRINCIPAL STRESS, T/SQ FT		σ_3	1.0	2.0	3.0	
MAX DEVIATOR STRESS, T/SQ FT		$(\sigma_1-\sigma_3)_{max}$	0.63	1.30	1.29	
TIME TO FAILURE, MIN		t_f	8	5	6	
RATE OF STRAIN, PERCENT/MIN			0.5	0.5	0.5	
EFFECTIVE NORMAL STRESS, T SQ FT						
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 = 0.65 T/SQ FT

METHOD OF SATURATION ____

☐ CONTROLLED STRESS

☒ CONTROLLED STRAIN

TYPE OF TEST UU	TYPE OF SPECIMEN Undisturbed		
CLASSIFICATION Stiff gray fissured clay w/silt lenses			
LL 94	PL 28	PI 66	G_s 2.74 Est.

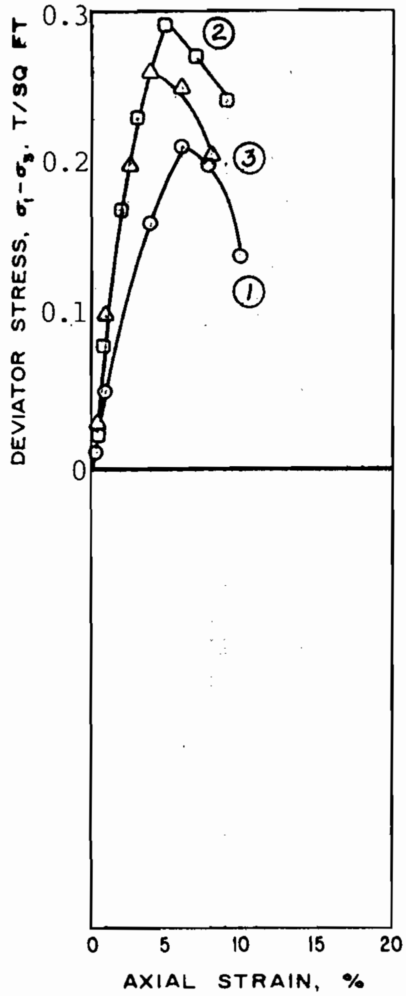
REMARKS ____

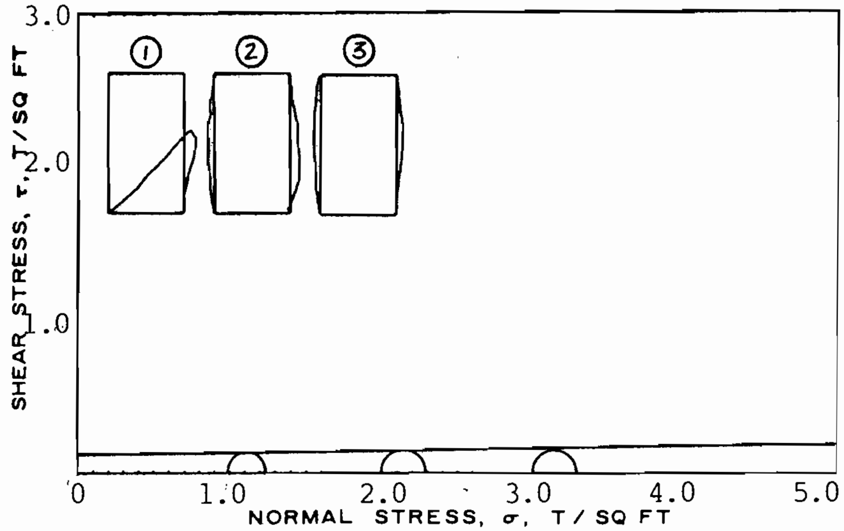
PROJECT	Orleans Levee District
	Seabrook Floodwall Extension
AREA	New Orleans, Louisiana
BORING NO. 6	SAMPLE NO. 21
DEPTH EL 53.5-54.5'	DATE 9/20/85

TRIAXIAL COMPRESSION TEST REPORT

EUSTIS ENGINEERING COMPANY
SOIL AND FOUNDATION CONSULTANTS
METAIRIE, LOUISIANA

Fig. 16





TEST NO.			1	2	3	
INITIAL	WATER CONTENT %	w_o	25.3	25.3	23.9	
	VOID RATIO	e_o	0.638	0.634	0.575	
	SATURATION %	S_o	100	100	100	
	DRY DENSITY, LB/CU FT	γ_d	101.7	102.0	105.8	
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	25.3	25.3	23.9	
	VOID RATIO	e_f	0.638	0.634	0.575	
MINOR PRINCIPAL STRESS, T/SQ FT		σ_3	1.0	2.0	3.0	
MAX DEVIATOR STRESS, T/SQ FT		$(\sigma_1 - \sigma_3)_{max}$	0.21	0.29	0.26	
TIME TO FAILURE, MIN		t_f	12	10	8	
RATE OF STRAIN, PERCENT/MIN			0.5	0.5	0.5	
EFFECTIVE NORMAL STRESS, T SQ FT						
ULT DEVIATOR STRESS, T/SQ FT		$(\sigma_1 - \sigma_3)_{ult}$				
INITIAL DIAMETER, IN.		D_o	1.38	1.37	1.36	
INITIAL HEIGHT, IN.		H_o	3.00	3.00	3.00	

SHEAR STRENGTH PARAMETERS

ϕ = 1°

TAN ϕ = .0174

c = 0.12 T/SQ FT

METHOD OF SATURATION

☐ CONTROLLED STRESS

☒ CONTROLLED STRAIN

TYPE OF TEST UU

TYPE OF SPECIMEN Undisturbed

CLASSIFICATION Very loose gray silty sand w/clay pockets

LL Non-Plastic | PL | PI | G_s 2.67 Est.

REMARKS

PROJECT Orleans Levee District
Seabrook Floodwall Extension

AREA New Orleans, Louisiana

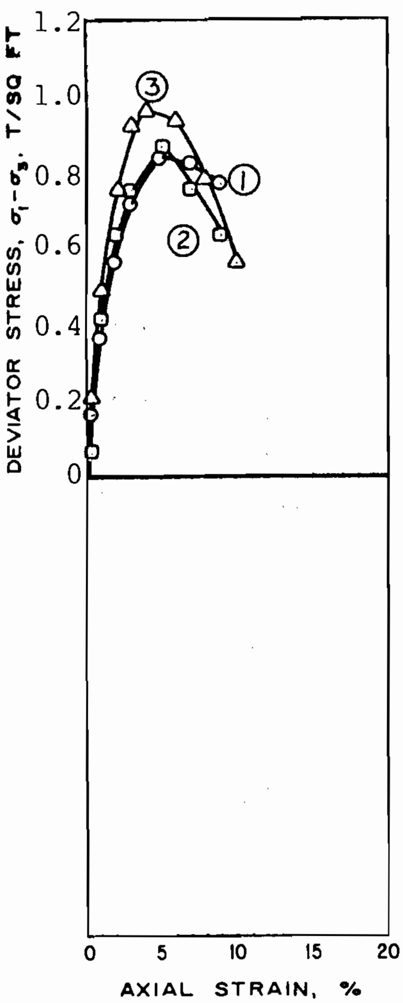
BORING NO. 8 SAMPLE NO. 14

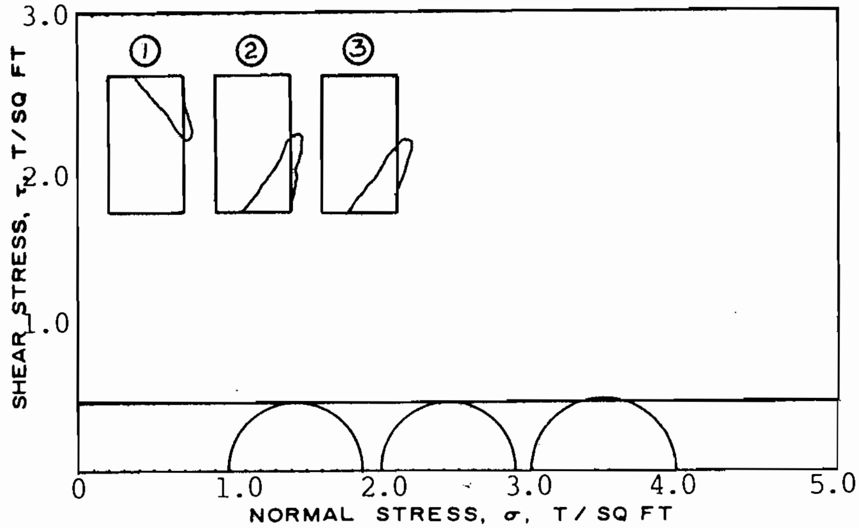
DEPTH EL 29.5'-30.5' DATE 9/19/85

TRIAXIAL COMPRESSION TEST REPORT

EUSTIS ENGINEERING COMPANY
SOIL AND FOUNDATION CONSULTANTS
METAIRIE, LOUISIANA

Fig. 17





TEST NO.			1	2	3	
INITIAL	WATER CONTENT %	w_o	32.7	36.4	32.7	
	VOID RATIO	e_o	0.889	0.986	0.888	
	SATURATION %	S_o	100	100	100	
	DRY DENSITY, LB/CU FT	γ_d	89.8	85.5	89.9	
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	32.7	36.4	32.7	
	VOID RATIO	e_f	0.889	0.986	0.888	
MINOR PRINCIPAL STRESS, T/SQ FT		σ_3	1.0	2.0	3.0	
MAX DEVIATOR STRESS, T/SQ FT		$(\sigma_1-\sigma_3)_{max}$	0.84	0.86	0.96	
TIME TO FAILURE, MIN		t_f	10	10	8	
RATE OF STRAIN, PERCENT/MIN			0.5	0.5	0.5	
EFFECTIVE NORMAL STRESS, T SQ FT						
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 = 0.43 T/SQ FT

METHOD OF SATURATION

☐ CONTROLLED STRESS

☒ CONTROLLED STRAIN

TYPE OF TEST: UU	TYPE OF SPECIMEN: Undisturbed		
CLASSIFICATION: Medium stiff gray silty clay w/sand pockets & shells			
LL 43	PL 19	PI 24	G_s 2.72 Est.

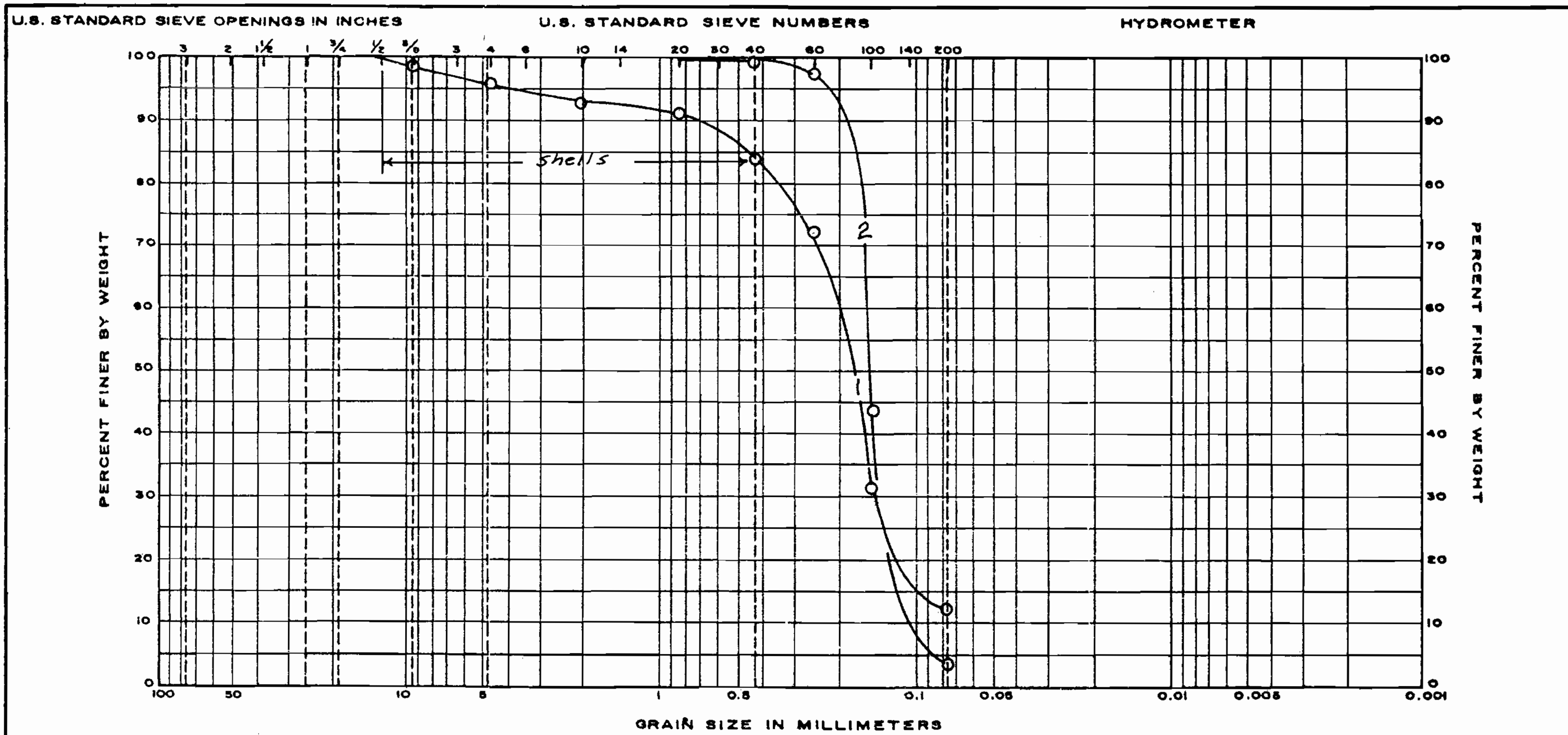
REMARKS

PROJECT	Orleans Levee District
	Seabrook Floodwall Extension
AREA	New Orleans, Louisiana
BORING NO. 8	SAMPLE NO. 24
DEPTH EL 68.5'-69.5'	DATE 9/22/85

TRIAXIAL COMPRESSION TEST REPORT

EUSTIS ENGINEERING COMPANY
SOIL AND FOUNDATION CONSULTANTS
METAIRIE, LOUISIANA

Fig. 18



UNIFIED	GRAVEL		SAND			SILT OR CLAY		
	COARSE	FINE	COARSE	MEDIUM	FINE			
AASHO	GRAVEL			SAND		SILT	CLAY	
	COARSE	MEDIUM	FINE	COARSE	FINE			

GRAIN SIZE ANALYSIS

CURVE NO.	BORING NO.	SAMPLE NO.	DEPTH IN FT.	NATURAL WATER CONTENT	ATTERBERG LIMITS LL	PL	PI
1	2	5	8.5'-10.0'				
2	2	17	39.5'-41.0'				

PROJECT Geotechnical Investigation

Orleans Levee District, Seabrook Floodwall Extension

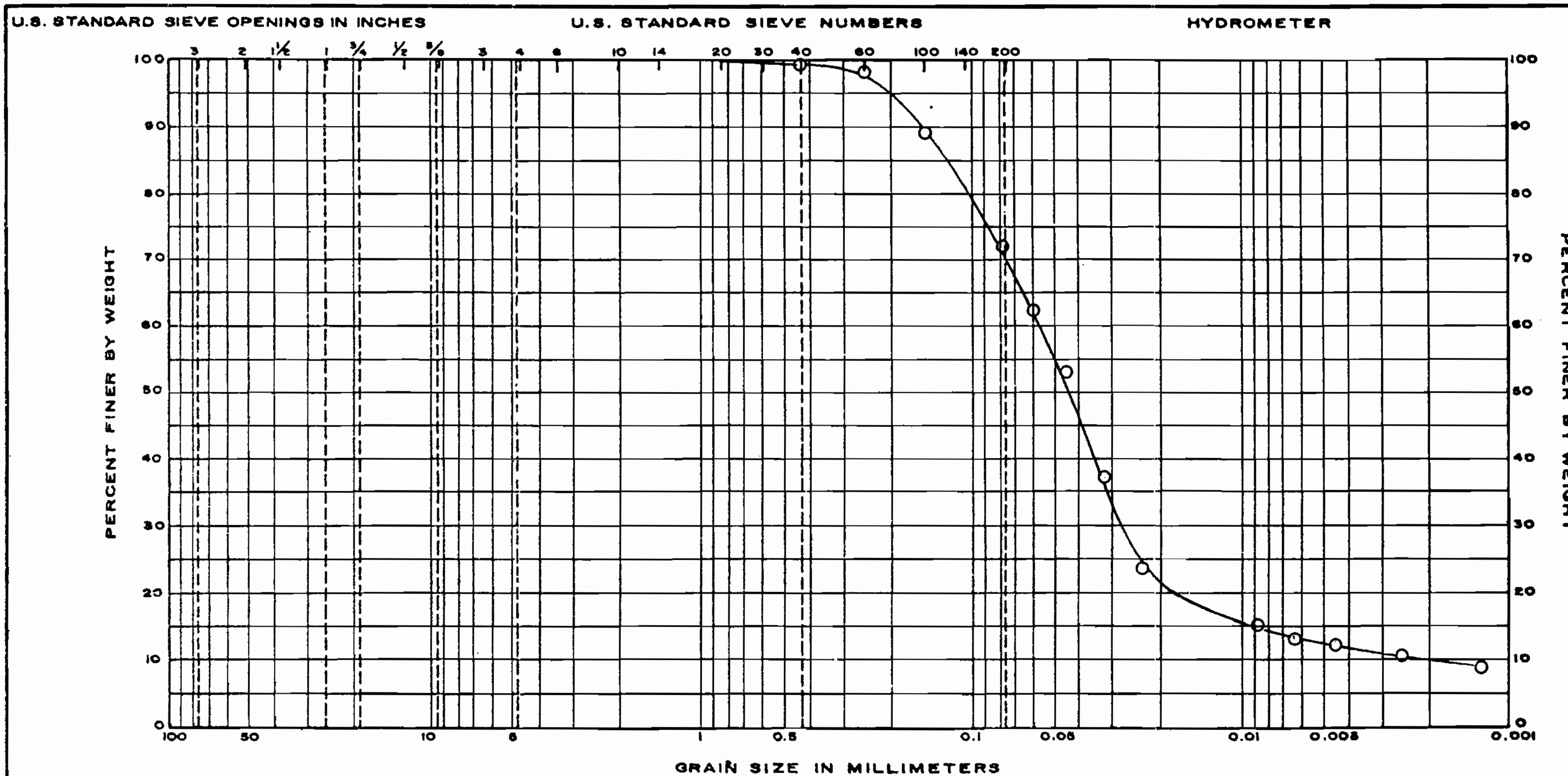
OLB Project No. 2042-0320, New Orleans, La.

For: The Board of Levee Commissioners

of the Orleans Levee District, New Orleans, La.

EUSTIS ENGINEERING COMPANY
CONSULTING FOUNDATION ENGINEERS
METAIRIE, LA.

Fig. 19



UNIFIED	GRAVEL		SAND			SILT OR CLAY	
	COARSE	FINE	COARSE	MEDIUM	FINE		
AASHO	GRAVEL			SAND		SILT	CLAY
	COARSE	MEDIUM	FINE	COARSE	FINE		

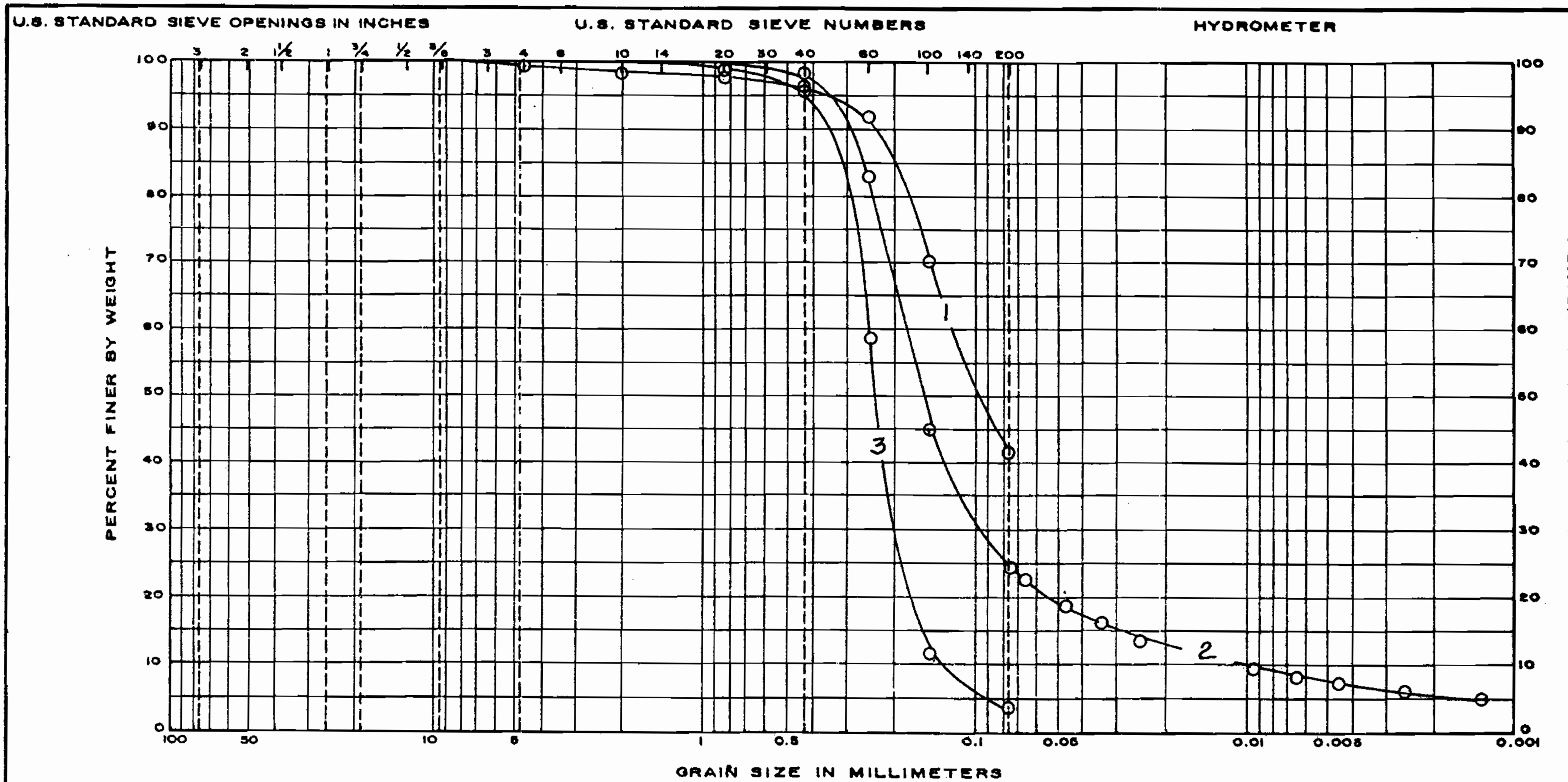
GRAIN SIZE ANALYSIS

CURVE NO.	BORING NO.	SAMPLE NO.	DEPTH IN FT.	NATURAL WATER CONTENT	ATTERBERG LIMITS LL	PL	PI
	4	7	15.5'-17.0'				

PROJECT Geotechnical Investigation
Orleans Levee District, Seabrook Floodwall Extension
OLB Project No. 2042-0320, New Orleans, La.
For: The Board of Levee Commissioners
of the Orleans Levee District, New Orleans, La.

EUSTIS ENGINEERING COMPANY
CONSULTING FOUNDATION ENGINEERS
METAIRIE, LA.

Fig. 20



UNIFIED	GRAVEL		SAND			SILT OR CLAY	
	COARSE	FINE	COARSE	MEDIUM	FINE		
AASHO	GRAVEL			SAND		SILT	CLAY
	COARSE	MEDIUM	FINE	COARSE	FINE		

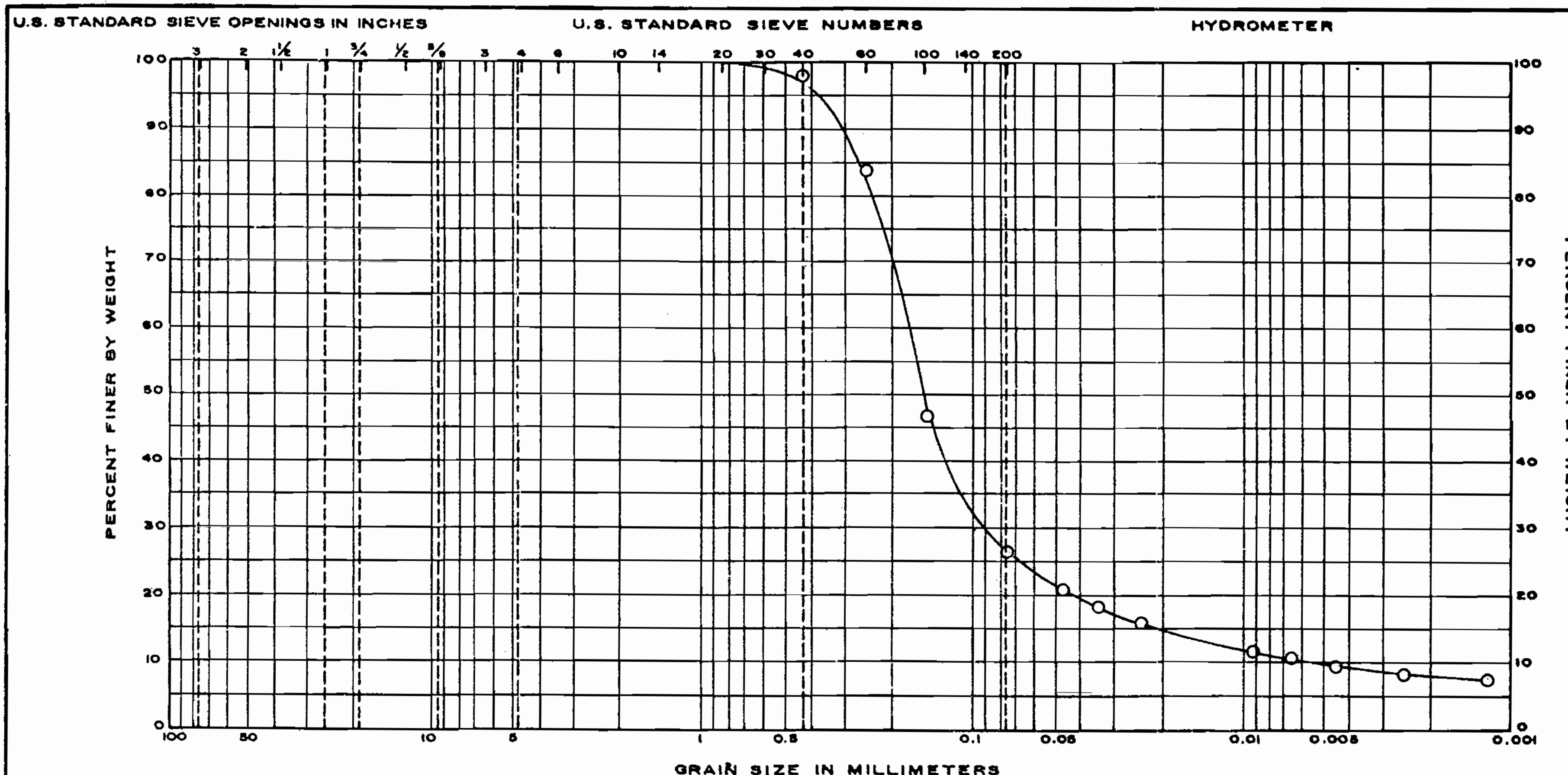
GRAIN SIZE ANALYSIS

CURVE NO.	BORING NO.	SAMPLE NO.	DEPTH IN FT.	NATURAL WATER CONTENT	ATTERBERG LIMITS LL	PL	PI
1	6	4	7.5-9.0				
2	6	11	23.0-24.0				
3	6	17	38.0-39.5				

PROJECT Geotechnical Investigation
Orleans Levee District, Seabrook Floodwall Extension
OLB Project No. 2042-0320, New Orleans, La.
For: The Board of Levee Commissioners
of the Orleans Levee District, New Orleans, La.

EUSTIS ENGINEERING COMPANY
CONSULTING FOUNDATION ENGINEERS
METAIRIE, LA.

Fig. 21



UNIFIED	GRAVEL		SAND			SILT OR CLAY	
	COARSE	FINE	COARSE	MEDIUM	FINE		
AASHO	GRAVEL			SAND		SILT	CLAY
	COARSE	MEDIUM	FINE	COARSE	FINE		

GRAIN SIZE ANALYSIS

CURVE NO.	BORING NO.	SAMPLE NO.	DEPTH IN FT.	NATURAL WATER CONTENT	ATTERBERG LIMITS LL	PL	PI
	8	14	29.5-30.5				

PROJECT Geotechnical Investigation

Orleans Levee District, Seabrook Floodwall Extension

OLB Project No. 2042-0320, New Orleans, La.

For: The Board of Levee Commissioners

of the Orleans Levee District, New Orleans, La.

EUSTIS ENGINEERING COMPANY
CONSULTING FOUNDATION ENGINEERS
METAIRIE, LA.

Fig. 22

CAPACITY OF PILE GROUPS

$$Q_a = \frac{P \times L \times c}{(FSF)} + \frac{2.6\, q_u \left(1 + 0.2\, \frac{w}{b}\right) A}{(FSB)}$$

In Which:

Q_a = Allowable load carrying capacity of pile group, lb

P = Perimeter distance of pile group, ft

L = Length of pile, ft

c = Average (weighted) cohesion or shear strength of material between surface and depth of pile tip, psf
(c = one-half the unconfined compressive strength)

q_u = Average unconfined compressive strength of material in the zone immediately below pile tips, psf

w = Width of base of pile group, ft

b = Length of base of pile group, ft

A = Base area of pile group, sq ft

(FSF) = Factor of safety for the friction area = 2

(FSB) = Factor of safety for the base area = 3

The values of c and q_u used in this formula should be based on applicable soil data shown on the Summary of Laboratory Test Results tabulations and logs of soil borings for this report. In the application of this formula, the weight of the piles, pile caps and mats, considering the effect of buoyancy, should be included.

Fig. 25

STRATUM	DESCRIPTION	γ	Q - CASE		S - CASE	
			C	ϕ	C	ϕ
(A)	MD-VD SAND	120	0	35	0	35
(B)	VLo-MD SAND	120	0	30	0	30
(C)	Lo SANDY SILT	120	200	15	0	25
(D)	Lo CLAYEY SILT	120	200	15	0	25
(E)	Lo CLAYEY SAND	120	200	15	0	25
(F)	MSt-VSt CLAYS	120	1000	0	0	25
(G)	So-MSt CLAYS	110	500	0	0	22
(H)	ORGANIC CLAYS	90	500	0	0	18
(I)	SHELLS	90	0	35	0	35
(J)	COHESIVE FILL	115	400	0	400	0

γ=EFFECTIVE UNIT WEIGHT IN POUNDS PCF.
C=COHESION IN POUNDS PSF.
ϕ=ANGLE OF INTERNAL FRICTION IN DEGREES.

PIEZOMETER DATA

	P-1	P-2	P-3	GAGE
INSTALLATION DATA:				
ELEV. TOP OF RISER	1.56	5.25	5.63	
ELEV. GROUND SURFACE	-0.44	3.25	3.83	
ELEV. BOTTOM OF SCREEN	-20.44	-20.75	-12.17	
RESULTS OF PUMP TEST:				
K_H - FT/MIN $\times 10^{-4}$	2.6	1.4	0.5	
WATER ELEVATION READINGS:				
27 SEPT. 85	-2.02	-1.21	-1.45	--
30 SEPT. 85	-1.69	-0.88	-1.16	--
1 OCT. 85	-1.61	-0.75	-1.12	--
7 OCT. 85	-1.93	-1.01	-2.22	1.57
14 OCT. 85	-2.12	-1.25	-1.37	1.42

NOTE: ALL ELEVATIONS REFER TO NGVD.
GAGE LOCATED ON SOUTH SIDE OF RAILROAD BRIDGE.

GEOTECHNICAL INVESTIGATION
ORLEANS LEVEE DISTRICT
SEABROOK FLOODWALL EXTENSION
OLB PROJECT NO. 2042 - 0320
NEW ORLEANS, LOUISIANA

CROSS SECTIONS & SOIL PARAMETERS

FOR
THE BOARD OF LEVEE COMMISSIONERS
OF THE ORLEANS LEVEE DISTRICT
NEW ORLEANS, LOUISIANA

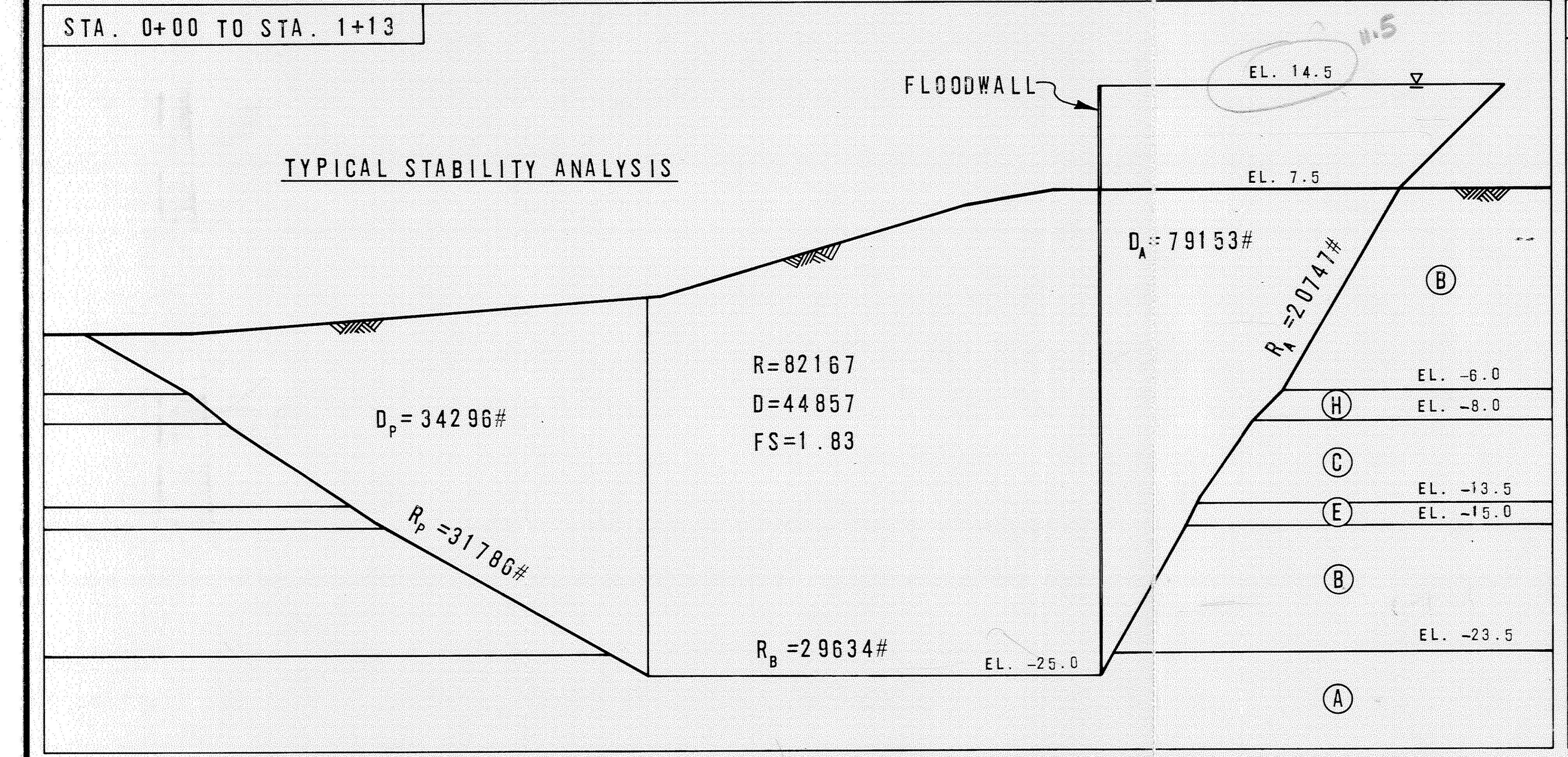
WALDEMAR S. NELSON & CO., INC.
ENGINEERS AND ARCHITECTS
NEW ORLEANS, LOUISIANA

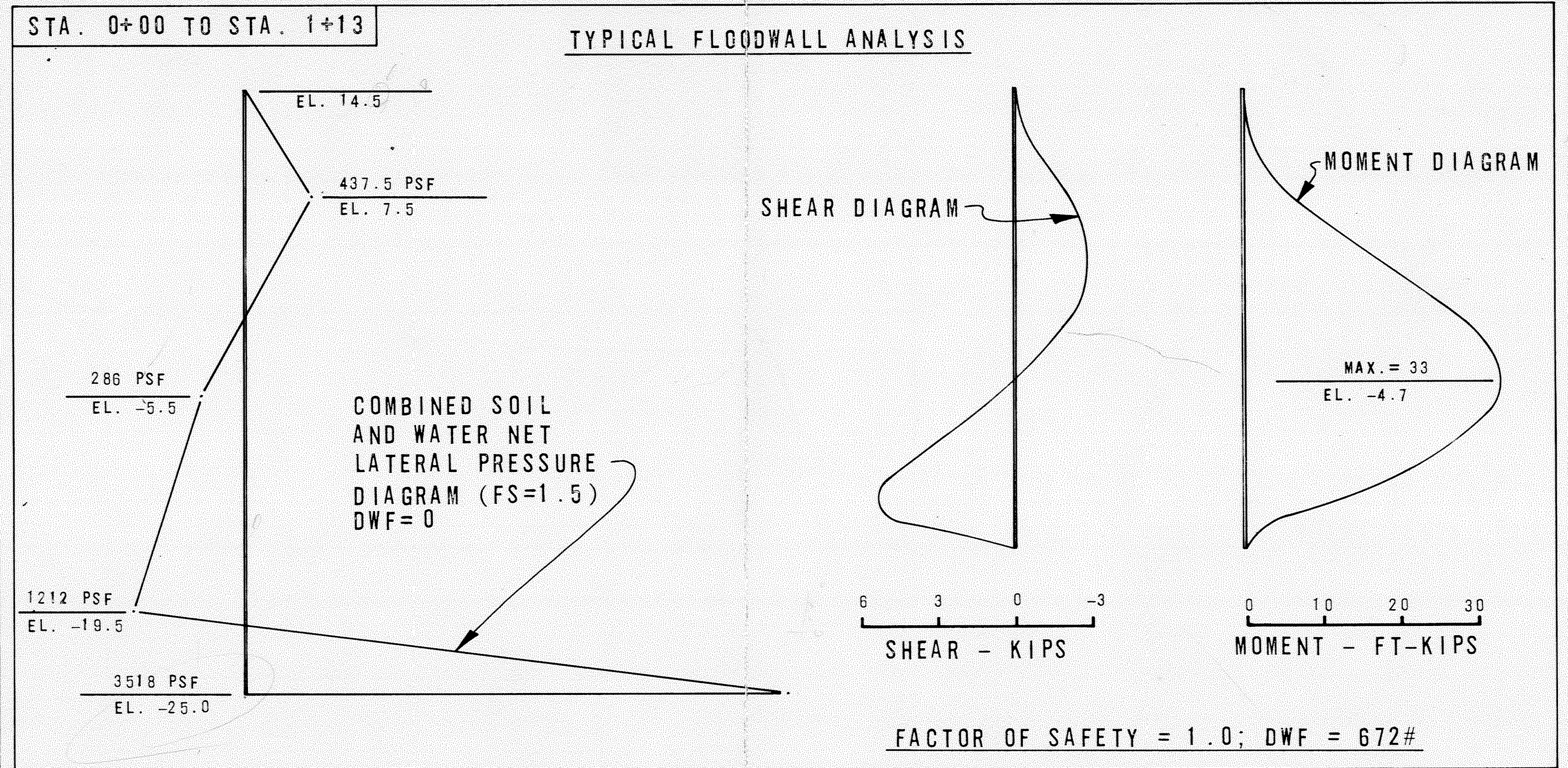
DESIGN ENGINEERING, INC.
METAIRIE, LOUISIANA

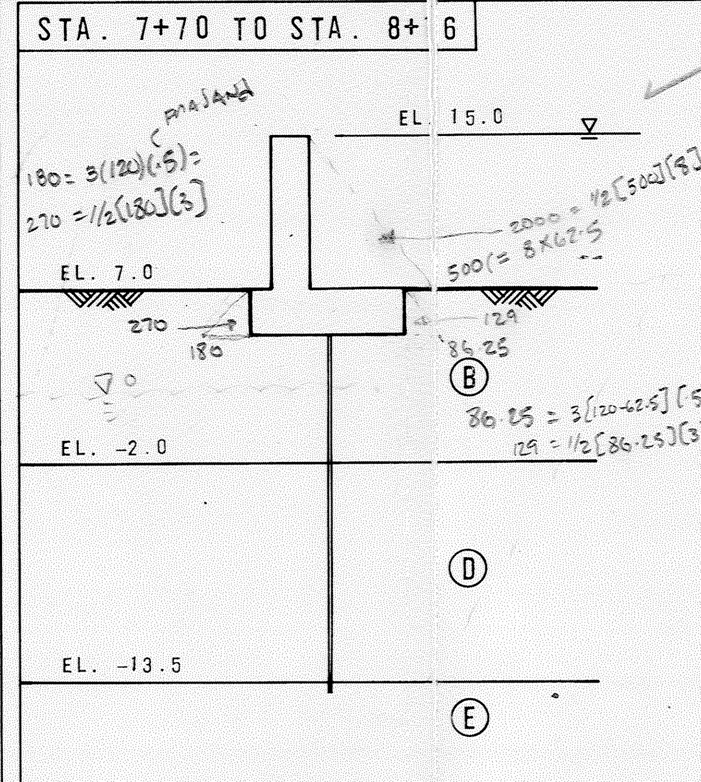
EUSTIS ENGINEERING COMPANY
SOIL AND FOUNDATION CONSULTANTS
OCTOBER 1985 METAIRIE, LA.

FIGURE 23

9219





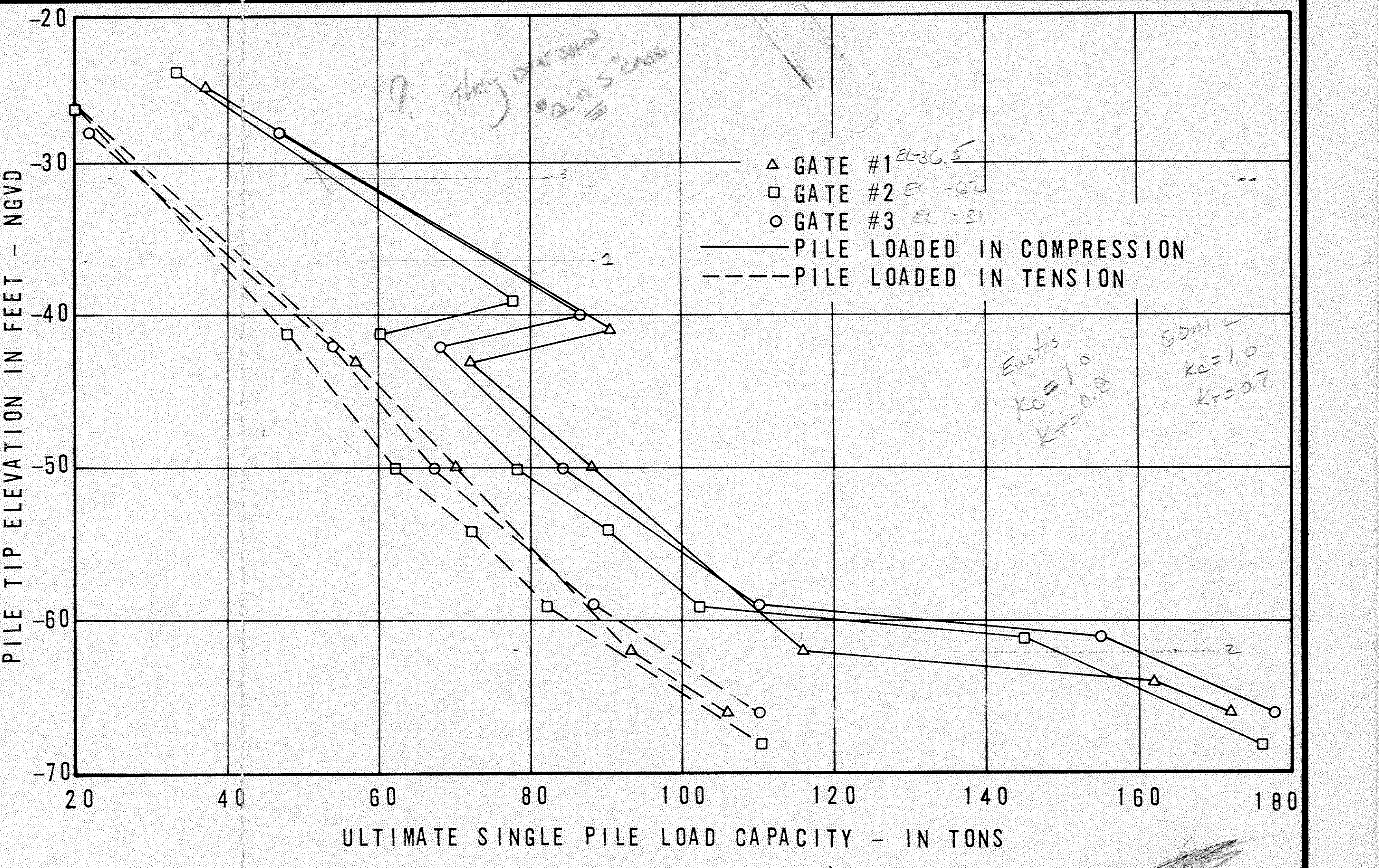


DEEP SEATED ANALYSIS

FAIL. EL.	WEDGES ACT. - PAS.	FORCES - LBS. ΣR	ΣD	ΔE$_C$
4.0	195 - 203	1132	3500	2368
1.0	195 - 203	3279	5008	1729
-2.0	195 - 203	6445	6508	63
-2.07	195 - 203	6543	6543	0
-5.0	195 - 203	10629	8017	-2612

$E_B = 8(62.5)\left[8/2 + 2.5\right] = 3250\#$

NOTE: ΣR INCLUDES FACTOR OF SAFETY = 1.3 APPLIED TO SOIL SHEAR STRENGTHS.

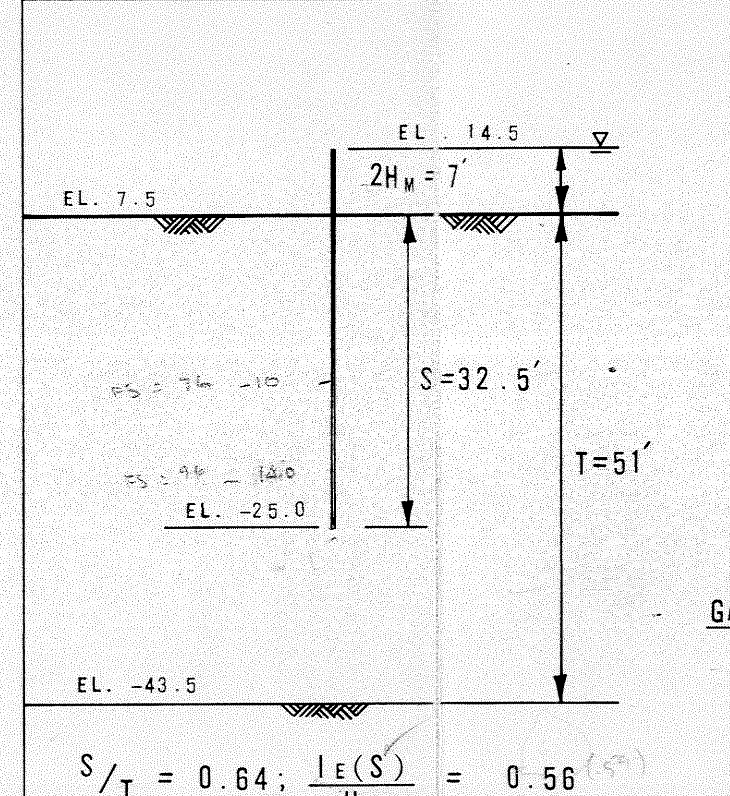


LOCATION	F.E.	WEDGES ACTIVE	WEDGES PASSIVE	FORCES ΣR	FORCES ΣD	FACTOR OF SAFETY
0+00 TO 1+13	-25	200	230	82.2	44.9	1.83
1+13 TO 1+58	-8	195	211	30.2	6.3	4.82
1+58 TO 2+70	-12.5	200	220	39.8	11.9	3.34
2+97 TO 6+10*	-12.5	213	236	42.6	27.7	1.54
6+10 TO 7+15*	-17.5	223	246	54.7	36.3	1.51
7+15 TO 7+70	-17.5	200	224	44.4	24.2	1.83
7+70 TO 8+16	-14	195	217	39.5	12.5	3.16
8+16 TO 14+30						*

F.E. FAILURE ELEVATION - NGVD
WEDGES: COORDINATES OF CRITICAL ACTIVE & PASSIVE WEDGES (W.L. @ 200)
FORCES: RESISTING & DRIVING FORCES OF CRITICAL WEDGES (KIPS)
F OF S: FACTOR OF SAFETY FOR POTENTIAL FAILURE TOWARD PROTECTED SIDE
FAILURE TOWARD FLOOD SIDE NOT CRITICAL.
* ANALYSIS NOT REQUIRED BY COMPARISON TO OTHER LOCATIONS.
ǂ ANALYSIS INCLUDES 6" OVERBUILD FOR FUTURE SETTLEMENT.

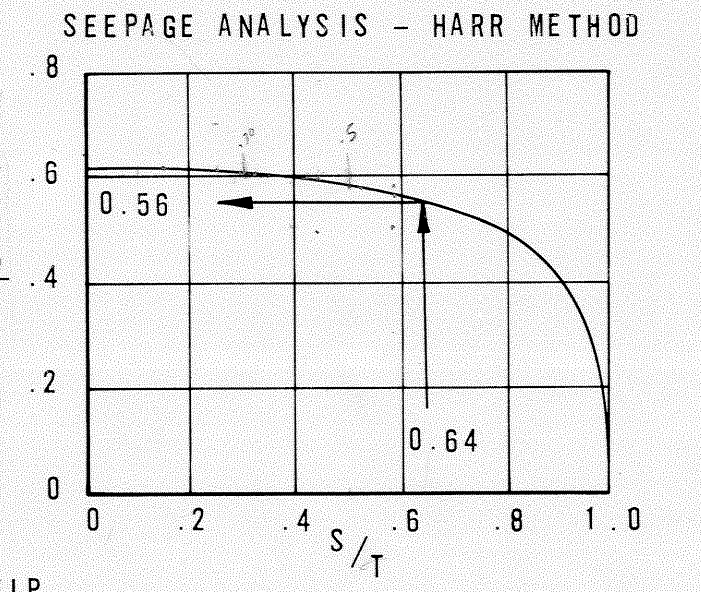
LOCATION	DWF	TIP EL. - NGVD FS=1.5*	FS=1.25	FACTOR OF SAFETY=1 M.B.M. @ EL.	S.D.	E.G.
0+00 TO 1+13	672	-25.0	-21.5	33.0 @ -4.7	1.51	15
1+58 TO 2+70	480	-7.0	-6.5	11.0 @ 2.4	0.18	12
7+15 TO 7+70	576	-17.0	-15.0	22.0 @ -1.1	0.71	14
8+16 TO 8+67	624	-17.0	-15.0	22.0 @ -1.1	0.71	14
9+04 TO 14+30ǂ	672	-14.5	-13.5	25.0 @ -0.5	0.76	10
9+04 TO 14+30#	240	3.0	4.0	2.5 @ 8.4	0.01	11

DWF: DYNAMIC WAVE FORCE = 96 PSF/FT FURNISHED BY C OF E.
TIP EL.: BOTTOM ELEVATION OF SHEETPILES.
M.B.M.: MAXIMUM BENDING MOMENT IN SHEETPILES @ ELEVATION (NGVD).
S.D.: SCALED DEFLECTION $\times 10^{10}$; MUST DIVIDE BY E (PSI) $\times$ I(IN^4) TO GET DEFLECTION AT TOP OF SHEETPILES IN INCHES.
E.G.: FACTOR OF SAFETY WITH RESPECT TO EXIT GRADIENT (HARR METHOD).
* DOES NOT ENCLUDE DYNAMIC WAVE FORCE.
ǂ BASED ON LOWEST GROUND SURFACE = EL. 8.5 NGVD.
\# BASED ON HIGHEST GROUND SURFACE = EL. 13.0 NGVD.



$S/T = 0.64$; $\frac{I_E(S)}{H_M} = 0.56$

$I_E = 0.06$; $FS = 1/I_E = 15.5$



GATE	TIP ELEV.	T	H$_M$	S	I$_E$	FS
1	-4.0	53'	2.5'	13.5'	0.115	8.0
2	-14.0	54'	4.0'	21.0'	0.114	8.1
3	-5.5	52'	2.75'	15.0'	0.114	8.1

GATE #1 STA. 1+13 TO STA. 1+58
GATE #2 STA. 7+70 TO STA. 8+16
GATE #3 STA. 8+67 TO STA. 9+04

GEOTECHNICAL INVESTIGATION
ORLEANS LEVEE DISTRICT
SEABROOK FLOODWALL EXTENSION
OLB PROJECT NO. 2042 - 0320
NEW ORLEANS, LOUISIANA

SUMMARY OF ANALYSES

FOR
THE BOARD OF LEVEE COMMISSIONERS
OF THE ORLEANS LEVEE DISTRICT
NEW ORLEANS, LOUISIANA

WALDEMAR S. NELSON & CO., INC.
ENGINEERS AND ARCHITECTS
NEW ORLEANS, LOUISIANA

DESIGN ENGINEERING, INC.
METAIRIE, LOUISIANA

EUSTIS ENGINEERING COMPANY
SOIL AND FOUNDATION CONSULTANTS
METAIRIE, LA.
OCTOBER 1985

FIGURE 24