GRAND ISLE, LOUISIANA AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)

DESIGN MEMORANDUM NO. 1, GENERAL DESIGN

L,180
-625

Prepared by:

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

May 1972

D.O

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

IN REPLY REFER TO
LMNED-PP

5 May 1972

SUBJECT: Grand Isle, La. and Vicinity (Larose to Vicinity of Golden Meadow) Design Memorandum No. 1 - General Design

Division Engineer, Lower Mississippi Valley
ATTN: LMVED-TD

1. The subject general design memorandum has been prepared generally in accordance with ER 1110-2-1150 with the exception of the Phase I--Phase II requirements and is submitted herewith for review and approval.

2. The environmental impact statement is scheduled to be submitted to CEQ in October 1972.

3. Approval of this general design memorandum is recommended.

Richard L. Hunt

1 Incl (16 cys) fwd sep
GDM No. 1

RICHARD L. HUNT
Colonel, CE
District Engineer

GRAND ISLE, LOUISIANA AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1, GENERAL DESIGN

STATUS OF DESIGN MEMORANDUMS

Design Memo No.	Title	Status
1	Grand Isle, Louisiana and Vicinity (Larose to Vicinity of Golden Meadow) Design Memorandum No. 1, General Design	May 72 (actual)
2	Grand Isle, Louisiana and Vicinity (Larose to Vicinity of Golden Meadow) Design Memorandum No. 2, Detail Design Larose Floodgate	Nov 73 (est)
3	Grand Isle, Louisiana and Vicinity (Larose to Vicinity of Golden Meadow) Design Memorandum No. 3, Detail Design Golden Meadow Floodgate and Roadgate	Dec 73 (est)

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APPENDIXES

GRAND ISLE, LOUISIANA AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1, GENERAL DESIGN

PERTINENT DATA

Location of Project		Along Bayou Lafourche from Larose to two miles south of Golden Meadow, Lafourche Parish
Datum plane		Mean sea level
Climatologic data		
Temperature:	Monthly means	
	Maximum	82 degrees Fahrenheit
	Minimum	57 degrees Fahrenheit
	Average annual	70 degrees Fahrenheit
Annual precipitation:	Maximum	87.5 inches
	Minimum	33.0 inches
	Average annual	62.9 inches
Hydraulic design criteria - tidal		
Design hurricane		
Frequency		1 in 100 years
Central pressure index		28.00 inches of mercury
Maximum 5-min. average wind speed		92 m.p.h.
Hydraulic design criteria-drainage structures		
Assumed Manning's "n" value		0.021
Entrance loss coefficient, k_e		0.2
Exit loss coefficient, k_o		1.0
Hydrologic design criteria-drainage		
Design rainfall frequencies		
For agricultural lands		1 in 5 years
For residential lands		1 in 25 years
For drainage structure stilling basin		1 in 100 years

PERTINENT DATA (Cont'd)

Levees	
Method of construction	Dragline (semi-compacted cast embankment)
Length (approximate)	43 miles
Crown elevation	8.5 to 13.0 feet(1)
Crown width	10 feet
Drainage Facilities	
Borrow pit location	Protected side
Drainage outlet	Metal culvert with both automatic and manual gates and concrete wingwalls
Floodgates	
Type gates	Steel sector gates in concrete navigation opening
Road gates	
Type gates	Steel with rollers
Estimated first cost	
Federal	$14,770,000
Non-Federal	6,330,000
Total	$21,100,000
Economics	
Average annual benefits	$ 4,112,100
Average annual charges	984,700
Benefit-cost ratio	4.2 to 1

(1) Elevations herein are in feet referred to mean sea level unless otherwise noted.

GRAND ISLE, LOUISIANA AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
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PROJECT AUTHORIZATION

1. Project authorization. Public Law 298-89th Congress, 1st Session approved 27 October 1965 authorized the project "Grand Isle, La., and Vicinity" to provide protection in accordance with the recommendations of the Chief of Engineers in his report entitled "Grand Isle and Vicinity, La.," and contained in House Document No. 184, Eighty-ninth Congress, 1st Session. The report of the Chief of Engineers submitted for transmittal to Congress the report of the Board of Engineers for Rivers and Harbors, accompanied by the reports of the District and Division Engineers. The Chief of Engineers in his report concurred in the recommendations of the Board of Engineers for Rivers and Harbors which are as follows:

". . . Accordingly, the Board recommends authorization for construction of improvements for the prevention of hurricane tidal damages and loss of life in the area between Larose and Golden Meadow, Louisiana, consisting of:

"A loop levee approximately 36 miles in length along both banks of Bayou Lafourche;

"Enlargement of about 3 miles of the existing levee at Golden Meadow;

"Floodgates for navigation in Bayou Lafourche at the upper and lower bayou crossings;

"Approximately 8 miles of low interior levees to regulate intercepted drainage, and

"Seven drainage structures;

"all generally in accordance with the plans of the District Engineer and with such modifications thereof as in the discretion of the Chief of Engineers may be advisable, at an estimated cost of $7,857,000, consisting of $6,323,000 for construction and $1,534,000 for lands, rights-of-way, and relocations. . ."

2. Purpose and scope. The purpose of this general design memorandum is to:

a. Present the essential data, assumptions, criteria and computations for developing the plan, design and costs for the project in sufficient detail to provide an adequate basis for preparing plans and specifications for the first lift levee and floodwalls, exclusive of the floodwalls associated with the floodgates at Larose and Golden Meadow, without additional design analyses; and

b. Present an economic reanalysis of the project based on current criteria.

3. Local cooperation.

a. Local cooperation specified in authorizing document (H.D. 184). Conditions of local cooperation specified in the report of the Board of Engineers for Rivers and Harbors, and concurred in by the Chief of Engineers, are as follows:

". . . that prior to construction local interests give assurances satisfactory to the Secretary of the Army that they will:

"a. Provide without cost to the United States all lands, easements, and rights-of-way, including borrow areas and spoil disposal areas, and accomplish alterations to roads, pipelines, cables, wharves, oil wells, and any other facilities necessary for construction of the project, all at an estimated cost of $1,534,000;

"b. Bear 30 percent of the total project cost, a sum presently estimated at $2,357,000 to consist of the items listed in subparagraph a above and a cash contribution presently estimated at $823,000, or equivalent work specifically undertaken as an integral part of the project after authorization and in accordance with construction schedules as required by the Chief of Engineers;

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

"d. Maintain and operate all the works after completion in accordance with regulations prescribed by the Secretary of the Army; and "e. Prevent any encroachment on ponding areas unless substitute storage capacity or equivalent pumping capacity is provided promptly without cost to the United States."

b. Local cooperation specified by legislation subsequent to project authorization. In addition to the items of local cooperation specified above, local interests must comply with the provisions of Section 221 of Public Law 91-611 and Sections 210 and 305 of Public Law 91-646.

(1) Section 221 of Public Law 91-611 provides that prior to the commencement of the construction of any water resources project by the Secretary of the Army, acting through the Chief of Engineers, local interests will furnish as part of its required assurances of local cooperation for the project an agreement (a) to pay damages to the United States, if necessary, in the event local interests fail to perform the terms of its required assurances of local cooperation; and (b) that such assurances of local cooperation granted to the United States for the project shall be enforceable by the United States in the appropriate district court of the United States. This section shall not apply to any project, the construction of which was commenced before 1 January 1972.

(2) Public Law 91-646, 91st Congress, 1st Session, authorized an act to provide for uniform and equitable treatment of persons displaced from their homes, businesses, or farms by Federal and federally assisted programs and to establish uniform and equitable land acquisition policies for Federal and federally assisted programs.

INVESTIGATIONS

4. Investigations made in connection with the project document. Studies and investigations made in connection with the project document (H.D. No. 184, 89th Congress, 1st Session) consisted of: research of information which was available from previous reports and existing projects in the area; extensive research in history and records of hurricane damages and characteristics of hurricanes; extensive tidal hydraulics investigations; an economic survey; and design and cost studies. A public hearing was held at Morgan City, Louisiana on 15 March 1956, to determine the views of local interests. Federal and state agencies were consulted. The District Engineer made a personal reconnaissance of the area.

5. Investigations made subsequent to project authorization. Studies and investigations made subsequent to project authorization include:

a. Aerial and topographic surveys of the project area;

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

c. Tidal hydraulic studies required for establishing design grades for protective works based on revised hurricane parameters furnished by the U. S. Weather Bureau (now the National Weather Service) subsequent to project authorization;

d. Hydraulic studies required for design of interior drainage;

e. Detailed design studies for construction of levees, and structures;

f. Determination of real estate requirements and costs.

g. Cost estimates for levees, structures and relocations;

h. Economic studies for evaluating justification for recommended works; and

i. Environmental studies required by the National Environmental Policy Act of 1969.

LOCAL COOPERATION

6. Local cooperation requirements. The items of local cooperation are listed in paragraph 3. Essentially local interests are required to furnish all lands, easements, rights-of-way; accomplish all necessary alterations and relocations; bear 30 percent of the total cost, inclusive of lands, damages, and relocations, and a cash contribution or equivalent work; hold and save the United States free from damages due to the construction works; maintain and operate all works after completion; prevent an encroachment on ponding areas unless equivalent storage or pumping capacity is provided,and comply with the provisions of Section 221 of Public Law 91-611 and Sections 210 and 305 of Public Law 91-646.

7. Status of local cooperation. The required Act of Assurance and authorization resolution, both executed by the Lafourche Parish Police Jury on 8 February 1967 were accepted for and on behalf of the United States on 15 March 1967. On 14 June 1967 the Police Jury amended its original Act of Assurance to correct the estimated cost of non-Federal lands and relocations from $1,534,000 to $1,910,000. The assurances will be revised to include the additional items of local cooperation required by Public Law 91-611 and Public Law 91-646. The principal officers in Lafourche Parish responsible for the fulfillment of the conditions of local cooperation required by the authorizing and subsequent Acts are as follows: Lafourche Parish Police Jury, Thibodaux, Louisiana - Mr. Thomas M. Barker, President, Mr. Charles O. Naquin, Vice-President, and Mr. G. G. Zimmerman, Secretary-Treasurer.

8. Views of local interests. The Lafourche Parish Police Jury represents local interests and is in agreement with the general plan. Concurrence has also been expressed by the South Louisiana Tidal Water Control Levee District.

9. Estimated costs to local interests. The total cost for constructing the project to be borne by local interests is estimated to be $6,330,000, which includes $2,850,000 for lands, damages and relocations, and a cash contribution or equivalent work valued at $3,480,000. Details of the estimate are shown in Appendix C, Table C-1.

LOCATION OF PROJECT AND TRIBUTARY AREA

10. Location of project. The project area is located along Bayou Lafourche and includes lands on both banks of the bayou from Larose to two miles south of Golden Meadow. A general plan, index map and vicinity map are shown on plate 1.

11. Tributary area.

a. The project area comprises approximately 32,400 acres. Principal towns in the project area include Golden Meadow at the South end (population 2,681-1970 Census)and Larose at the North end (population 4,267-1970 Census). Total population within the project area between Larose and Golden Meadow is 17,200 (1970 Census).

b. Transportation facilities serving the area include Louisiana Highway 1, Louisiana Highway 308, Bayou Lafourche, and the Gulf Intracoastal Waterway.

c. Economic activity in the project area is quite varied. Extensive gas and oil fields exist in and adjacent to the project area, and commercial fishing, agriculture, and industries, such as shipyards for the manufacture and repair of shrimp and oyster fishing vessels and other work boats, ice and cold storage plants, seafood processing plants, machine shops, the manufacture and leasing of marsh buggies for the oil industry, and oil storage and barge loading facilities, are important activities.

PROJECT PLAN

12. Project Plan. The current plan of protection presented herein and indicated on plate 1 provides for constructing hurricane protection levees with appurtenant features from Larose to South Golden Meadow. Major components of the plan are as follows:

a. A loop levee will extend approximately 21 miles on the west bank of Bayou Lafourche, including about 3 miles of the existing levee at Golden Meadow, and 22 miles on the east bank of the bayou. The levee system will have a net grade of elevation 13.0 feet mean sea level [1] at Golden Meadow and will vary to elevation 8.5 at Larose.

b. Floodwalls will be provided where levee construction is not possible because of the congested nature of improvements and limited available right-of-way and at transitions from levees to roadgates or floodgates. The types of floodwalls are inverted T-type, single I-wall, as dictated by their function and structural requirements.

c. Access into the protected area will be provided by floodgates in Bayou Lafourche - one at Larose and one at Golden Meadow. Each gate will have a width of 56 feet. The sill elevations are minus 10.78 feet and minus 13.78 feet at the Larose and Golden Meadow gates, respectively.

d. Land access into the protected area at Larose will be provided by Louisiana Highways 1 and 308 without modification, since the finished grades of both roadways are above the predicted flood level. Access at Golden Meadow will be provided by raising Louisiana Highway 1 to elevation 5.0 and a 44-foot wide gap. A steel roller gate will be provided

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[1] All elevations used herein are in feet mean sea level (M.S.L.), unless otherwise noted.

to close this gap during hurricanes. The gap will not be closed until the flood waters approach elevation 5.0, at which time Highway 1 south of Golden Meadow will be impassable for ordinary vehicular traffic. However, to provide for possible emergencies, a bypass shell surfaced ramp will be provided over the levee on the west side of the bayou.

Two overhead roller type road gates will also be provided at gaps in the levee for access to oil installations west of the Town of Golden Meadow. Both gates will have 16 feet overhead clearance. The northernmost at Station 206+50, ring levee traverse, is proposed to be 28 feet wide at a skewed crossing and the southernmost at Station 141+50, ring levee traverse, is 20 feet wide.

e. Construction of the loop levee would interrupt the natural drainage which is away from the bayou banks to the lower-lying marshes on either side of the waterway. A landside levee borrow pit drainage channel and a system of eight drainage structures will provide gravity drainage of the area within the levee. The existing pumping station for Golden Meadow now provides adequate drainage from within the existing ring levee that protects the town. Some alteration of the discharge pipelines to accommodate the protection facilities is proposed.

f. Construction of the protection system will require the relocation of 14 overhead powerlines, 96 known oil and gas pipelines varying from 1 through 20 inches in diameter, local roadway relocations (ramps over the proposed levees), a permanent emergency road by-pass at La. Hwy. 1 road gate, and a temporary road location at each of 2 road gates west of Golden Meadow.

DEPARTURES FROM PROJECT DOCUMENT PLANS

13. General. The project document plan (H.D. 184, 89th Congress, 1st Session) provided for the levee system to terminate at Golden Meadow, for the Golden Meadow floodgate to be constructed in a bypass channel adjacent to the bayou on the east bank, and for ramping Louisiana Highway 1 over the levee south of Golden Meadow. The following changes which are considered to be within the discretionary authority of the Chief of Engineers were made to the project document plan:

a. Extension of levee systems. (1) The Lafourche Parish Police Jury, by resolution dated 10 June 1967, requested ". . . that the levee be extended approximately two 2 miles below the south corporate limit of Golden Meadow ..." By letter dated 28 June 1967, the Louisiana Department of Public Works, in behalf of the Lafourche Parish Police Jury, forwarded a map showing the alignment desired by local interest.

(2) Design studies made for this general design memorandum indicated that the requested extension of the levee was economically justified incrementally, and accordingly the levee extension has been included in this design memorandum as a departure from the project document plan. The estimated cost for extending the levee is shown on Table C-3, Appendix C. The estimated additional annual benefits are shown on Table C-12, Appendix B.

b. Golden Meadow floodgate. For reasons of economy the bypass channel at the Golden Meadow end of the project area has been eliminated and the floodgate located in the bayou. Cost comparison between the project document plan and the revised plan is presented on Table C-4, Appendix C.

c. Louisiana Highway 1. The design speed for Highway 1 is 60 m.p.h. The required finished grade to bring the highway over the levee would be the least elevation 14.5. To provide the required nonpassing sight distance for the design speed, grades of 2.85% with 300 feet long sag curves and a crest curve 900 feet long are required. This would require the reconstruction of about 1,800 feet of the highway. Since the elevation of the highway is greater than that of the levee, the maximum base width of the highway embankment would be at least as great as that of the levee which is approximately 370 feet. Because of the importance of this highway as an evacuation route for inhabitants of Grand Isle and those between Grand Isle and Golden Meadow, a high type detour road would have to be constructed and maintained while the new highway was under construction. The completion time for the levee, which would be the same for the highway, is four years plus construction time. Access to adjacent property from the highway would not be feasible for several hundred feet on either side of the levee, possibly necessitating a frontage road. The great width of right of way required would destroy all culture in the area. Because of all of these objectionable features and the obvious greater cost of bringing the highway over the levee, the project document plan was revised to provide for a crossing at grade through a gap in the levee described in paragraph 12.

d. Floodwalls. (1) The extensive oil installations, development and existing drainage facilities west of Golden Meadow allow limited available right-of-way for hurricane protection facilities. As a result, floodwalls are provided at two locations along the Golden Meadow ring levee. A roadgate will be provided in each of the floodwalls to maintain access to the oil installations outside of the levee.

(2) Also, in the vicinity of the north closure levee at Larose, limited area and expensive rights-of-way dictate that a floodwall be used.

HYDROLOGY AND HYDRAULICS

14. General. Detailed results of the hydrology and hydraulic analysis for the project are presented in appendix A in three sections. Section I presents the climatology and hydrology of the area. Section II presents detailed descriptions and analyses of tidal hydraulic design. Included in the descriptions and analyses are the essential data, assumptions, and criteria used for studies reported herein which provide the bases for determining the wind tide level, wave runup, overtopping, and frequency of the design hurricane. Section III furnishes information relative to the interior drainage for the project area. Section IV presents the bibliography.

a. Hurricanes of record. Flooding in or near the project area has occurred many times since 1900. However, reliable surge heights are available only since 1909. Some of the hurricanes which caused major flooding in or near the project area occurred in 1893, 1909, 1915, 1956 (Flossy), 1961 (Carla), 1964 (Hilda), and 1965 (Betsy). Some observed stages experienced at or near the project area as a result of these hurricanes were: 1909, 5.0 feet at Golden Meadow, 8.0 feet at Leeville, and 15.0 feet at Seabreeze; 1915, 5.5 feet at Golden Meadow, 9.0 feet at Leeville and Grand Isle; 1956 (Flossy), 3.3 feet at Golden Meadow, 6.5 feet below Leeville, and 8.0 feet at Grand Isle; 1961 (Carla), 3.7 feet at Golden Meadow; 1964 (Hilda), 4.7 feet at Golden Meadow, 5.5 feet at Leeville, and 9.8 feet at Cocodrie; and 1965 (Betsy), 5.4 feet at Leeville and 8.8 feet at Grand Isle.

b. Frequencies. Hurricanes with tracks having major components from the south or west generate stages which are most critical to the project area. Records indicate that approximately two-thirds of all hurricanes approach from the south and west while one-third approach from the east. The average azimuth of tracks approaching from the south and west is 180°, while the average azimuth of tracks approaching from the east is 117°. Therefore, in the computation of stage-frequencies, 67 percent or two-thirds of the probability for stages computed for hurricanes approaching from the south and west and 33 percent or one-third of the probability for stages computed for hurricanes approaching from the east were used in determining stage-frequencies for the project area. The final stage-frequency curve depicts the probability of equal stages for both groups of tracks added arithmetically to develop a curve representing a probability of stages for hurricanes from all directions.

c. Design hurricane. A hurricane that would produce a 100-year stage was selected as the design hurricane for the project area. A hurricane of lesser intensity would require a lower levee grade and would expose the protected areas to hazards of life and property that would be disastrous in the event a hurricane with the intensity and destructive capability of the design hurricane or a greater hurricane occurred. The design hurricane critical to Golden Meadow and vicinity, the lower part of the project area, has a central pressure index of 28.1 inches of mercury and a maximum windspeed of 89 m.p.h. at a radius of 30 nautical miles. The forward speed of the hurricane is 10 knots.

d. Design hurricane wave characteristics. The data used to determine design hurricane wave characteristics for the protective system in the vicinity of Golden Meadow are as follows: fetch length, 5 miles; windspeed, 77 m.p.h.; stillwater level, 10.2 feet; and average depth of fetch, 7.2 feet. From this data, it was determined that the design wave height for levee design is 3.4 feet. Other portions of the project area are farther inland from the coast than Golden Meadow. Therefore, the hurricane parameters and wave characteristics become less severe as the distance from the coast increases.

e. Design elevation of protective structures. Using the data in paragraph d above, the design runup on the levee in the vicinity of Golden Meadow was computed to be 2.8 feet, which, when superimposed on the design stillwater elevation of 10.2 feet, determined a design levee height of 13.0 feet

The design elevation of floodwalls is also at 13.0 feet. Some slight overtopping of the walls would be evident during the occurrence of a design hurricane, but such overtopping would be minimal and would not endanger the integrity of the project. As the alinement of the levee progresses away from the coast, the design height of the levee decreases to a minimum elevation of 8.5 feet at Larose.

f. Interior drainage. Evacuation of storm water runoff is to be accomplished by gravity drainage systems operating during periods of normal water surface elevations outside the levee enclosure. Flap gates and sluice gates will be provided to prevent a backflow into the project area during periods of high water on the exterior of the enclosure. Inflows to each drainage area was computed using synthetic inflow hydrographs for the 5-year, 25-year, and 100-year 24-hour storms applied to the characteristics of the drainage area. Rainfall for these storms amounted to 7.90, 10.85 and 13.70 inches respectively. Using the method of flood routing the number of pipes for drainage structures 1, 2, 3, 4, 5, 6, 7 and 8 were calculated to be 7, 3, 2, 4, 4, 5, 2 and 1 respectively. During periods of intense rainfall, water surface elevations within the levees will increase due to a "heading up" at the drainage structures. This causes minor flooding of the low lying areas. However, agricultural lands will be flooded by the design storm only in areas 1 and 6 where the minimum elevation of agricultural lands are 1.3 feet and 2.0 feet and the maximum sump pool elevations are 1.62 feet and 2.02 feet. This slight flooding will not cause any measurable damage because of the short duration of inundation.

GEOLOGY

15. Physiography. The project area is situated on the deltaic plain of the Mississippi River, which is a region of extremely low relief. Specifically, the area is situated on an ancient lobate delta of the Mississippi River known as the Lafourche delta. Principal physiographic features of the area are natural levee ridges which mark the position of ancient courses of the Mississippi River and its distributary channels, and marshlands that lie between the natural levee ridges. Elevations of the crests of the natural levee ridges range from about 8.0 at the northern edge of the project area to about elevation 3.0 at the southern extremity. The marshlands are generally at elevations 0.0 to 1.0.

16. General geology. The project area was created during the advance of the Lafourche Delta between 1800 and 1000 years ago. At this delta built outward, complex formations of clay, silt, and sand were deposited along and at the mouths of the numerous distributary channels, and marsh deposits accumulated at the surface in the low areas between the channels. The present Bayou Lafourche built its natural levees during this period of activity as a natural distributary of the present Mississippi River. A predominance of sand and silt is found in the natural levees of the old channels. The subsurface of the marshlands consists of peat and soft organic clays underlain by a deep stratum of clay.

17. Subsidence. The project area is situated near the central portion of the axis of the Gulf Coast Geosyncline where down warping and consolidation of the Quaternary sediments have been occurring concurrently with deposition of these sediments since the end of the Tertiary Period. The present rate of subsidence is estimated to be slightly less than one foot per century.

18. Investigations performed. General type 3-inch diameter and 5-inch core undisturbed borings were made and the samples obtained were tested and analyzed as described elsewhere in this design memorandum.

19. Foundation conditions. The best foundation conditions are on the natural levee ridges. Generally, foundation conditions become progressively worse with increasing distance from these ridges. Foundation conditions are described more in detail elsewhere in this design memorandum.

20. Mineral resources. The U. S. Bureau of Mines has stated that the proposed construction would be beneficial to the numerous mineral industries in the project area. Oil and gas production are found in the project area, and future exploration and production may take place. It is anticipated that this project will not adversely affect existing or future exploration and production or will this existing or future exploration and production adversely affect the project.

21. Conclusions. Levees can be constructed over both the natural levees and marshlands with material obtained from side borrow. Because of the poor subsurface conditions, levees will have to be constructed in several lifts, and structures, except culverts under the levees, will have to be supported on friction piles.

SOILS AND FOUNDATIONS INVESTIGATION AND DESIGN

22. General. This report covers the soils and foundations investigation and design for the levees and floodwalls from Larose to the vicinity of Golden Meadow; the flood gates in Bayou Lafourche at the northern and southern boundaries of the project; and the associated drainage structures.

23. Field investigations.

a. In 1967, eleven (11) 5-inch diameter undisturbed soil borings were made along the levee alignment. Six were made in the levee reach west of Bayou Lafourche, and five in the levee reach east of Bayou Lafourche. One hundred twenty-seven (127) 3-inch diameter general type core borings were made along the levee alignment, fifty-six west of Bayou Lafourche, and seventy-one east of Bayou Lafourche. The borings were made at intervals of approximately 2000 feet along the project alignment. The borings extended in depth to elevations of approximately -35 to -100. Six (6) additional general type borings were made to depths of about 20 feet each in and adjacent to old stream beds east of Bayou Lafourche. The locations of the borings are shown on plates 2 through 25 and the boring logs are shown on plates between 46 and 83.

b. In 1969, five (5) additional 5-inch diameter undisturbed soil borings were made at locations very close to five of the previously drilled undisturbed soil borings. These additional borings, all drilled to approximately elevation -100, were designated as Borings 19AUW, 45 AUW, 63AUW, 16AUE, and 61AUE, and were located, respectively, near the previous borings designated as 19UW, 45UW, 63UW, 16UE and 61UE.

24. Laboratory tests.

a. Soil mechanics laboratory tests consisting of consolidation (C), unconfined compression (UC), unconsolidated undrained triaxial compression (Q), consolidated-undrained triaxial compression (R), and consolidated-drained direct shear (S) were performed on representative soil samples from the 5-inch undisturbed borings. Other related tests, such as natural water content, unit weight, and Atterberg liquid and plastic limits tests, were also performed on selected samples.

b. Natural water content, unit weight, and unconfined compression shear tests were performed on many of the samples obtained from the general type borings. Atterberg limits and grain size analyses were also performed on selected samples from the general type borings.

c. The location and results of laboratory tests for the 5-inch diameter undisturbed borings are shown on plates 46 through 77. The location and results of laboratory tests on samples obtained from the general type borings are shown on plates 78 through 83.

25. Foundation conditions. The subsurface conditions along the project alignment are shown on the generalized soil profiles on plates 44 and 45. The generalized soil profile on plate 44 follows the alignment of the west levee beginning at its northern terminus at about Station 789+53 on the west traverse and extending along the proposed levee alignment to its southern terminus near Bayou Lafourche at approximately Station 225+00 on the south traverse. The generalized soil profile for the east levee shown on plate 45 begins at the northern terminus of the east levee near Bayou Lafourche at approximately Station 0+00 on the east traverse and extends along the proposed alignment of the east levee to its southern terminus near Bayou Lafourche at approximately Station 230+00 on the south traverse.

a. Soil conditions - west levee. Reference to the generalized soil profile on plate 44 and to the detailed logs of borings on plates 46 through 57, 68 through 73 and 78 through 80 shows that the predominant soil type for this entire reach is fat clay (CH), which varies in consistency from very soft at or near the ground surface to medium or stiff at elevations of -80 to -100. For approximately one-third of this levee reach, these fat clays are exposed on the surface. For the remainder of the reach, the surface soils consist principally of peat (Pt) or organic clays (OH). Where encountered, the peats and organic clays generally terminate at elevations varying from about -3 to -10. Relatively thin strata of silt (ML), silty sand (SM), and clayey sand (SC) are encountered throughout much of the alignment of the west levee, primarily at elevations between -10 and -20. The most significant stratum of these materials extends southerly from approximately Station 170+00 on the west traverse to approximately Station 120+00 on the south traverse, and consists of silty sand generally encountered at elevations varying from about -26 to -35 and terminating at elevations varying from -37 to -43. Minor strata of very soft to soft lean clays (CL) occur in the reach south of Station 220+00 on the west traverse.

b. Soil conditions - east levee. (1) Reference to the generalized soil profile shown on plate 45 and to the detailed logs of borings shown on plates 58 through 67, 74 through 77, and 81 through 83 shows that the predominant soil type along the alignment of the east levee is also fat clay (CH) which begins at or near the ground surface and extends to the final depths of the borings at about elevation -100. The consistency of these CH materials ranges from very soft near the ground surface to medium to stiff at elevation -100. In the reach from approximately Station 0+00 to Station 635+00 on the east traverse, the (CH) materials are not encountered at the surface, but are overlain by peat (Pt) and organic clays (OH) which extend to elevations ranging from about -3 to -13. From Station 635+00 to about Station 715+00, east traverse, a stratum of very soft to soft lean clay (CL) is encountered at the surface and extends to elevations of approximately -4 to -7. From Station 715+00 to the southern terminus of the east levee, the surface materials consist principally of peat (Pt) and organic clays (OH) extending to elevations of -1 to -7.

(2) Intermittent strata of loose silt (ML), silty sand (SM) and clayey sand (SC) are encountered throughout the entire reach of the east levee as are relatively minor strata of very soft to soft lean clays (CL).

26. Types of protection. In general the protection will consist of conventional earthen levees. Where existing conditions are such that insufficient space is available for construction of levees, floodwalls will be utilized. Floodwall roadgate monolith structures will be used to permit passage of roads. Closures in Bayou Lafourche at Larose and Golden Meadow will be made by floodgates. Access to the floodgates will be by way of the shell levees shown on the plates for floodgates at Larose and Golden Meadow. Closure between floodgates and earth levee or adjacent high ground, as at Larose floodgate, will be by I-type floodwalls driven in small shell levees. Inverted T-type floodwalls supported on 12 in. square precast prestressed concrete batter piles will be used for the storage bay of the floodgate monoliths, for two overhead roadway roller gates and for one rail supported roadway gate. An inverted T-type floodwall will be used adjacent to the road gate monolith at La. Hwy. 1 shown in sections A-A and B-B on plate 39. Cantilevered I-walls consisting of steel sheet piling capped with concrete above grade will be used for floodwalls in the vicinity of Station 206+50, ring levee, at the Golden Meadow pumping station; at Larose, and for portions of the floodwall at the Golden Meadow

floodgate. One pedestrian opening in the floodwall at Larose will have provision for needle beam closure.

27. Location of protection. The project alignment is shown on plates 2 through 25. Specific data relative to the design levee sections is shown listed in table 1 and shown on plates 26 through 31.

28. Stability of levees and floodwalls.

a. Stability of levees. Using cross-sections representative of existing conditions along the proposed alignment, the slopes and berm distances for the recommended levees were designed with borrow pits on the protected side except in the reach from Station 720+00 to Station 845+00 (east traverse) where the borrow pit will be on the flood side. The stability of the levees was determined by the Method of Planes using the design (Q) shear strengths as shown on the plots of soil data on plates 46 through 77. A minimum factor of safety with respect to the specified design shear strengths of approximately 1.3 was used for design of the levees. A minimum factor of safety of approximately 1.5 was used in determining borrow pit locations and slopes. Levee design sections developed from these analyses are shown on plates 26 through 31.

b. Stability of I-type floodwalls. The stability and required penetration of the sheet pile below the earth surface were determined by the Method of Planes using the (S) shear strengths. The floodwalls were programmed and the analyses were run on computer. A factor of safety of 1.5 and 1.25 was used for the static loading and the static plus dynamic wave force cases respectively. The factor of safety was applied to the design shear strengths as follows:

$$(C=0)\text{: } \emptyset \text{ developed} = \tan^{-1} \frac{(\tan \emptyset \text{ available})}{(\text{factor of safety})}.$$

Using the resulting shear strengths, net horizontal water and earth pressure diagrams were determined for movements toward each side of the sheet pile. Using these distributions of pressures, the horizontal force was equated to zero for various tip penetrations. At these penetrations, summations of overturning moments about the bottom of the sheet pile were determined. The required depths of penetration were determined as those where the summation of moments and forces was equal to zero. Dynamic wave forces were a design factor in the floodwalls below drainage structure no. 5 in the east levee and drainage structure no. 1 in the west levee. The results of hydraulic analysis indicate that these walls will be subjected to the pressures and forces imparted by a "broken wave." One percent of the waves will be equal to or larger than the magnitude of the design wave. The height of these maximum waves average 5.69 feet and a design crest elevation of 13.0 was used in the stability analysis for determining static water pressures. Static water pressure for these same walls without wave force was determined using a still water surface elevation of 10.2. To determine the effect of the dynamic action of the design wave of the wall stability, the dynamic action was applied as a line force acting through the centroid of the dynamic wave action distribution diagram superimposed on the static pressure distribution. It was considered that the time of action of the dynamic design wave force against the wall was insufficient to significantly change the slopes of the lateral earth and water pressure distribution diagrams of the static water level analysis.

29. Foundations for structures.

a. Twelve-inch square prestressed concrete piles will be used to support the highway gap closure structure and untreated timber piles will be used to support the floodgates. Design single pile compression and tension capacities versus tip elevations for piles were determined for locations at which 5-inch diameter undisturbed sample borings were drilled to approximately elevation -100. Design data were determined for the (Q) and (S) shear strengths disregarding the skin friction above elevation -15. In compression, a factor of safety of 1.75 was applied to the shear strengths, and a conjugate stress ratio, K_0 of 1.0 was used in the (S) case for determining the normal pressure on the pile surface. In tension, a factor of safety of 2.0 was applied to the shear strengths, and a K_0 of 0.7 was used in the (S) case. In some instances the (Q) case indicates the least pile capacities, and in other instances the (S) case yields the least result. It is recommended that the minimum value whether (Q) or (S) be used for design. The results of these analyses are plotted on plates 104 through 106.

b. Except in a few instances where piles may be driven to tip bearing in the underlying sand strata, all of the pile foundations will derive support primarily through skim friction. Ultimate supporting capacity of pile groups should be made in accordance with the following formula. A factor of safety of three should be applied to this ultimate to determine the allowable group capacity.

For rectangular groups of piles:

$$Qc = (2.85)(qu)(L)(W)\left(1+0.3(W)/L\right)+(L)(W)(D)(S)$$

Qc = Ultimate capacity of pile group.

qu = unconfined compressive strength.

L = length of rectangle inscribing group of piles.

W = width of rectangle inscribing group of piles.

D = pile penetration depth.

S = average shearing resistance of soil per unit of area, between surface and depth D.

QA = allowable capacity of pile group = Qc/3.

30. Sources of fill material. The proposed levees may be built of the materials obtainable from adjacent borrow pits as shown on plates 2 through 25.

31. Methods of construction.

a. Levee. As indicated in table 2, it is proposed that the levees be constructed in three (3) lifts with an approximate two-year interval between successive lifts. Lift 1 consists of constructing the levee and berms to full net grade and section with construction of the berms preceding levee construction. The levees will be restored to net grade in Lift 2; in Lift 3, the levee crown will be built one (1) foot above net grade. The berms will not be rebuilt after initial placement as part of Lift 1.

b. Drainage structures. It is recommended that installation of the culverts be delayed until completion of levee construction, that is, after completion of Lift 3. Required drainage prior to levee completion should be provided by temporary gaps in the levees near existing drainage outlets. The permanent culverts should be constructed in the completed levee, and they should be cambered to provide for a differential settlement from levee crown to berm equal to the estimated residual settlements shown in table 4. The construction of levee cuts and earthen cofferdam perimeter dikes for culvert installations were designed for the same safety factors as were prescribed for the levee in paragraph 28.a. The cofferdam dikes assume a top elevation of 5.0 and an exterior water surface elevation of 4.5 based on abnormal non-hurricane high tide records. Dewatering inside the earthen cofferdams shall be by wellpoints for drainage structure numbers 1, 2, 4, 5 and 6 and by pumping for numbers 3, 7 and 8. The results of stability analyses are shown on plates 96 through 103.

c. Floodgates. The construction of floodgates is proposed to be done "in the dry" within a cellular sheet pile cofferdam which is dewatered by pumping. Other type cofferdams will be investigated in the feature design memorandum for these structures.

32. Settlements.

a. Construction settlement. Based on foundation conditions determined from the soil borings and consolidation test data from the undisturbed borings, estimates of settlement beneath the levees along the proposed alignment were made for each of the proposed levee sections. Estimates of settlement to occur during the construction period are shown in table 2 for typical reaches of the proposed levees.

b. Borrow ratios. Based on the results of the settlement analyses, computations were made to determine the estimated ratio of borrow material to net levee section for the proposed levee sections. To provide a basis for determining borrow area requirements and rights-of-way limits, both estimated and recommended values of the ratio of borrow to net section for each of the levee sections are shown in table 3. As indicated in table 3, it was assumed that approximately 1.3 cy of excavation would be required to produce 1 cy of fill.

c. Residual settlement. The results of settlement analyses indicate long term residual settlements on the order of 0.5 to 1 foot will occur after completion of construction. The estimated residual settlements derived as a result of the analyses are shown in table 4 for each of the levee sections.

TABLE 1
TABULATION OF DESIGN SECTIONS

Stations		Traverse	Levee Section	Crown Elevation
From	To			
246+32	86+00.58	Golden Meadow	1	13.0
0+11.92	62+50	West	2	13.0
62+50	162+50	West	2	13.0 to 12.5
162+50	172+50	West	Transition	
172+50	232+50	West	3	12.5 to 12.1
232+50	242+50	West	Transition	
242+50	441+00	West	4&5	12.1 to 11.1
441+00	443+00	West	Transition	
443+00	562+50	West	6	11.1 to 10.5
562+50	564+50	West	Transition	
564+50	635+00	West	7	10.5 to 9.5
635+00	643+00	West	Transition	
643+00	720+14	West	8	9.5 to 8.5
720+14	721+14	West	Transition	
721+14	789+53	West	9	8.5
0+00	165+00	East	10	8.5
165+00	170+00	East	Transition	
170+00	405+00	East	11	8.5
405+00	410+00	East	Transition	
410+00	635+00	East	12	8.5
635+00	640+00	East	Transition	
640+00	715+00	East	13	8.5
715+00	720+00	East	Transition	
720+00	845+00	East	14	8.5 to 9.5
845+00	850+00	East	Transition	
850+00	890+00	East	15	9.5 to 10.75
890+00	895+00	East	Transition	
895+00	960+00	East	16	10.75 to 13.0
960+00	1025+00	East	16	13.0
387+00	235+00	South	16	13.0
235+00	100+00	South	17	13.0

TABLE 2

SETTLEMENT DURING CONSTRUCTION OF LEVEES

Golden Meadow Ring Levee Enlargement (Levee Section 1):
Net Grade: 13.0 feet

Lift No.	Time in Years	Settlement in Feet Base	Settlement in Feet In Fill	Settlement in Feet Crown	Elev. in Feet Base	Elev. in Feet Crown
	0				0.0	6.0
1	0 + Construction	0.3			-0.3	13.0
	2	0.9	1.0	1.9	-1.2	11.1
2	2 + Construction	0.1			-1.3	13.0
	4	0.4	0.3	0.7	-1.7	12.3
3	4 + Construction	0.1			-1.8	14.0

Levee Sections 2 and 3:
Net Grade varies from 13.0 to 12.1 feet; tabulation based on 12.5 feet

	0				0.0	4.5
1	0 + Construction	0.5			-0.5	12.5
	2	1.2	1.2	2.4	-1.7	10.1
2	2 + Construction	0.1			-1.8	12.5
	4	0.5	0.4	0.9	-2.3	11.6
3	4 + Construction	0.1			-2.4	13.5

TABLE 2
(Cont'd)

SETTLEMENT DURING CONSTRUCTION OF LEVEES

Levee Sections 4 through 10:
Net Grade varies from 12.1 to 8.5 feet; tabulation based on 10.5 feet

Lift No.	Time in Years	Settlement in Feet			Elev. in Feet	
		Base	In Fill	Crown	Base	Crown
	0				1.0	1.0
1	0 + Construction	0.6			0.4	10.5
	2	1.4	1.4	2.8	-1.0	7.7
2	2 + Construction	0.1			-1.1	10.5
	4	0.6	0.4	1.0	-1.7	9.5
3	4 + Construction	0.1			-1.8	11.5
Levee Sections 11 through 13: Net Grade: 8.5 feet						
	0				1.0	1.0
1	0 + Construction	0.3			0.7	8.5
	2	0.9	1.3	2.2	-0.2	6.3
2	2 + Construction	0.1			-0.3	8.5
	4	0.4	0.4	0.8	-0.7	7.7
3	4 + Construction	0.1			-0.8	9.5

TABLE 2
(Cont'd)

SETTLEMENT DURING CONSTRUCTION OF LEVEES

Levee Sections 14 and 15:
Net Grade varies from 8.5 to 10.75 feet; tabulation based on 10.75 feet

Lift No.	Time in Years	Settlement in Feet			Elev. in Feet	
		Base	In Fill	Crown	Base	Crown
	0				0.0	7.5
1	0 + Construction	0.3			-0.3	10.75
	2	0.6	0.5	1.1	-0.9	9.65
2	2 + Construction	0.1			-1.0	10.75
	4	0.3	0.2	0.5	-1.3	10.25
3	4 + Construction	0.1			-1.4	11.75

Levee Sections 16 and 17:
Net Grade varies from 10.75 to 13.0 feet; tabulation based on 13.0 feet

Lift No.	Time in Years	Settlement in Feet			Elev. in Feet	
		Base	In Fill	Crown	Base	Crown
	0				0.0	0.0
1	0 + Construction	0.5			-0.5	13.0
	2	1.4	2.0	3.4	-1.9	9.6
2	2 + Construction	0.1			-2.0	13.0
	4	0.6	0.5	1.1	-2.6	11.9
3	4 + Construction	0.1			-2.7	14.0

TABLE 3

FACTORS FOR DETERMINATION OF ESTIMATED FILL, ESTIMATED EXCAVATION, AND AVAILABLE BORROW QUANTITIES

Levee Section No.	Lift No.	Volume Ratio: $\frac{\text{Lift}}{\text{Net Section}}$	Assumed Volume Ratio: $\frac{\text{Excavation}}{\text{Fill}}$	Estimated Ratio: $\frac{\text{Excavation}}{\text{Net Section}}$	Recommended Ratio $\frac{\text{Available Borrow}}{\text{Net Section}}$
1	1	1.01			
	2	0.07			
	3	0.06			
	Total	1.14	1.3	1.5	2.0
2-3	1	1.01			
	2	0.04			
	3	0.03			
	Total	1.08	1.3	1.4	2.0
4-10	1	1.04			
	2	0.17			
	3	0.12			
	Total	1.33	1.3	1.7	2.25
11-13	1	1.03			
	2	0.19			
	3	0.15			
	Total	1.37	1.3	1.8	2.25
14-15	1	1.01			
	2	0.03			
	3	0.04			
	Total	1.09	1.3	1.4	2.0
16-17	1	1.01			
	2	0.05			
	3	0.03			
	Total	1.09	1.3	1.4	2.0

TABLE 4

RESIDUAL SETTLEMENT AFTER CONSTRUCTION OF LEVEES

Levee Section	Estimated Residual Settlement In Feet
1	0.7
2	0.8
3	0.8
4	1.0
5	1.0
6	1.0
7	1.0
8	1.0
9	1.0
10	1.0
11	0.7
12	0.7
13	0.7
14	0.5
15	0.5
16	0.8
17	0.8

33. Erosion protection. The drainage structures will be provided with stilling basins at the outlets, headwalls at the inlets, and riprap protection will be provided at both ends. Riprap protection will be provided around the Larose and Golden Meadow floodgates. No protection is considered necessary along the levee other than seeding the levees, exclusive of stability berms. Any erosion caused by hurricane floods will be restored under normal maintenance.

34. Settlement observations. Settlement observations will be made on all structures and walls after completion of construction and yearly thereafter until settlement is essentially complete. Before and after construction, profiles and sections will be obtained for each construction stage for the levees, berms and road ramps, and yearly thereafter until settlement is essentially completed. Observations will be made on all protection features periodically thereafter.

DESCRIPTION OF PROPOSED STRUCTURES AND IMPROVEMENTS

35. Levees. The alignment of the protection levee is shown on plate 1. The detailed alignment and profile of the levee and features contiguous thereto are shown on plates 2 through 25. Levee design sections are shown on plates 26 through 31. Beautification measures beyond those which are normally associated with levee construction, namely grading and sodding, are considered not necessary.

36. Structures.

a. Criteria for structural design. The criteria and calculations for structural design of the floodwalls, floodgates and roadgates are presented in appendix D.

b. Louisiana Highway 1 roadgate at Golden Meadow at Station 223+61, south traverse. Louisiana Highway at the Golden Meadow floodgate will be raised to elevation 5.0 and a pile supported reinforced concrete gate structure constructed as shown on plate 40. The gate structure will provide 44 feet horizontal clearance to accommodate a 24 foot roadway with 10 foot shoulders. Unlimited vertical clearance will be provided. A single leaf structural steel roller gate will be provided to close the gap during hurricanes. The roller gate will ride on tracks embedded in the base slab of the concrete gate structure. Manual operation only will be provided for opening and closing the gates.

c. Overhead Roller Gate No. 1 (Ring traverse Station 141+50) and Overhead Roller Gate No. 2 (Ring traverse Station 206+50). Clear opening widths of 20 feet and 28 feet for Gate no. 1 and Gate no. 2 respectively have been provided. Each gate will have a vertical clearance of 16 feet. Each gate will consist of a single leaf overhead roller gate riding on an I-beam suspended from a reinforced concrete beam supported by three concrete columns. The top beam over the opening will be removable to permit the passage of over-height loads. A stop will be provided to restrain the gate against wind forces during closing operation. Operation of these gates will be by chain operated geared trolley.

d. Drainage structures. (1) Gravity structures. The drainage system consists of interior interceptor canals paralleling the levees and eight gravity outlet structures through the levees. The drainage structures shown on plates 42 and 43 will consist of the number shown below of 72-inch round, corrugated metal pipes equipped with automatic flap gates and independent vertical lift slide gates in concrete operating towers located in the flood side berm. Access into the tower top for inspection purposes will be by service bridge at the same elevation as the top of the levee. The vertical lift gates will be closed before storm tides reach the maximum sump pool elevations shown in appendix A to preclude the possibility of back flow in the event that the flap gates fail to close. After the tide recedes the vertical lift gates will be opened.

Drainage Structure No.	Station	Number of 72-inch round pipes
1	66+87 West	7
2	362+75 West	3
3	722+64 West	2
4	960+60 East	4
5	842+82 East	4
6	634+75 East	5
7	325+00 East	2
8	217+00 South	1

(2) Pumping station. Golden Meadow, with a contiguous area of 900 acres, is enclosed by a 7-foot ring levee on three sides tying in to the Bayou Lafourche ridge and a pumping station of 230 c.f.s. drains the area. The existing pumping station provides adequate drainage from within the existing levee, and will be left in place. Features of the plan are shown on plate 32.

e. Floodwalls north levee closure (Sta. 0+18 to Sta. 26+54 East). A study was made to determine the optimum alignment through the church property east of Bayou Lafourche. It was not feasible to divide this property with the protection levee. The most desirable solution was found to be as shown on plate 37. An L-type floodwall will be constructed from station 0+18 to station 8+10, east traverse. The floodwall will occupy the space between the north row of tombs and the property line and will cause the minimum property damages. A 4-foot wide pedestrian gap will be provided for pedestrian traffic with closure to be made with needle beams. A cantilever I-type floodwall will be constructed from station 8+10 to station 26+49, east traverse, where the floodwall will terminate in a conventional earthen levee. This is in an area reserved for residential sub-division and the floodwall is the most economical solution. Beautification measures will consist of planting Algerian ivy vines, hedera canarienses, on 8 feet intervals along each side of the floodwalls.

f. Floodwalls south levee closure at Station 220+83 to 221+49, south traverse. A cantilevered I-type floodwall consisting of steel sheet piling capped with concrete will be used between the conventional earthen levee terminating west of Louisiana Highway 1 and the highway gap closure. Between the highway gap closure structure and the floodgate structure an inverted T-wall type floodwall supported by concrete bearing piles will be provided. A steel sheet pile cut-off wall will be provided beneath the inverted T-wall footing. Between the floodgate structure and the conventional earthen levee terminating east of the floodgate I-type floodwalls driven in a shell levee will be used. The structure complex is shown on plates 39 and 40.

g. Floodwall at Golden Meadow pumping station at Station 138+50 to 149+00, ring traverse. A cantilever I-type floodwall will be constructed at the Golden Meadow pumping station as shown on plate 32. The existing ring levee will be shaped to a section having an 8-foot crown at elevation 7.0 with 1 on 3 side slopes, and the I-type floodwall constructed to elevation 13.0 along the centerline of the levee. Where the floodwall intersects the discharge pipes, a 5-foot section of pipe will be removed, sheet piling driven, and a steel sleeve will be installed on the removed section of pipe, which will then be replaced. The sleeve will then be packed with plastic sealant and the seal plates will be clamped on the pipes prior to pouring the concrete portion of the floodwall. Overhead Roller Gate No. 1 (Ring traverse Station 141+50) will provide a 20 foot wide gap to accommodate the existing shell road.

h. Floodwall at station 211+68 to station 202+42, ring traverse. The existing ring levee will be shaped, an I-type floodwall constructed and roadway gap provided as described above at the Golden Meadow pumping station and as shown on plate 33. Construction of a conventional earthen levee at this location would necessitate the reconstruction or relocation of extensive oil industry installations; such as docking facilities, bulkheads, and building, resulting in excessive property damages. The floodwall is the most economic solution. Overhead Roller Gate No. 2 (Ring traverse Station 206+50) will be provided to accommodate the existing road with a 28-foot wide gap.

i. Floodgates.

(1) Two navigable floodgates are required, one in the north levee closure at Larose, and one in the south levee closure below Golden Meadow. Each floodgate will consist of one concrete bay approximately 70 feet long, with steel sector type gates and with treated timber guide walls at each end, and will provide clear horizontal openings of 56 feet. The vertical clearance will be unlimited. The sills will be at elevation -10.78 at Larose and -13.78 at Golden Meadow. The top of the walls will be at elevation 10.5 for the Larose floodgate and at elevation 15.0 for the Golden Meadow floodgate. The top of the sector gate skinplates will be at elevation 8.5 for the Larose floodgate and at elevation 13.0 at the Golden Meadow floodgate. Recesses will be provided at each end of the structures for needle beams to permit unwatering for gate maintenance and repair. Details of the floodgates are shown on plates 38 and 39.

(2) The gate operating machinery will consist of a reducer and a wire-rope drum powered by an electric motor. The sector gates will be operated by wire rope. Internal combustion engine-generator sets will furnish power for the electric motors, lighting, and control circuits.

(3) Both structures will be constructed within cellular steel sheet pile cofferdams located in Bayou Lafourche. The structures will be supported on untreated timber batter piles.

(4) Construction of the north floodgate at Larose in Bayou Lafourche will necessitate closing the Bayou to navigation during construction of the floodgate. It is not considered that this will create a hardship for navigation as it is believed Bayou Lafourche Auxiliary Channel will be in operation before construction of the floodgate is started.

(5) Consideration was given to the construction of the south floodgate in a bypass channel adjacent to Bayou Lafourche as provided in the project document plan, but studies indicated it would be more economical to construct the floodgate in the Bayou as shown in table C-4. It will not be necessary to close the Bayou to navigation during construction of the south floodgate as the Bayou, with a relatively small amount of dredging, is wide enough to permit navigation during construction.

(6) The floodgates will remain in the open position at all times that normal stages are experienced in the Bayou, to permit navigation and tidal flushing. Closing of the gates will be prescribed only upon announcement by the National Weather Service of the approach of a hurricane or tropical disturbance on a path that might cause the rise of tides in the general vicinity of the project area, or when the stage in Bayou Lafourche, in the vicinity of Golden Meadow, exceeds an elevation that would cause the Bayou to overflow its banks. Full time operating personnel will not be required.

j. Corrosion Mitigation. The following protective means will be employed to combat corrosion and to beautify the structure:

(1) Floodgates - protective painting and cathodic protection.

(2) Roadgates - protective paint system for road gate skin plates and members.

(3) Structural steel walers - corrosion resisting steel.

(4) Tie rods - galvanized, coated and wrapped.

ACCESS ROADS

37. General. The work areas may be reached via Louisiana Highways 1 and 308 and local roads. Permanent access to the floodgates will be provided from Highway 1 as shown on plates 38 and 39.

SOURCES OF CONSTRUCTION MATERIALS

38. Portland cement, sand and gravel, and clamshells. Portland cement and clamshells are available within 80 miles of the project; sand and gravel are available within 150 miles.

39. Rock material. Available sources of rock, suitable for use as riprap, in Texas, Oklahoma, Arkansas, Missouri and Kentucky include the following:

Source	Type	Unit Wt.
Big Rock Stone & Material Co. Little Rock, Ark. Quarry at Little Rock	Nepheline Syenite	136#/CF
Cliffdale Quarry & Mfg. Co. Box 201, St. Genevieve, Mo. Quarry at St. Genevieve	Crystalline Limestone	164#/CF
Federal Materials Co. Cape Girardeu, Mo. Quarry at mile 50 above Cairo	Limestone	169#/CF
West Lake Quarry & Mtl. Co. Box 206, Bridgeton, Mo. Quarry at Selma, Mo.	Crystalline Limestone	167#/CF
Three Rivers Rock Co. Box 218, Smithland, Ky. Quarry at Smithland	Crystalline Limestone	170#/CF
Reed Crush Stone Co. Box 35, Gilbertsville, Ky. Quarry at Gilbertsville	Crystalline Limestone	169#/CF
Trinity Concrete Products Co. 1700 Repub. Bk. Bldg., Dallas, Tex. Quarry at Chico, Texas	Limestone	167#/CF
Quarry at Knippa, Texas	Igneous Basalt	195#/CF
Quarry at Springtown, Okla.	Argillaceous Limestone	161#/CF

40. Concrete aggregate.

a. The following is a list of sources from which concrete aggregate, suitable for construction of the various features of this project, can be obtained. The test data for these sources are included in volumes III and IV of WES TM 6-370, "Concrete Aggregates." The locations and index number of these sources are as follows:

Plant	Vol.	Lat.	Long.	Index No.	Used At
T4S, R12E, Sec. 16 Washington, Ph, La.	IV	30	89	9	Bayou Teche Siphon
Jahncke Plant at Sun, La.	-	30	89	-	-
1 mi. south of Tangipahoa, La.	III	30	90	-	Freshwater Bayou Lock
Mitchell Pit at Fluker, La.	III	30	90	6	Freshwater Nav. Lock
La. Ind. at Franklinton	-	30	90	-	-
La. Ind. at Tangipahoa	-	30	90	-	-
Morse-Ory at Amite, La.	-	30	90	-	-
Anderson Gravel Co. at Amite, La.	-	30	90	-	-
Bayou Sara at Baines, La.	III	30	91	1 (suppl)	Old River Bridge
Thompson Creek at St. Fran., La.	III	30	91	2 (suppl 2)	St. Francisville, Casting Yard

Plant	Vol.	Lat.	Long.	Index No.	Used At
Miss. River mi. 249 AHP	III	30	91	9	do
Kinder, La.	III	30	92	2 (suppl 3)	Calcasieu S.W. Barrier Freshwater By Lock
Longville, La.	III	30	93	2 (rev)	do

b. Test data in WES TM 6-370 are applicable to the above sources of concrete aggregate. All of the above sources were investigated and approved as concrete, sand, and/or gravel sources subject to complete test analyses by the U. S. Army Engineers Waterways Experiment Station, Vicksburg, Mississippi.

c. The gradation of coarse aggregate shown in CE-1401.01, Standard Guide Specifications for Concrete, "August 1963," is not available from pits within an economic distance of the project. Therefore, the gradation shown below, in one size, will be specified:

Sieve Size U.S. Standard Square Mesh	Percent by Weight Passing Individual Sieve
1-1/2 in.	100
1 in.	90-97
1/2 in.	40-60
No. 4	0-6

d. The above gradation was approved for Wax Lake East Pumping Station, Wax Lake West Pumping Station, Calcasieu Saltwater Barrier, Freshwater Bayou Lock, and the hurricane protection project, "Lake Pontchartrain, La. and Vicinity."

COORDINATION WITH OTHER AGENCIES

41. U.S. Department of the Interior. The Regional Director, U. S. Fish and Wildlife Service, Atlanta, Georgia,

was informed by letter dated 19 October 1967 of the proposed design memorandum studies, and requested to furnish views or comments relative to the project. The Service replied by letter dated 16 January 1968 stating, in part: "Proposed construction will, therefore, have only local minor effects on fish and wildlife". A copy of this letter is included in appendix E.

42. U.S. Department of the Interior. The Regional Director, Federal Water Pollution Control Administration (Now Environmental Protection Agency, Water Quality Office), Dallas, Texas, was informed by letter dated 15 May 1968 of the proposed design memorandum studies and requested to furnish views or comments relative to the project. The Agency replied by letter dated 6 June 1968 stating, in part: "This proposed project should have little effect on the water quality with implementation of your current specifications. . . . . . However, all contractors should: (a) perform construction operations in a manner that will reduce turbidity to the lowest practical level and (b) take precautions in the relocation of petroleum products pipelines . . . " A copy of this letter is included in appendix E.

43. State of Louisiana.

a. The Wild Life and Fisheries Commission. The Director of the Wild Life and Fisheries Commission was informed by letter, dated 19 October 1967, of the proposed design memorandum studies and requested to furnish views or comments relative to the project. The Commission replied by letter dated 28 December 1967, offering no adverse comment. A copy of this letter is included in appendix E.

b. The Department of Public Works. The Department of Public Works was informed of the authorized improvements and of the design memorandum studies. Numerous meetings were held with officials of the Department during the studies and the Department has indicated its concurrence in the plan of improvement.

c. The Department of Highways. The Department of Highways was informed of the authorized improvements and of the design memorandum studies, and has offered no adverse comment to the plan of improvement.

REAL ESTATE REQUIREMENTS

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

RELOCATIONS

45. Federal. There are no Federal relocations involved in this project.

46. Non-Federal. The authorizing act specifies that local interests, prior to initiation of construction, give assurances to the Secretary of the Army that they will: "Accomplish without expense to the United States alterations as required to roads, culverts, pipelines, cables, wharves, oil wells, and any other facilities necessary for the construction of the project." All relocations for this project are the responsibility of local interests and consist of the following:

DESCRIPTIONS	STA.
1-6" Oil Pipeline	23+70E
2-6" Oil Pipelines	38+60E
3-Overhead Powerlines	43+30E
1-20" Gas Pipeline	224+80E
1-16" Gas Pipeline	231+00E
1-3" Gas Pipeline	355+09E
1-4" Oil Pipeline	379+75E
1-3" Gas Pipeline	379+75E
1-6" Oil Pipeline	639+05E
1-8" Gas Pipeline	972+81E
1-3" Gas Pipeline	972+81E
6-Overhead Powerlines	999+01E
1-8" Gas Pipeline	1012+60E
1-8" Oil Pipeline	278+64S
2-Overhead Powerlines	274+64S
1-12" Oil Pipeline	240+73S
1-4" Gas Pipeline	232+43S
1-8" Gas Pipeline	232+43S
3-Overhead Powerlines	218+00S
1-3" Gas Pipeline	206+30R
2-6" Gas Pipelines	205+70R
1-12" Gas Pipeline	205+70R
1-8" Gas Pipeline	158+70R

DESCRIPTION	STA.
1-2" Gas Pipeline	144+23R
1-3" Gas Pipeline	144+23R
3-3" Gas Pipelines	141+40R
1-1" Gas Pipeline	132+80R
3-3" Gas Pipelines	132+40R
1-3" Gas Pipeline	122+70R
1-3" Gas Pipeline	370+11W
1-3" Gas Pipeline	404+62W
1-6" Oil Pipeline	420+71W
1-20" Gas Pipeline	619+55W
1-16" Gas Pipeline	633+80W
Roadway	326+35E
Roadway (La. Hwy. 1)	223+60S
Roadway (Overhead Roller Gate No. 2)	206+50R
Roadway	169+00R
Roadway	146+53R
Roadway (Overhead Roller Gate No. 1)	141+50R
Roadway	132+60R
Roadway	112+86R
Roadway	62+40W

E = East Traverse
S = South Traverse
R = Ring Traverse
W = West Traverse

ENVIRONMENTAL QUALITY

47. Environmental Quality.

a. General. The engineering treatment required for preserving and maintaining the environmental quality of the project has been considered during preparation of this design memorandum. Specifically, levee erosion protection and corrosion mitigation are discussed in paragraphs 33 and 36k. Further, as indicated in paragraphs 41 through 43, extensive coordination has been accomplished with appropriate agencies relative to effects of the project on fish and wildlife resources and water quality during and subsequent to construction.

b. Protection and enhancement of the cultural environment (E.O. 11593). There are no federally or non-federally owned sites, structures or objects of historical, architectural or archaeological significance which will be affected by the project.

COST ESTIMATES

48. General. Based on June 1971 price levels, the estimated total first cost for the project is $21,100,000 comprised of $18,250,000 for construction, $1,120,000 for lands and damages, and $1,730,000 for relocations. Detailed estimates of first costs are shown in appendix C. These costs include the levee extension south of Golden Meadow. Of the estimated total first cost, $14,770,000 is Federal and $6,330,000 is non-Federal. These costs are summarized in table 5.

TABLE 5
SUMMARY OF FIRST COST

ITEM	FEDERAL	NON-FEDERAL	TOTAL
01 Lands and damages		$1,120,000	$1,120,000
02 Relocations and modifications		1,450,000	1,450,000
11 Levees, floodwalls, drainage structures and floodgates	$15,247,900		15,247,900
30 E & D	1,602,800	145,000	1,747,800
31 S & A	1,399,300	135,000	1,534,300
	$18,250,000	$2,850,000	$21,100,000
Cash Contribution(1)	-3,480,000	+3,480,000	
Total	$14,770,000	$6,330,000	$21,100,000

(1) See table C-2, appendix C, for apportionment of cost between Federal and non-Federal interests.

49. Comparison of cost with latest approved estimate. The estimated total first cost of $21,100,000 is an increase of $6,270,000 over the corresponding cost included in the PB-3 dated 28 January 1971, effective date 1 July 1971. Comparison of the estimate contained in the project document, PB-3, and the General Design Memorandum No. 1 is shown in table 6. The reasons for the increases are as follows:

a. Levees, floodwalls, drainage structures, and floodgates. The increase of $4,951,900 reflects the following:

(1) Based on tidal hydraulic studies utilizing the latest hurricane parameters developed by the National Weather Service (formerly the U. S. Weather Bureau) subsequent to preparation of the survey report on which project authorization is based, the levee grade was increased 0.5 foot at Larose and 1.5 feet at Golden Meadow which resulted in substantially larger levee cross sections.

(2) Soil investigations and detail design analyses demonstrated that stability berms would be required which further increased the levee cross sections.

(3) Enlargement of the levee sections made construction of the levee through two heavily developed areas along the Golden Meadow ring levees impracticable and forced the adoption of the basically more expensive floodwall. Also in the vicinity of Larose, limited area dictated that a floodwall be used.

(4) The additional cost of the levee extension south of Golden Meadow was not included in the PB-3.

b. Engineering and design. The increase of $790,800 reflects the increased engineering and design on the increased construction cost.

c. Supervision and administration. The increase of $787,300 reflects the supervision and administration on the increased engineering and design and on the increased construction cost.

d. Lands and damages. The increase of $543,000 reflects an increase in area because of wider rights-of-way required by the larger levee sections and borrow pits, additional lands required for the levee extension, and a higher appraisal value of the land.

e. Relocations. The decrease of $803,000 resulted from changes in the alignment of the levees which reduced the cost of the relocation.

TABLE 6
COMPARISON OF ESTIMATED COSTS

	PROJECT DOCUMENT $	PB-3 $	DESIGN MEMO NO.1 $	DIFFERENCE GDM NO. 1 & PB-3 $
11 Levees, floodwalls, drainage structures and flood-gates	$5,498,000	$10,296,000	$15,247,900	+ $4,951,900
30 Engineering & design	458,600	957,000	1,747,800	+ 790,800
31 Supervision & administration	524,400	747,000	1,534,300	+ 787,300
Subtotal	$6,481,000	$12,000,000	$18,530,000	+ $6,530,000
01 Lands & damages	322,000	577,000	1,120,000	+ 543,000
02 Relocations	1,054,000	2,253,000	1,450,000	- 803,000
Total	$7,857,000	$14,830,000	$21,100,000	$6,270,000

SCHEDULES FOR DESIGN AND CONSTRUCTION

50. Schedule. The sequence of contracts and the schedule for design and construction are shown in table 7. The levees are to be constructed in three lifts, and each lift in six sections to be constructed in separate contracts. The sections, as referred to in table 7, are as follows:

Section A. Section A includes the east levee from sta. 961+61 east traverse (Yankee Canal) to sta. 1025+00 east traverse = sta. 387+79.95 south traverse, to station 100+00 south traverse = sta. 246+32 ring traverse, to sta. 146+53 ring traverse (Golden Meadow Pumping Station).

Section B. Section B includes the levee from sta. 146+53 ring traverse (Golden Meadow Pumping Station) to sta. 356+84 west traverse (Lateral A) and lateral "A" Levee.

Section C. Section C includes the levee from sta. 356+84 west traverse (Lateral A) to sta. 802+32.81 west traverse at Larose and the lateral "B" levee.

Section D. Section D includes the east levee from sta. 650+07 east traverse (Breton Canal) to sta. 961+61 east traverse (Yankee Canal), the Breton Canal lateral levee and the lower lateral levee.

Section E. Section E includes the east levee from sta. 650+07 east traverse (Breton Canal) to sta. 325+00 east traverse (Scully Canal).

Section F. Section F includes the east levee from sta. 325+00 east traverse (Scully Canal) to sta. 0+00 east traverse at Larose.

TABLE 7
SCHEDULE FOR DESIGN AND CONSTRUCTION

CONTRACTS	DESIGN (1)		CONSTRUCTION			ESTIMATE CONSTRUCTION COST (2)
	START	COMP.	ADVERT.	AWARD	COMP.	
1. Levee, First Lift Section A	May 1967	Dec. 1972	Feb. 1973	April 1973	April 1975	$ 1,025,000
2. Levee, First Lift Section B	May 1967	April 1973	May 1973	July 1973	July 1975	1,422,500
3. Levee, First Lift, Section C	May 1967	Aug. 1973	Sept. 1973	Nov. 1973	Nov. 1975	1,472,700
4. Levee, First Lift Section D	May 1967	Dec. 1973	Jan. 1974	March 1974	March 1976	1,486,400
5. Levee, First Lift, Section E	May 1967	April 1974	May 1974	July 1974	July 1976	948,000
6. Levee, First Lift, Section F	May 1967	Aug. 1974	Sept. 1974	Nov. 1974	Nov. 1976	947,600
7. Golden Meadow Floodgate & Floodwalls	May 1967	Dec. 1974	Jan. 1975	March 1975	July 1977	2,228,300

TABLE 7 (CONT'D)
SCHEDULE FOR DESIGN AND CONSTRUCTION

CONTRACTS	DESIGN (1)		CONSTRUCTION			ESTIMATE CONSTRUCTION COST (2)
	START	COMP.	ADVERT.	AWARD	COMP.	
8. Levee, Second Lift, Section A	May 1967	Oct. 1976	Nov. 1976	Jan. 1977	Feb. 1978	$ 72,400
9. Levee, Second Lift, Section B	May 1967	Feb. 1977	March 1977	May 1977	April 1978	100,900
10. Levee, Second Lift, Section C	May 1967	Aug. 1976	Sept. 1976	Nov. 1976	Aug. 1977	104,300
11. Levee, Second Lift Section D	May 1967	Dec. 1976	Jan. 1977	March 1977	Dec. 1977	105,200
12. Levee, Second Lift, Section E	May 1967	April 1977	May 1977	July 1977	Aug. 1978	67,100
13. Levee, Second Lift, Section F	May 1967	Aug. 1977	Sept. 1977	Nov. 1977	Dec. 1978	67,000
14. Floodwalls at Golden Meadow Pumping Station and at Sta. 221+68 to 202+42 Ring Traverse	May 1967	July 1976	Aug. 1976	Oct. 1976	July 1977	331,100

TABLE 7 (CONT'D)
SCHEDULE FOR DESIGN AND CONSTRUCTION

CONTRACTS	DESIGN (1)		CONSTRUCTION			ESTIMATE CONSTRUCTION COST (2)
	START	COMP.	ADVERT.	AWARD	COMP.	
15. Levee, Third Lift & Seeding, Section A	May 1967	Nov. 1979	Dec. 1979	Feb. 1980	Jan. 1981	$ 93,600
16. Levee, Third Lift & Seeding, Section B	May 1967	March 1980	April 1980	June 1980	March 1981	130,300
17. Levee, Third Lift & Seeding, Section C	May 1967	May 1979	June 1979	Aug. 1979	March 1980	134,700
18. Levee, Third Lift & Seeding, Section D	May 1967	Sept 1979	Oct. 1979	Dec. 1979	Aug. 1980	136,000
19. Levee, Third Lift & Seeding Section E	May 1967	Jan. 1980	Feb. 1980	April 1980	Jan. 1981	86,600
20. Levee, Third Lift & Seeding Section F	May 1967	May 1980	June 1980	Aug. 1980	May 1981	86,600

TABLE 7 (CONT'D)
SCHEDULE FOR DESIGN AND CONSTRUCTION

CONTRACTS	DESIGN (1)		CONSTRUCTION			ESTIMATE CONSTRUCTION COST (2)
	START	COMP.	ADVERT.	AWARD	COMP.	
21. Larose Floodgate & floodwalls	May 1967	Oct. 1975	Nov. 1975	Jan. 1976	Jan. 1978	$ 1,786,500
22. Larose floodwalls Station 0+18 to Station 26+49	May 1967	April 1976	May 1976	July 1976	July 1977	694,500
23. Drainage Structures 1, 4, 5 & 8	May 1967	April 1980	May 1980	July 1980	Jan. 1982	1,784,700
24. Drainage tructures 2, 3, 6 & 7	May 1967	July 1979	Aug. 1979	Oct. 1979	April 1981	733,300
25. Close Temp. Levee Gap at Drainage Structures 1, 4, 5 & 8	May 1967	April 1981	May 1981	July 1981	July 1985	120,600
26. Close Temp. Levee Gap at Drainage Structures 2, 3, 6 & 7	May 1967	July 1980	Aug. 1980	Oct. 1980	Oct. 1984	111,700

TABLE 7 (CONT'D)
SCHEDULE FOR DESIGN AND CONSTRUCTION

CONTRACTS	DESIGN		CONSTRUCTION			ESTIMATE CONSTRUCTION COST (2)
	START	COMP.	ADVERT.	AWARD	COMP.	
27. Floodwall at Golden Meadow Pumping Station Sta 138+50 to 149+00 Ring Traverse	May 1967	Dec. 1974	Jan. 1975	March 1975	July 1977	$ 369,600
Total Construction Cost Including Contingencies & S. & A.						$16,647,200

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(1) Includes General Design Memorandum, Feature Design Memorandum, and plans and specifications for the period from start to final approval.

(2) Including contingencies and supervision and administration.

51. Funds. To maintain the schedule as shown in table 7 funds will be required by fiscal years as follows:

Total estimated cost through fiscal year	1971 -	$ 408,000
Funds required by fiscal year	1972 -	99,300
	1973 -	745,300
	1974 -	2,497,600
	1975 -	4,035,500
	1976 -	3,852,400
	1977 -	2,728,100
	1978 -	240,200
	1979 -	169,500
	1980 -	1,567,200
	1981 -	1,601,800
	1982 -	167,500
	1983 -	61,900
	1984 -	56,900
	1985 -	18,800
	TOTAL -	$18,250,000

The total shown above includes the $3,480,000 cash contribution to be made by local interests.

OPERATION AND MAINTENANCE

52. Federal. Federal operation and maintenance costs are not involved in the project.

53. Non-Federal. As specified in the authorizing act, local interests are to maintain and operate the completed works in accordance with regulations prescribed by the Secretary of the Army and good maintenance practices. The estimated total annual cost of operation, maintenance and replacements for the project is $174,800, broken down as follows:

Maintenance levees	$ 47,000
Maintenance & operation, floodgates	50,000
Replacements of Component Parts of Floodgates, Drainage Structures & Roadgates	77,800
Total	$174,800

ECONOMICS

54. Benefits.

a. General. The plan of improvement would provide a high degree of protection (100 years) to approximately 32,400 acres of land. The estimated value of all residential and commercial facilities within the project area, excluding contents, is approximately $52 million. Benefits which would accrue from the project would be in the form of flood damages prevented on crops, non-crop flood damages prevented, intensified land use, and area redevelopment. The economic analyses are enclosed as Appendix B.

b. Average annual benefits. The average annual benefits which would accrue to the project are as follows:

Average Annual Benefits

	Non-Crop				
Crop	Existing development	Future development	Intensified land use	Area redevelopment	Total
7,000	2,534,100	990,900	529,000	51,100	4,112,100

55. Average annual charges. The total annual charges for constructing the project are $984,700 of which $549,200 are Federal costs and $435,500 are non-Federal costs. Details of the annual charges are shown on Table 8.

56. Economic justification. The average annual benefits of $4,112,100 and average annual charges of $984,700 result in a favorable benefit-cost ratio of 4.2 to 1.

TABLE 8

ESTIMATE OF ANNUAL CHARGES

Summary of project costs	Federal $	Non-Federal $	Total $
Construction	18,250,000	-	18,250,000
Lands, damages, relocations	-	2,850,000	2,850,000
	18,250,000	2,850,000	21,100,000
Less cash contribution	-3,480,000	+3,480,000	-
First cost	14,770,000	6,330,000	21,100,000
Interest during construction	1,440,000	617,000	2,057,000
Total project investment	16,210,000	6,947,000	23,157,000
Annual economic costs			
Interest (3-1/4%)	526,800	225,800	752,600
Amortization (100 yrs.)	22,400	9,600	32,000
Maintenance and operation		97,000	97,000
Replacements		77,800	77,800
Economic loss on lands		25,300	25,300
Total annual economic costs	549,200	435,500	984,700

57. Recommendations. The overall plan of protection from the design hurricane of the low lying residential and agricultural lands bordering and on both sides of Bayou Lafourche from Larose on the north end to the vicinity of Golden Meadow on the south end is to enclose this entire area within a protective levee system consisting of conventional earthen levees or floodwalls designed to withstand the design hurricane tides and forces throughout its length. The natural drainage of the protected area is provided for by 8 drainage structures. Access to the protected area both by land and water has been provided by road gates and floodgates respectively.

This plan is considered to be the best means of accomplishing the project objectives and is recommended for approval.

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

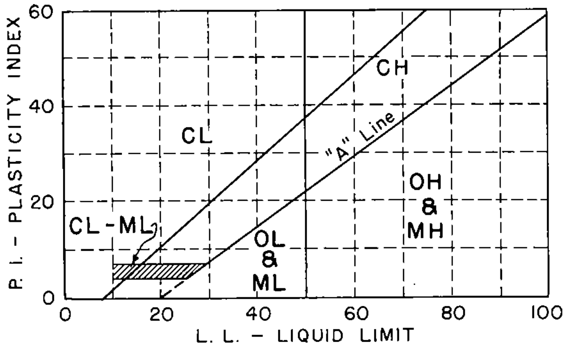
DESCRIPTIVE SYMBOLS

COLOR

COLOR	SYMBOL
TAN	T
YELLOW	Y
RED	R
BLACK	BK
GRAY	Gr
LIGHT GRAY	lGr
DARK GRAY	dGr
BROWN	Br
LIGHT BROWN	lBr
DARK BROWN	dBr
BROWNISH-GRAY	br Gr
GRAYISH-BROWN	gy Br
GREENISH-GRAY	gn Gr
GRAYISH-GREEN	gy Gn
GREEN	Gn
BLUE	Bl
BLUE-GREEN	Bl Gn
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 sub-surface materials of the region are anticipated and, if encountered, such variations will not be considered as differing materially within the purview of clause 4 of the contract.

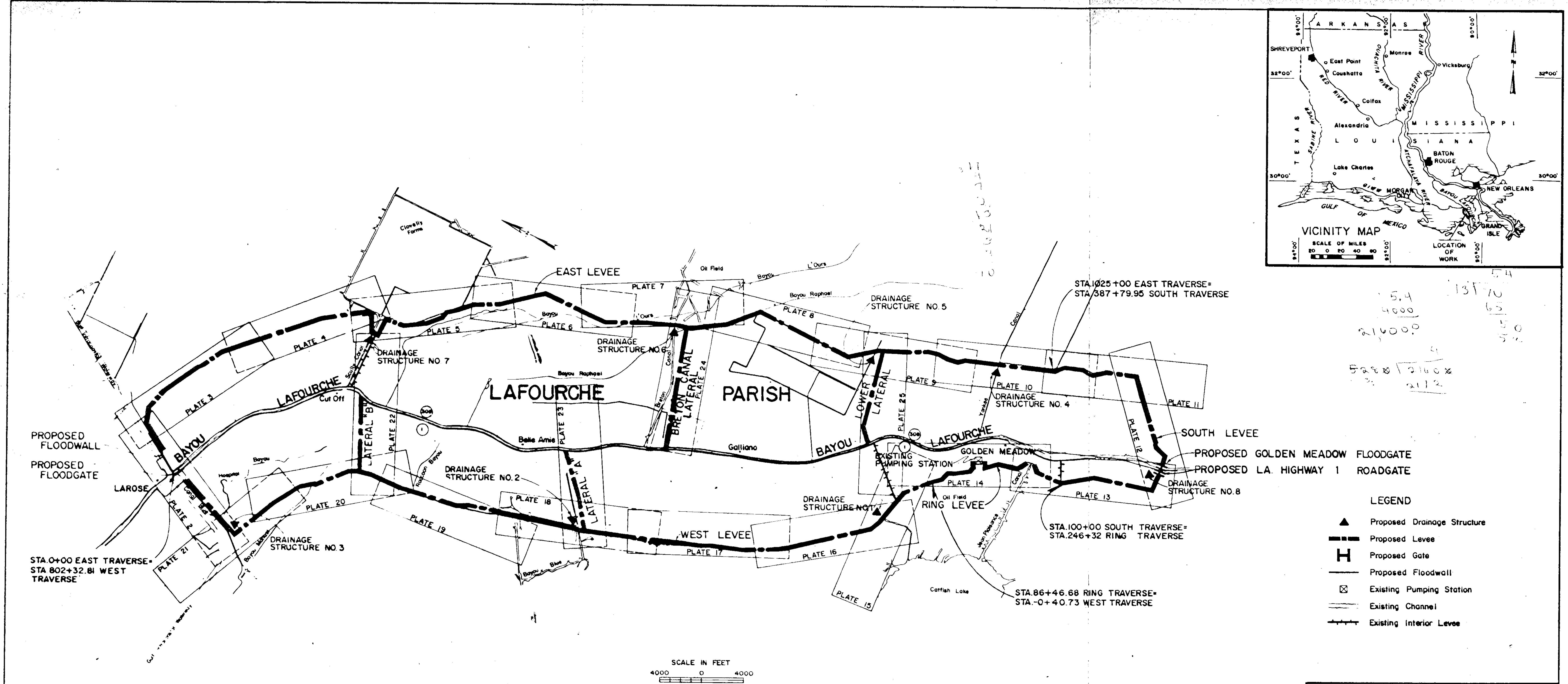
Ground-water elevations shown on the boring logs represent ground-water surfaces encountered on the dates shown. Absence of water surface data on certain borings implies that no ground-water data is available, but does not necessarily mean that ground water will not be encountered at the locations or within the vertical reaches of these borings.

Consistency of cohesive soils shown on the boring logs is based on driller's log and visual examination and is approximate, except within those vertical reaches of the borings where shear strengths from unconfined compression tests are shown.

REVISION	DATE	DESCRIPTION	BY
3	5-3-71	ADDED UPPER LIMIT LINE (P.I.= 0.9 (LL-8)) ON PLASTICITY CHART	LMVED-G LETTER D'T'D 29 APRIL 1971
2	6-8-64	SYMBOL FW, NOTE REVISED	ORAL FROM L.M.V.G.G. 5 JUNE 1964
1	9-17-63	IST PAR. OF GENERAL NOTES REVISED	L M V D MULTIPLE LETTER, DATED 5 SEPT., 1963

SOIL BORING LEGEND

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
FILE NO. H-2-21800



5.4
4000
21600.0

5280 | 21600
4
2112

LIMITS OF TRAVERSES

EAST TRAVERSE STA. 0+00 TO STA. 1025+00
SOUTH TRAVERSE STA. 387+79.95 TO STA. 100+00
RING TRAVERSE STA. 246+32 TO STA. 86+46.68
WEST TRAVERSE STA. -0+40.73 TO STA. 802+32.81

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

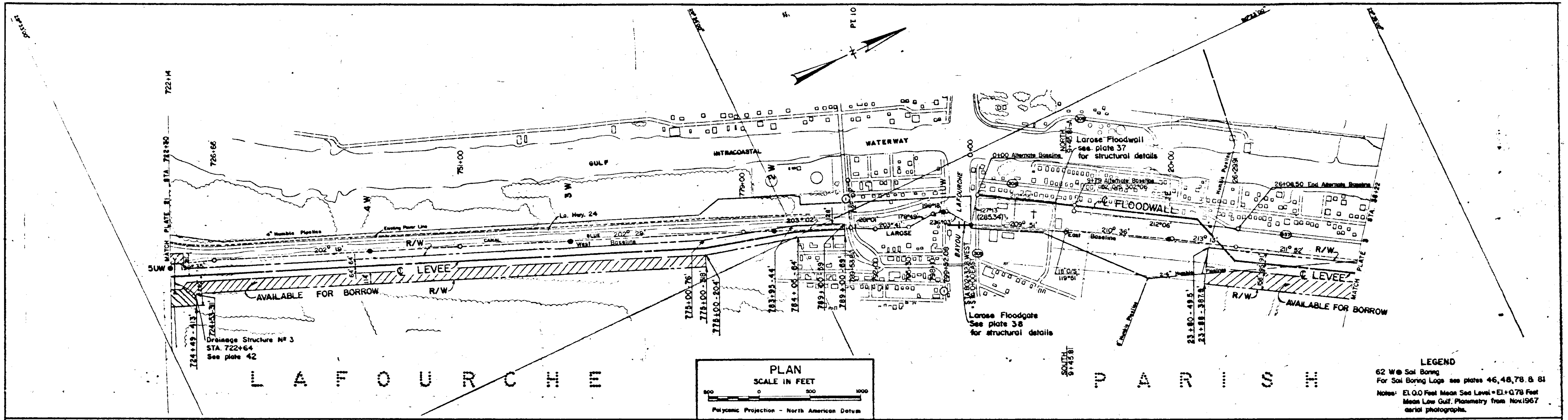
GENERAL PLAN, INDEX AND VICINITY MAP

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE: MARCH, 1972
FILE NO. H-2-24314

PLATE 1



LEGEND

62 W ● Soil Boring

For Soil Boring Logs see plates 46, 48, 78 & 81

Notes: El. 0.0 Feet Mean Sea Level = El. + 0.78 Feet Mean Low Gulf. Planimetry from Nov. 1967 aerial photographs.

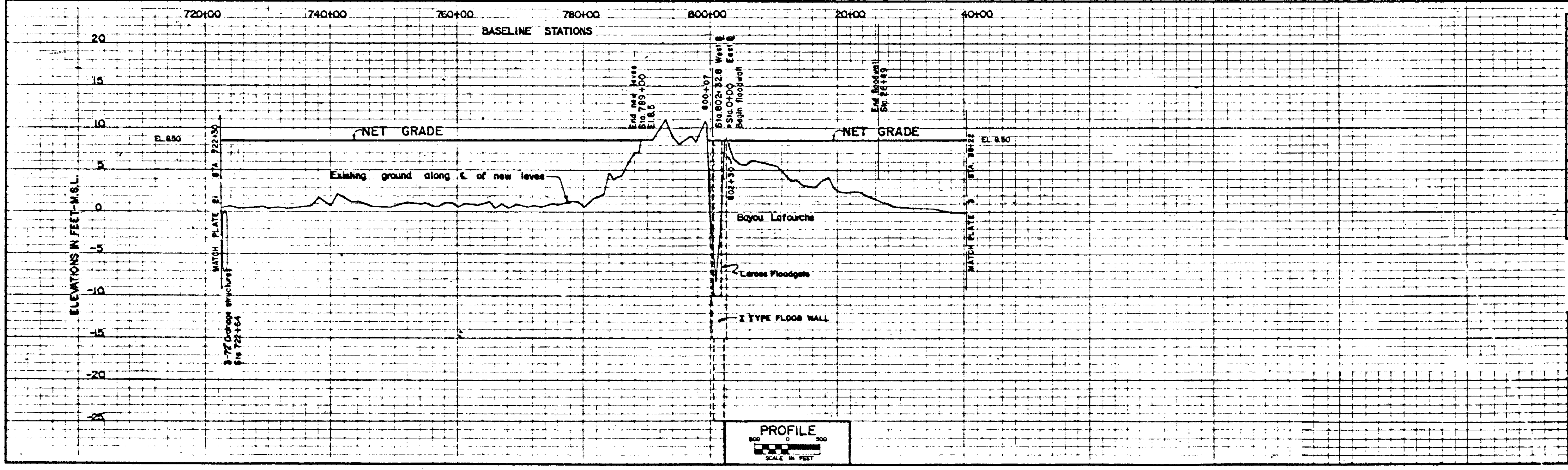


TABLE OF OFFSET

BASELINE STATION		OFFSET TO ℄ LEVEE	BASELINE STATION		OFFSET TO ℄ LEVEE
726+66 * *	P.S.	140'	36+00	P.S.	135'
775+00	P.S.	140'			
784+00	P.S.	20'			
789+00	P.S.	5'			
A 0+00 * * *					
A 9+79 * * *					
A 22+00	F.S.	72'			
26+49 * *	P.S.	135'			

* Normal to back tangent
* * Normal to forward tangent
* * * ℄ & ℄ same

F.S. Flood side
P.S. Protected side
A Alternate ℄

WEST AND EAST TRAVERSE

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

PLAN AND PROFILE

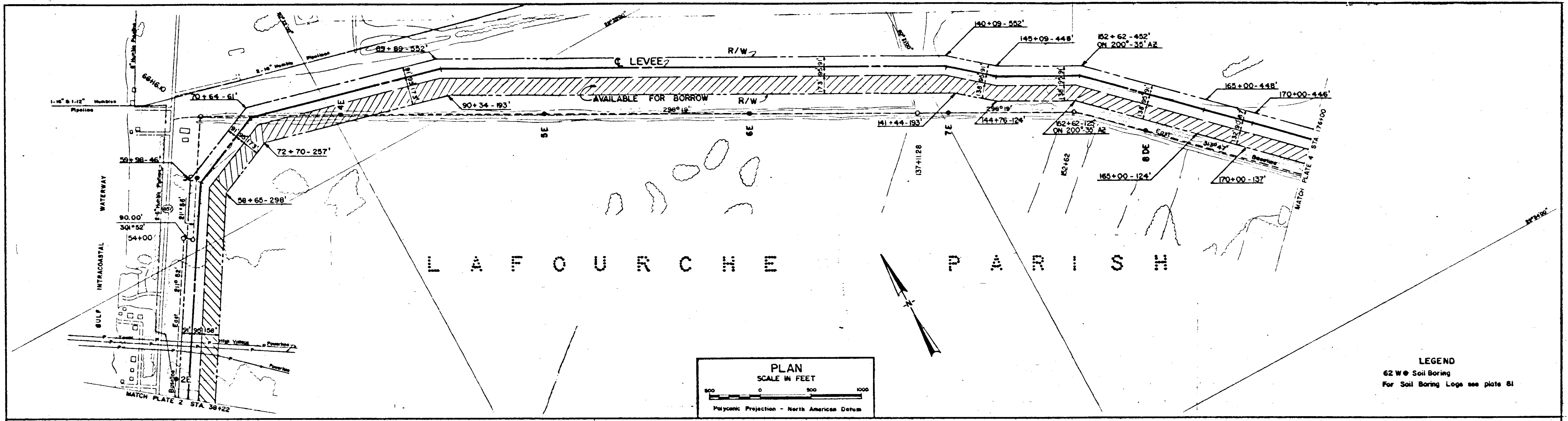
Sta. 722+30 to Sta. 802+32.8 = Sta. 0+00
Sta. 0+00 to Sta. 38+22

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE: MARCH, 1972

FILE NO. H-2-24314



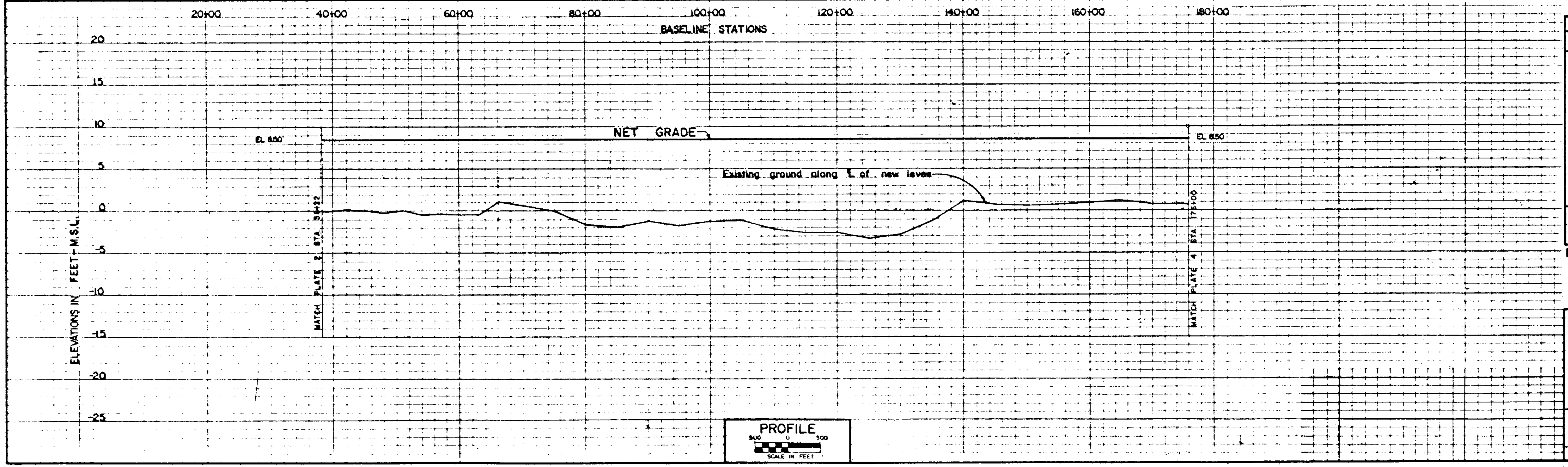


TABLE OF OFFSET

BASELINE STATION		OFFSET TO ℄ LEVEE	BASELINE STATION		OFFSET TO ℄ LEVEE
59+70	P.S.	45'	165+00	F.S.	357'
71+16	P.S.	20'	170+00	F.S.	359'
90+00	F.S.	461'			
140+00	F.S.	461'			
145+00	F.S.	357'			
152+62 *	F.S.	357'			
152+62 **	F.S.	357'			

* Normal to back tangent
** Normal to forward tangent
*** ℄ & ℞ same

F.S. Flood side
P.S. Protected side

EAST TRAVERSE

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

PLAN AND PROFILE

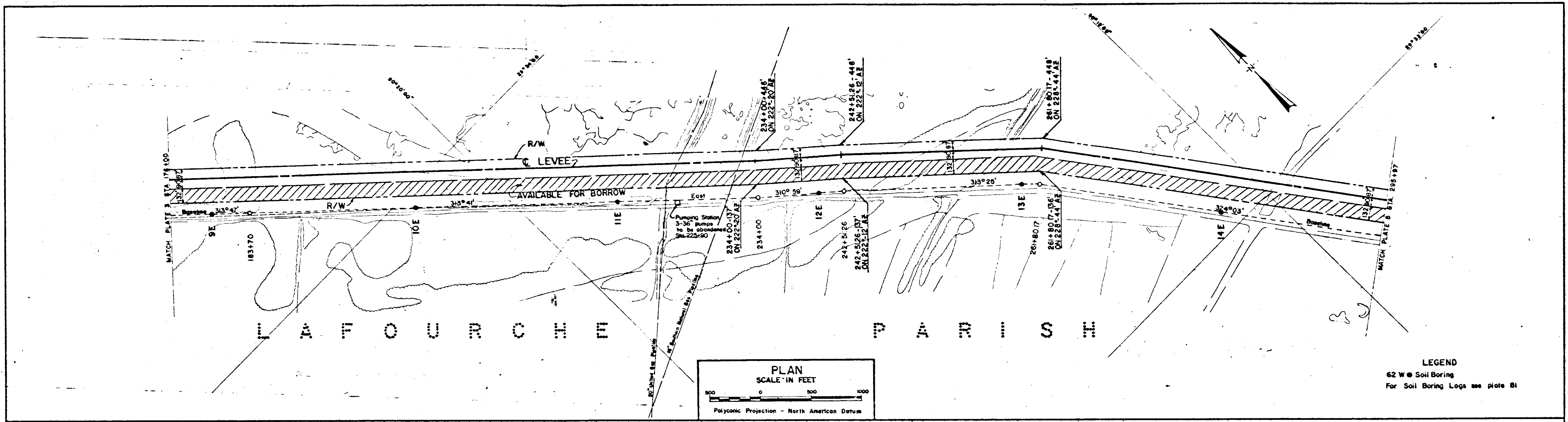
Sta. 38+22 to Sta. 176+00

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

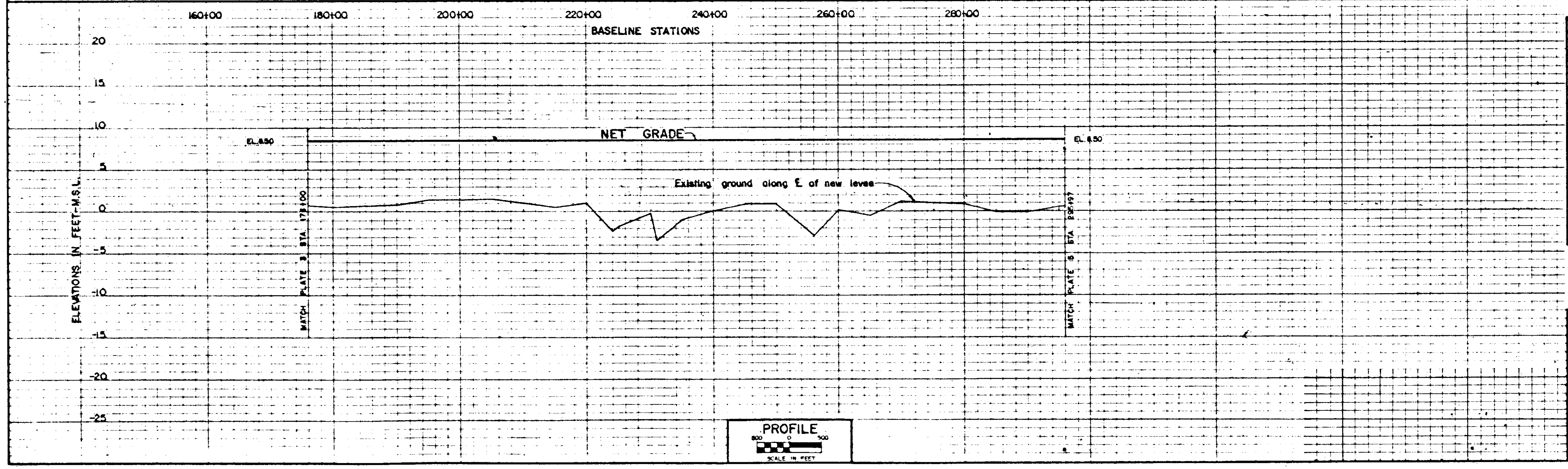
DATE: MARCH, 1972
FILE NO. H-2-24314

PLATE 3



PLAN
SCALE IN FEET
500 0 500 1000
Polyconic Projection - North American Datum

LEGEND
62 W ● Soil Boring
For Soil Boring Logs see plate 81



PROFILE
SCALE IN FEET
500 0 500

TABLE OF OFFSET

BASELINE STATION		OFFSET TO ℄ LEVEE	BASELINE STATION		OFFSET TO ℄ LEVEE
234+00 *	F.S.	359'			
234+00 * *	F.S.	359'			
242+51.26 *	F.S.	359'			
242+51.26 * *	F.S.	359'			
261+80.17 *	F.S.	359'			
261+80.17 * *	F.S.	359'			

* Normal to back tangent F.S. Flood side
* * Normal to forward tangent P.S. Protected side
* * * ℄ & ℄ same

EAST TRAVERSE

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

PLAN AND PROFILE

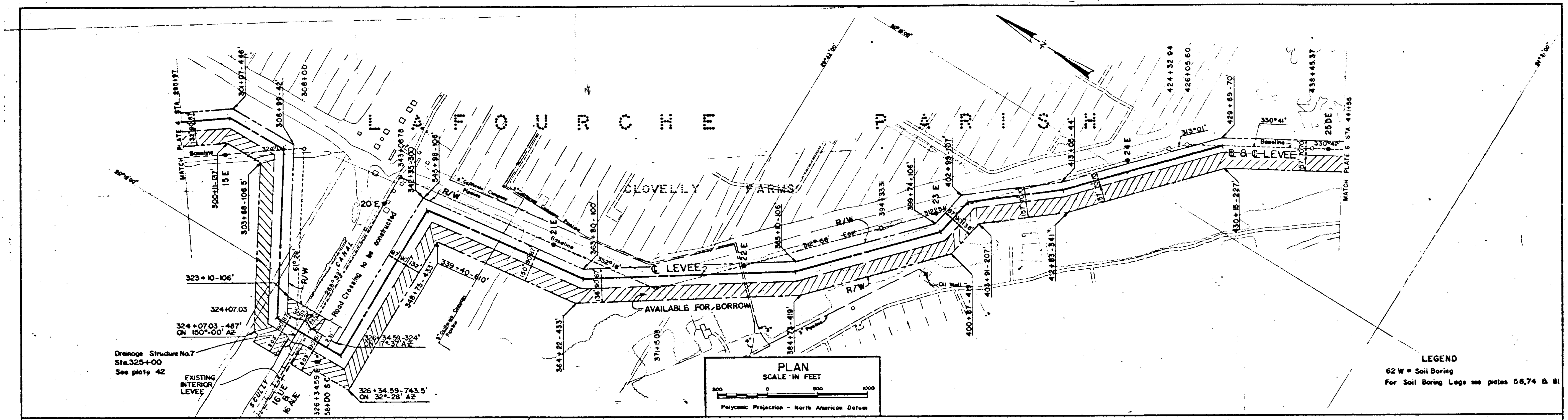
Sta. 176+00 to Sta. 295+97

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE: MARCH, 1972
FILE NO. H-2-24314

PLATE 4



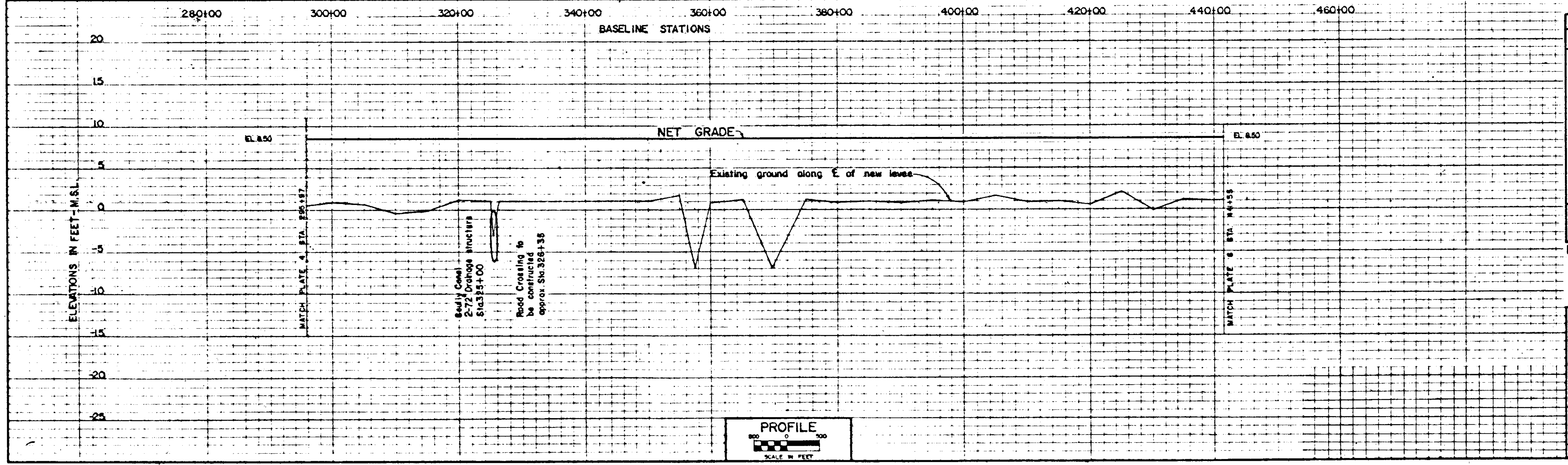


TABLE OF OFFSET

BASELINE STATION		OFFSET TO ℄ LEVEE	BASELINE STATION		OFFSET TO ℄ LEVEE
300+80	F.S.	359'	364+00	P.S.	193'
			367+99.73***		0'
306+05.37***		0'	376+99.84***		0'
			385+00	P.S.	193'
324+07.03*	P.S.	193'	400+00	P.S.	193'
			402+94.26***		0'
324+07.03**	P.S.	193'	403+40	F.S.	30'
			405+40.00***		0'
326+34.59*	P.S.	193'	413+00	P.S.	114'
326+34.59**	P.S.	393'	429+79.72***		0'
346+76.84	P.S.	193'.	438+45.37***		0'

* Normal to back tangent
** Normal to forward tangent
*** ℄ & BL same

F.S. Flood side
P.S. Protected side

EAST TRAVERSE

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

PLAN AND PROFILE

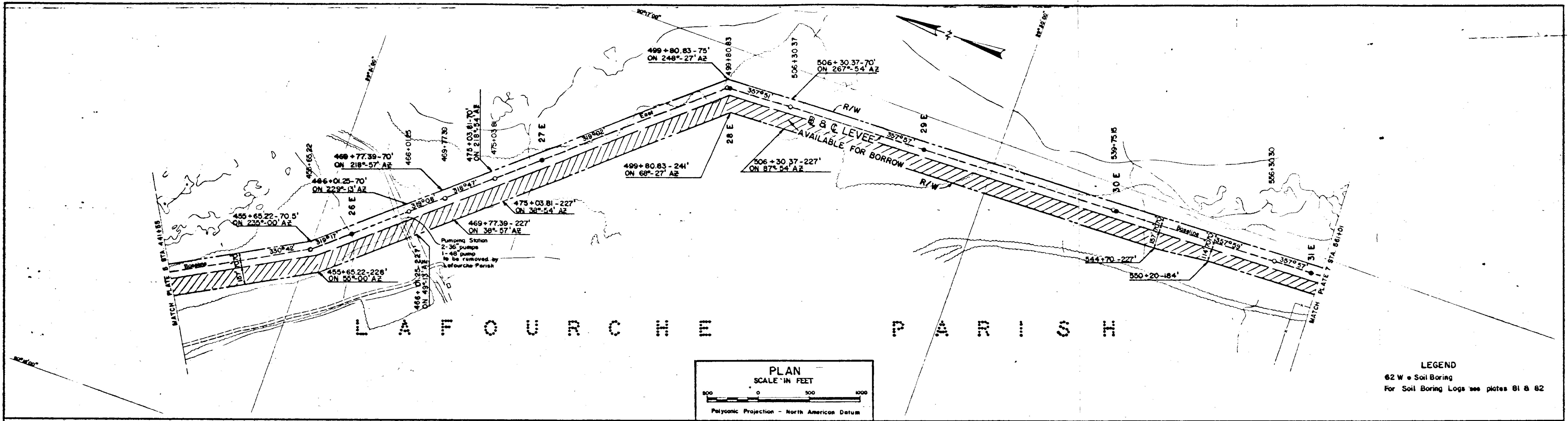
Sta. 295+97 to Sta. 441+55

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE: MARCH, 1972
FILE NO. H-2-24314

PLATE 5



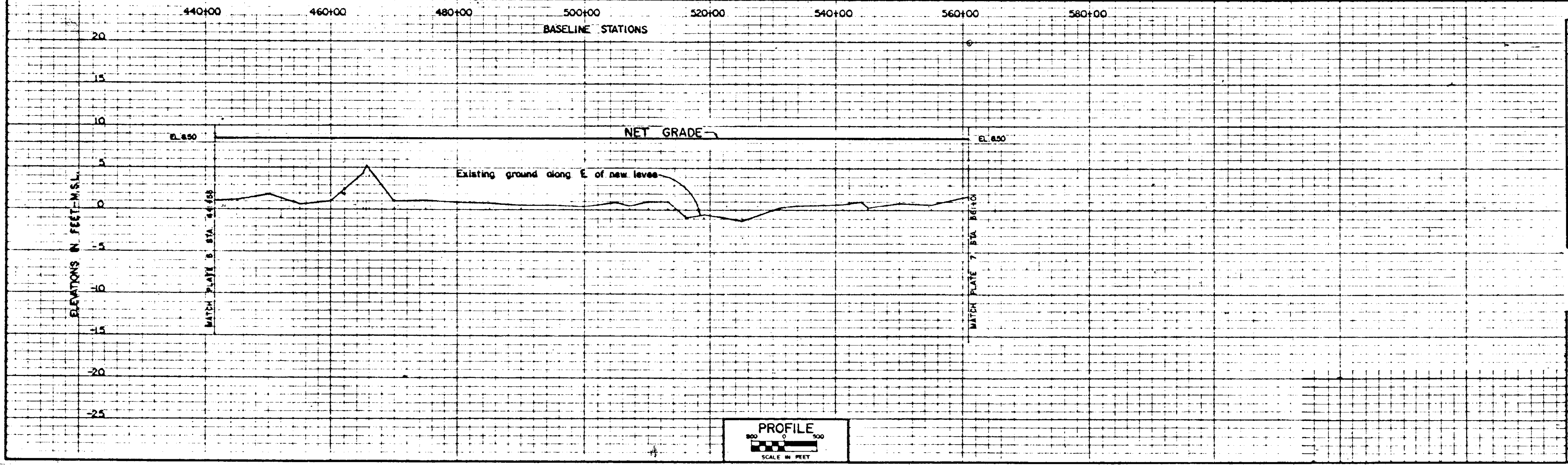


TABLE OF OFFSET

BASELINE STATION	OFFSET TO ℄ LEVEE	BASELINE STATION	OFFSET TO ℄ LEVEE
255+65.22***	0'	556+30.30***	0'
466+01.25***	0'		
469+77.39***	0'		
475+03.81***	0'		
499+80.83***	0'		
506+30.37***	0'		
539+75.15***			

* Normal to back tangent
** Normal to forward tangent
*** ℄ & ℞ same

F.S. Flood side
P.S. Protected side

EAST TRAVERSE

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I - GENERAL DESIGN

PLAN AND PROFILE

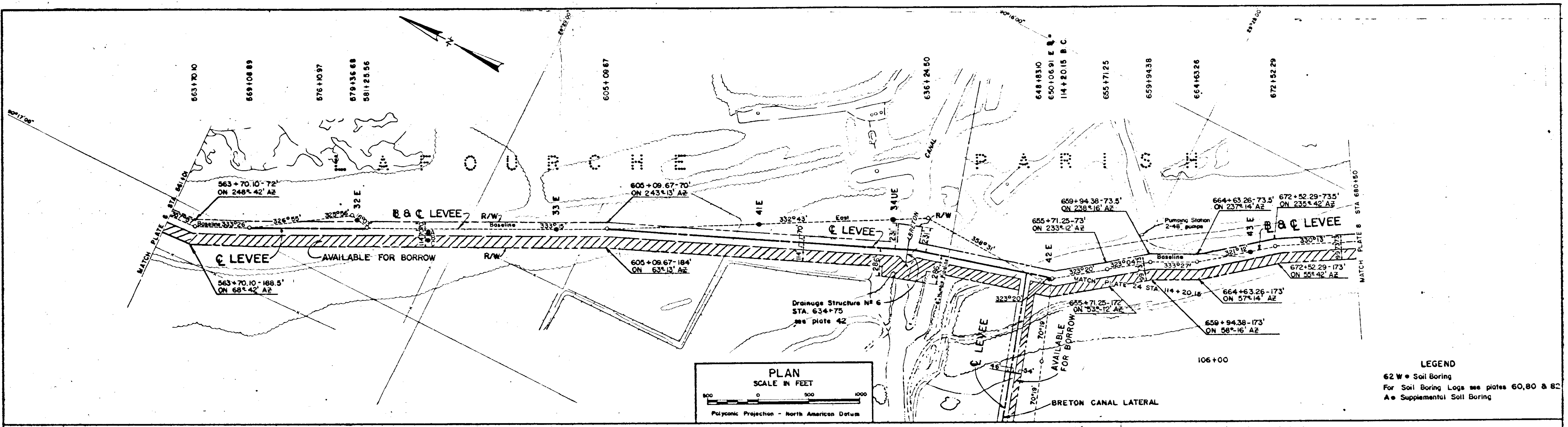
Sta. 441+55 to Sta. 561+01

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE: MARCH, 1972
FILE NO. H-2-24314

PLATE 6



LEGEND

62 W ● Soil Boring

For Soil Boring Logs see plates 60,80 & 82

A● Supplemental Soil Boring

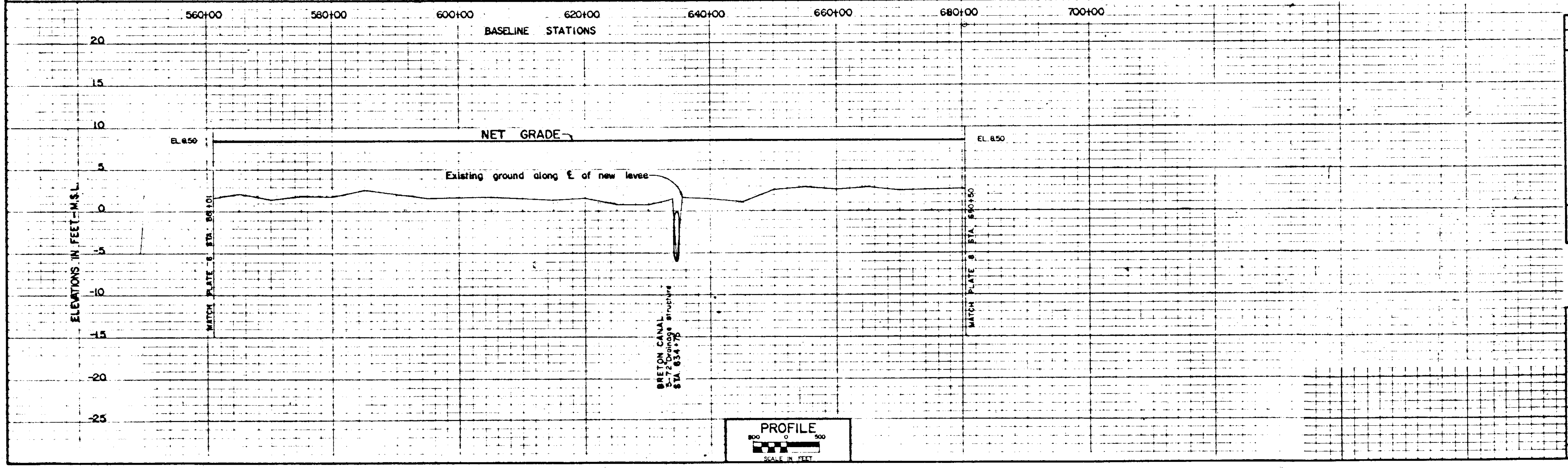


TABLE OF OFFSET

BASELINE STATION		OFFSET TO ℄ LEVEE	BASELINE STATION		OFFSET TO ℄ LEVEE
569+08.89 ***		0'	664+63.26***		0'
581+25.56 ***		0'	672+52.29***		0'
605+09.67 ***		0'			
635+00	P.S.	310'			
650+06.91 ***		0'			
655+71.25 ***		0'			
659+94.38 ***		0'			

* Normal to back tangent
** Normal to forward tangent
*** ℄ & ℗ same
F.S. Flood side
P.S. Protected side

EAST TRAVERSE

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I - GENERAL DESIGN

PLAN AND PROFILE

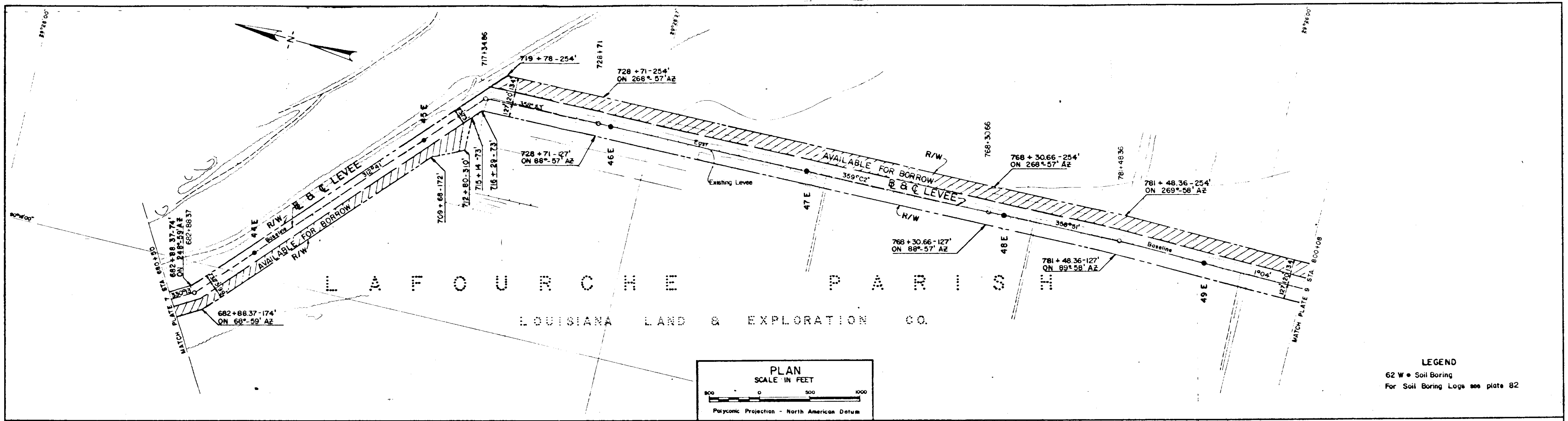
Sta. 561+01 to Sta. 680+50

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE: MARCH, 1972
FILE NO. H-2-24314

PLATE 7



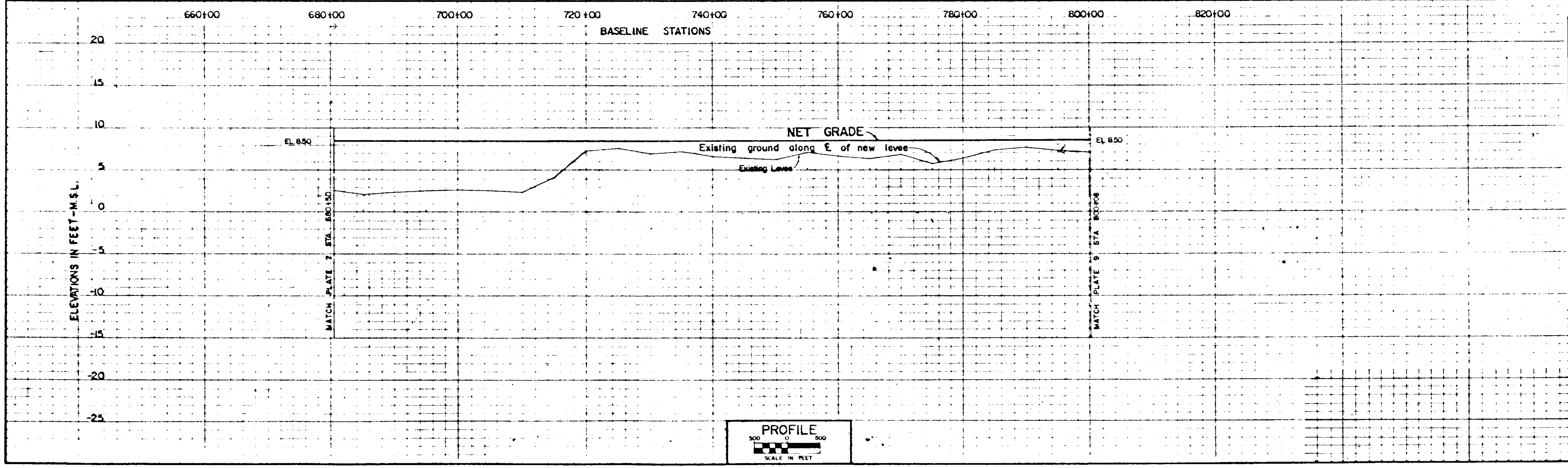


TABLE OF OFFSET

BASELINE STATION		OFFSET TO ℄ LEVEE	BASELINE STATION		OFFSET TO ℄ LEVEE
682+88.37	***	0'			
717+34.86	***	0'			
728+71	***	0'			
768+30.66	***	0'			
781+48.36	***	0'			

* Normal to back tangent

** Normal to forward tangent

*** ℄ & B same

F.S. Flood side

P.S. Protected side

EAST TRAVERSE

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I - GENERAL DESIGN

PLAN AND PROFILE

Sta. 680+50 to Sta. 800+08

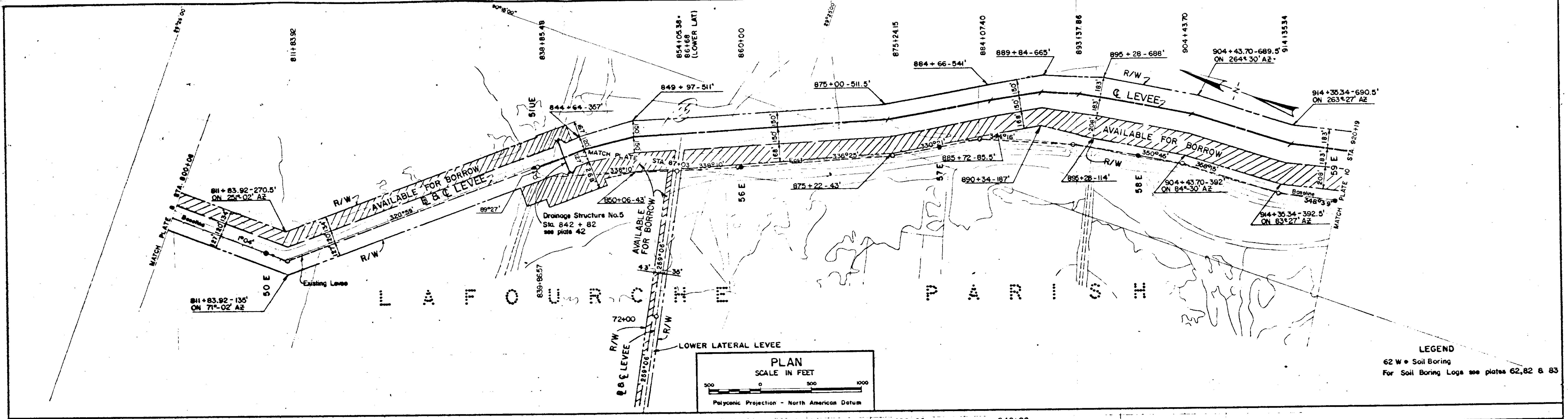
BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE: MARCH, 1972

FILE NO. H-2-24314

PLATE 8



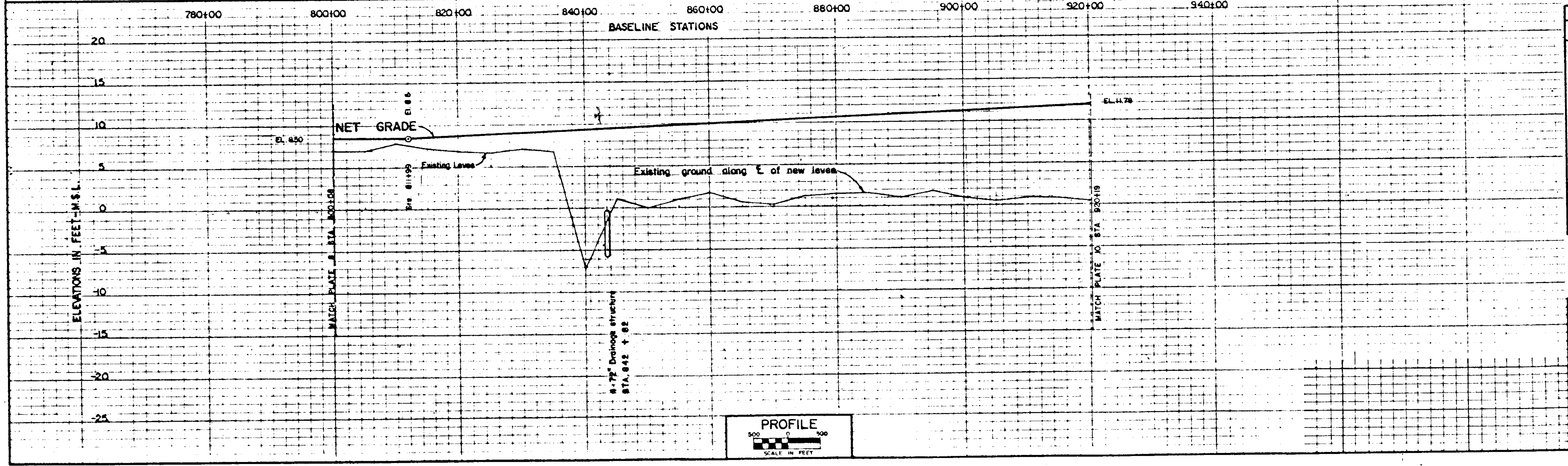


TABLE OF OFFSET

BASELINE STATION		OFFSET TO ℄ LEVEE	BASELINE STATION		OFFSET TO ℄ LEVEE
838+85.48***		0'	890+00	F.S.	505'
845+00	F.S.	242'	893+37.86*	F.S.	505'
850+00	F.S.	361'	893+37.86* *	F.S.	505'
875+24.15*	F.S.	361'	904+43.70*	F.S.	505'
875+24.15* *	F.S.	361'	904+43.70* *	F.S.	505'
884+07.40*	F.S.	361'	914+35.34*	F.S.	505'
885+00	F.S.	395'	914+35.34* *	F.S.	505'

* Normal to back tangent

* * Normal to forward tangent

* * * ℄ & B same

F.S. Flood side

P.S. Protected side

EAST TRAVERSE

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I - GENERAL DESIGN

PLAN AND PROFILE

Sta. 800+08 to Sta. 920+19

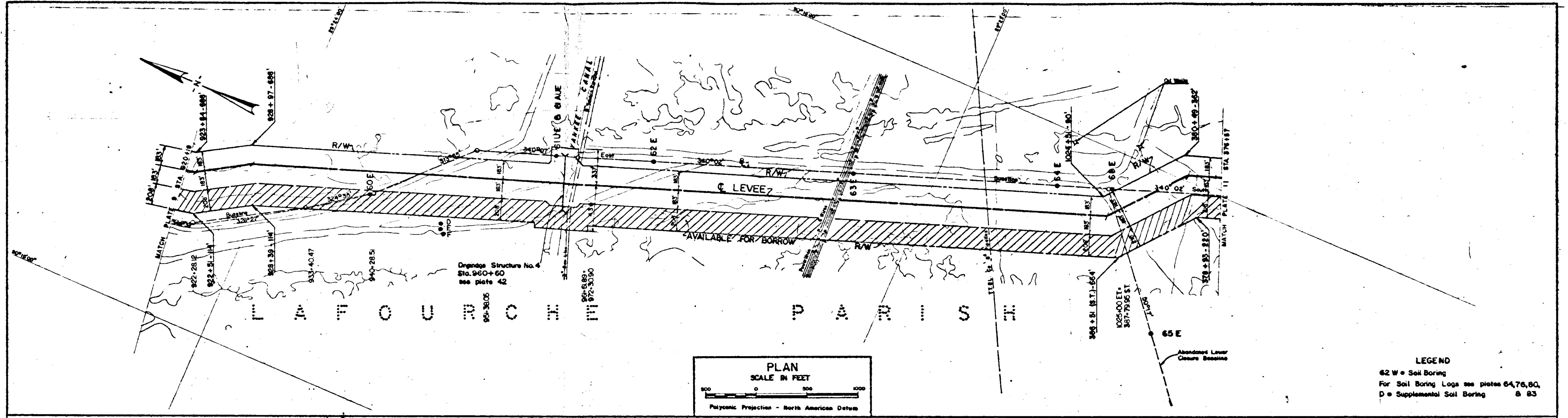
BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE: MARCH, 1972

FILE NO. H-2-24314

PLATE 9



LEGEND

62 W ● Soil Boring

For Soil Boring Logs see plates 64,76,80, & 83

D ● Supplemental Soil Boring

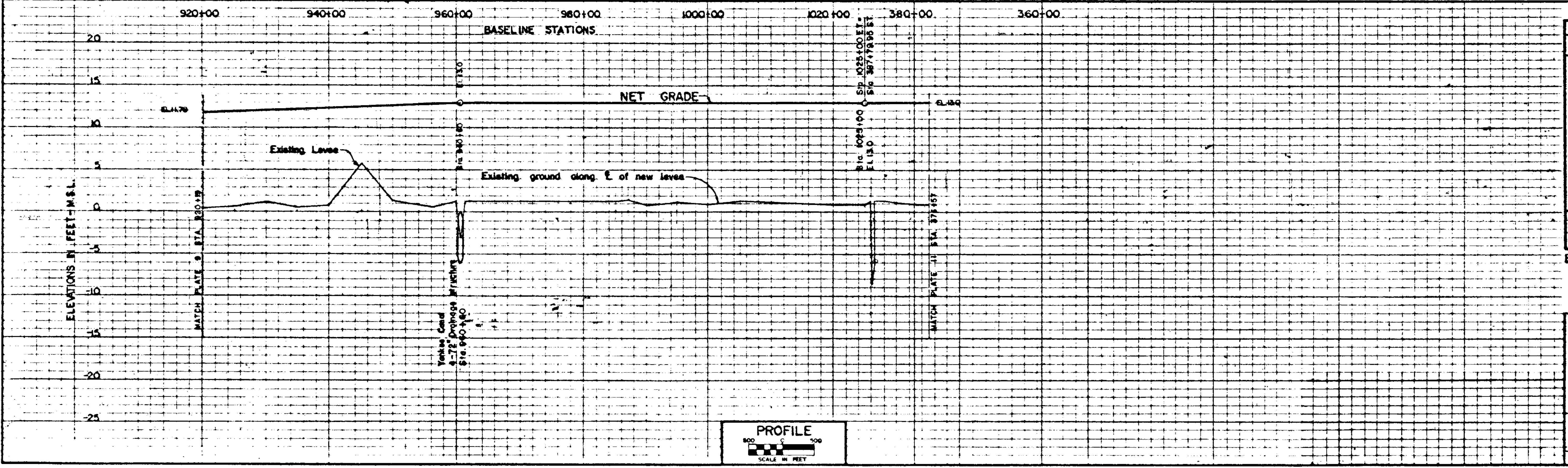


TABLE OF OFFSET

BASELINE STATION		OFFSET TO ℄ LEVEE	BASELINE STATION		OFFSET TO ℄ LEVEE
923+28 ✱✱	F.S.	505'			
928+78.37	F.S.	505'			
945+15.71 ✱✱✱		0'			
1025+00	P.S.	273'			
380+00	F.S.	179'			

✱ . Normal, to back tangent — F.S. Flood side

✱✱ Normal to forward tangent — P.S. Protected side

✱✱✱ ℄ & ℙ same

EAST AND SOUTH TRAVERSE

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I - GENERAL DESIGN

PLAN AND PROFILE

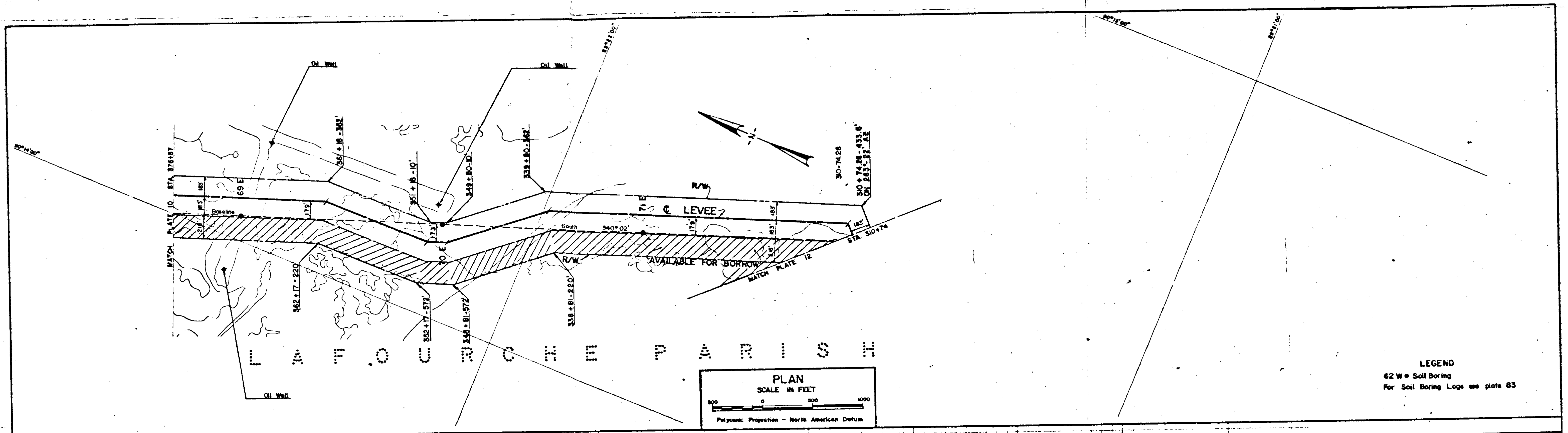
Sta. 920+19 to Sta. 1025+00 = Sta. 387+79.95
Sta. 387+79.95 to Sta. 376+57

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE: MARCH, 1972 — FILE NO. H-2-24314

PLATE 10



LEGEND
62 W ● Soil Boring
For Soil Boring Logs see plate 83

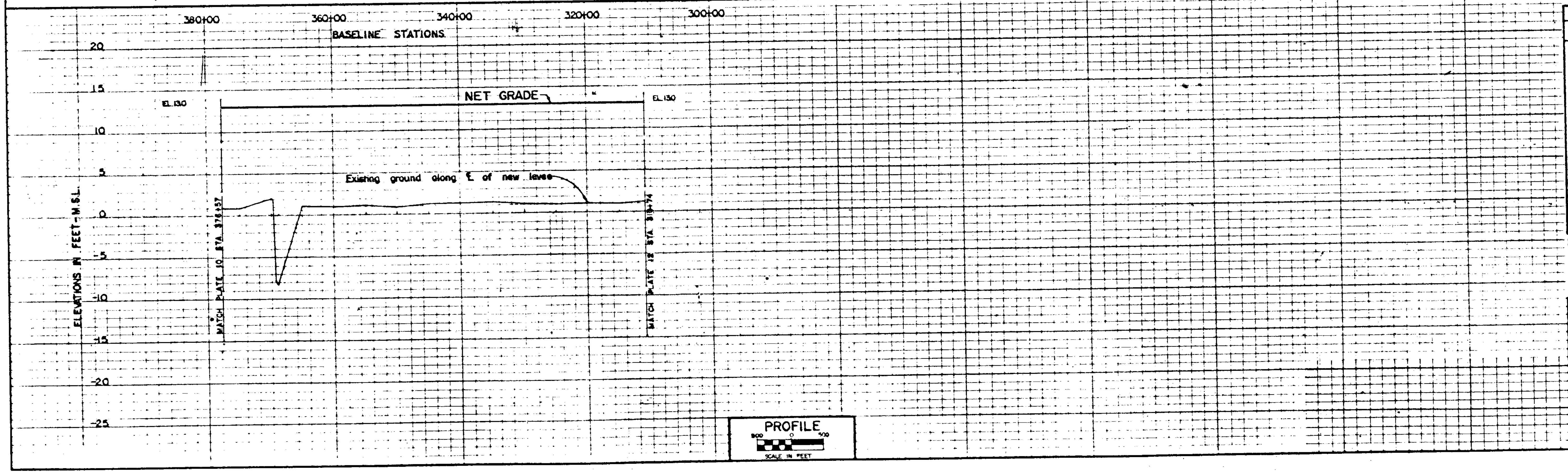


TABLE OF OFFSET

BASELINE STATION		OFFSET TO ℄ LEVEE	BASELINE STATION		OFFSET TO ℄ LEVEE
361+49	F.S.	179'			
351+49	P.S.	173'			
349+49	P.S.	173'			
339+49	F.S.	179'			
310+74 *	F.S.	179'			
310+74 **	F.S.	179'			

* Normal to back tangent
** Normal to forward tangent
*** ℄ & ℞ same

F.S.- Flood side
P.S. Protected side

SOUTH TRAVERSE

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I - GENERAL DESIGN

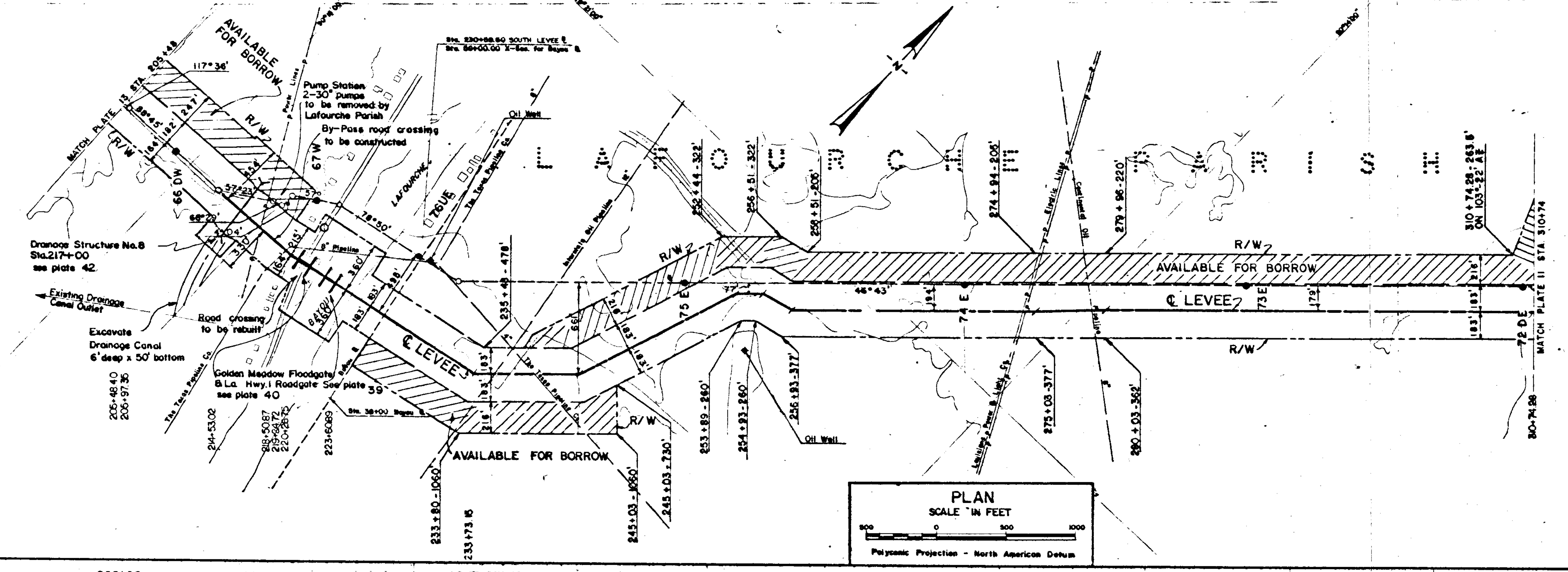
PLAN AND PROFILE
Sta. 376+57 to Sta. 310+74

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE: MARCH, 1972
FILE NO. H-2-24314

PLATE 11



PLAN

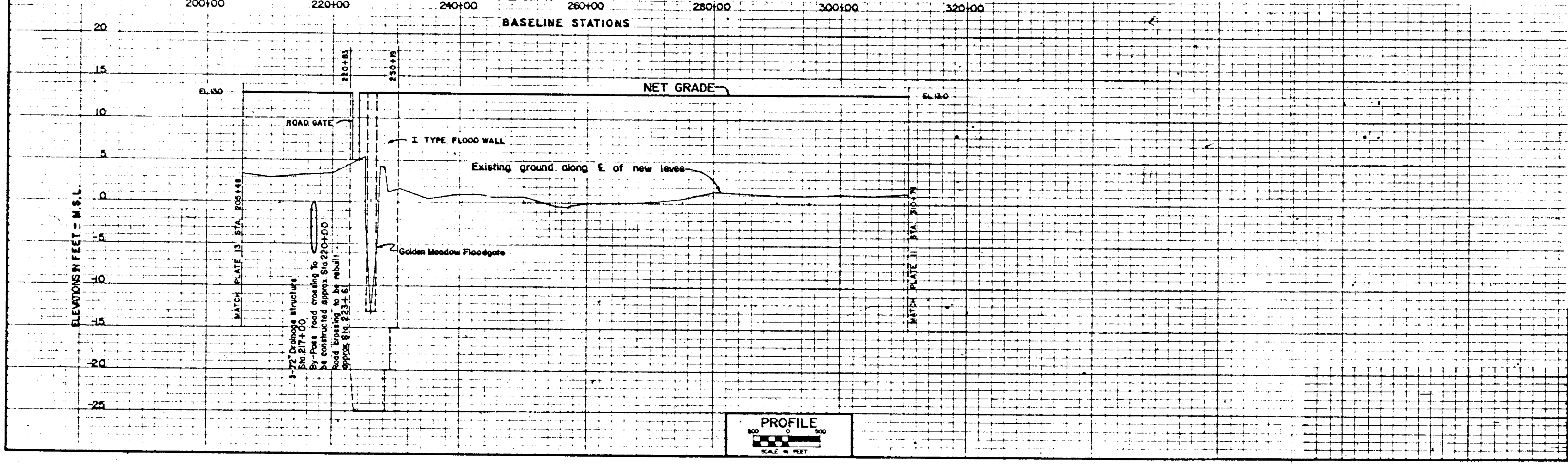
SCALE IN FEET

Polyconic Projection - North American Datum

LEGEND

62 W ● Soil Boring

For Soil Boring Logs see plates 66,80 & 83



PROFILE

TABLE OF OFFSET

BASELINE STATION		OFFSET TO ℄ LEVEE	BASELINE STATION		OFFSET TO ℄ LEVEE
280+00	F.S.	179'	219+25	F.S.	355' on Az. 309°37'58"
275+00	F.S.	194'	214+53 * * *		0'
257+43	F.S.	194'	206+97.36 * * *		0'
255+43	F.S.	77'			
253+43	F.S.	77'			
242+43	F.S.	661'			
234+95	F.S.	661'			

* Normal to back tangent

* * Normal to forward tangent

* * * ℄ & ℄ same

F.S. Flood side

P.S. Protected side

SOUTH TRAVERSE

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

PLAN AND PROFILE

Sta. 205+48 to Sta. 310+74

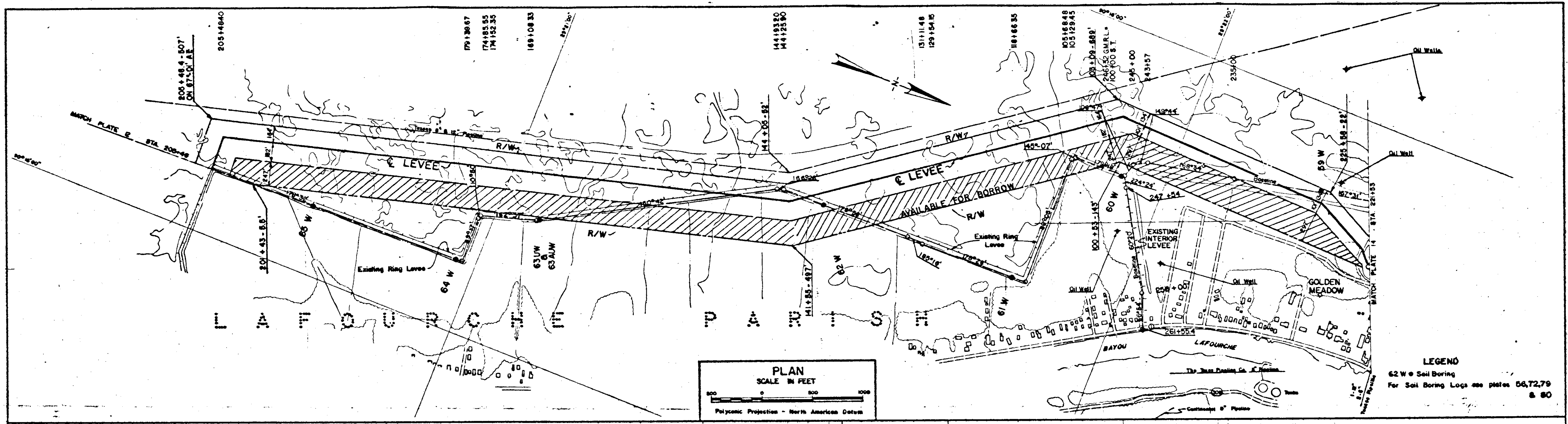
BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE: MARCH, 1972

FILE NO. H-2-24314

PLATE 12



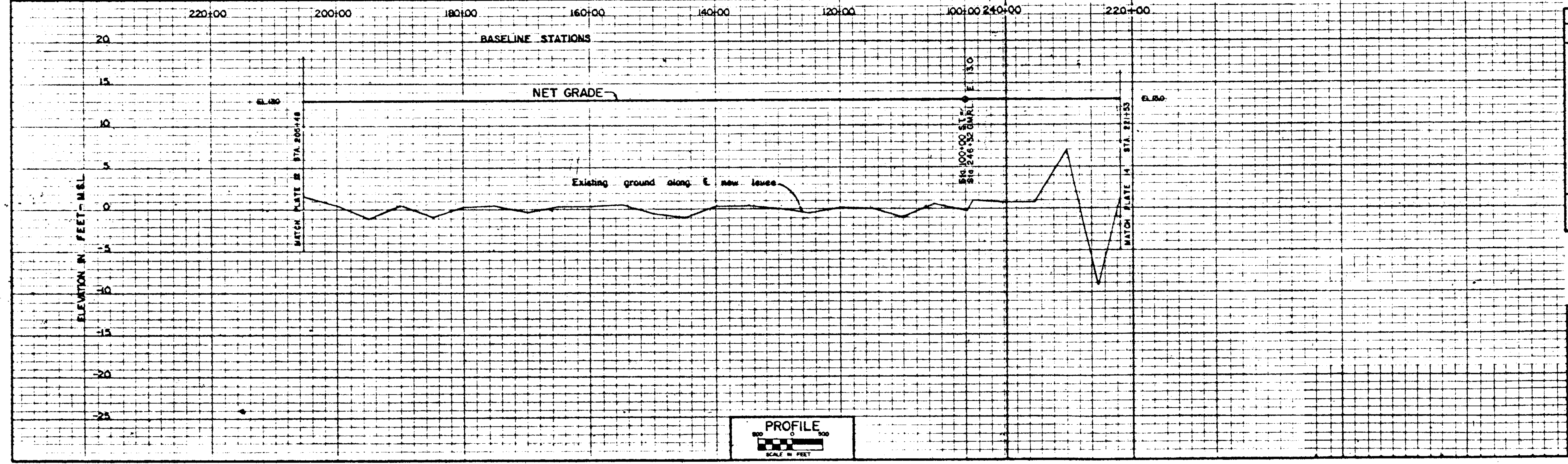


TABLE OF OFFSET

BASELINE STATION		OFFSET TO ℄ LEVEE	BASELINE STATION		OFFSET TO ℄ LEVEE
205+48.4	F.S.	343.3' ON 84° 46' AZ.			
143+36	P.S.	100'	149+88.21 ***		0'
102+20	F.S.	550'	142+59.49***		0'
226+20	P.S.	100'	229+97.74***		0'

* Normal to back tangent
** Normal to forward tangent
*** ℄ & Ⓑ same
F.S. Flood side
P.S. Protected side

SOUTH AND RING TRAVERSE

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)

DESIGN MEMORANDUM NO. I - GENERAL DESIGN

PLAN AND PROFILE

Sta. 205+48 to Sta. 100+00 = Sta. 246+32.
Sta. 246+32 to Sta. 221+53

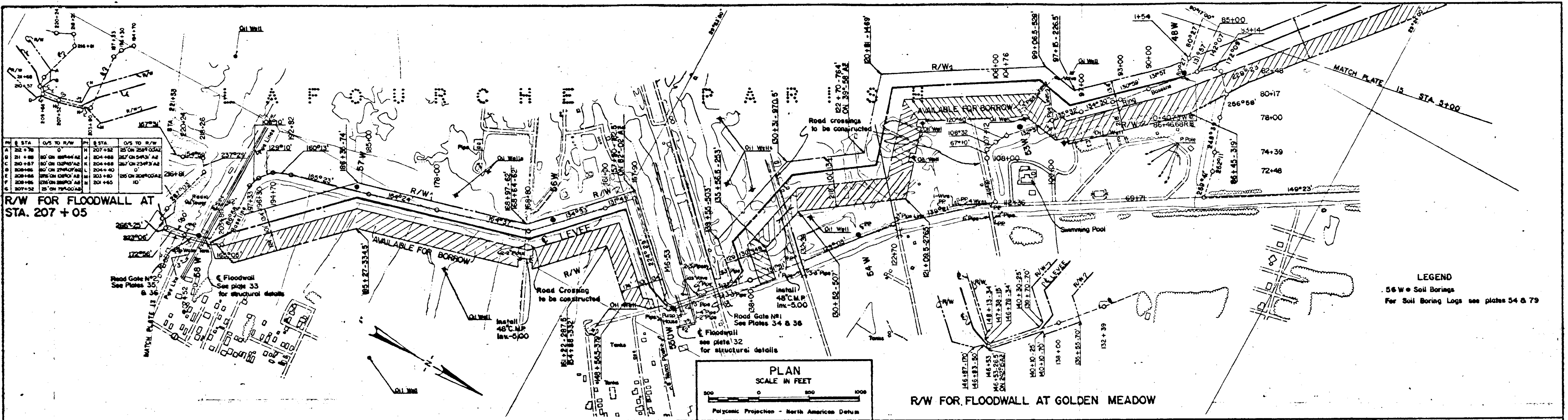
BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE: MARCH, 1972

FILE NO. H-2-24314

PLATE 13



Pt.	℄ STA.	O/S TO R/W	Pt.	℄ STA.	O/S TO R/W
A	212+78	0'	H	207+52	25' ON 258°00' AZ
B	211+68	80' ON 188°44' AZ	J	204+88	267' ON 54°31' AZ
C	210+57	80' ON 132°45' AZ	K	204+88	267' ON 234°31' AZ
D	209+66	80' ON 274°07' AZ	L	204+40	0'
E	208+66	275' ON 108°01' AZ	M	203+80	215' ON 208°00' AZ
F	208+66	275' ON 288°01' AZ	N	201+65	10'
G	207+52	25' ON 78°00' AZ			

R/W FOR FLOODWALL AT STA. 207 + 05

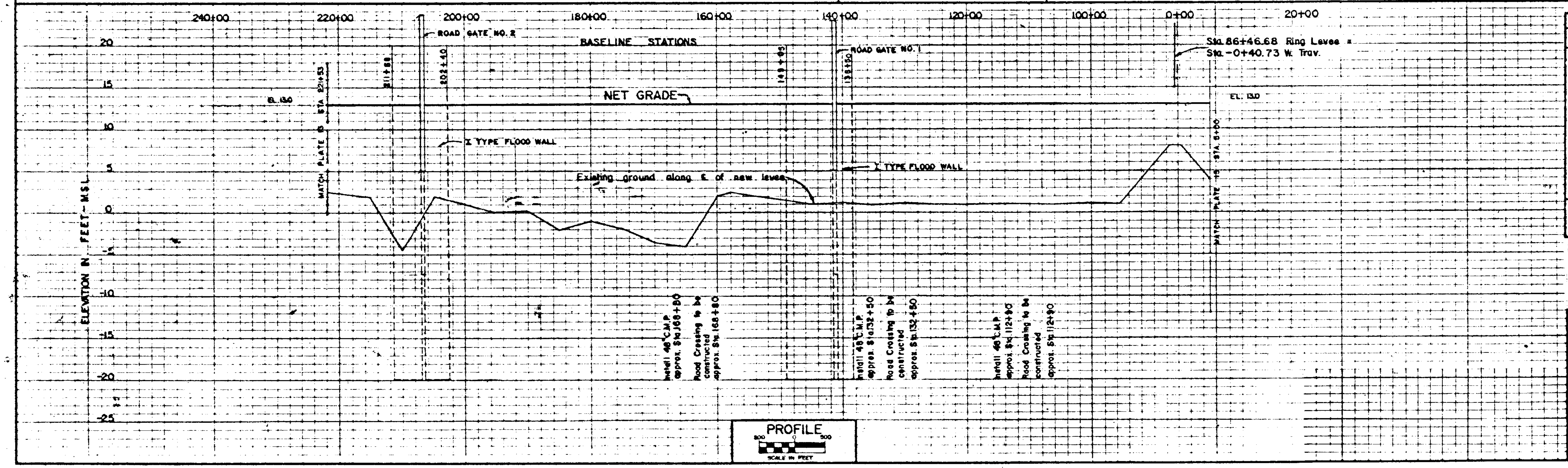


TABLE OF OFFSET					
BASELINE STATION		OFFSET TO ℄ LEVEE	BASELINE STATION		OFFSET TO ℄ LEVEE
			168+95*	P.S.	75'
			159+00	P.S.	75'
211+68	P.S.	89' on Az. 8°55'	149+00	P.S.	100'
210+57		0'	146+53***		0'
209+66***		0'	140+00***		0'
207+52***		0'	138+50	F.S.	95'
204+88***		0'	138+30	F.S.	425'
202+42	P.S.	15'	130+25	F.S.	830'
186+00	P.S.	60'	120+00**	F.S.	1320'
			99+90	F.S.	410'

* Normal to back tangent. F.S. Flood side

** Normal to forward tangent P.S. Protected side

*** ℄ & ℞ same

RING TRAVERSE

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

PLAN AND PROFILE

Sta. 221+53 to Sta. 86+46.68 = Sta. 0+00
Sta. 0+00 to Sta. 5+00

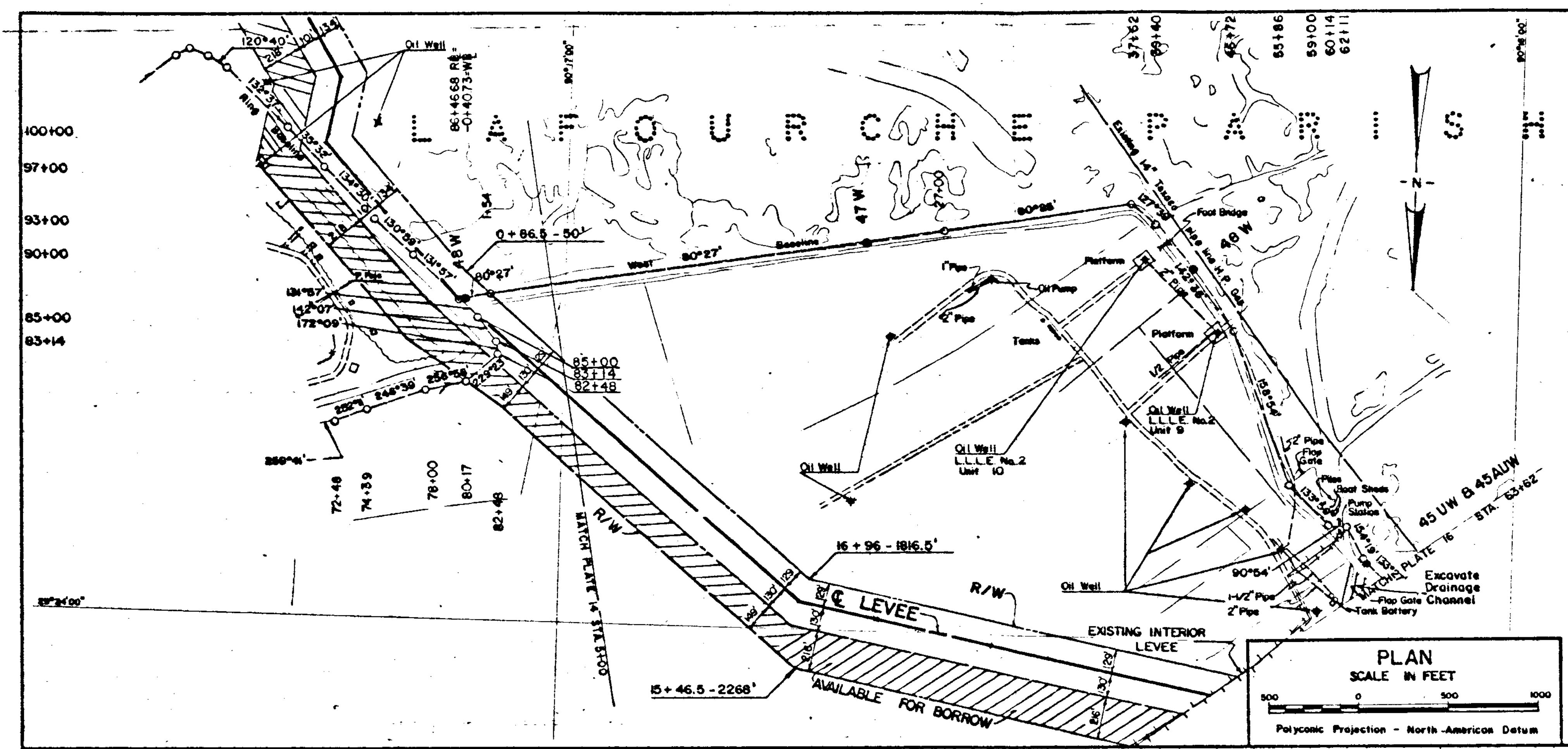
BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE: MARCH, 1972

FILE NO. H-2-24314

PLATE 14



LEGEND

48 W ● Soil Borings

For Soil Boring Logs see plates 52,70 & 79

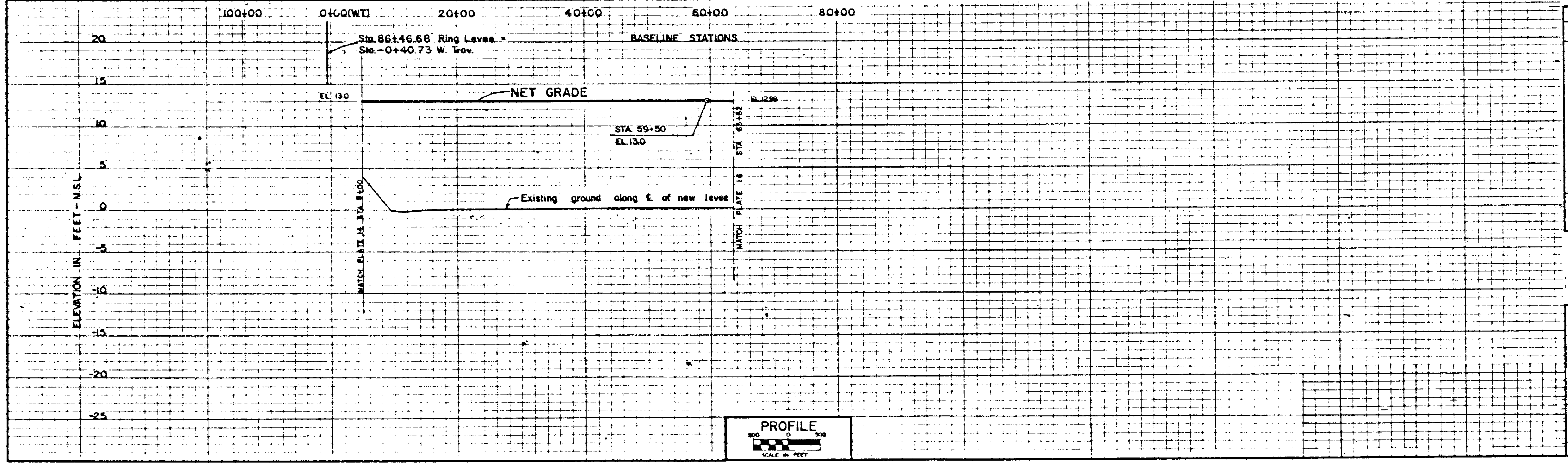


TABLE OF OFFSET

BASELINE STATION		OFFSET TO ℄ LEVEE	BASELINE STATION		OFFSET TO ℄ LEVEE
97+85	F.S.	95'			
86+46.68***		0'			
16+19	P.S.	1925'			

* Normal to back tangent
* * Normal to forward tangent
* * * ℄ & ℄ same

F.S. Flood side
P.S. Protected side

WEST TRAVERSE

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

PLAN AND PROFILE

Sta. 5+00 to Sta. 63+62

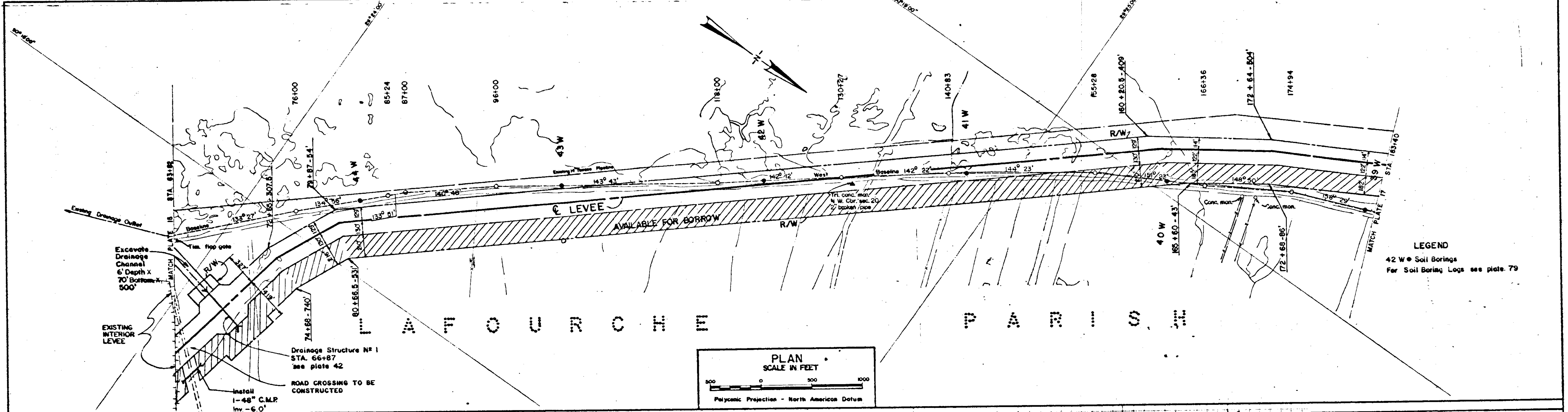
BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE: MARCH, 1972

FILE NO. H-2-24314

PLATE 15



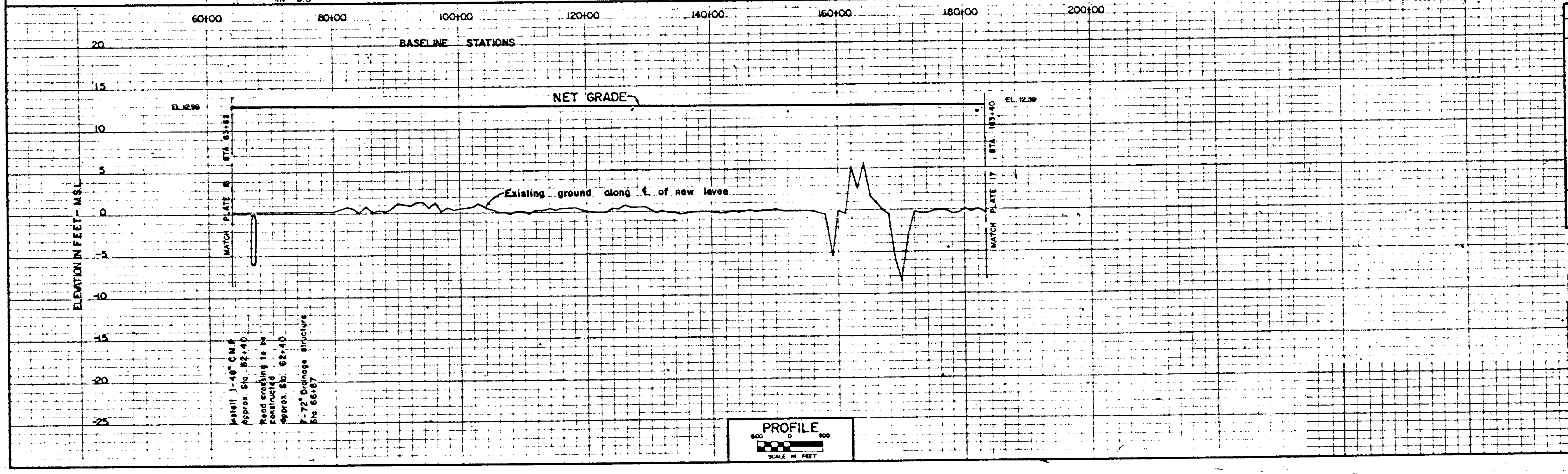


TABLE OF OFFSET

BASELINE STATION		OFFSET TO ℄ LEVEE	BASELINE STATION		OFFSET TO ℄ LEVEE
73+20	P.S.	425'			
80+05	P.S.	185'	131+28.8 * * *		0'
161+78	F.S.	310'			
172+65	F.S.	390'			

* Normal to back tangent
* * Normal to forward tangent
* * * ℄ & ℞ same

F.S. Flood side
P.S. Protected side

WEST TRAVERSE

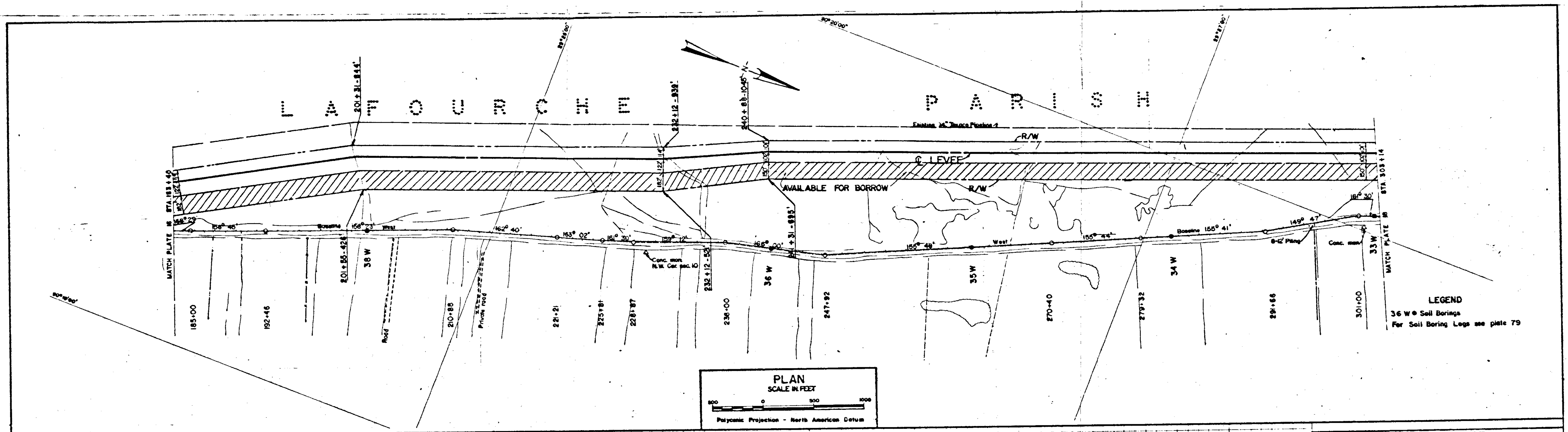
GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

PLAN AND PROFILE
Sta. 63+62 to Sta. 183+40

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE: MARCH, 1972
FILE NO. H-2-24314



LEGEND

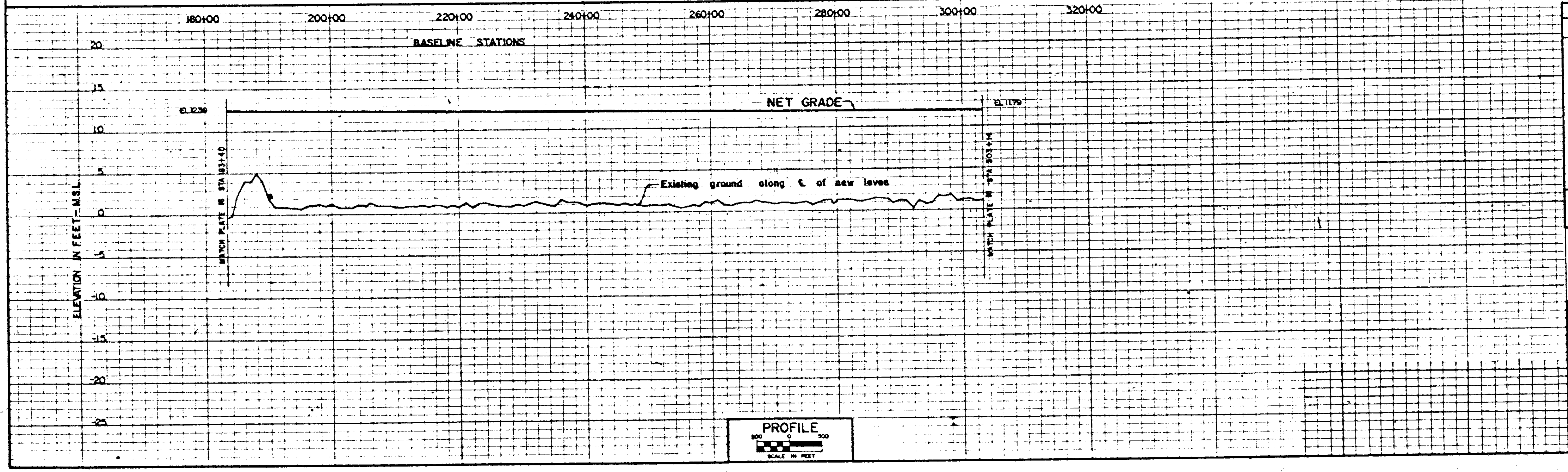
36 W ● Soil Borings

For Soil Boring Logs see plate 79

PLAN

SCALE IN FEET

Polyconic Projection - North American Datum



PROFILE

SCALE IN FEET

TABLE OF OFFSET					
BASELINE STATION		OFFSET TO ℄ LEVEE	BASELINE STATION		OFFSET TO ℄ LEVEE
201+ 36	F.S.	730'			
232+12	F.S.	825'			
241+ 00	F.S.	945'			

* Normal to back tangent

* * Normal to forward tangent

* * * ℄ & ℄ same

F.S. Flood side

P.S. Protected side

WEST TRAVERSE

GRAND ISLE, LOUISIANA, AND VICINITY

(LAROSE TO VICINITY OF GOLDEN MEADOW)

DESIGN MEMORANDUM NO. I - GENERAL DESIGN

PLAN AND PROFILE

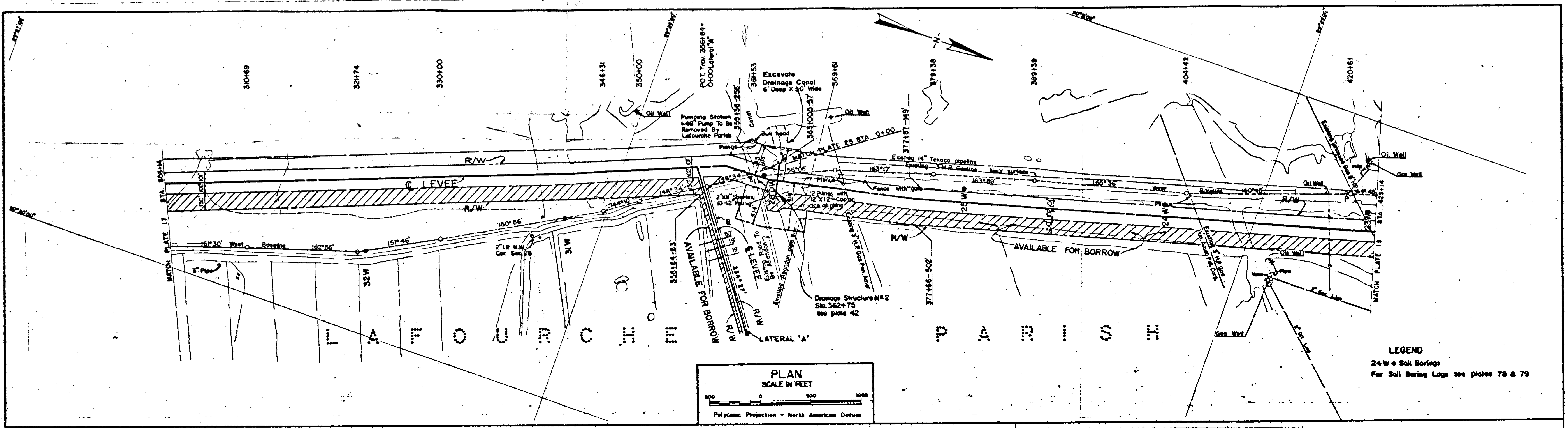
Sta. 183+40 to Sta. 303+14

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE: MARCH, 1972

FILE NO. H-2-24314



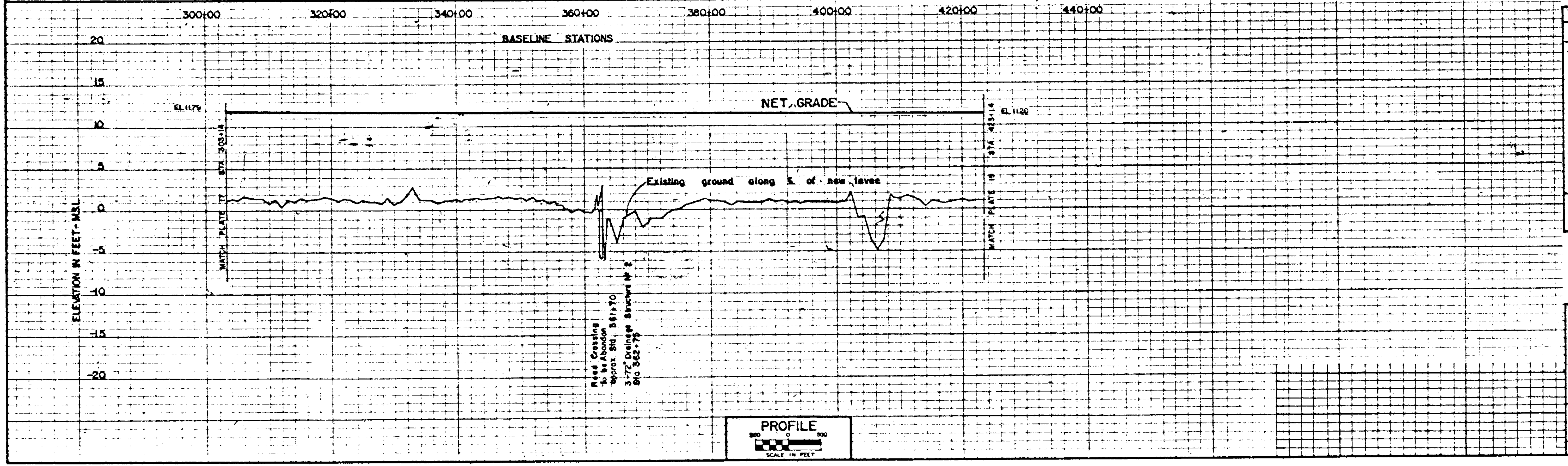


TABLE OF OFFSET

BASELINE STATION		OFFSET TO ℄ LEVEE	BASELINE STATION		OFFSET TO ℄ LEVEE
359+00 **	F.S.	160'	361+76 ***		0'
362+70 **	P.S.	40'			
377 +80	P.S.	250'			

* Normal to back tangent
* * Normal to forward tangent
* * * ℄ & ℄ same

F.S. Flood side
P.S. Protected side

WEST TRAVERSE

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I - GENERAL DESIGN

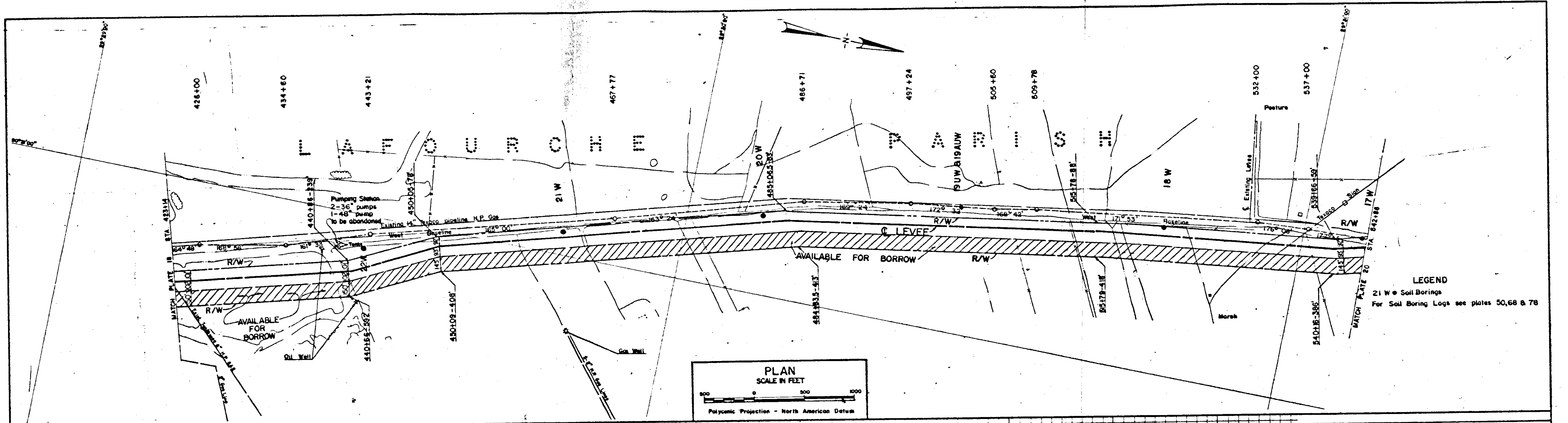
PLAN AND PROFILE
Sta. 303+14 to Sta. 423+14

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE: MARCH, 1972
FILE NO. H-2-24314

PLATE 18



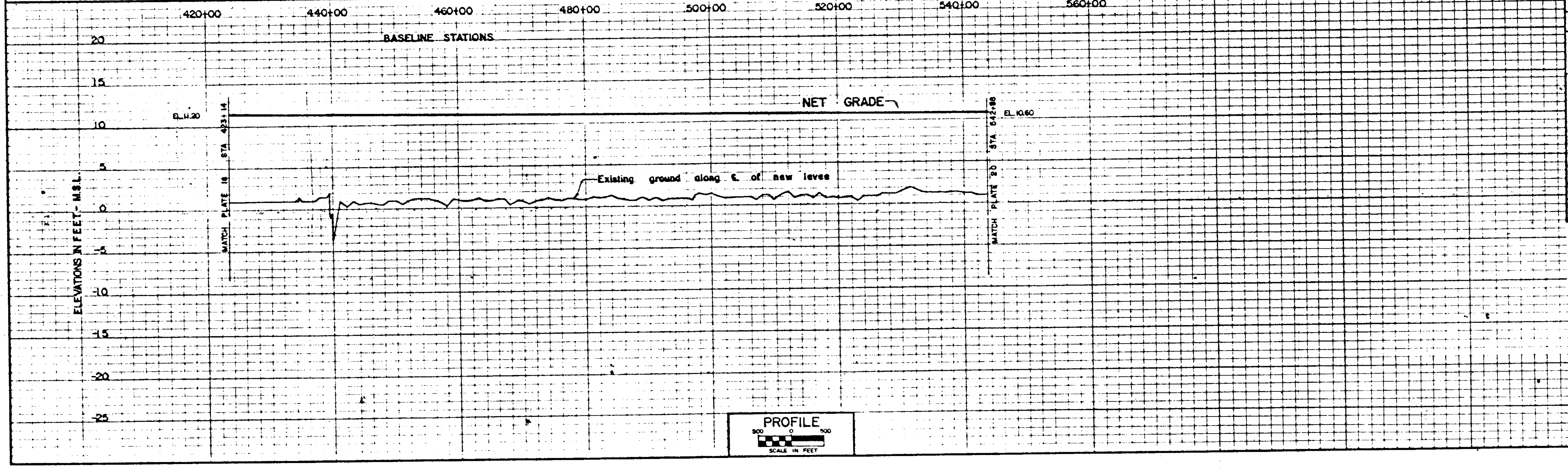


TABLE OF OFFSET

BASELINE STATION		OFFSET TO € LEVEE	BASELINE STATION		OFFSET TO € LEVEE
440+80	P.S.	340'			
450+06	P.S.	170'			
485+00	P.S.	175'			
515+78	P.S.	180'			
539+80	P.S.	150'			

* Normal to back tangent
** Normal to forward tangent
*** € & Ɓ same

F.S. Flood side
P.S. Protected side

WEST TRAVERSE

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I - GENERAL DESIGN

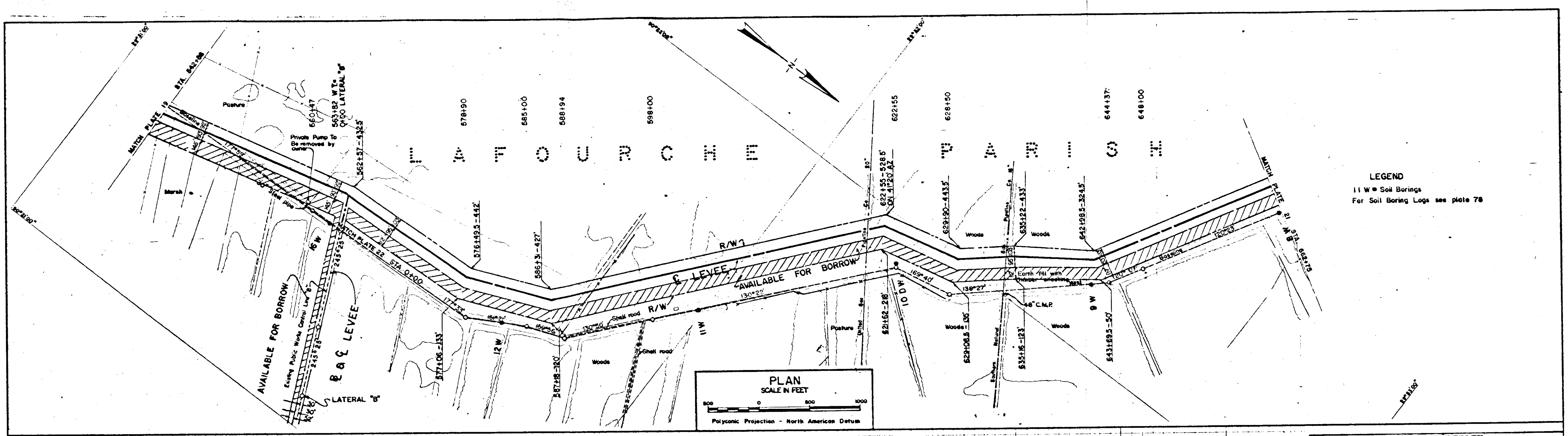
PLAN AND PROFILE
Sta. 423+14 to Sta. 542+88

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE: MARCH, 1972
FILE NO. H-2-24314

PLATE 19



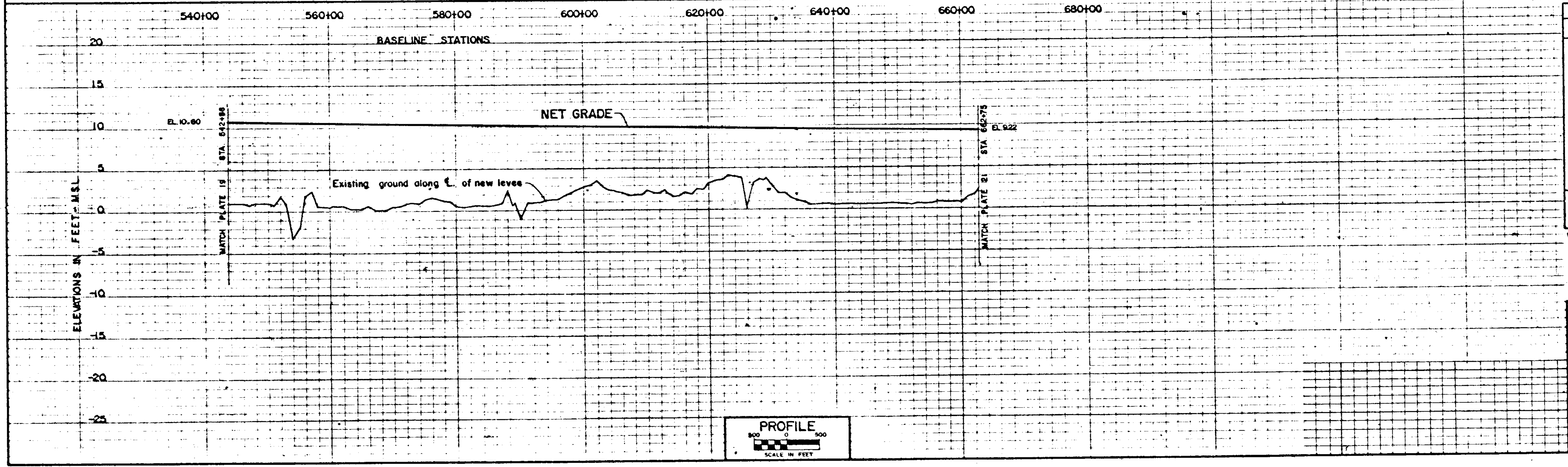


TABLE OF OFFSET

BASELINE STATION		OFFSET TO ℄ LEVEE	BASELINE STATION		OFFSET TO ℄ LEVEE
562+17	F.S.	330'	546+76.43***		0'
576+70	F.S.	340'			
586+60	F.S.	325'			
622+30	F.S.	425'			
627+70	F.S.	350'			
635+20	F.S.	330'			
643+07	F.S.	240'			

* Normal to back tangent
* * Normal to forward tangent
* * * ℄ & ℞ same

F.S. Flood side
P.S. Protected side

WEST TRAVERSE

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I - GENERAL DESIGN

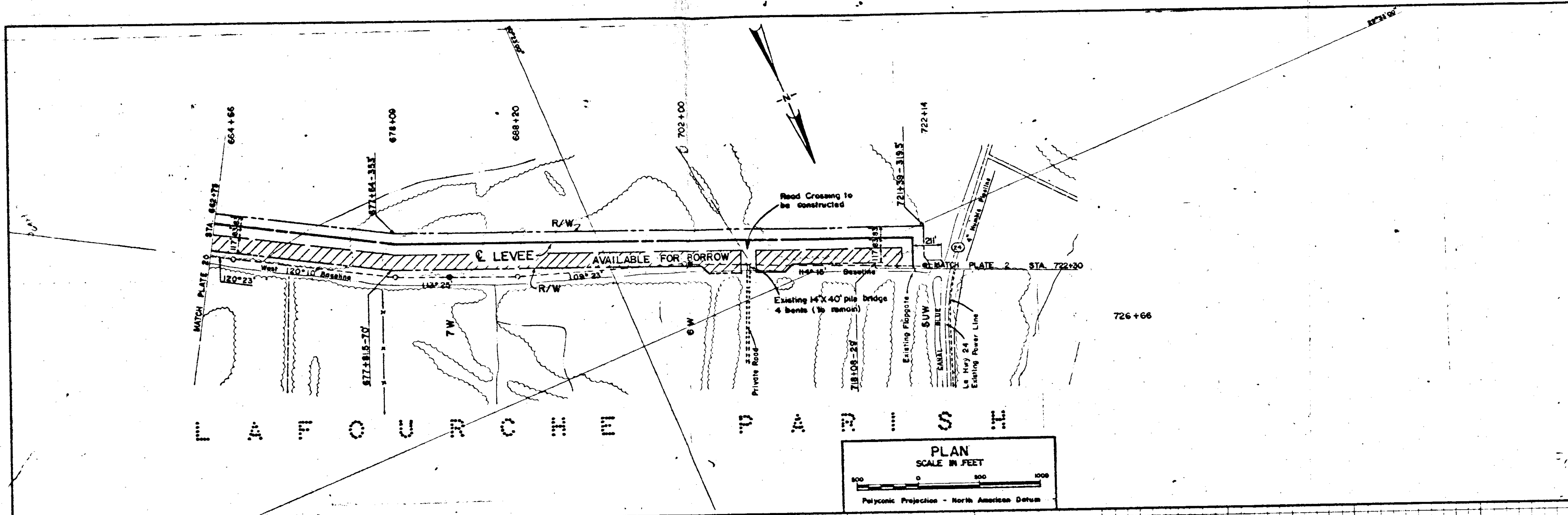
PLAN AND PROFILE
Sta. 542+88 to Sta. 662+75

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE: MARCH, 1972
FILE NO. H-2-24314

PLATE 20



LEGEND
6 W ● Soil Boring
For Soil Boring Logs see plates 48 & 76

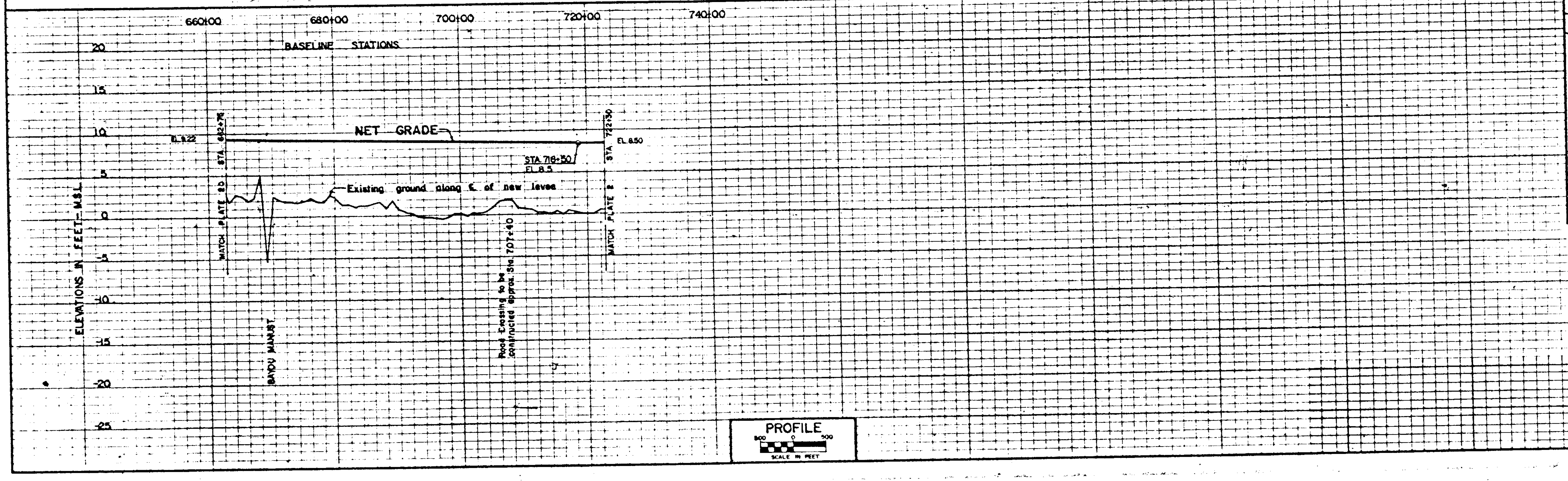


TABLE OF OFFSET

BASELINE STATION		OFFSET TO ℄ LEVEE	BASELINE STATION		OFFSET TO ℄ LEVEE
677+69	F.S.	270'			
720+79	F.S.	235'			

* Normal to back tangent
** Normal to forward tangent
*** ℄ & ℄ same

F.S. Flood side
P.S. Protected side

WEST TRAVERSE

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I - GENERAL DESIGN

PLAN AND PROFILE

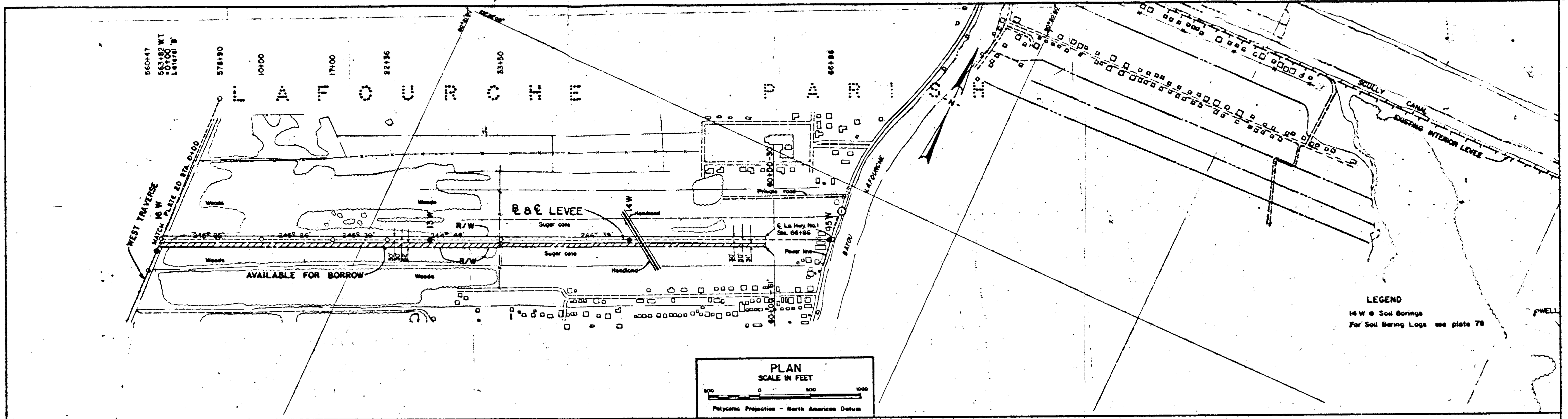
Sta. 662+75 to Sta. 722+30

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE: MARCH, 1972
FILE NO. H-2-24314

PLATE 21



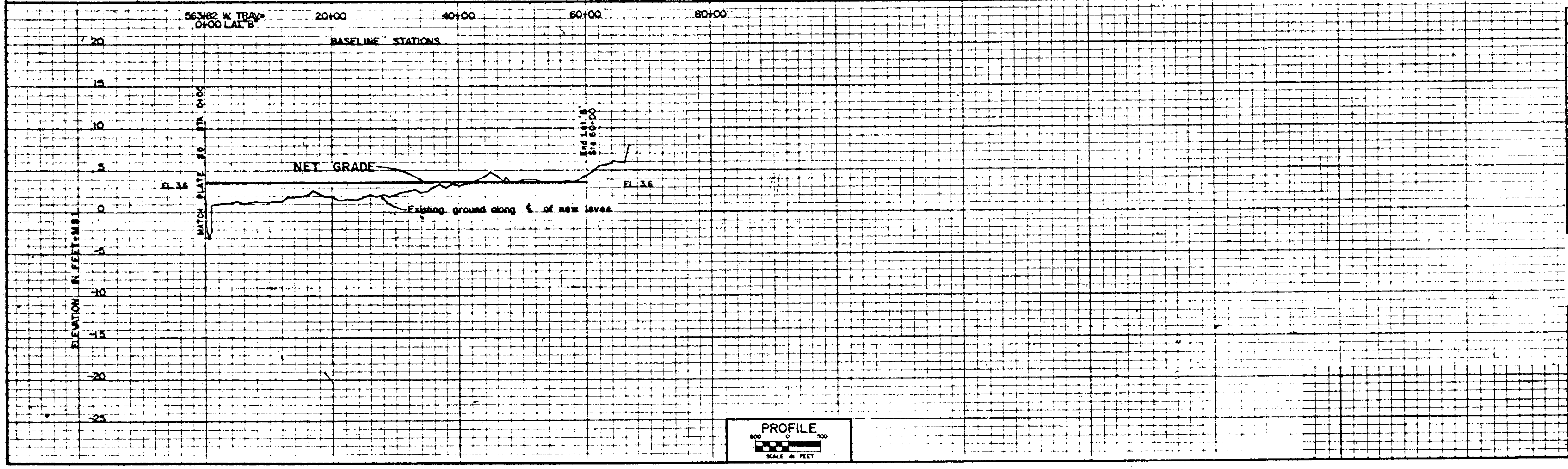


TABLE OF OFFSET

BASELINE STATION		OFFSET TO ℄ LEVEE	BASELINE STATION		OFFSET TO ℄ LEVEE
0+00***		0			
60+00***		0			

* Normal to back tangent
** Normal to back tangent
*** ℄ & ℄ same

Rt. Right Of ℄
Lt. Left Of ℄

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)

DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

PLAN AND PROFILE
LATERAL "B"
Sta. 0+00 to Sta. 60+00

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE: MARCH, 1972

FILE NO. H-2-24314

PLATE 22

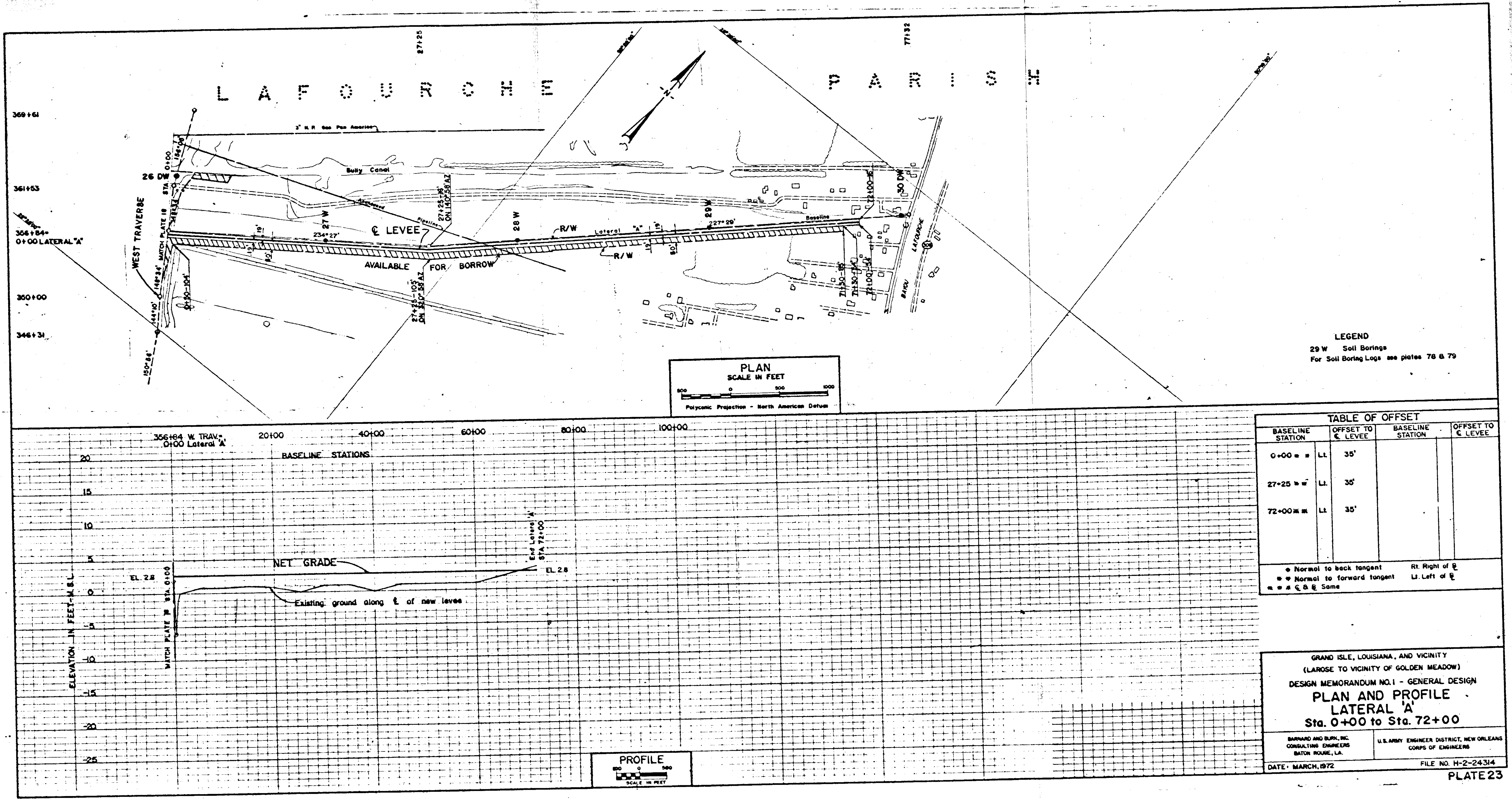


TABLE OF OFFSET

BASELINE STATION		OFFSET TO ℄ LEVEE	BASELINE STATION		OFFSET TO ℄ LEVEE
0+00 ✱ ✱	Lt.	35'			
27+25 ✱ ✱	Lt.	35'			
72+00 ✱ ✱	Lt.	35'			

✱ Normal to back tangent
✱ ✱ Normal to forward tangent
✱ ✱ ✱ ℄ & ℗ Same

Rt. Right of ℗
Lt. Left of ℗

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

PLAN AND PROFILE
LATERAL 'A'
Sta. 0+00 to Sta. 72+00

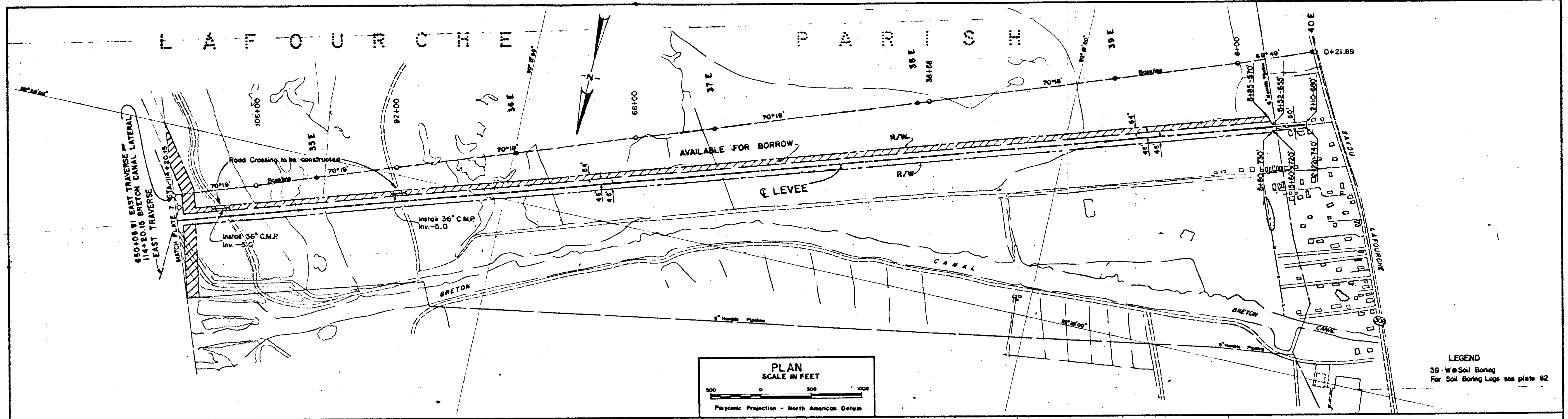
BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE: MARCH, 1972

FILE NO. H-2-24314

PLATE 23



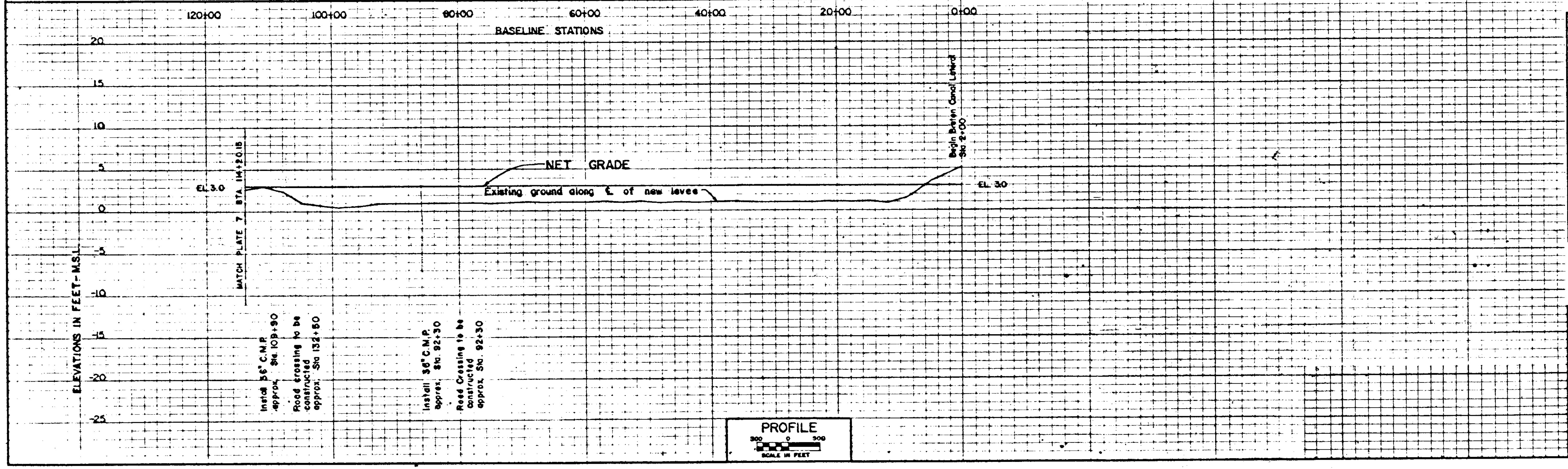


TABLE OF OFFSET

BASELINE STATION		OFFSET TO ℄ LEVEE	BASELINE STATION		OFFSET TO ℄ LEVEE
2+00	Lt.	710'			
8+00**	Lt.	660'			
38+68*	Lt.	545'			
68+00*	Lt.	430'			
92+00*	Lt.	340'			
106+00*	Lt.	280'			

* Normal to back tangent
** Normal to forward tangent
*** ℄ & ℄ Same

Rt. Right Of ℄
Lt. Left Of ℄

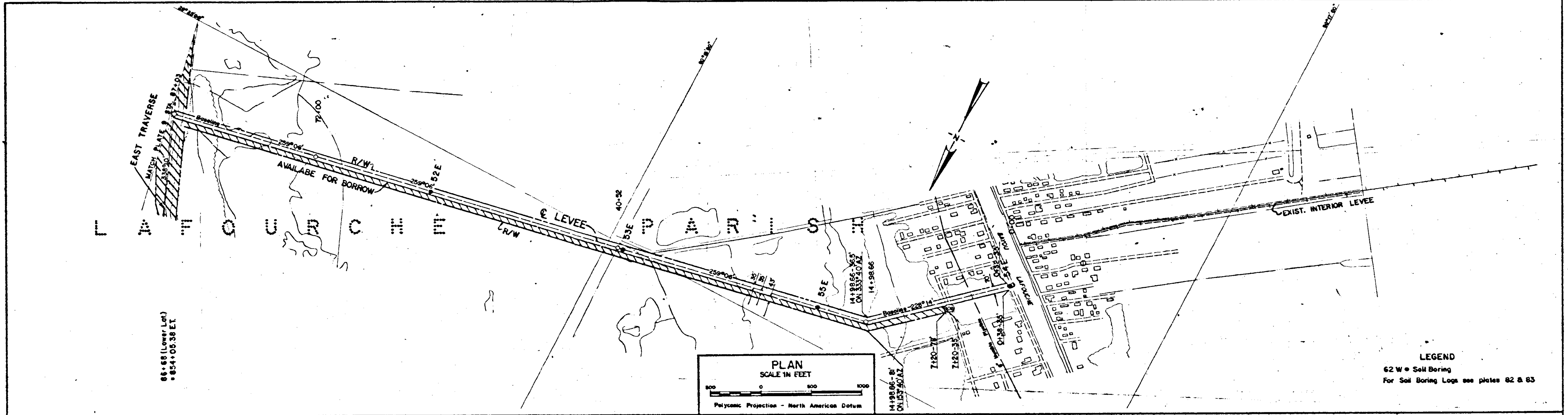
GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I - GENERAL DESIGN

PLAN AND PROFILE BRETON CANAL LATERAL Sta. 114+20.15 to Sta. 2+00

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

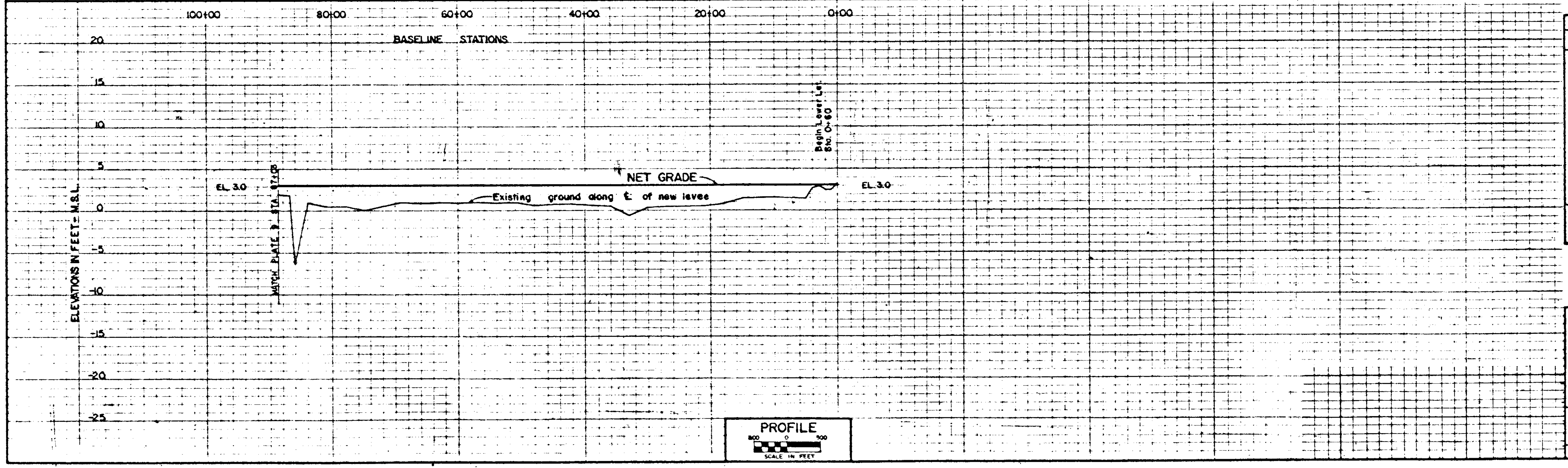
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

DATE: MARCH, 1972
FILE NO. H-2-24314



PLAN
SCALE IN FEET
800 0 500 1000
Polyconic Projection - North American Datum

LEGEND
62 W ● Soil Boring
For Soil Boring Logs see plates 82 & 83



PROFILE
800 0 500
SCALE IN FEET

TABLE OF OFFSET					
BASELINE STATION		OFFSET TO ℄ LEVEE	BASELINE STATION		OFFSET TO ℄ LEVEE
0+60***		0			
14+98.66***		0			
86+86***		0			

* Normal to back tangent
** Normal to forward tangent
*** ℄ & ℄ same
Rt. Right of ℄
Lt. Left of ℄

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

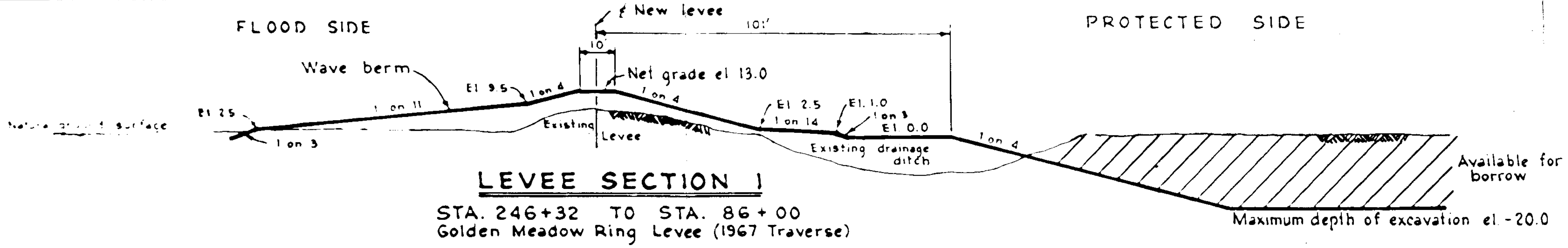
PLAN AND PROFILE
LOWER LATERAL
Sta. 87+03 to Sta. 0+60

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

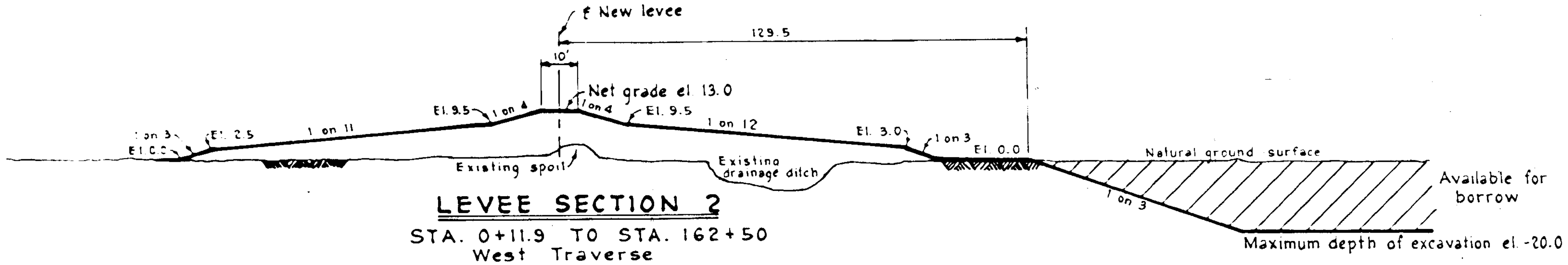
DATE: MARCH, 1972
FILE NO. H-2-24314

PLATE 25



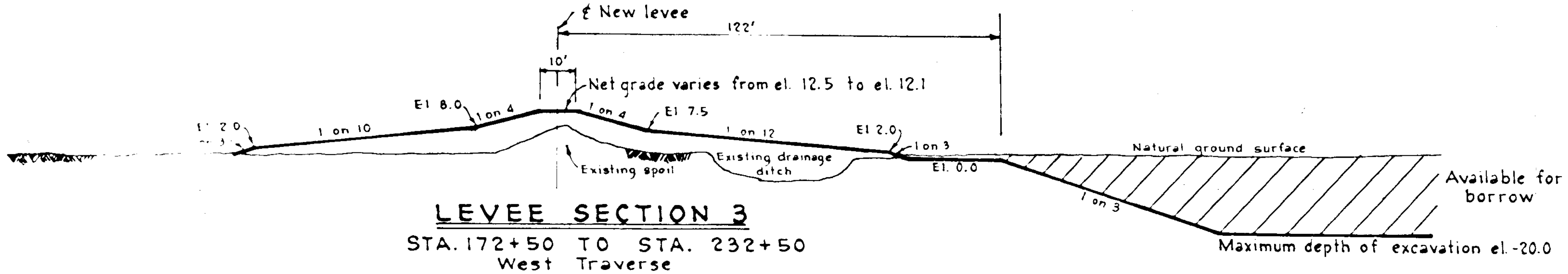
LEVEE SECTION 1

STA. 246+32 TO STA. 86+00
Golden Meadow Ring Levee (1967 Traverse)



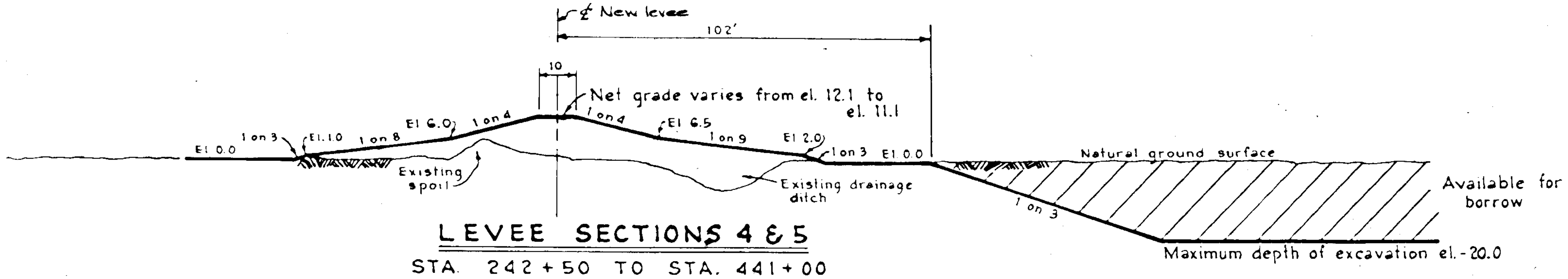
LEVEE SECTION 2

STA. 0+11.9 TO STA. 162+50
West Traverse



LEVEE SECTION 3

STA. 172+50 TO STA. 232+50
West Traverse



LEVEE SECTIONS 4 & 5

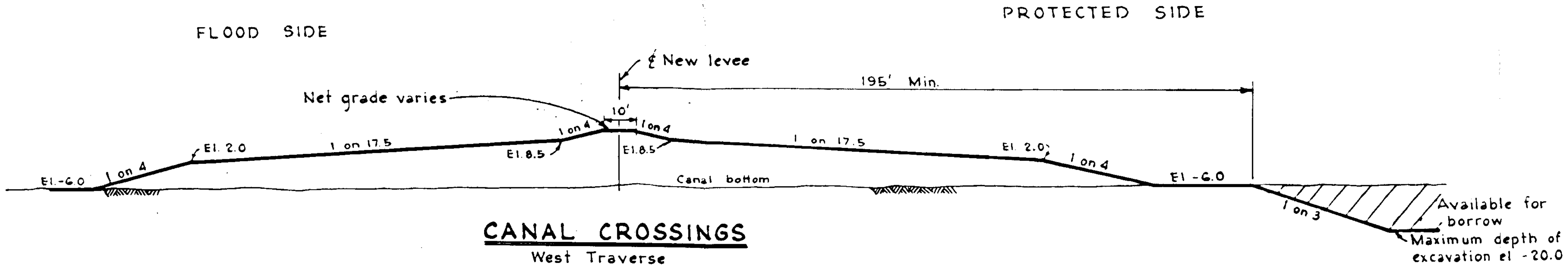
STA. 242+50 TO STA. 441+00
West Traverse

NOTES:
Sections plotted are not to scale.
Elevations are in feet and refer to m.s.l.
For plan, profile & limits of R/W see Plates 2 thru 25

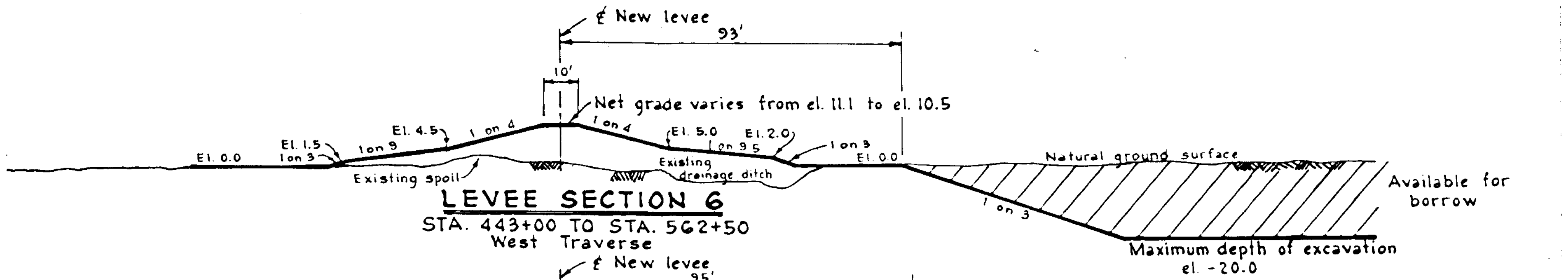
GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

DESIGN SECTIONS
LEVEE SECTIONS 1, 2, 3, 4 & 5

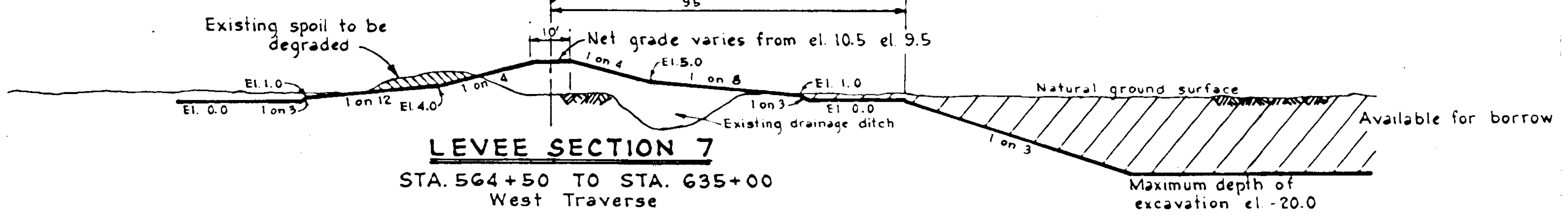
BARNARD AND BURK, INC. CONSULTING ENGINEERS BATON ROUGE, LA	U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS
DATE: MARCH, 1972	FILE NO. H-2-24314



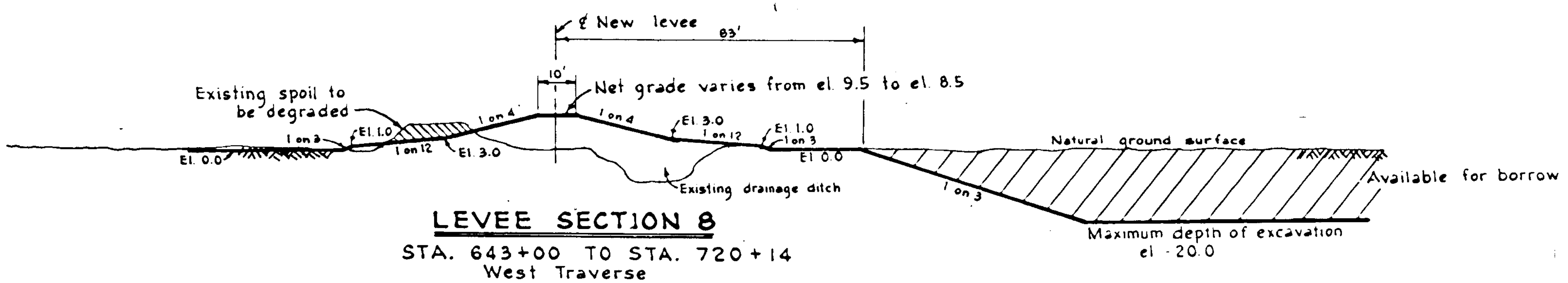
CANAL CROSSINGS
West Traverse



LEVEE SECTION 6
STA. 443+00 TO STA. 562+50
West Traverse



LEVEE SECTION 7
STA. 564+50 TO STA. 635+00
West Traverse



LEVEE SECTION 8
STA. 643+00 TO STA. 720+14
West Traverse

NOTES:
Sections plotted are not to scale.
Elevations are in feet and refer to m.s.l.
For plan, profile & limits of R/W see Plates 2 Thru 25

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

DESIGN SECTIONS
CANAL CROSSINGS (WEST TRAVERSE) AND LEVEE SECTIONS 6, 7, & 8

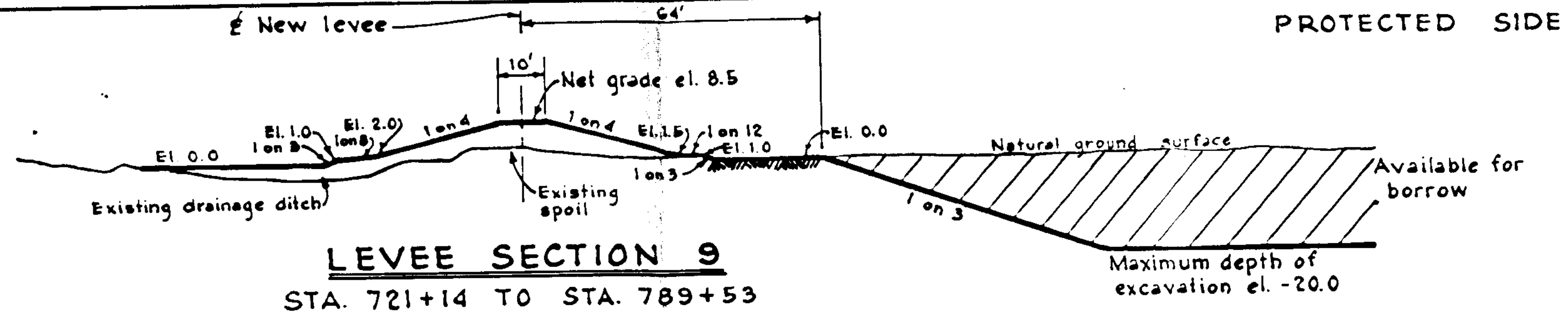
BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA

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

DATE MARCH, 1972
FILE NO H-2-24314

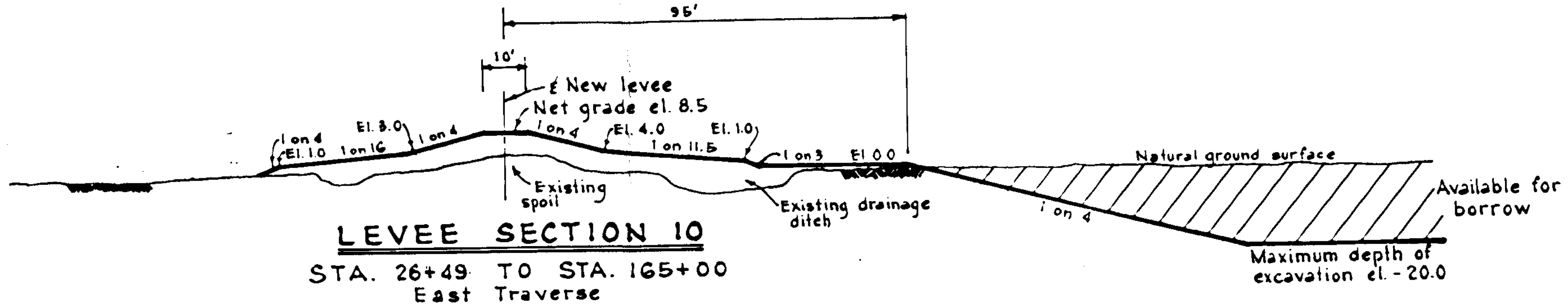
FLOOD SIDE

PROTECTED SIDE



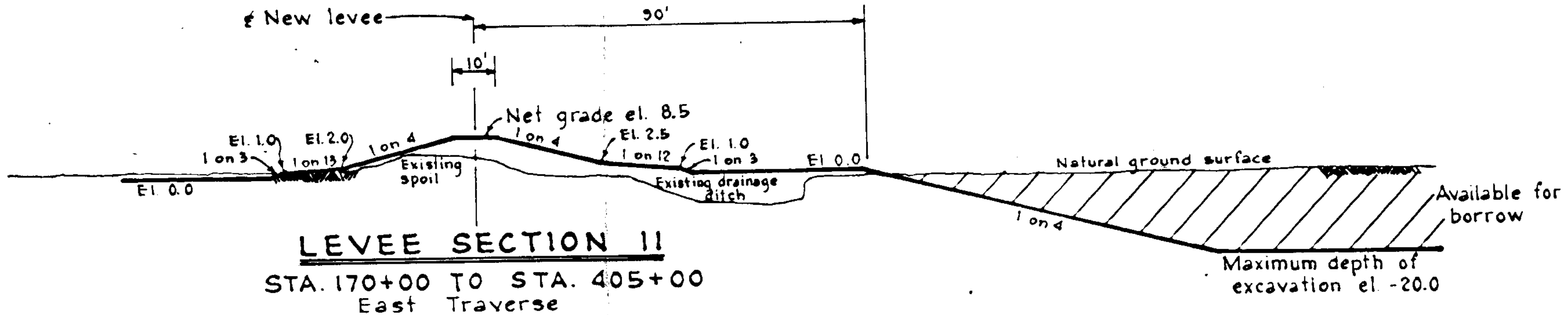
LEVEE SECTION 9

STA. 721+14 TO STA. 789+53
West Traverse



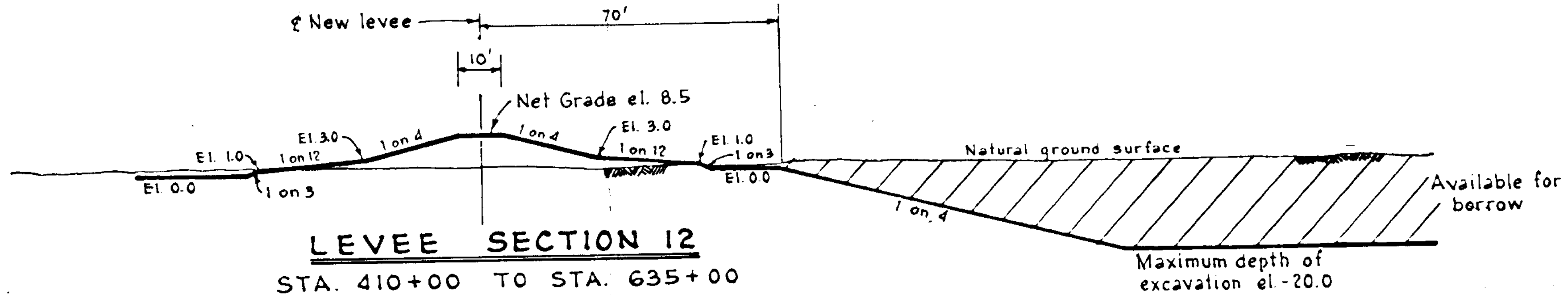
LEVEE SECTION 10

STA. 26+49 TO STA. 165+00
East Traverse



LEVEE SECTION 11

STA. 170+00 TO STA. 405+00
East Traverse



LEVEE SECTION 12

STA. 410+00 TO STA. 635+00
East Traverse

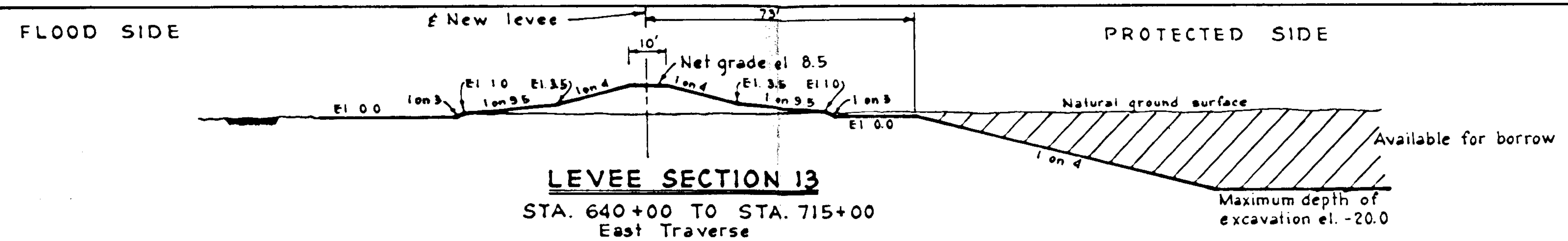
NOTES:
Sections plotted are not to scale.
Elevations are in feet and refer to m.s.l
For plan, profile & limits of R/W see Plates 2 Thru 25

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

DESIGN SECTIONS
LEVEE SECTIONS 9, 10, 11 & 12

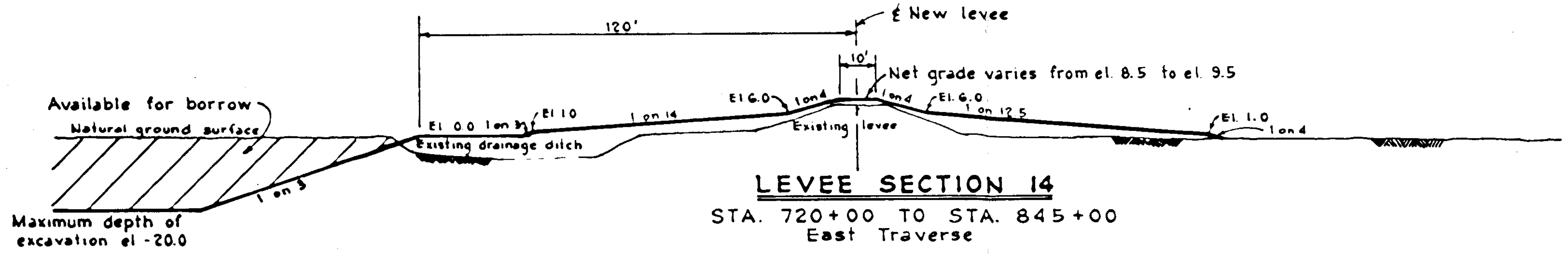
BARNARD AND BURK, INC. CONSULTING ENGINEERS BATON ROUGE, LA	U S ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS
DATE: MARCH, 1972	FILE NO H-2-24314

PLATE 28



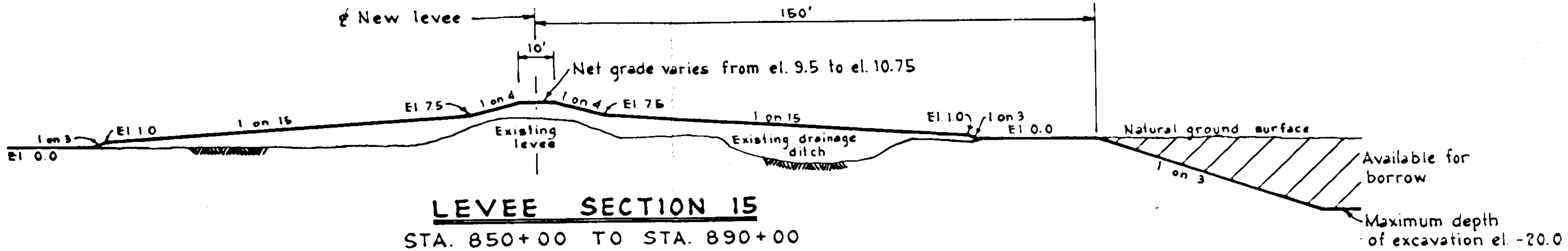
LEVEE SECTION 13

STA. 640+00 TO STA. 715+00
East Traverse



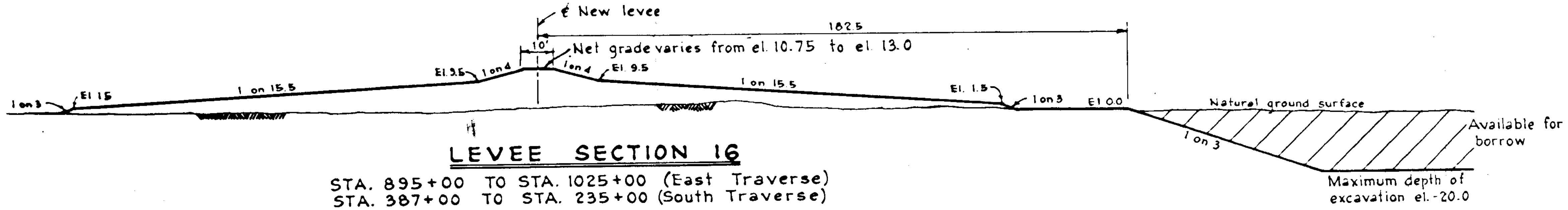
LEVEE SECTION 14

STA. 720+00 TO STA. 845+00
East Traverse



LEVEE SECTION 15

STA. 850+00 TO STA. 890+00
East Traverse



LEVEE SECTION 16

STA. 895+00 TO STA. 1025+00 (East Traverse)
STA. 387+00 TO STA. 235+00 (South Traverse)

NOTES:
Sections plotted are not to scale.
Elevations are in feet and refer to m.s.l.
For plan, profile & limits of R/W see Plates 2 Thru 25

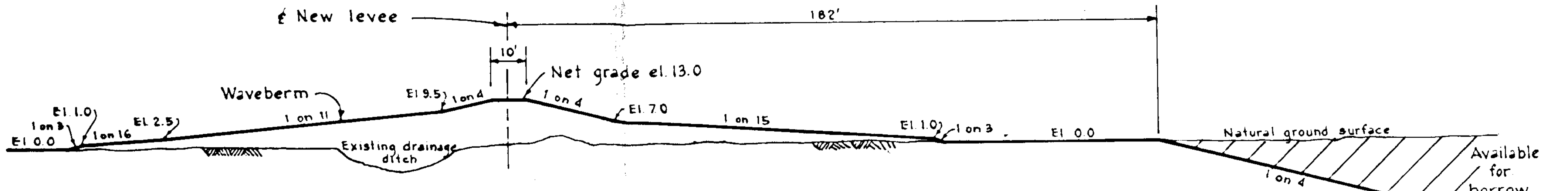
GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

DESIGN SECTIONS
LEVEE SECTIONS 13, 14, 15 & 16

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

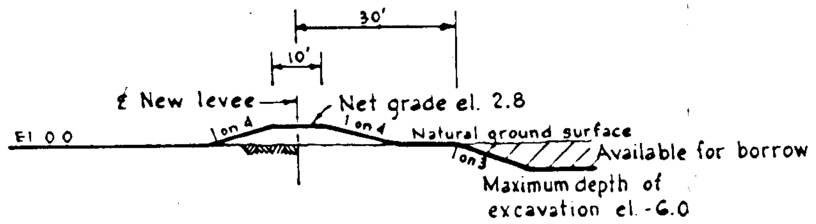
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

DATE: MARCH, 1972
FILE NO. H-2-24314

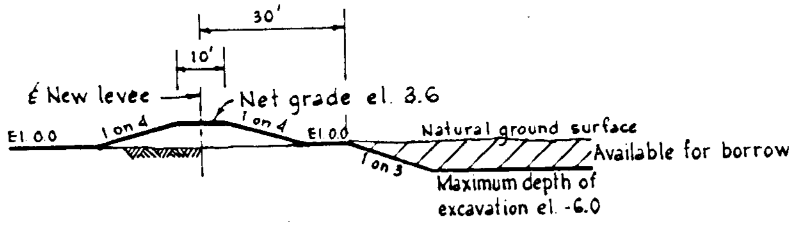


LEVEE SECTION 17

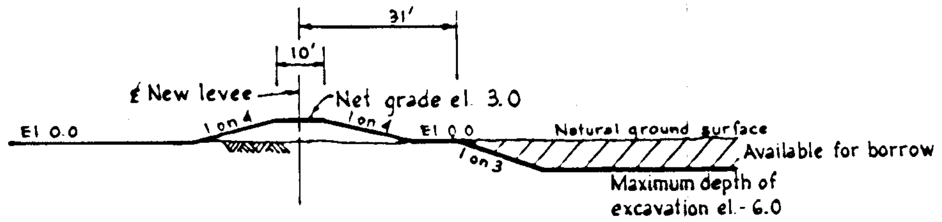
STA. 235+00 TO STA. 100+00
South Traverse



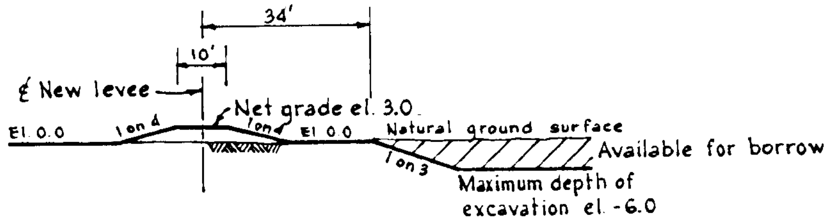
LATERAL A



LATERAL B



BRETON CANAL LATERAL



LOWER LATERAL

NOTES:

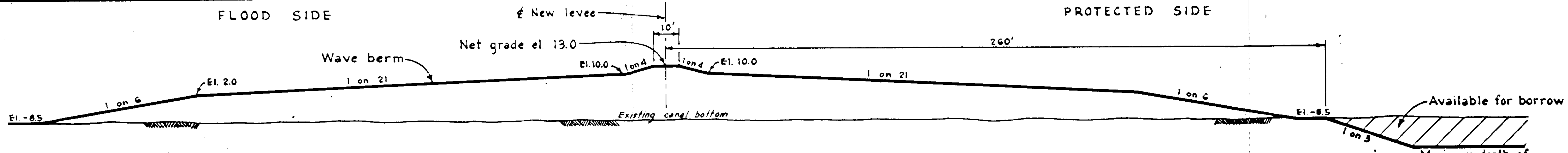
Sections plotted are not to scale.
Elevations are in feet and refer to m.s.l.
For plan, profile & limits of R/W see Plates 2 Thru 25.

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO.1 - GENERAL DESIGN
DESIGN SECTIONS
LEVEE SECTION 17, LATERAL "A", LATERAL "B",
BRETON CANAL LATERAL, LOWER LATERAL

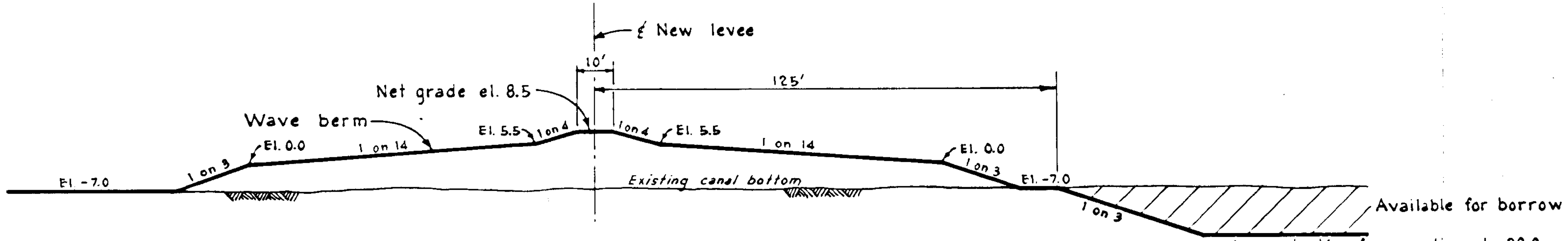
BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE: MARCH, 1972
FILE NO. H-2-24314

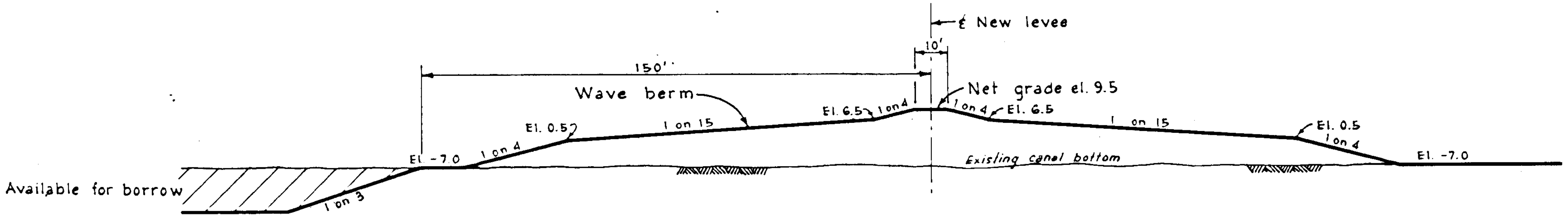


GOLDEN MEADOW RING LEVEE
(1967 TRAVERSE)

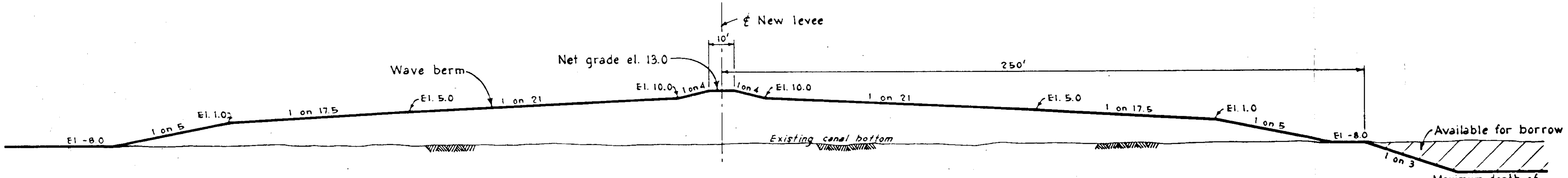


STA. 26+49 TO STA. 715+00
(EAST TRAVERSE)

NOTES:
Sections plotted are not to scale.
Elevations are in feet and refer to m. s. l.
For plan, profile, & limits of R/W see plates 2 thru 25



STA. 720+00 TO STA. 845+00
(EAST TRAVERSE)



STA. 895+00 TO STA. 1025+00 (EAST TRAVERSE)
STA. 387+00 TO STA. 235+00 (SOUTH TRAVERSE)

CANAL CROSSINGS

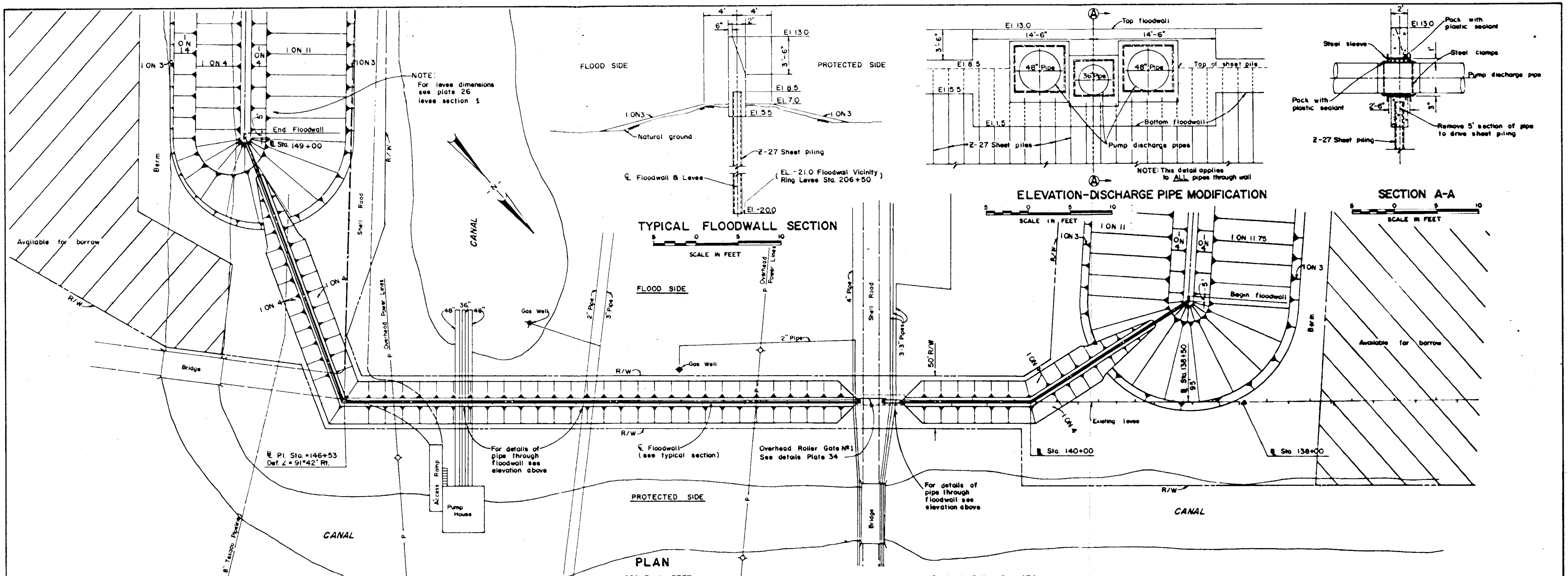
GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
DESIGN SECTIONS
CANAL CROSSINGS (GOLDEN MEADOW RING LEVEE 1967, EAST, AND SOUTH TRAVERSES)

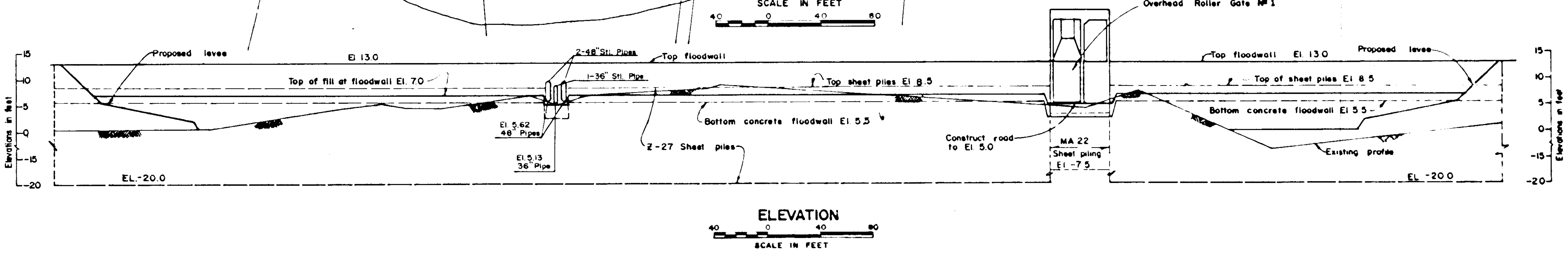
BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA

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

DATE: MARCH, 1972
FILE NO. H-2-24314

PLATE 31





NOTE
Elevations are in feet and refer to mean sea level

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I - GENERAL DESIGN

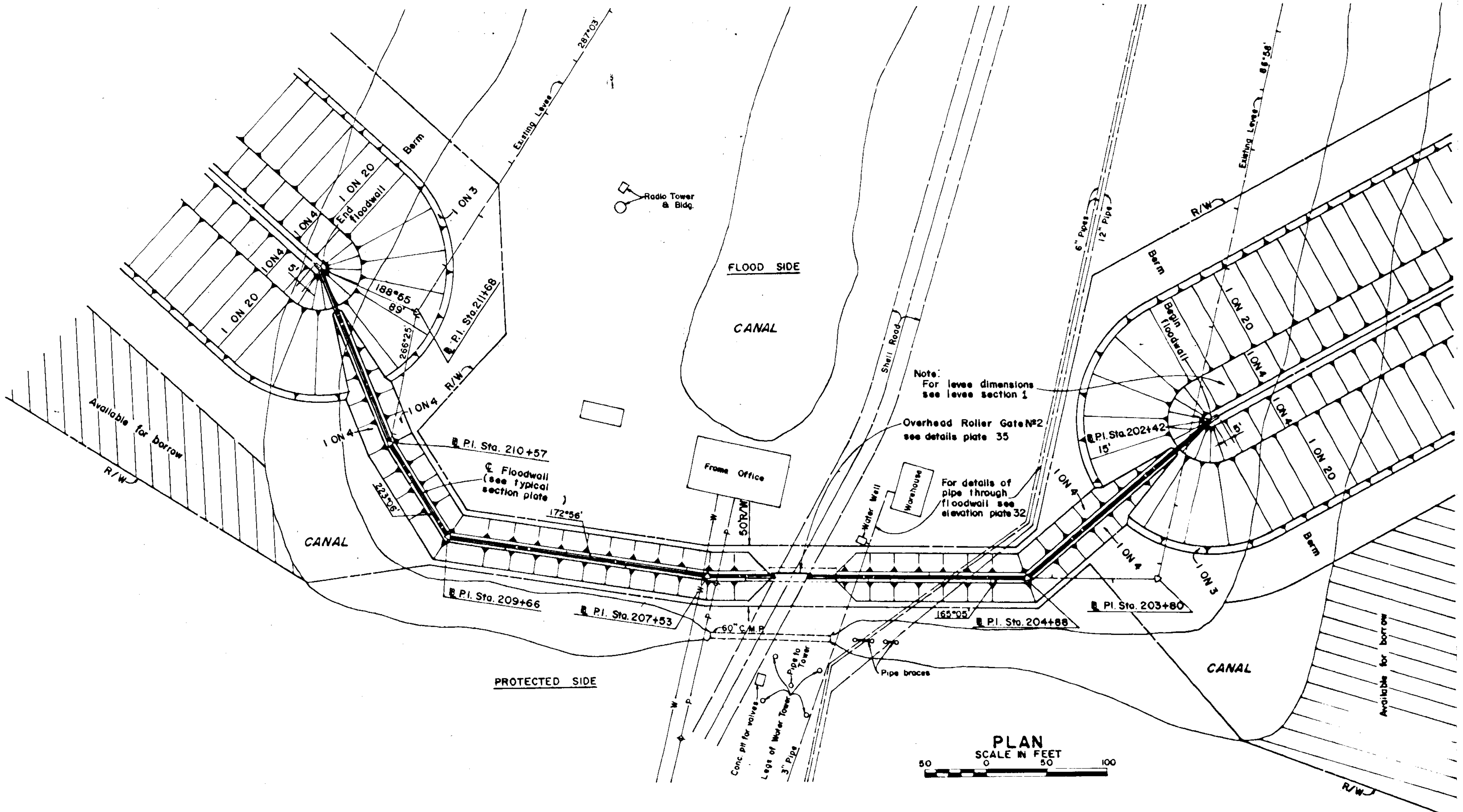
FLOODWALL AT GOLDEN MEADOW PUMPING STATION

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA

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

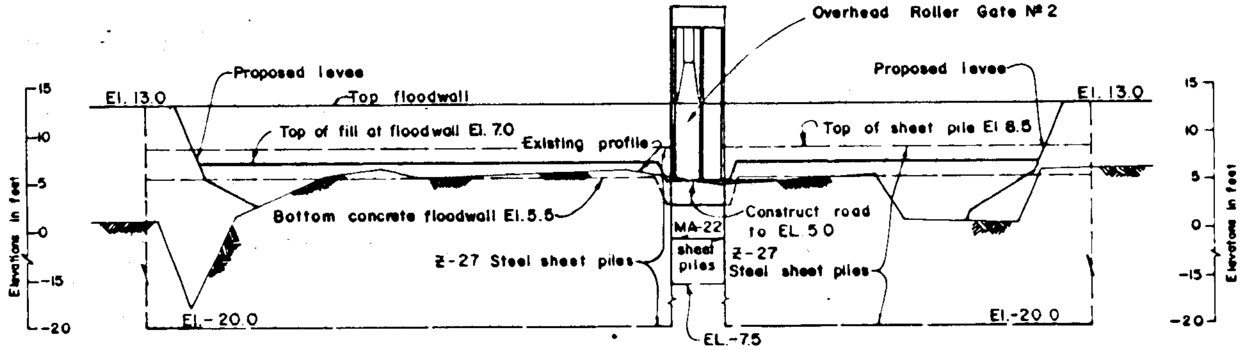
DATE MARCH 1972
FILE NO H-2-24314

PLATE 32



PLAN

SCALE IN FEET



ELEVATION

SCALE IN FEET

NOTE:
For typical floodwall section, see plate 32.

NOTE:
Elevations are in feet and refer to mean sea level.

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

FLOODWALL
STA. 211+68 to STA. 202+42
RING LEVEE TRAVERSE

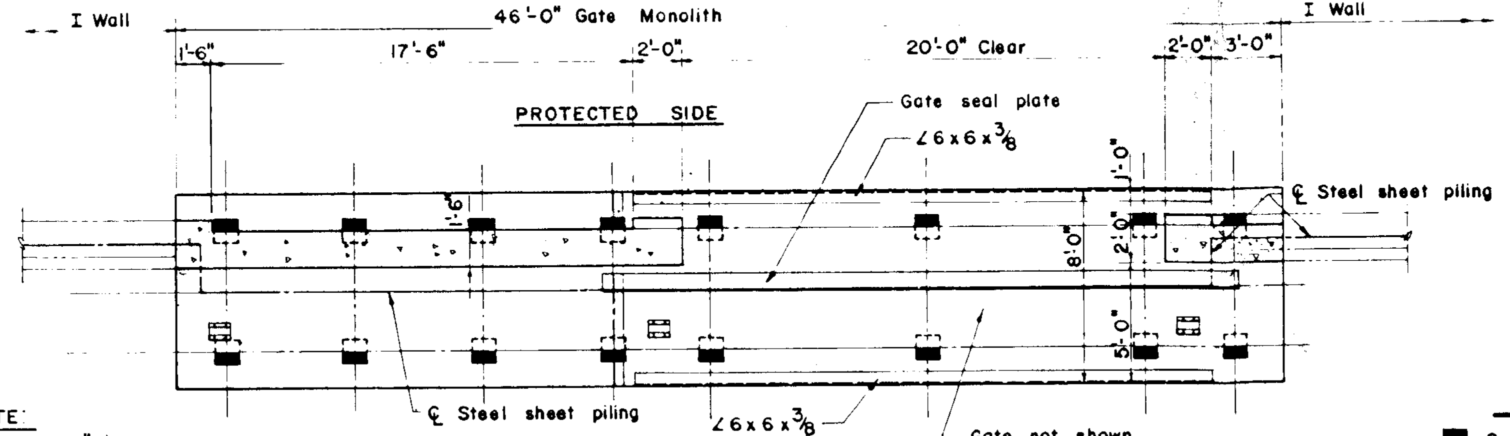
BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA

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

DATE MARCH 1972

FILE NO. H-2-24314

PLATE 33

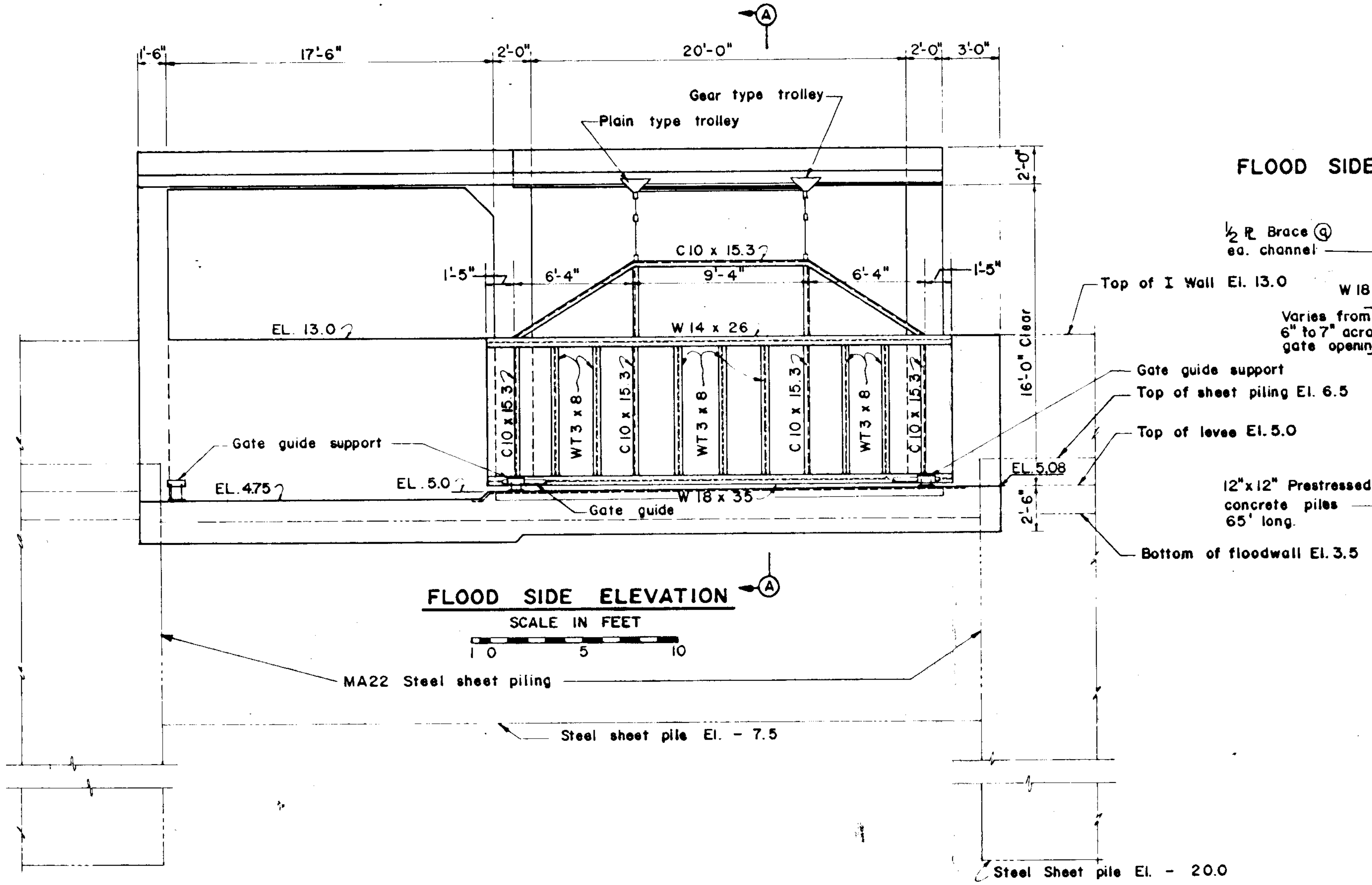


NOTE:
All piles 12" ϕ
prestressed concrete

PLAN BELOW ELEVATION 13.0'

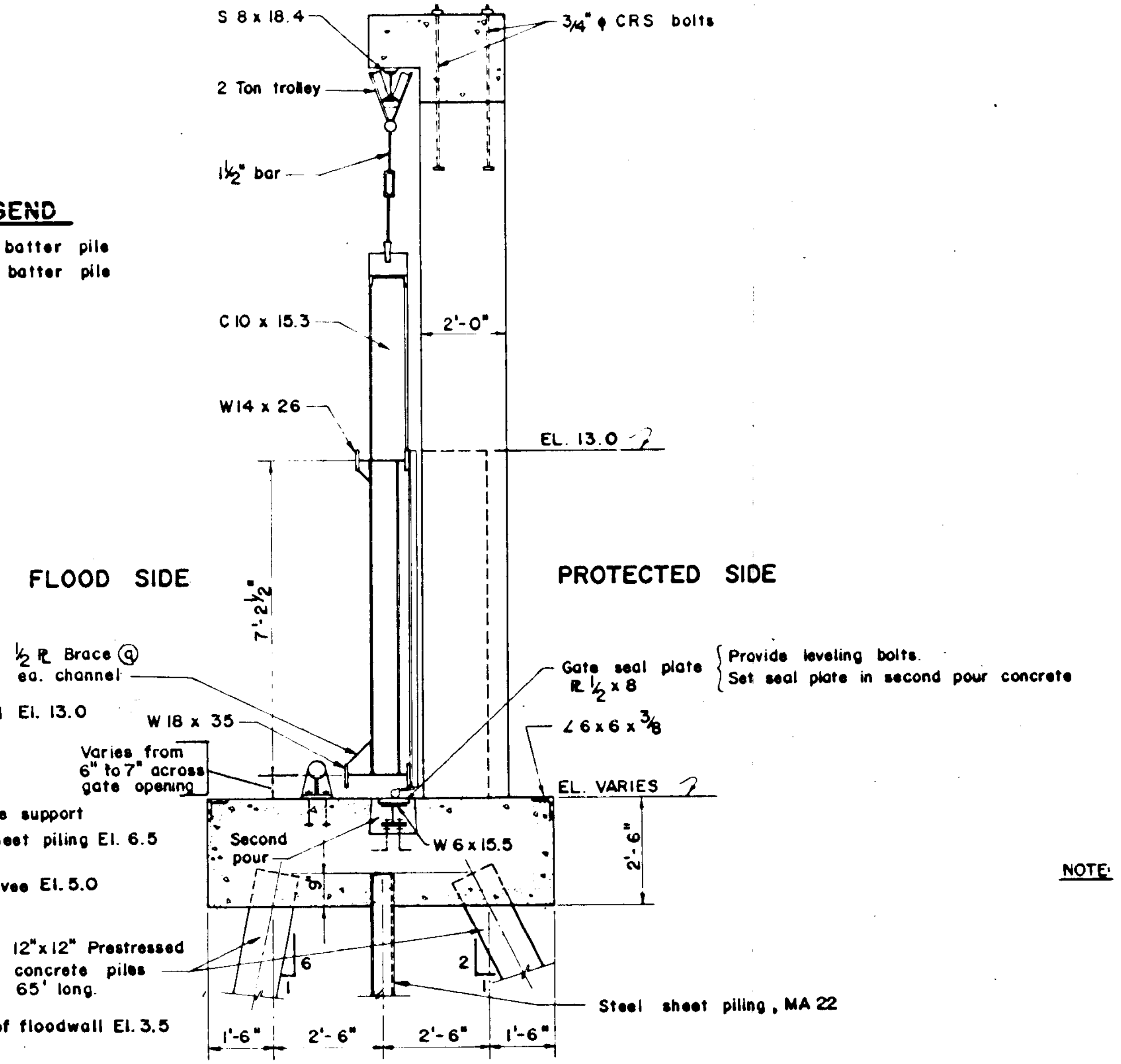
LEGEND

▬ 2 on 1 batter pile
▭ 6 on 1 batter pile



FLOOD SIDE ELEVATION

SCALE IN FEET
1 0 5 10



SECTION A-A

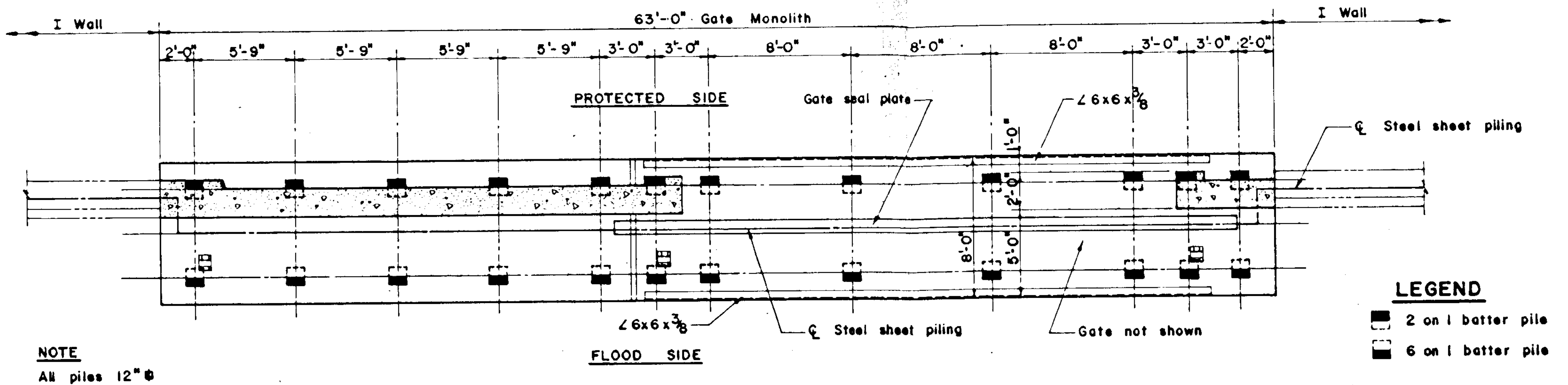
SCALE IN FEET
1 0 5

NOTE: For details of Roller Gate, Gate Guide and Gate Guide Support See Plate 36

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

OVERHEAD ROLLER GATE NO. 1
STA. 141+50 — RING LEVEE TRAVERSE

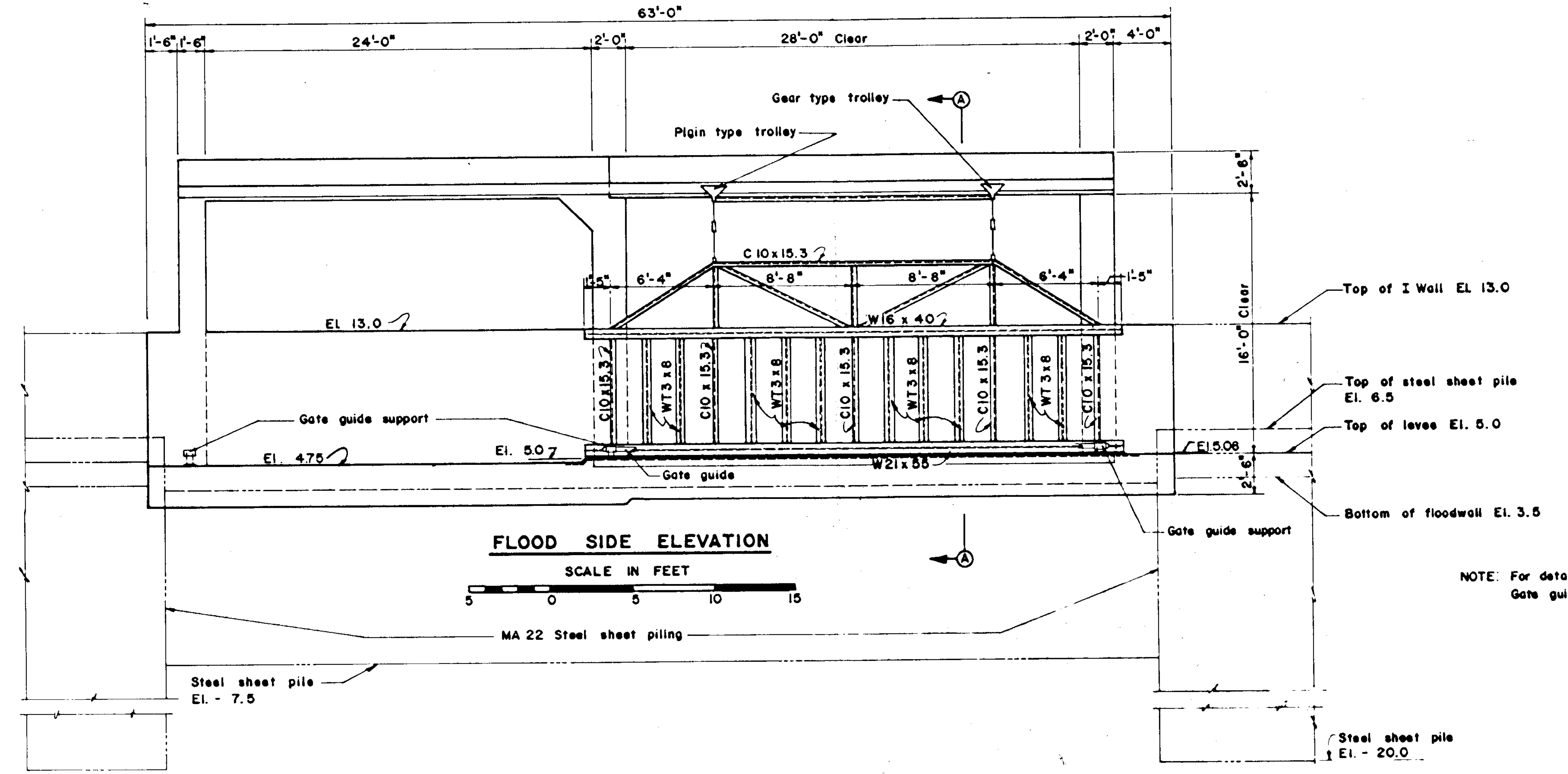
BARNARD AND BURK, INC. CONSULTING ENGINEERS BATON ROUGE, LA.	U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS
DATE: MARCH 1972	FILE NO. H-2-24314



NOTE
All piles 12" ⌀
prestressed concrete

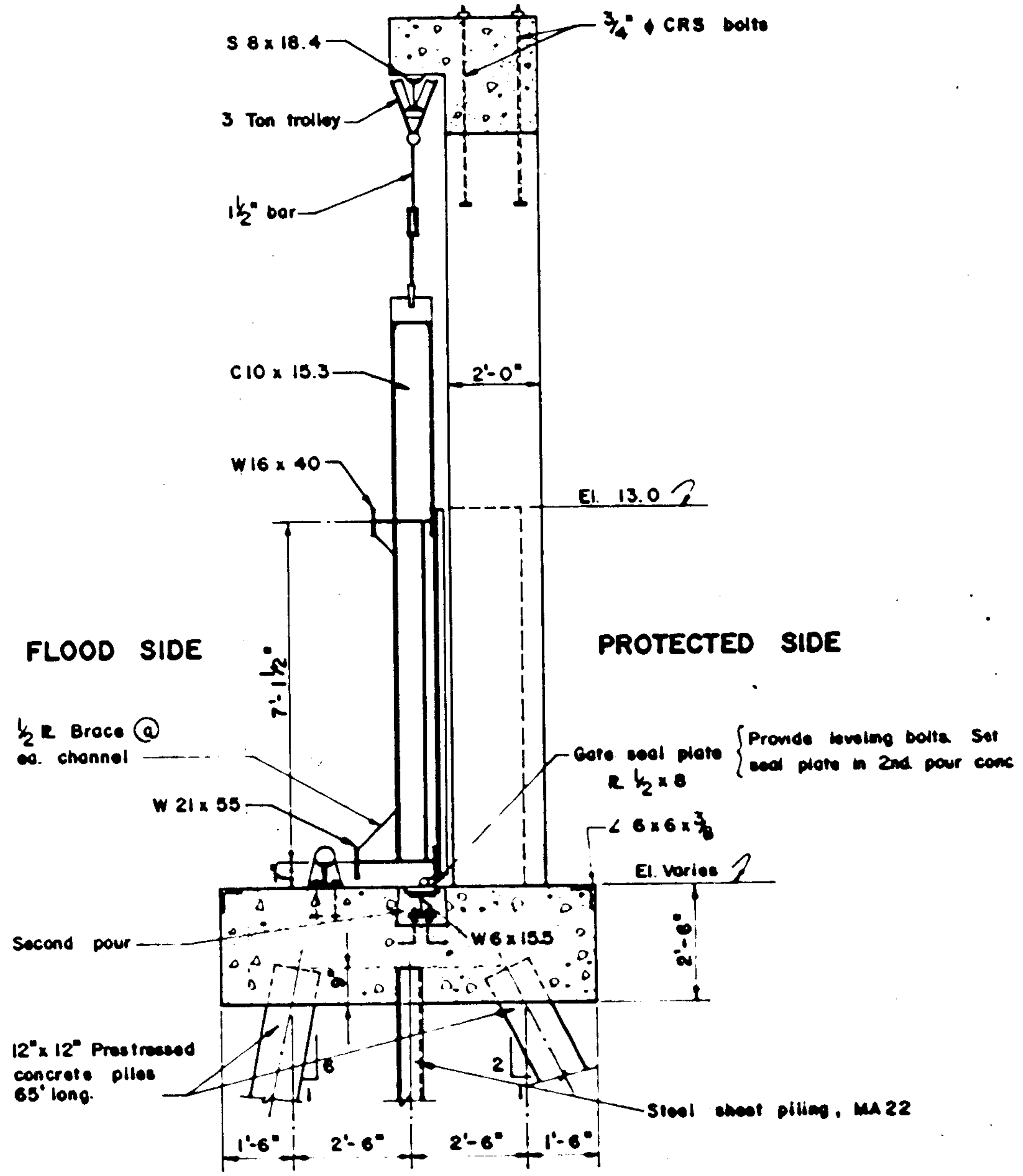
PLAN BELOW ELEVATION 13.0

SCALE IN FEET
5 0 5 10 15



FLOOD SIDE ELEVATION

SCALE IN FEET
5 0 5 10 15



SECTION A-A

SCALE IN FEET
1 0 5

NOTE: For details of Roller Gate, Gate guide and Gate guide support See Plate 36

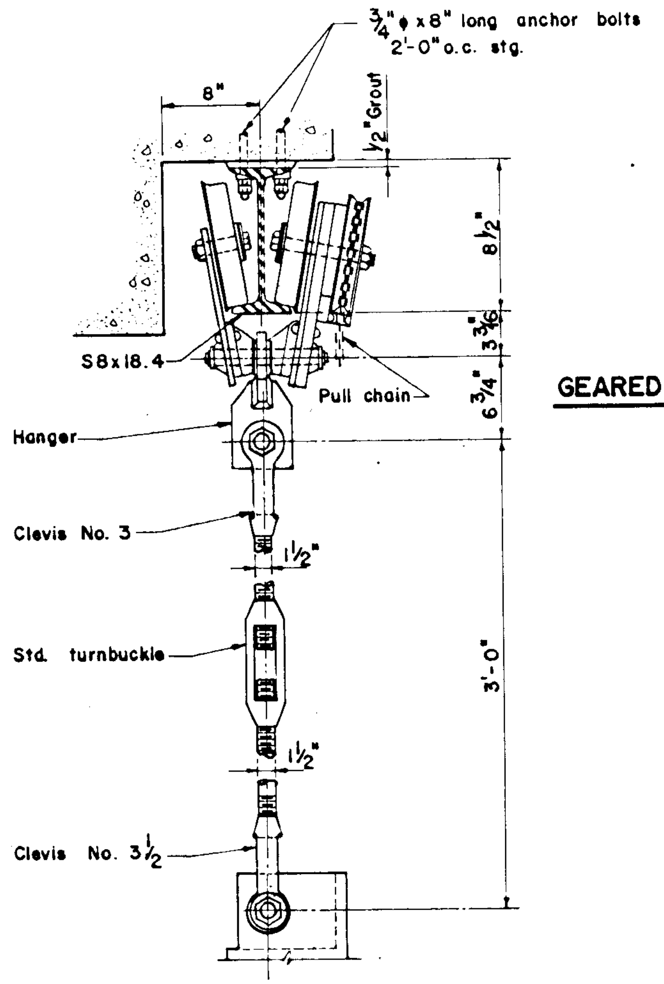
GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

OVERHEAD ROLLER GATE NO. 2
STA. 206+50 - RING LEVEE TRAVERSE

BARNARD AND BURK, INC
CONSULTING ENGINEERS
BATON ROUGE, LA

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

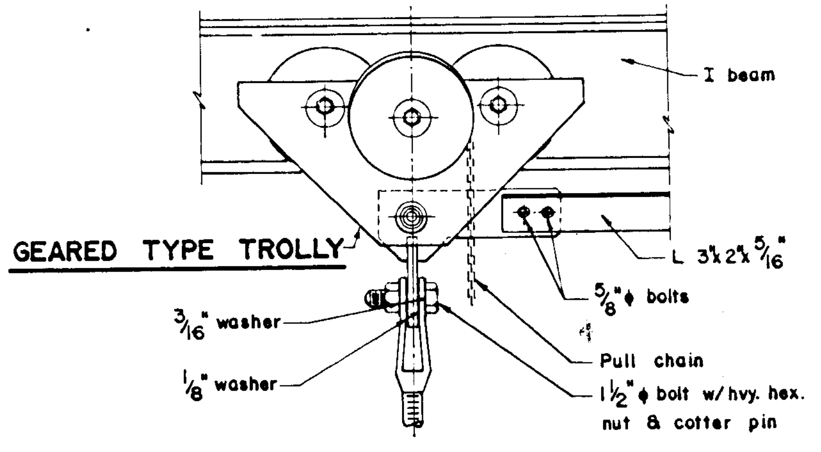
DATE · MARCH 1972
FILE NO H-2-24314



SECTION THRU TROLLEY

SCALE IN INCHES

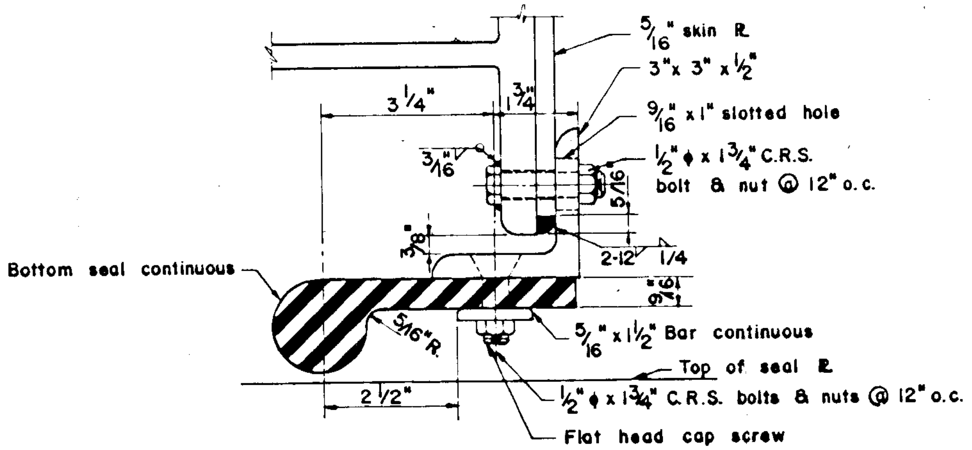
12 9 6 3 0 12



FLOODSIDE ELEVATION

SCALE IN INCHES

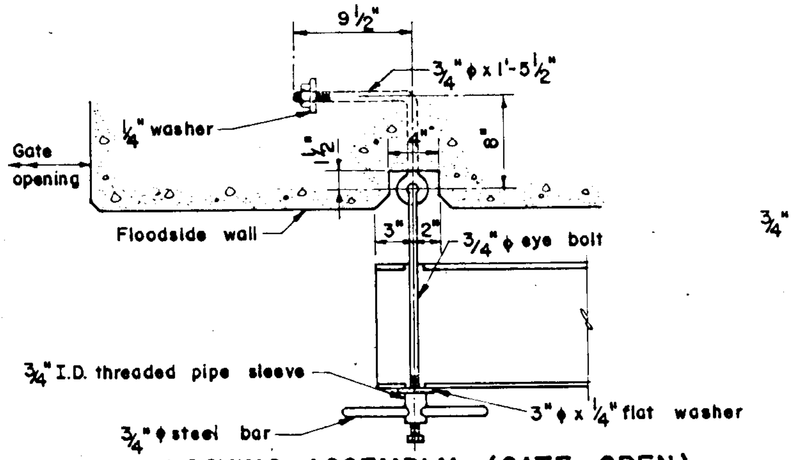
12 9 6 3 0 12



DETAIL BOTTOM SEAL

SCALE IN INCHES

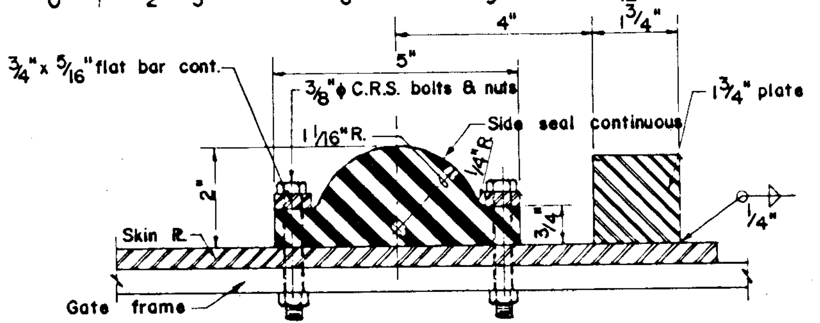
0 1 2 3 6 9 12



LOCKING ASSEMBLY (GATE OPEN)

SCALE IN INCHES

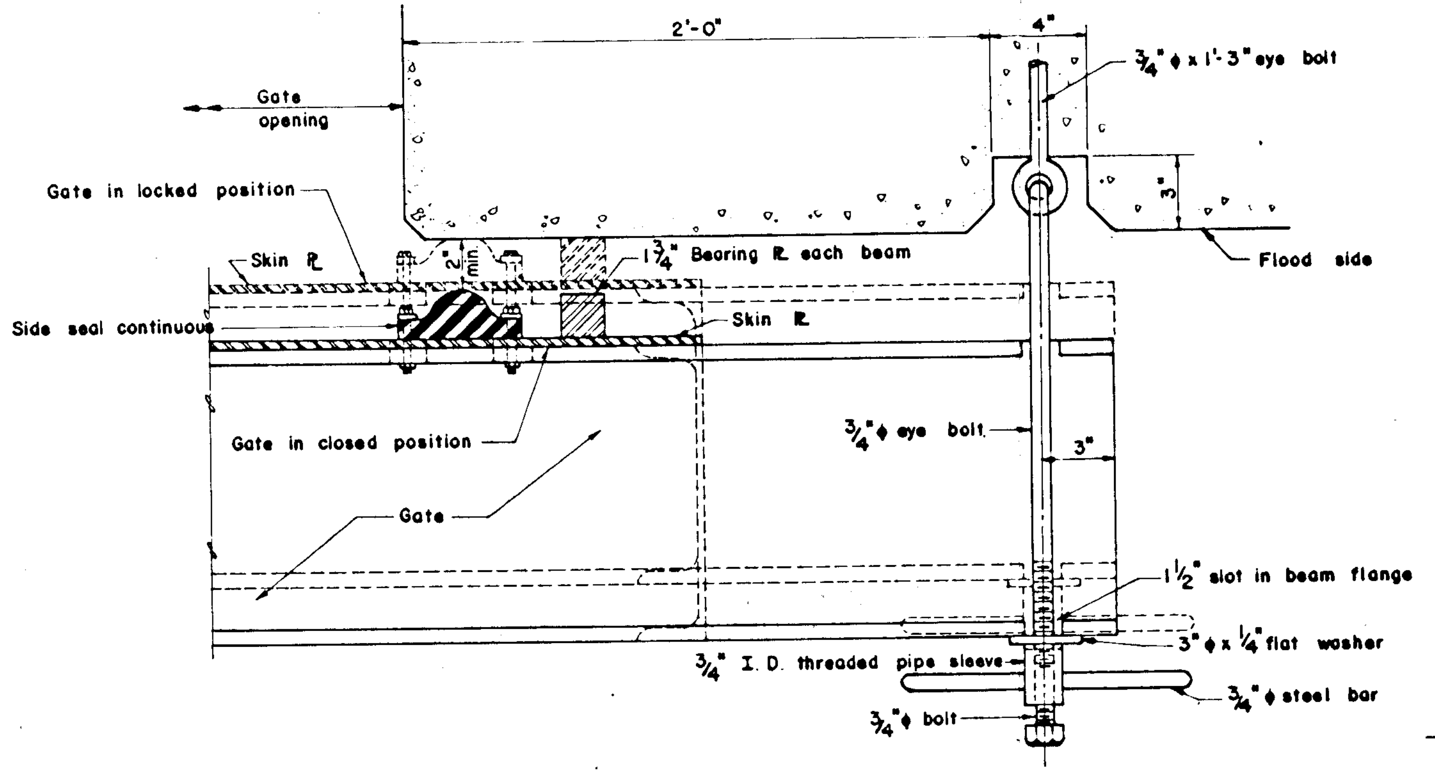
12 9 6 3 0 12



DETAIL SIDE SEAL

SCALE IN INCHES

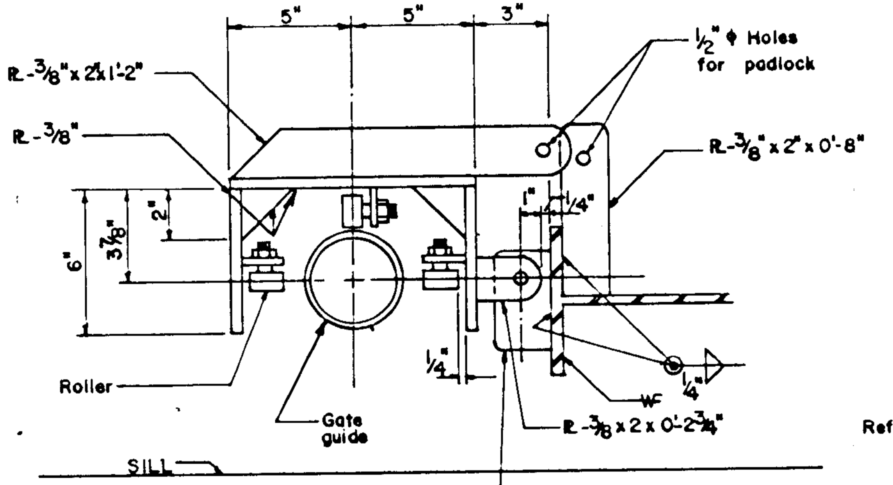
0 1 2 3 6 9 12



PART PLAN

SCALE IN INCHES

0 1 2 3 6 9 12

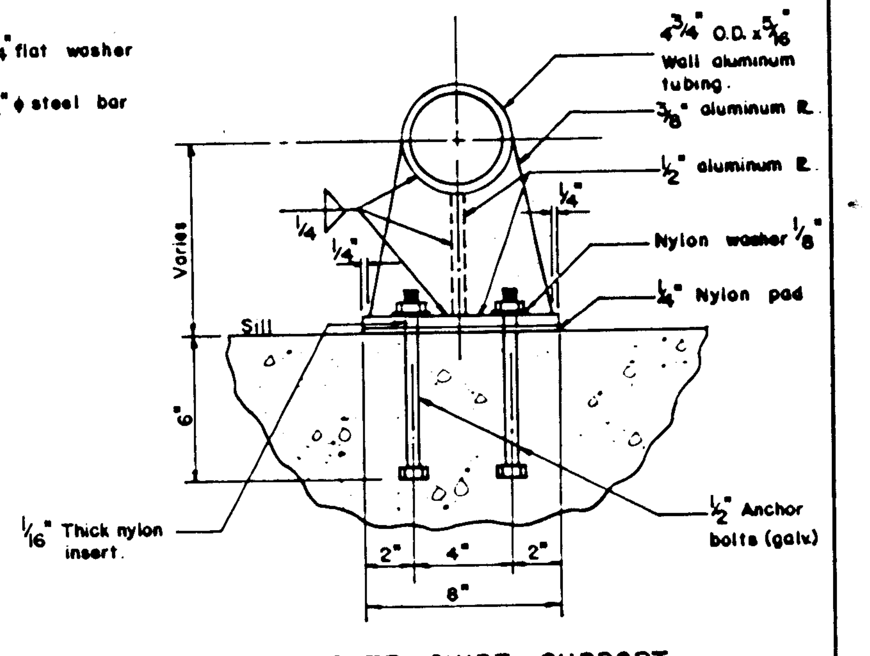


SECTION THRU GATE GUIDE

SCALE IN INCHES

12 0 1 2 3 6 9 12

Reference Plates 34 & 35



DETAIL GATE GUIDE SUPPORT

SCALE IN INCHES

12 0 1 2 3 6 9 12

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I - GENERAL DESIGN

OVERHEAD ROLLER GATE DETAILS

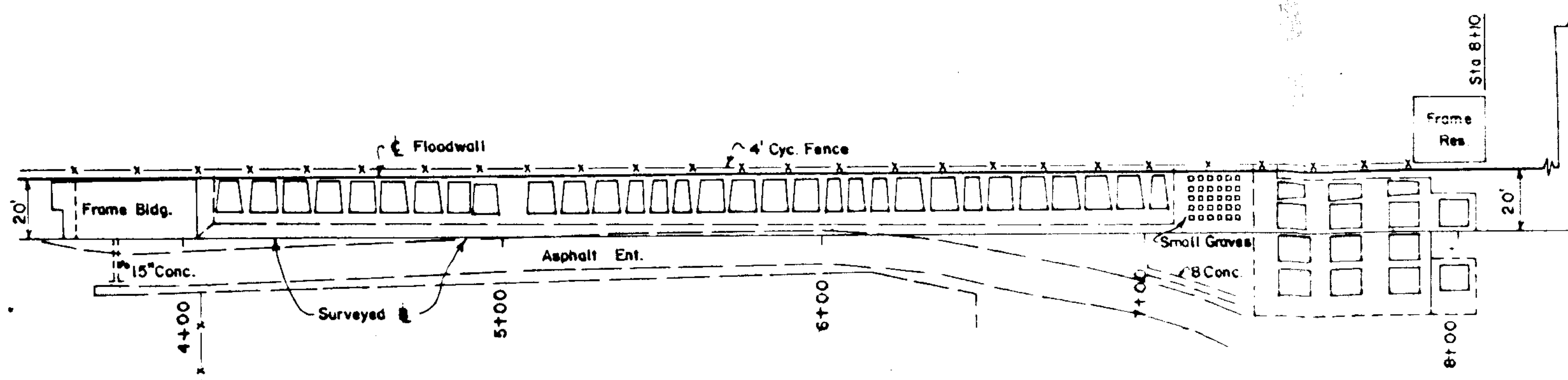
BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA

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

DATE: MARCH 1972

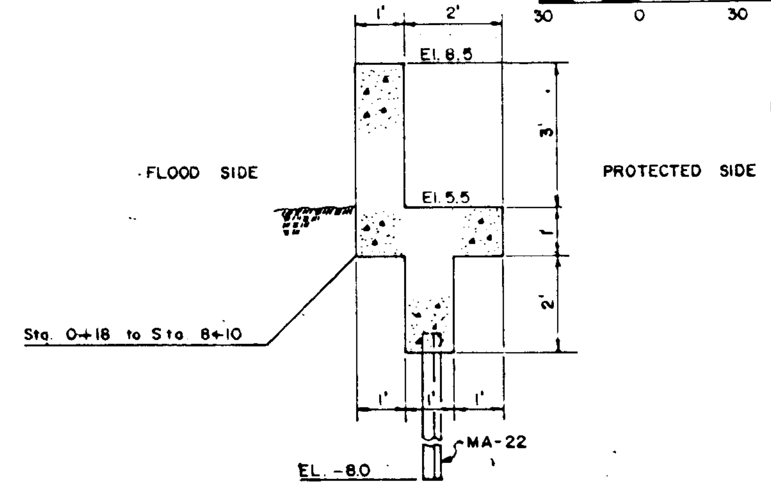
FILE NO. H-2-24314

PLATE 36



LOCATION OF FLOODWALL THROUGH CEMETERY AREA

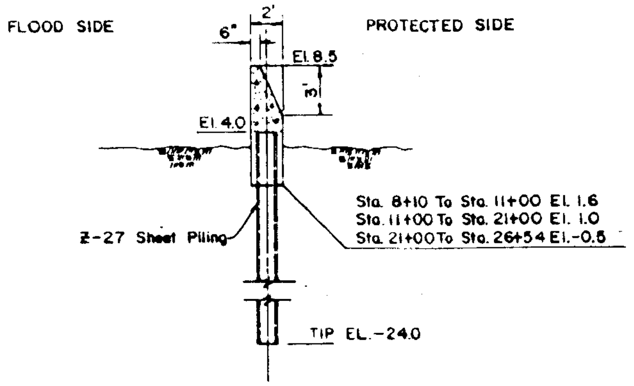
30 0 30 60



SECTION A-A

1 0 1 2

SCALE IN FEET

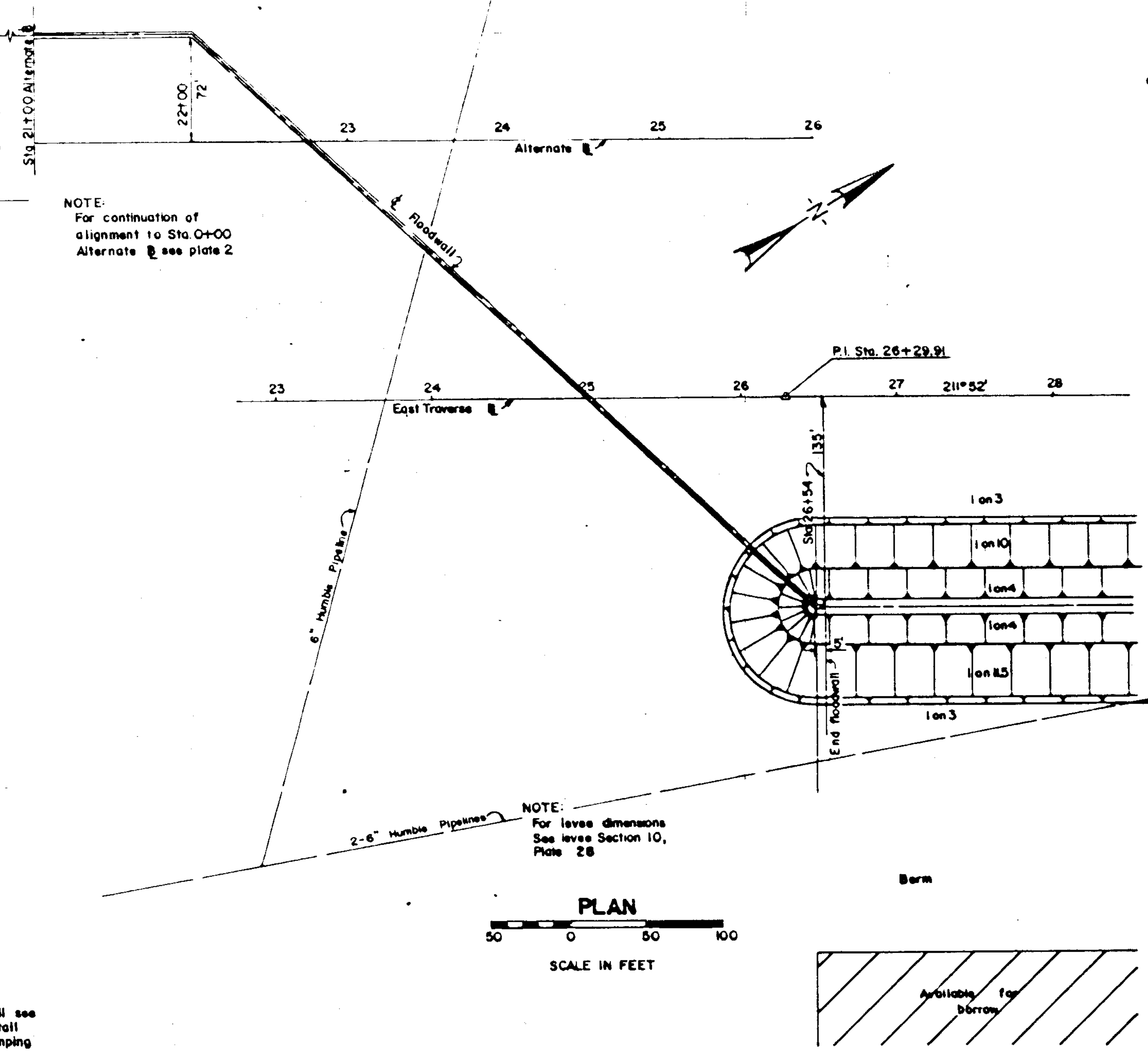


SECTION B-B

1 0 1 2

SCALE IN FEET

NOTE:
For continuation of alignment to Sta. 0+00 Alternate ℄ see plate 2

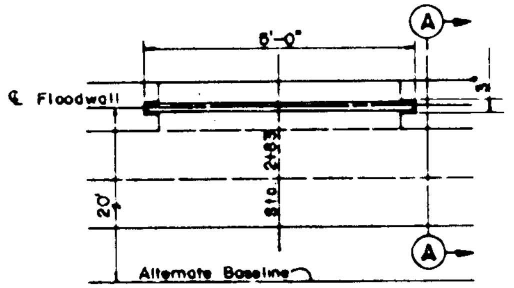


NOTE:
For levee dimensions See levee Section 10, Plate 28

PLAN

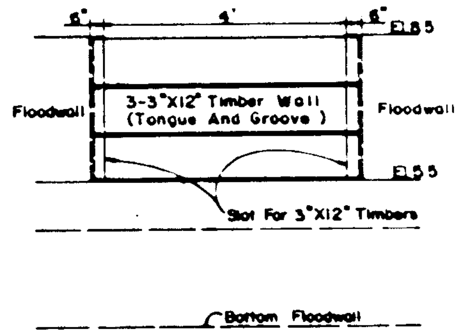
50 0 50 100

SCALE IN FEET



PLAN

NOT TO SCALE



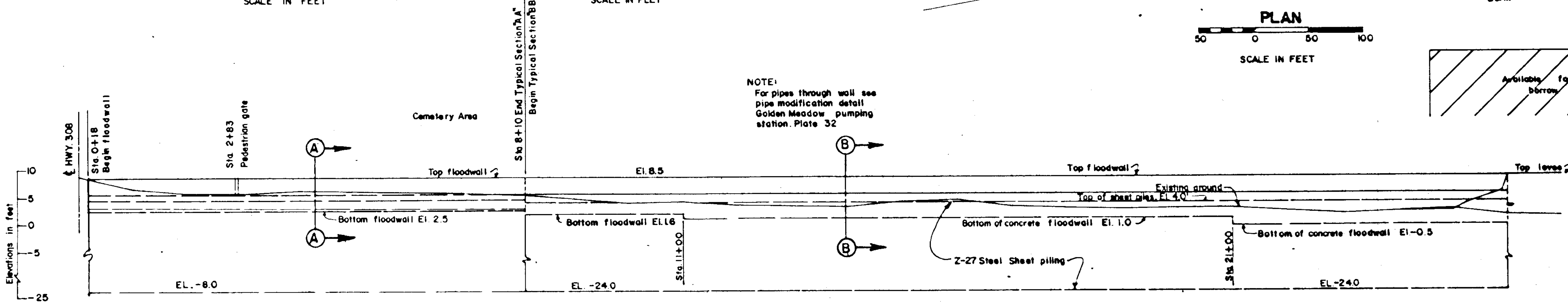
ELEVATION

NOT TO SCALE

TIMBER GATE AT STA. 2+83 ALTERNATE BASELINE

NOTE:
For pipes through wall see pipe modification detail Golden Meadow pumping station. Plate 32

NOTE:
Elevations are in feet, mean sea level



ELEVATION

100 0 100 200

SCALE IN FEET

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

LAROSE FLOODWALL
PLAN AND DETAILS

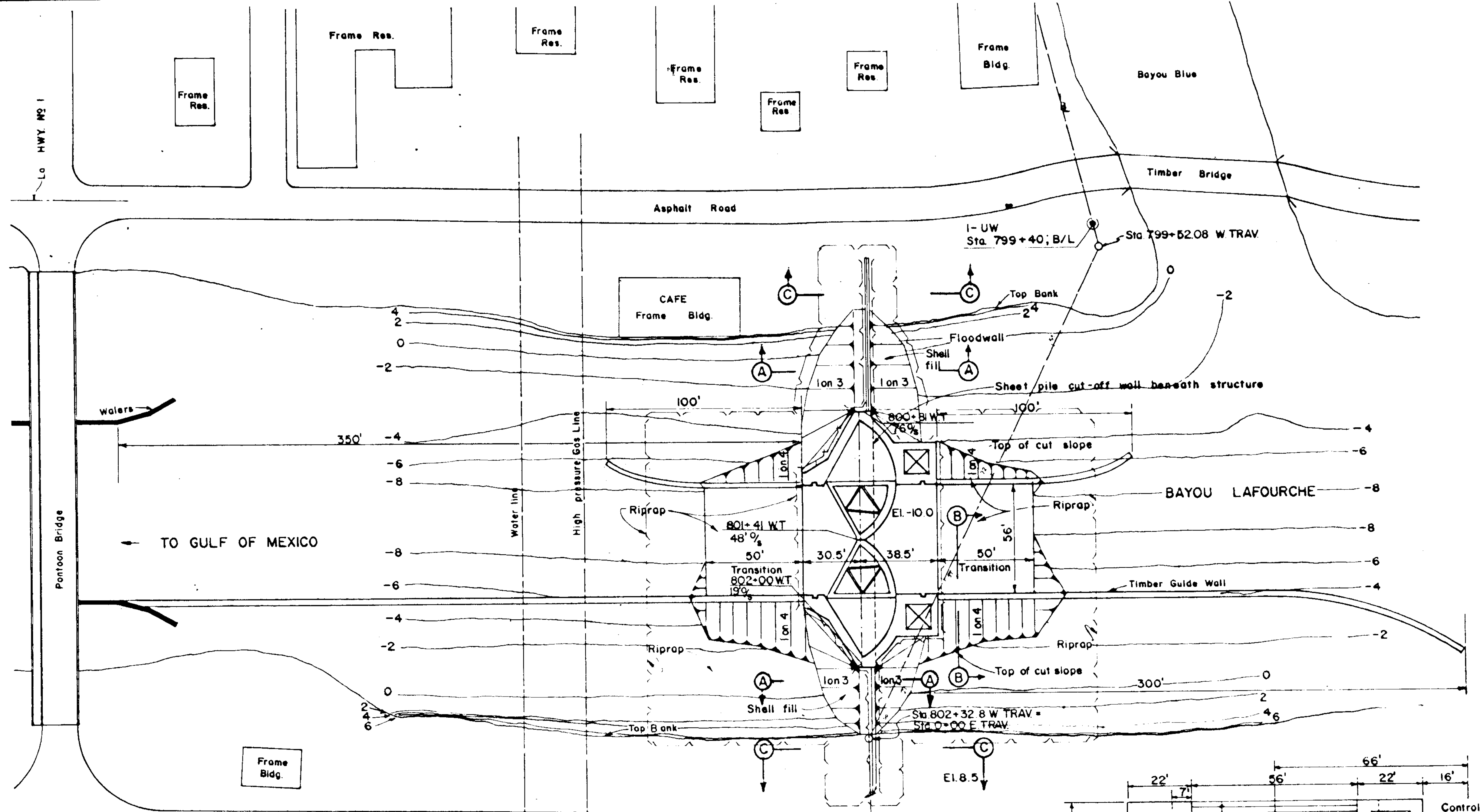
BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA

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

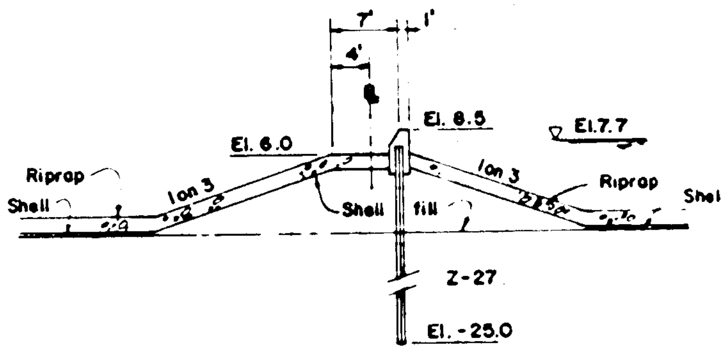
DATE MARCH 1972

FILE NO H-2-24314

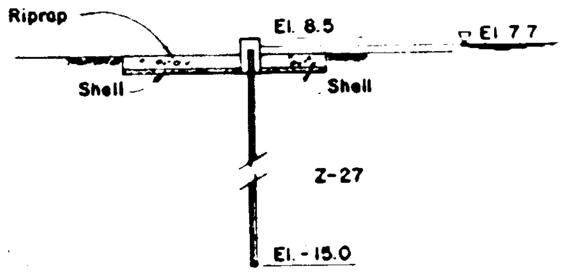
PLATE 37



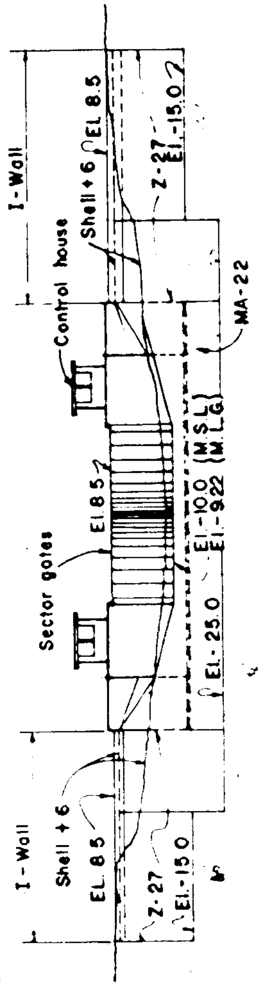
PLAN
SCALE IN FEET
30 0 30



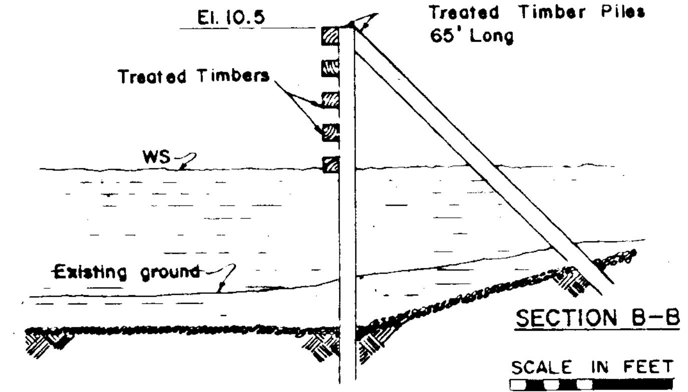
SECTION A-A
SCALE IN FEET
10 0 10 20



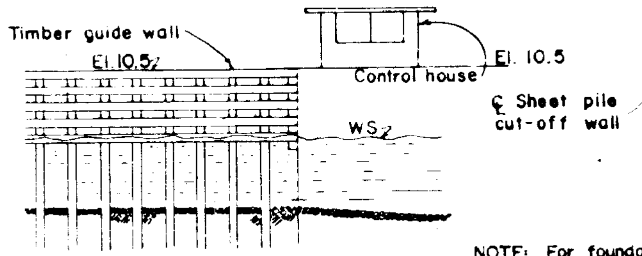
SECTION B-B
SCALE IN FEET
10 0 10 20



ELEVATION
NORTH GATE
SCALE IN FEET
30 0 30

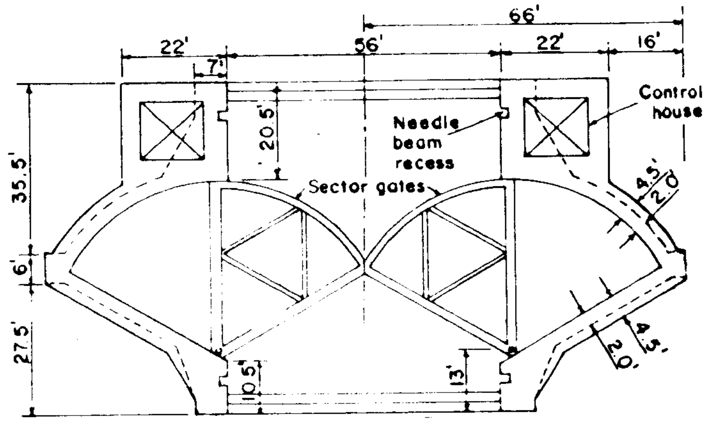


SECTION B-B
SCALE IN FEET
5 0 5



ELEVATION
GUIDE WALL
SCALE IN FEET
10 0 10

NOTE: For foundation and cofferdam layout see plate Nº 41



PLAN
NAVIGATION STRUCTURE
SCALE IN FEET
20 0 20

NOTE:
Elevations are in feet, mean sea level unless noted otherwise.
For log boring I-UW see plate 46

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

LAROSE FLOODGATE
PLAN AND SECTIONS

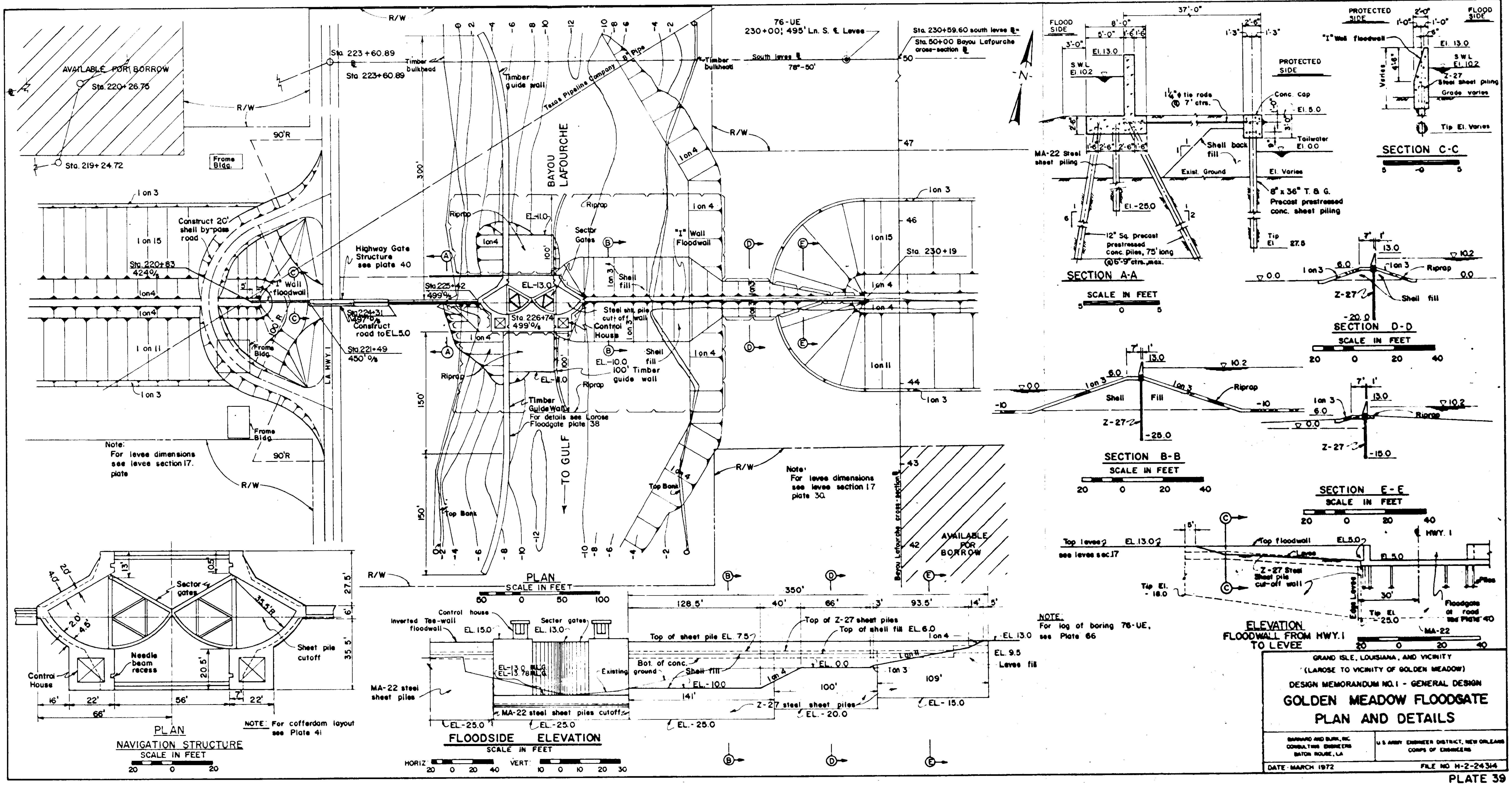
BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA

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

DATE: MARCH 1972

FILE NO. H-2-24314

PLATE 38



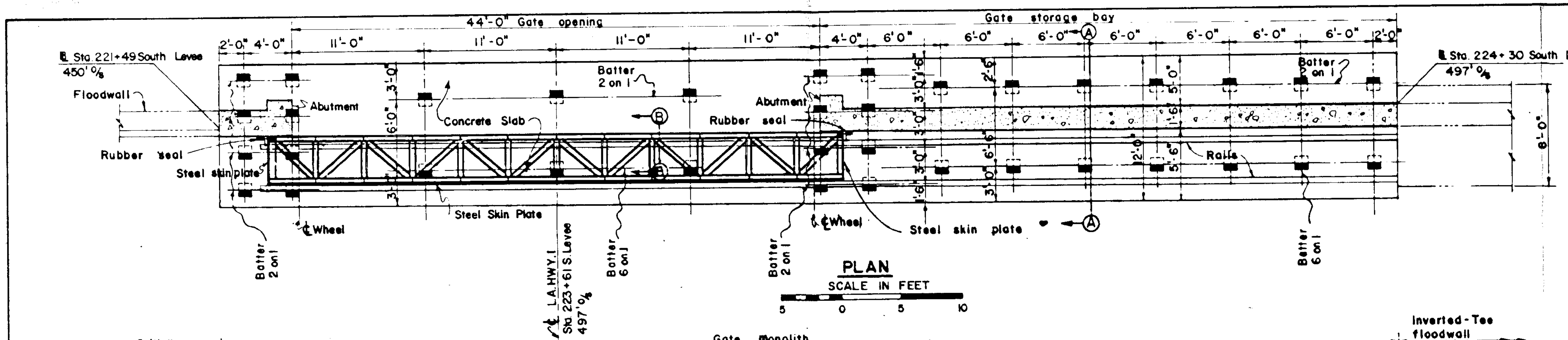
GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

GOLDEN MEADOW FLOODGATE
PLAN AND DETAILS

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA

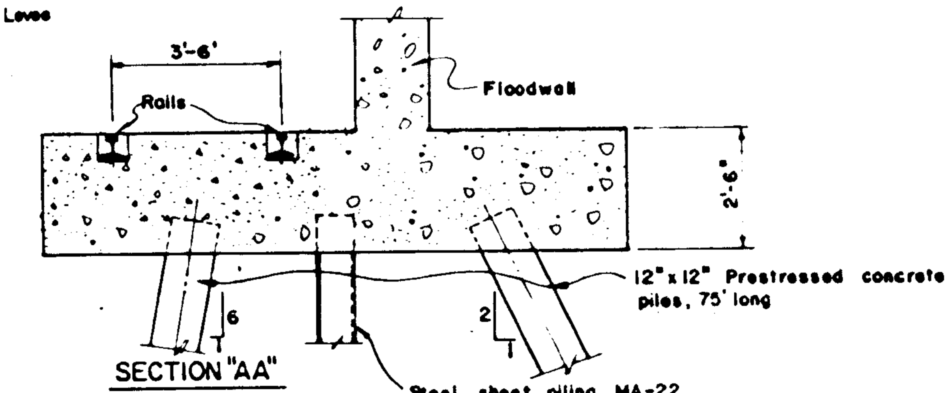
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

DATE: MARCH 1972
FILE NO. H-2-24314



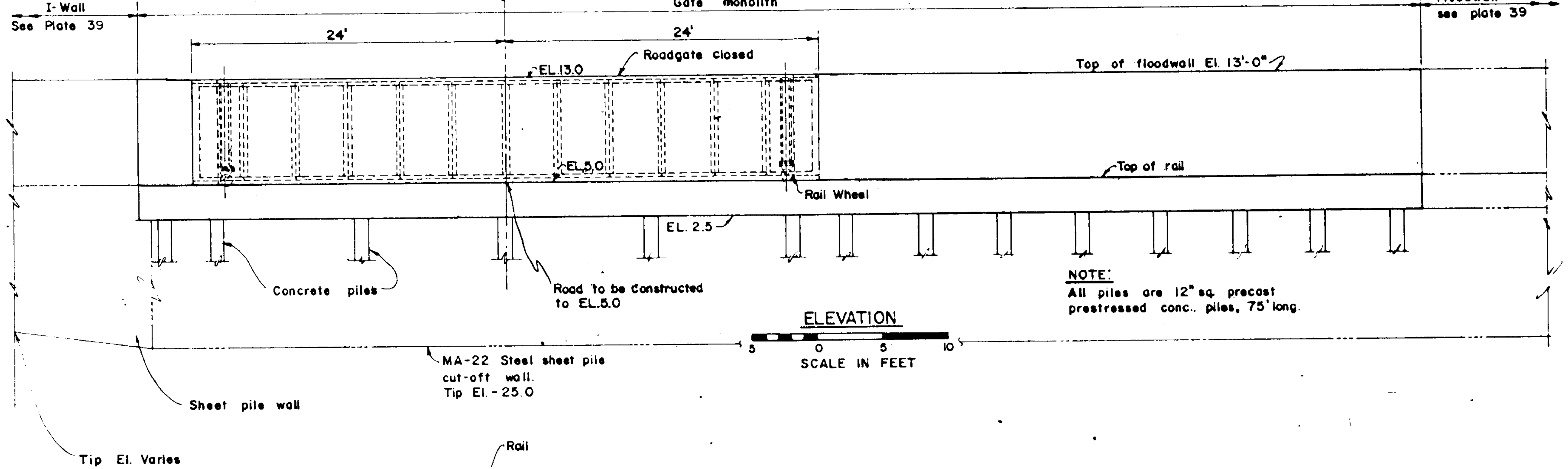
PLAN

SCALE IN FEET



SECTION "AA"

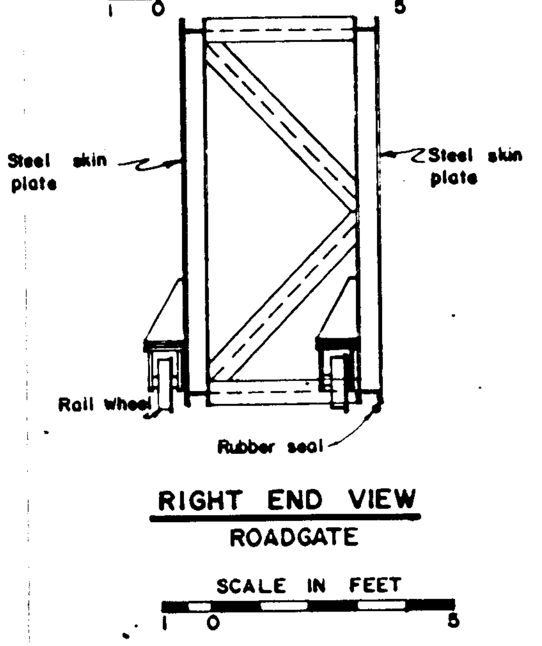
SCALE IN FEET



NOTE: All piles are 12" sq. precast prestressed conc. piles, 75' long.

ELEVATION

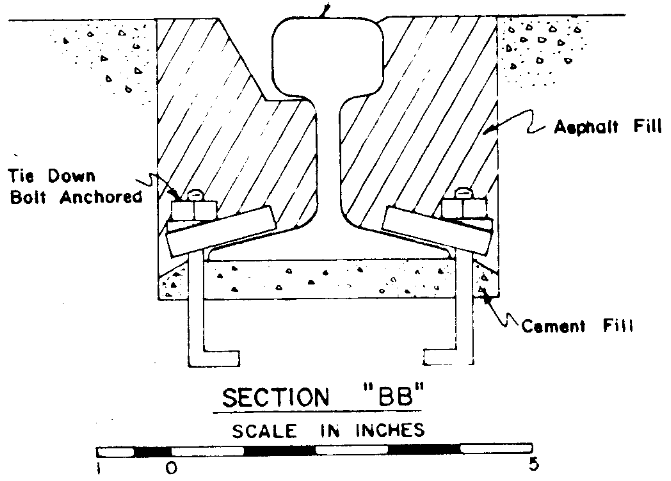
SCALE IN FEET



RIGHT END VIEW

ROADGATE

SCALE IN FEET



SECTION "BB"

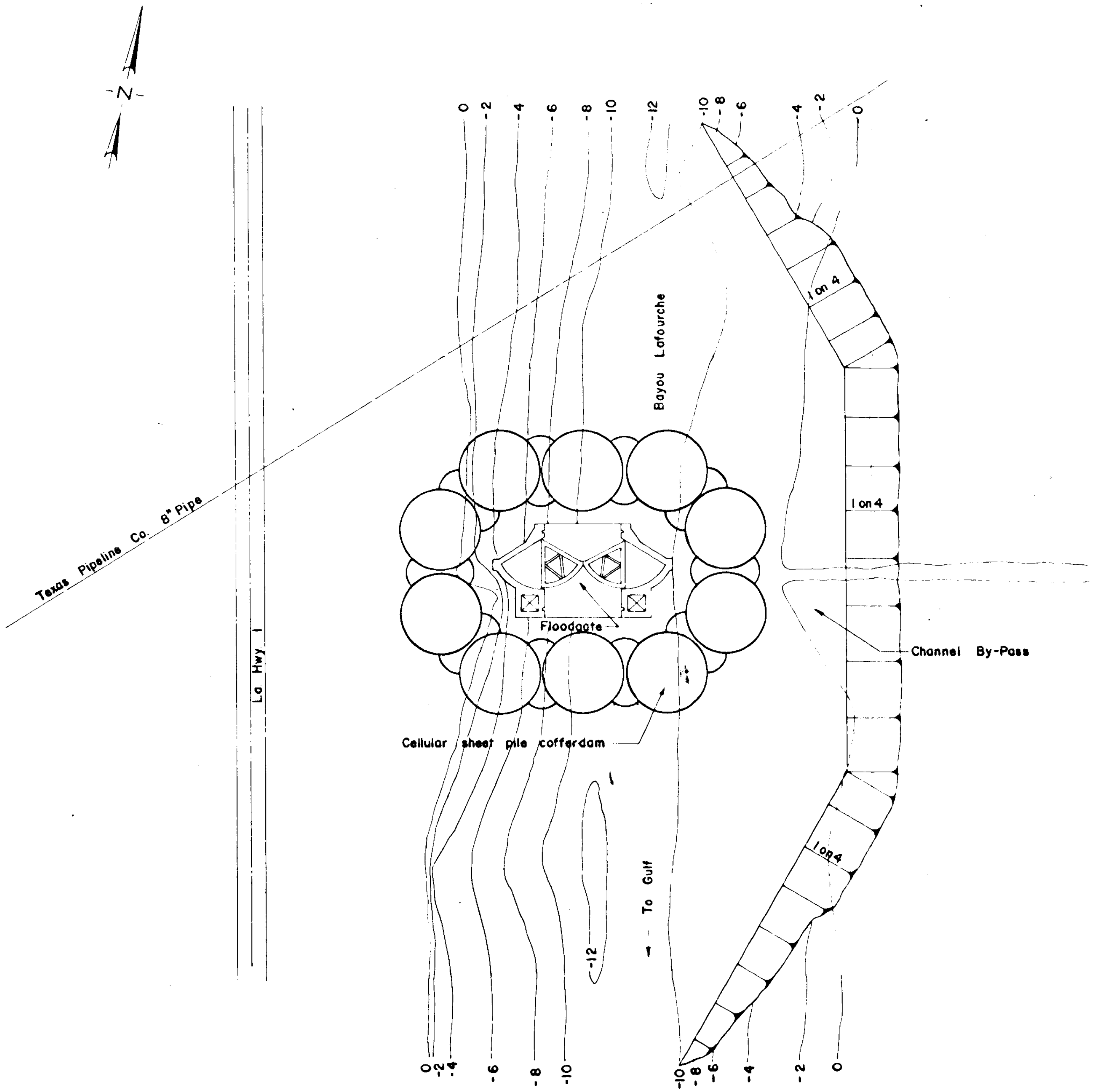
SCALE IN INCHES

NOTE: Elevations are in feet M.S.L.

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I - GENERAL DESIGN

LA. HWY. I ROAD GATE AT GOLDEN MEADOW PLAN AND DETAILS

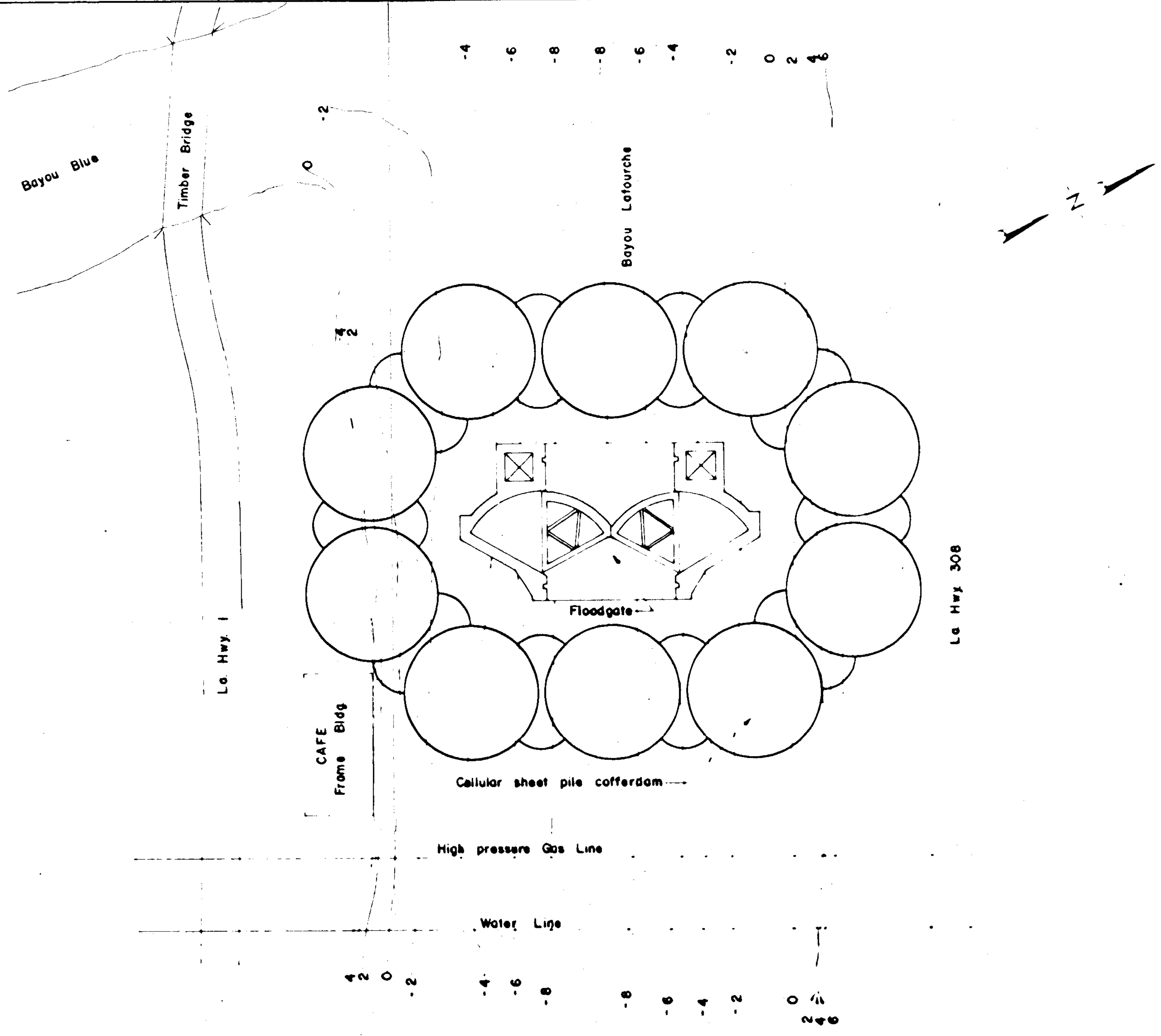
BARNARD AND BURK, INC. CONSULTING ENGINEERS BATON ROUGE, LA.	U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS
DATE: MARCH 1972	FILE NO. H-2-24314



GOLDEN MEADOW COFFERDAM LAYOUT

SCALE IN FEET

50 0 50 100 150



LAROSE COFFERDAM LAYOUT

SCALE IN FEET

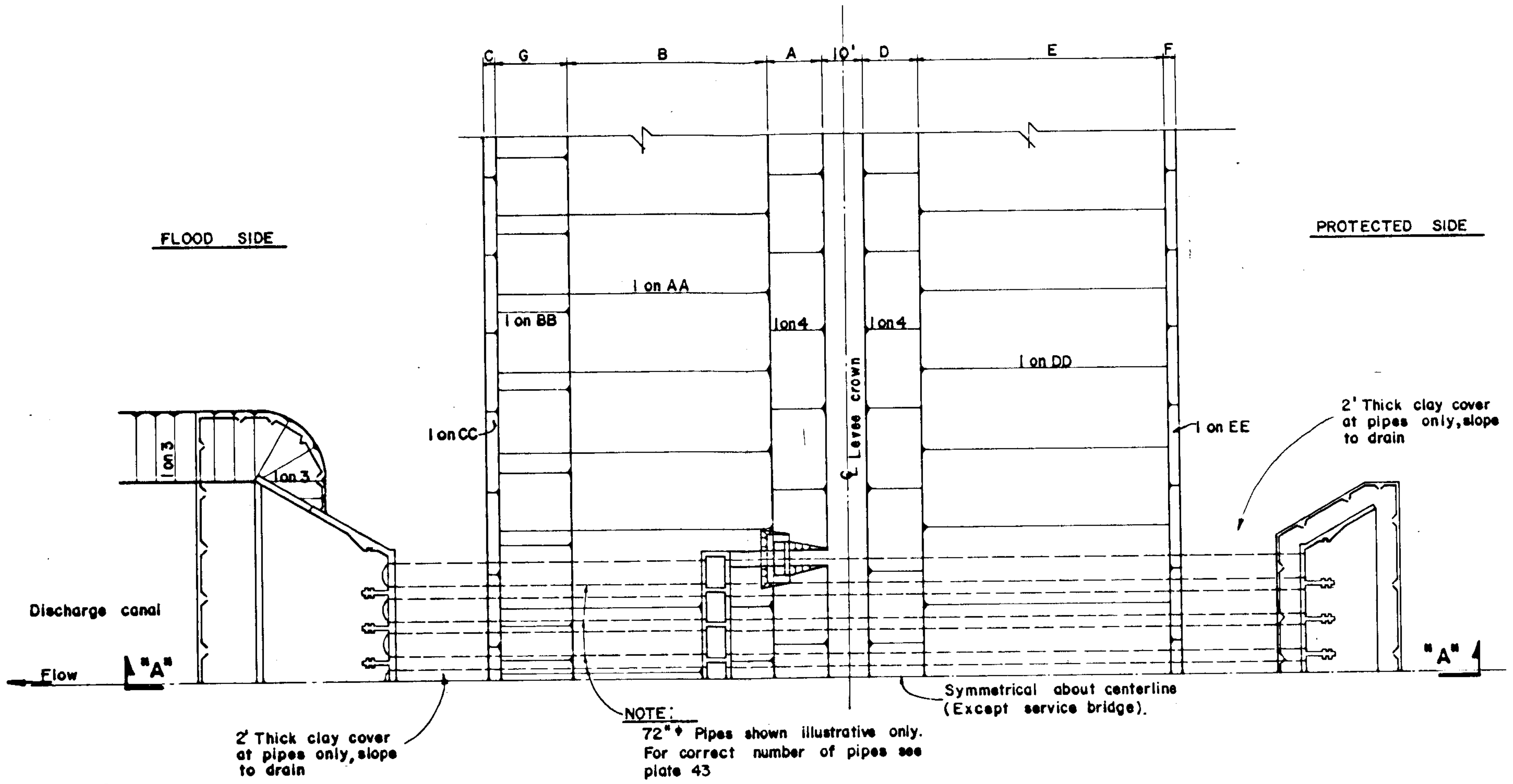
30 0 50 100

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I - GENERAL DESIGN

COFFERDAM LAYOUT

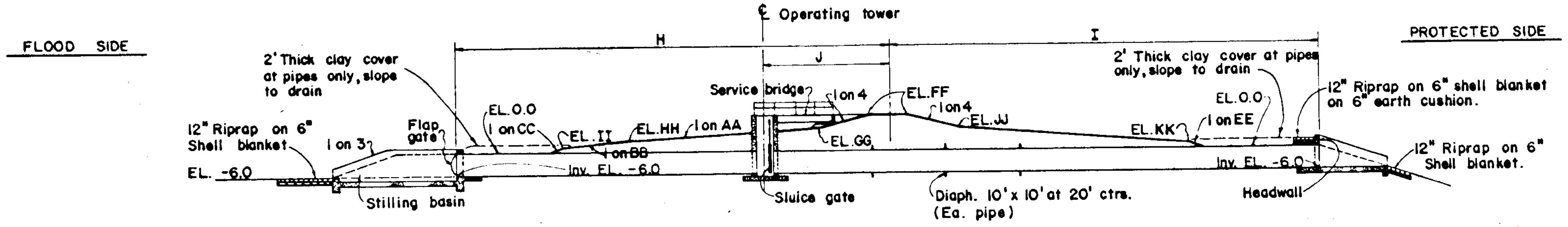
BARNARD AND BURK, INC. CONSULTING ENGINEERS BATON ROUGE, LA	U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS
DATE · MARCH 1972	FILE NO H-2-24314

PLATE 41



PLAN

NOT TO SCALE



SECTION "A-A"

NOT TO SCALE

NOTES:

1. Elevations are in feet and refer to mean sea level.
2. For details of stilling basin, operating tower, service bridge & headwall, see drainage structure details, plate 43

TABLE OF DIMENSIONS

DRAINAGE STRUCTURE		No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8
STATION & TRAVERSE		66+87 WEST	362 + 75 WEST	722 + 64 WEST	960 + 60 EAST	842 + 82 EAST	634 + 75 EAST	325 + 00 EAST	217+00 SOUTH
CAMBER-FT.		0.8	1.0	1.0	0.8	0.5	0.7	0.7	0.8
DIAPH. EA.		7	7	4	8	4	4	4	8
DIMENSIONS IN FEET	A	14	22	22	14	14	22	26	14
	B	77	40.5	10	124	70	24	13	77
	C	7.5	6	8	4.5	3	3	3	3
	D	14	22	22	14	14	22	24	24
	E	78	40.5	10	124	62.5	24	18	90
	F	9	6	8	4.5	3	3	3	3
	G	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24
	H	103.5	93	74	157	115	70	65	123
	I	106	93	74	157	115	70	65	122
	J	38	30	30	53	34	30	30	44
SLOPE	AA	11	9	10	15.5	14	12	13	11
	BB	—	—	—	—	—	—	—	16
	CC	3	3	4	3	3	3	3	3
	DD	12	9	10	15.5	12.5	12	12	15
	EE	3	3	4	3	3	3	3	3
ELEVATIONS IN FEET	FF	13.0	12.0	8.5	13.0	9.5	8.5	8.5	13.0
	GG	9.5	6.5	3.0	9.5	6.0	3.0	2.0	9.5
	HH	—	—	—	—	—	—	—	2.5
	II	2.5	2.0	2.0	1.5	1.0	1.0	1.0	1.0
	JJ	9.5	6.5	3.0	9.5	6.0	3.0	2.5	7.0
	KK	3.0	2.0	2.0	1.5	1.0	1.0	1.0	1.0
ADJACENT LEVEE SECTION		2	4* & 5*	9*	16	14	12	11	17

* LEVEE SECTION AT DRAINAGE STRUCTURE SLIGHTLY DIFFERENT FROM ADJACENT LEVEE SECTION. BEGIN TRANSITION TO ADJACENT LEVEE SECTION AT A POINT 20' BEYOND OUTSIDE PIPES, EACH WAY. OTHER DRAINAGE STRUCTURES SAME AS ADJACENT LEVEE SECTIONS.

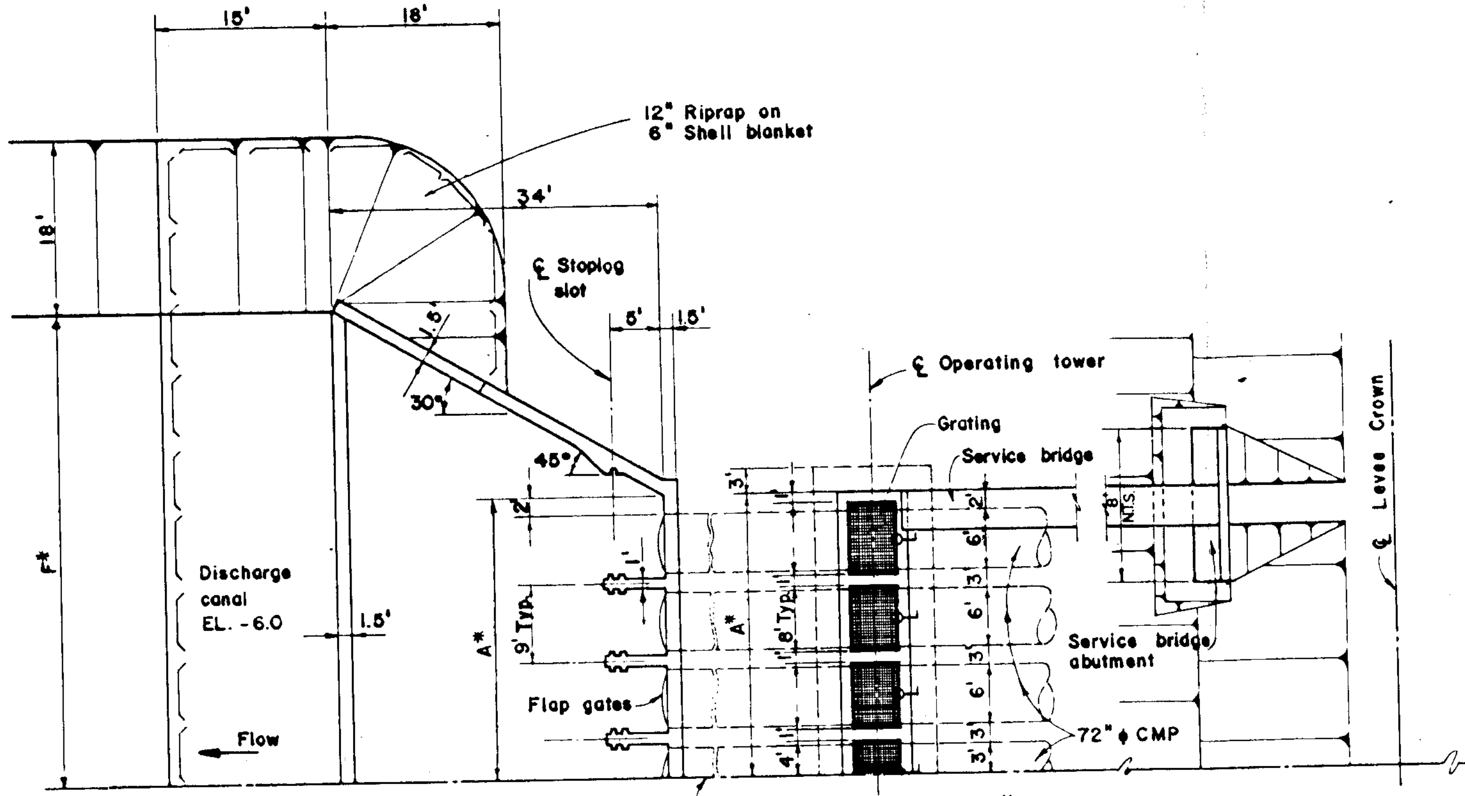
GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

DRAINAGE STRUCTURES
Nº 1,2,3,4,5,6,7 & 8

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE: MARCH 1972
FILE NO. H-2-24314

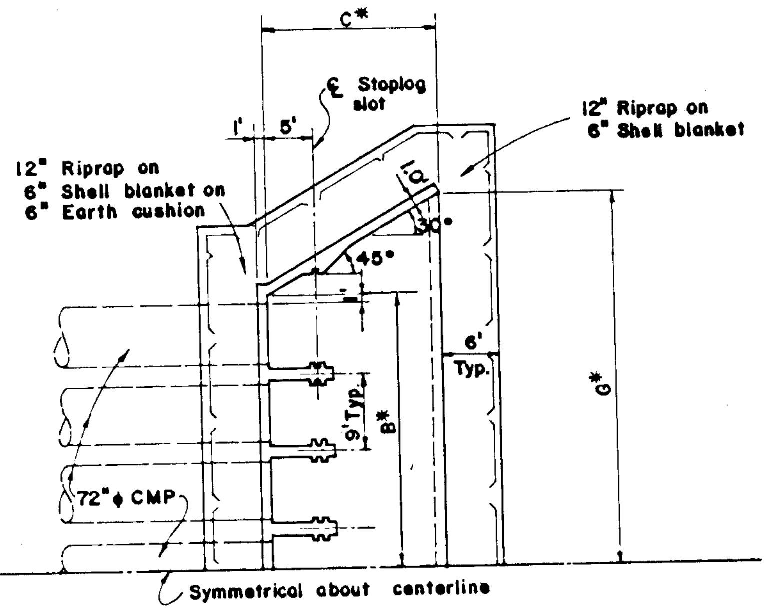


PLAN

SCALE IN FEET
10 5 0 10 20

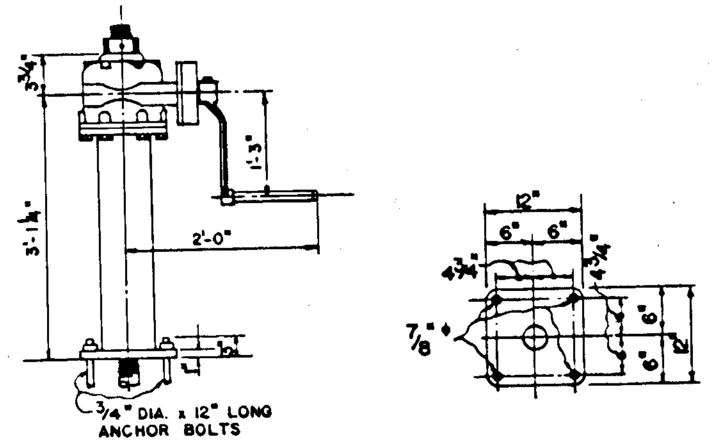
*Variable dimensions for drainage structures.

D.S. DIM.	1	2	3	4	5	6	7	8
NO. PIPES	7	3	2	4	4	5	2	1
A	32	14	9.5	18.5	18.5	23	9.5	5
B	31	13	8.5	17.5	17.5	22	8.5	4
C	18	18	18	18	18	24	24	24
D	19	19	19	19	19	25	25	25
E	3	3	3	3	3	4	4	4
F	51.6	33.6	29.1	38.1	38.1	42.6	29.1	24.6
G	41.4	23.4	18.9	27.9	27.9	35.9	22.4	17.9



PLAN

SCALE IN FEET
10 5 0 10 20

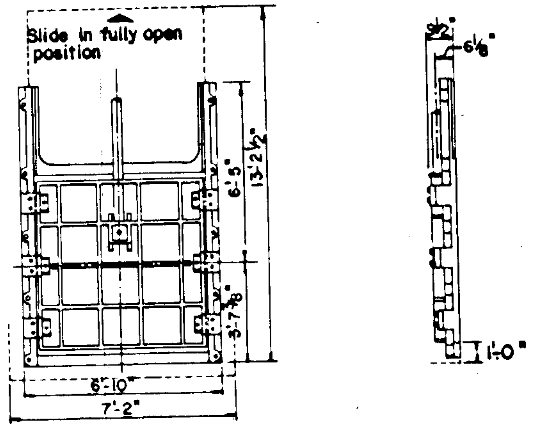


ELEVATION

PLAN OF BASE

ENCLOSED GEAR PEDESTAL LIFT DETAILS

NOT TO SCALE

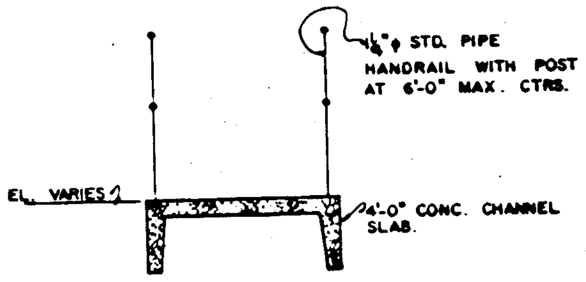


FRONT VIEW

END VIEW

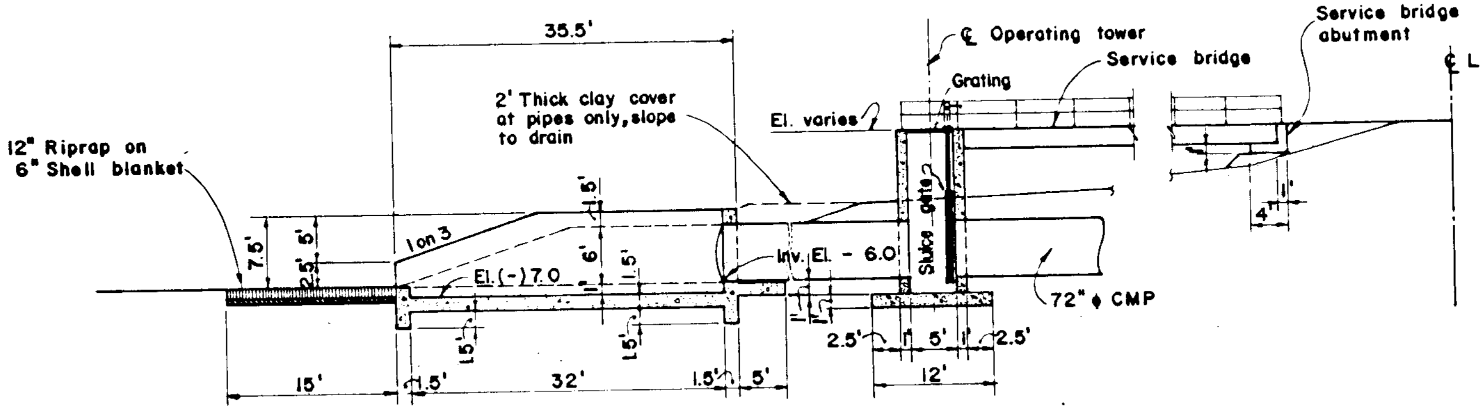
SLUICE GATE DETAILS

NOT TO SCALE



TYPICAL SECTION THRU SERVICE BRIDGE

SCALE IN FEET
SCALE IN FEET
1 0 5



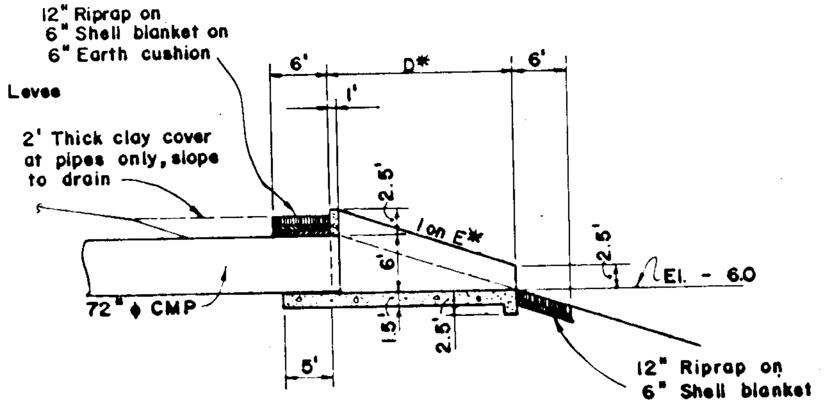
SECTION

STILLING BASIN

OPERATING TOWER

SERVICE BRIDGE

SCALE IN FEET
10 5 0 10 20



SECTION

INLET BASIN

SCALE IN FEET
10 5 0 10 20

NOTE: Elevations are in feet and refer to mean sea level.

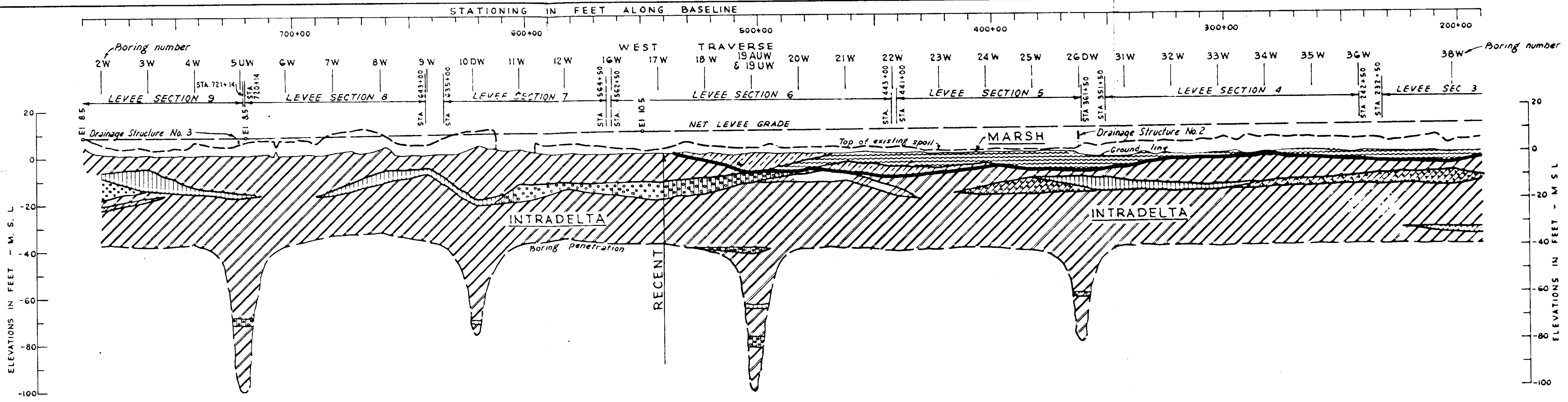
GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I - GENERAL DESIGN

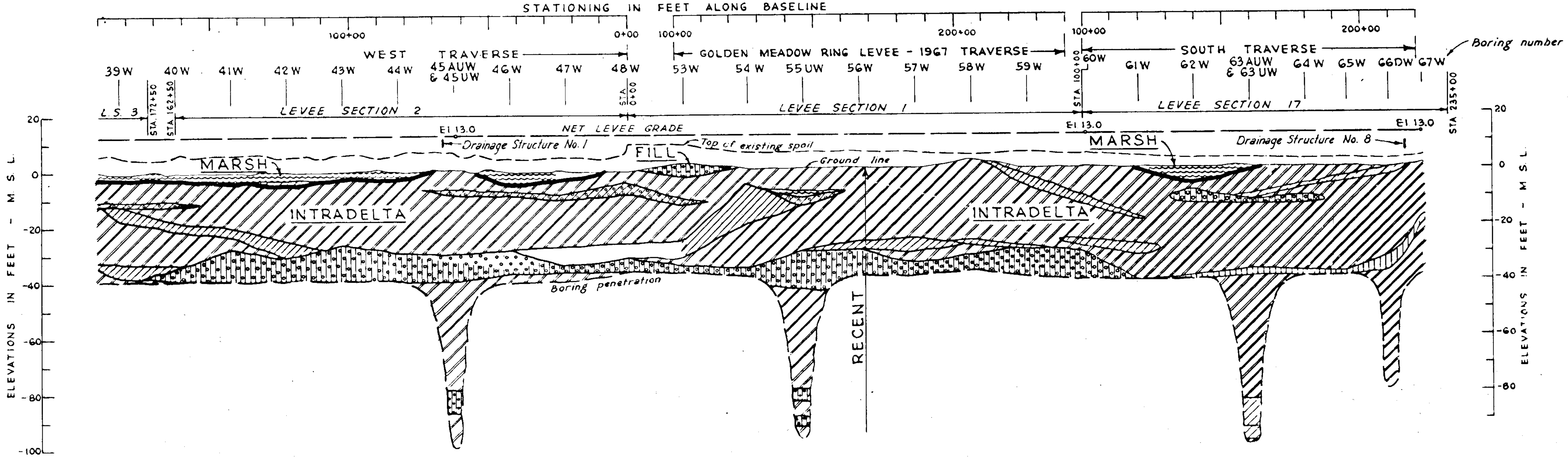
DRAINAGE STRUCTURE DETAILS

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE · MARCH 1972
FILE NO. H-2-24314





LEGEND

▤	PT - Peat
▨	CH - Fat clay
▨	OH - Organic clays
▨	CL - Lean clay
▥	ML - Silt
░	SM - Silty sand
▩	SC - Clayey sand
░	SP - Sand

MARSH *Very soft clays with organic material & peat*

INTRADELTA *Very soft to medium clays with layers and lenses of silt and sand.*

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

GENERALIZED SOIL AND GEOLOGIC PROFILE
WEST LEVEE

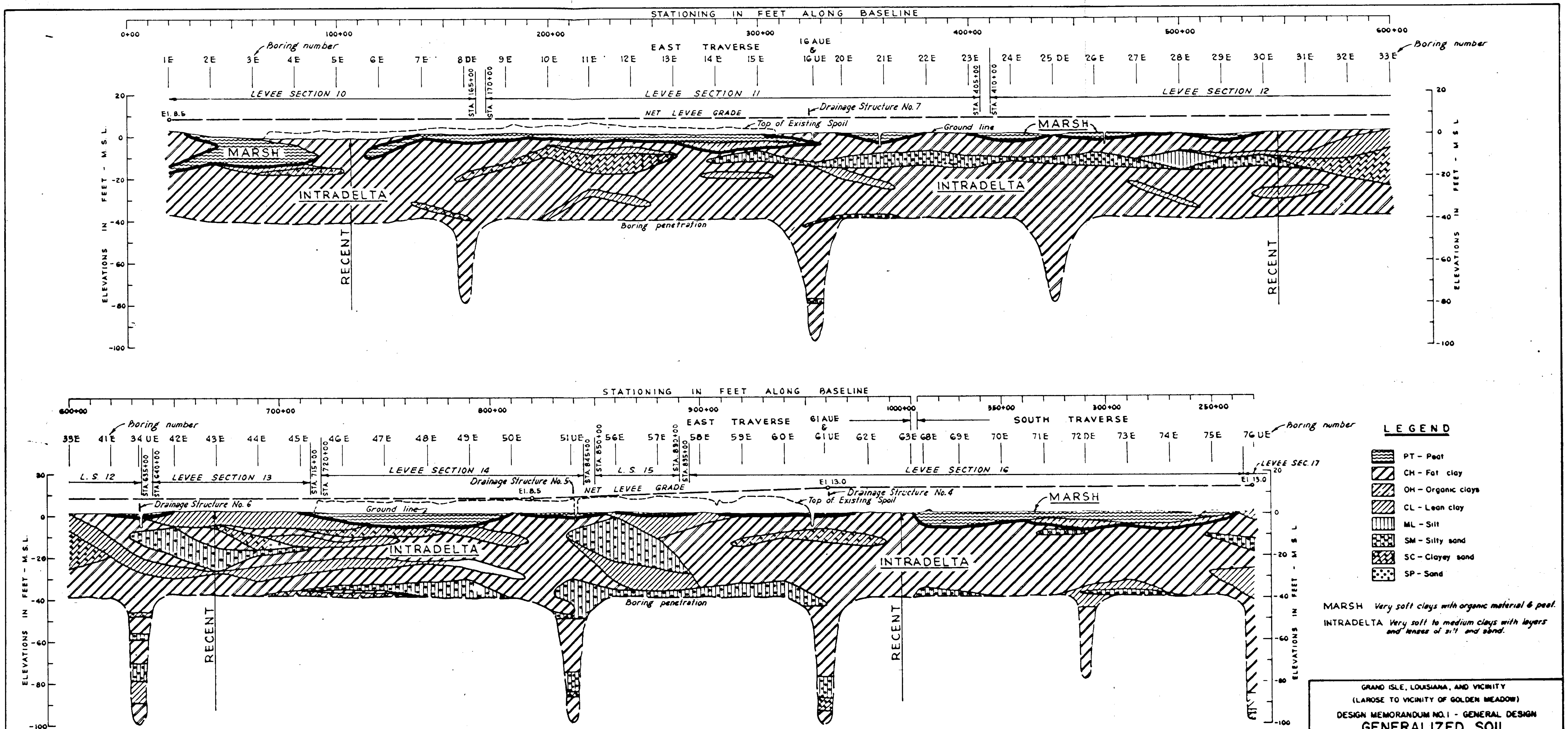
BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA

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

DATE: MARCH 1972

FILE NO. H-2-24314

PLATE 44



GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

GENERALIZED SOIL AND GEOLOGIC PROFILE

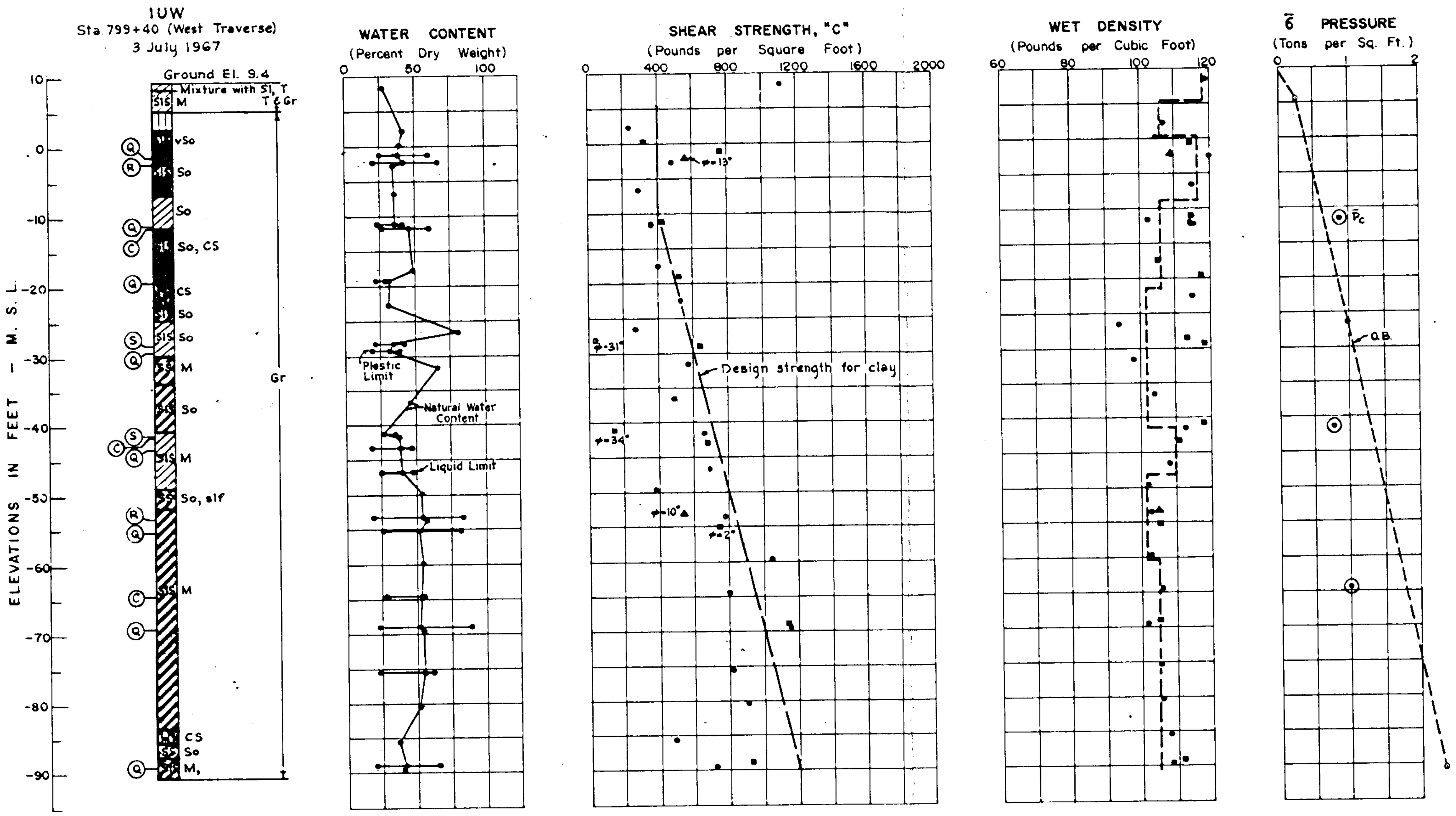
EAST LEVEE

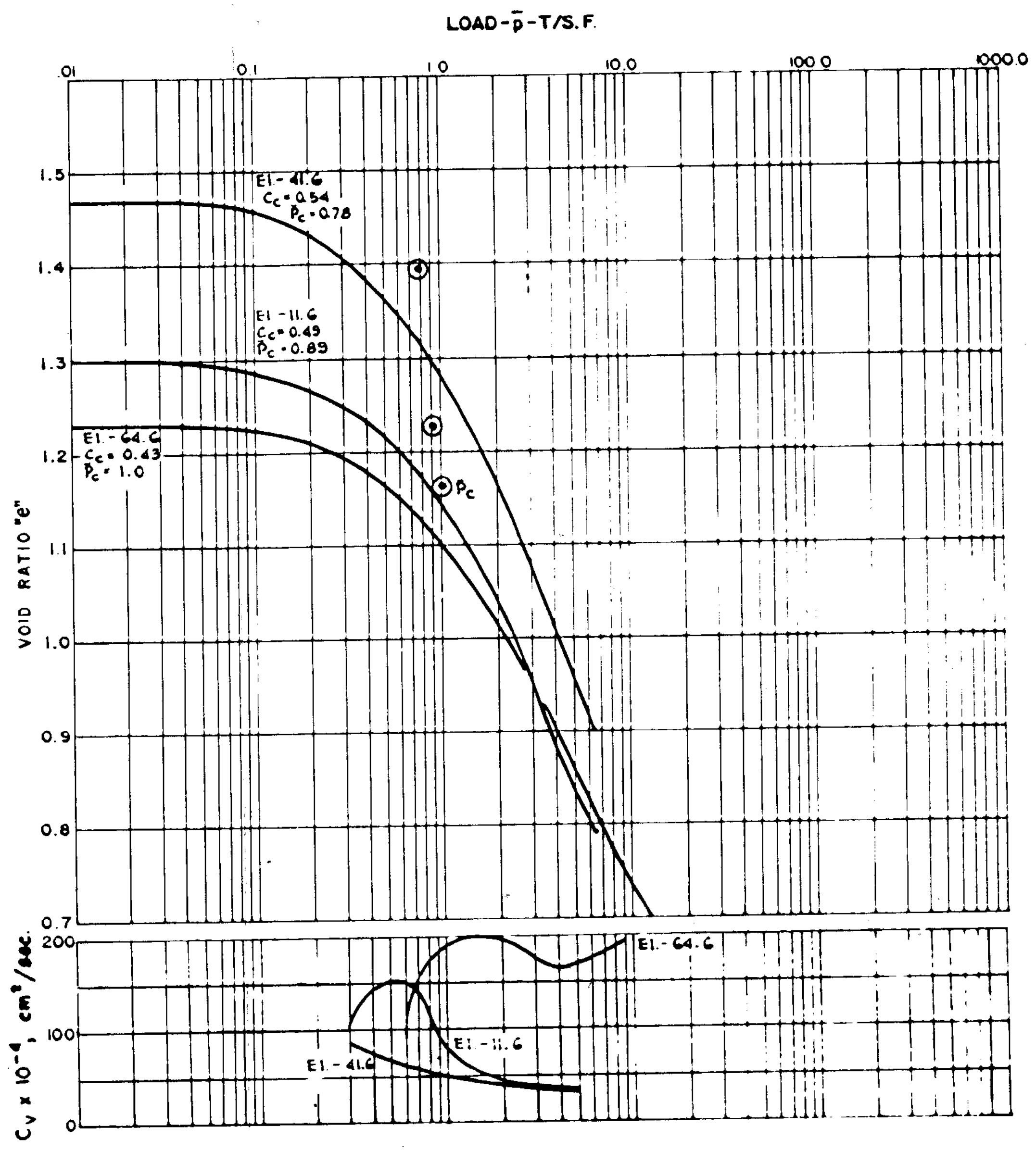
BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA

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

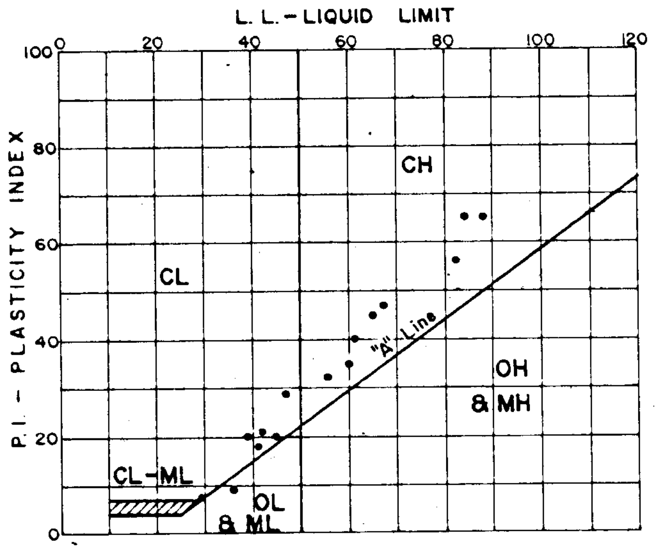
DATE: MARCH 1972
FILE NO. H-2-24314

PLATE 45

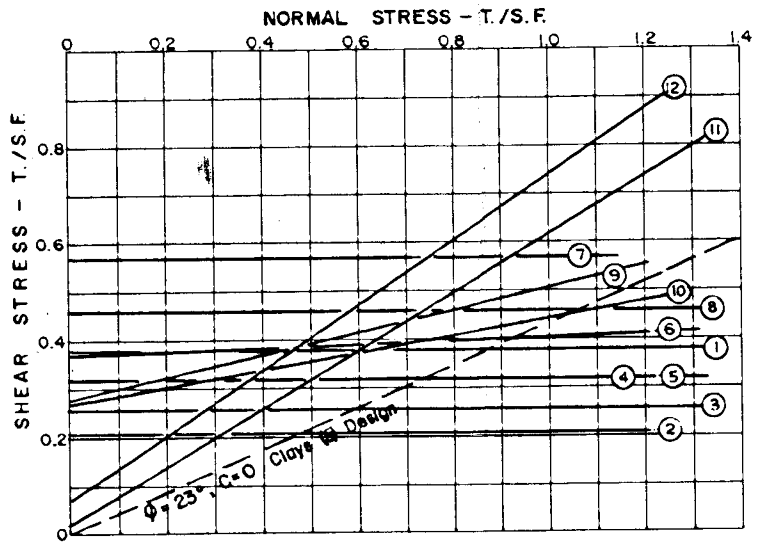




CONSOLIDATION DATA



PLASTICITY CHART



SHEAR STRENGTH DATA

ENVELOPE		TYPE	STRENGTH		CLASS.
NO.	EL.		φ	c t.s.f.	
1	-1.1	Q	0	0.38	CH
2	-11.1		0	0.21	CL
3	-19.1		0	0.26	SM
4	-29.1		0	0.32	ML
5	-43.1		0	0.32	SM
6	-55.1		2	0.37	CH
7	-69.1		0	0.57	CH
8	-89.1		0	0.46	CH
9	-2.1	R	13	0.28	CH
10	-53.1		10	0.27	CH
11	-28.1	S	31	0.02	CL
12	-41.1		34	0.07	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
LL Liquid limit
PL Plastic limit
c Unit cohesion
φ Angle of friction
γ Unit of weight of soil-water system
$\bar{\sigma}$ Normal stress
O.B. Overburden
$\bar{P}_c$ Preconsolidation pressure
e Void ratio
C_c Compression index

For soil boring legend see plate A

For detail shear test data see plate 47
For location of boring see plate 2

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

SOIL BORING 1 UW DATA

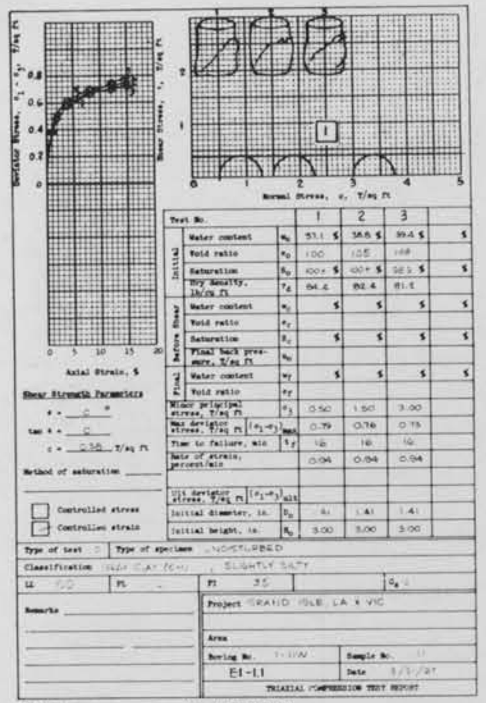
BARNARD AND BURK, INC
CONSULTING ENGINEERS
BATON ROUGE, LA

U S ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

DATE MARCH 1972

FILE NO. H-2-24314

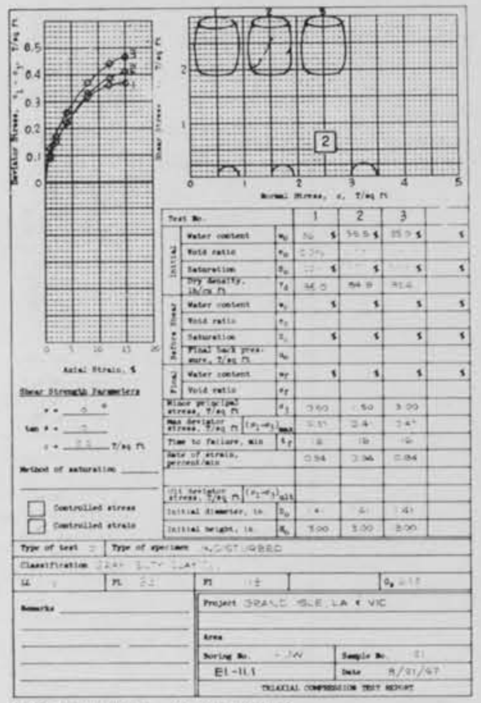
PLATE 46



Shear Strength Parameters
φ = 0 °
tan φ = 0
c = 0.38 T/sq ft
Method of saturation
☐ Controlled stress
☑ Controlled strain

Test No.	1	2	3	
Initial – Water content w_o	53.1 %	38.8 %	39.4 %	%
Initial – Void ratio e_o	1.00	1.05	1.08	
Initial – Saturation S_o	100+ %	100+ %	98.5 %	%
Initial – Dry density, lb/cu ft γ_d	84.4	82.4	81.1	
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 $(\sigma_1-\sigma_3)_{max}$	0.79	0.76	0.75	
Time to failure, min t_f	16	16	16	
Rate of strain, percent/min	0.94	0.94	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	

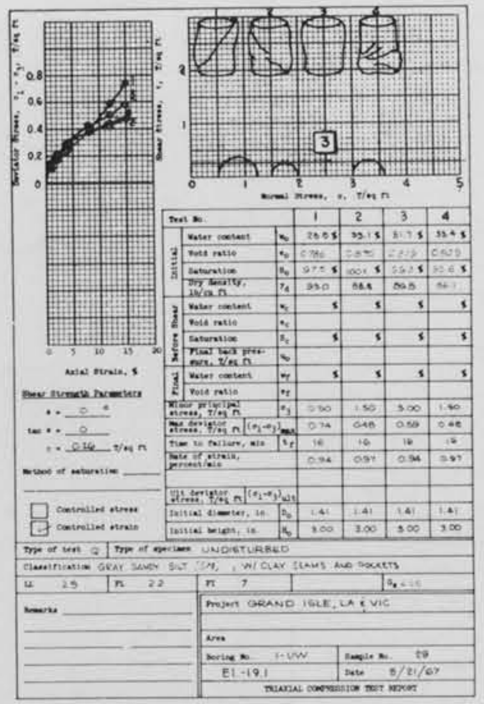
Type of test Q | Type of specimen UNDISTURBED
Classification GRAY CLAY (CH), SLIGHTLY SILTY
LL 60 | PL [illegible] | PI 35 | G_s [illegible]
Remarks
Project GRAND ISLE, LA & VIC
Area
Boring No. 1-UW | Sample No. 11
E1-11.1 | Date 8/1/67
TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE
TRANSLUCENT



Shear Strength Parameters
φ = 0 °
tan φ = 0
c = 0.2 T/sq ft
Method of saturation
☐ Controlled stress
☑ Controlled strain

Test No.	1	2	3	
Initial – Water content w_o	50 %	38.5 %	35.9 %	%
Initial – Void ratio e_o	[illegible]	[illegible]	[illegible]	
Initial – Saturation S_o	[illegible] %	[illegible] %	[illegible] %	%
Initial – Dry density, lb/cu ft γ_d	84.5	84.9	81.6	
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 $(\sigma_1-\sigma_3)_{max}$	0.31	0.41	0.41	
Time to failure, min t_f	18	16	16	
Rate of strain, percent/min	0.94	0.94	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	

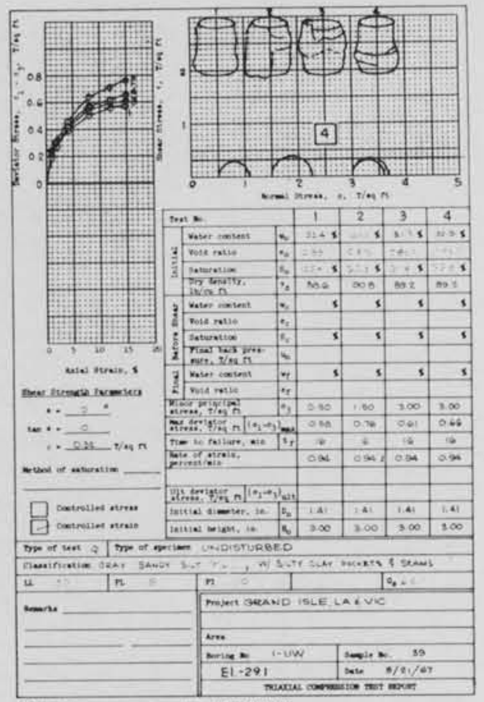
Type of test Q | Type of specimen UNDISTURBED
Classification GRAY SILTY CLAY (CL)
LL [illegible] | PL [illegible] | PI 14 | G_s [illegible]
Remarks
Project GRAND ISLE, LA & VIC
Area
Boring No. 1-UW | Sample No. 21
E1-11.1 | Date 8/31/67
TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE
TRANSLUCENT



Shear Strength Parameters
φ = 0 °
tan φ = 0
c = 0.16 T/sq ft
Method of saturation
☐ Controlled stress
☑ Controlled strain

Test No.	1	2	3	4
Initial – Water content w_o	26.5 %	35.1 %	31.7 %	33.4 %
Initial – Void ratio e_o	0.786	0.875	[illegible]	0.929
Initial – Saturation S_o	97.5 %	100+ %	[illegible] %	95.6 %
Initial – Dry density, lb/cu ft γ_d	93.0	88.4	89.5	[illegible]
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	1.50
Max deviator stress, T/sq ft $(\sigma_1-\sigma_3)_{max}$	0.74	0.48	0.59	0.48
Time to failure, min t_f	16	16	19	15
Rate of strain, percent/min	0.94	0.97	0.94	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

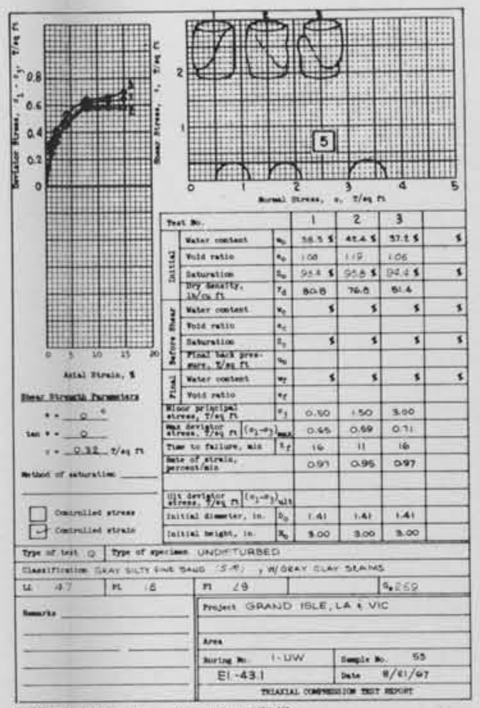
Type of test Q | Type of specimen UNDISTURBED
Classification GRAY SANDY SILT (ML), W/ CLAY SEAMS AND POCKETS
LL 25 | PL 22 | PI 7 | G_s [illegible]
Remarks
Project GRAND ISLE, LA & VIC
Area
Boring No. 1-UW | Sample No. 29
E1-19.1 | Date 8/21/67
TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE
TRANSLUCENT



Shear Strength Parameters
φ = 0 °
tan φ = 0
c = 0.36 T/sq ft
Method of saturation
☐ Controlled stress
☑ Controlled strain

Test No.	1	2	3	4
Initial – Water content w_o	31.4 %	[illegible] %	[illegible] %	[illegible] %
Initial – Void ratio e_o	[illegible]	[illegible]	[illegible]	[illegible]
Initial – Saturation S_o	[illegible] %	[illegible] %	[illegible] %	[illegible] %
Initial – Dry density, lb/cu ft γ_d	86.6	90.8	89.2	89.1
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	3.00
Max deviator stress, T/sq ft $(\sigma_1-\sigma_3)_{max}$	0.58	0.78	0.61	0.66
Time to failure, min t_f	19	[illegible]	19	19
Rate of strain, percent/min	0.94	0.94	0.94	0.94
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

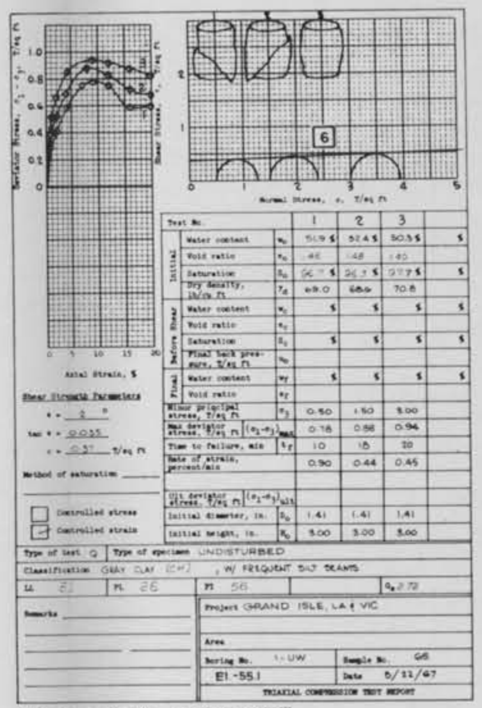
Type of test Q | Type of specimen UNDISTURBED
Classification GRAY SANDY SILT (ML), W/ SILTY CLAY POCKETS & SEAMS
LL [illegible] | PL [illegible] | PI [illegible] | G_s [illegible]
Remarks
Project GRAND ISLE, LA & VIC
Area
Boring No. 1-UW | Sample No. 39
E1-29.1 | Date 8/21/67
TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE
TRANSLUCENT



Shear Strength Parameters
φ = 0 °
tan φ = 0
c = 0.32 T/sq ft
Method of saturation
☐ Controlled stress
☑ Controlled strain

Test No.	1	2	3	
Initial – Water content w_o	38.5 %	41.4 %	37.2 %	%
Initial – Void ratio e_o	1.08	1.19	1.06	
Initial – Saturation S_o	95.4 %	95.8 %	94.4 %	%
Initial – Dry density, lb/cu ft γ_d	80.8	76.8	81.4	
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	0.69	0.71	
Time to failure, min t_f	16	11	16	
Rate of strain, percent/min	0.97	0.95	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	

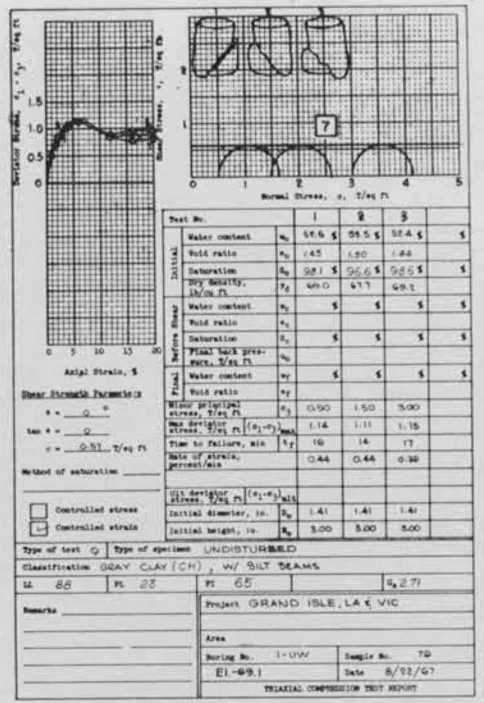
Type of test Q | Type of specimen UNDISTURBED
Classification GRAY SILTY FINE SAND (SM), W/GRAY CLAY SEAMS
LL 47 | PL 18 | PI 29 | G_s 2.69
Remarks
Project GRAND ISLE, LA & VIC
Area
Boring No. 1-UW | Sample No. 55
E1-43.1 | Date 8/21/67
TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE
TRANSLUCENT



Shear Strength Parameters
φ = 2 °
tan φ = 0.035
c = 0.37 T/sq ft
Method of saturation
☐ Controlled stress
☑ Controlled strain

Test No.	1	2	3	
Initial – Water content w_o	51.9 %	52.4 %	50.3 %	%
Initial – Void ratio e_o	1.46	1.48	1.40	
Initial – Saturation S_o	[illegible] %	[illegible] %	97.7 %	%
Initial – Dry density, lb/cu ft γ_d	69.0	68.6	70.8	
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 $(\sigma_1-\sigma_3)_{max}$	0.78	0.88	0.94	
Time to failure, min t_f	10	18	20	
Rate of strain, percent/min	0.90	0.44	0.45	
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	

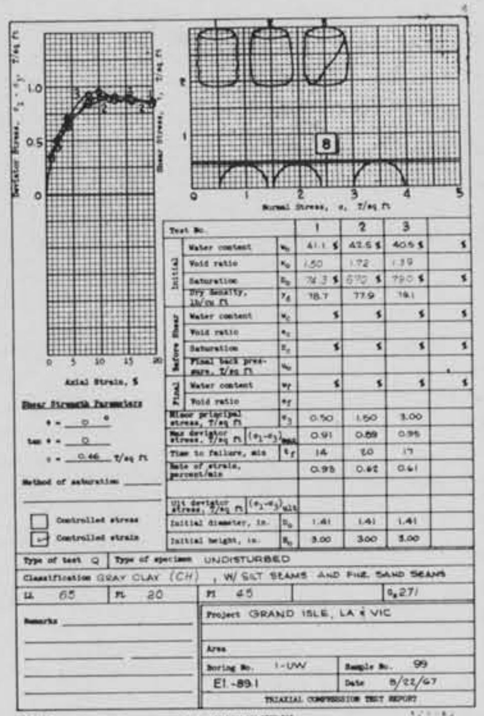
Type of test Q | Type of specimen UNDISTURBED
Classification GRAY CLAY (CH), W/ FREQUENT SILT SEAMS
LL 81 | PL 26 | PI 56 | G_s 2.72
Remarks
Project GRAND ISLE, LA & VIC
Area
Boring No. 1-UW | Sample No. 66
E1-55.1 | Date 8/11/67
TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE
TRANSLUCENT



Shear Strength Parameters
φ = 0 °
tan φ = 0
c = 0.57 T/sq ft
Method of saturation
☐ Controlled stress
☑ Controlled strain

Test No.	1	2	3	
Initial – Water content w_o	55.6 %	59.5 %	52.4 %	%
Initial – Void ratio e_o	1.45	1.50	1.44	
Initial – Saturation S_o	98.1 %	96.6 %	98.6 %	%
Initial – Dry density, lb/cu ft γ_d	69.0	67.7	69.2	
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 $(\sigma_1-\sigma_3)_{max}$	1.14	1.11	1.15	
Time to failure, min t_f	16	14	17	
Rate of strain, percent/min	0.44	0.44	0.39	
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	

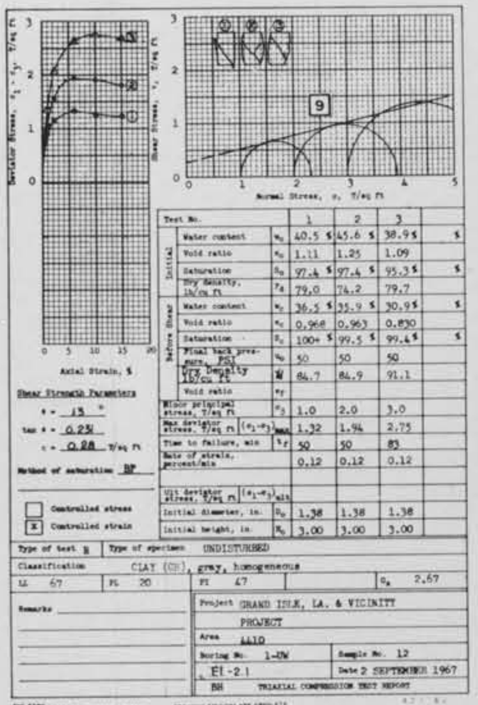
Type of test Q | Type of specimen UNDISTURBED
Classification GRAY CLAY (CH), W/ SILT SEAMS
LL 88 | PL 23 | PI 65 | G_s 2.71
Remarks
Project GRAND ISLE, LA & VIC
Area
Boring No. 1-UW | Sample No. 79
E1-69.1 | Date 8/22/67
TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE
TRANSLUCENT



Shear Strength Parameters
φ = 0 °
tan φ = 0
c = 0.46 T/sq ft
Method of saturation
☐ Controlled stress
☑ Controlled strain

Test No.	1	2	3	
Initial – Water content w_o	41.1 %	42.5 %	40.5 %	%
Initial – Void ratio e_o	1.50	1.72	1.39	
Initial – Saturation S_o	74.3 %	67.0 %	79.0 %	%
Initial – Dry density, lb/cu ft γ_d	78.7	77.9	78.1	
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 $(\sigma_1-\sigma_3)_{max}$	0.91	0.89	0.95	
Time to failure, min t_f	14	20	17	
Rate of strain, percent/min	0.93	0.62	0.61	
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	

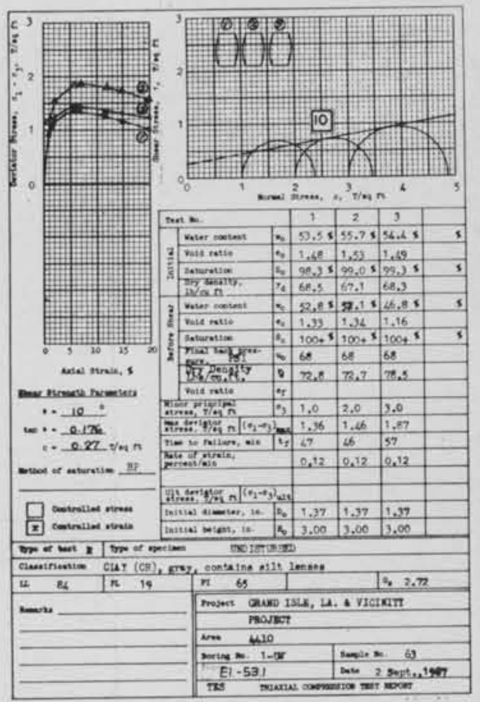
Type of test Q | Type of specimen UNDISTURBED
Classification GRAY CLAY (CH), W/ SILT SEAMS AND FINE SAND SEAMS
LL 65 | PL 20 | PI 45 | G_s 2.71
Remarks
Project GRAND ISLE, LA & VIC
Area
Boring No. 1-UW | Sample No. 99
E1-89.1 | Date 8/22/67
TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE
TRANSLUCENT



Shear Strength Parameters
φ = 13 °
tan φ = 0.231
c = 0.28 T/sq ft
Method of saturation BP
☐ Controlled stress
☒ Controlled strain

Test No.	1	2	3	
Initial – Water content w_o	40.5 %	45.6 %	38.9 %	%
Initial – Void ratio e_o	1.11	1.25	1.09	
Initial – Saturation S_o	97.4 %	97.4 %	95.3 %	%
Initial – Dry density, lb/cu ft γ_d	79.0	74.2	79.7	
Before Shear – Water content w_c	36.5 %	35.9 %	30.9 %	%
Before Shear – Void ratio e_c	0.968	0.963	0.830	
Before Shear – Saturation S_c	100+ %	99.5 %	99.4 %	%
Before Shear – Final back pressure, PSI u_o	50	50	50	
Dry Density lb/cu ft	84.7	84.9	91.1	
Void ratio e_f				
Minor principal stress, T/sq ft σ_3	1.0	2.0	3.0	
Max deviator stress, T/sq ft $(\sigma_1-\sigma_3)_{max}$	1.32	1.94	2.75	
Time to failure, min t_f	50	50	83	
Rate of strain, percent/min	0.12	0.12	0.12	
Ult deviator stress, T/sq ft $(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in. D_o	1.38	1.38	1.38	
Initial height, in. H_o	3.00	3.00	3.00	

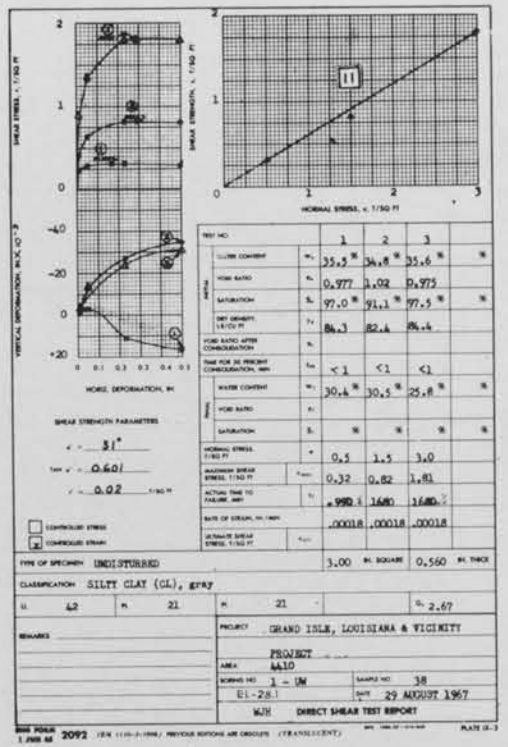
Type of test R | Type of specimen UNDISTURBED
Classification CLAY (CH), gray, homogeneous
LL 67 | PL 20 | PI 47 | G_s 2.67
Remarks
Project GRAND ISLE, LA. & VICINITY PROJECT
Area 4410
Boring No. 1-UW | Sample No. 12
E1-2.1 | Date 2 SEPTEMBER 1967
BH TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE
TRANSLUCENT



Shear Strength Parameters
φ = 10 °
tan φ = 0.176
c = 0.27 T/sq ft
Method of saturation BP
☐ Controlled stress
☒ Controlled strain

Test No.	1	2	3	
Initial – Water content w_o	53.5 %	55.7 %	54.4 %	%
Initial – Void ratio e_o	1.48	1.53	1.49	
Initial – Saturation S_o	98.3 %	99.0 %	99.3 %	%
Initial – Dry density, lb/cu ft γ_d	68.5	67.1	68.3	
Before Shear – Water content w_c	52.8 %	52.1 %	46.8 %	%
Before Shear – Void ratio e_c	1.33	1.34	1.16	
Before Shear – Saturation S_c	100+ %	100+ %	100+ %	%
Before Shear – Final back pressure, PSI u_o	68	68	68	
Dry Density lb/cu ft	72.8	72.7	78.5	
Void ratio e_f				
Minor principal stress, T/sq ft σ_3	1.0	2.0	3.0	
Max deviator stress, T/sq ft $(\sigma_1-\sigma_3)_{max}$	1.36	1.46	1.87	
Time to failure, min t_f	47	46	57	
Rate of strain, percent/min	0.12	0.12	0.12	
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	

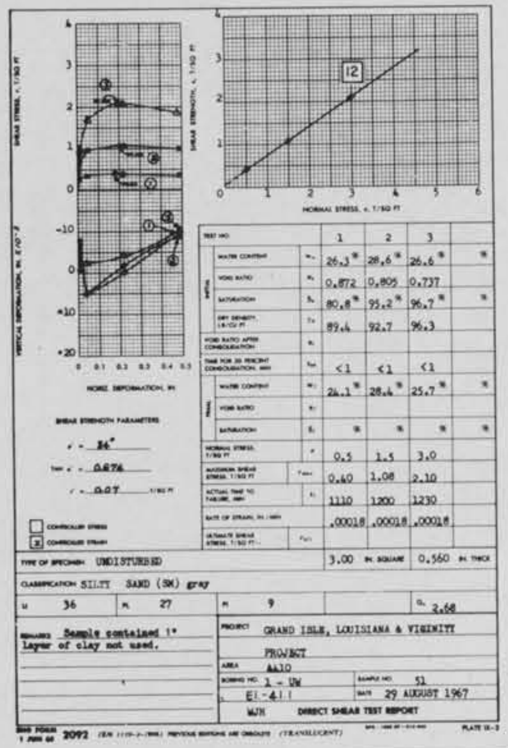
Type of test R | Type of specimen UNDISTURBED
Classification CLAY (CH), gray, contains silt lenses
LL 84 | PL 19 | PI 65 | G_s 2.72
Remarks
Project GRAND ISLE, LA. & VICINITY PROJECT
Area 4410
Boring No. 1-UW | Sample No. 63
E1-53.1 | Date 2 Sept., 1967
TES TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE
TRANSLUCENT



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	35.5 %	34.8 %	35.6 %	%
INITIAL – VOID RATIO e_o	0.977	1.02	0.975	
INITIAL – SATURATION S_o	97.0 %	91.1 %	97.5 %	%
INITIAL – DRY DENSITY, LB/CU FT γ_d	84.3	82.4	84.4	
VOID RATIO AFTER CONSOLIDATION e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN t_{50}	<1	<1	<1	
FINAL – WATER CONTENT w_f	30.4 %	30.5 %	25.8 %	%
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}	0.32	0.82	1.81	
ACTUAL TIME TO FAILURE, MIN t_f	990	1680	1680	
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 SILTY CLAY (CL), gray
LL 42 | PL 21 | PI 21 | G_s 2.67
REMARKS
PROJECT GRAND ISLE, LOUISIANA & VICINITY PROJECT
AREA 4410
BORING NO. 1 - UW | SAMPLE NO. 38
E1-28.1 | DATE 29 AUGUST 1967
WJH DIRECT SHEAR TEST REPORT
ENG FORM 2092 1 JUN 66 (EM 1110-2-1906) PREVIOUS EDITIONS ARE OBSOLETE (TRANSLUCENT) PLATE IX-3



SHEAR STRENGTH PARAMETERS
φ = 34°
TAN φ = 0.674
c = 0.07 T/SQ FT
☐ CONTROLLED STRESS
☒ CONTROLLED STRAIN

TEST NO.	1	2	3	
INITIAL – WATER CONTENT w_o	26.3 %	28.6 %	26.6 %	%
INITIAL – VOID RATIO e_o	0.872	0.805	0.737	
INITIAL – SATURATION S_o	80.8 %	95.2 %	96.7 %	%
INITIAL – DRY DENSITY, LB/CU FT γ_d	89.4	92.7	96.3	
VOID RATIO AFTER CONSOLIDATION e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN t_{50}	<1	<1	<1	
FINAL – WATER CONTENT w_f	24.1 %	28.4 %	25.7 %	%
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}	0.40	1.08	2.10	
ACTUAL TIME TO FAILURE, MIN t_f	1110	1200	1230	
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 SILTY SAND (SM) gray
LL 36 | PL 27 | PI 9 | G_s 2.68
REMARKS Sample contained 1" layer of clay not used.
PROJECT GRAND ISLE, LOUISIANA & VICINITY PROJECT
AREA 4410
BORING NO. 1 - UW | SAMPLE NO. 51
E1-41.1 | DATE 29 AUGUST 1967
WJH DIRECT SHEAR TEST REPORT
ENG FORM 2092 1 JUN 66 (EM 1110-2-1906) PREVIOUS EDITIONS ARE OBSOLETE (TRANSLUCENT) PLATE IX-3

NOTE:
7 Indicates reference number shown under shear data on Plate 46
(Q) - Unconsolidated - undrained triaxial compression test.
(R) - Consolidated - undrained triaxial compression test.
(S) - Consolidated - drained direct shear test.

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)

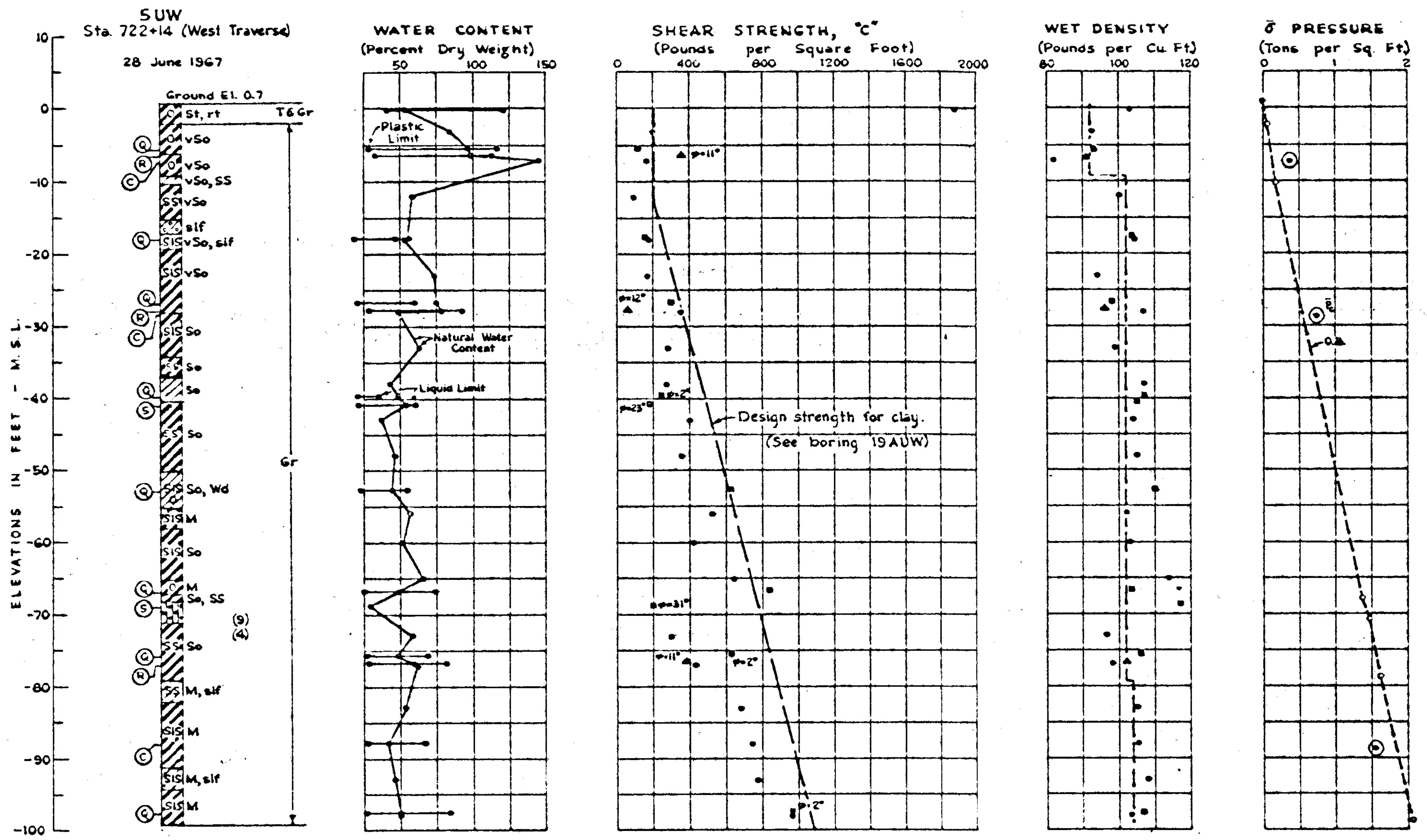
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

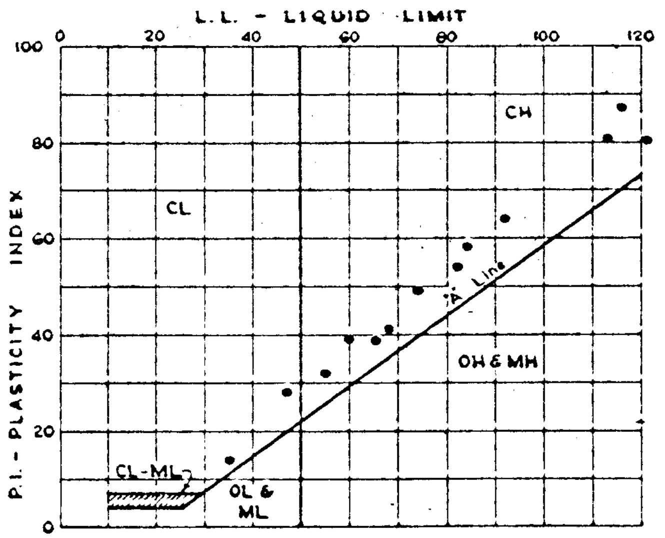
DETAIL SHEAR STRENGTH DATA
BORING 1 UW

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

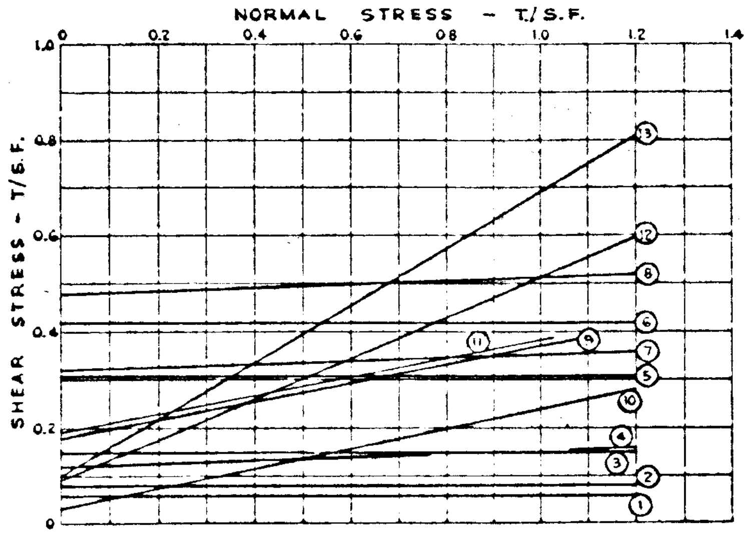
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

DATE: MARCH, 1972 | FILE NO. H-2-24314



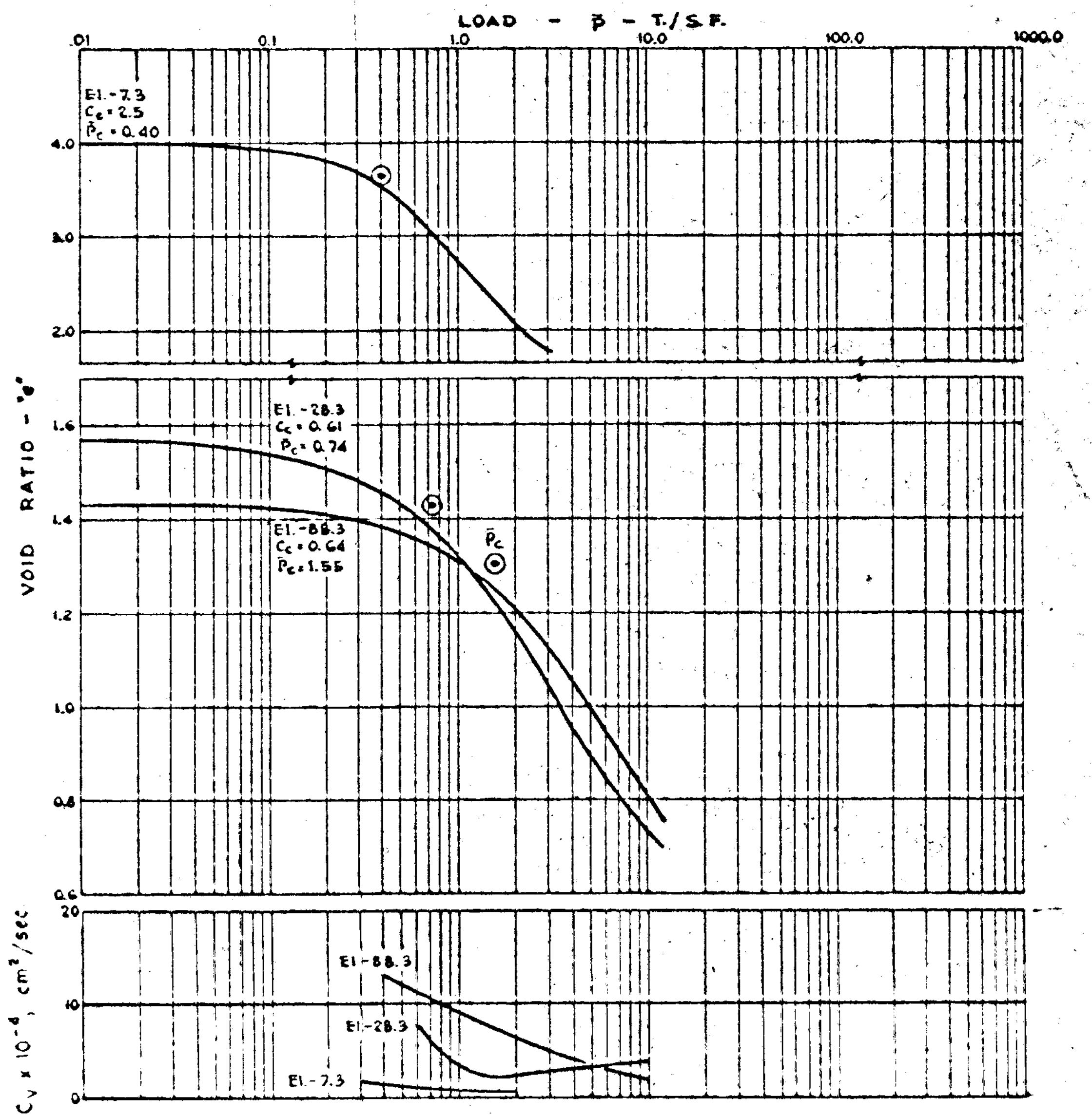


PLASTICITY CHART



SHEAR STRENGTH DATA

ENVELOPE		TYPE	STRENGTH		CLASS
NO.	EL.		φ	c (t.s.f)	
1	-5.8	Q	0	0.06	CH
2	-17.8		0	0.08	CL
3	-26.8		0	0.15	CH
4	-39.8		2	0.12	CL
5	-52.8		0	0.31	CH
6	-66.8		0	0.42	CH
7	-75.8		2	0.32	CH
8	-97.8		2	0.48	CH
9	-6.8	R	11	0.18	CH
10	-27.8		12	0.03	CH
11	-76.8		11	0.19	CH
12	-40.8	S	23	0.09	CH
13	-68.8		31	0.10	SM



CONSOLIDATION DATA

For general notes see plate 46
For detail shear strength data see plate 49
For location of boring see plate 2

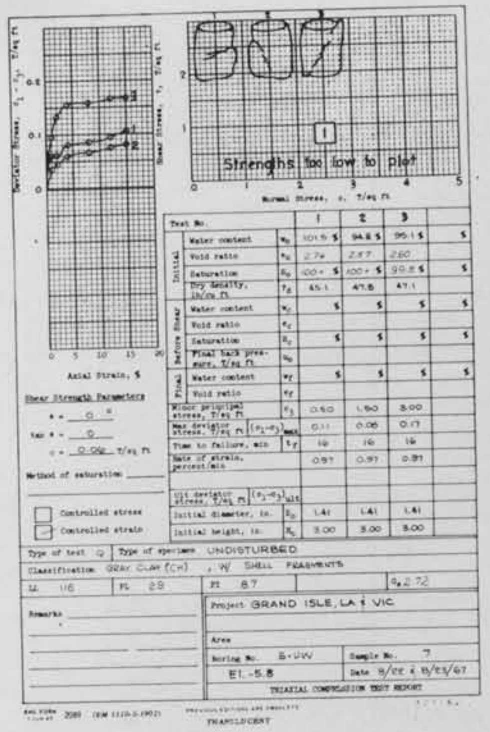
GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

SOIL BORING 5UW DATA

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

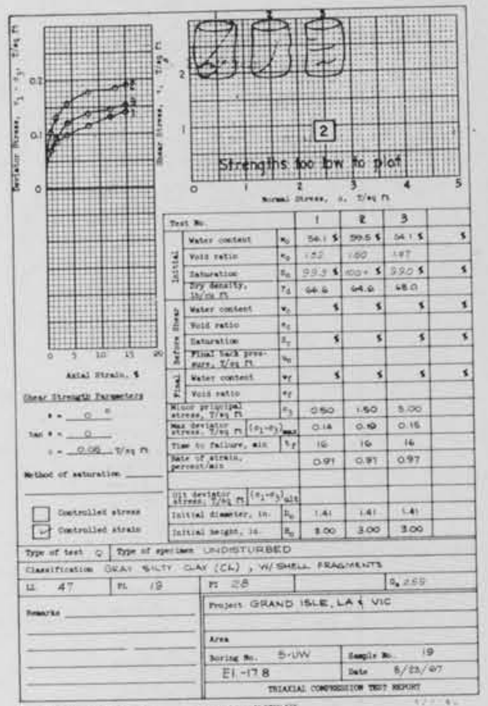
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

DATE: MARCH 1972
FILE NO. H-2-24314



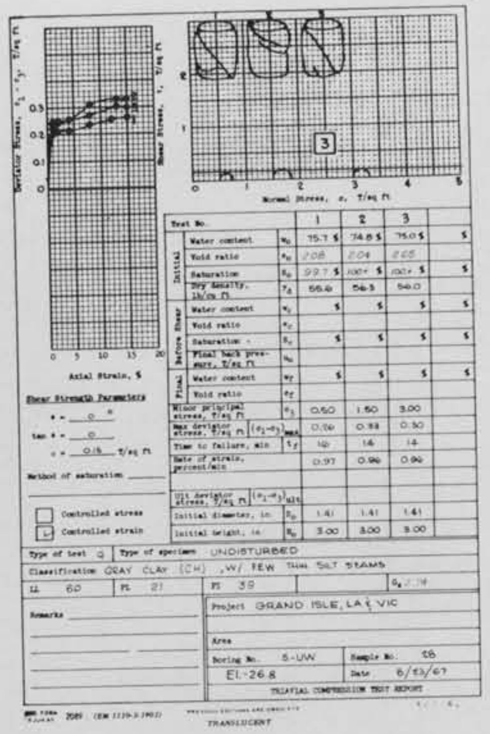
Test No.	1	2	3
Initial water content w_0, %	101.5	94.8	95.1
Initial void ratio e_0	2.74	2.87	2.60
Initial saturation S_0, %	100+	100+	99.8
Dry density γ_d, lb/cu ft	45.1	47.8	47.1
Minor principal stress σ_3, T/sq ft	0.50	1.50	3.00
Max deviator stress $(\sigma_1-\sigma_3)_{max}$, T/sq ft	0.11	0.06	0.17
Time to failure t_f, min	16	16	16
Rate of strain, percent/min	0.97	0.97	0.97
Initial diameter D_0, in.	1.41	1.41	1.41
Initial height H_0, in.	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: GRAY CLAY (CH), W/ SHELL FRAGMENTS
LL 116; PL 29; PI 87; G_s 2.72
Project: GRAND ISLE, LA & VIC
Boring No. 5-UW; El. -5.8; Sample No. 7; Date 8/22 & 8/23/67
TRIAXIAL COMPRESSION TEST REPORT



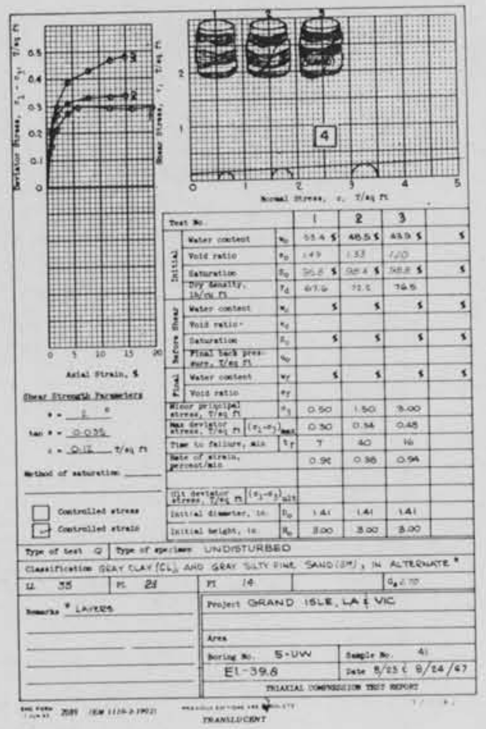
Test No.	1	2	3
Initial water content w_0, %	56.1	59.5	54.1
Initial void ratio e_0	1.52	1.60	1.47
Initial saturation S_0, %	99.3	100+	99.0
Dry density γ_d, lb/cu ft	64.6	64.0	68.0
Minor principal stress σ_3, T/sq ft	0.50	1.50	3.00
Max deviator stress $(\sigma_1-\sigma_3)_{max}$, T/sq ft	0.14	0.19	0.15
Time to failure t_f, min	16	16	16
Rate of strain, percent/min	0.97	0.97	0.97
Initial diameter D_0, in.	1.41	1.41	1.41
Initial height H_0, in.	3.00	3.00	3.00

Shear Strength Parameters: φ = 0°; tan φ = 0; c = 0.06 T/sq ft
☐ Controlled stress
☑ Controlled strain
Type of test: Q. Type of specimen: UNDISTURBED
Classification: GRAY SILTY CLAY (CL), W/ SHELL FRAGMENTS
LL 47; PL 19; PI 28; G_s 2.69
Project: GRAND ISLE, LA & VIC
Boring No. 5-UW; El. -17.8; Sample No. 19; Date 8/23/67
TRIAXIAL COMPRESSION TEST REPORT



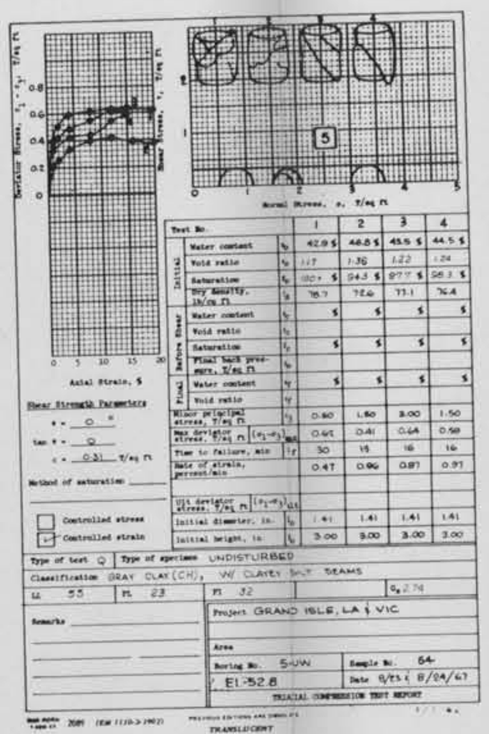
Test No.	1	2	3
Initial water content w_0, %	75.7	74.8	75.0
Initial void ratio e_0	2.08	2.04	2.05
Initial saturation S_0, %	99.7	100+	100+
Dry density γ_d, lb/cu ft	56.6	56.3	56.0
Minor principal stress σ_3, T/sq ft	0.50	1.50	3.00
Max deviator stress $(\sigma_1-\sigma_3)_{max}$, T/sq ft	0.26	0.33	0.30
Time to failure t_f, min	16	16	14
Rate of strain, percent/min	0.97	0.96	0.96
Initial diameter D_0, in.	1.41	1.41	1.41
Initial height H_0, in.	3.00	3.00	3.00

Shear Strength Parameters: φ = 0°; tan φ = 0; c = 0.16 T/sq ft
☐ Controlled stress
☑ Controlled strain
Type of test: Q. Type of specimen: UNDISTURBED
Classification: GRAY CLAY (CH), W/ FEW THIN SILT SEAMS
LL 60; PL 21; PI 39; G_s 2.74
Project: GRAND ISLE, LA & VIC
Boring No. 5-UW; El. -26.8; Sample No. 28; Date 8/23/67
TRIAXIAL COMPRESSION TEST REPORT



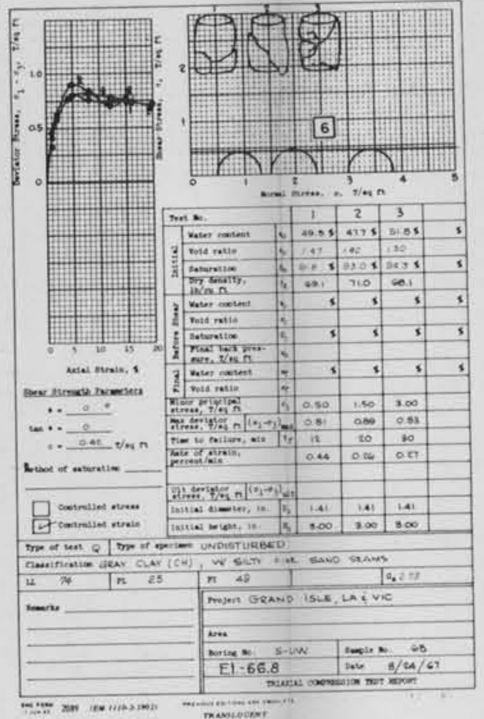
Test No.	1	2	3
Initial water content w_0, %	53.4	48.5	43.9
Initial void ratio e_0	1.49	1.33	1.20
Initial saturation S_0, %	96.8	98.4	98.8
Dry density γ_d, lb/cu ft	67.6	72.5	76.5
Minor principal stress σ_3, T/sq ft	0.50	1.50	3.00
Max deviator stress $(\sigma_1-\sigma_3)_{max}$, T/sq ft	0.30	0.34	0.48
Time to failure t_f, min	7	40	16
Rate of strain, percent/min	0.96	0.98	0.94
Initial diameter D_0, in.	1.41	1.41	1.41
Initial height H_0, in.	3.00	3.00	3.00

Shear Strength Parameters: φ = 2°; tan φ = 0.035; c = 0.12 T/sq ft
☐ Controlled stress
☑ Controlled strain
Type of test: Q. Type of specimen: UNDISTURBED
Classification: GRAY CLAY (CL) AND GRAY SILTY FINE SAND (SM), IN ALTERNATE *
LL 35; PL 21; PI 14; G_s 2.70
Remarks: * LAYERS
Project: GRAND ISLE, LA & VIC
Boring No. 5-UW; El. -39.8; Sample No. 41; Date 8/23 & 8/24/67
TRIAXIAL COMPRESSION TEST REPORT



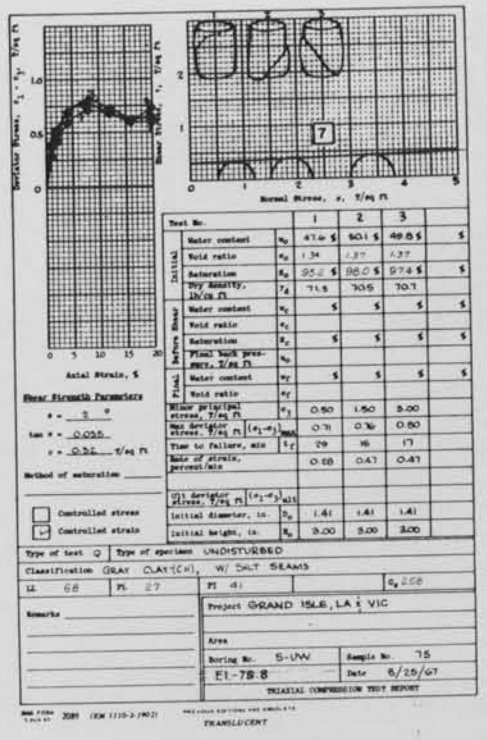
Test No.	1	2	3	4
Initial water content w_0, %	42.9	48.8	45.5	44.5
Initial void ratio e_0	1.17	1.36	1.22	1.24
Initial saturation S_0, %	100+	94.3	97.7	98.3
Dry density γ_d, lb/cu ft	78.7	72.6	77.1	76.4
Minor principal stress σ_3, T/sq ft	0.50	1.50	3.00	1.50
Max deviator stress $(\sigma_1-\sigma_3)_{max}$, T/sq ft	0.65	0.41	0.64	0.59
Time to failure t_f, min	30	15	16	16
Rate of strain, percent/min	0.47	0.96	0.87	0.97
Initial diameter D_0, in.	1.41	1.41	1.41	1.41
Initial height H_0, in.	3.00	3.00	3.00	3.00

Shear Strength Parameters: φ = 0°; tan φ = 0; c = 0.31 T/sq ft
☐ Controlled stress
☑ Controlled strain
Type of test: Q. Type of specimen: UNDISTURBED
Classification: GRAY CLAY (CH), W/ CLAYEY SILT SEAMS
LL 55; PL 23; PI 32; G_s 2.74
Project: GRAND ISLE, LA & VIC
Boring No. 5-UW; El. -52.8; Sample No. 64; Date 8/23 & 8/24/67
TRIAXIAL COMPRESSION TEST REPORT



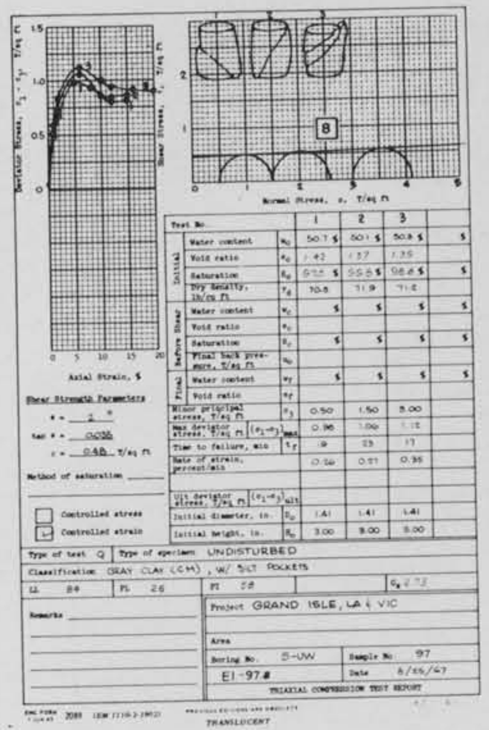
Test No.	1	2	3
Initial water content w_0, %	49.5	47.7	51.8
Initial void ratio e_0	1.47	1.42	1.50
Initial saturation S_0, %	[illegible]	93.0	94.3
Dry density γ_d, lb/cu ft	69.1	71.0	68.1
Minor principal stress σ_3, T/sq ft	0.50	1.50	3.00
Max deviator stress $(\sigma_1-\sigma_3)_{max}$, T/sq ft	0.81	0.89	0.83
Time to failure t_f, min	11	20	30
Rate of strain, percent/min	0.44	0.26	0.27
Initial diameter D_0, in.	1.41	1.41	1.41
Initial height H_0, in.	3.00	3.00	3.00

Shear Strength Parameters: φ = 0°; tan φ = 0; c = 0.45 T/sq ft
☐ Controlled stress
☑ Controlled strain
Type of test: Q. Type of specimen: UNDISTURBED
Classification: GRAY CLAY (CH), W/ SILTY FINE SAND SEAMS
LL 74; PL 25; PI 49; G_s 2.72
Project: GRAND ISLE, LA & VIC
Boring No. 5-UW; El. -66.8; Sample No. 65; Date 8/24/67
TRIAXIAL COMPRESSION TEST REPORT



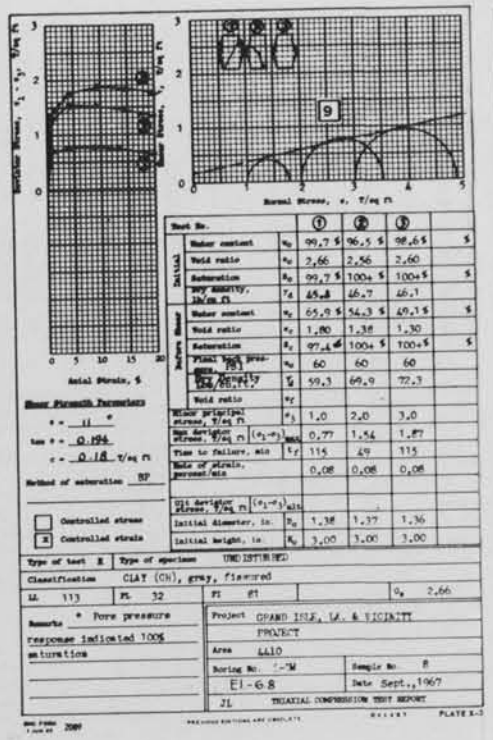
Test No.	1	2	3
Initial water content w_0, %	47.6	50.1	49.8
Initial void ratio e_0	1.34	1.37	1.37
Initial saturation S_0, %	95.2	98.0	97.4
Dry density γ_d, lb/cu ft	71.5	70.5	70.7
Minor principal stress σ_3, T/sq ft	0.50	1.50	3.00
Max deviator stress $(\sigma_1-\sigma_3)_{max}$, T/sq ft	0.71	0.76	0.80
Time to failure t_f, min	29	16	17
Rate of strain, percent/min	0.68	0.47	0.47
Initial diameter D_0, in.	1.41	1.41	1.41
Initial height H_0, in.	3.00	3.00	3.00

Shear Strength Parameters: φ = 2°; tan φ = 0.035; c = 0.32 T/sq ft
☐ Controlled stress
☑ Controlled strain
Type of test: Q. Type of specimen: UNDISTURBED
Classification: GRAY CLAY (CH), W/ SILT SEAMS
LL 68; PL 27; PI 41; G_s 2.68
Project: GRAND ISLE, LA & VIC
Boring No. 5-UW; El. -78.8; Sample No. 75; Date 8/25/67
TRIAXIAL COMPRESSION TEST REPORT



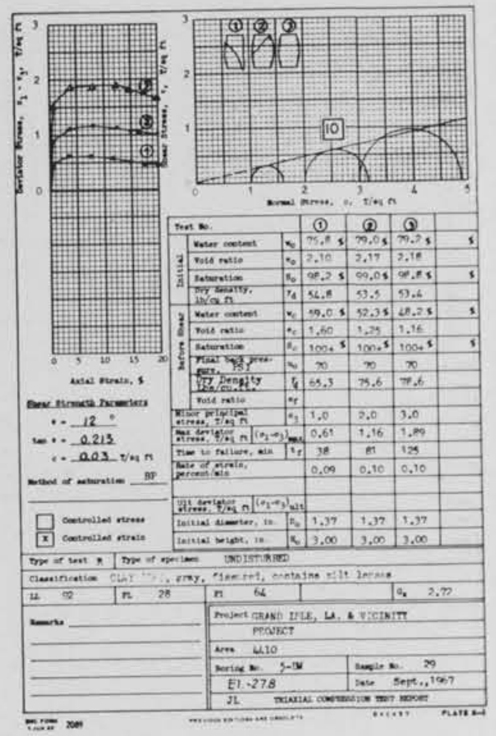
Test No.	1	2	3
Initial water content w_0, %	50.7	50.1	50.8
Initial void ratio e_0	1.42	1.37	1.35
Initial saturation S_0, %	97.5	99.5	98.8
Dry density γ_d, lb/cu ft	70.5	71.9	71.8
Minor principal stress σ_3, T/sq ft	0.50	1.50	3.00
Max deviator stress $(\sigma_1-\sigma_3)_{max}$, T/sq ft	0.96	1.06	1.12
Time to failure t_f, min	9	25	17
Rate of strain, percent/min	0.26	0.27	0.35
Initial diameter D_0, in.	1.41	1.41	1.41
Initial height H_0, in.	3.00	3.00	3.00

Shear Strength Parameters: φ = 2°; tan φ = 0.035; c = 0.48 T/sq ft
☐ Controlled stress
☑ Controlled strain
Type of test: Q. Type of specimen: UNDISTURBED
Classification: GRAY CLAY (CH), W/ SILT POCKETS
LL 84; PL 26; PI 58; G_s 2.72
Project: GRAND ISLE, LA & VIC
Boring No. 5-UW; El. -97.8; Sample No. 97; Date 8/26/67
TRIAXIAL COMPRESSION TEST REPORT



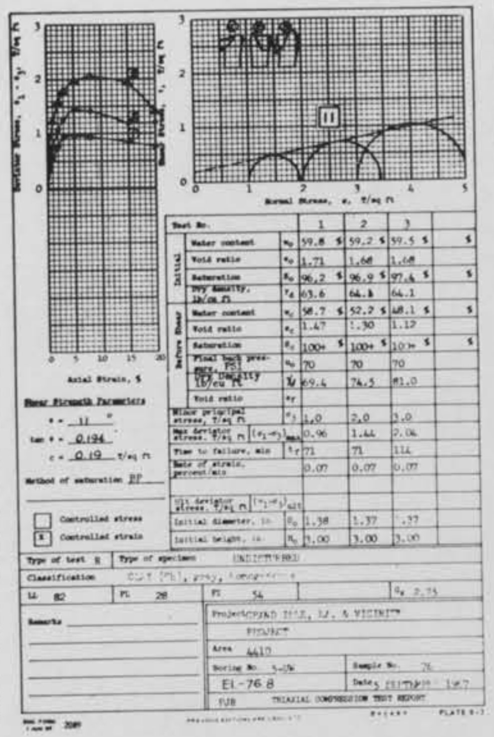
Test No.	①	②	③
Initial water content w_0, %	99.7	96.5	98.6
Initial void ratio e_0	2.66	2.56	2.60
Initial saturation S_0, %	99.7	100+	100+
Dry density γ_d, lb/cu ft	45.8	46.7	46.1
Before shear water content w_c, %	65.9	54.3	49.1
Before shear void ratio e_c	1.80	1.38	1.30
Before shear saturation S_c, %	97.4	100+	100+
Final back pressure, PSI	60	60	60
Dry Density lb/cu.ft.	59.3	69.9	72.3
Minor principal stress σ_3, T/sq ft	1.0	2.0	3.0
Max deviator stress $(\sigma_1-\sigma_3)_{max}$, T/sq ft	0.77	1.54	1.87
Time to failure t_f, min	115	49	115
Rate of strain, percent/min	0.08	0.08	0.08
Initial diameter D_0, in.	1.38	1.37	1.36
Initial height H_0, in.	3.00	3.00	3.00

Shear Strength Parameters: φ = 11°; tan φ = 0.194; c = 0.18 T/sq ft
Method of saturation: BP
☐ Controlled stress
☒ Controlled strain
Type of test: R. Type of specimen: UNDISTURBED
Classification: CLAY (CH), gray, fissured
LL 113; PL 32; PI 81; G_s 2.66
Remarks: * Pore pressure response indicated 100% saturation
Project: GRAND ISLE, LA. & VICINITY PROJECT
Area: 4410
Boring No. 5-UW; El -6.8; Sample No. 8; Date Sept., 1967
JL TRIAXIAL COMPRESSION TEST REPORT



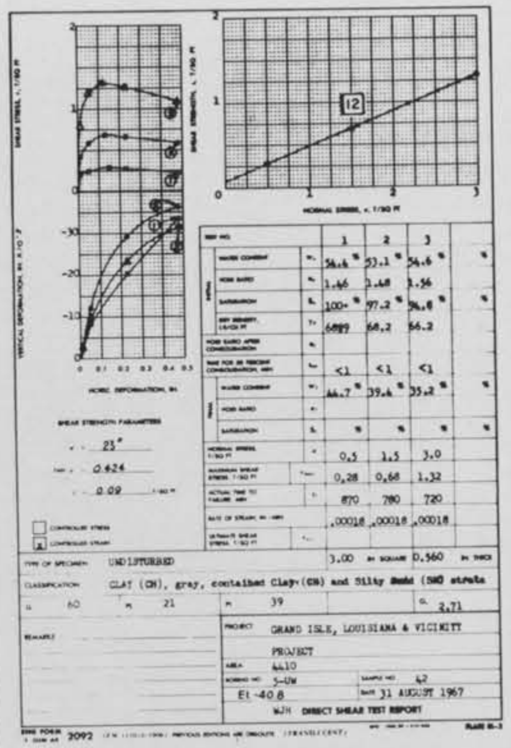
Test No.	①	②	③
Initial water content w_0, %	75.8	79.0	79.2
Initial void ratio e_0	2.10	2.17	2.18
Initial saturation S_0, %	98.2	99.0	98.8
Dry density γ_d, lb/cu ft	54.8	53.5	53.4
Before shear water content w_c, %	59.0	52.3	48.2
Before shear void ratio e_c	1.60	1.25	1.16
Before shear saturation S_c, %	100+	100+	100+
Final back pressure, PSI	70	70	70
Dry Density lbs/cu.ft.	65.3	75.6	78.6
Minor principal stress σ_3, T/sq ft	1.0	2.0	3.0
Max deviator stress $(\sigma_1-\sigma_3)_{max}$, T/sq ft	0.61	1.16	1.89
Time to failure t_f, min	38	81	125
Rate of strain, percent/min	0.09	0.10	0.10
Initial diameter D_0, in.	1.37	1.37	1.37
Initial height H_0, in.	3.00	3.00	3.00

Shear Strength Parameters: φ = 12°; tan φ = 0.215; c = 0.03 T/sq ft
Method of saturation: BP
☐ Controlled stress
☒ Controlled strain
Type of test: R. Type of specimen: UNDISTURBED
Classification: CLAY (CH), gray, fissured, contains silt lenses
LL 92; PL 28; PI 64; G_s 2.77
Project: GRAND ISLE, LA. & VICINITY PROJECT
Area: 4410
Boring No. 5-UW; El -27.8; Sample No. 29; Date Sept., 1967
JL TRIAXIAL COMPRESSION TEST REPORT



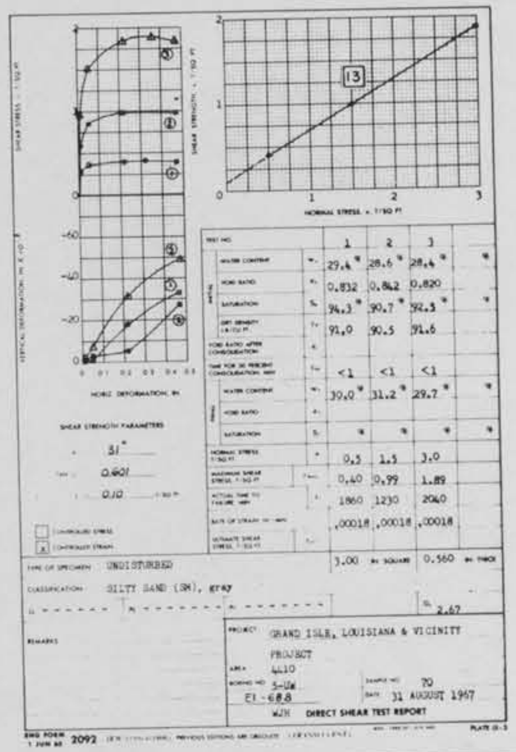
Test No.	1	2	3
Initial water content w_0, %	59.8	59.2	59.5
Initial void ratio e_0	1.71	1.68	1.68
Initial saturation S_0, %	96.2	96.9	97.4
Dry density γ_d, lb/cu ft	63.6	64.1	64.1
Before shear water content w_c, %	58.7	52.2	48.1
Before shear void ratio e_c	1.47	1.30	1.12
Before shear saturation S_c, %	100+	100+	100+
Final back pressure, PSI	70	70	70
Dry Density lb/cu ft	69.4	74.5	81.0
Minor principal stress σ_3, T/sq ft	1.0	2.0	3.0
Max deviator stress $(\sigma_1-\sigma_3)_{max}$, T/sq ft	0.96	1.44	2.06
Time to failure t_f, min	71	71	114
Rate of strain, percent/min	0.07	0.07	0.07
Initial diameter D_0, in.	1.38	1.37	1.37
Initial height H_0, in.	3.00	3.00	3.00

Shear Strength Parameters: φ = 11°; tan φ = 0.194; c = 0.19 T/sq ft
Method of saturation: BP
☐ Controlled stress
☒ Controlled strain
Type of test: R. Type of specimen: UNDISTURBED
Classification: CLAY (CH), gray, homogeneous
LL 82; PL 28; PI 54; G_s 2.73
Project: GRAND ISLE, LA. & VICINITY PROJECT
Area: 4410
Boring No. 5-UW; El -76.8; Sample No. 76; Date 5 SEPTEMBER 1967
FJB TRIAXIAL COMPRESSION TEST REPORT



Test No.	1	2	3
Initial water content, %	54.6	53.1	54.6
Initial void ratio	1.46	1.48	1.56
Initial saturation, %	100+	97.2	94.8
Dry density, lb/cu ft	68.9	68.2	66.2
Time for 50 percent consolidation, min	<1	<1	<1
Final water content, %	46.7	39.4	35.2
Normal stress, T/sq ft	0.5	1.5	3.0
Maximum shear stress, T/sq ft	0.28	0.68	1.32
Actual time to failure, min	870	780	720
Rate of strain, in./min	.00018	.00018	.00018

3.00 in. square; 0.560 in. thick
Shear Strength Parameters: φ = 23°; tan φ = 0.424; c = 0.09 T/sq ft
☐ Controlled stress
☒ Controlled strain
Type of specimen: UNDISTURBED
Classification: CLAY (CH), gray, contained Clay (CH) and Silty Sand (SM) strata
LL 60; PL 21; PI 39; G_s 2.71
Project: GRAND ISLE, LOUISIANA & VICINITY PROJECT
Area: 4410
Boring No. 5-UW; El -40.8; Sample No. 42; Date 31 AUGUST 1967
WJH DIRECT SHEAR TEST REPORT



Test No.	1	2	3
Initial water content, %	29.4	28.6	28.4
Initial void ratio	0.832	0.842	0.820
Initial saturation, %	94.3	90.7	92.5
Dry density, lb/cu ft	91.0	90.5	91.6
Time for 50 percent consolidation, min	<1	<1	<1
Final water content, %	30.0	31.2	29.7
Normal stress, T/sq ft	0.5	1.5	3.0
Maximum shear stress, T/sq ft	0.40	0.99	1.89
Actual time to failure, min	1860	1230	2040
Rate of strain, in./min	.00018	.00018	.00018

3.00 in. square; 0.560 in. thick
Shear Strength Parameters: φ = 31°; tan φ = 0.601; c = 0.10 T/sq ft
☐ Controlled stress
☒ Controlled strain
Type of specimen: UNDISTURBED
Classification: SILTY SAND (SM), gray
G_s 2.67
Project: GRAND ISLE, LOUISIANA & VICINITY PROJECT
Area: 4410
Boring No. 5-UW; El -68.8; Sample No. 70; Date 31 AUGUST 1967
WJH DIRECT SHEAR TEST REPORT

NOTE:
7 - Indicates reference number shown under shear data on Plate 48
(Q) - Unconsolidated - undrained triaxial compression test.
(R) - Consolidated - undrained triaxial compression test.
(S) - Consolidated - drained direct shear test.

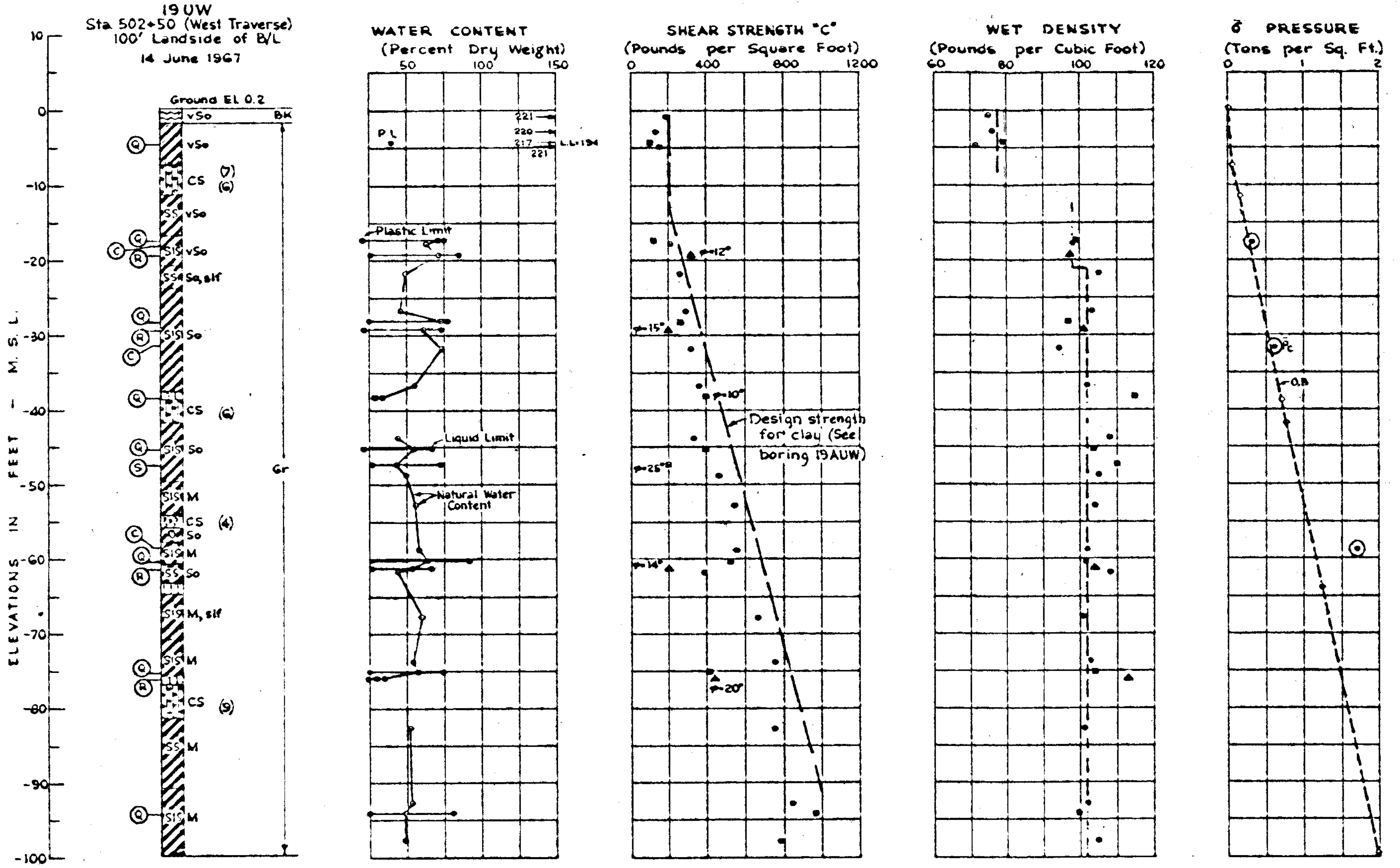
GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

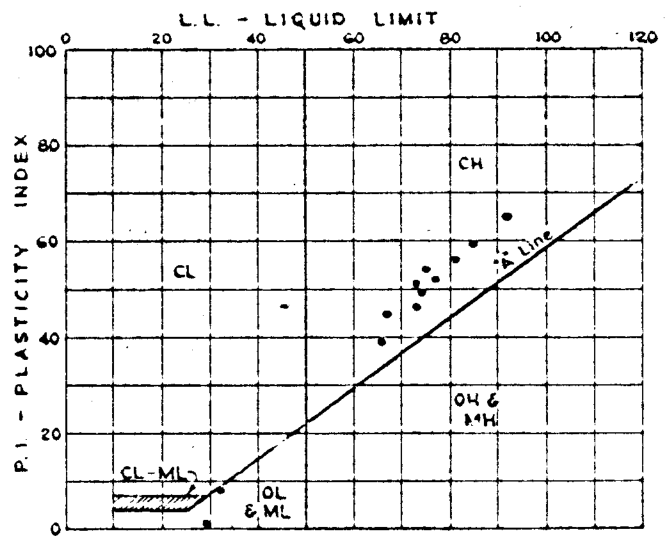
DETAIL SHEAR STRENGTH DATA BORING 5 UW

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

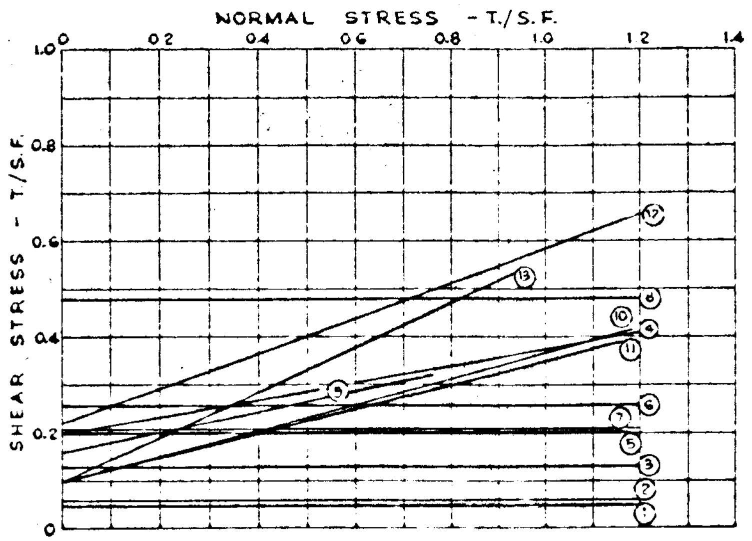
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

DATE: MARCH, 1972
FILE NO. H-2-24314



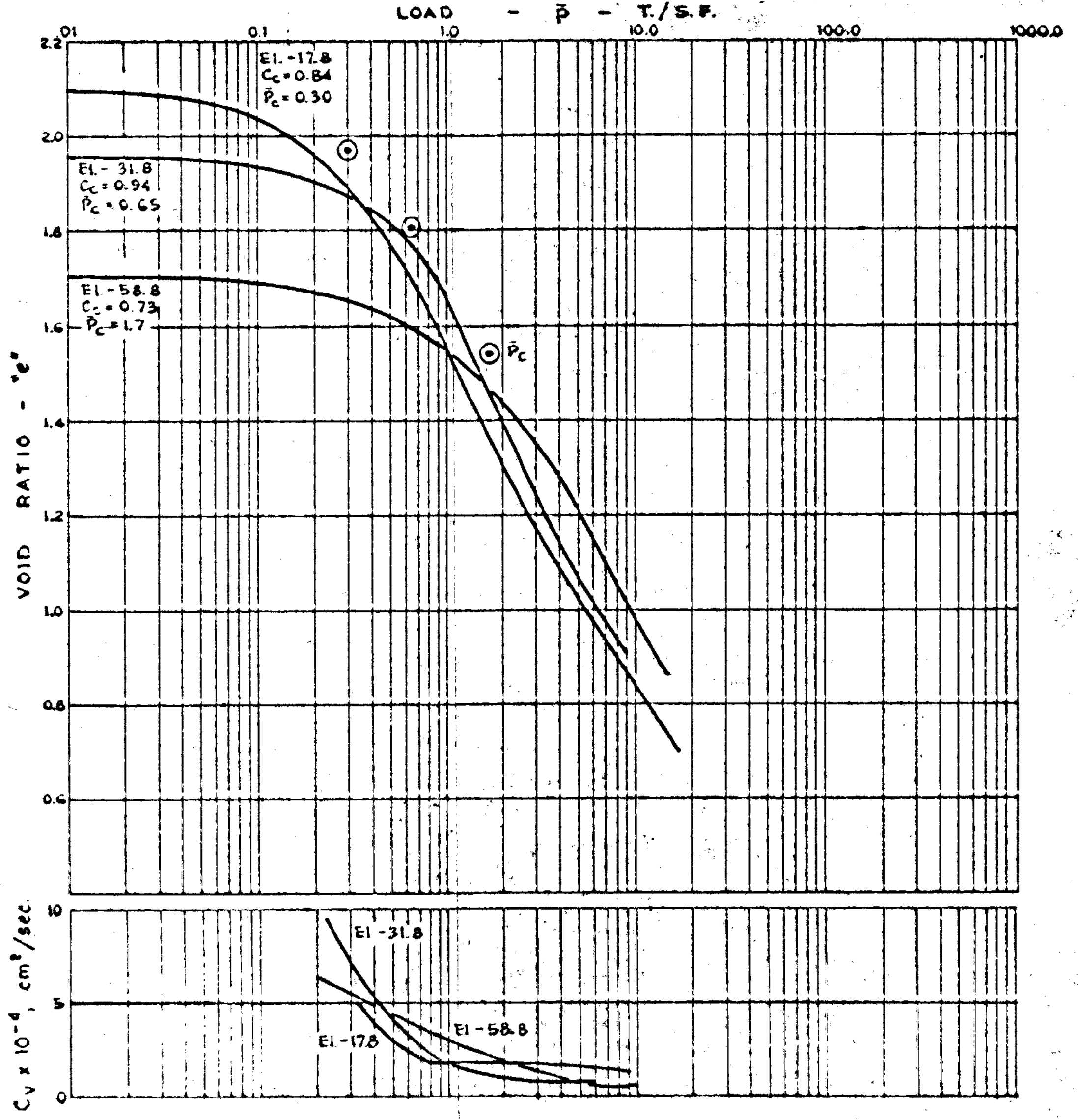


PLASTICITY CHART



SHEAR STRENGTH DATA

ENVELOPE		TYPE	STRENGTH		CLASS
NO	EL.		φ	c (t.s.f)	
1	-4 3	Q	0	0.05	CH
2	-17.3		0	0.06	CH
3	-28 3		0	0.13	CH
4	-38.3		10	0.20	ML
5	-45.3		0	0.20	CH
6	-60.3		0	0.26	CH
7	-75.3		0	0.21	CH
8	-94.3		0	0.48	CH
9	-19 3	R	12	0.16	CH
10	-29 3		15	0.10	CH
11	-61 3		14	0.10	CH
12	-76 3		20	0.22	ML
13	-47.3	S	25	0.10	CH



CONSOLIDATION DATA

For general notes see plate 46
For detail shear test data see plate 51
For location of boring see plate 19

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO.1 - GENERAL DESIGN

SOIL BORING 19UW DATA

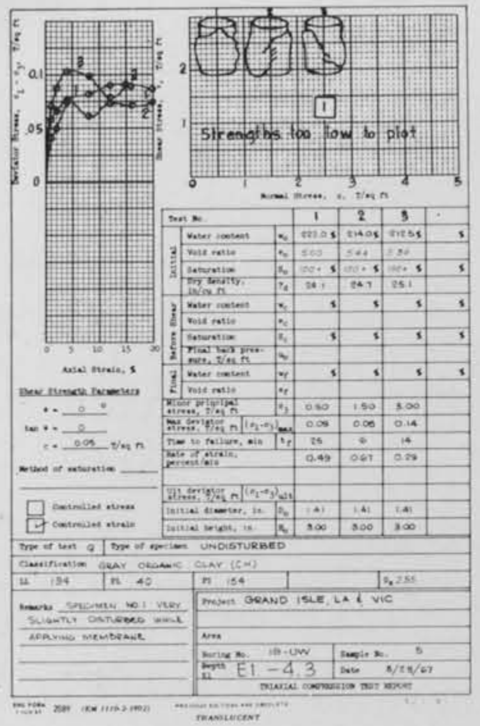
BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE · MARCH 1972

FILE NO. H-2-24314

PLATE 50



Test No.			1	2	3	
Initial	Water content	w_o	222.0 %	214.0 %	212.5 %	%
	Void ratio	e_o	5.00	5.44	5.30	
	Saturation	S_o	100+ %	100+ %	100+ %	%
	Dry density, lb/cu ft	γ_d	24.1	24.7	25.1	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_b				
Final	Water content	w_f	%	%	%	%
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	0.50	1.50	3.00	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.09	0.08	0.14	
Time to failure, min		t_f	26	9	14	
Rate of strain, percent/min			0.49	0.97	0.29	
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 ORGANIC CLAY (CH)

LL 194 | PL 40 | PI 154 | G_s 2.55

Remarks SPECIMEN NO. 1 VERY SLIGHTLY DISTURBED WHILE APPLYING MEMBRANE

Project GRAND ISLE, LA & VIC

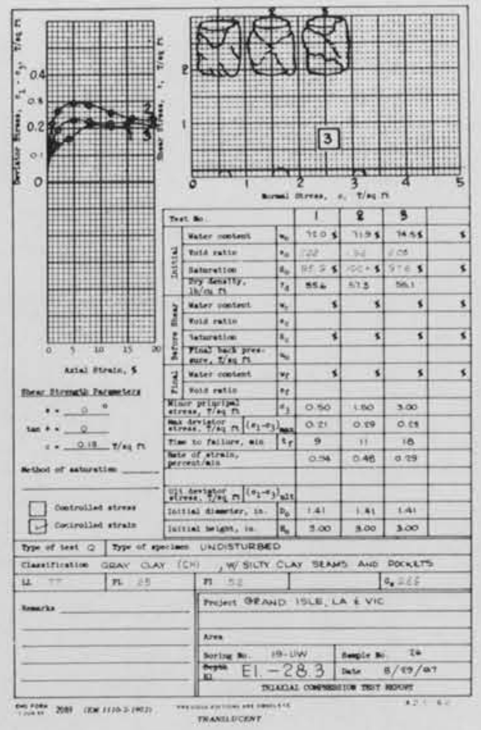
Area

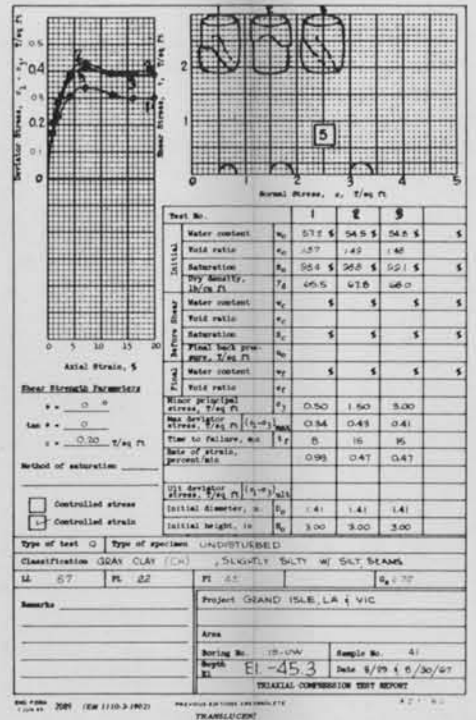
Boring No. 19-UW | Sample No. 5

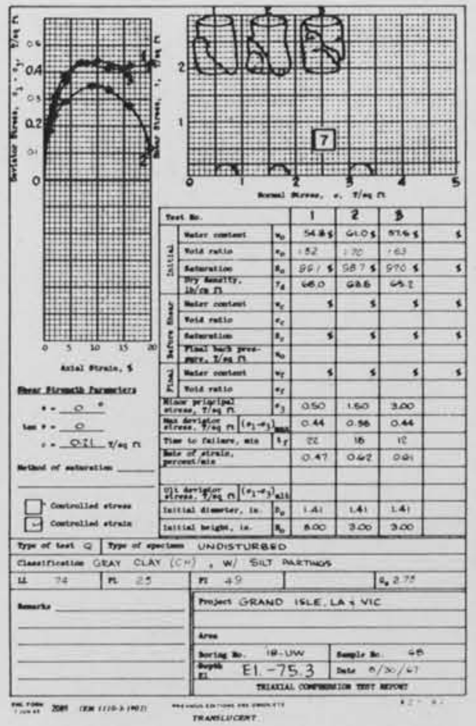
Depth El. El -4.3 | Date 8/28/67

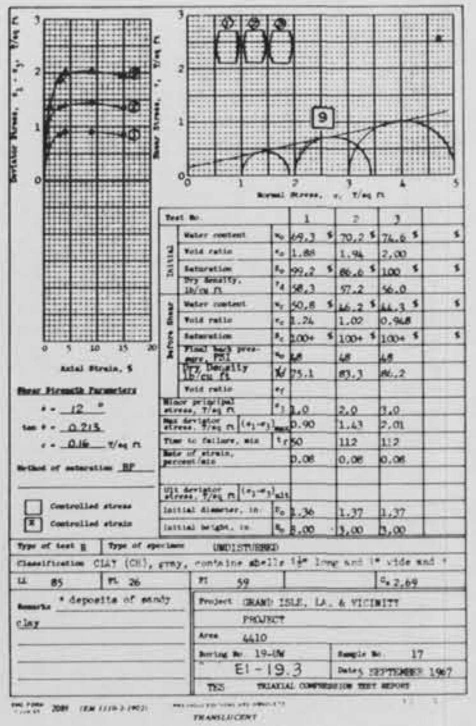
TRIAXIAL COMPRESSION TEST REPORT

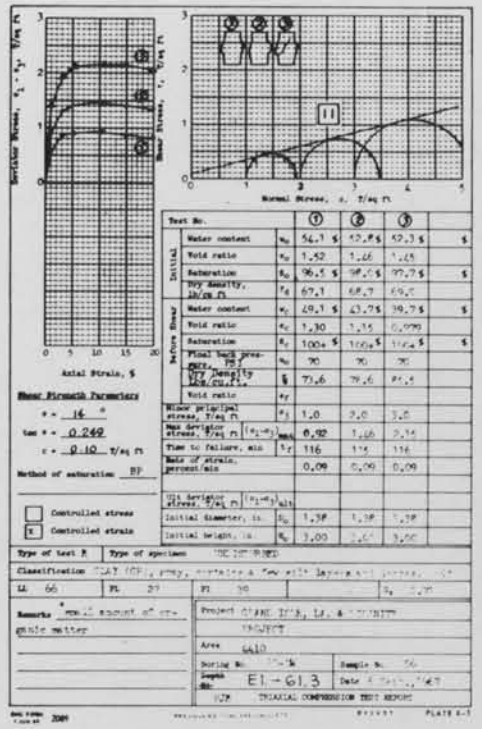
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT

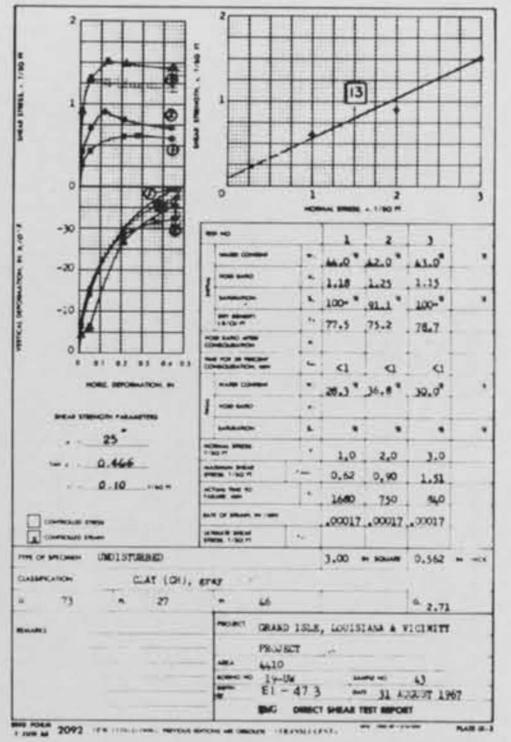


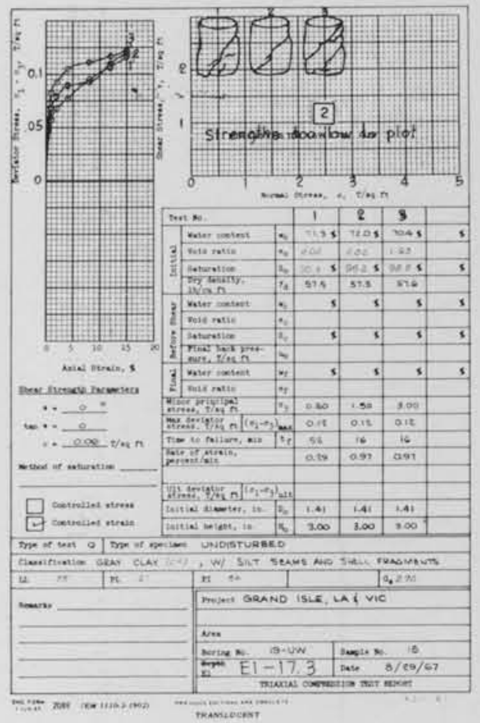


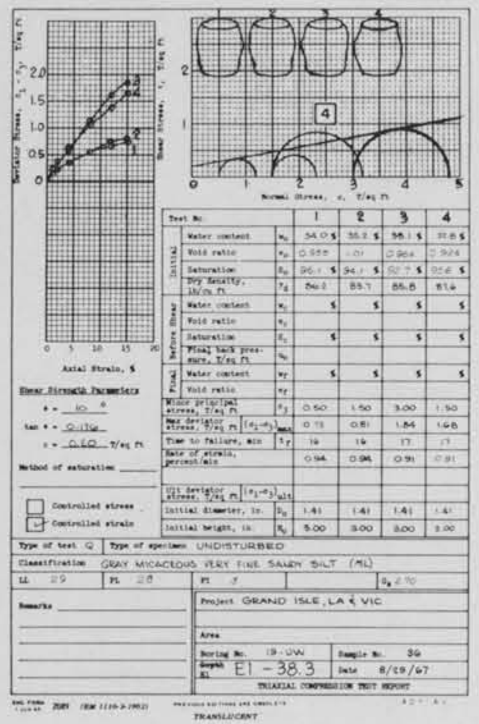


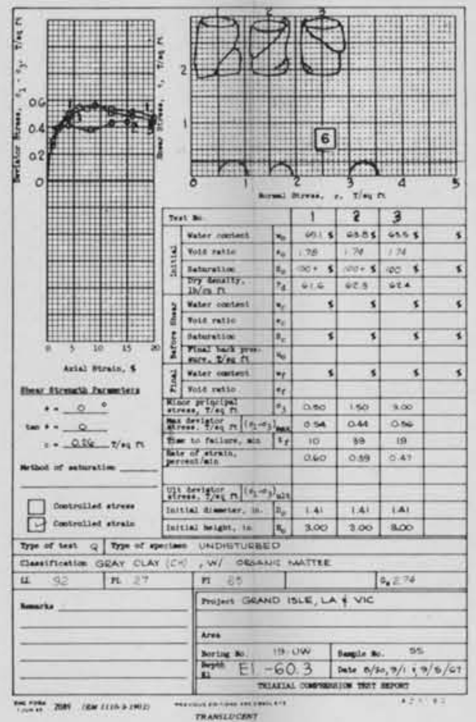


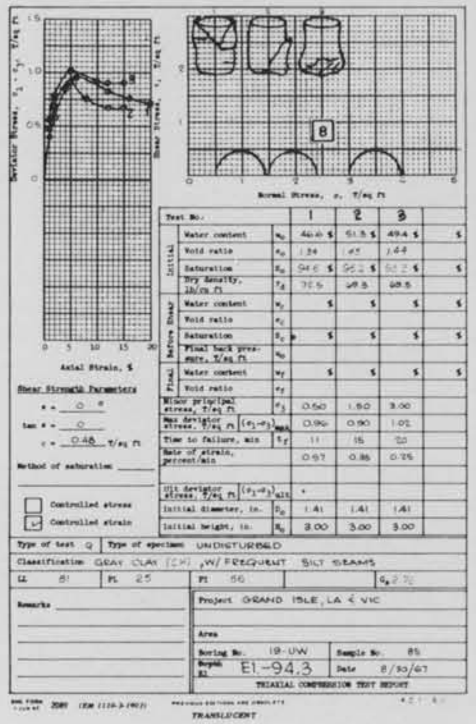


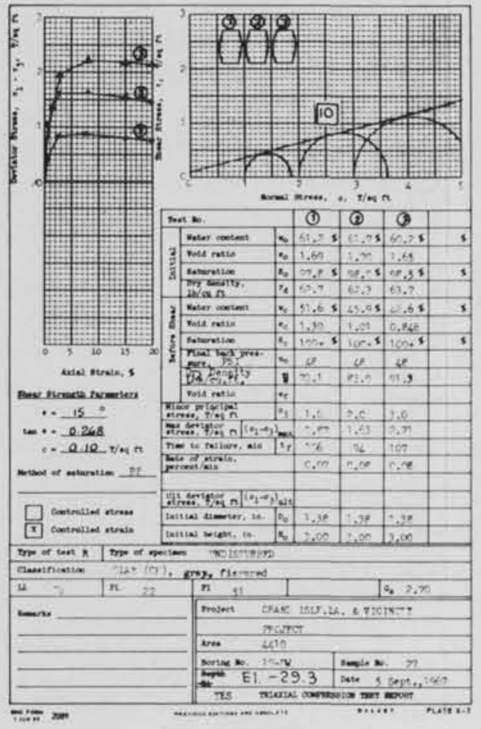


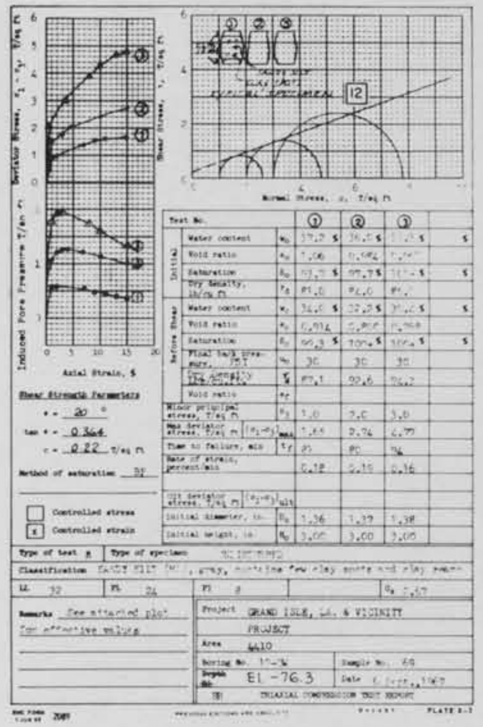












NOTE:

[7] Indicates reference number shown under shear data on Plate 50

(Q) - Unconsolidated - undrained triaxial compression test.

(R) - Consolidated - undrained triaxial compression test.

(S) - Consolidated - drained direct shear test.

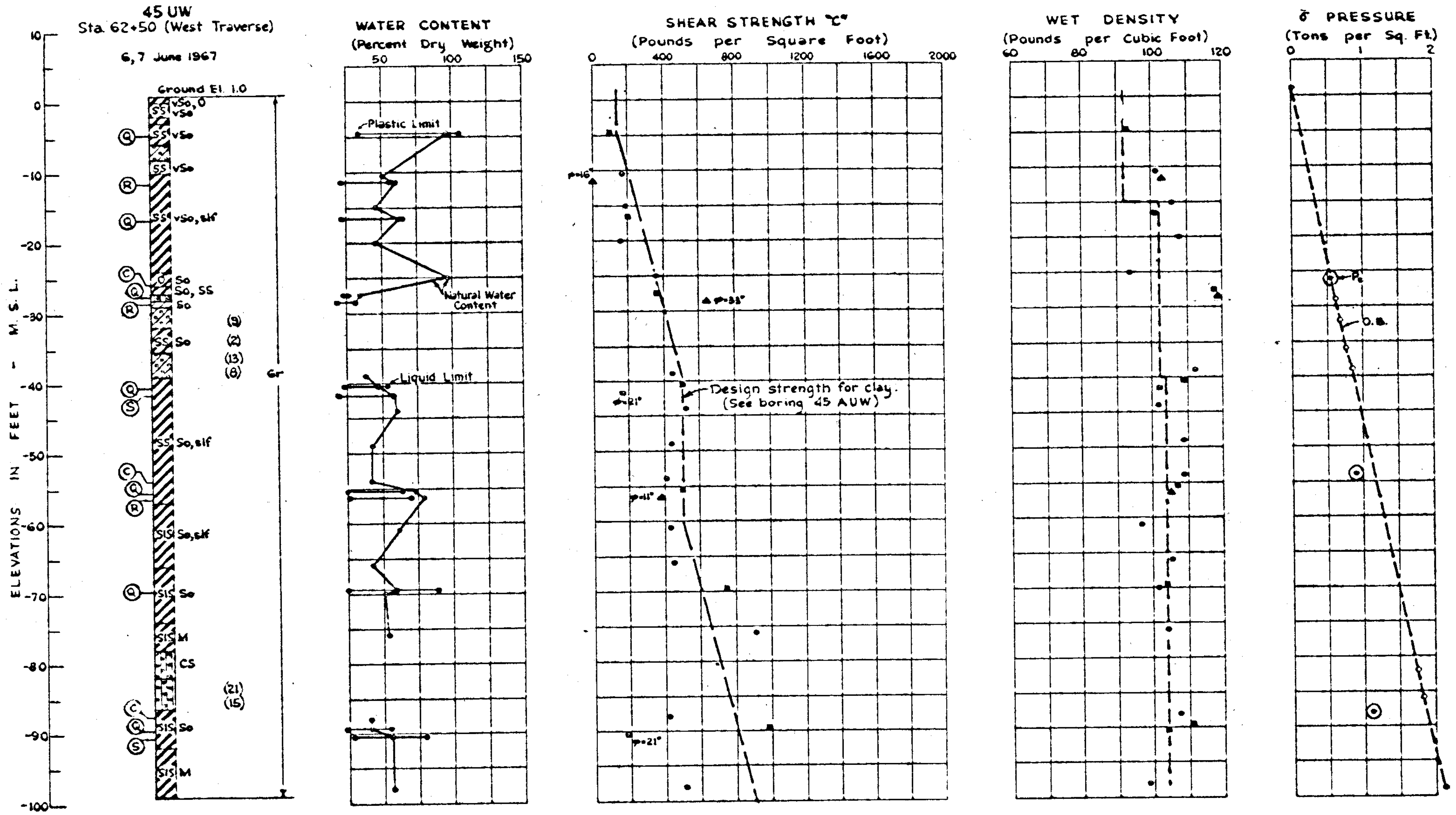
GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)

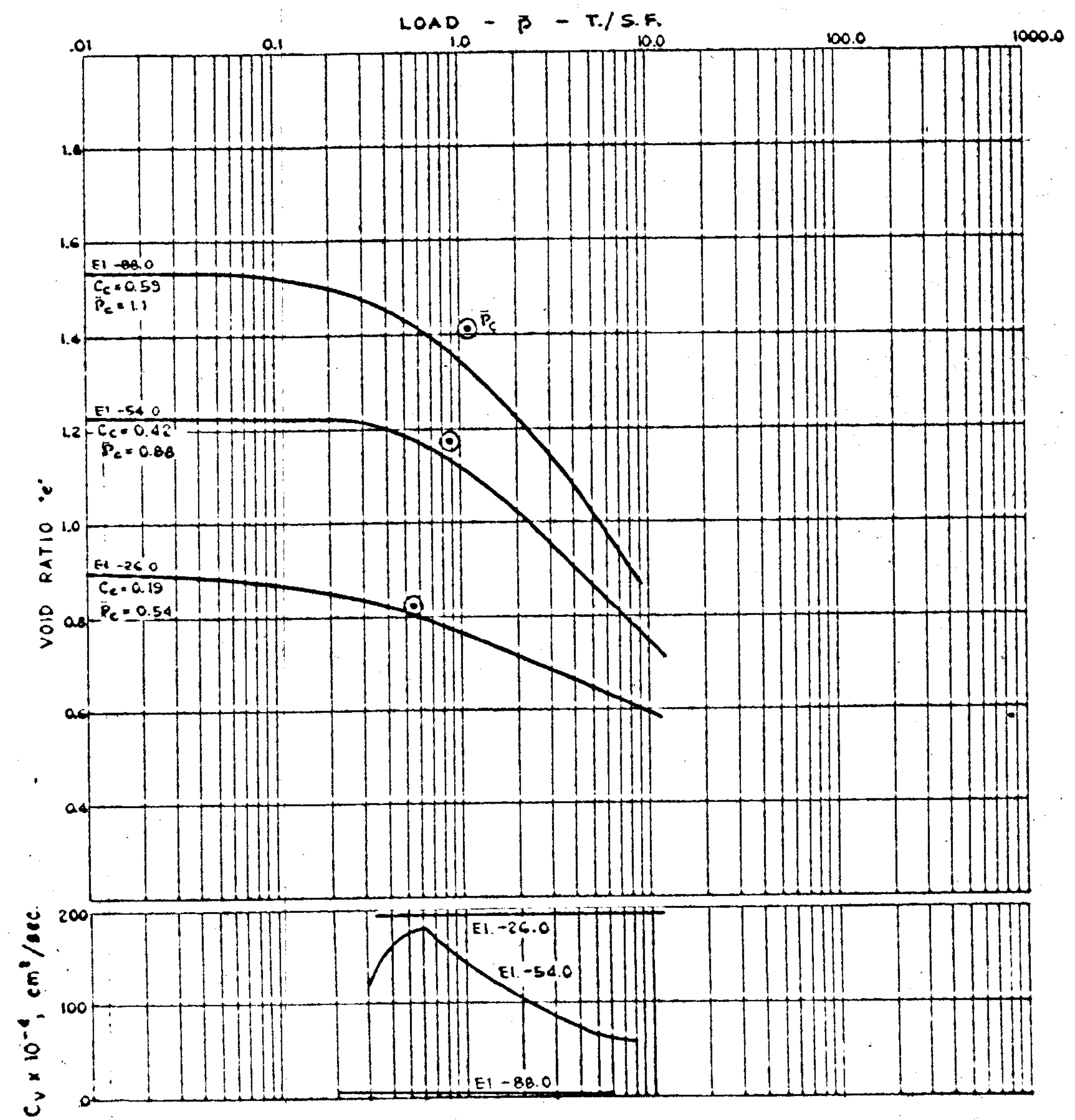
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

DETAIL SHEAR STRENGTH DATA
BORING 19 UW

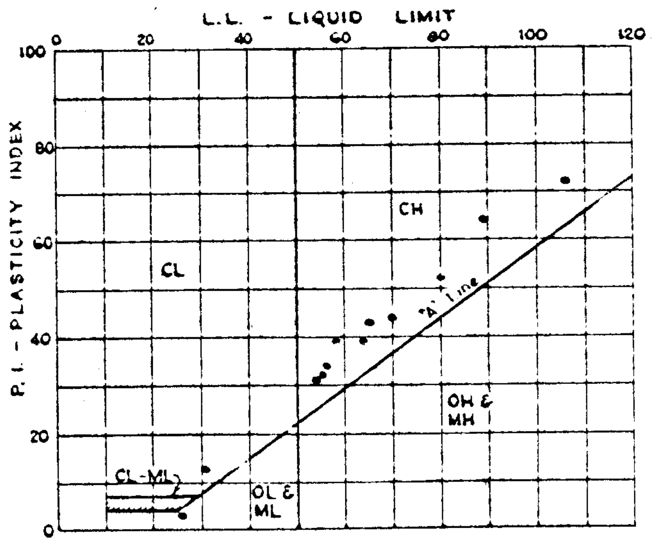
BARNARD AND BURK, INC. CONSULTING ENGINEERS BATON ROUGE, LA.	U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS
DATE: MARCH, 1972	FILE NO. H-2-24314

PLATE 51

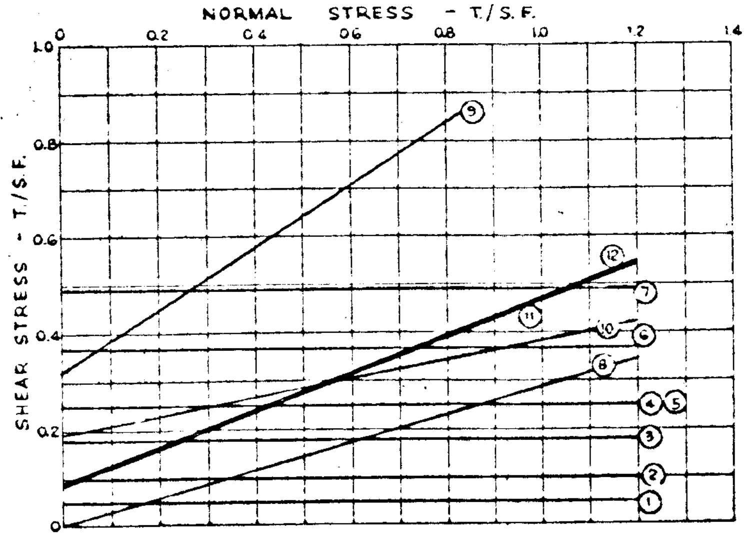




CONSOLIDATION DATA



PLASTICITY CHART



ENVELOPE		TYPE	STRENGTH		CLASS
NO	EL		φ	c (t s f)	
1	-4.5	Q	0	0.05	CH
2	-16.5		0	0.10	CH
3	-27.5		0	0.18	SM
4	-40.5		0	0.25	CH
5	-55.5		0	0.25	CH
6	-63.5		0	0.37	CH
7	-89.5		0	0.49	CH
8	-11.5	R	16	0.0	CH
9	-28.5		33	0.32	CL
10	-56.5		11	0.19	CH
11	-41.5	S	21	0.08	CH
12	-90.5		21	0.09	CH

SHEAR STRENGTH DATA

For general notes see plate 46
For detail shear test data see plate 53
For location of boring see plate 15

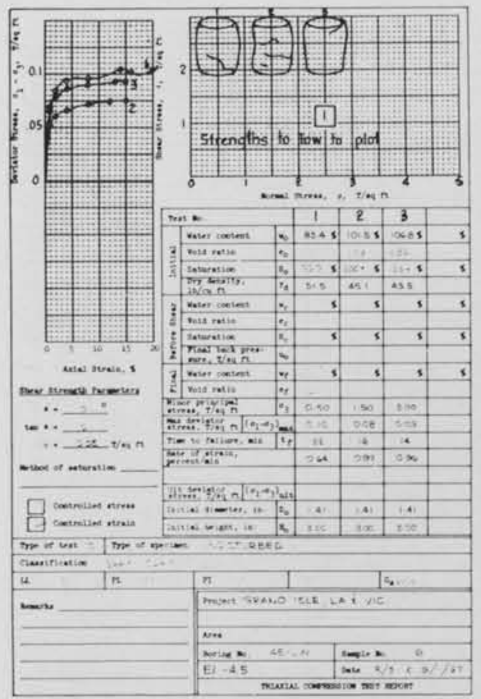
GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I - GENERAL DESIGN

SOIL BORING 45UW DATA

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

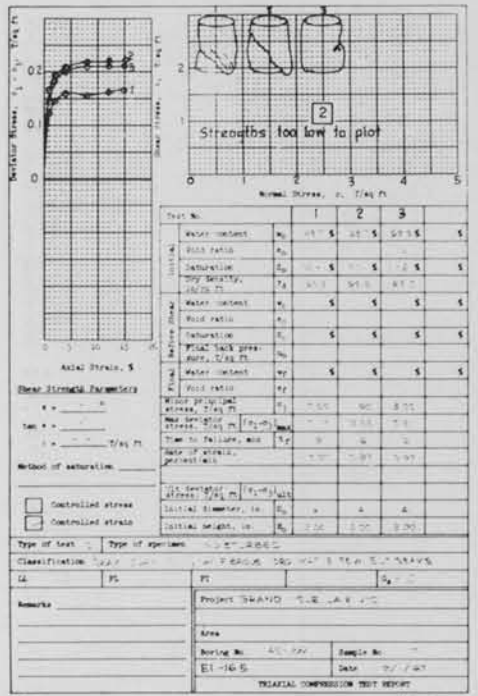
DATE: MARCH 1972
FILE NO. H-2-24314



Test No.		1	2	3	
Initial Water content	w_0	83.4 %	101.5 %	106.8 %	%
Void ratio	e_0	[illegible]	[illegible]	[illegible]	
Saturation	S_0	[illegible] %	100+ %	100+ %	%
Dry density, lb/cu ft	γ_d	51.5	45.1	43.5	
Before Shear Water content	w_c	%	%	%	%
Void ratio	e_c				
Saturation	S_c	%	%	%	%
Final back pressure, T/sq ft	u_0				
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	0.08	0.09	
Time to failure, min	t_f	11	16	14	
Rate of strain, percent/min		0.64	0.91	0.96	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_0	1.41	1.41	1.41	
Initial height, in.	H_0	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

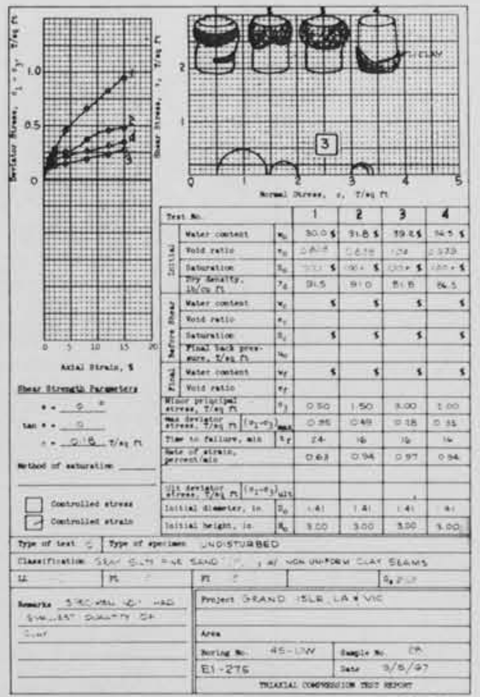
Type of test Q | Type of specimen UNDISTURBED
Classification GRAY CLAY
LL | PL | PI | G_s
Remarks
Project GRAND ISLE, LA & VIC
Area
Boring No. 45-UW | Sample No. 9
El -4.5 | Date 9/5 & 9/6/67
TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



Test No.		1	2	3	
Initial Water content	w_0	[illegible] %	[illegible] %	[illegible] %	%
Void ratio	e_0			[illegible]	
Saturation	S_0	[illegible] %	[illegible] %	[illegible] %	%
Dry density, lb/cu ft	γ_d	[illegible]	[illegible]	[illegible]	
Before Shear Water content	w_c	%	%	%	%
Void ratio	e_c				
Saturation	S_c	%	%	%	%
Final back pressure, T/sq ft	u_0				
Final Water content	w_f	%	%	%	%
Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	[illegible]	[illegible]	[illegible]	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	[illegible]	[illegible]	[illegible]	
Time to failure, min	t_f	[illegible]	[illegible]	[illegible]	
Rate of strain, percent/min		[illegible]	[illegible]	[illegible]	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_0	[illegible]	[illegible]	[illegible]	
Initial height, in.	H_0	[illegible]	[illegible]	[illegible]	

Shear Strength Parameters
φ = [illegible] °
tan φ = [illegible]
c = [illegible] T/sq ft
Method of saturation ______
☐ Controlled stress
☑ Controlled strain

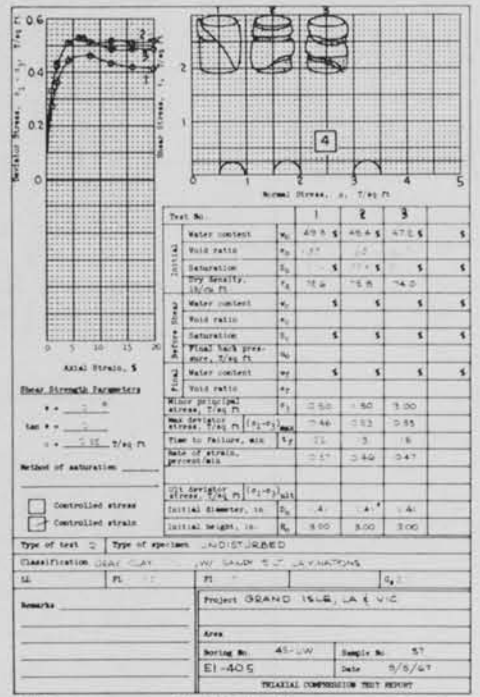
Type of test Q | Type of specimen UNDISTURBED
Classification [illegible], w/ PEAT [illegible] SILT SEAMS
LL | PL | PI | G_s
Remarks
Project GRAND ISLE, LA & VIC
Area
Boring No. 45-UW | Sample No. [illegible]
El -16.5 | Date 9/[illegible]/67
TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



Test No.		1	2	3	4
Initial Water content	w_0	30.0 %	31.8 %	39.6 %	34.5 %
Void ratio	e_0	[illegible]	0.838	1.04	0.973
Saturation	S_0	[illegible] %	100+ %	100+ %	100+ %
Dry density, lb/cu ft	γ_d	91.5	91.0	81.8	86.5
Before Shear Water content	w_c	%	%	%	%
Void ratio	e_c				
Saturation	S_c	%	%	%	%
Final back pressure, T/sq ft	u_0				
Final Water content	w_f	%	%	%	%
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	$(\sigma_1-\sigma_3)_{max}$	0.85	0.49	0.18	0.31
Time to failure, min	t_f	24	16	16	16
Rate of strain, percent/min		0.63	0.94	0.97	0.94
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_0	1.41	1.41	1.41	1.41
Initial height, in.	H_0	3.00	3.00	3.00	3.00

Shear Strength Parameters
φ = 0 °
tan φ = 0
c = 0.16 T/sq ft
Method of saturation ______
☐ Controlled stress
☑ Controlled strain

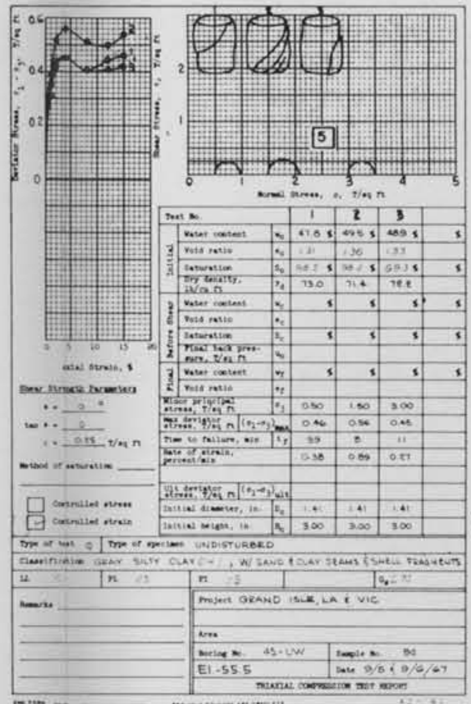
Type of test Q | Type of specimen UNDISTURBED
Classification GRAY SILTY FINE SAND (..), w/ NON-UNIFORM CLAY SEAMS
LL | PL | PI | G_s 2.[illegible]
Remarks SPECIMEN (4) HAD SMALLEST QUANTITY OF CLAY
Project GRAND ISLE, LA & VIC
Area
Boring No. 45-UW | Sample No. 28
El -27.6 | Date 9/5/67
TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



Test No.		1	2	3	
Initial Water content	w_0	49.5 %	45.6 %	47.2 %	%
Void ratio	e_0	[illegible]	[illegible]		
Saturation	S_0	[illegible] %	[illegible] %	[illegible] %	%
Dry density, lb/cu ft	γ_d	72.6	75.8	74.0	
Before Shear Water content	w_c	%	%	%	%
Void ratio	e_c				
Saturation	S_c	%	%	%	%
Final back pressure, T/sq ft	u_0				
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	$(\sigma_1-\sigma_3)_{max}$	0.46	0.52	0.55	
Time to failure, min	t_f	11	13	16	
Rate of strain, percent/min		0.57	0.49	0.47	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_0	1.41	1.41	1.41	
Initial height, in.	H_0	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

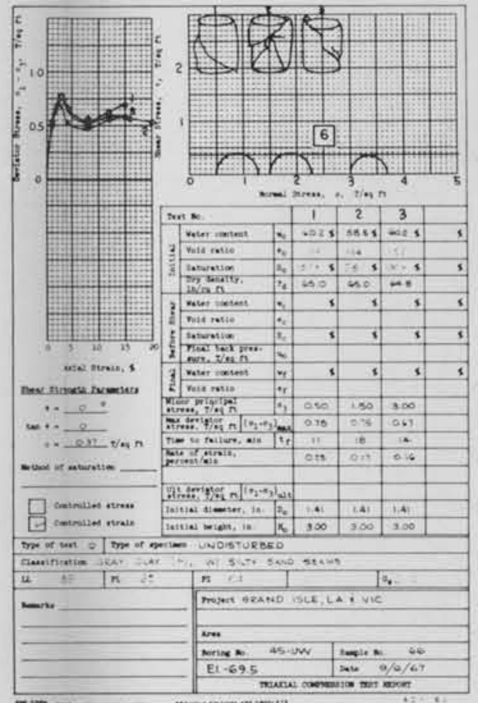
Type of test Q | Type of specimen UNDISTURBED
Classification GRAY CLAY (..), W/ SANDY SILT LAMINATIONS
LL | PL [illegible] | PI [illegible] | G_s [illegible]
Remarks
Project GRAND ISLE, LA & VIC
Area
Boring No. 45-UW | Sample No. 57
El -40.5 | Date 9/6/67
TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



Test No.		1	2	3	
Initial Water content	w_0	47.6 %	49.5 %	48.9 %	%
Void ratio	e_0	1.31	1.36	1.33	
Saturation	S_0	98.7 %	98.[illegible] %	99.3 %	%
Dry density, lb/cu ft	γ_d	73.0	71.4	78.8	
Before Shear Water content	w_c	%	%	%	%
Void ratio	e_c				
Saturation	S_c	%	%	%	%
Final back pressure, T/sq ft	u_0				
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	$(\sigma_1-\sigma_3)_{max}$	0.46	0.56	0.45	
Time to failure, min	t_f	59	8	11	
Rate of strain, percent/min		0.38	0.89	0.27	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_0	1.41	1.41	1.41	
Initial height, in.	H_0	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

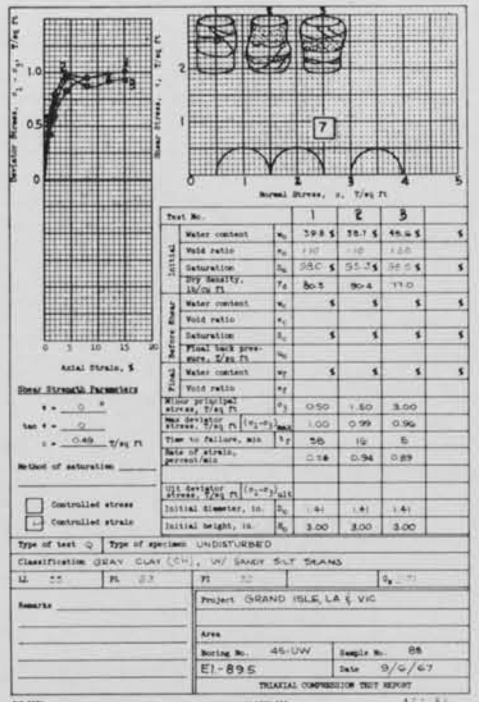
Type of test Q | Type of specimen UNDISTURBED
Classification GRAY SILTY CLAY (CH), W/ SAND & CLAY SEAMS & SHELL FRAGMENTS
LL [illegible] | PL 23 | PI 25 | G_s 2.72
Remarks
Project GRAND ISLE, LA & VIC
Area
Boring No. 45-UW | Sample No. 56
El -55.5 | Date 9/5 & 9/6/67
TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



Test No.		1	2	3	
Initial Water content	w_0	40.2 %	58.5 %	60.2 %	%
Void ratio	e_0	[illegible]	1.64	[illegible]	
Saturation	S_0	[illegible] %	[illegible] %	[illegible] %	%
Dry density, lb/cu ft	γ_d	65.0	65.0	64.8	
Before Shear Water content	w_c	%	%	%	%
Void ratio	e_c				
Saturation	S_c	%	%	%	%
Final back pressure, T/sq ft	u_0				
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	$(\sigma_1-\sigma_3)_{max}$	0.78	0.75	0.67	
Time to failure, min	t_f	11	18	14	
Rate of strain, percent/min		0.15	0.17	0.16	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_0	1.41	1.41	1.41	
Initial height, in.	H_0	3.00	3.00	3.00	

Shear Strength Parameters
φ = 0 °
tan φ = 0
c = 0.37 T/sq ft
Method of saturation ______
☐ Controlled stress
☑ Controlled strain

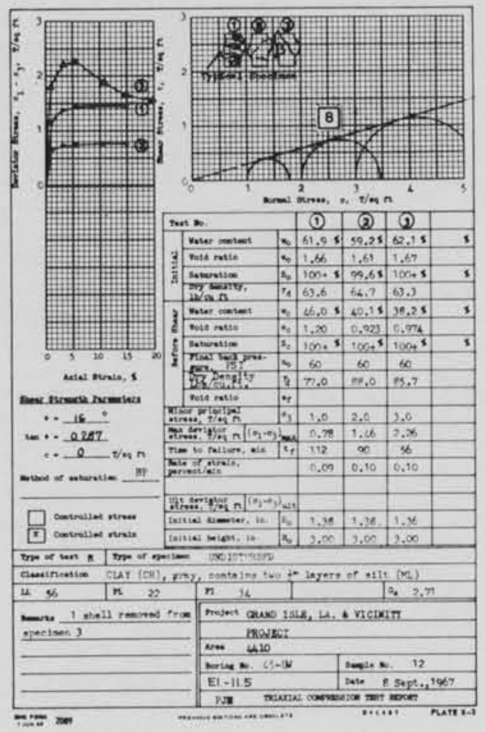
Type of test Q | Type of specimen UNDISTURBED
Classification GRAY CLAY (CH), W/ SILTY SAND SEAMS
LL [illegible] | PL 2[illegible] | PI [illegible] | G_s [illegible]
Remarks
Project GRAND ISLE, LA & VIC
Area
Boring No. 45-UW | Sample No. 66
El -69.5 | Date 9/6/67
TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



Test No.		1	2	3	
Initial Water content	w_0	39.8 %	38.7 %	45.6 %	%
Void ratio	e_0	1.10	1.18	1.28	
Saturation	S_0	98.0 %	95.3 %	98.5 %	%
Dry density, lb/cu ft	γ_d	80.5	80.4	77.0	
Before Shear Water content	w_c	%	%	%	%
Void ratio	e_c				
Saturation	S_c	%	%	%	%
Final back pressure, T/sq ft	u_0				
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	$(\sigma_1-\sigma_3)_{max}$	1.00	0.99	0.96	
Time to failure, min	t_f	58	16	5	
Rate of strain, percent/min		0.18	0.94	0.89	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_0	1.41	1.41	1.41	
Initial height, in.	H_0	3.00	3.00	3.00	

Shear Strength Parameters
φ = 0 °
tan φ = 0
c = 0.49 T/sq ft
Method of saturation ______
☐ Controlled stress
☑ Controlled strain

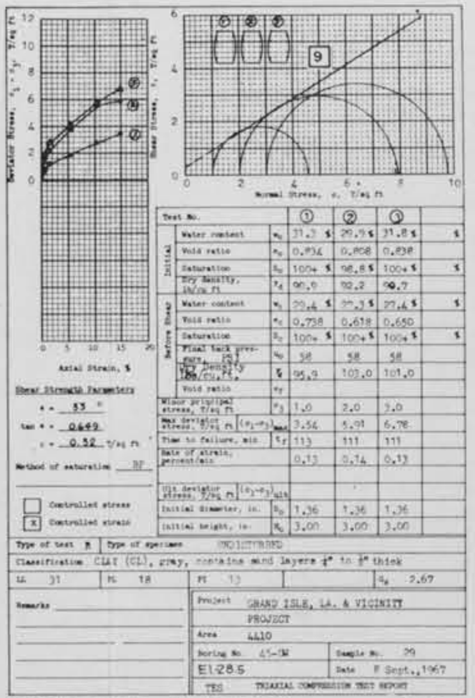
Type of test Q | Type of specimen UNDISTURBED
Classification GRAY CLAY (CH), W/ SANDY SILT SEAMS
LL 55 | PL 23 | PI 32 | G_s 2.71
Remarks
Project GRAND ISLE, LA & VIC
Area
Boring No. 45-UW | Sample No. 88
El -89.5 | Date 9/6/67
TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



Test No.		①	②	③	
Initial Water content	w_0	61.9 %	59.2 %	62.1 %	%
Void ratio	e_0	1.66	1.61	1.67	
Saturation	S_0	100+ %	99.6 %	100+ %	%
Dry density, lb/cu ft	γ_d	63.6	64.7	63.3	
Before Shear Water content	w_c	46.0 %	40.1 %	38.2 %	%
Void ratio	e_c	1.20	0.923	0.974	
Saturation	S_c	100+ %	100+ %	100+ %	%
Final back pressure, PSI	u_0	60	60	60	
Dry Density lbs/cu.ft.	γ_d	77.0	88.0	85.7	
Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	1.0	2.0	3.0	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.78	1.46	2.26	
Time to failure, min	t_f	112	90	56	
Rate of strain, percent/min		0.09	0.10	0.10	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_0	1.38	1.38	1.36	
Initial height, in.	H_0	3.00	3.00	3.00	

Shear Strength Parameters
φ = 16 °
tan φ = 0.287
c = 0 T/sq ft
Method of saturation BP
☐ Controlled stress
☒ Controlled strain

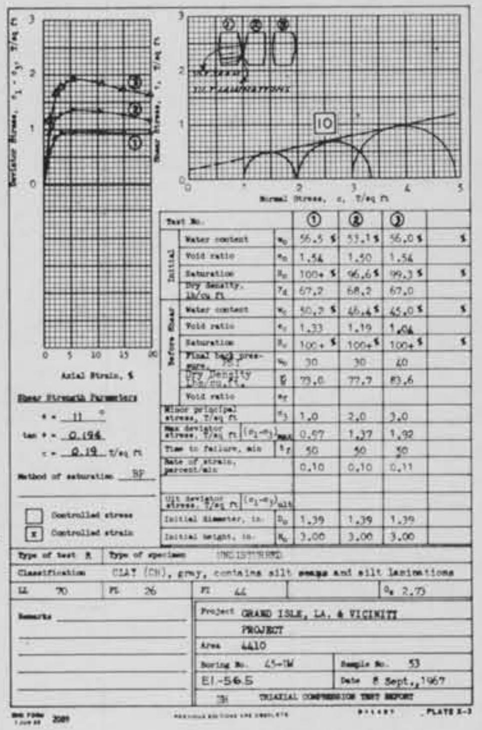
Type of test R | Type of specimen UNDISTURBED
Classification CLAY (CH), gray, contains two ½" layers of silt (ML)
LL 56 | PL 22 | PI 34 | G_s 2.71
Remarks 1 shell removed from specimen 3
Project GRAND ISLE, LA. & VICINITY PROJECT
Area 4410
Boring No. 45-UW | Sample No. 12
El -11.5 | Date 8 Sept., 1967
PJH TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 PREVIOUS EDITIONS ARE OBSOLETE PLATE X-3



Test No.		①	②	③	
Initial Water content	w_0	31.3 %	29.9 %	31.8 %	%
Void ratio	e_0	0.834	0.808	0.838	
Saturation	S_0	100+ %	98.8 %	100+ %	%
Dry density, lb/cu ft	γ_d	90.0	92.2	90.7	
Before Shear Water content	w_c	29.4 %	27.3 %	27.4 %	%
Void ratio	e_c	0.738	0.618	0.650	
Saturation	S_c	100+ %	100+ %	100+ %	%
Final back pressure, PSI	u_0	58	58	58	
Dry Density lbs/cu.ft.	γ_d	95.9	103.0	101.0	
Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	1.0	2.0	3.0	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	3.56	5.91	6.78	
Time to failure, min	t_f	113	111	111	
Rate of strain, percent/min		0.13	0.14	0.13	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_0	1.36	1.36	1.36	
Initial height, in.	H_0	3.00	3.00	3.00	

Shear Strength Parameters
φ = 33 °
tan φ = 0.649
c = 0.52 T/sq ft
Method of saturation BP
☐ Controlled stress
☒ Controlled strain

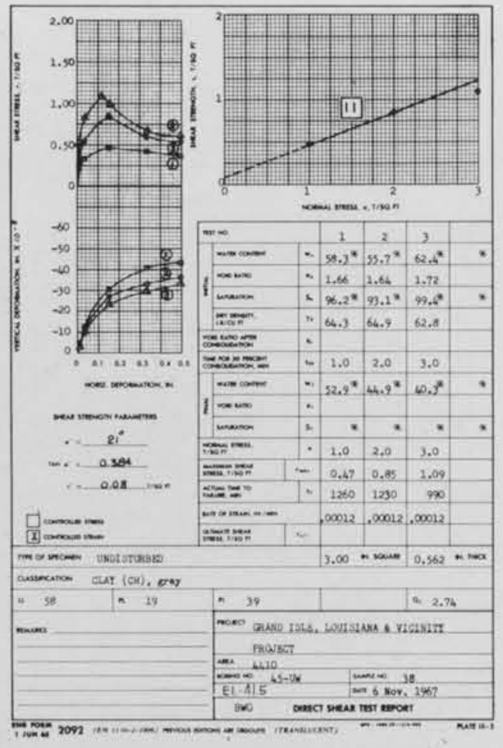
Type of test R | Type of specimen UNDISTURBED
Classification CLAY (CL), gray, contains sand layers ¼" to ½" thick
LL 31 | PL 18 | PI 13 | G_s 2.67
Remarks
Project GRAND ISLE, LA. & VICINITY PROJECT
Area 4410
Boring No. 45-UW | Sample No. 29
El -28.5 | Date 8 Sept., 1967
TES TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



Test No.		①	②	③	
Initial Water content	w_0	56.5 %	53.1 %	56.0 %	%
Void ratio	e_0	1.54	1.50	1.54	
Saturation	S_0	100+ %	96.6 %	99.3 %	%
Dry density, lb/cu ft	γ_d	67.2	68.2	67.0	
Before Shear Water content	w_c	50.2 %	46.4 %	45.0 %	%
Void ratio	e_c	1.33	1.19	1.04	
Saturation	S_c	100+ %	100+ %	100+ %	%
Final back pressure, PSI	u_0	30	30	40	
Dry Density lbs/cu.ft.	γ_d	73.0	77.7	83.6	
Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	1.0	2.0	3.0	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.97	1.37	1.92	
Time to failure, min	t_f	50	50	50	
Rate of strain, percent/min		0.10	0.10	0.11	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_0	1.39	1.39	1.39	
Initial height, in.	H_0	3.00	3.00	3.00	

Shear Strength Parameters
φ = 11 °
tan φ = 0.194
c = 0.19 T/sq ft
Method of saturation BP
☐ Controlled stress
☒ Controlled strain

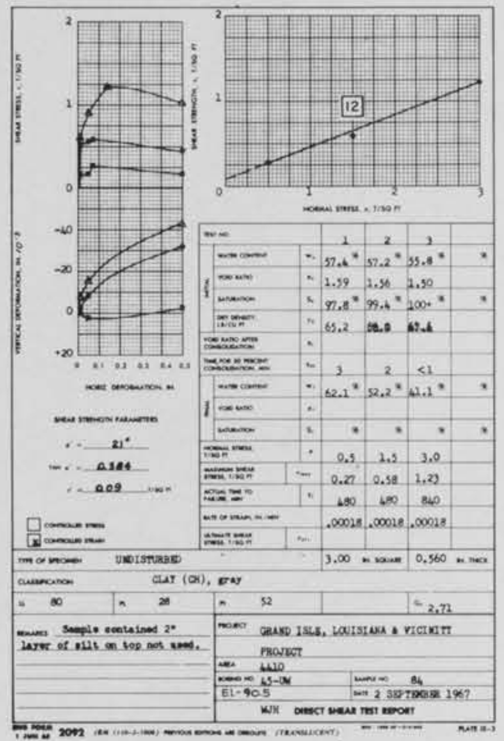
Type of test R | Type of specimen UNDISTURBED
Classification CLAY (CH), gray, contains silt seams and silt laminations
LL 70 | PL 26 | PI 44 | G_s 2.73
Remarks
Project GRAND ISLE, LA. & VICINITY PROJECT
Area 4410
Boring No. 45-UW | Sample No. 53
El -56.5 | Date 8 Sept., 1967
JH TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 PREVIOUS EDITIONS ARE OBSOLETE PLATE X-3



TEST NO.		1	2	3	
INITIAL WATER CONTENT	w_0	58.3 %	55.7 %	62.4 %	%
VOID RATIO	e_0	1.66	1.64	1.72	
SATURATION	S_0	96.2 %	93.1 %	99.4 %	%
DRY DENSITY, LB/CU FT	γ_d	64.3	64.9	62.8	
VOID RATIO AFTER CONSOLIDATION	e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN	t_{50}	1.0	2.0	3.0	
FINAL WATER CONTENT	w_f	52.9 %	44.9 %	60.3 %	%
VOID RATIO	e_f				
SATURATION	S_f	%	%	%	%
NORMAL STRESS, T/SQ FT	σ	1.0	2.0	3.0	
MAXIMUM SHEAR STRESS, T/SQ FT	τ_{max}	0.47	0.85	1.09	
ACTUAL TIME TO FAILURE, MIN	t_f	1260	1230	990	
RATE OF STRAIN, IN./MIN		.00012	.00012	.00012	
ULTIMATE SHEAR STRESS, T/SQ FT	τ_{ult}				

SHEAR STRENGTH PARAMETERS
φ = 21°
TAN φ = 0.384
c = 0.08 T/SQ FT
☐ CONTROLLED STRESS
☒ CONTROLLED STRAIN

TYPE OF SPECIMEN UNDISTURBED | 3.00 IN. SQUARE | 0.562 IN. THICK
CLASSIFICATION CLAY (CH), gray
LL 58 | PL 19 | PI 39 | G_s 2.74
REMARKS
PROJECT GRAND ISLE, LOUISIANA & VICINITY PROJECT
AREA 4410
BORING NO. 45-UW | SAMPLE NO. 38
El -41.5 | DATE 6 Nov. 1967
BWG DIRECT SHEAR TEST REPORT
ENG FORM 2092 1 JUN 60 (EM 1110-2-1906) PREVIOUS EDITIONS ARE OBSOLETE (TRANSLUCENT) PLATE IX-3



TEST NO.		1	2	3	
INITIAL WATER CONTENT	w_0	57.4 %	57.2 %	55.8 %	%
VOID RATIO	e_0	1.59	1.56	1.50	
SATURATION	S_0	97.8 %	99.4 %	100+ %	%
DRY DENSITY, LB/CU FT	γ_d	65.2	68.8	67.4	
VOID RATIO AFTER CONSOLIDATION	e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN	t_{50}	3	2	<1	
FINAL WATER CONTENT	w_f	62.1 %	52.2 %	41.1 %	%
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	0.58	1.23	
ACTUAL TIME TO FAILURE, MIN	t_f	480	480	840	
RATE OF STRAIN, IN./MIN		.00018	.00018	.00018	
ULTIMATE SHEAR STRESS, T/SQ FT	τ_{ult}				

SHEAR STRENGTH PARAMETERS
φ = 21°
TAN φ = 0.384
c = 0.09 T/SQ FT
☐ CONTROLLED STRESS
☒ CONTROLLED STRAIN

TYPE OF SPECIMEN UNDISTURBED | 3.00 IN. SQUARE | 0.560 IN. THICK
CLASSIFICATION CLAY (CH), gray
LL 80 | PL 28 | PI 52 | G_s 2.71
REMARKS Sample contained 2" layer of silt on top not used.
PROJECT GRAND ISLE, LOUISIANA & VICINITY PROJECT
AREA 4410
BORING NO. 45-UW | SAMPLE NO. 84
El -90.5 | DATE 2 SEPTEMBER 1967
MJK DIRECT SHEAR TEST REPORT
ENG FORM 2092 1 JUN 60 (EM 1110-2-1906) PREVIOUS EDITIONS ARE OBSOLETE (TRANSLUCENT) PLATE IX-3

NOTE:
7 Indicates reference number shown under shear data on Plate 52
(Q) - Unconsolidated - undrained triaxial compression test.
(R) - Consolidated - undrained triaxial compression test.
(S) - Consolidated - drained direct shear test.

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)

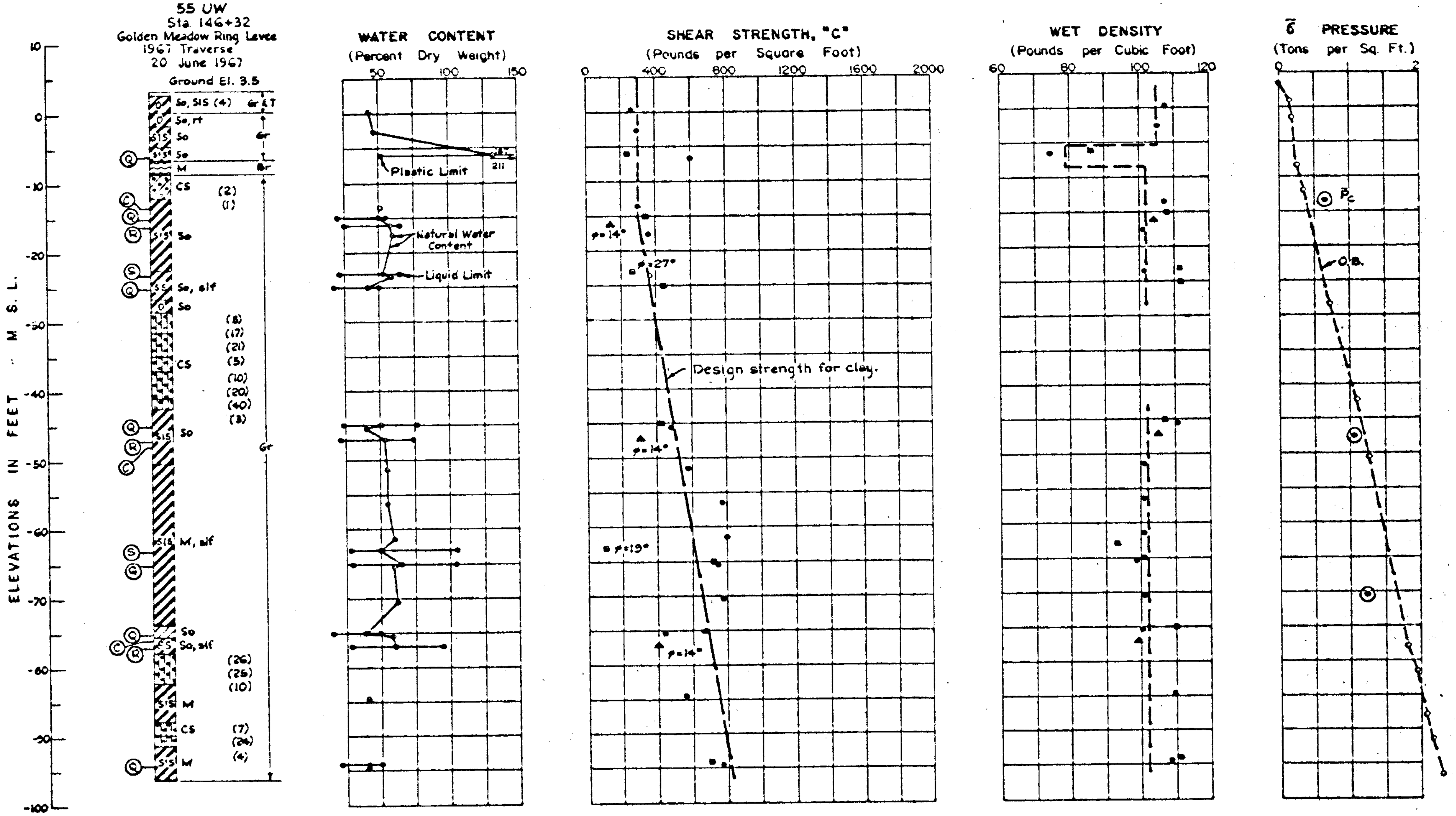
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

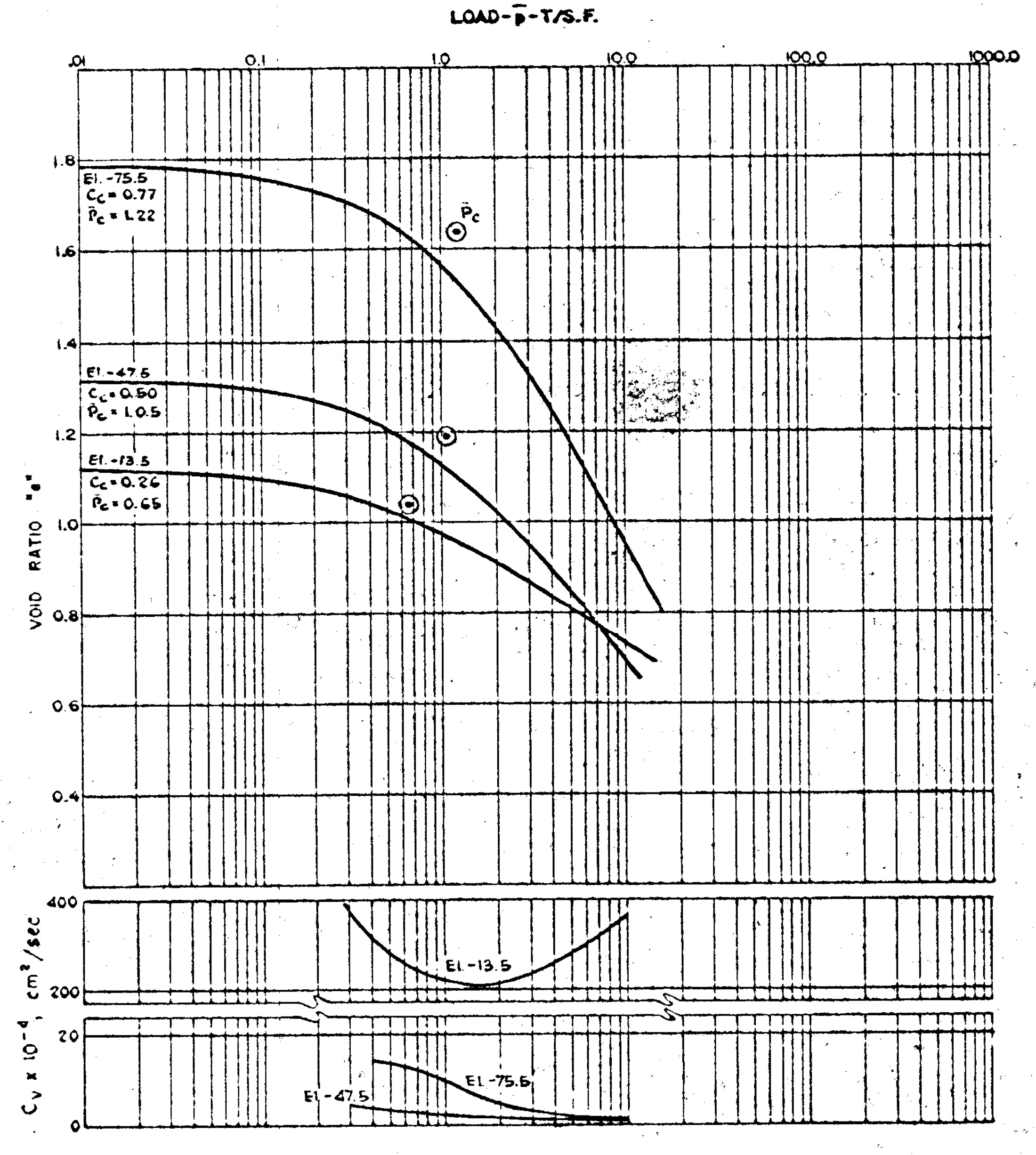
DETAIL SHEAR STRENGTH DATA
BORING 45UW

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

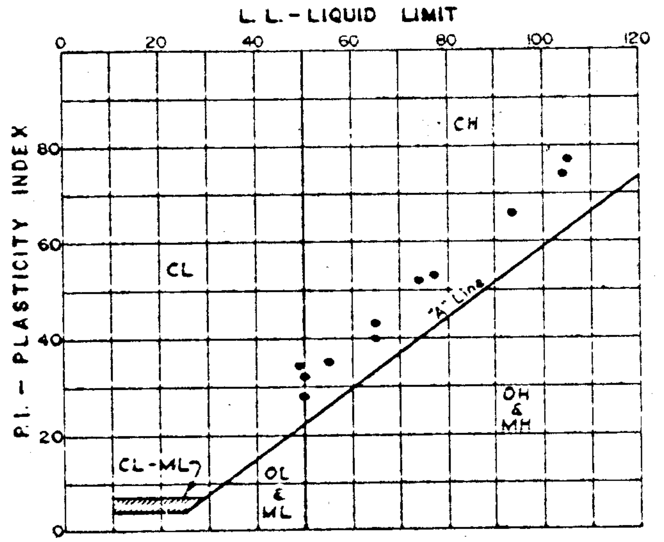
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

DATE: MARCH, 1972
FILE NO. H-2-24314

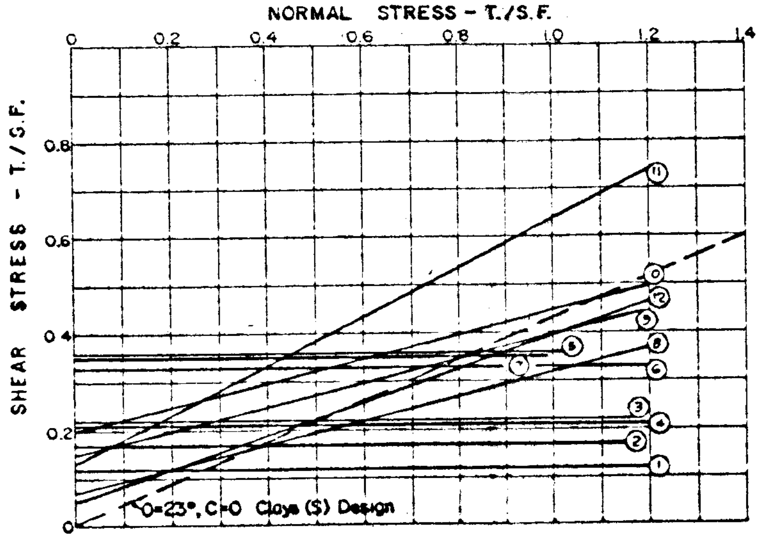




CONSOLIDATION DATA



PLASTICITY CHART



SHEAR STRENGTH DATA

ENVELOPE		TYPE	STRENGTH		CLASS
NO.	EL.		ø	c (T.S.F.)	
1	-6.0	Q	0	0.12	CH
2	-15.0		0	0.17	CH
3	-25.0		0	0.22	CL
4	-45.0		0	0.21	CH
5	-65.0		0	0.36	CH
6	-75.0		0	0.33	CL
7	-94.0		0	0.35	CL
8	-16.0	R	14	0.07	CH
9	-47.0		14	0.16	CH
10	-77.0		14	0.20	CH
11	-23.0	S	27	0.13	CH
12	-63.0		19	0.06	CH

For general notes see plate 46
For detail shear test data see plate 55
For location of boring see plate 14

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

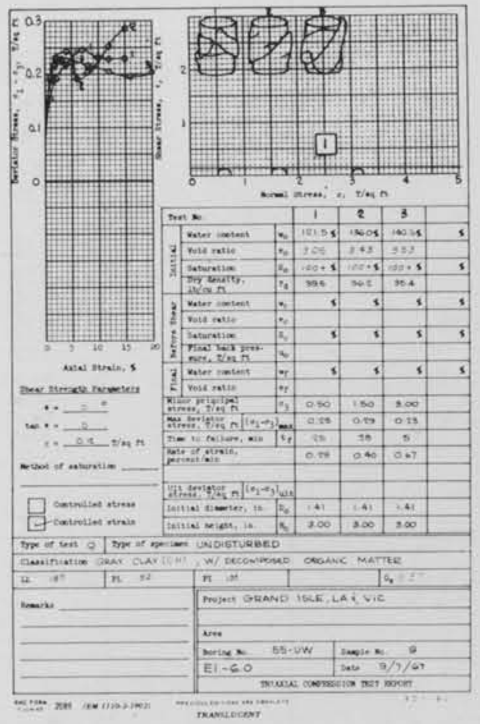
SOIL BORING 55 UW DATA

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA

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

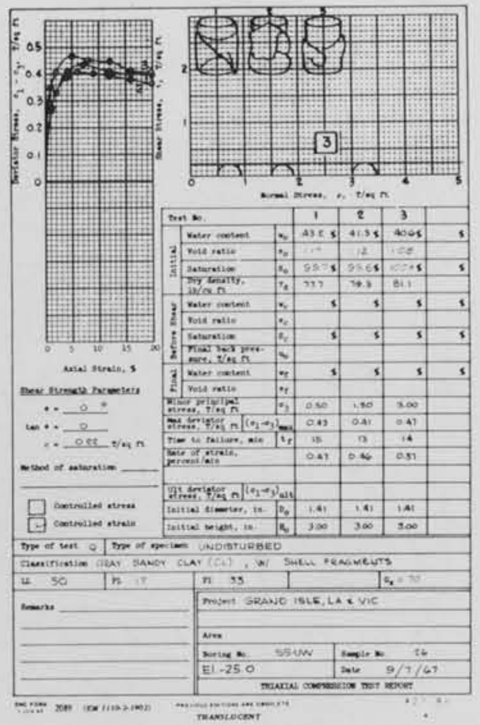
DATE: MARCH 1972
FILE NO. H-2-24314

PLATE 54



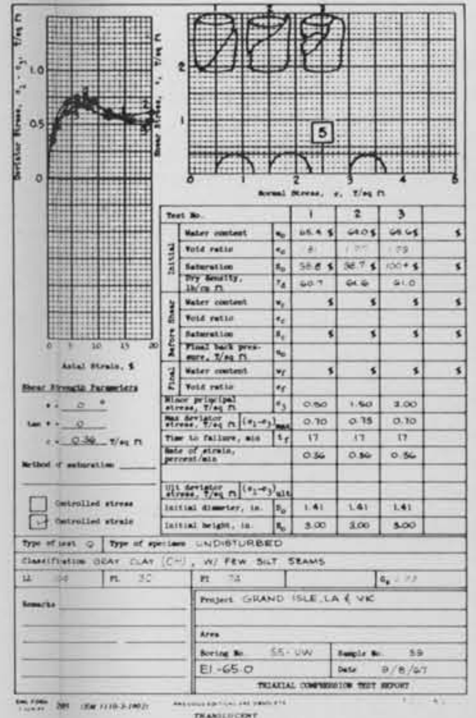
Test No.		1	2	3	
Initial: Water content	w_o	121.5 %	136.0 %	140.1 %	%
Void ratio	e_o	3.05	3.43	3.53	
Saturation	S_o	100+ %	100+ %	100+ %	%
Dry density, lb/cu ft	γ_d	39.6	36.2	35.4	
Minor principal stress, T/sq ft	σ_3	0.50	1.50	3.00	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.25	0.29	0.23	
Time to failure, min	t_f	15	38	5	
Rate of strain, percent/min		0.79	0.40	0.47	
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), W/ DECOMPOSED ORGANIC MATTER
LL 187 | PL 52 | PI 135 | G_s [illegible]
Remarks
Project GRAND ISLE, LA & VIC
Area
Boring No. 55-UW | Sample No. 9
El -6.0 | Date 9/7/67
TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



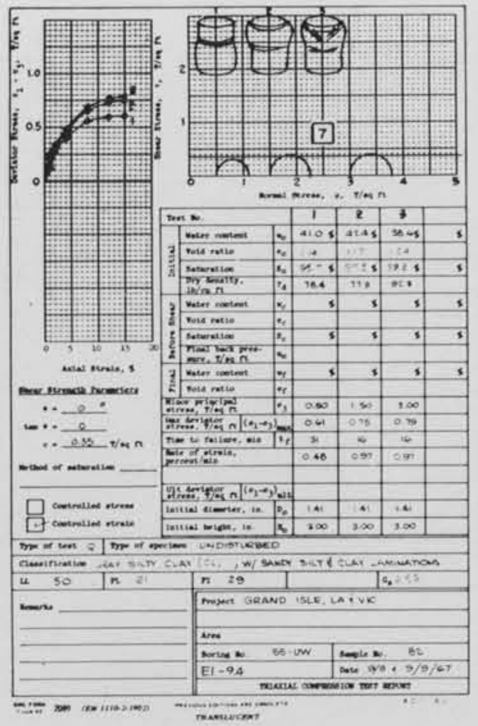
Test No.		1	2	3	
Initial: Water content	w_o	43.5 %	41.3 %	40.6 %	%
Void ratio	e_o	1.1	1.2	1.08	
Saturation	S_o	99.7 %	95.6 %	100+ %	%
Dry density, lb/cu ft	γ_d	77.7	78.3	81.1	
Minor principal stress, T/sq ft	σ_3	0.50	1.50	3.00	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.43	0.41	0.41	
Time to failure, min	t_f	15	13	14	
Rate of strain, percent/min		0.41	0.46	0.51	
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 = 0.22 T/sq ft
Method of saturation
☐ Controlled stress
☑ Controlled strain
Type of test Q | Type of specimen UNDISTURBED
Classification GRAY SANDY CLAY (CL), W/ SHELL FRAGMENTS
LL 50 | PL 17 | PI 33 | G_s 2.70
Remarks
Project GRAND ISLE, LA & VIC
Area
Boring No. 55-UW | Sample No. 26
El -25.0 | Date 9/7/67
TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



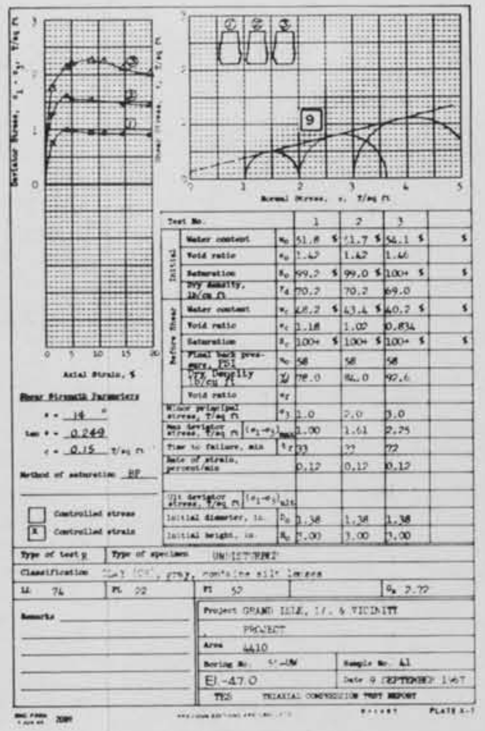
Test No.		1	2	3	
Initial: Water content	w_o	65.4 %	64.0 %	64.6 %	%
Void ratio	e_o	1.81	1.77	1.79	
Saturation	S_o	98.8 %	98.7 %	100+ %	%
Dry density, lb/cu ft	γ_d	60.7	64.6	61.0	
Minor principal stress, T/sq ft	σ_3	0.50	1.50	3.00	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.70	0.75	0.70	
Time to failure, min	t_f	17	17	17	
Rate of strain, percent/min		0.56	0.56	0.56	
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 = 0.36 T/sq ft
Method of saturation
☐ Controlled stress
☑ Controlled strain
Type of test Q | Type of specimen UNDISTURBED
Classification GRAY CLAY (CH), W/ FEW SILT SEAMS
LL [illegible] | PL 30 | PI 72 | G_s [illegible]
Remarks
Project GRAND ISLE, LA & VIC
Area
Boring No. 55-UW | Sample No. 59
El -65.0 | Date 9/8/67
TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



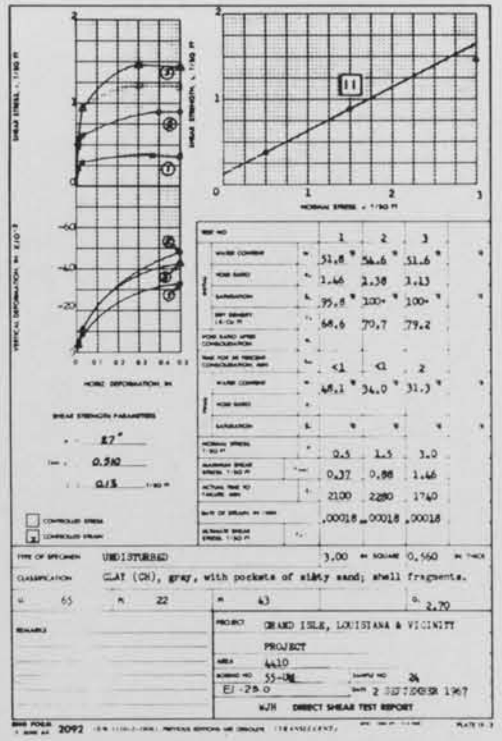
Test No.		1	2	3	
Initial: Water content	w_o	41.0 %	41.4 %	38.4 %	%
Void ratio	e_o	[illegible]	[illegible]	[illegible]	
Saturation	S_o	95.7 %	97.2 %	97.2 %	%
Dry density, lb/cu ft	γ_d	78.4	77.8	80.9	
Minor principal stress, T/sq ft	σ_3	0.50	1.50	3.00	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.61	0.75	0.79	
Time to failure, min	t_f	31	16	16	
Rate of strain, percent/min		0.48	0.97	0.97	
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 = 0.35 T/sq ft
Method of saturation
☐ Controlled stress
☑ Controlled strain
Type of test Q | Type of specimen UNDISTURBED
Classification GRAY SILTY CLAY (CL), W/ SANDY SILT & CLAY LAMINATIONS
LL 50 | PL 21 | PI 29 | G_s 2.65
Remarks
Project GRAND ISLE, LA & VIC
Area
Boring No. 55-UW | Sample No. 82
El -94 | Date 9/8 & 9/9/67
TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



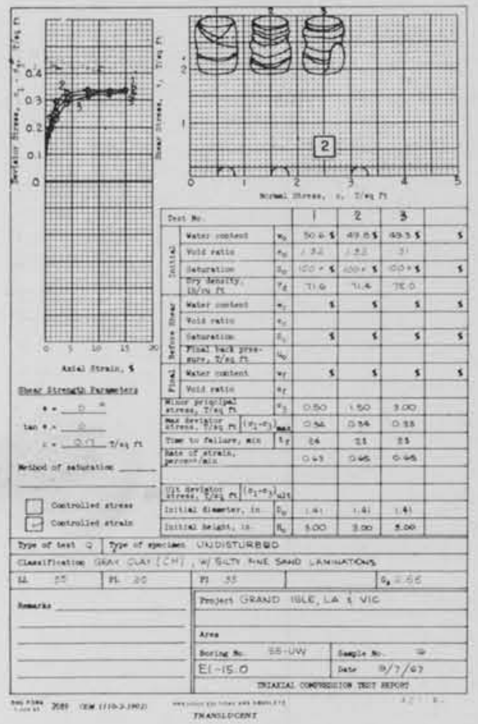
Test No.		1	2	3	
Initial: Water content	w_o	51.8 %	51.7 %	54.1 %	%
Void ratio	e_o	1.42	1.42	1.46	
Saturation	S_o	99.2 %	99.0 %	100+ %	%
Dry density, lb/cu ft	γ_d	70.2	70.2	69.0	
Before shear: Water content	w_c	48.2 %	43.4 %	40.2 %	%
Void ratio	e_c	1.18	1.02	0.834	
Saturation	S_c	100+ %	100+ %	100+ %	%
Final back pressure, PSI	u_o	58	58	58	
Dry Density lb/cu ft	γ_d	78.0	86.0	97.6	
Minor principal stress, T/sq ft	σ_3	1.0	2.0	3.0	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	1.00	1.61	2.25	
Time to failure, min	t_f	33	22	72	
Rate of strain, percent/min		0.12	0.12	0.12	
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 = 14°; tan φ = 0.249; c = 0.15 T/sq ft
Method of saturation BP
☐ Controlled stress
☒ Controlled strain
Type of test R | Type of specimen UNDISTURBED
Classification CLAY (CH), gray, contains silt lenses
LL 74 | PL 22 | PI 52 | G_s 2.72
Remarks
Project GRAND ISLE, LA. & VICINITY PROJECT
Area 4410
Boring No. 55-UW | Sample No. 41
El -47.0 | Date 9 SEPTEMBER 1967
TES TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 PREVIOUS EDITIONS ARE OBSOLETE PLATE X-7



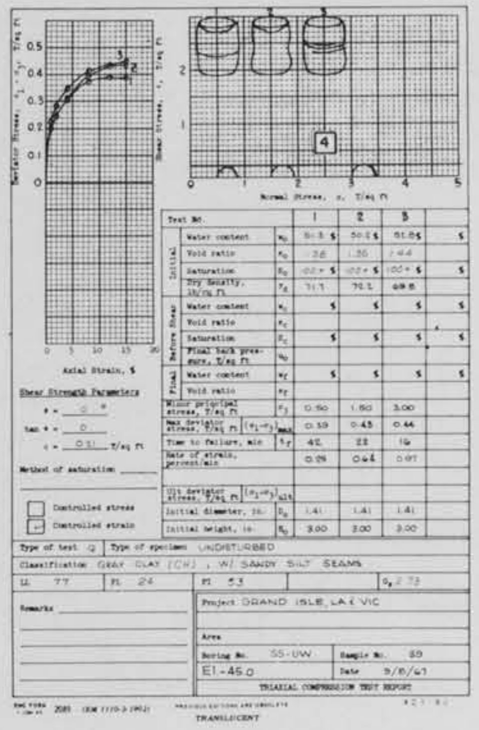
TEST NO		1	2	3	
Initial: WATER CONTENT	w_o	51.8 %	54.6 %	51.6 %	%
VOID RATIO	e_o	1.46	1.38	1.13	
SATURATION	S_o	95.8 %	100+ %	100+ %	%
DRY DENSITY LB/CU FT	γ_d	68.6	70.7	79.2	
VOID RATIO AFTER CONSOLIDATION	e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN	t_{50}	<1	<1	2	
Final: WATER CONTENT	w_f	48.1 %	34.0 %	31.3 %	%
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}	0.37	0.88	1.66	
ACTUAL TIME TO FAILURE, MIN	t_f	2100	2280	1740	
RATE OF STRAIN, IN / MIN		.00018	.00018	.00018	
ULTIMATE SHEAR STRESS T/SQ FT	τ_{ult}				

SHEAR STRENGTH PARAMETERS: φ = 27°; tan φ = 0.510; c = 0.13 T/SQ FT
☐ CONTROLLED STRESS
☒ CONTROLLED STRAIN
TYPE OF SPECIMEN UNDISTURBED | 3.00 IN SQUARE | 0.560 IN THICK
CLASSIFICATION CLAY (CH), gray, with pockets of silty sand; shell fragments.
LL 65 | PL 22 | PI 43 | G_s 2.70
REMARKS
PROJECT GRAND ISLE, LOUISIANA & VICINITY PROJECT
AREA 4410
BORING NO 55-UW | SAMPLE NO 26
EL -25.0 | DATE 2 SEPTEMBER 1967
WJH DIRECT SHEAR TEST REPORT
ENG FORM 2092 1 JUN 60



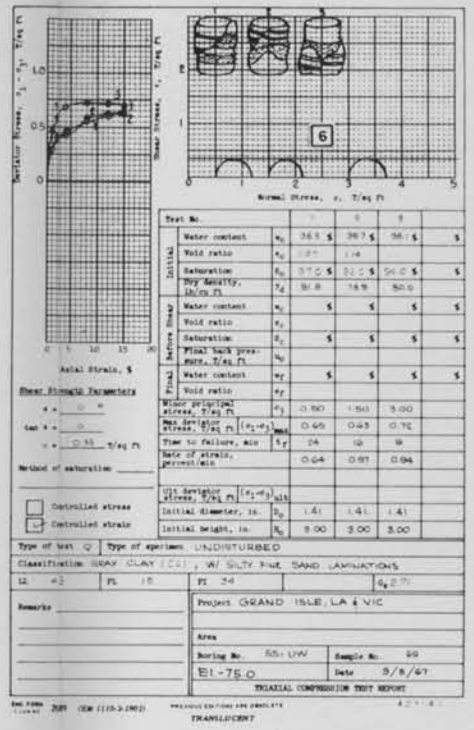
Test No.		1	2	3	
Initial: Water content	w_o	50.6 %	49.8 %	49.3 %	%
Void ratio	e_o	1.32	1.32	1.31	
Saturation	S_o	100+ %	100+ %	100+ %	%
Dry density, lb/cu ft	γ_d	71.6	71.4	72.0	
Minor principal stress, T/sq ft	σ_3	0.50	1.50	3.00	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.34	0.34	0.33	
Time to failure, min	t_f	24	21	23	
Rate of strain, percent/min		0.43	0.45	0.45	
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 = 0.17 T/sq ft
Method of saturation
☐ Controlled stress
☑ Controlled strain
Type of test Q | Type of specimen UNDISTURBED
Classification GRAY CLAY (CH), W/ SILTY FINE SAND LAMINATIONS
LL 55 | PL 20 | PI 35 | G_s 2.66
Remarks
Project GRAND ISLE, LA & VIC
Area
Boring No. 55-UW | Sample No. 19
El -15.0 | Date 9/7/67
TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



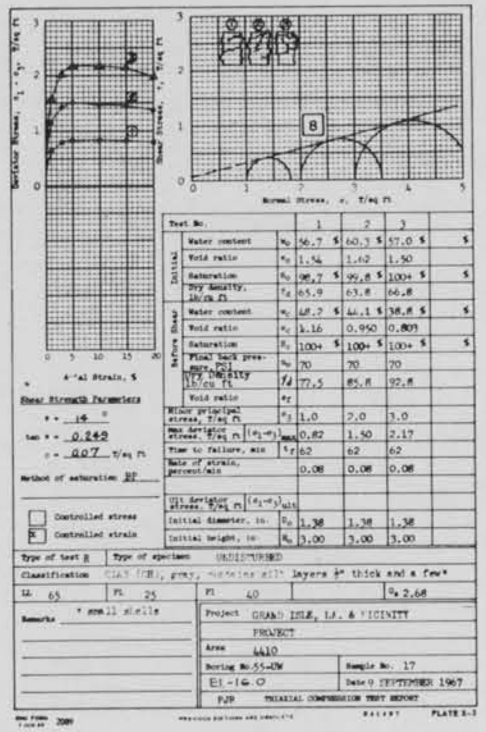
Test No.		1	2	3	
Initial: Water content	w_o	51.3 %	50.2 %	51.8 %	%
Void ratio	e_o	1.36	1.36	1.44	
Saturation	S_o	102+ %	102+ %	100+ %	%
Dry density, lb/cu ft	γ_d	71.1	70.1	68.8	
Minor principal stress, T/sq ft	σ_3	0.50	1.50	3.00	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.39	0.43	0.44	
Time to failure, min	t_f	42	22	16	
Rate of strain, percent/min		0.29	0.64	0.87	
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 = 0.21 T/sq ft
Method of saturation
☐ Controlled stress
☑ Controlled strain
Type of test Q | Type of specimen UNDISTURBED
Classification GRAY CLAY (CH), W/ SANDY SILT SEAMS
LL 77 | PL 24 | PI 53 | G_s 2.73
Remarks
Project GRAND ISLE, LA & VIC
Area
Boring No. 55-UW | Sample No. 39
El -45.0 | Date 9/8/67
TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



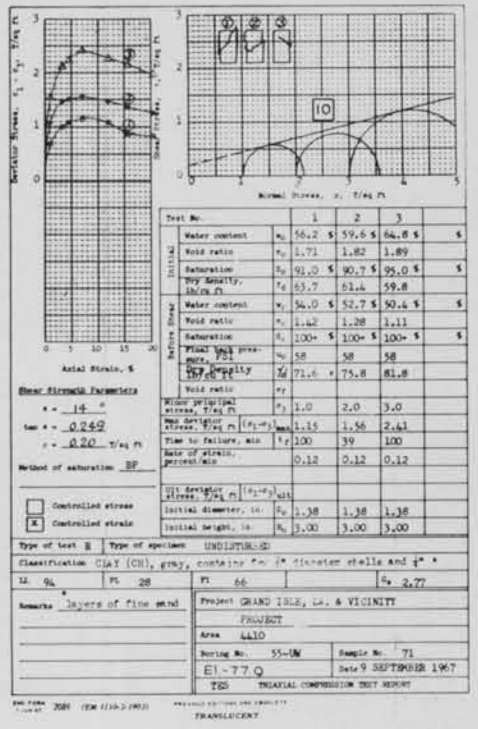
Test No.		1	2	3	
Initial: Water content	w_o	36.3 %	38.7 %	36.1 %	%
Void ratio	e_o	[illegible]	1.14		
Saturation	S_o	97.0 %	92.0 %	94.0 %	%
Dry density, lb/cu ft	γ_d	81.8	78.9	80.0	
Minor principal stress, T/sq ft	σ_3	0.50	1.50	3.00	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.65	0.63	0.72	
Time to failure, min	t_f	24	12	9	
Rate of strain, percent/min		0.64	0.97	0.94	
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 = 0.33 T/sq ft
Method of saturation
☐ Controlled stress
☑ Controlled strain
Type of test Q | Type of specimen UNDISTURBED
Classification GRAY CLAY (CL), W/ SILTY FINE SAND LAMINATIONS
LL 43 | PL 19 | PI 24 | G_s 2.71
Remarks
Project GRAND ISLE, LA & VIC
Area
Boring No. 55-UW | Sample No. 99
El -75.0 | Date 9/8/67
TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



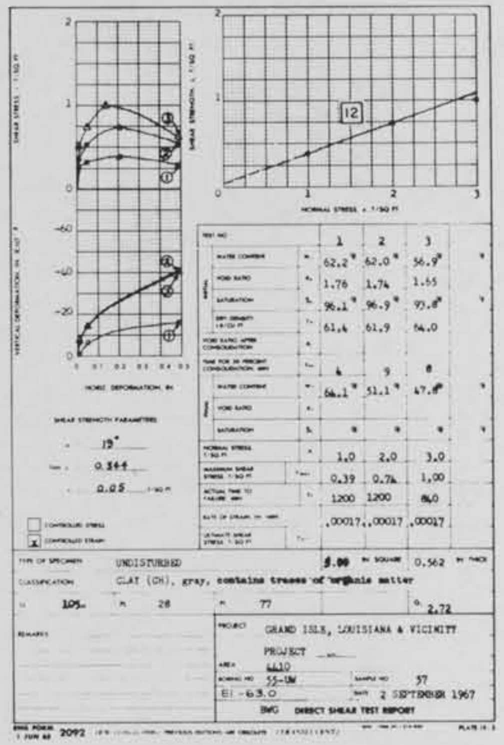
Test No.		1	2	3	
Initial: Water content	w_o	56.7 %	60.3 %	57.0 %	%
Void ratio	e_o	1.54	1.62	1.50	
Saturation	S_o	98.7 %	99.8 %	100+ %	%
Dry density, lb/cu ft	γ_d	65.9	63.8	66.8	
Before shear: Water content	w_c	48.7 %	44.1 %	38.8 %	%
Void ratio	e_c	1.16	0.950	0.809	
Saturation	S_c	100+ %	100+ %	100+ %	%
Final back pressure, PSI	u_o	70	70	70	
Dry Density lb/cu ft	γ_d	77.5	85.8	92.8	
Minor principal stress, T/sq ft	σ_3	1.0	2.0	3.0	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.82	1.50	2.17	
Time to failure, min	t_f	62	62	62	
Rate of strain, percent/min		0.08	0.08	0.08	
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 = 14°; tan φ = 0.249; c = 0.07 T/sq ft
Method of saturation BP
☐ Controlled stress
☒ Controlled strain
Type of test R | Type of specimen UNDISTURBED
Classification CLAY (CH), gray, contains silt layers ¼" thick and a few*
LL 65 | PL 25 | PI 40 | G_s 2.68
Remarks * small shells
Project GRAND ISLE, LA. & VICINITY PROJECT
Area 4410
Boring No. 55-UW | Sample No. 17
El -16.0 | Date 9 SEPTEMBER 1967
PJP TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 PREVIOUS EDITIONS ARE OBSOLETE PLATE X-3



Test No.		1	2	3	
Initial: Water content	w_o	56.2 %	59.6 %	64.8 %	%
Void ratio	e_o	1.71	1.82	1.89	
Saturation	S_o	91.0 %	90.7 %	95.0 %	%
Dry density, lb/cu ft	γ_d	63.7	61.4	59.8	
Before shear: Water content	w_c	54.0 %	52.7 %	50.4 %	%
Void ratio	e_c	1.42	1.28	1.11	
Saturation	S_c	100+ %	100+ %	100+ %	%
Final back pressure, PSI	u_o	58	58	58	
Dry Density lb/cu ft	γ_d	71.6	75.8	81.8	
Minor principal stress, T/sq ft	σ_3	1.0	2.0	3.0	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	1.15	1.56	2.41	
Time to failure, min	t_f	100	39	100	
Rate of strain, percent/min		0.12	0.12	0.12	
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 = 14°; tan φ = 0.249; c = 0.20 T/sq ft
Method of saturation BP
☐ Controlled stress
☒ Controlled strain
Type of test R | Type of specimen UNDISTURBED
Classification CLAY (CH), gray, contains few ½" diameter shells and ¼" *
LL 94 | PL 28 | PI 66 | G_s 2.77
Remarks *layers of fine sand
Project GRAND ISLE, LA. & VICINITY PROJECT
Area 4410
Boring No. 55-UW | Sample No. 71
El -77.0 | Date 9 SEPTEMBER 1967
TES TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



TEST NO		1	2	3	
Initial: WATER CONTENT	w_o	62.2 %	62.0 %	56.9 %	%
VOID RATIO	e_o	1.76	1.74	1.65	
SATURATION	S_o	96.1 %	96.9 %	93.8 %	%
DRY DENSITY LB/CU FT	γ_d	61.4	61.9	64.0	
VOID RATIO AFTER CONSOLIDATION	e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN	t_{50}	4	9	8	
Final: WATER CONTENT	w_f	64.1 %	51.1 %	47.8 %	%
VOID RATIO	e_f				
SATURATION	S_f	%	%	%	%
NORMAL STRESS T/SQ FT	σ	1.0	2.0	3.0	
MAXIMUM SHEAR STRESS T/SQ FT	τ_{max}	0.39	0.74	1.00	
ACTUAL TIME TO FAILURE, MIN	t_f	1200	1200	840	
RATE OF STRAIN, IN / MIN		.00017	.00017	.00017	
ULTIMATE SHEAR STRESS T/SQ FT	τ_{ult}				

SHEAR STRENGTH PARAMETERS: φ = 19°; tan φ = 0.344; c = 0.05 T/SQ FT
☐ CONTROLLED STRESS
☒ CONTROLLED STRAIN
TYPE OF SPECIMEN UNDISTURBED | 3.00 IN SQUARE | 0.562 IN THICK
CLASSIFICATION CLAY (CH), gray, contains traces of organic matter
LL 105 | PL 28 | PI 77 | G_s 2.72
REMARKS
PROJECT GRAND ISLE, LOUISIANA & VICINITY PROJECT
AREA 4410
BORING NO 55-UW | SAMPLE NO 57
EL -63.0 | DATE 2 SEPTEMBER 1967
BWG DIRECT SHEAR TEST REPORT
ENG FORM 2092 1 JUN 60

NOTE:
- [7] Indicates reference number shown under shear data on Plate 54
- (Q) - Unconsolidated - undrained triaxial compression test.
- (R) - Consolidated - undrained triaxial compression test.
- (S) - Consolidated - drained direct shear test.

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)

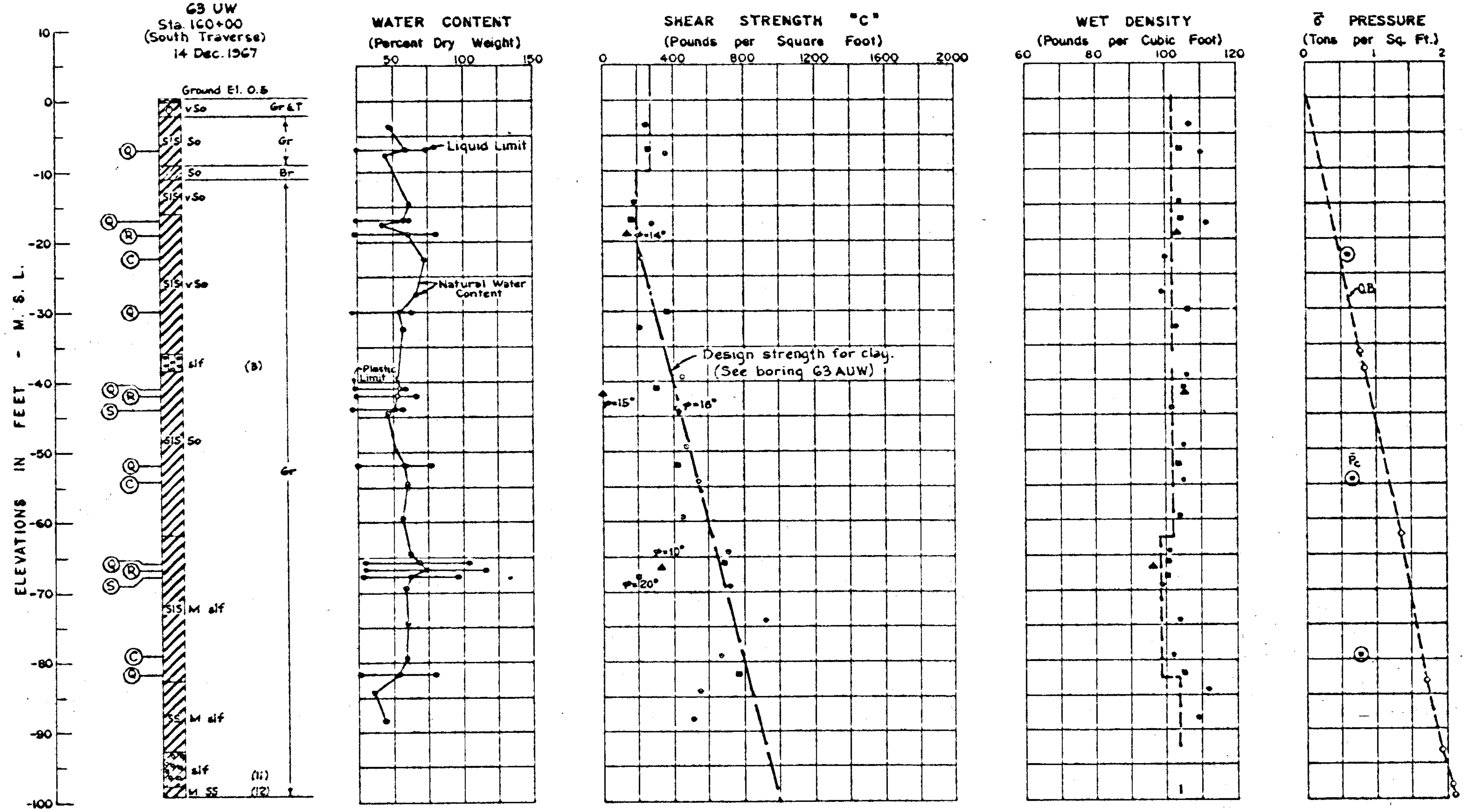
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

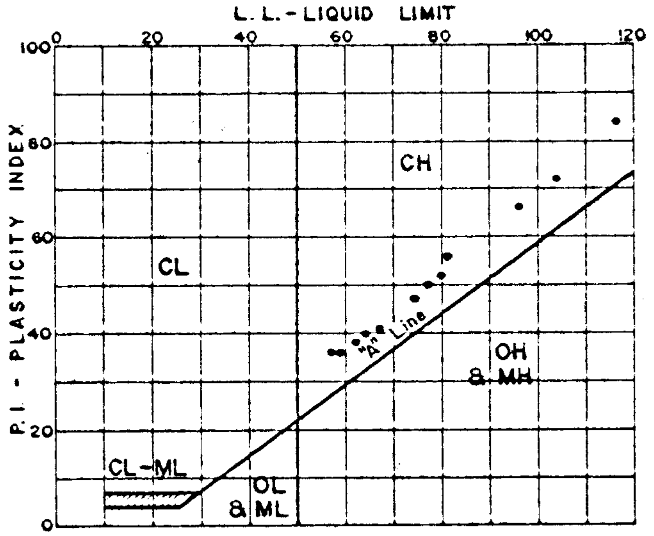
DETAIL SHEAR STRENGTH DATA
BORING 55 UW

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

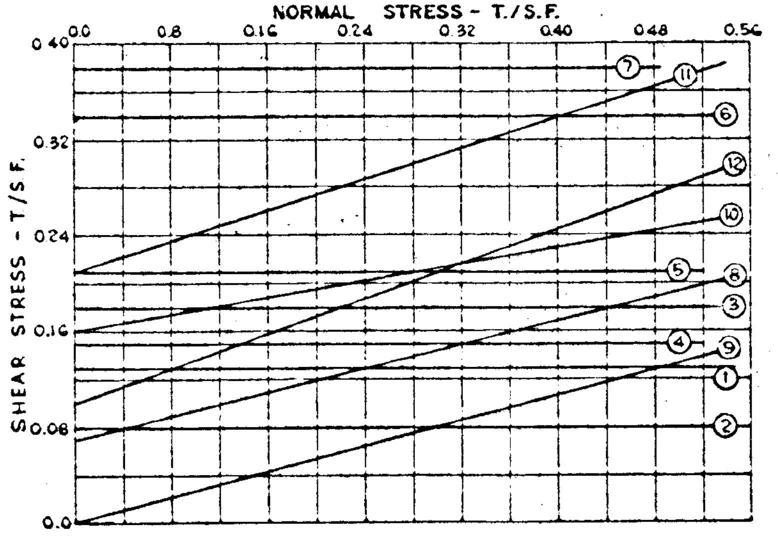
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

DATE: MARCH, 1972
FILE NO. H-2-24314



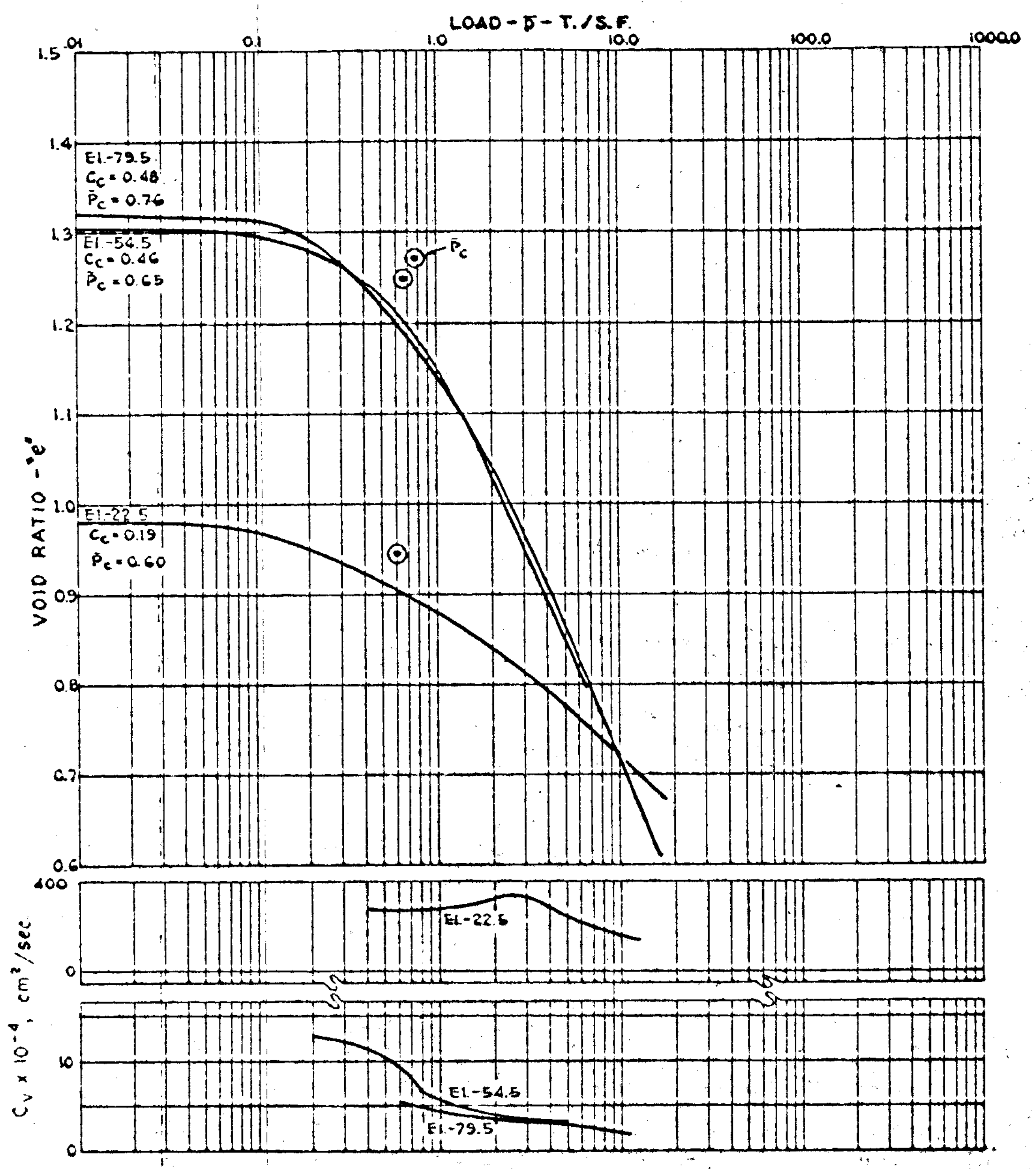


PLASTICITY CHART



SHEAR STRENGTH DATA

ENVELOPE		TYPE	STRENGTH		CLASS.
NO.	El		φ	c t.s.f.	
1	-7.0	Q	0	0.13	CH.
2	-17.0			0.CB	
3	-30.0			0.18	
4	-41.0			0.15	
5	-52.0			0.21	
6	-66.0			0.34	
7	-82.0			0.38	
8	-19.0	R	14°	0.07	CH
9	-42.0		15°	0.0	
10	-67.0		10°	0.16	
11	-44.0	S	18°	0.21	CH
12	-68.0		20°	0.10	



CONSOLIDATION DATA

For general notes see plate 46
For detail shear test data see plate 57
For location of boring see plate 13

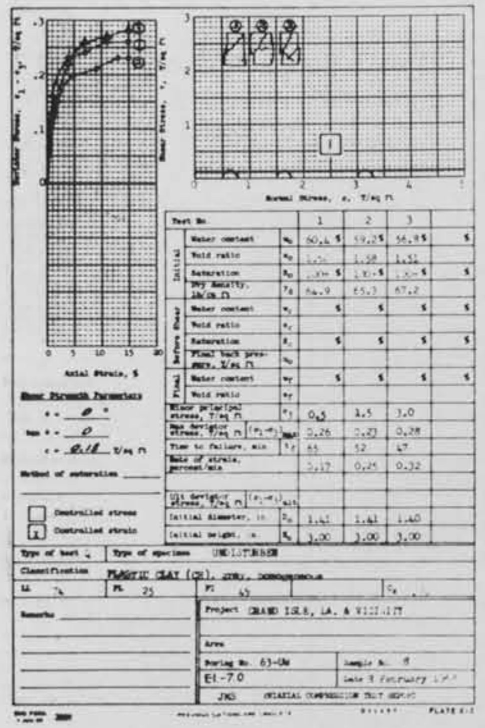
GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

SOIL BORING 63 UW DATA

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE: MARCH 1972
FILE NO. H-2-24314



Test No.		1	2	3
Initial: Water content	w_o	60.4 %	59.2 %	56.8 %
Void ratio	e_o	[illegible]	1.58	1.52
Saturation	S_o	100+ %	100+ %	100+ %
Dry density, lb/cu ft	γ_d	64.9	65.3	67.2
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	0.27	0.28
Time to failure, min	t_f	65	52	47
Rate of strain, percent/min		0.17	0.25	0.32
Initial diameter, in.	D_o	1.41	1.41	1.40
Initial height, in.	H_o	3.00	3.00	3.00

Shear Strength Parameters: φ = 0°; tan φ = 0; c = 0.18 T/sq ft

☐ Controlled stress ☒ Controlled strain

Type of test Q; Type of specimen UNDISTURBED

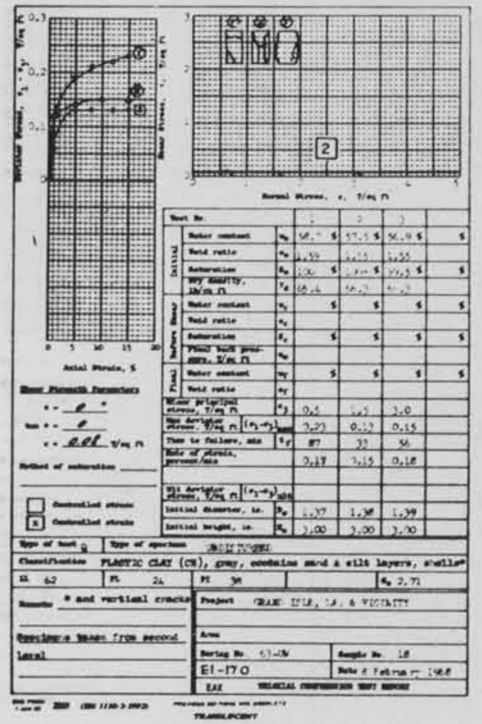
Classification PLASTIC CLAY (CH), gray, homogeneous

LL 74; PL 25; PI 49

Project GRAND ISLE, LA. & VICINITY

Boring No. 63-UW; Sample No. 8; El-7.0; Date 8 February 1968

JKS TRIAXIAL COMPRESSION TEST REPORT



Test No.		1	2	3
Initial: Water content	w_o	58.7 %	57.5 %	56.9 %
Void ratio	e_o	1.59	1.55	1.55
Saturation	S_o	100 %	100+ %	99.5 %
Dry density, lb/cu ft	γ_d	65.4	[illegible]	[illegible]
Minor principal stress, T/sq ft	σ_3	0.5	1.5	3.0
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.23	0.12	0.15
Time to failure, min	t_f	87	32	56
Rate of strain, percent/min		0.17	0.15	0.18
Initial diameter, in.	D_o	1.37	1.38	1.39
Initial height, in.	H_o	3.00	3.00	3.00

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

☐ Controlled stress ☒ Controlled strain

Type of test Q; Type of specimen UNDISTURBED

Classification PLASTIC CLAY (CH), gray, contains sand & silt layers, shells*

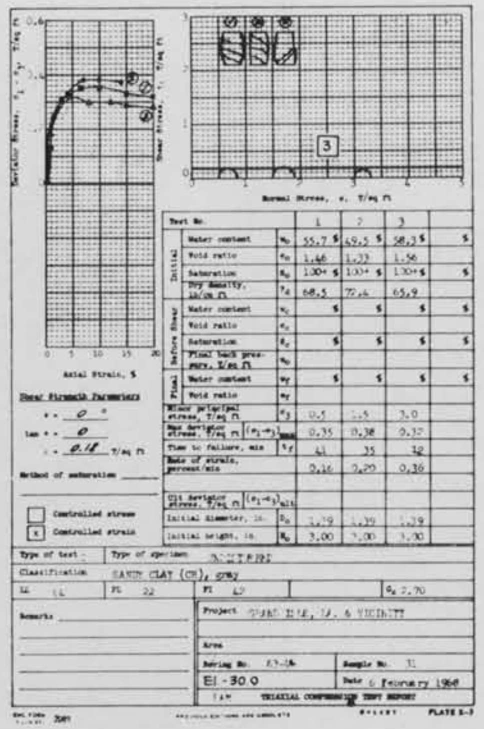
LL 62; PL 24; PI 38; G_s 2.71

Remarks * and vertical cracks. Specimens taken from second level

Project GRAND ISLE, LA. & VICINITY

Boring No. 63-UW; Sample No. 18; El-17.0; Date 8 February 1968

EAK TRIAXIAL COMPRESSION TEST REPORT



Test No.		1	2	3
Initial: Water content	w_o	55.7 %	49.5 %	58.3 %
Void ratio	e_o	1.46	1.33	1.56
Saturation	S_o	100+ %	100+ %	100+ %
Dry density, lb/cu ft	γ_d	68.5	72.4	65.9
Minor principal stress, T/sq ft	σ_3	0.5	1.5	3.0
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.35	0.38	0.37
Time to failure, min	t_f	41	35	32
Rate of strain, percent/min		0.16	0.20	0.36
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 = 0.18 T/sq ft

☐ Controlled stress ☒ Controlled strain

Type of specimen UNDISTURBED

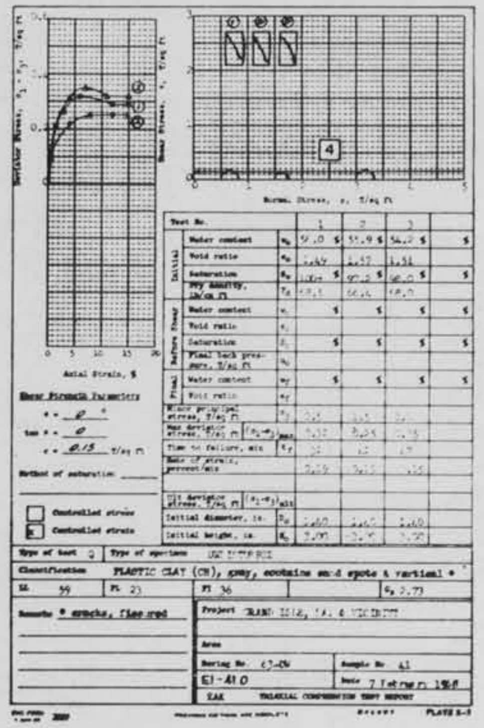
Classification SANDY CLAY (CH), gray

LL 71; PL 22; PI 49; G_s 2.70

Project GRAND ISLE, LA. & VICINITY

Boring No. 63-UW; Sample No. 31; El-30.0; Date 6 February 1968

TRIAXIAL COMPRESSION TEST REPORT



Test No.		1	2	3
Initial: Water content	w_o	57.0 %	51.9 %	54.2 %
Void ratio	e_o	1.49	1.37	1.51
Saturation	S_o	100+ %	97.2 %	98.0 %
Dry density, lb/cu ft	γ_d	[illegible]	66.4	68.0
Minor principal stress, T/sq ft	σ_3	[illegible]	[illegible]	[illegible]
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	[illegible]	[illegible]	[illegible]
Time to failure, min	t_f	[illegible]	[illegible]	[illegible]
Rate of strain, percent/min		[illegible]	[illegible]	[illegible]
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 = 0.15 T/sq ft

☐ Controlled stress ☒ Controlled strain

Type of test Q; Type of specimen UNDISTURBED

Classification PLASTIC CLAY (CH), gray, contains sand spots & vertical *

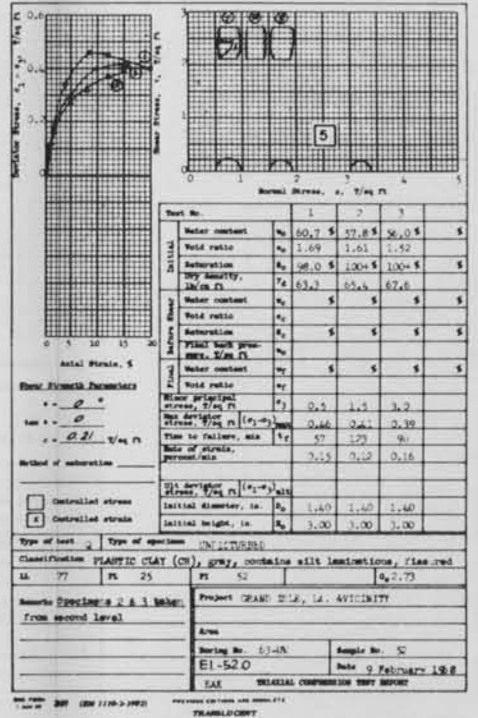
LL 59; PL 23; PI 36; G_s 2.73

Remarks * cracks, fissured

Project GRAND ISLE, LA. & VICINITY

Boring No. 63-UW; Sample No. 41; El-41.0; Date 7 February 1968

EAK TRIAXIAL COMPRESSION TEST REPORT



Test No.		1	2	3
Initial: Water content	w_o	60.7 %	57.8 %	56.0 %
Void ratio	e_o	1.69	1.61	1.52
Saturation	S_o	98.0 %	100+ %	100+ %
Dry density, lb/cu ft	γ_d	63.3	65.4	67.6
Minor principal stress, T/sq ft	σ_3	0.5	1.5	3.0
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.46	0.41	0.39
Time to failure, min	t_f	57	173	96
Rate of strain, percent/min		0.15	0.12	0.16
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 = 0.21 T/sq ft

☐ Controlled stress ☒ Controlled strain

Type of test Q; Type of specimen UNDISTURBED

Classification PLASTIC CLAY (CH), gray, contains silt laminations, fissured

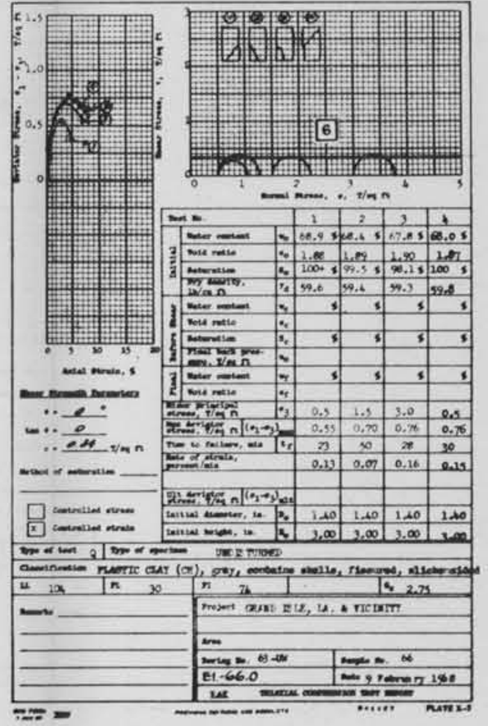
LL 77; PL 25; PI 52; G_s 2.73

Remarks Specimens 2 & 3 taken from second level

Project GRAND ISLE, LA. & VICINITY

Boring No. 63-UW; Sample No. 52; El-52.0; Date 9 February 1968

EAK TRIAXIAL COMPRESSION TEST REPORT



Test No.		1	2	3	4
Initial: Water content	w_o	68.9 %	68.4 %	67.8 %	68.0 %
Void ratio	e_o	1.88	1.89	1.90	1.87
Saturation	S_o	100+ %	99.5 %	98.1 %	100 %
Dry density, lb/cu ft	γ_d	59.6	59.4	59.3	59.8
Minor principal stress, T/sq ft	σ_3	0.5	1.5	3.0	0.5
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.55	0.70	0.76	0.76
Time to failure, min	t_f	23	50	28	30
Rate of strain, percent/min		0.13	0.07	0.16	0.15
Initial diameter, in.	D_o	1.40	1.40	1.40	1.40
Initial height, in.	H_o	3.00	3.00	3.00	3.00

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

☐ Controlled stress ☒ Controlled strain

Type of test Q; Type of specimen UNDISTURBED

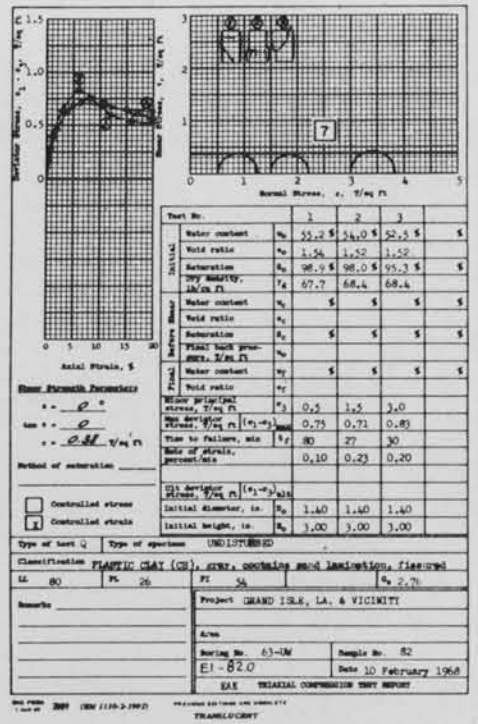
Classification PLASTIC CLAY (CH), gray, contains shells, fissured, slickensided

LL 104; PL 30; PI 74; G_s 2.75

Project GRAND ISLE, LA. & VICINITY

Boring No. 63-UW; Sample No. 66; El-66.0; Date 9 February 1968

EAK TRIAXIAL COMPRESSION TEST REPORT



Test No.		1	2	3
Initial: Water content	w_o	55.2 %	54.0 %	52.5 %
Void ratio	e_o	1.54	1.52	1.52
Saturation	S_o	98.9 %	98.0 %	95.3 %
Dry density, lb/cu ft	γ_d	67.7	68.4	68.4
Minor principal stress, T/sq ft	σ_3	0.5	1.5	3.0
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.75	0.71	0.83
Time to failure, min	t_f	80	27	30
Rate of strain, percent/min		0.10	0.23	0.20
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 = 0.38 T/sq ft

☐ Controlled stress ☒ Controlled strain

Type of test Q; Type of specimen UNDISTURBED

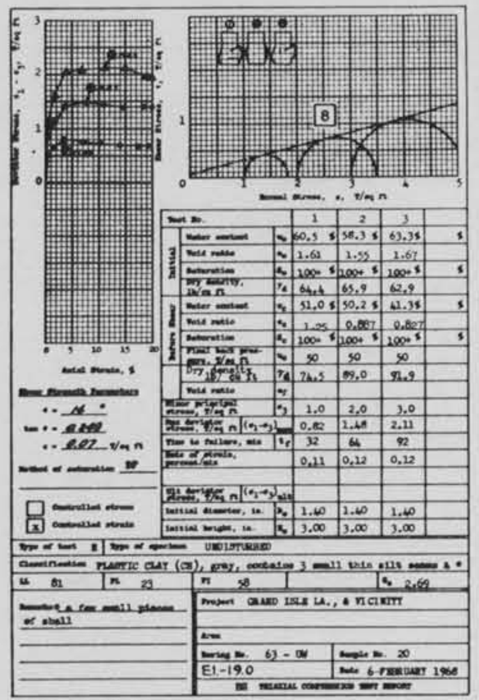
Classification PLASTIC CLAY (CH), gray, contains sand lamination, fissured

LL 80; PL 26; PI 54; G_s 2.71

Project GRAND ISLE, LA. & VICINITY

Boring No. 63-UW; Sample No. 82; El-82.0; Date 10 February 1968

EAK TRIAXIAL COMPRESSION TEST REPORT



Test No.		1	2	3
Initial: Water content	w_o	60.5 %	58.3 %	63.3 %
Void ratio	e_o	1.61	1.55	1.67
Saturation	S_o	100+ %	100+ %	100+ %
Dry density, lb/cu ft	γ_d	64.4	65.9	62.9
Before Shear: Water content	w_c	51.0 %	50.2 %	41.3 %
Void ratio	e_c	1.25	0.887	0.827
Saturation	S_c	100+ %	100+ %	100+ %
Final back pressure, T/sq ft	u_o	50	50	50
Dry density, lb/cu ft	γ_d	74.5	89.0	91.9
Minor principal stress, T/sq ft	σ_3	1.0	2.0	3.0
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.82	1.48	2.11
Time to failure, min	t_f	32	64	92
Rate of strain, percent/min		0.11	0.12	0.12
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 = 16°; tan φ = 0.249; c = 0.07 T/sq ft

Method of saturation BP

☐ Controlled stress ☒ Controlled strain

Type of test R; Type of specimen UNDISTURBED

Classification PLASTIC CLAY (CH), gray, contains 3 small thin silt seams & *

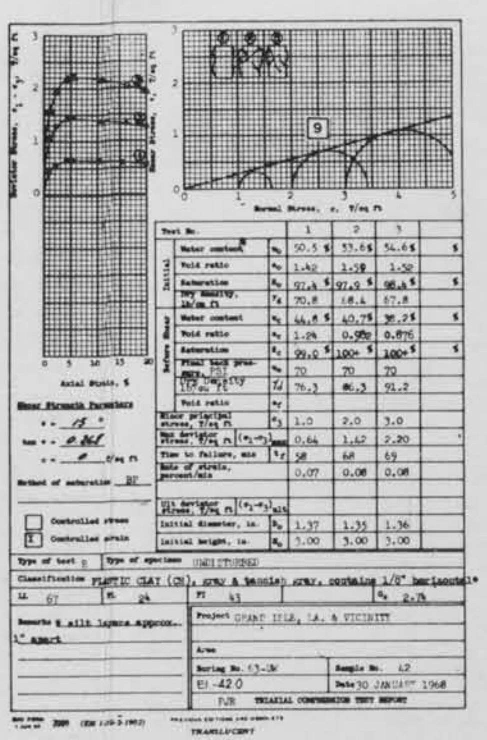
LL 81; PL 23; PI 58; G_s 2.69

Remarks* a few small pieces of shell

Project GRAND ISLE LA., & VICINITY

Boring No. 63 - UW; Sample No. 20; El-19.0; Date 6-FEBRUARY 1968

TRIAXIAL COMPRESSION TEST REPORT



Test No.		1	2	3
Initial: Water content	w_o	50.5 %	53.6 %	54.6 %
Void ratio	e_o	1.42	1.59	1.52
Saturation	S_o	97.4 %	97.9 %	98.4 %
Dry density, lb/cu ft	γ_d	70.8	68.4	67.8
Before Shear: Water content	w_c	44.8 %	40.7 %	38.2 %
Void ratio	e_c	1.24	0.980	0.876
Saturation	S_c	99.0 %	100+ %	100+ %
Final back pressure, PSI	u_o	70	70	70
Dry density, lb/cu ft	γ_d	76.3	86.3	91.2
Minor principal stress, T/sq ft	σ_3	1.0	2.0	3.0
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.64	1.42	2.20
Time to failure, min	t_f	58	68	69
Rate of strain, percent/min		0.07	0.08	0.08
Initial diameter, in.	D_o	1.37	1.35	1.36
Initial height, in.	H_o	3.00	3.00	3.00

Shear Strength Parameters: φ = 15°; tan φ = 0.268; c = 0 T/sq ft

Method of saturation BP

☐ Controlled stress ☒ Controlled strain

Type of test R; Type of specimen UNDISTURBED

Classification PLASTIC CLAY (CH), gray & tannish gray, contains 1/8" horizontal*

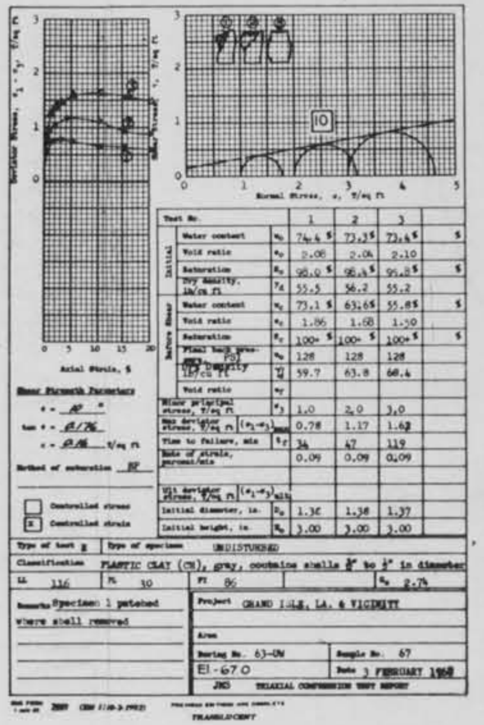
LL 67; PL 24; PI 43; G_s 2.74

Remarks * silt layers approx. 1" apart

Project GRAND ISLE, LA. & VICINITY

Boring No. 63-UW; Sample No. 42; El-42.0; Date 30 JANUARY 1968

PJR TRIAXIAL COMPRESSION TEST REPORT



Test No.		1	2	3
Initial: Water content	w_o	74.6 %	73.3 %	73.4 %
Void ratio	e_o	2.08	2.04	2.10
Saturation	S_o	98.0 %	98.4 %	95.8 %
Dry density, lb/cu ft	γ_d	55.5	56.2	55.2
Before Shear: Water content	w_c	73.1 %	63.6 %	55.8 %
Void ratio	e_c	1.86	1.68	1.50
Saturation	S_c	100+ %	100+ %	100+ %
Final back pressure, PSI	u_o	128	128	128
Dry density, lb/cu ft	γ_d	59.7	63.8	68.4
Minor principal stress, T/sq ft	σ_3	1.0	2.0	3.0
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.78	1.17	1.63
Time to failure, min	t_f	34	47	119
Rate of strain, percent/min		0.09	0.09	0.09
Initial diameter, in.	D_o	1.36	1.38	1.37
Initial height, in.	H_o	3.00	3.00	3.00

Shear Strength Parameters: φ = 10°; tan φ = 0.176; c = 0.16 T/sq ft

Method of saturation BP

☐ Controlled stress ☒ Controlled strain

Type of test R; Type of specimen UNDISTURBED

Classification PLASTIC CLAY (CH), gray, contains shells ⅛" to ½" in diameter

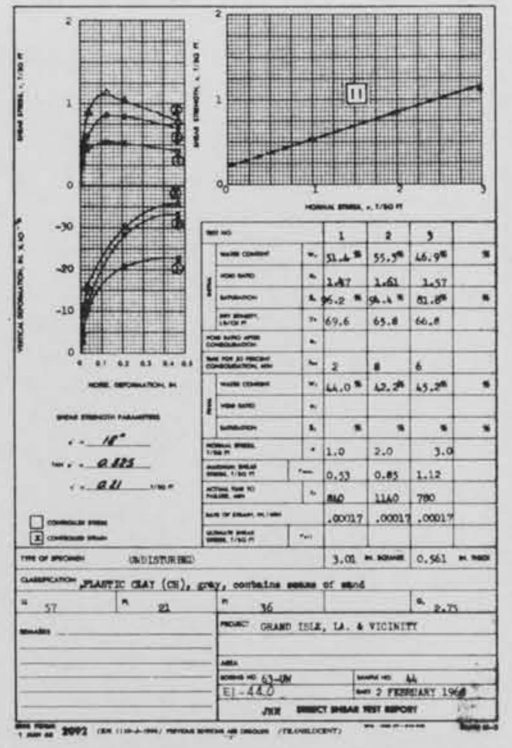
LL 116; PL 30; PI 86; G_s 2.74

Remarks Specimen 1 patched where shell removed

Project GRAND ISLE, LA. & VICINITY

Boring No. 63-UW; Sample No. 67; El-67.0; Date 3 FEBRUARY 1968

JKS TRIAXIAL COMPRESSION TEST REPORT



TEST NO.		1	2	3
Initial: Water content	w_o	51.4 %	55.5 %	46.9 %
Void ratio	e_o	1.47	1.61	1.57
Saturation	S_o	96.2 %	94.4 %	81.8 %
Dry density, lb/cu ft	γ_d	69.6	65.8	66.8
Time for 50 percent consolidation, min	t_{50}	2	8	6
Final: Water content	w_f	44.0 %	42.2 %	45.2 %
Normal stress, T/sq ft	σ	1.0	2.0	3.0
Maximum shear stress, T/sq ft	τ_{max}	0.53	0.85	1.12
Actual time to failure, min	t_f	840	1140	780
Rate of strain, in./min		.00017	.00017	.00017

Shear Strength Parameters: φ = 18°; tan φ = 0.325; c = 0.21 T/sq ft

☐ Controlled stress ☒ Controlled strain

Type of specimen UNDISTURBED; 3.01 in. square; 0.561 in. thick

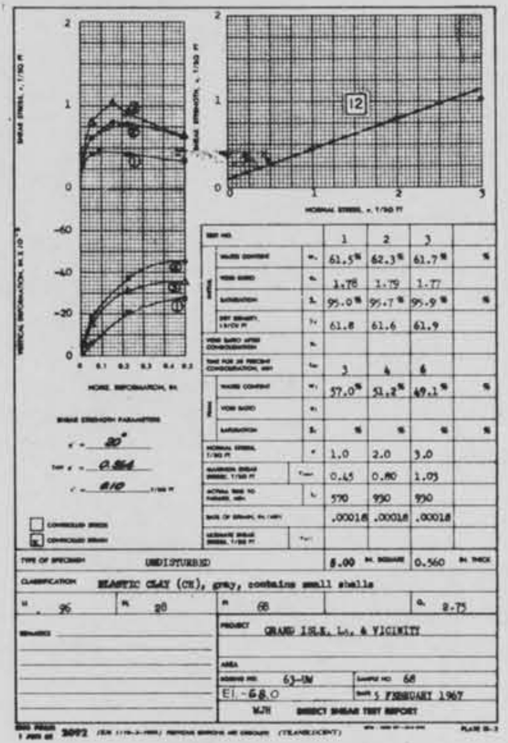
Classification PLASTIC CLAY (CH), gray, contains seams of sand

LL 57; PL 21; PI 36; G_s 2.75

Project GRAND ISLE, LA. & VICINITY

Boring No. 63-UW; Sample No. 44; El-44.0; Date 2 FEBRUARY 1968

JKR DIRECT SHEAR TEST REPORT



TEST NO.		1	2	3
Initial: Water content	w_o	61.5 %	62.3 %	61.7 %
Void ratio	e_o	1.78	1.79	1.77
Saturation	S_o	95.0 %	95.7 %	95.9 %
Dry density, lb/cu ft	γ_d	61.8	61.6	61.9
Time for 50 percent consolidation, min	t_{50}	3	4	6
Final: Water content	w_f	57.0 %	51.2 %	49.1 %
Normal stress, T/sq ft	σ	1.0	2.0	3.0
Maximum shear stress, T/sq ft	τ_{max}	0.45	0.80	1.05
Actual time to failure, min	t_f	570	950	950
Rate of strain, in./min		.00018	.00018	.00018

Shear Strength Parameters: φ = 20°; tan φ = 0.364; c = 0.10 T/sq ft

☐ Controlled stress ☒ Controlled strain

Type of specimen UNDISTURBED; 3.00 in. square; 0.560 in. thick

Classification PLASTIC CLAY (CH), gray, contains small shells

LL 96; PL 28; PI 68; G_s 2.75

Project GRAND ISLE, La. & VICINITY

Boring No. 63-UW; Sample No. 68; El-68.0; Date 5 FEBRUARY 1967

WJH DIRECT SHEAR TEST REPORT

NOTE:

- 7 Indicates reference number shown under shear data on Plate 56
- (Q) - Unconsolidated - undrained triaxial compression test.
- (R) - Consolidated - undrained triaxial compression test.
- (S) - Consolidated - drained direct shear test.

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)

DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

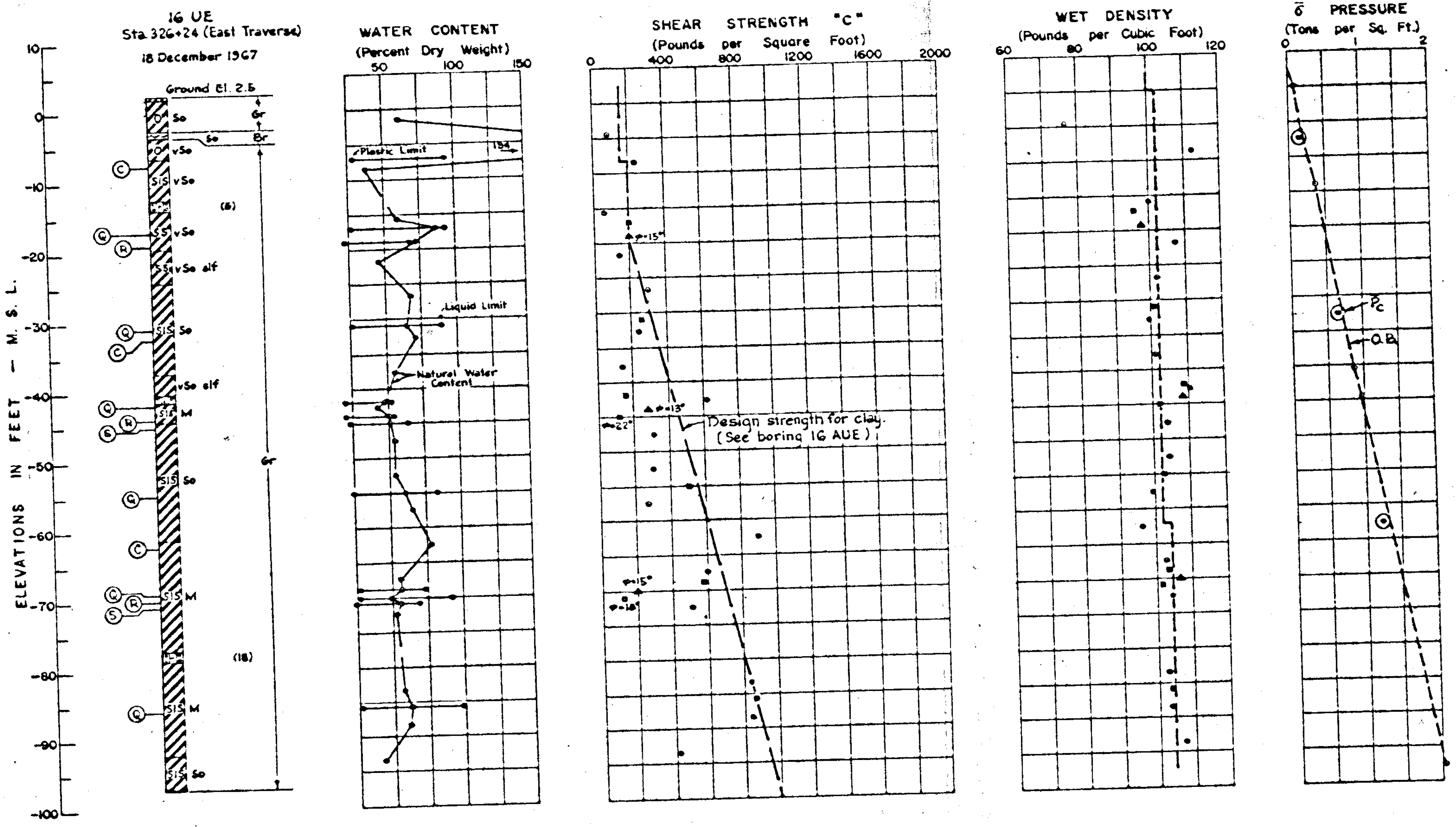
DETAIL SHEAR STRENGTH DATA
BORING 63 UW

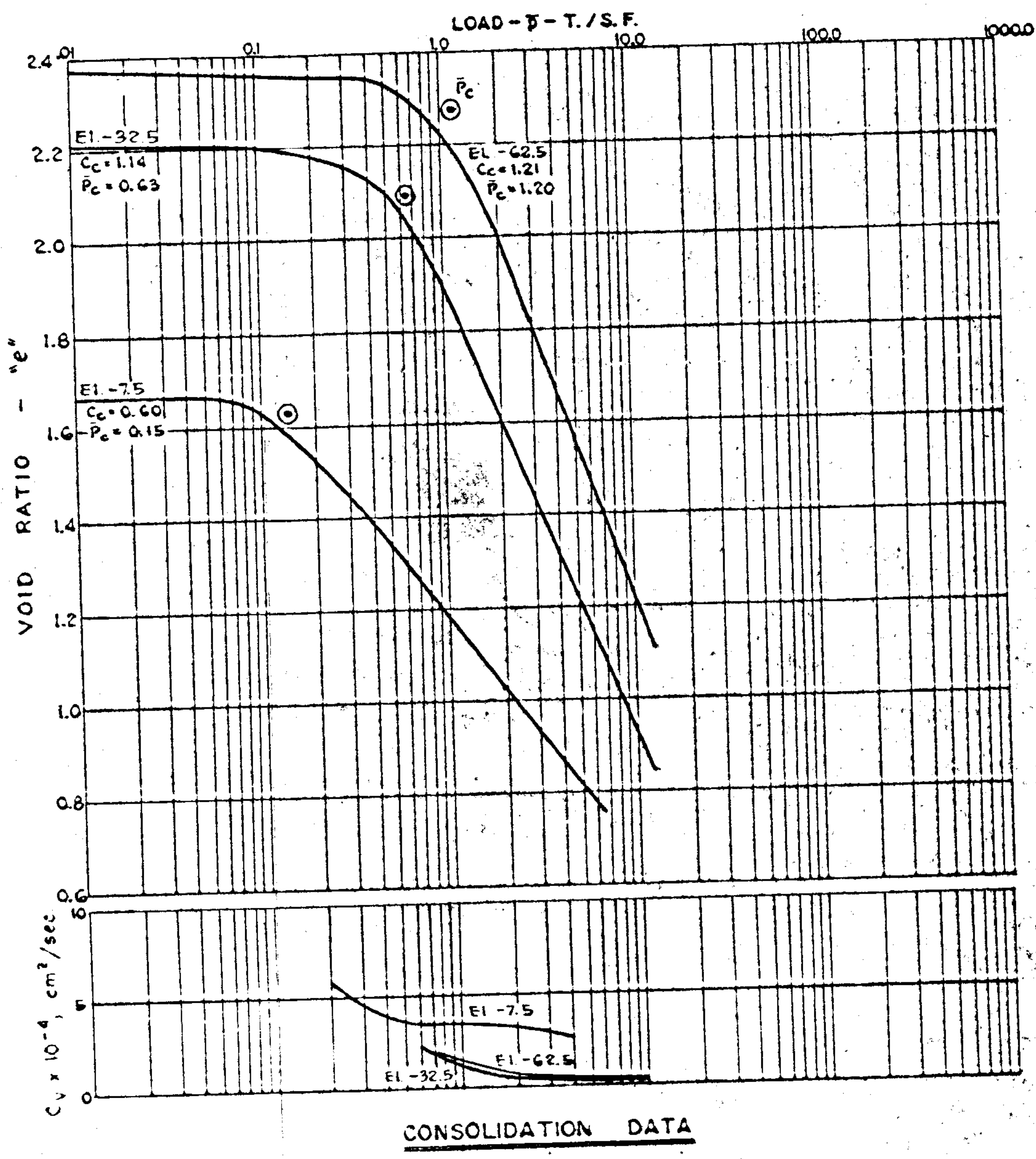
BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

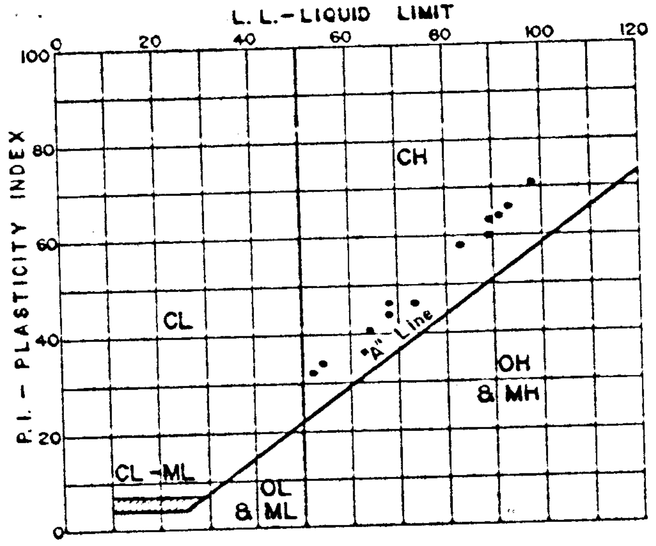
DATE: MARCH, 1972

FILE NO. H-2-24314

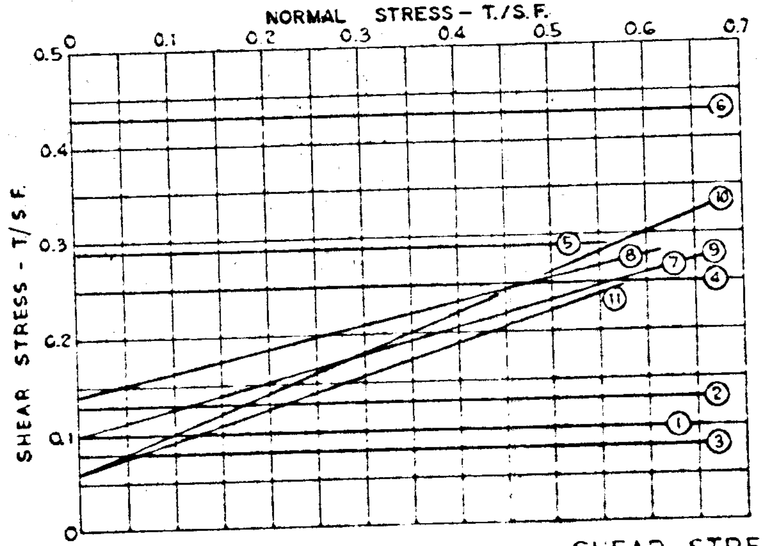




CONSOLIDATION DATA



PLASTICITY CHART



ENVELOPE		TYPE	STRENGTH		CLASS.
NO.	EL.		φ	c t.s.f.	
1	-17.0	Q	0	0.10	CH
2	-31.0			0.13	
3	-42.0			0.08	
4	-55.0			0.25	
5	-69.0			0.29	
6	-86.0			0.43	
7	-19.0	R	15°	0.10	CH
8	-44.0		13°	0.14	
9	-70.0		15°	0.10	
10	-45.0	S	22°	0.06	CH
11	-71.0		18°	0.06	

SHEAR STRENGTH DATA

For general notes see plate 46
For detail shear test data see plate 59
For location of boring see plate 6

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

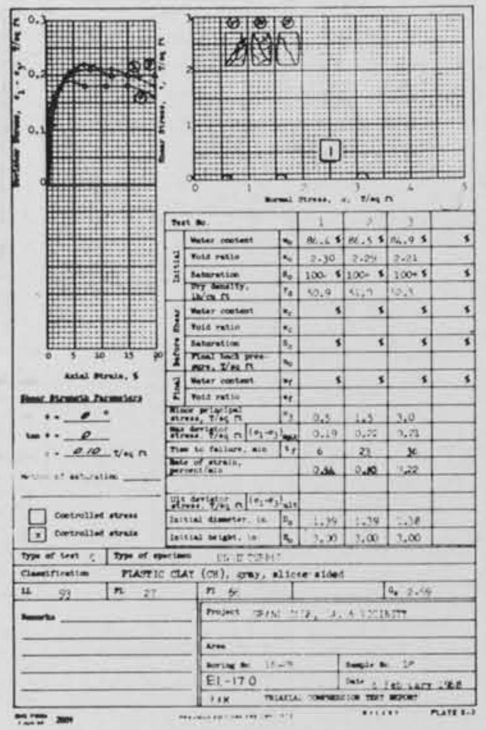
SOIL BORING 16 UE DATA

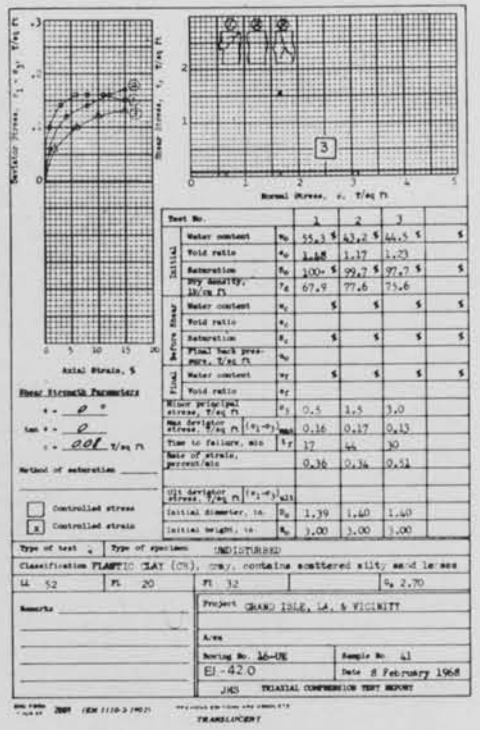
BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

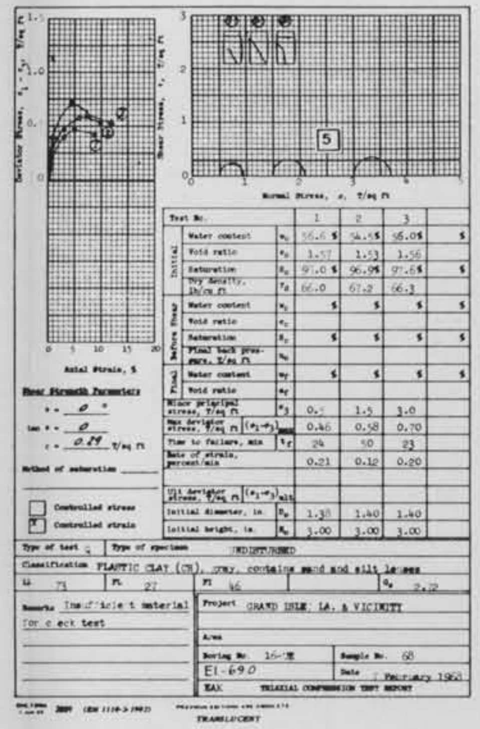
U.S. ARMY, ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

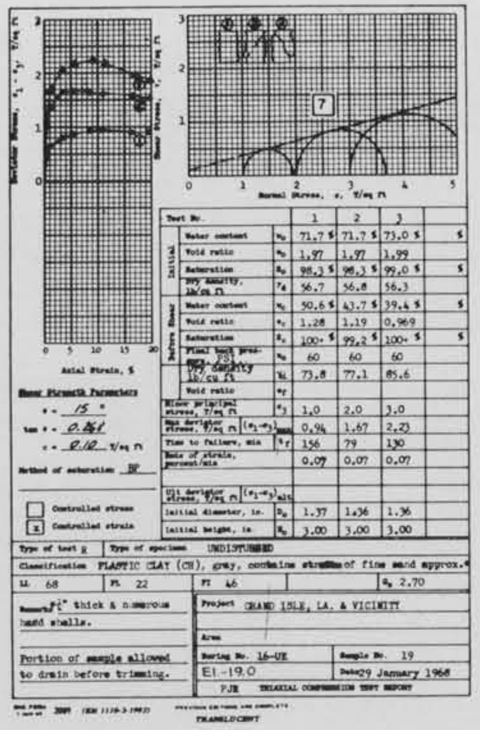
DATE: MARCH 1972
FILE NO. H-2-24314

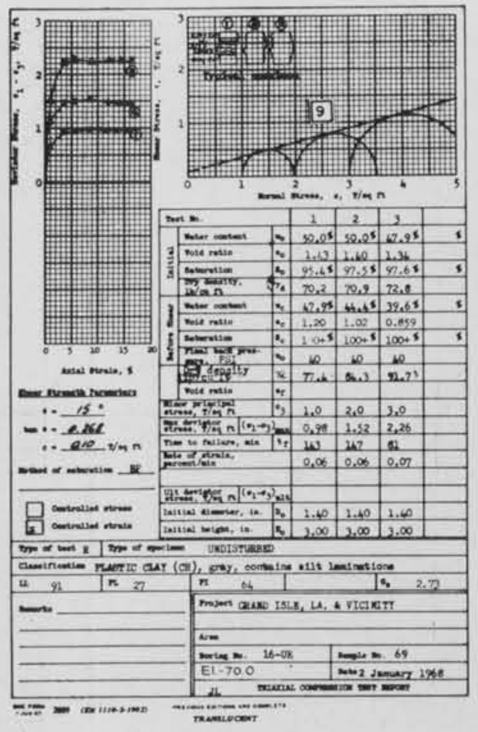
PLATE 58

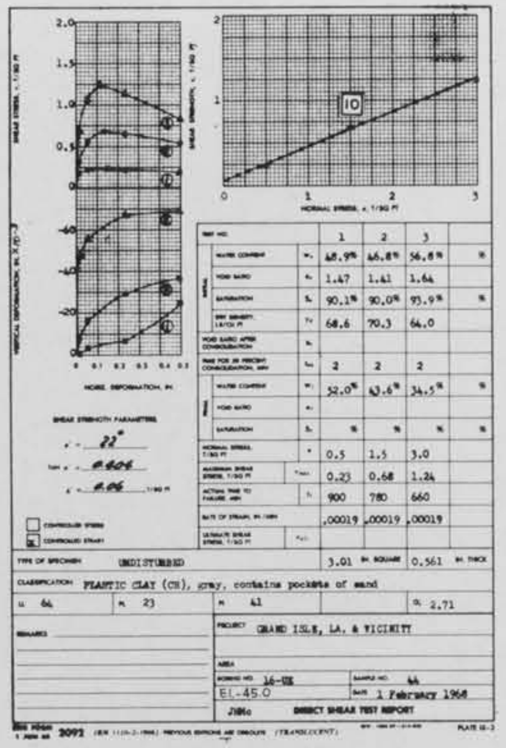


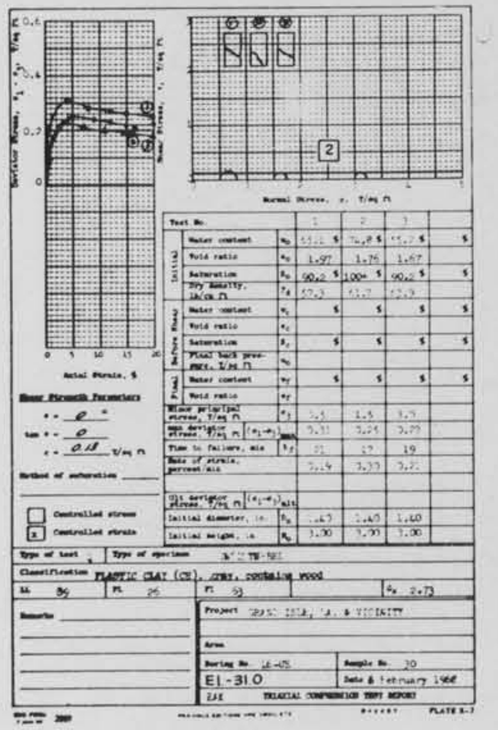


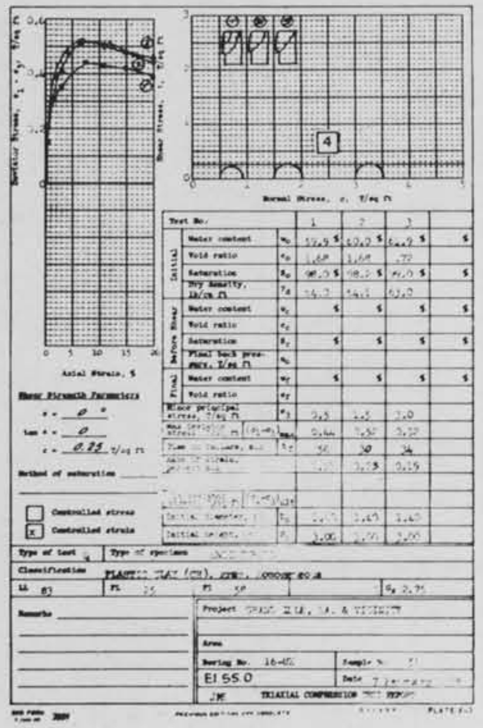


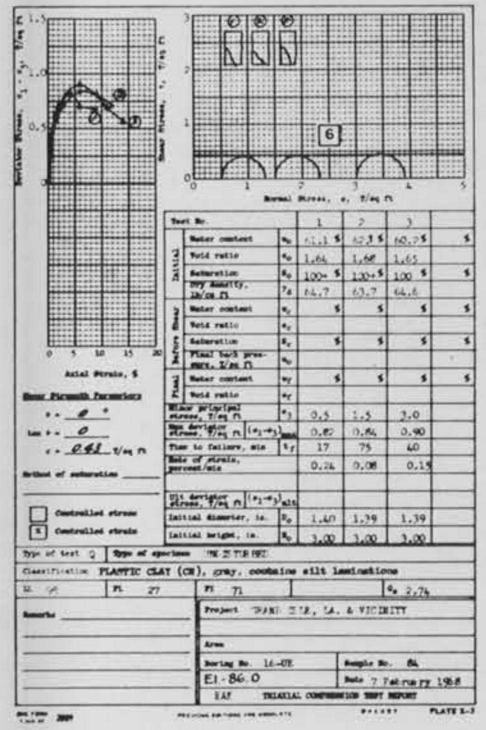


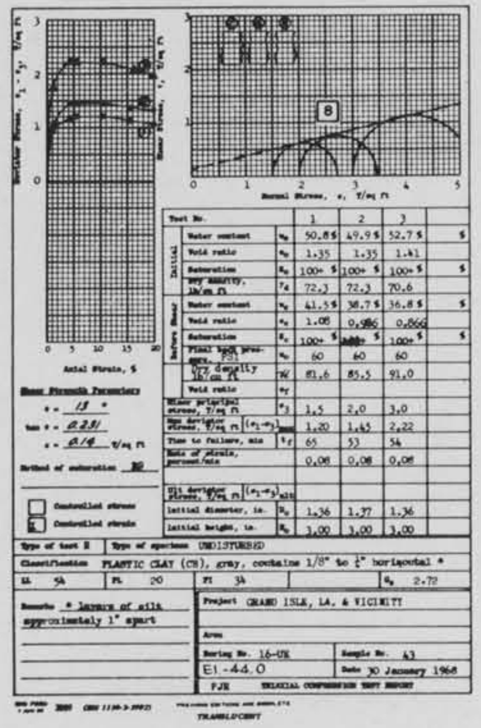


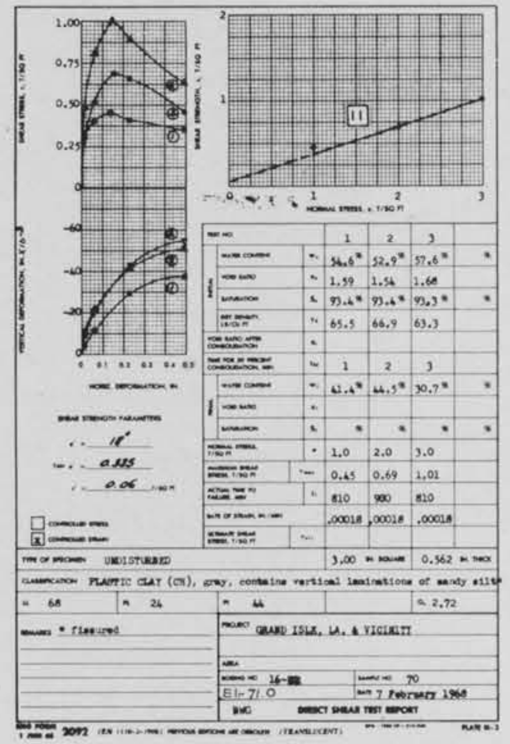












NOTE:

- 7 Indicates reference number shown under shear data on Plate 58
- (Q) - Unconsolidated - undrained triaxial compression test.
- (R) - Consolidated - undrained triaxial compression test.
- (S) - Consolidated - drained direct shear test.

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)

DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

DETAIL SHEAR STRENGTH DATA
BORING 16 UE

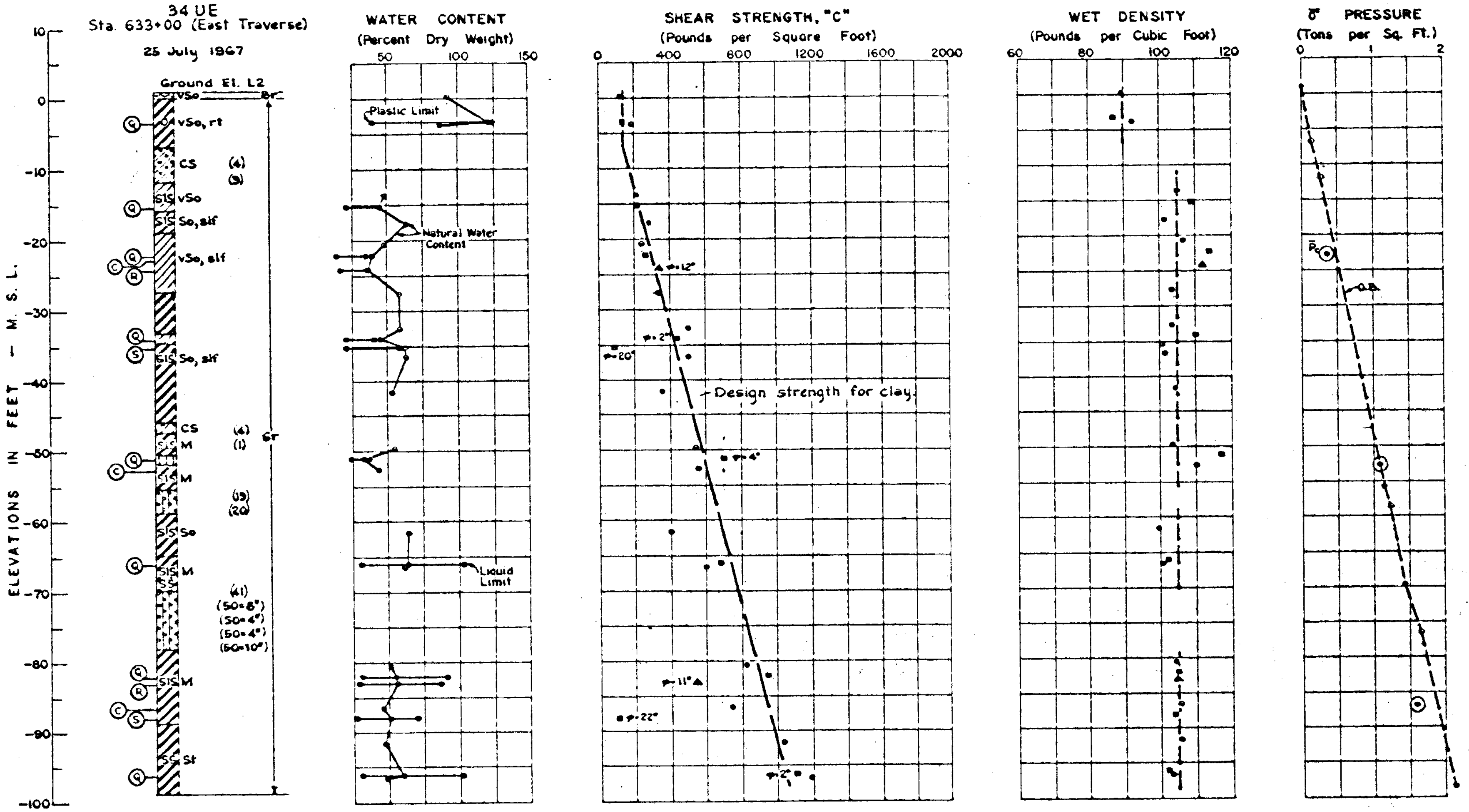
BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

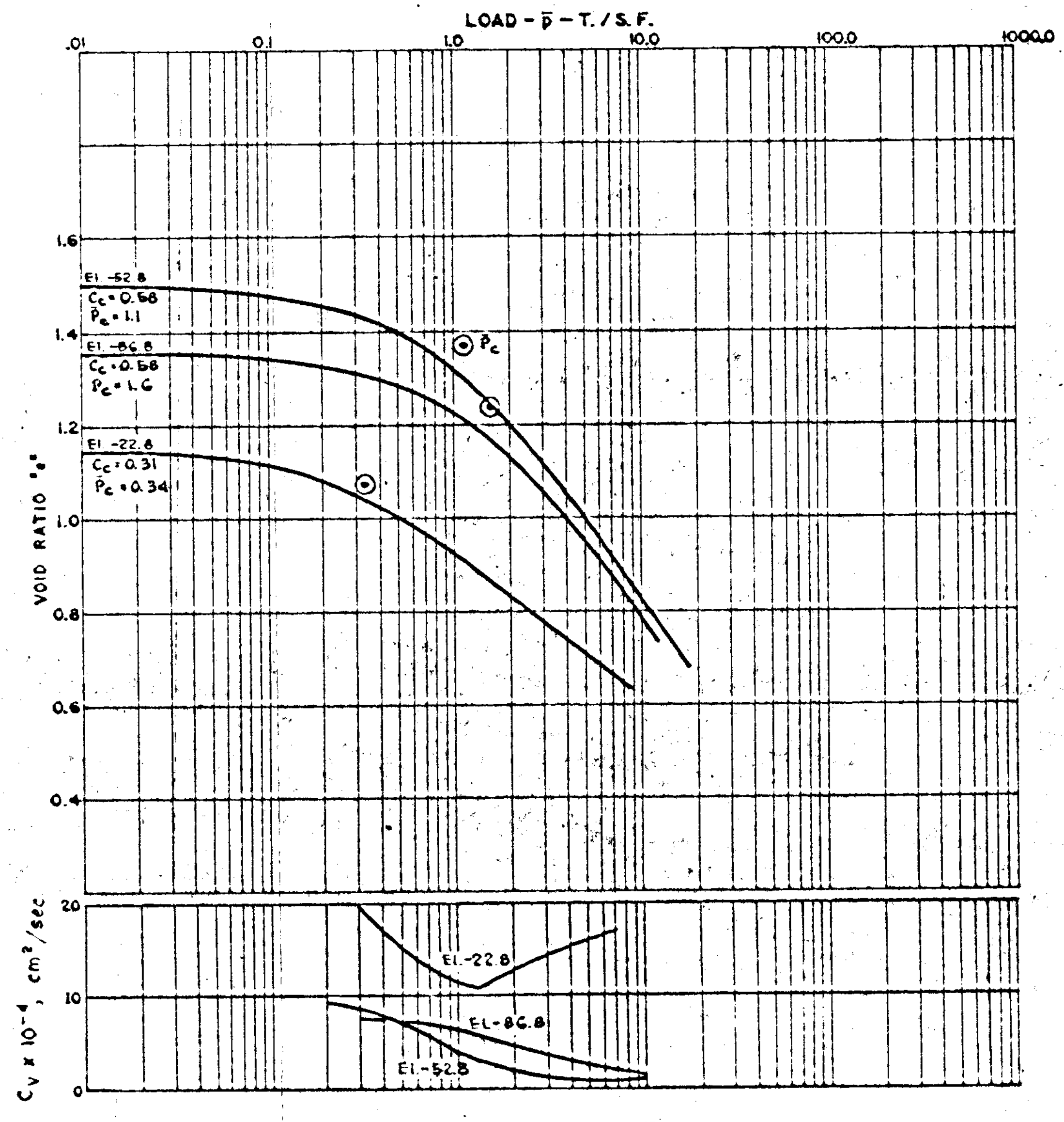
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

DATE: MARCH, 1972

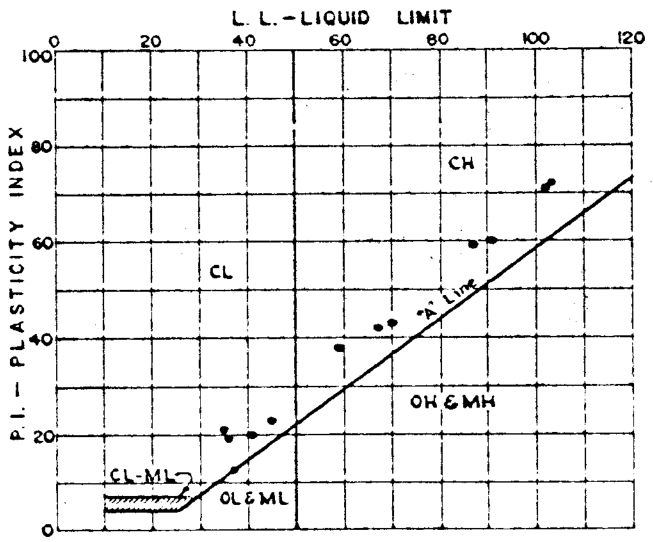
FILE NO. H-2-24314

PLATE 59

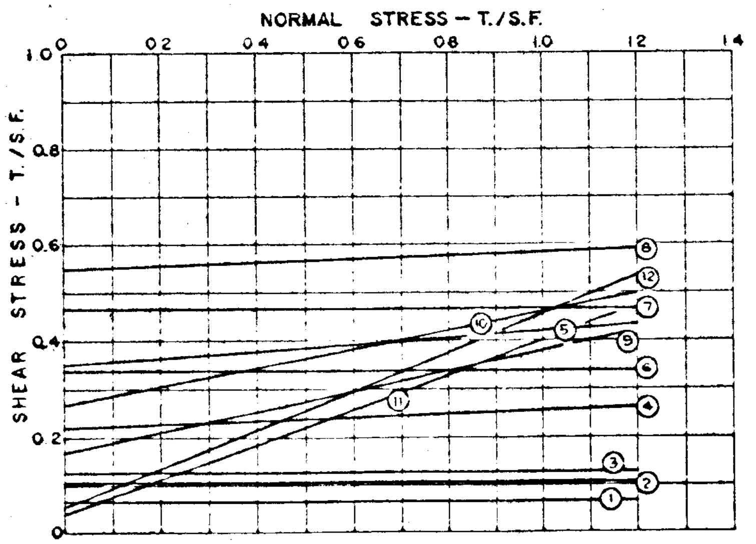




CONSOLIDATION DATA



PLASTICITY CHART



ENVELOPE		TYPE	STRENGTH		CLASS
NO.	EL.		φ	c (t.s.f.)	
1	- 3.3	Q	0	0.07	CH
2	-15.3		0	0.11	CL
3	-22.3		0	0.13	CL
4	-34.3		2	0.22	CL
5	-51.3		4	0.35	ML
6	-66.3		0	0.34	CH
7	-82.3		0	0.47	CH
8	-96.3		2	0.55	CH
9	-24.3	R	12	0.17	CL
10	-83.3		11	0.27	CH
11	-35.3	S	20	0.04	CH
12	-88.3		22	0.05	CH

SHEAR STRENGTH DATA

For general notes see plate 46
For detail shear test data see plate 61
For location of boring see plate 7

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

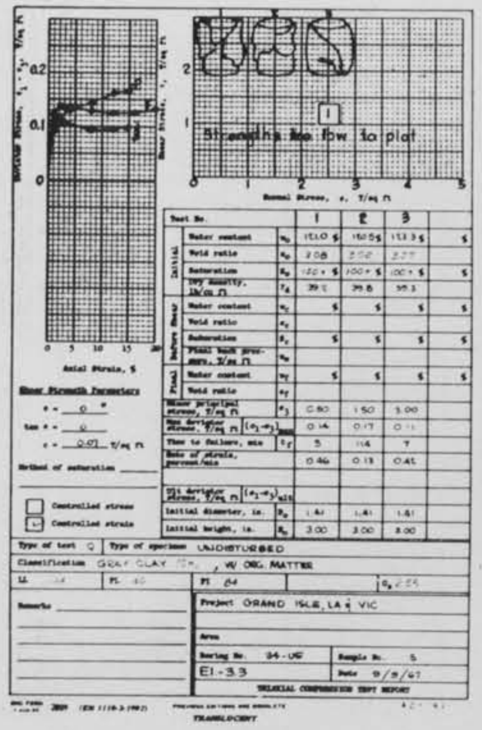
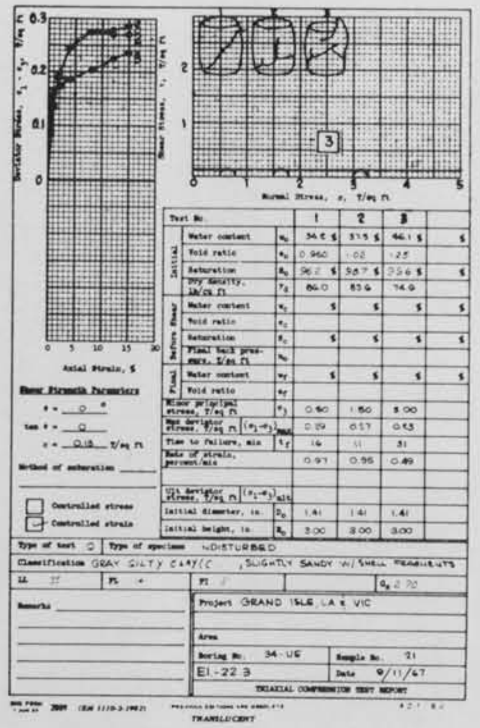
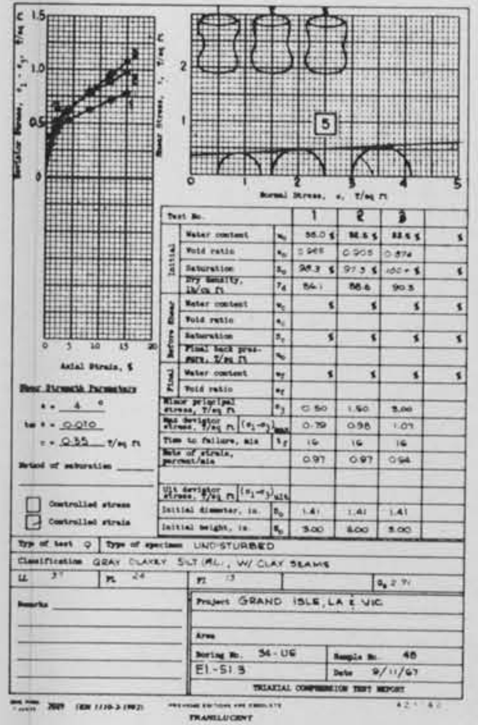
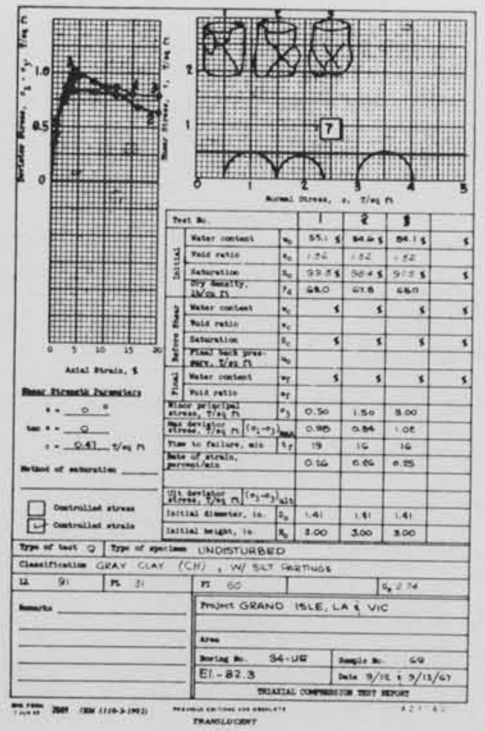
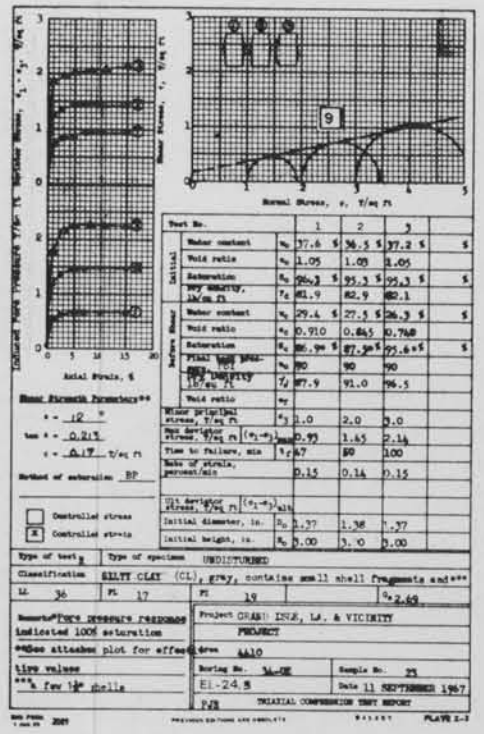
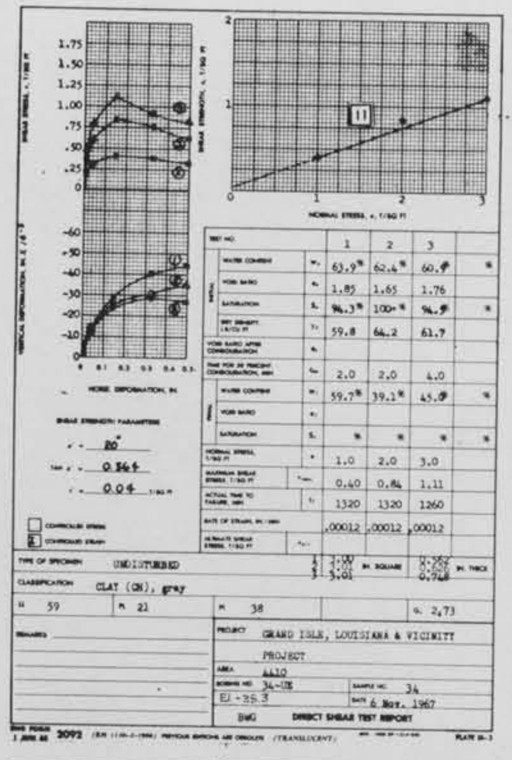
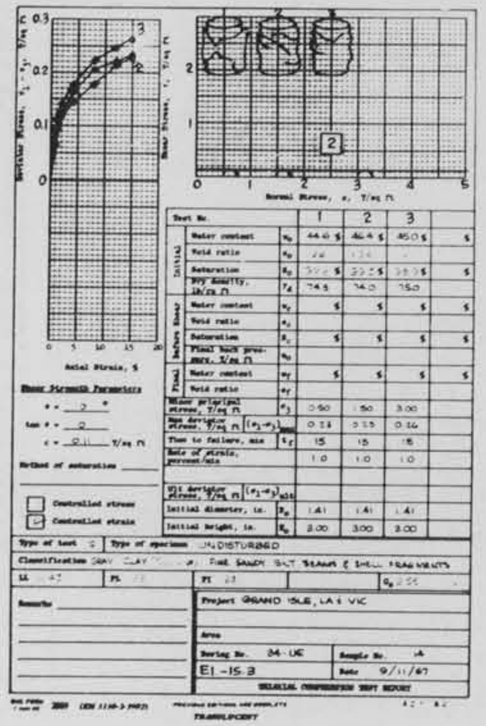
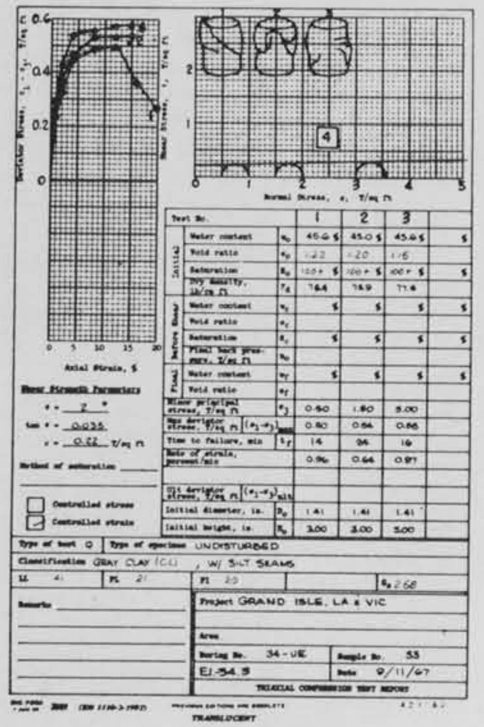
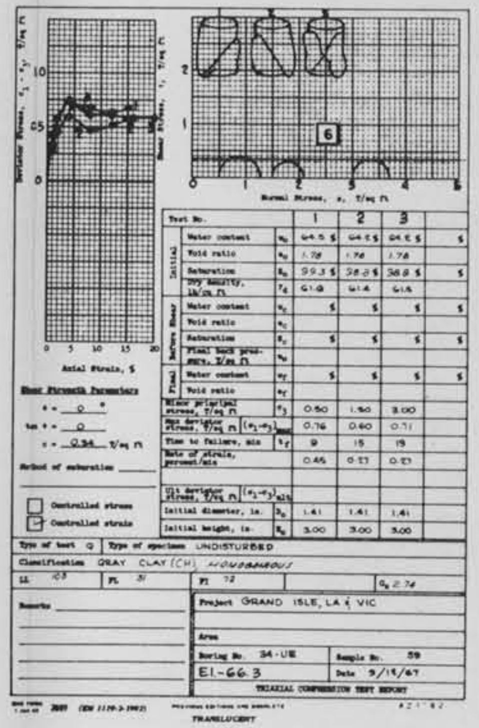
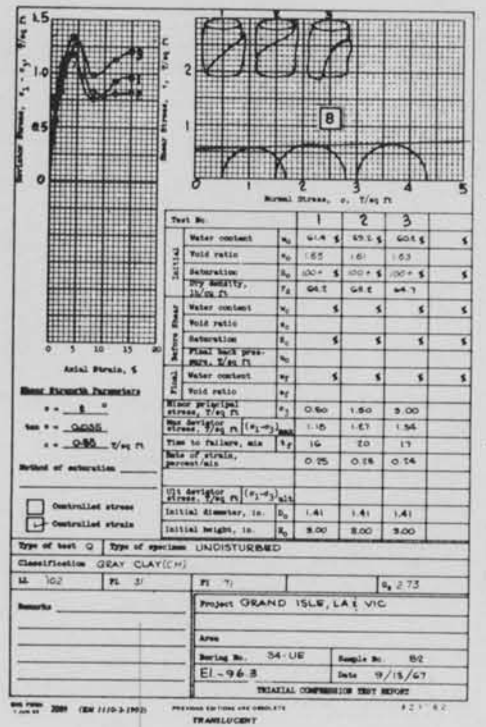
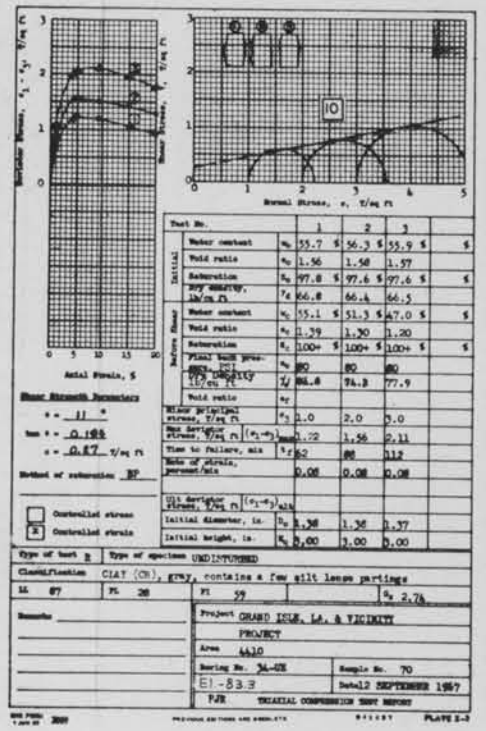
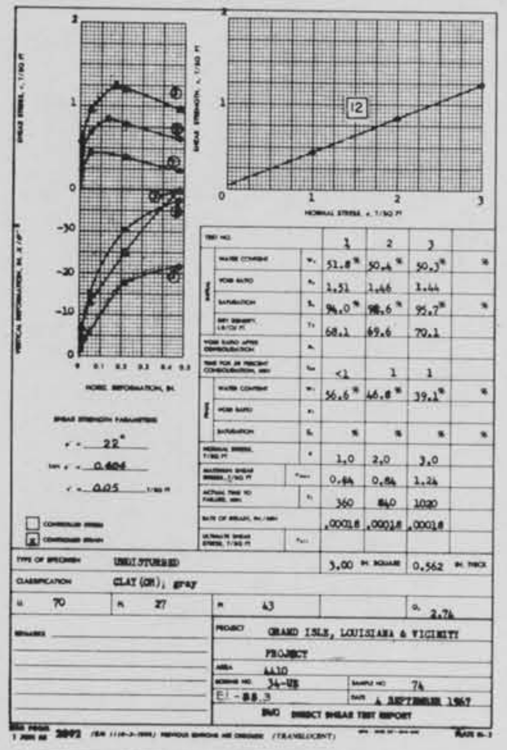
SOIL BORING 34UE DATA

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE: MARCH 1972
FILE NO. H-2-24314

PLATE 60

NOTE:

[7] Indicates reference number shown under shear data on Plate 60

(Q) – Unconsolidated – undrained triaxial compression test.

(R) – Consolidated – undrained triaxial compression test.

(S) – Consolidated – drained direct shear test.

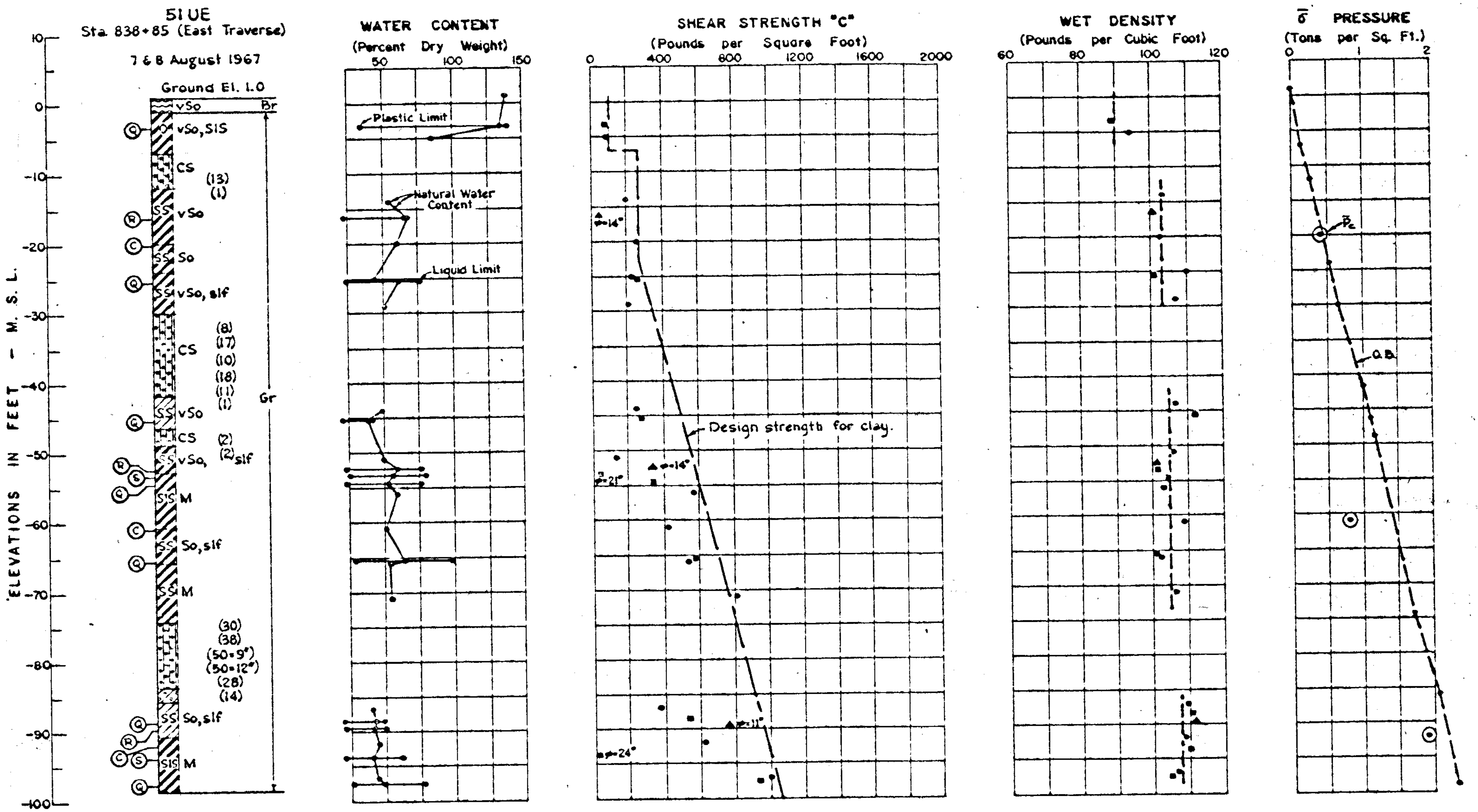
GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)

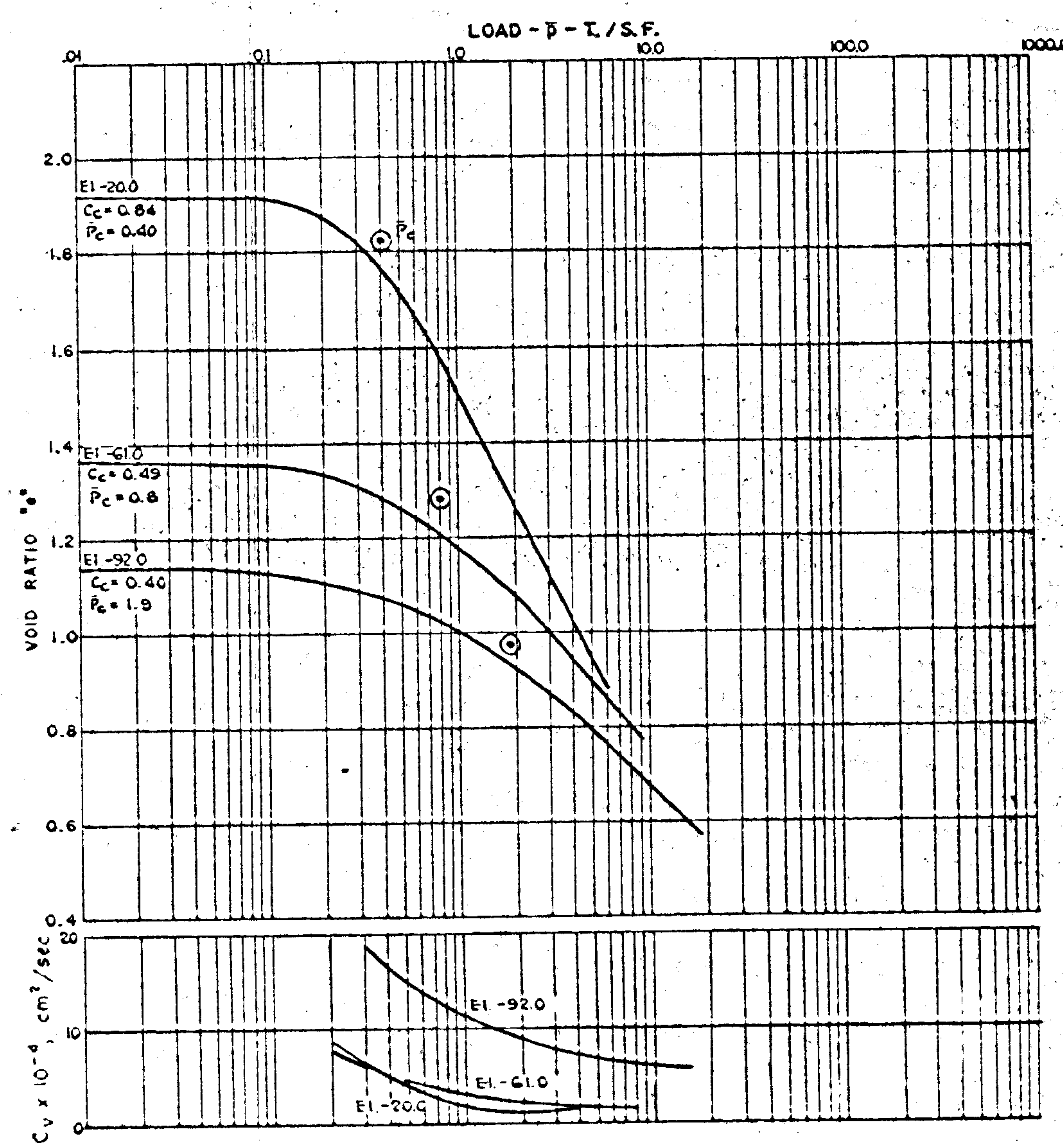
DESIGN MEMORANDUM NO. 1 – GENERAL DESIGN

DETAIL SHEAR STRENGTH DATA
BORING 34 UE

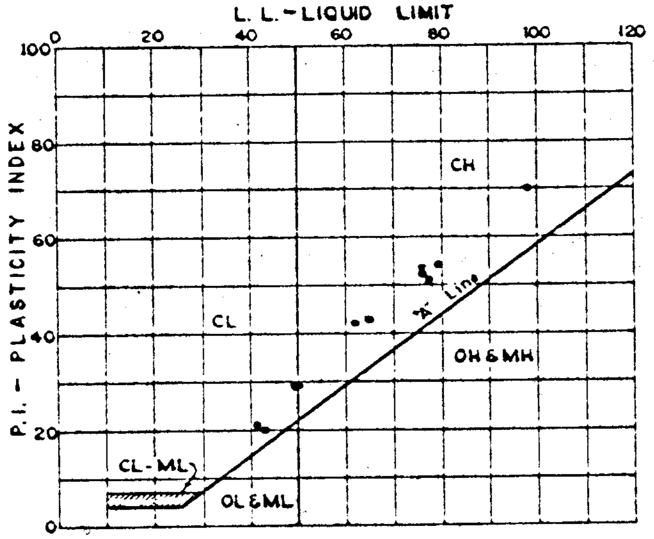
BARNARD AND BURK, INC. CONSULTING ENGINEERS BATON ROUGE, LA.	U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS
DATE: MARCH, 1972	FILE NO. H-2-24314

PLATE 61

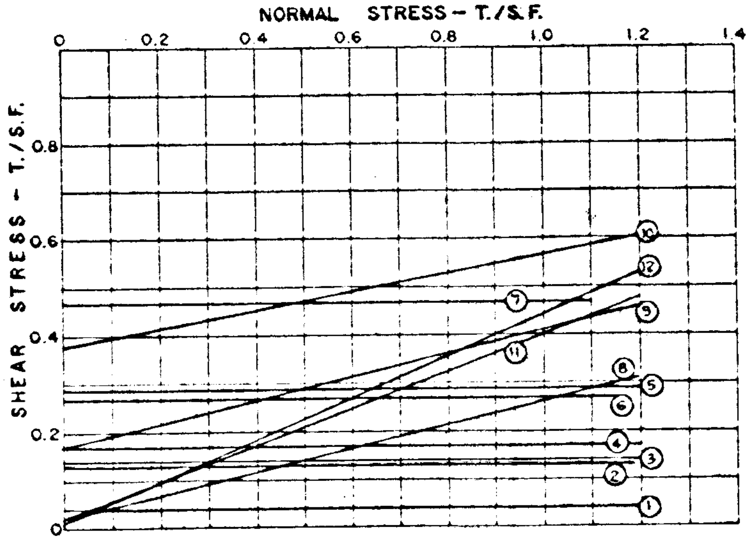




CONSOLIDATION DATA



PLASTICITY CHART



SHEAR STRENGTH DATA

ENVELOPE		TYPE	STRENGTH		CLASS
NO.	EL		φ	c (T.S.F.)	
1	-3.5	Q	0	0.04	CH
2	-25.5		0	0.13	CH
3	-45.5		0	0.14	CL
4	-54.5		0	0.17	CH
5	-65.5		0	0.29	CH
6	-88.5		0	0.27	CL
7	-97.5		0	0.47	CH
8	-16.5	R	14	0.02	CH
9	-52.5		14	0.17	CH
10	-89.5		11	0.38	CL
11	-53.5	S	21	0.02	CH
12	-93.5		24	0.01	CH

For general notes see plate 46
For detail shear test data see plate 63
For location of boring see plate 9

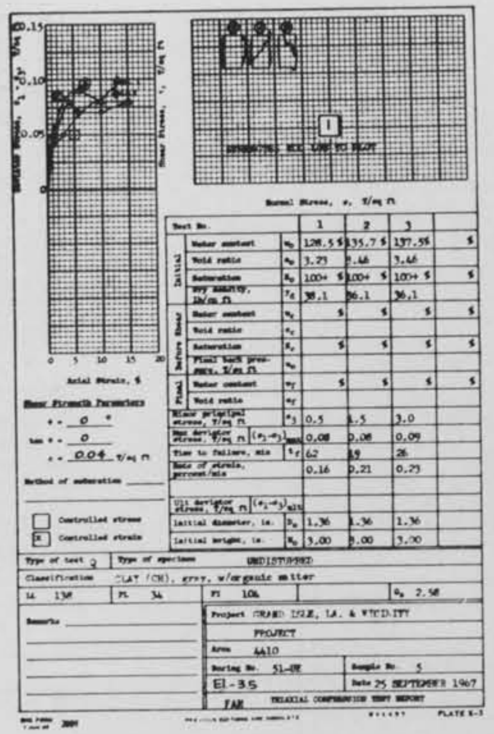
GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

SOIL BORING 51 UE DATA

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

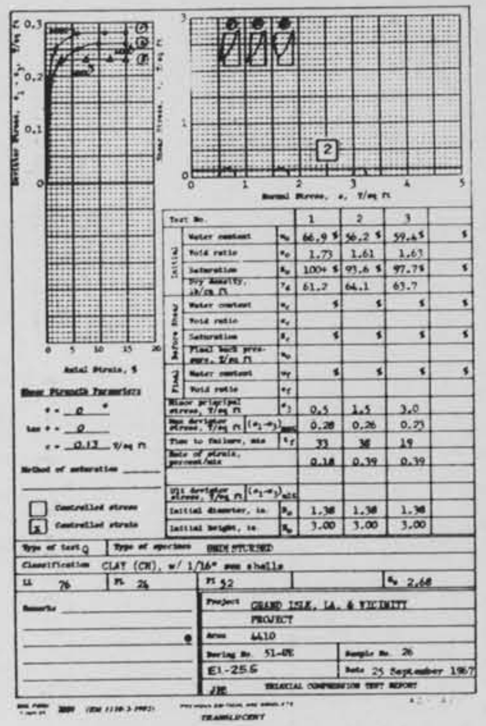
DATE: MARCH 1972
FILE NO. H-2-24314



Shear Strength Parameters
φ = 0°
tan φ = 0
c = 0.04 T/sq ft
Method of saturation
☐ Controlled stress
☒ Controlled strain

Test No.			1	2	3	
Initial	Water content	w_o	128.5 %	135.7 %	137.5 %	%
	Void ratio	e_o	3.23	3.46	3.46	
	Saturation	S_o	100+ %	100+ %	100+ %	%
	Dry density, lb/cu ft	γ_d	38.1	36.1	36.1	
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		$(\sigma_1-\sigma_3)_{max}$	0.08	0.08	0.09	
Time to failure, min		t_f	62	39	26	
Rate of strain, percent/min			0.16	0.21	0.23	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.36	1.36	1.36	
Initial height, in.		H_o	3.00	3.00	3.00	

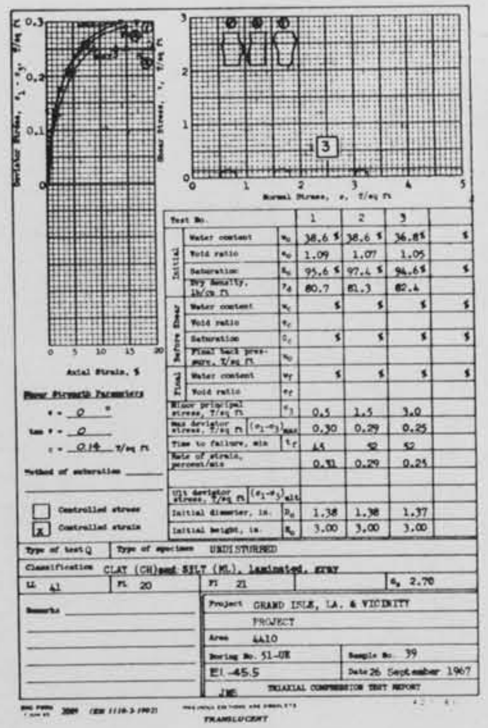
Type of test Q | Type of specimen UNDISTURBED
Classification CLAY (CH), gray, w/organic matter
LL 138 | PL 34 | PI 104 | G_s 2.58
Remarks
Project GRAND ISLE, LA. & VICINITY PROJECT
Area 4410
Boring No. 51-UE | Sample No. 5
El-35 | Date 25 SEPTEMBER 1967
FAH TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 PREVIOUS EDITIONS ARE OBSOLETE



Shear Strength Parameters
φ = 0°
tan φ = 0
c = 0.13 T/sq ft
Method of saturation
☐ Controlled stress
☒ Controlled strain

Test No.			1	2	3	
Initial	Water content	w_o	66.9 %	56.2 %	59.4 %	%
	Void ratio	e_o	1.73	1.61	1.63	
	Saturation	S_o	100+ %	93.6 %	97.7 %	%
	Dry density, lb/cu ft	γ_d	61.2	64.1	63.7	
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	0.26	0.23	
Time to failure, min		t_f	33	38	19	
Rate of strain, percent/min			0.18	0.39	0.39	
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	

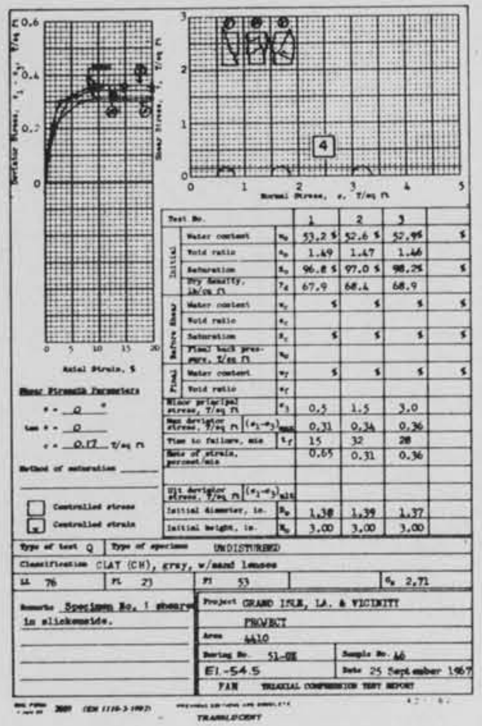
Type of test Q | Type of specimen UNDISTURBED
Classification CLAY (CH), w/ 1/16" sea shells
LL 76 | PL 24 | PI 52 | G_s 2.68
Remarks
Project GRAND ISLE, LA. & VICINITY PROJECT
Area 4410
Boring No. 51-UE | Sample No. 26
El-25.6 | Date 25 September 1967
JHE TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



Shear Strength Parameters
φ = 0°
tan φ = 0
c = 0.14 T/sq ft
Method of saturation
☐ Controlled stress
☒ Controlled strain

Test No.			1	2	3	
Initial	Water content	w_o	38.6 %	38.6 %	36.8 %	%
	Void ratio	e_o	1.09	1.07	1.05	
	Saturation	S_o	95.6 %	97.4 %	94.6 %	%
	Dry density, lb/cu ft	γ_d	80.7	81.3	82.4	
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	0.5	1.5	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.30	0.29	0.25	
Time to failure, min		t_f	45	52	52	
Rate of strain, percent/min			0.31	0.29	0.25	
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	

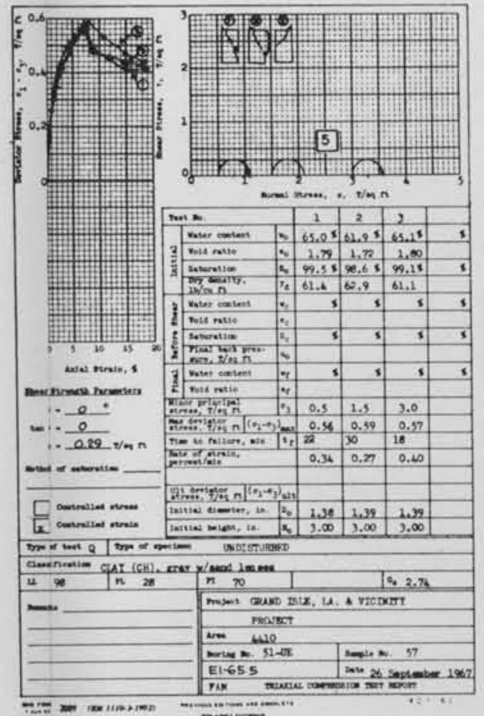
Type of test Q | Type of specimen UNDISTURBED
Classification CLAY (CH) and SILT (ML), laminated, gray
LL 41 | PL 20 | PI 21 | G_s 2.70
Remarks
Project GRAND ISLE, LA. & VICINITY PROJECT
Area 4410
Boring No. 51-UE | Sample No. 39
El-45.5 | Date 26 September 1967
JHE TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



Shear Strength Parameters
φ = 0°
tan φ = 0
c = 0.17 T/sq ft
Method of saturation
☐ Controlled stress
☒ Controlled strain

Test No.			1	2	3	
Initial	Water content	w_o	53.2 %	52.6 %	52.9 %	%
	Void ratio	e_o	1.49	1.47	1.46	
	Saturation	S_o	96.8 %	97.0 %	98.2 %	%
	Dry density, lb/cu ft	γ_d	67.9	68.4	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		$(\sigma_1-\sigma_3)_{max}$	0.31	0.34	0.36	
Time to failure, min		t_f	15	32	28	
Rate of strain, percent/min			0.65	0.31	0.36	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.38	1.39	1.37	
Initial height, in.		H_o	3.00	3.00	3.00	

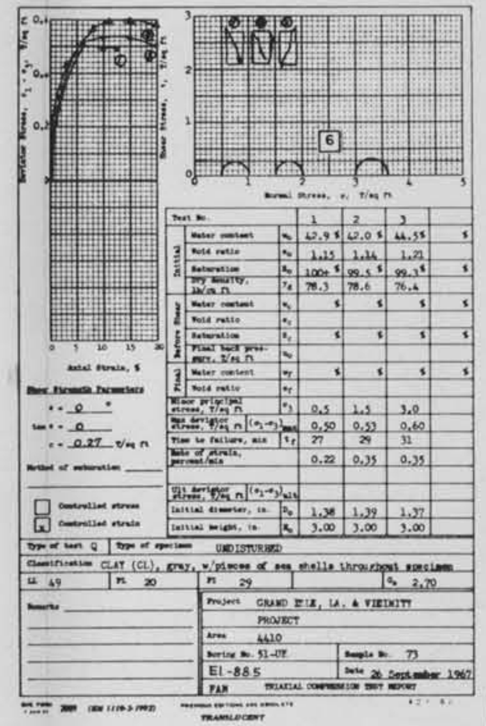
Type of test Q | Type of specimen UNDISTURBED
Classification CLAY (CH), gray, w/sand lenses
LL 76 | PL 23 | PI 53 | G_s 2.71
Remarks Specimen No. 1 sheared in slickenside.
Project GRAND ISLE, LA. & VICINITY PROJECT
Area 4410
Boring No. 51-UE | Sample No. 46
El-54.5 | Date 25 September 1967
FAH TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



Shear Strength Parameters
φ = 0°
tan φ = 0
c = 0.29 T/sq ft
Method of saturation
☐ Controlled stress
☒ Controlled strain

Test No.			1	2	3	
Initial	Water content	w_o	65.0 %	61.9 %	65.1 %	%
	Void ratio	e_o	1.79	1.72	1.80	
	Saturation	S_o	99.5 %	98.6 %	99.1 %	%
	Dry density, lb/cu ft	γ_d	61.4	62.9	61.1	
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		$(\sigma_1-\sigma_3)_{max}$	0.56	0.59	0.57	
Time to failure, min		t_f	22	30	18	
Rate of strain, percent/min			0.34	0.27	0.40	
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	

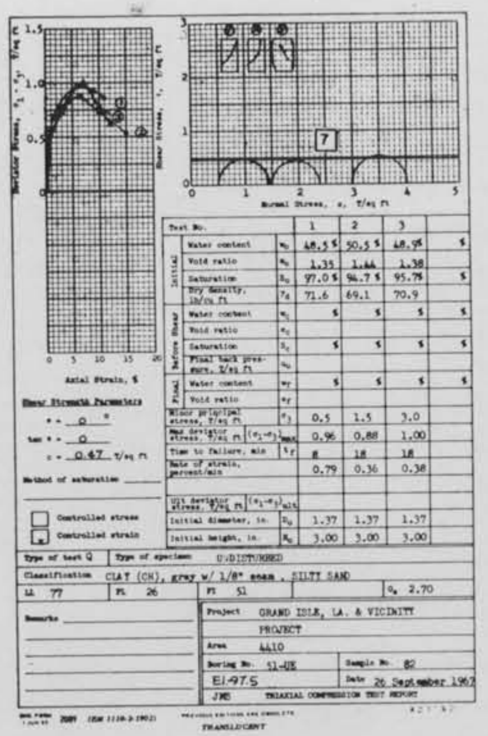
Type of test Q | Type of specimen UNDISTURBED
Classification CLAY (CH), gray w/sand lenses
LL 98 | PL 28 | PI 70 | G_s 2.74
Remarks
Project GRAND ISLE, LA. & VICINITY PROJECT
Area 4410
Boring No. 51-UE | Sample No. 57
El-65.5 | Date 26 September 1967
FAH TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



Shear Strength Parameters
φ = 0°
tan φ = 0
c = 0.27 T/sq ft
Method of saturation
☐ Controlled stress
☒ Controlled strain

Test No.			1	2	3	
Initial	Water content	w_o	42.9 %	42.0 %	44.5 %	%
	Void ratio	e_o	1.15	1.14	1.21	
	Saturation	S_o	100+ %	99.5 %	99.3 %	%
	Dry density, lb/cu ft	γ_d	78.3	78.6	76.4	
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	0.5	1.5	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.50	0.53	0.60	
Time to failure, min		t_f	27	29	31	
Rate of strain, percent/min			0.22	0.35	0.35	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.38	1.39	1.37	
Initial height, in.		H_o	3.00	3.00	3.00	

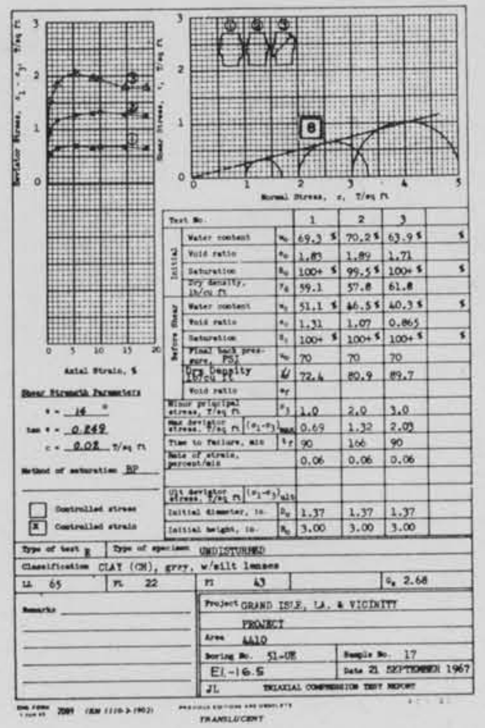
Type of test Q | Type of specimen UNDISTURBED
Classification CLAY (CL), gray, w/pieces of sea shells throughout specimen
LL 49 | PL 20 | PI 29 | G_s 2.70
Remarks
Project GRAND ISLE, LA. & VICINITY PROJECT
Area 4410
Boring No. 51-UE | Sample No. 73
El-88.5 | Date 26 September 1967
FAH TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



Shear Strength Parameters
φ = 0°
tan φ = 0
c = 0.47 T/sq ft
Method of saturation
☐ Controlled stress
☒ Controlled strain

Test No.			1	2	3	
Initial	Water content	w_o	48.5 %	50.5 %	48.9 %	%
	Void ratio	e_o	1.35	1.44	1.38	
	Saturation	S_o	97.0 %	94.7 %	95.7 %	%
	Dry density, lb/cu ft	γ_d	71.6	69.1	70.9	
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		$(\sigma_1-\sigma_3)_{max}$	0.96	0.88	1.00	
Time to failure, min		t_f	8	18	18	
Rate of strain, percent/min			0.79	0.36	0.38	
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	

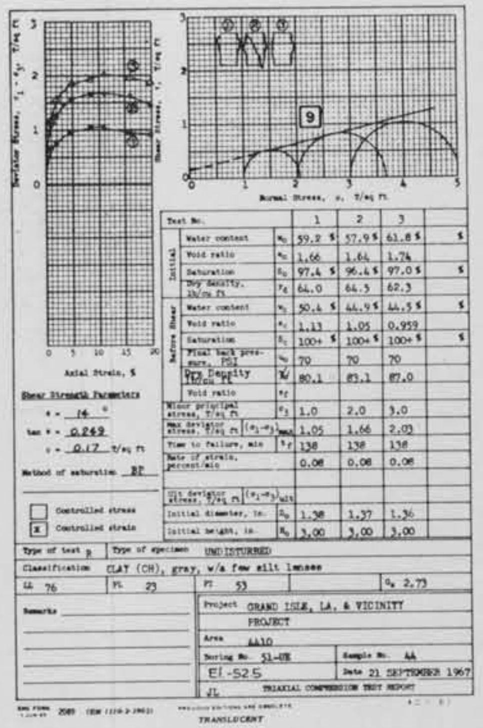
Type of test Q | Type of specimen UNDISTURBED
Classification CLAY (CH), gray w/ 1/8" seam, SILTY SAND
LL 77 | PL 26 | PI 51 | G_s 2.70
Remarks
Project GRAND ISLE, LA. & VICINITY PROJECT
Area 4410
Boring No. 51-UE | Sample No. 82
El-97.5 | Date 26 September 1967
JHE TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



Shear Strength Parameters
φ = 14°
tan φ = 0.249
c = 0.08 T/sq ft
Method of saturation BP
☐ Controlled stress
☒ Controlled strain

Test No.			1	2	3	
Initial	Water content	w_o	69.3 %	70.2 %	63.9 %	%
	Void ratio	e_o	1.83	1.89	1.71	
	Saturation	S_o	100+ %	99.5 %	100+ %	%
	Dry density, lb/cu ft	γ_d	59.1	57.8	61.8	
Before Shear	Water content	w_c	51.1 %	46.5 %	40.3 %	%
	Void ratio	e_c	1.31	1.07	0.865	
	Saturation	S_c	100+ %	100+ %	100+ %	%
	Final back pressure, PSI	u_o	70	70	70	
Final	Dry Density lb/cu ft	γ_d	72.4	80.9	89.7	
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	1.0	2.0	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.69	1.32	2.03	
Time to failure, min		t_f	90	166	90	
Rate of strain, percent/min			0.06	0.06	0.06	
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	

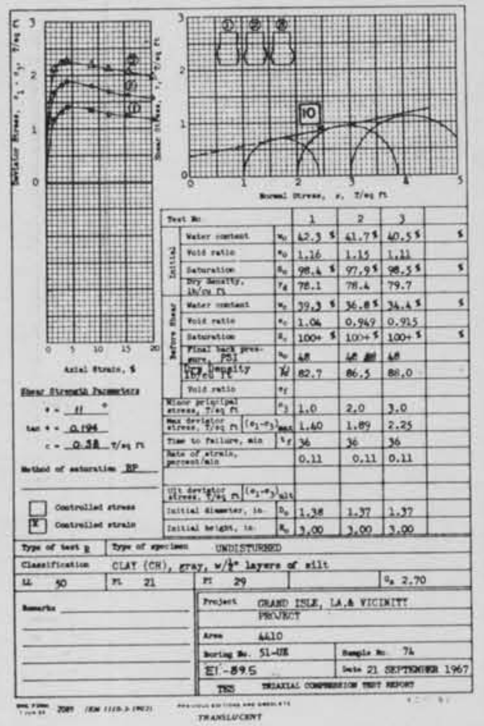
Type of test R | Type of specimen UNDISTURBED
Classification CLAY (CH), gray, w/silt lenses
LL 65 | PL 22 | PI 43 | G_s 2.68
Remarks
Project GRAND ISLE, LA. & VICINITY PROJECT
Area 4410
Boring No. 51-UE | Sample No. 17
El-16.5 | Date 21 SEPTEMBER 1967
JL TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



Shear Strength Parameters
φ = 14°
tan φ = 0.249
c = 0.17 T/sq ft
Method of saturation BP
☐ Controlled stress
☒ Controlled strain

Test No.			1	2	3	
Initial	Water content	w_o	59.2 %	57.9 %	61.8 %	%
	Void ratio	e_o	1.66	1.64	1.74	
	Saturation	S_o	97.4 %	96.4 %	97.0 %	%
	Dry density, lb/cu ft	γ_d	64.0	64.5	62.3	
Before Shear	Water content	w_c	50.4 %	44.9 %	44.5 %	%
	Void ratio	e_c	1.13	1.05	0.959	
	Saturation	S_c	100+ %	100+ %	100+ %	%
	Final back pressure, PSI	u_o	70	70	70	
Final	Dry Density lb/cu ft	γ_d	80.1	83.1	87.0	
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	1.0	2.0	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	1.05	1.66	2.03	
Time to failure, min		t_f	138	138	138	
Rate of strain, percent/min			0.08	0.08	0.08	
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	

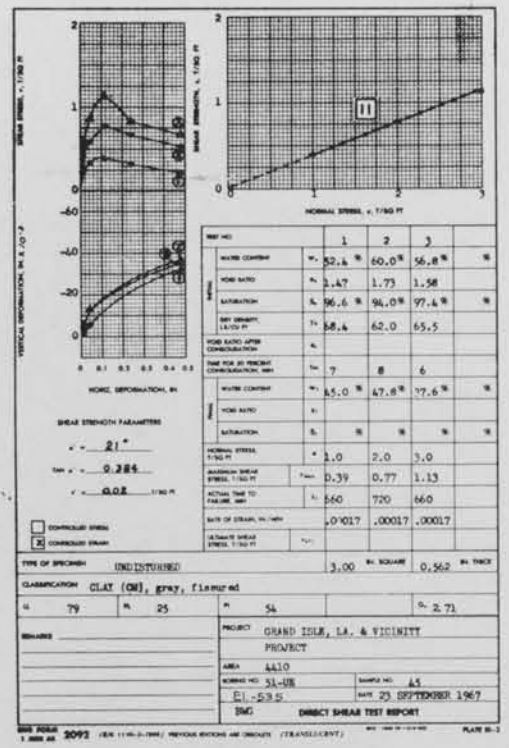
Type of test R | Type of specimen UNDISTURBED
Classification CLAY (CH), gray, w/a few silt lenses
LL 76 | PL 23 | PI 53 | G_s 2.73
Remarks
Project GRAND ISLE, LA. & VICINITY PROJECT
Area 4410
Boring No. 51-UE | Sample No. 44
El-52.5 | Date 21 SEPTEMBER 1967
JL TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



Shear Strength Parameters
φ = 11°
tan φ = 0.194
c = 0.38 T/sq ft
Method of saturation BP
☐ Controlled stress
☒ Controlled strain

Test No.			1	2	3	
Initial	Water content	w_o	42.3 %	41.7 %	40.5 %	%
	Void ratio	e_o	1.16	1.15	1.11	
	Saturation	S_o	98.4 %	97.9 %	98.5 %	%
	Dry density, lb/cu ft	γ_d	78.1	78.4	79.7	
Before Shear	Water content	w_c	39.3 %	36.8 %	34.4 %	%
	Void ratio	e_c	1.04	0.949	0.915	
	Saturation	S_c	100+ %	100+ %	100+ %	%
	Final back pressure, PSI	u_o	48	48	48	
Final	Dry Density lb/cu ft	γ_d	82.7	86.5	88.0	
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	1.0	2.0	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	1.40	1.89	2.25	
Time to failure, min		t_f	36	36	36	
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	1.38	1.37	1.37	
Initial height, in.		H_o	3.00	3.00	3.00	

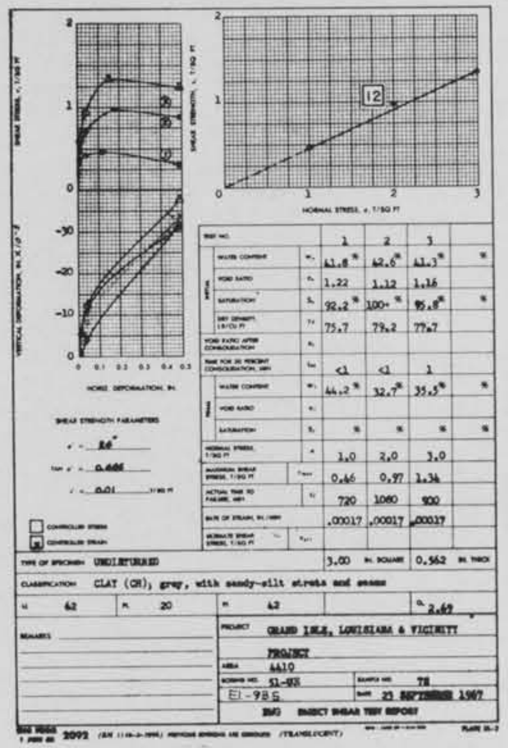
Type of test R | Type of specimen UNDISTURBED
Classification CLAY (CH), gray, w/½" layers of silt
LL 50 | PL 21 | PI 29 | G_s 2.70
Remarks
Project GRAND ISLE, LA.& VICINITY PROJECT
Area 4410
Boring No. 51-UE | Sample No. 74
El-89.5 | Date 21 SEPTEMBER 1967
TBS TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



SHEAR STRENGTH PARAMETERS
φ = 21°
TAN φ = 0.384
c = 0.02 T/SQ FT
☐ CONTROLLED STRESS
☒ CONTROLLED STRAIN

TEST NO.			1	2	3	
INITIAL	WATER CONTENT	w_o	52.4 %	60.0 %	56.8 %	%
	VOID RATIO	e_o	1.47	1.73	1.58	
	SATURATION	S_o	96.6 %	94.0 %	97.4 %	%
	DRY DENSITY, LB/CU FT	γ_d	68.4	62.0	65.5	
VOID RATIO AFTER CONSOLIDATION		e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN		t_{50}	7	8	6	
FINAL	WATER CONTENT	w_f	45.0 %	47.8 %	37.6 %	%
	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}	0.39	0.77	1.13	
ACTUAL TIME TO FAILURE, MIN		t_f	660	720	660	
RATE OF STRAIN, IN./MIN			.00017	.00017	.00017	
ULTIMATE SHEAR STRESS, T/SQ FT		τ_{ult}				

TYPE OF SPECIMEN UNDISTURBED | 3.00 IN. SQUARE | 0.562 IN. THICK
CLASSIFICATION CLAY (CH), gray, fissured
LL 79 | PL 25 | PI 54 | G_s 2.71
REMARKS
PROJECT GRAND ISLE, LA. & VICINITY PROJECT
AREA 4410
BORING NO. 51-UE | SAMPLE NO. 45
El-53.5 | DATE 23 SEPTEMBER 1967
BWG DIRECT SHEAR TEST REPORT
ENG FORM 2092 (TRANSLUCENT)



SHEAR STRENGTH PARAMETERS
φ = 26°
TAN φ = 0.488
c = 0.01 T/SQ FT
☐ CONTROLLED STRESS
☒ CONTROLLED STRAIN

TEST NO.			1	2	3	
INITIAL	WATER CONTENT	w_o	41.8 %	42.6 %	41.3 %	%
	VOID RATIO	e_o	1.22	1.12	1.16	
	SATURATION	S_o	92.2 %	100+ %	95.8 %	%
	DRY DENSITY, LB/CU FT	γ_d	75.7	79.2	77.7	
VOID RATIO AFTER CONSOLIDATION		e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN		t_{50}	<1	<1	1	
FINAL	WATER CONTENT	w_f	44.2 %	32.7 %	35.5 %	%
	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}	0.46	0.97	1.34	
ACTUAL TIME TO FAILURE, MIN		t_f	720	1080	900	
RATE OF STRAIN, IN./MIN			.00017	.00017	.00017	
ULTIMATE SHEAR STRESS, T/SQ FT		τ_{ult}				

TYPE OF SPECIMEN UNDISTURBED | 3.00 IN. SQUARE | 0.562 IN. THICK
CLASSIFICATION CLAY (CH), gray, with sandy-silt strata and seams
LL 62 | PL 20 | PI 42 | G_s 2.69
REMARKS
PROJECT GRAND ISLE, LOUISIANA & VICINITY PROJECT
AREA 4410
BORING NO. 51-UE | SAMPLE NO. 78
El-98.5 | DATE 23 SEPTEMBER 1967
BWG DIRECT SHEAR TEST REPORT
ENG FORM 2092 (TRANSLUCENT)

NOTE:

- $\boxed{7}$ Indicates reference number shown under shear data on Plate 62.
- (Q) - Unconsolidated - undrained triaxial compression test.
- (R) - Consolidated - undrained triaxial compression test.
- (S) - Consolidated - drained direct shear test.

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)

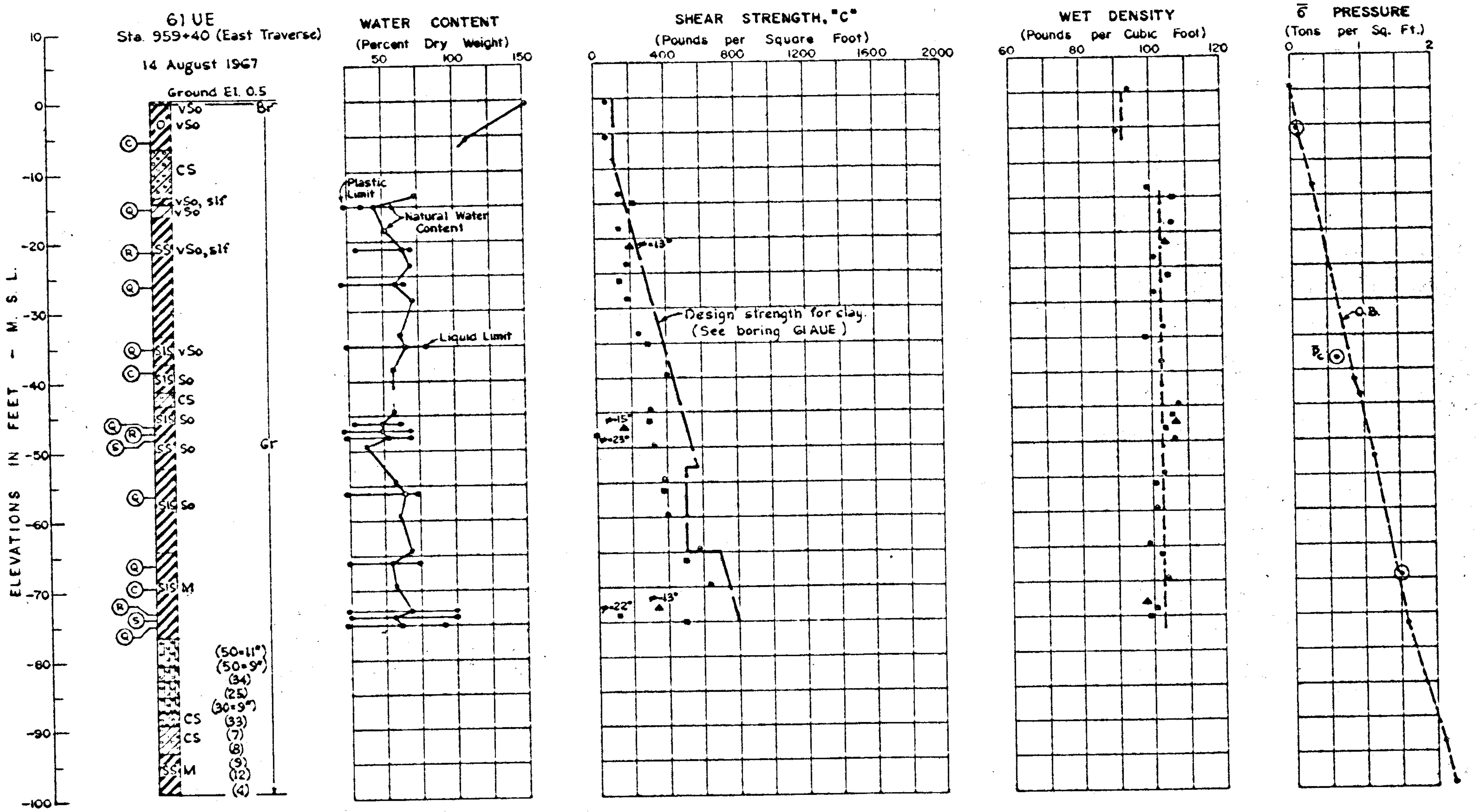
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

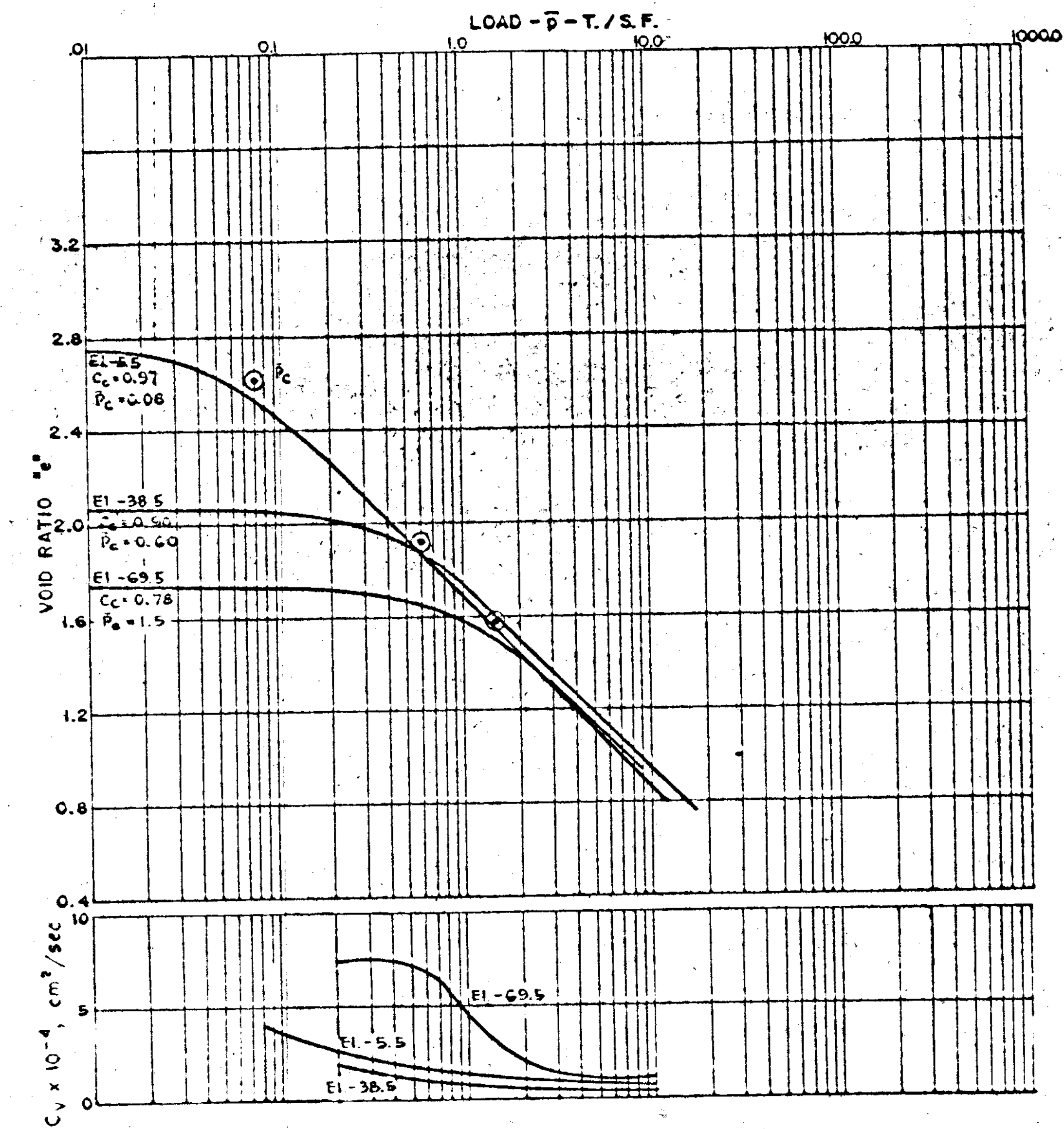
DETAIL SHEAR STRENGTH DATA BORING 51 UE

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

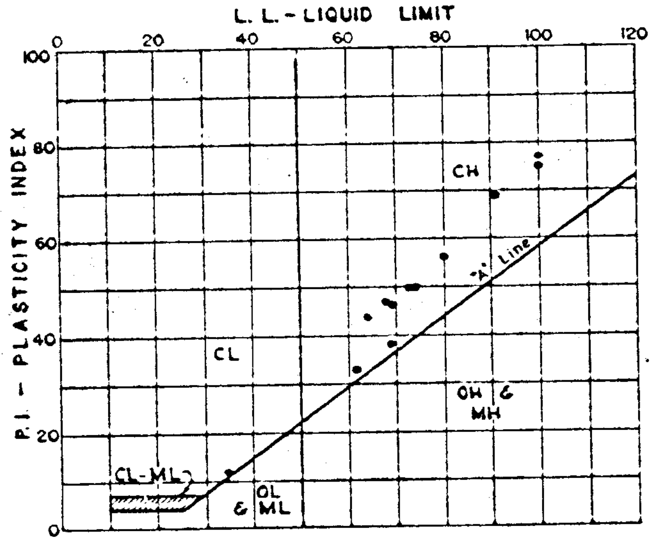
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

DATE: MARCH, 1972
FILE NO. H-2-24314

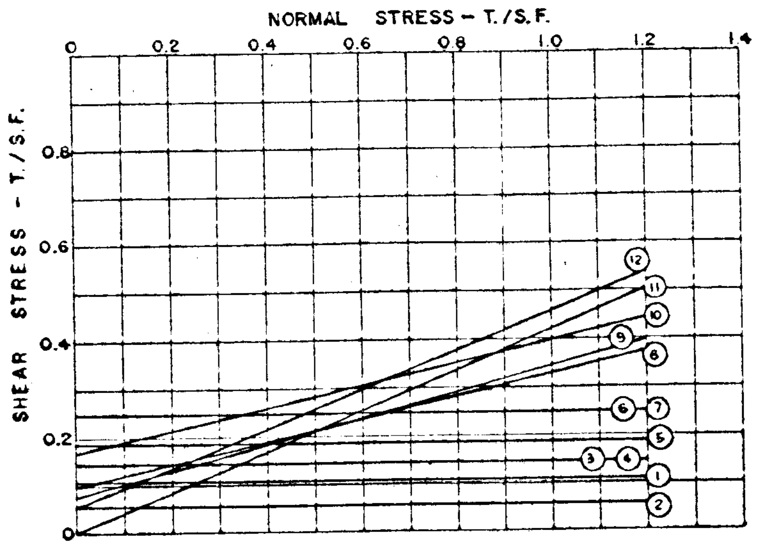




CONSOLIDATION DATA



PLASTICITY CHART



ENVELOPE		TYPE	STRENGTH		CLASS
NO.	EL.		φ	c (t.s.f.)	
1	-15.0	Q	0	0.11	ML
2	-26.0		0	0.06	CH
3	-35.0		0	0.15	CH
4	-46.0		0	0.15	CH
5	-56.0		0	0.19	CH
6	-66.0		0	0.25	CH
7	-75.0		0	0.25	CH
8	-21.0	R	13	0.10	CH
9	-47.0		15	0.08	CH
10	-73.0		13	0.17	CH
11	-48.0	S	23	0.0	CH
12	-74.0		22	0.06	CH

SHEAR STRENGTH DATA

For general notes see plate 46
For detail shear test data see plate 65
For location of boring see plate 10

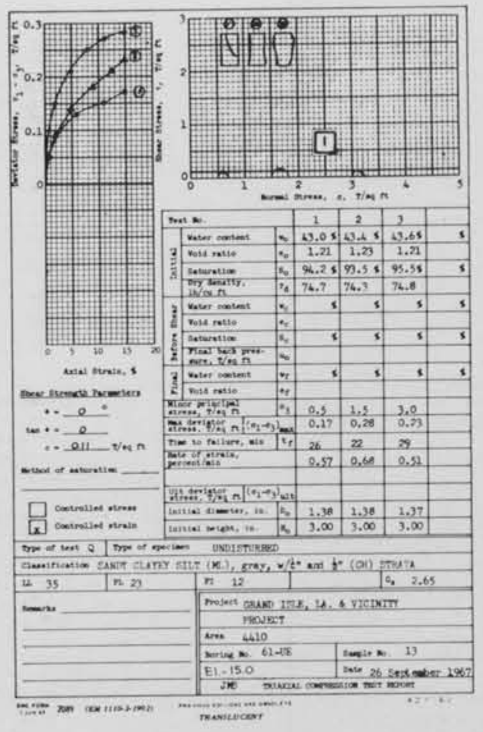
GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

SOIL BORING 61UE DATA

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE: MARCH 1972
FILE NO. H-2-24314



Test No.			1	2	3	
Initial	Water content	w_o	43.0 %	43.4 %	43.6%	%
	Void ratio	e_o	1.21	1.23	1.21	
	Saturation	S_o	94.2 %	93.5 %	95.5%	%
	Dry density, lb/cu ft	γ_d	74.7	74.3	74.8	
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		$(\sigma_1-\sigma_3)_{max}$	0.17	0.28	0.23	
Time to failure, min		t_f	26	22	29	
Rate of strain, percent/min			0.57	0.68	0.51	
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 = 0.11 T/sq ft

Method of saturation ______

☐ Controlled stress

☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED

Classification SANDY CLAYEY SILT (ML), gray, w/¼" and ½" (CH) STRATA

LL 35 | PL 23 | PI 12 | G_s 2.65

Remarks ______

Project GRAND ISLE, LA. & VICINITY PROJECT

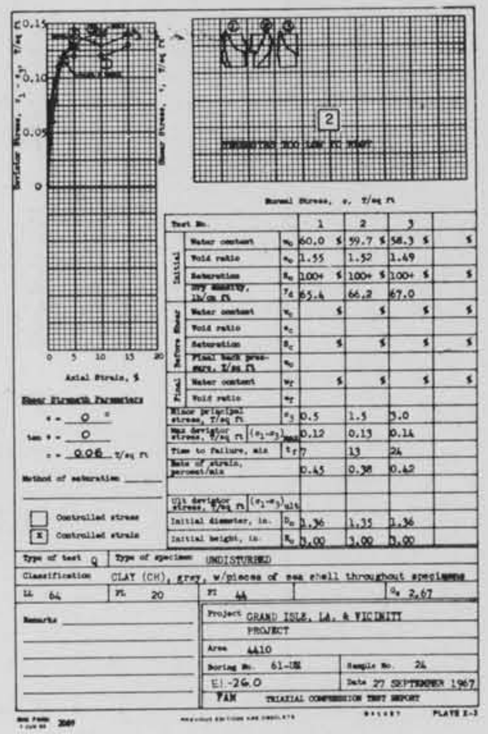
Area 4410

Boring No. 61-UE | Sample No. 13

El.-15.0 | Date 26 September 1967

JMS TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 1 JUN 65 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



Test No.			1	2	3	
Initial	Water content	w_o	60.0 %	59.7 %	58.3 %	%
	Void ratio	e_o	1.55	1.52	1.49	
	Saturation	S_o	100+ %	100+ %	100+ %	%
	Dry density, lb/cu ft	γ_d	65.4	66.2	67.0	
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		$(\sigma_1-\sigma_3)_{max}$	0.12	0.13	0.14	
Time to failure, min		t_f	7	13	24	
Rate of strain, percent/min			0.45	0.38	0.42	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.36	1.35	1.36	
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), grey, w/pieces of sea shell throughout specimens

LL 64 | PL 20 | PI 44 | G_s 2.67

Remarks ______

Project GRAND ISLE, LA. & VICINITY PROJECT

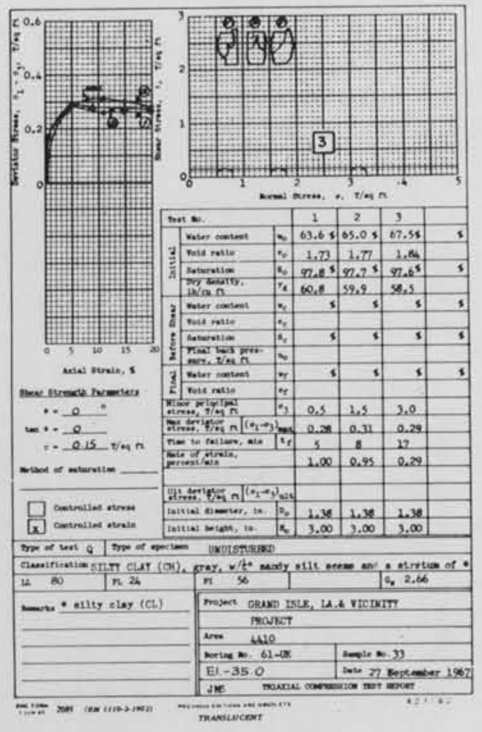
Area 4410

Boring No. 61-UE | Sample No. 24

El.-26.0 | Date 27 SEPTEMBER 1967

FAM TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 1 JUN 65 2089 PREVIOUS EDITIONS ARE OBSOLETE PLATE E-3



Test No.			1	2	3	
Initial	Water content	w_o	63.6 %	65.0 %	67.5%	%
	Void ratio	e_o	1.73	1.77	1.84	
	Saturation	S_o	97.8 %	97.7 %	97.6%	%
	Dry density, lb/cu ft	γ_d	60.8	59.9	58.5	
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		$(\sigma_1-\sigma_3)_{max}$	0.28	0.31	0.29	
Time to failure, min		t_f	5	8	17	
Rate of strain, percent/min			1.00	0.95	0.29	
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 = 0.15 T/sq ft

Method of saturation ______

☐ Controlled stress

☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED

Classification SILTY CLAY (CH), gray, w/½" sandy silt seams and a stratum of *

LL 80 | PL 24 | PI 56 | G_s 2.66

Remarks * silty clay (CL)

Project GRAND ISLE, LA.& VICINITY PROJECT

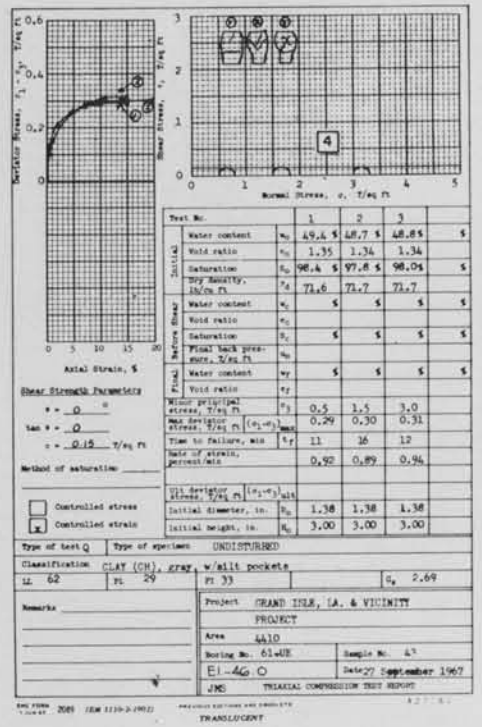
Area 4410

Boring No. 61-UE | Sample No. 33

El.-35.0 | Date 27 September 1967

JMS TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 1 JUN 65 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



Test No.			1	2	3	
Initial	Water content	w_o	49.4 %	48.7 %	48.8%	%
	Void ratio	e_o	1.35	1.34	1.34	
	Saturation	S_o	98.4 %	97.8 %	98.0%	%
	Dry density, lb/cu ft	γ_d	71.6	71.7	71.7	
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		$(\sigma_1-\sigma_3)_{max}$	0.29	0.30	0.31	
Time to failure, min		t_f	11	16	12	
Rate of strain, percent/min			0.92	0.89	0.94	
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 = 0.15 T/sq ft

Method of saturation ______

☐ Controlled stress

☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED

Classification CLAY (CH), gray, w/silt pockets

LL 62 | PL 29 | PI 33 | G_s 2.69

Remarks ______

Project GRAND ISLE, LA. & VICINITY PROJECT

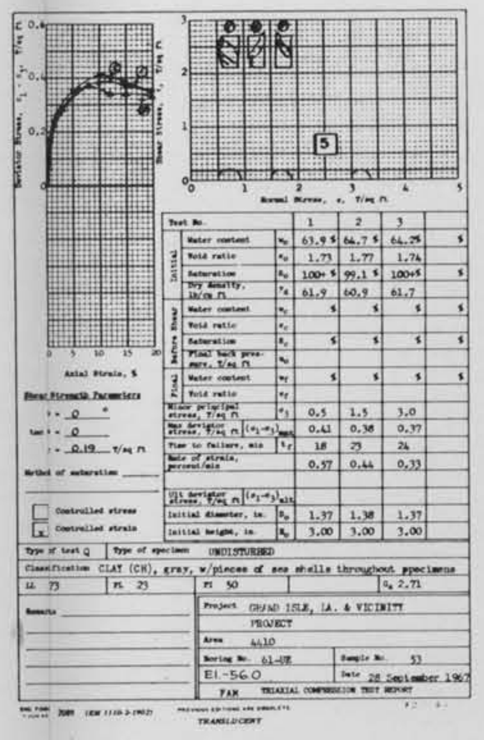
Area 4410

Boring No. 61-UE | Sample No. 43

El.-46.0 | Date 27 September 1967

JMS TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 1 JUN 65 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



Test No.			1	2	3	
Initial	Water content	w_o	63.9 %	64.7 %	64.2%	%
	Void ratio	e_o	1.73	1.77	1.74	
	Saturation	S_o	100+ %	99.1 %	100+%	%
	Dry density, lb/cu ft	γ_d	61.9	60.9	61.7	
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		$(\sigma_1-\sigma_3)_{max}$	0.41	0.38	0.37	
Time to failure, min		t_f	18	23	24	
Rate of strain, percent/min			0.57	0.44	0.33	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.37	1.38	1.37	
Initial height, in.		H_o	3.00	3.00	3.00	

Shear Strength Parameters

ϕ = 0 °

tan ϕ = 0

c = 0.19 T/sq ft

Method of saturation ______

☐ Controlled stress

☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED

Classification CLAY (CH), gray, w/pieces of sea shells throughout specimens

LL 73 | PL 23 | PI 50 | G_s 2.71

Remarks ______

Project GRAND ISLE, LA. & VICINITY PROJECT

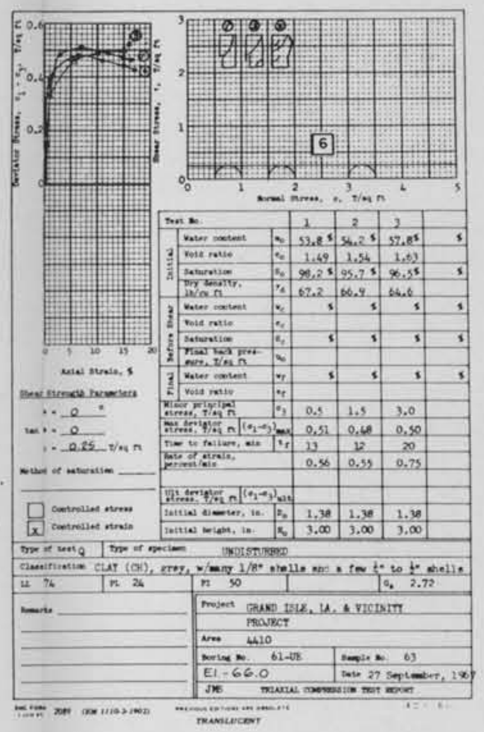
Area 4410

Boring No. 61-UE | Sample No. 53

El.-56.0 | Date 28 September 1967

FAM TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 1 JUN 65 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



Test No.			1	2	3	
Initial	Water content	w_o	53.8 %	54.2 %	57.8%	%
	Void ratio	e_o	1.49	1.54	1.63	
	Saturation	S_o	98.2 %	95.7 %	96.5%	%
	Dry density, lb/cu ft	γ_d	67.2	66.9	64.6	
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		$(\sigma_1-\sigma_3)_{max}$	0.51	0.48	0.50	
Time to failure, min		t_f	13	12	20	
Rate of strain, percent/min			0.56	0.55	0.75	
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 CLAY (CH), grey, w/many 1/8" shells and a few ¼" to ½" shells

LL 74 | PL 24 | PI 50 | G_s 2.72

Remarks ______

Project GRAND ISLE, LA. & VICINITY PROJECT

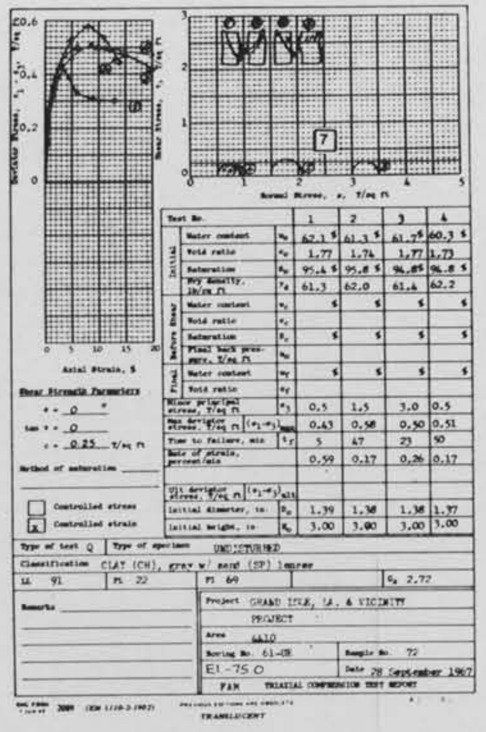
Area 4410

Boring No. 61-UE | Sample No. 63

El.-66.0 | Date 27 September, 1967

JMS TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 1 JUN 65 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



Test No.			1	2	3	4
Initial	Water content	w_o	62.1 %	61.3 %	61.7%	60.3 %
	Void ratio	e_o	1.77	1.74	1.77	1.73
	Saturation	S_o	95.4 %	95.8 %	96.8%	96.8 %
	Dry density, lb/cu ft	γ_d	61.3	62.0	61.4	62.2
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	0.5
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.43	0.58	0.50	0.51
Time to failure, min		t_f	5	47	23	50
Rate of strain, percent/min			0.59	0.17	0.26	0.17
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.39	1.38	1.38	1.37
Initial height, in.		H_o	3.00	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), grey w/ sand (SP) lenses

LL 91 | PL 22 | PI 69 | G_s 2.72

Remarks ______

Project GRAND ISLE, LA. & VICINITY PROJECT

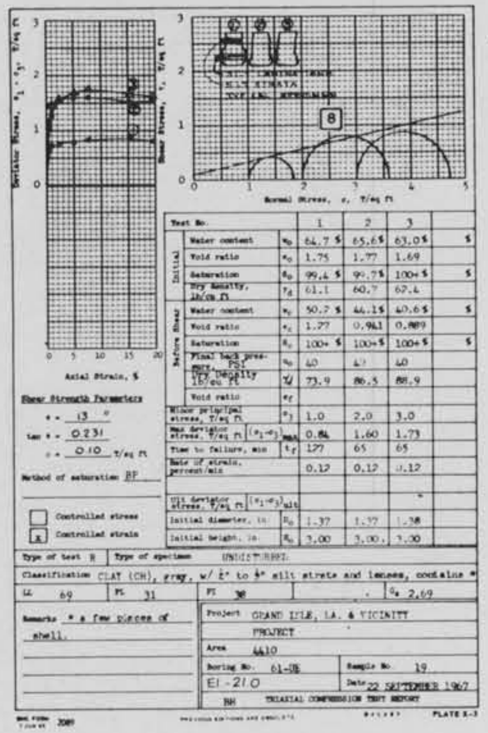
Area 4410

Boring No. 61-UE | Sample No. 72

El.-75.0 | Date 28 September 1967

FAM TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 1 JUN 65 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



Test No.			1	2	3	
Initial	Water content	w_o	64.7 %	65.6%	63.0%	%
	Void ratio	e_o	1.75	1.77	1.69	
	Saturation	S_o	99.4 %	99.7%	100+ %	%
	Dry density, lb/cu ft	γ_d	61.1	60.7	62.4	
Before Shear	Water content	w_c	50.7 %	44.1%	40.6%	%
	Void ratio	e_c	1.27	0.941	0.889	
	Saturation	S_c	100+ %	100+%	100+ %	%
	Final back pressure, PSI	u_o	40	40	40	
	Dry Density lb/cu ft	γ_d	73.9	86.5	88.9	
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	1.0	2.0	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.84	1.60	1.73	
Time to failure, min		t_f	177	65	65	
Rate of strain, percent/min			0.12	0.12	0.12	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.37	1.37	1.38	
Initial height, in.		H_o	3.00	3.00	3.00	

Shear Strength Parameters

ϕ = 13 °

tan ϕ = 0.231

c = 0.10 T/sq ft

Method of saturation BP

☐ Controlled stress

☒ Controlled strain

Type of test R | Type of specimen UNDISTURBED

Classification CLAY (CH), gray, w/ ¼" to ½" silt strata and lenses, contains *

LL 69 | PL 31 | PI 38 | G_s 2.69

Remarks * a few pieces of shell.

Project GRAND ISLE, LA. & VICINITY PROJECT

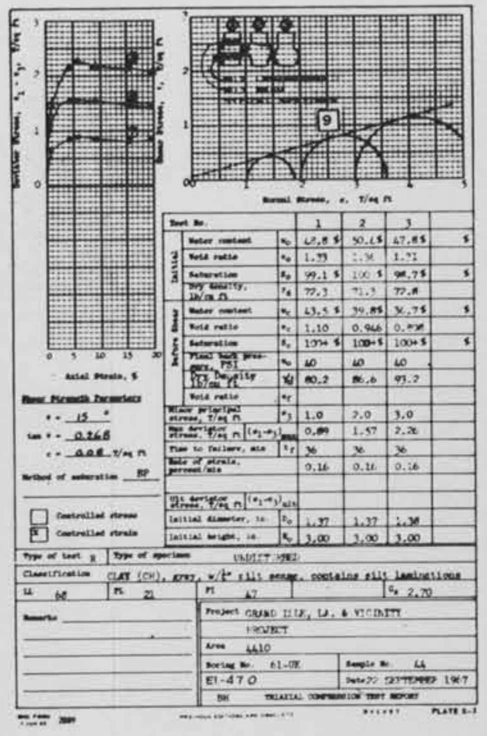
Area 4410

Boring No. 61-UE | Sample No. 19

El.-21.0 | Date 22 SEPTEMBER 1967

BH TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 1 JUN 65 2089 PREVIOUS EDITIONS ARE OBSOLETE PLATE E-3



Test No.			1	2	3	
Initial	Water content	w_o	48.8 %	50.4%	47.8%	%
	Void ratio	e_o	1.33	1.36	1.21	
	Saturation	S_o	99.1 %	100 %	98.7%	%
	Dry density, lb/cu ft	γ_d	77.3	71.3	77.8	
Before Shear	Water content	w_c	43.5 %	39.8%	36.7%	%
	Void ratio	e_c	1.10	0.946	0.838	
	Saturation	S_c	100+ %	100+%	100+ %	%
	Final back pressure, PSI	u_o	40	40	40	
	Dry Density lb/cu ft	γ_d	80.2	86.6	93.2	
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	1.0	2.0	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.89	1.57	2.26	
Time to failure, min		t_f	36	36	36	
Rate of strain, percent/min			0.16	0.16	0.16	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.37	1.37	1.38	
Initial height, in.		H_o	3.00	3.00	3.00	

Shear Strength Parameters

ϕ = 15 °

tan ϕ = 0.268

c = 0.08 T/sq ft

Method of saturation BP

☐ Controlled stress

☒ Controlled strain

Type of test R | Type of specimen UNDISTURBED

Classification CLAY (CH), gray, w/½" silt seams, contains silt laminations

LL 68 | PL 21 | PI 47 | G_s 2.70

Remarks ______

Project GRAND ISLE, LA. & VICINITY PROJECT

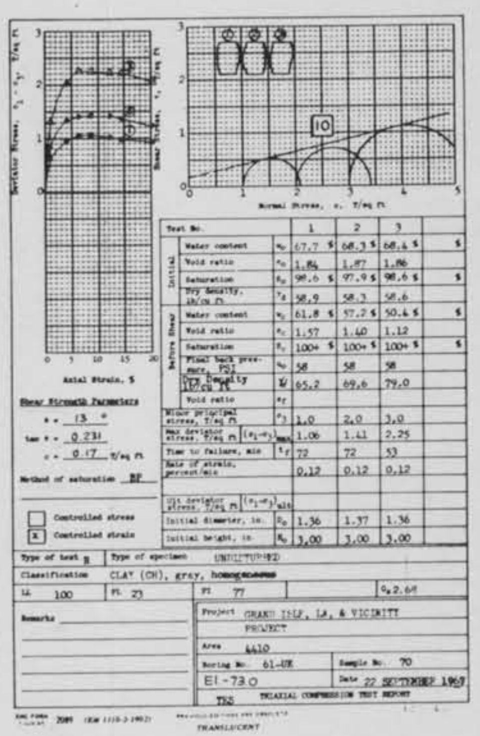
Area 4410

Boring No. 61-UE | Sample No. 44

El.-47.0 | Date 22 SEPTEMBER 1967

BH TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 1 JUN 65 2089 PREVIOUS EDITIONS ARE OBSOLETE PLATE E-3



Test No.			1	2	3	
Initial	Water content	w_o	67.7 %	68.3 %	68.4 %	%
	Void ratio	e_o	1.84	1.87	1.86	
	Saturation	S_o	98.6 %	97.9 %	98.6 %	%
	Dry density, lb/cu ft	γ_d	58.9	58.3	58.6	
Before Shear	Water content	w_c	61.8 %	57.2 %	50.4 %	%
	Void ratio	e_c	1.57	1.40	1.12	
	Saturation	S_c	100+ %	100+ %	100+ %	%
	Final back pressure, PSI	u_o	58	58	58	
	Dry Density lb/cu ft	γ_d	65.2	69.6	79.0	
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	1.0	2.0	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	1.06	1.41	2.25	
Time to failure, min		t_f	72	72	53	
Rate of strain, percent/min			0.12	0.12	0.12	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.36	1.37	1.36	
Initial height, in.		H_o	3.00	3.00	3.00	

Shear Strength Parameters

ϕ = 13 °

tan ϕ = 0.231

c = 0.17 T/sq ft

Method of saturation BP

☐ Controlled stress

☒ Controlled strain

Type of test R | Type of specimen UNDISTURBED

Classification CLAY (CH), gray, homogeneous

LL 100 | PL 23 | PI 77 | G_s 2.68

Remarks ______

Project GRAND ISLE, LA. & VICINITY PROJECT

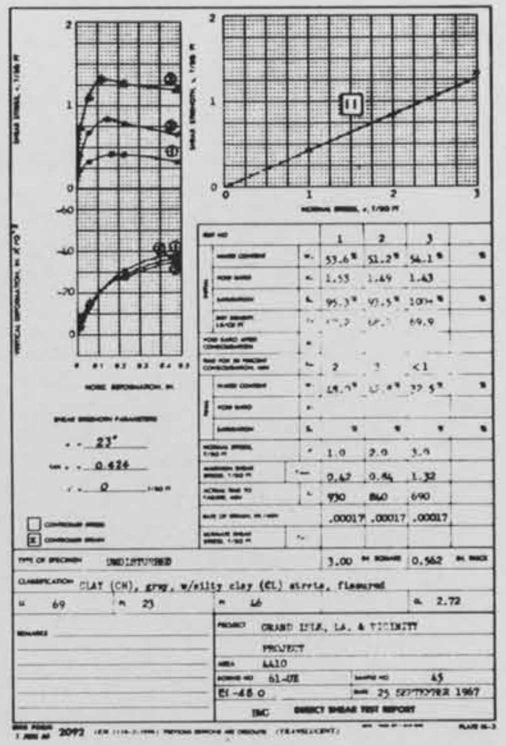
Area 4410

Boring No. 61-UE | Sample No. 70

El.-73.0 | Date 22 SEPTEMBER 1967

TES TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 1 JUN 65 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



TEST NO			1	2	3	
INITIAL	WATER CONTENT	w_o	53.6 %	51.2 %	54.1 %	%
	VOID RATIO	e_o	1.53	1.49	1.43	
	SATURATION	S_o	95.3 %	97.5 %	100+ %	%
	DRY DENSITY, LB/CU FT	γ_d	[illegible]	[illegible]	69.9	
VOID RATIO AFTER CONSOLIDATION		e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN		t_{50}	2	2	<1	
FINAL	WATER CONTENT	w_f	[illegible]	[illegible]	37.5 %	%
	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}	0.42	0.84	1.32	
ACTUAL TIME TO FAILURE, MIN		t_f	930	860	690	
RATE OF STRAIN, IN./MIN			.00017	.00017	.00017	
ULTIMATE SHEAR STRESS, T/SQ FT		τ_{ult}				

SHEAR STRENGTH PARAMETERS

ϕ = 23°

tan ϕ = 0.424

c = 0 T/SQ FT

☐ CONTROLLED STRESS

☒ CONTROLLED STRAIN

TYPE OF SPECIMEN UNDISTURBED | 3.00 IN. SQUARE | 0.562 IN. THICK

CLASSIFICATION CLAY (CH), gray, w/silty clay (CL) strata, fissured

LL 69 | PL 23 | PI 46 | G_s 2.72

REMARKS ______

PROJECT GRAND ISLE, LA. & VICINITY PROJECT

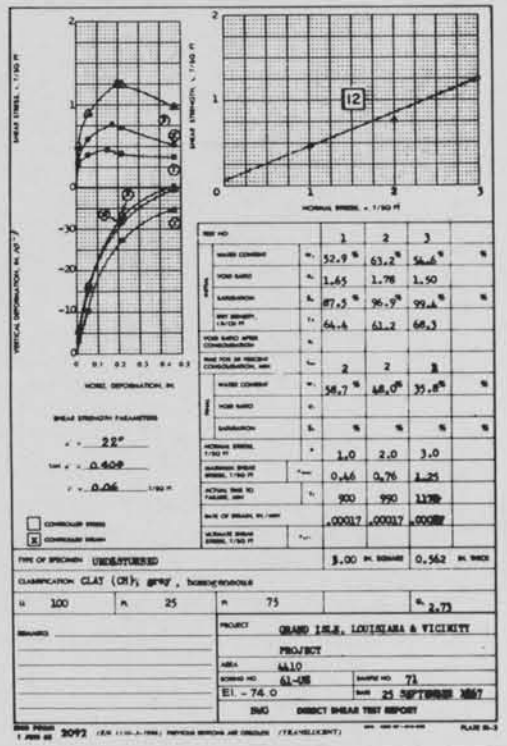
AREA 4410

BORING NO 61-UE | SAMPLE NO 45

El.-48.0 | DATE 25 SEPTEMBER 1967

IMC DIRECT SHEAR TEST REPORT

ENG FORM 1 JAN 66 2092 (EM 1110-2-1906) PREVIOUS EDITIONS ARE OBSOLETE (TRANSLUCENT)



TEST NO			1	2	3	
INITIAL	WATER CONTENT	w_o	52.9 %	63.2 %	54.6 %	%
	VOID RATIO	e_o	1.65	1.78	1.50	
	SATURATION	S_o	87.5 %	96.9 %	99.4 %	%
	DRY DENSITY, LB/CU FT	γ_d	64.4	61.2	68.3	
VOID RATIO AFTER CONSOLIDATION		e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN		t_{50}	2	2	3	
FINAL	WATER CONTENT	w_f	38.7 %	48.0 %	35.8 %	%
	VOID RATIO	e_f				
	SATURATION	S_f	%	%	%	%
NORMAL STRESS, T/SQ FT		σ	1.0	2.0	3.0	
MAXIMUM SHEAR STRESS, T/SQ FT		τ_{max}	0.46	0.76	1.25	
ACTUAL TIME TO FAILURE, MIN		t_f	900	990	1170	
RATE OF STRAIN, IN./MIN			.00017	.00017	.00017	
ULTIMATE SHEAR STRESS, T/SQ FT		τ_{ult}				

SHEAR STRENGTH PARAMETERS

ϕ = 22°

tan ϕ = 0.404

c = 0.06 T/SQ FT

☐ CONTROLLED STRESS

☒ CONTROLLED STRAIN

TYPE OF SPECIMEN UNDISTURBED | 3.00 IN. SQUARE | 0.562 IN. THICK

CLASSIFICATION CLAY (CH), gray, homogeneous

LL 100 | PL 25 | PI 75 | G_s 2.73

REMARKS ______

PROJECT GRAND ISLE, LOUISIANA & VICINITY PROJECT

AREA 4410

BORING NO 61-UE | SAMPLE NO 71

El.-74.0 | DATE 25 SEPTEMBER 1967

IMC DIRECT SHEAR TEST REPORT

ENG FORM 1 JAN 66 2092 (EM 1110-2-1906) PREVIOUS EDITIONS ARE OBSOLETE (TRANSLUCENT)

NOTE:

- 7 Indicates reference number shown under shear data on Plate 64
- (Q) - Unconsolidated - undrained triaxial compression test.
- (R) - Consolidated - undrained triaxial compression test.
- (S) - Consolidated - drained direct shear test.

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)

DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

DETAIL SHEAR STRENGTH DATA
BORING 61 UE

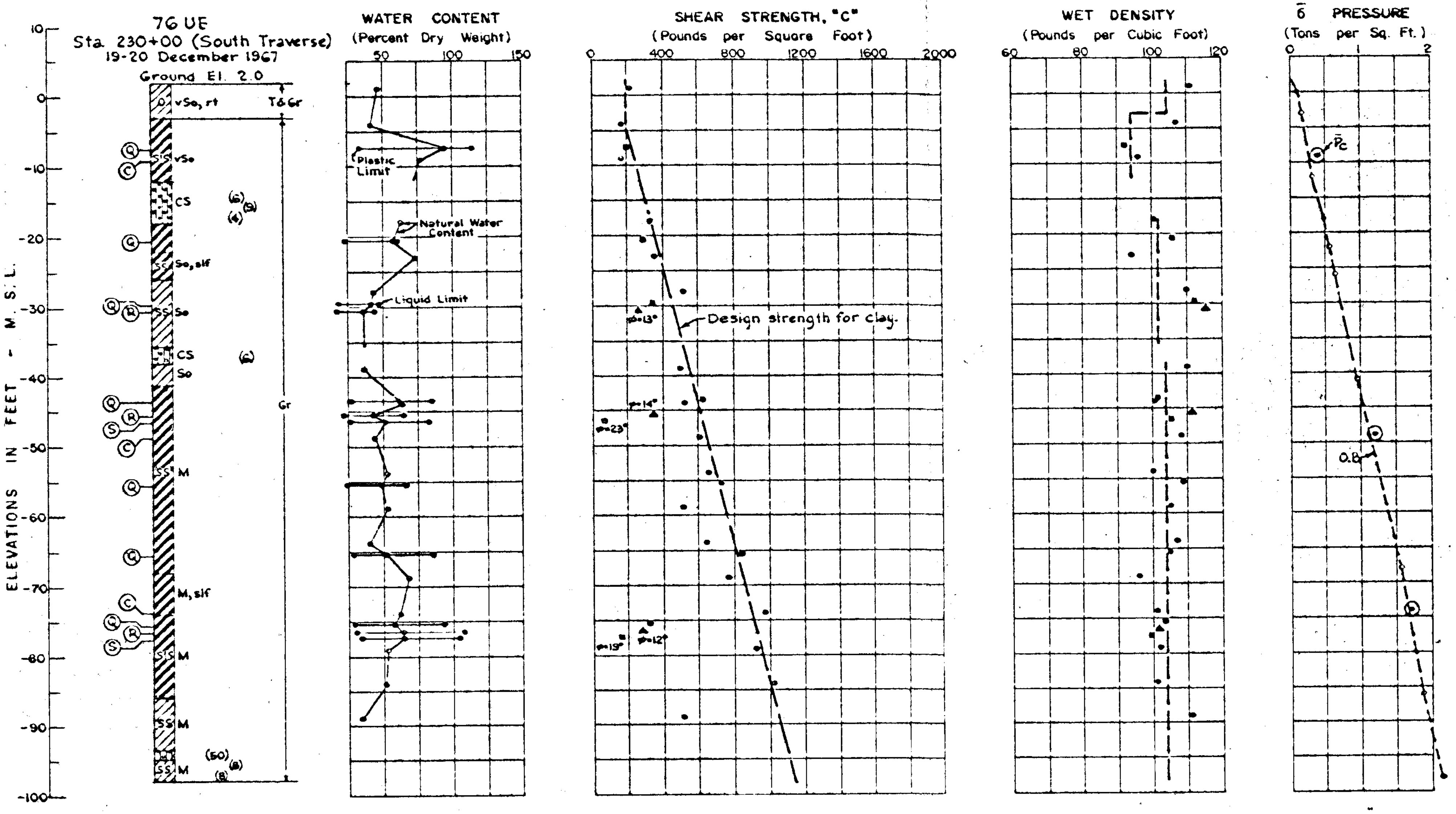
BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

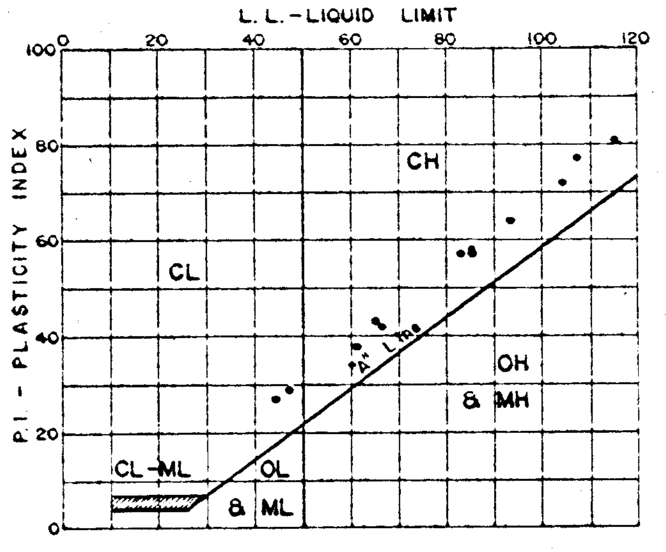
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

DATE: MARCH, 1972

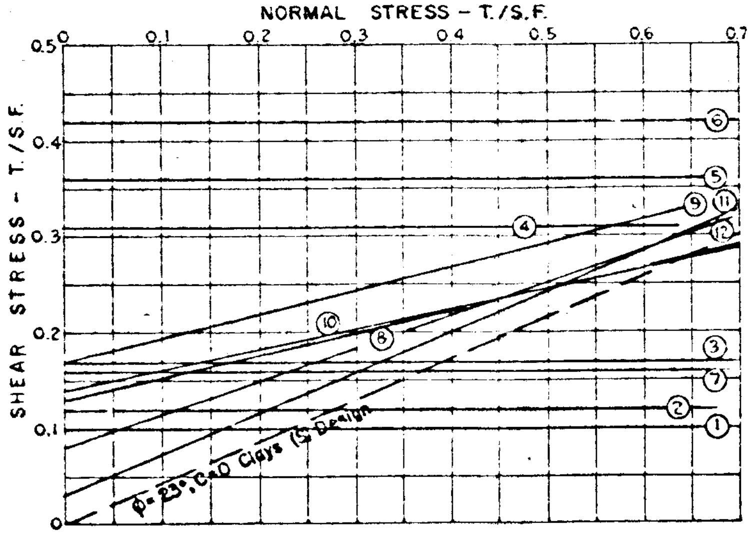
FILE NO. H-2-24314

PLATE 65



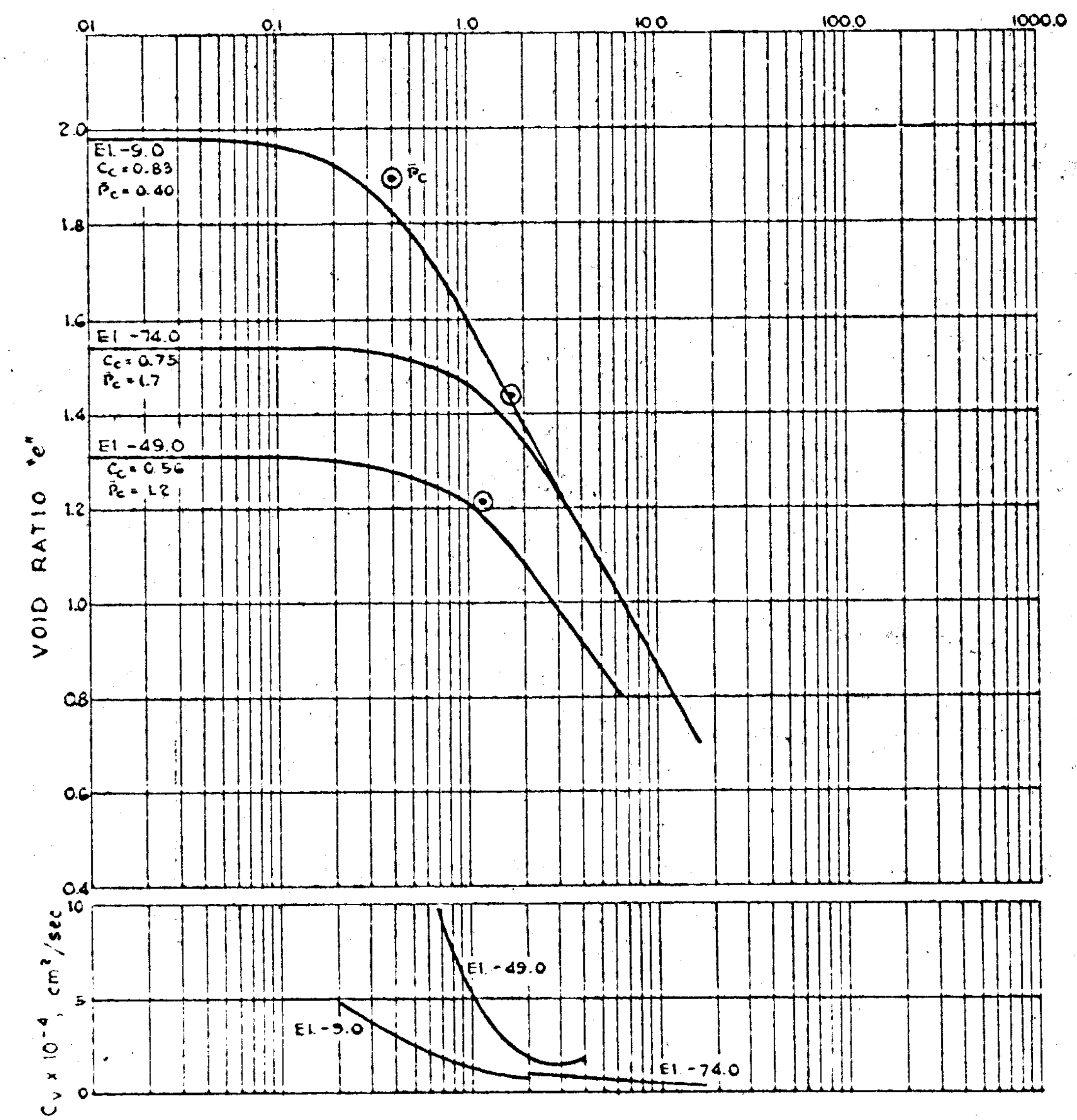


PLASTICITY CHART



ENVELOPE		TYPE	STRENGTH		CLASS.
NO	EL		φ	c t s f	
1	-7.5	Q	0	0.10	CH
2	-205			0.12	CH
3	-29.5			0.17	CL
4	-43.5			0.31	CH
5	-55.5			0.36	CH
6	-65.5			0.42	CH
7	-75.5			0.16	CH
8	-30.5	R	13°	0.13	CL
9	-45.5		14°	0.17	CH
10	-76.5		12°	0.14	CH
11	-46.5	S	23°	0.03	CH
12	-77.5		19°	0.08	

SHEAR STRENGTH DATA



CONSOLIDATION DATA

For general notes see plate 46
For detail shear test data see plate 67
For location of boring see plate 12

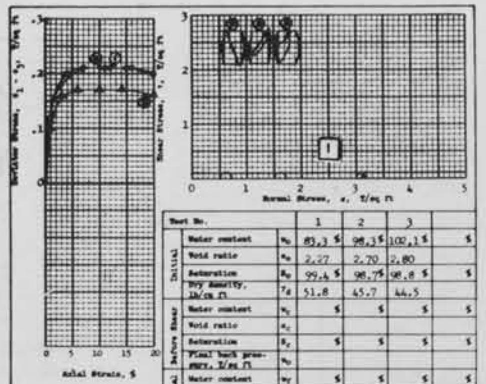
GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

SOIL BORING 76 UE DATA

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE: MARCH 1972
FILE NO. H-2-24314



Shear Strength Parameters

φ = 0°

tan φ = 0

c = 0.10 T/sq ft

Method of saturation ______

☐ Controlled stress

☒ Controlled strain

Test No.			1	2	3	
Initial	Water content	w_o	83.3 %	98.3 %	102.1 %	%
	Void ratio	e_o	2.27	2.70	2.80	
	Saturation	S_o	99.4 %	98.7 %	98.8 %	%
	Dry density, lb/cu ft	γ_d	51.8	45.7	44.5	
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		$(\sigma_1-\sigma_3)_{max}$	0.21	0.21	0.17	
Time to failure, min		t_f	18	18	23	
Rate of strain, percent/min			0.38	0.34	0.26	
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	

Type of test Q | Type of specimen UNDISTURBED

Classification PLASTIC CLAY (CH), gray, contains scattered small pieces of *

LL 115 | PL 34 | PI 81 | G_s 2.71

Remarks * wood

Project GRAND ISLE, LA. & VICINITY

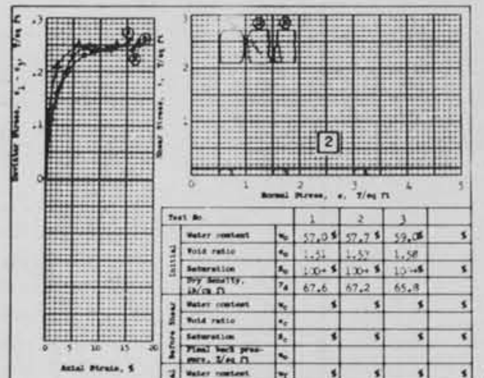
Area

Boring No. 76-UE | Sample No. 10

El-7.5 | Date 10 February 1968

JKS TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 2089 PLATE



Shear Strength Parameters

φ = 0°

tan φ = 0

c = 0.12 T/sq ft

Method of saturation ______

☐ Controlled stress

☒ Controlled strain

Test No.			1	2	3	
Initial	Water content	w_o	57.0 %	57.7 %	59.0 %	%
	Void ratio	e_o	1.51	1.52	1.58	
	Saturation	S_o	100+ %	100+ %	100+ %	%
	Dry density, lb/cu ft	γ_d	67.6	67.2	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	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.25	0.25	0.25	
Time to failure, min		t_f	82	26	25	
Rate of strain, percent/min			0.18	0.31	0.24	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.40	1.38	1.40	
Initial height, in.		H_o	3.00	3.00	3.00	

Type of test Q | Type of specimen UNDISTURBED

Classification PLASTIC CLAY (CH), gray, contains sand laminations & shells *

LL 61 | PL 23 | PI 38 | G_s 2.77

Remarks * slightly fissured

Project GRAND ISLE, LA. & VICINITY

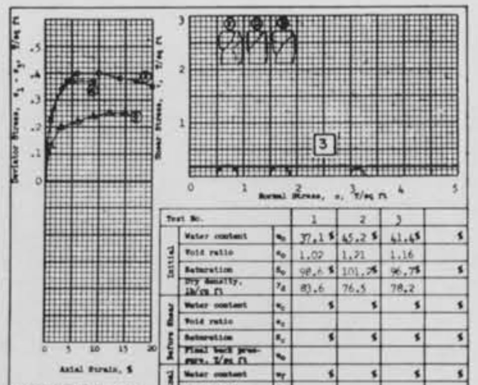
Area

Boring No. 76-UE | Sample No. 21

El-20.5 | Date 10 February 1968

EX TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 2089 (EM 1110-2-1902) TRANSLUCENT



Shear Strength Parameters

φ = 0°

tan φ = 0

c = 0.17 T/sq ft

Method of saturation ______

☐ Controlled stress

☒ Controlled strain

Test No.			1	2	3	
Initial	Water content	w_o	37.1 %	45.2 %	41.4 %	%
	Void ratio	e_o	1.02	1.21	1.16	
	Saturation	S_o	98.6 %	101.3 %	96.7 %	%
	Dry density, lb/cu ft	γ_d	83.6	76.5	78.2	
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		$(\sigma_1-\sigma_3)_{max}$	0.40	0.37	0.25	
Time to failure, min		t_f	19	31	171	
Rate of strain, percent/min			0.32	0.16	0.07	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.37	1.37	1.38	
Initial height, in.		H_o	3.00	3.00	3.00	

Type of test Q | Type of specimen UNDISTURBED

Classification LEAN CLAY (CL), gray, contains a few silty sand lenses and *

LL 47 | PL 18 | PI 29 | G_s 2.71

Remarks * 1/4" to 3/4" diameter shells

Specimen 1 patched where shell removed

Project GRAND ISLE, LA. & VICINITY

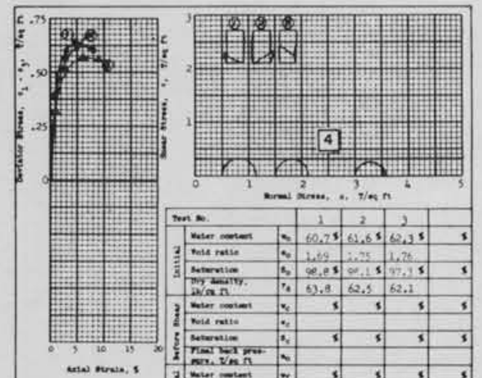
Area

Boring No. 76-UE | Sample No. 30

El-29.5 | Date 10 February 1968

JKS TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 2089 (EM 1110-2-1902) TRANSLUCENT



Shear Strength Parameters

φ = 0°

tan φ = 0

c = 0.31 T/sq ft

Method of saturation ______

☐ Controlled stress

☒ Controlled strain

Test No.			1	2	3	
Initial	Water content	w_o	60.7 %	61.6 %	62.3 %	%
	Void ratio	e_o	1.69	1.75	1.76	
	Saturation	S_o	98.8 %	98.1 %	97.3 %	%
	Dry density, lb/cu ft	γ_d	63.8	62.5	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		$(\sigma_1-\sigma_3)_{max}$	0.64	0.62	0.57	
Time to failure, min		t_f	11	26	32	
Rate of strain, percent/min			0.42	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	

Type of test Q | Type of specimen UNDISTURBED

Classification PLASTIC CLAY (CH), gray, contains small silt lenses

LL 85 | PL 27 | PI 58 | G_s 2.75

Remarks

Project GRAND ISLE, LA. & VICINITY

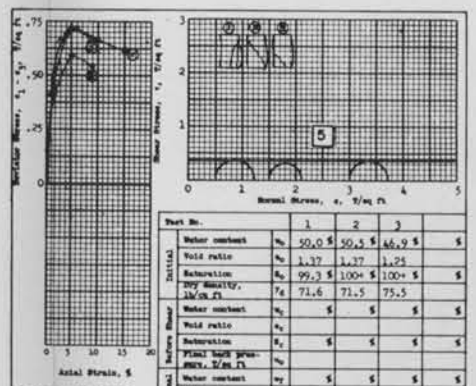
Area

Boring No. 76-UE | Sample No. 42

El-43.5 | Date 12 February 1968

GDA TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 2089 (EM 1110-2-1902) TRANSLUCENT



Shear Strength Parameters

φ = 0°

tan φ = 0

c = 0.36 T/sq ft

Method of saturation ______

☐ Controlled stress

☒ Controlled strain

Test No.			1	2	3	
Initial	Water content	w_o	50.0 %	50.5 %	46.9 %	%
	Void ratio	e_o	1.37	1.37	1.25	
	Saturation	S_o	99.3 %	100+ %	100+ %	%
	Dry density, lb/cu ft	γ_d	71.6	71.5	75.5	
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		$(\sigma_1-\sigma_3)_{max}$	0.72	0.59	0.72	
Time to failure, min		t_f	38	29	36	
Rate of strain, percent/min			0.16	0.17	0.14	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.40	1.40	1.40	
Initial height, in.		H_o	3.00	3.00	3.00	

Type of test Q | Type of specimen UNDISTURBED

Classification PLASTIC CLAY (CH), gray, contains silt laminations

LL 66 | PL 24 | PI 42 | G_s 2.77

Remarks

Project GRAND ISLE, LA. & VICINITY

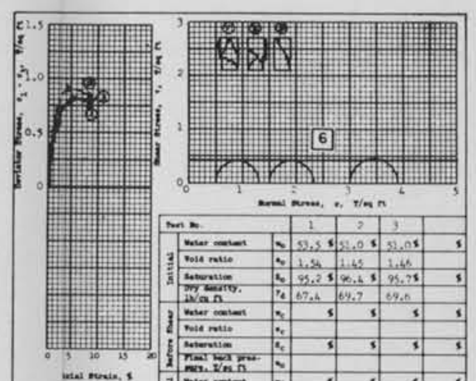
Area

Boring No. 76-UE | Sample No. 54

El-55.5 | Date 12 February 1968

EAE TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 2089 (EM 1110-2-1902) TRANSLUCENT



Shear Strength Parameters

φ = 0°

tan φ = 0

c = 0.42 T/sq ft

Method of saturation ______

☐ Controlled stress

☒ Controlled strain

Test No.			1	2	3	
Initial	Water content	w_o	53.5 %	51.0 %	51.0 %	%
	Void ratio	e_o	1.54	1.45	1.46	
	Saturation	S_o	95.2 %	96.4 %	95.7 %	%
	Dry density, lb/cu ft	γ_d	67.4	69.7	69.6	
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		$(\sigma_1-\sigma_3)_{max}$	0.80	0.82	0.90	
Time to failure, min		t_f	31	69	25	
Rate of strain, percent/min			0.16	0.08	0.18	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.40	1.40	1.40	
Initial height, in.		H_o	3.00	3.00	3.00	

Type of test Q | Type of specimen UNDISTURBED

Classification PLASTIC CLAY (CH), gray, contains silt lenses

LL 85 | PL 28 | PI 57 | G_s 2.74

Remarks

Project GRAND ISLE, LA. & VICINITY

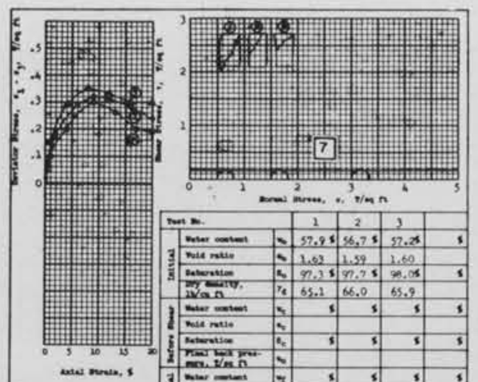
Area

Boring No. 76-UE | Sample No. 64

El-65.5 | Date 12 February 1968

GDA TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 2089 (EM 1110-2-1902) TRANSLUCENT



Shear Strength Parameters

φ = 0°

tan φ = 0

c = 0.16 T/sq ft

Method of saturation ______

☐ Controlled stress

☒ Controlled strain

Test No.			1	2	3	
Initial	Water content	w_o	57.9 %	56.7 %	57.2 %	%
	Void ratio	e_o	1.63	1.59	1.60	
	Saturation	S_o	97.3 %	97.7 %	98.0 %	%
	Dry density, lb/cu ft	γ_d	65.1	66.0	65.9	
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	0.32	0.35	
Time to failure, min		t_f	53	41	31	
Rate of strain, percent/min			0.17	0.22	0.26	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.40	1.40	1.40	
Initial height, in.		H_o	3.00	3.00	3.00	

Type of test Q | Type of specimen UNDISTURBED

Classification PLASTIC CLAY (CH), gray, fissured

LL 93 | PL 29 | PI 64 | G_s 2.74

Remarks

Project GRAND ISLE, LA. & VICINITY

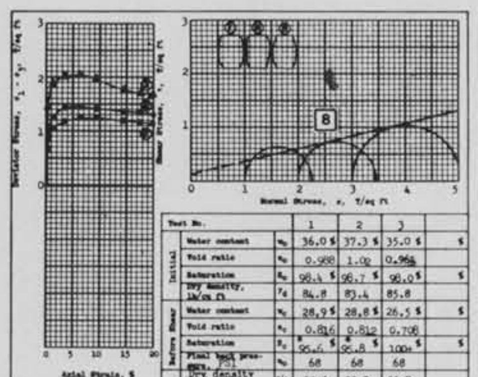
Area

Boring No. 76-UE | Sample No. 74

El-75.5 | Date 13 February 1968

EAE TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 2089 (EM 1110-2-1902) TRANSLUCENT



Shear Strength Parameters

φ = 13°

tan φ = 0.231

c = 0.18 T/sq ft

Method of saturation BP

☐ Controlled stress

☒ Controlled strain

Test No.			1	2	3	
Initial	Water content	w_o	36.0 %	37.3 %	35.0 %	%
	Void ratio	e_o	0.988	1.02	0.964	
	Saturation	S_o	98.4 %	98.7 %	98.0 %	%
	Dry density, lb/cu ft	γ_d	84.8	83.4	85.8	
Before Shear	Water content	w_c	28.9 %	28.8 %	26.5 %	%
	Void ratio	e_c	0.816	0.812	0.708	
	Saturation	S_c	*95.6 %	*95.8 %	100+ %	%
	Final back pressure, PSI	u_o	68	68	68	
	Dry density lb/cu ft	γ_d	92.8	93.0	98.7	
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	1.0	2.0	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	1.24	1.45	2.02	
Time to failure, min		t_f	124	124	105	
Rate of strain, percent/min			0.05	0.05	0.06	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.40	1.40	1.40	
Initial height, in.		H_o	3.00	3.00	3.00	

Type of test R | Type of specimen UNDISTURBED

Classification SANDY CLAY (CL), contains numerous shells, gray

LL 44 | PL 17 | PI 27 | G_s 2.70

Remarks * Pore pressure response indicated 100% saturation

Project GRAND ISLE, LA. & VICINITY

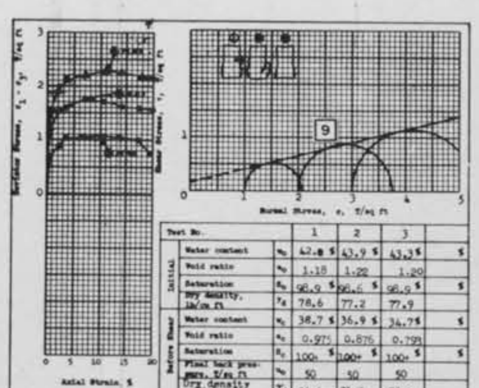
Area

Boring No. 76-UE | Sample No. 31

El-30.5 | Date 30 January 1968

TES TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 2089 (EM 1110-2-1902) TRANSLUCENT



Shear Strength Parameters

φ = 16°

tan φ = 0.260

c = 0.17 T/sq ft

Method of saturation ______

Back pressure

☐ Controlled stress

☒ Controlled strain

Test No.			1	2	3	
Initial	Water content	w_o	42.8 %	43.9 %	43.3 %	%
	Void ratio	e_o	1.18	1.22	1.20	
	Saturation	S_o	98.9 %	98.6 %	98.9 %	%
	Dry density, lb/cu ft	γ_d	78.6	77.2	77.9	
Before Shear	Water content	w_c	38.7 %	36.9 %	34.7 %	%
	Void ratio	e_c	0.975	0.876	0.793	
	Saturation	S_c	100+ %	100+ %	100+ %	%
	Final back pressure, T/sq ft	u_o	50	50	50	
	Dry density lb/cu ft	γ_d	86.6	91.2	95.4	
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	1.0	2.0	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	1.06	1.74	2.27	
Time to failure, min		t_f	69	47	71	
Rate of strain, percent/min			0.15	0.15	0.15	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.37	1.36	1.37	
Initial height, in.		H_o	3.00	3.00	3.00	

Type of test R | Type of specimen UNDISTURBED

Classification PLASTIC CLAY (CH), gray, contains clay (CL), stratum and *

LL 65 | PL 22 | PI 43 | G_s 2.74

Remarks * silt seams

Project GRAND ISLE LA, & VICINITY

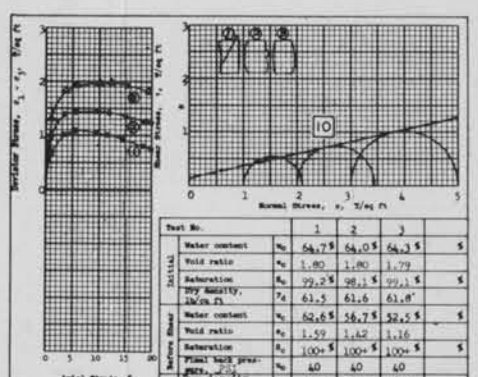
Area

Boring No. 76 - UE | Sample No. 44

El-45.5 | Date 6 FEBRUARY 1968

BH TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 2089 (EM 1110-2-1902) TRANSLUCENT



Shear Strength Parameters

φ = 12°

tan φ = 0.213

c = 0.46 T/sq ft

Method of saturation BP

☐ Controlled stress

☒ Controlled strain

Test No.			1	2	3	
Initial	Water content	w_o	64.7 %	64.0 %	64.3 %	%
	Void ratio	e_o	1.80	1.80	1.79	
	Saturation	S_o	99.2 %	98.1 %	99.1 %	%
	Dry density, lb/cu ft	γ_d	61.5	61.6	61.8	
Before Shear	Water content	w_c	62.6 %	56.7 %	52.5 %	%
	Void ratio	e_c	1.59	1.42	1.16	
	Saturation	S_c	100+ %	100+ %	100+ %	%
	Final back pressure, PSI	u_o	40	40	40	
	Dry density lb/cu ft	γ_d	66.4	71.1	79.6	
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	1.0	2.0	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	1.09	1.44	1.99	
Time to failure, min		t_f	110	196	246	
Rate of strain, percent/min			0.05	0.05	0.05	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.40	1.40	1.40	
Initial height, in.		H_o	3.00	3.00	3.00	

Type of test R | Type of specimen UNDISTURBED

Classification PLASTIC CLAY (CH), gray, slightly fissured

LL 107 | PL 30 | PI 77 | G_s 2.76

Remarks

Project GRAND ISLE, LA. & VICINITY

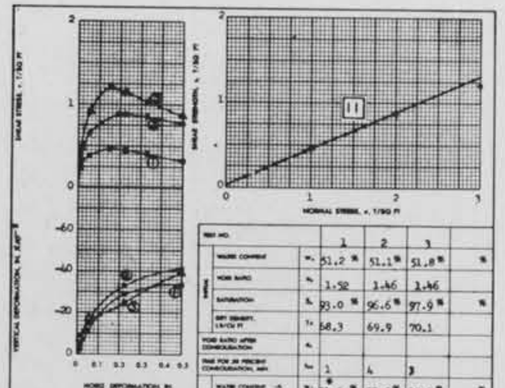
Area

Boring No. 76-UE | Sample No. 75

El-76.5 | Date 2 January 1968

JL TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 2089 (EM 1110-2-1902) TRANSLUCENT



SHEAR STRENGTH PARAMETERS

φ = 23°

tan φ = 0.424

c = 0.03 T/SQ FT

☐ CONTROLLED STRESS

☒ CONTROLLED STRAIN

TEST NO.			1	2	3	
Initial	WATER CONTENT	w_o	51.2 %	51.1 %	51.8 %	%
	VOID RATIO	e_o	1.52	1.46	1.46	
	SATURATION	S_o	93.0 %	96.6 %	97.9 %	%
	DRY DENSITY, LB/CU FT	γ_d	68.3	69.9	70.1	
VOID RATIO AFTER CONSOLIDATION		e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN		t_{50}	1	4	3	
Final	WATER CONTENT	w_f	*51.5 %	38.0 %	35.6 %	%
	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}	0.46	0.88	1.21	
ACTUAL TIME TO FAILURE, MIN		t_f	900	1170	930	
RATE OF STRAIN, IN./MIN			.00018	.00018	.00018	
ULTIMATE SHEAR STRESS, T/SQ FT		τ_{ult}				

TYPE OF SPECIMEN UNDISTURBED | 1&2- 3.00
3- 3.02 IN. SQUARE | 0.560
0.626 IN. THICK

CLASSIFICATION PLASTIC CLAY (CH), gray, homogeneous

LL 83 | PL 26 | PI 57 | G_s 2.76

REMARKS * Final water content for test no. 1 is erroneous

PROJECT GRAND ISLE, LA. & VICINITY

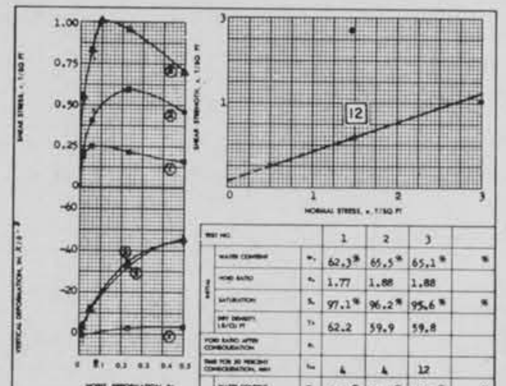
AREA

BORING NO. 76-UE | SAMPLE NO. 43

El-46.5 | DATE 7 FEBRUARY 1968

WJH DIRECT SHEAR TEST REPORT

ENG FORM 3092 (TRANSLUCENT) PLATE



SHEAR STRENGTH PARAMETERS

φ = 19°

tan φ = 0.344

c = 0.08 T/SQ FT

☐ CONTROLLED STRESS

☒ CONTROLLED STRAIN

TEST NO.			1	2	3	
Initial	WATER CONTENT	w_o	62.3 %	65.5 %	65.1 %	%
	VOID RATIO	e_o	1.77	1.88	1.88	
	SATURATION	S_o	97.1 %	96.2 %	95.6 %	%
	DRY DENSITY, LB/CU FT	γ_d	62.2	59.9	59.8	
VOID RATIO AFTER CONSOLIDATION		e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN		t_{50}	4	4	12	
Final	WATER CONTENT	w_f	68.0 %	58.7 %	49.8 %	%
	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}	0.25	0.59	1.02	
ACTUAL TIME TO FAILURE, MIN		t_f	360	1260	810	
RATE OF STRAIN, IN./MIN			.00018	.00018	.00018	
ULTIMATE SHEAR STRESS, T/SQ FT		τ_{ult}				

TYPE OF SPECIMEN UNDISTURBED | 3.01 IN. SQUARE | 0.561 IN. THICK

CLASSIFICATION PLASTIC CLAY (CH), gray, contains traces of shell

LL 104 | PL 34 | PI 70 | G_s 2.76

REMARKS

PROJECT GRAND ISLE, LA. & VICINITY

AREA

BORING NO. 76-UE | SAMPLE NO. 76

El-77.5 | DATE 8 February 1968

JBKc DIRECT SHEAR TEST REPORT

ENG FORM 3092 (TRANSLUCENT) PLATE

NOTE:

- [7] Indicates reference number shown under shear data on Plate 66
- (Q) - Unconsolidated - undrained triaxial compression test.
- (R) - Consolidated - undrained triaxial compression test.
- (S) - Consolidated - drained direct shear test.

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)

DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

DETAIL SHEAR STRENGTH DATA
BORING 76 UE

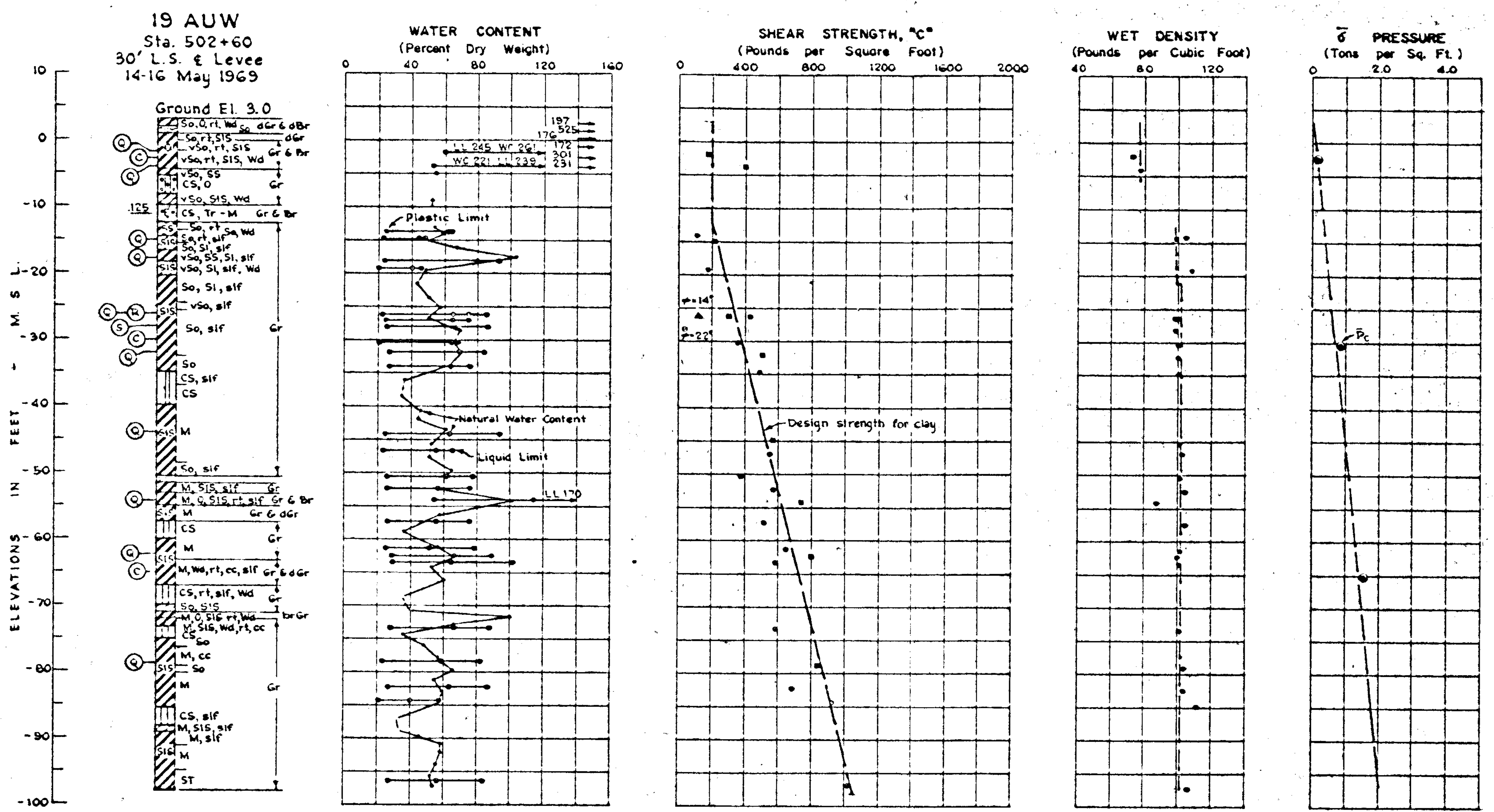
BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

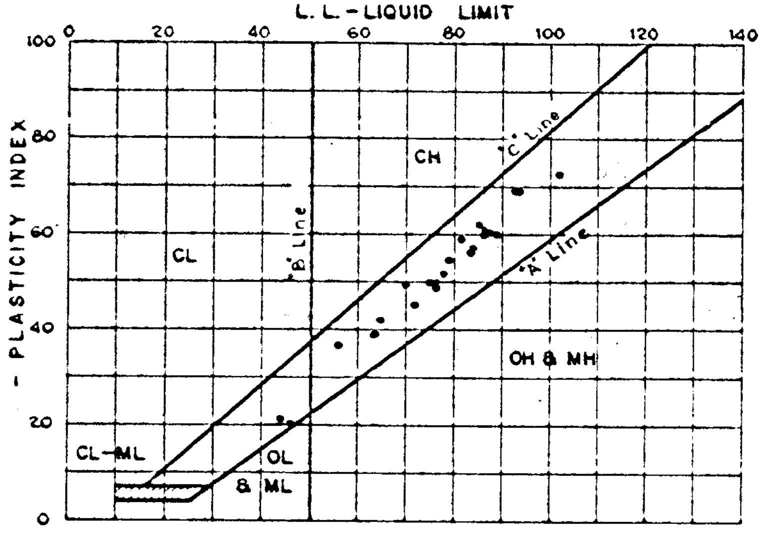
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

DATE: MARCH, 1972

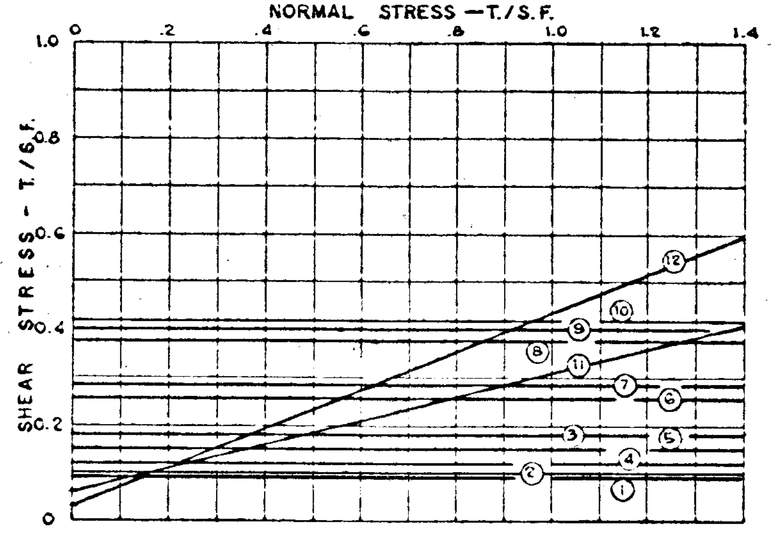
FILE NO. H-2-24314

PLATE 67



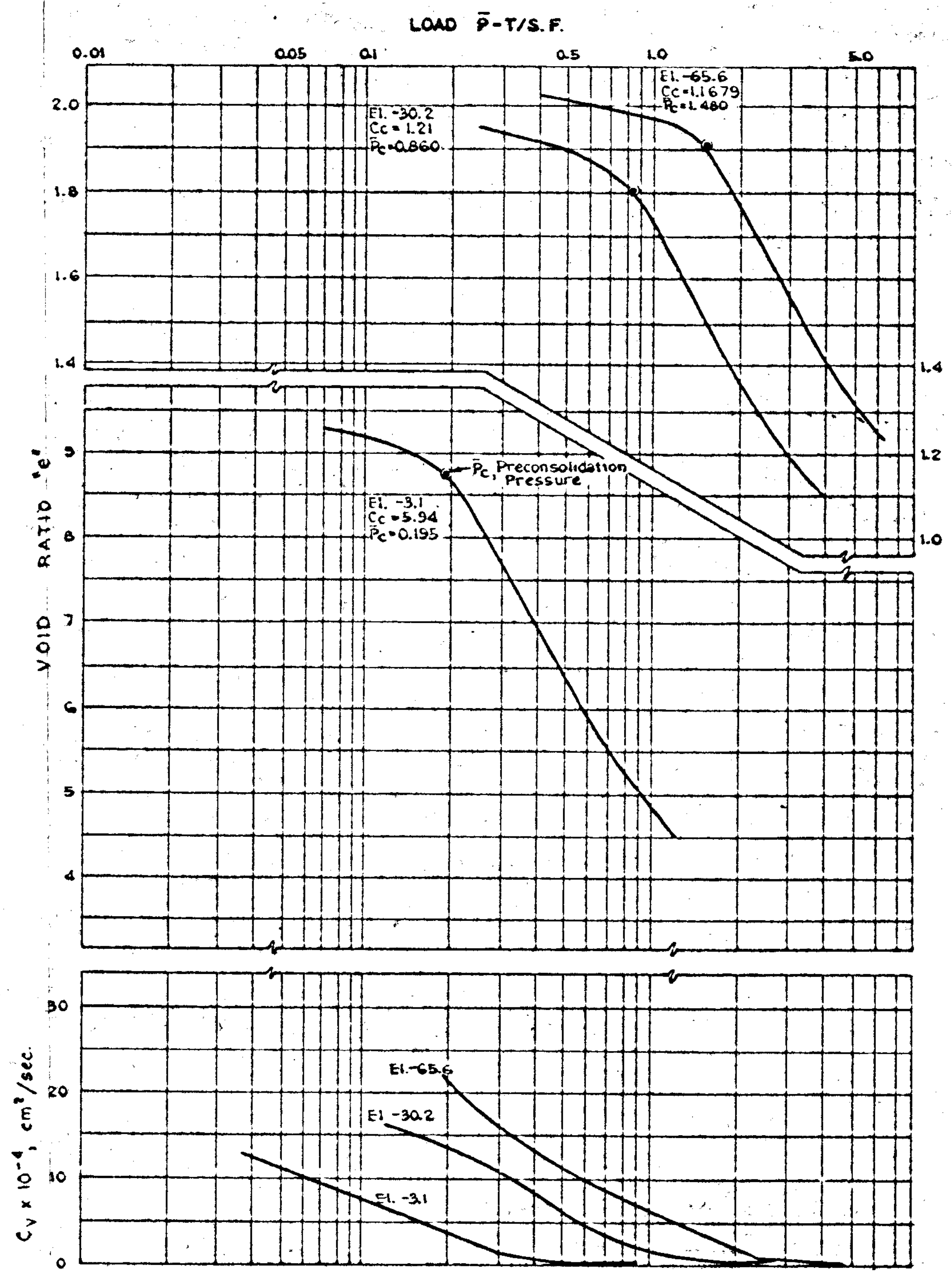


PLASTICITY CHART



ENVELOPE		TYPE	STRENGTH		CLASS
No	EL.		φ	c. t.s.f.	
1	- 2.2	Q	0	.090	CH
2	- 4.0			.100	
3	-15.1			.180	CL
4	-17.8			.120	CH
5	-26.2			.150	
6	-37.0			.253	
7	-44.0			.285	
8	-54.2			.375	
9	-62.5			.400	
10	-78.5			.418	
11	-26.2	R	14°	.060	CH
12	-28.0	S	22°	.030	CH

SHEAR STRENGTH DATA



CONSOLIDATION DATA

For general notes see plate 46
For detail shear strength data see plate 69
For location of boring see plate 19

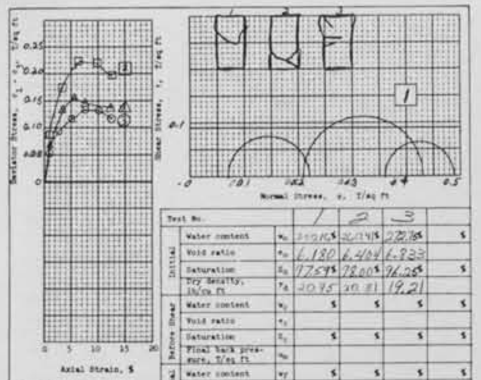
GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

SOIL BORING 19 AUW DATA

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

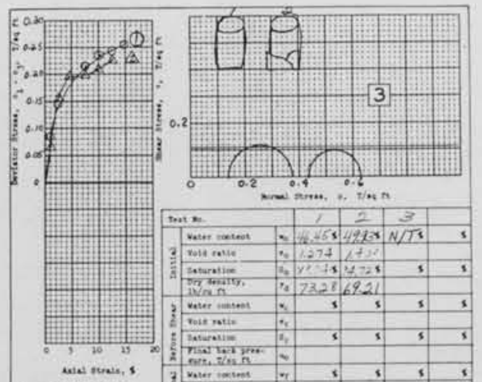
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

DATE: MARCH 1972
FILE NO. H-2-24314



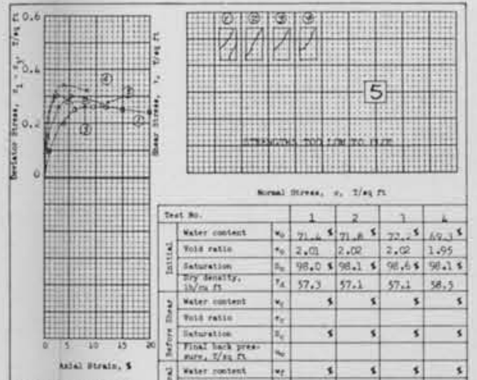
Test No.		1	2	3	
Initial: Water content	w_o	215.16%	220.41%	222.76%	%
Void ratio	e_o	6.180	6.404	6.333	
Saturation	S_o	97.59%	92.00%	96.25%	%
Dry density, lb/cu ft	γ_d	20.75	20.81	19.21	
Before Shear: Water content	w_c	%	%	%	%
Void ratio	e_c				
Saturation	S_c	%	%	%	%
Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.07	0.21	0.36	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.15	0.22	0.13	
Time to failure, min	t_f	8.24	9.68	10.21	
Rate of strain, percent/min		0.68	0.67	0.66	
Wet density lb/cu ft		73.37	73.21	71.60	
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 = 0.09 T/sq ft
Method of saturation
☐ Controlled stress
☒ Controlled strain
Type of test "Q" Type of specimen 5" Undisturbed
Classification vSo(Gr&Br)CH4-OC;lnsMl;dw;rt
LL 245 PL 60 PI 185 UCT-N/T G_s 2.4137
Remarks NOD Testing Section
Project Grand Isle, La. & Vic. Hurr. Prot.
Area Sta. 502+60 30'L.S. C.L. Levee
Boring No. 19-AUW Sample No. 2-B
Depth 5.3 El -2.3 Date 30 Sept 69
TRIAXIAL COMPRESSION TEST REPORT Q7H
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



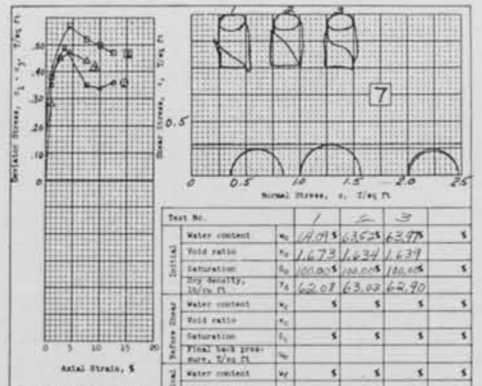
Test No.		1	2	3	
Initial: Water content	w_o	46.45%	49.93%	N/T%	%
Void ratio	e_o	1.274	1.431		
Saturation	S_o	[illegible]%	94.72%	%	%
Dry density, lb/cu ft	γ_d	73.28	69.21		
Before Shear: Water content	w_c	%	%	%	%
Void ratio	e_c				
Saturation	S_c	%	%	%	%
Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.14	0.43		
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.23	0.20		
Time to failure, min	t_f	14.[illegible]	5.54		
Rate of strain, percent/min		0.66	0.68		
Wet density lb/cu ft		107.32	103.76		
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.40	1.40		
Initial height, in.	H_o	3.00	3.00		

Shear Strength Parameters
φ = 0°
tan φ = 0
c = 0.106 T/sq ft
Method of saturation
☐ Controlled stress
☒ Controlled strain
Type of test "Q" Type of specimen 5" Undisturbed
Classification So(Gr)CL&lns&slt lys ML;slf;rt
LL 44 PL 23 PI 21 UCT-N/T G_s 2.6715
Remarks NOD Testing Section
Project Grand Isle,La. & Vicinity Hurricane Protection
Area Sta. 502+60 30'L.S. C/L Levee
Boring No. 19-AUW Sample No. 5-C
Depth 18.1 El -15.1 Date 30 Sept 69
TRIAXIAL COMPRESSION TEST REPORT Q7H
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



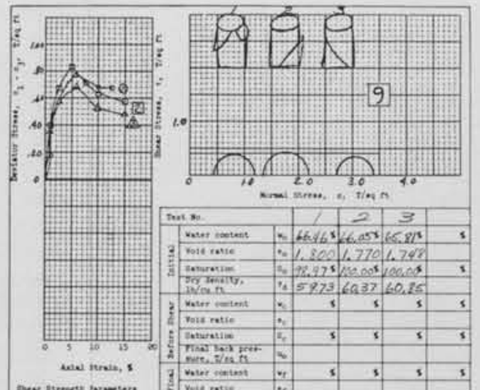
Test No.		1	2	3	4
Initial: Water content	w_o	71.4 %	71.8 %	72.2 %	69.3 %
Void ratio	e_o	2.01	2.02	2.02	1.95
Saturation	S_o	98.0 %	98.1 %	98.6 %	98.1 %
Dry density, lb/cu ft	γ_d	57.3	57.1	57.1	58.5
Before Shear: Water content	w_c	%	%	%	%
Void ratio	e_c				
Saturation	S_c	%	%	%	%
Final back pressure, T/sq 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	0.5
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.26	0.30	0.31	0.34
Time to failure, min	t_f	60	26	10	31
Rate of strain, percent/min		0.16	0.20	0.22	0.13
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.40	1.40	1.40	1.40
Initial height, in.	H_o	3.00	3.00	3.00	3.00

Shear Strength Parameters
φ = 0°
tan φ = 0
c = 0.15 T/sq ft
Method of saturation
☐ Controlled stress
☒ Controlled strain
Type of test Q Type of specimen UNDISTURBED
Classification PLASTIC CLAY (CH), gray, contains a few silt lenses
LL - PL - PI - G_s 2.76 from 8-B
Remarks
Project HURRICANE PROTECTION - 1969
GRAND ISLE & VICINITY (CHECK BORINGS)
Area
Boring No. 19-AUW Sample No. 8-B
Depth El -26.2 Date 8 AUGUST 1969
JMS TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT [illegible] SOILS TEST SECTION



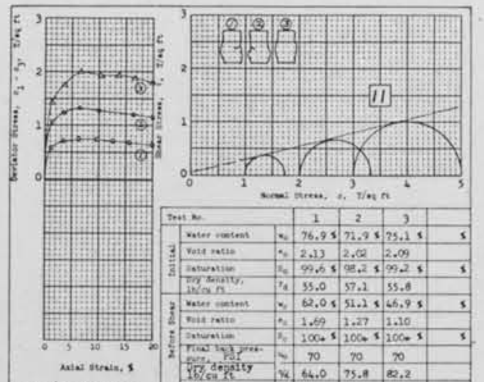
Test No.		1	2	3	
Initial: Water content	w_o	64.09%	63.52%	63.97%	%
Void ratio	e_o	1.673	1.634	1.639	
Saturation	S_o	100.00%	100.00%	100.00%	%
Dry density, lb/cu ft	γ_d	62.07	63.03	62.90	
Before Shear: Water content	w_c	%	%	%	%
Void ratio	e_c				
Saturation	S_c	%	%	%	%
Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.36	1.00	2.00	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.49	0.57	0.47	
Time to failure, min	t_f	5.00	15.15	15.31	
Rate of strain, percent/min		0.69	0.27	0.28	
Wet density, lb/cu ft		101.86	103.07	103.14	
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 = 0.285 T/sq ft
Method of saturation
☐ Controlled stress
☒ Controlled strain
Type of test "Q" Type of specimen 5" Undisturbed
Classification M(Gr)CH4;few lns&slt thin lys
LL 94 PL 25 PI 69 UCT-527 G_s 2.6608
Remarks NOD Testing Section
Project Grand Isle,La. & Vicinity Hurricane Protection
Area Sta. 502 +60 - 30' L.S. C/L Levee
Boring No. 19-AUW Sample No. 12-D
Depth 47.0 El -44.0 Date 30 Sept 69
TRIAXIAL COMPRESSION TEST REPORT Q7H
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



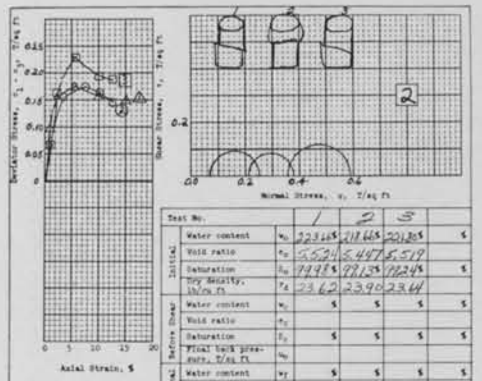
Test No.		1	2	3	
Initial: Water content	w_o	66.46%	66.05%	65.81%	%
Void ratio	e_o	1.800	1.770	1.748	
Saturation	S_o	98.97%	100.00%	100.00%	%
Dry density, lb/cu ft	γ_d	59.73	60.37	60.85	
Before Shear: Water content	w_c	%	%	%	%
Void ratio	e_c				
Saturation	S_c	%	%	%	%
Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.43	1.36	2.71	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.77	0.83	0.63	
Time to failure, min	t_f	9.31	7.91	7.80	
Rate of strain, percent/min		0.64	0.64	0.66	
Wet Density lb/cu ft		99.44	100.24	100.90	
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 = 0.40 T/sq ft
Method of saturation
☐ Controlled stress
☒ Controlled strain
Type of test "Q" Type of specimen 5" Undisturbed
Classification M(Gr)CH4;lns&few thin lys ML;few org stks
LL 89 PL 29 PI 60 UCT-735 G_s 2.6839
Remarks NOD Testing Section
Project Grand Isle, La. & Vicinity Hurricane Protection
Area 502+60 - 30' L.S. C/L Levee
Boring No. 19-AUW Sample No. 17-D
Depth 55.5 El -52.5 Date 30 Sept 69
TRIAXIAL COMPRESSION TEST REPORT Q7H
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



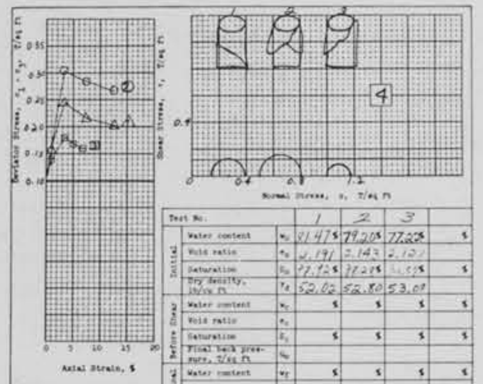
Test No.		1	2	3	
Initial: Water content	w_o	76.9 %	71.9 %	75.1 %	%
Void ratio	e_o	2.13	2.02	2.09	
Saturation	S_o	99.6 %	98.2 %	99.2 %	%
Dry density, lb/cu ft	γ_d	55.0	57.1	55.8	
Before Shear: Water content	w_c	62.0 %	51.1 %	46.9 %	%
Void ratio	e_c	1.69	1.27	1.10	
Saturation	S_c	100+ %	100+ %	100+ %	%
Final back pressure, PSI	u_o	70	70	70	
Final: Dry density lb/cu ft	γ_d	64.0	75.8	82.2	
Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	1.0	2.0	3.0	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.73	1.32	2.00	
Time to failure, min	t_f	52	107	110	
Rate of strain, percent/min		0.12	0.06	0.06	
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 = 14°
tan φ = 0.249
c = 0.06 T/sq ft
Method of saturation BP
☐ Controlled stress
☒ Controlled strain
Type of test R Type of specimen UNDISTURBED
Classification PLASTIC CLAY (CH), gray, contains a few 1/16" horizontal *
LL 85 PL 23 PI 62 G_s 2.76
Remarks * silt lenses
Project HURRICANE PROTECTION - 1969
GRAND ISLE & VICINITY (CHECK BORINGS)
Area
Boring No. 19-AUW Sample No. 8-B
Depth El -26.2 Date 7 August 1969
PJR TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT [illegible] SOILS TEST SECTION



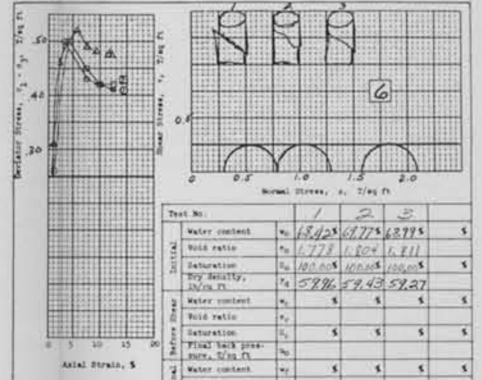
Test No.		1	2	3	
Initial: Water content	w_o	223.16%	218.66%	201.30%	%
Void ratio	e_o	5.534	5.497	5.519	
Saturation	S_o	99.98%	98.13%	98.24%	%
Dry density, lb/cu ft	γ_d	23.62	23.90	23.64	
Before Shear: Water content	w_c	%	%	%	%
Void ratio	e_c				
Saturation	S_c	%	%	%	%
Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.07	0.21	0.36	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.18	0.17	0.23	
Time to failure, min	t_f	7.26	13.57	8.15	
Rate of strain, percent/min		0.68	0.69	0.68	
Wet density, lb/cu ft		76.44	76.16	76.06	
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 5" Undisturbed
Classification vSo(Gr&Br)CH4-OB; lns Ml;dw;rt
LL 239 PL 54 PI 185 UCT-N/T G_s 2.4650
Remarks NOD Testing Section
Project Grand Isle, La. & Vicinity Hurricane Protection
Area Sta. 502+60 30'L.S. C.L. Levee
Boring No. 19-AUW Sample No. 2-D
Depth 7.0 El -4.0 Date 30 Sept 69
TRIAXIAL COMPRESSION TEST REPORT Q7H
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



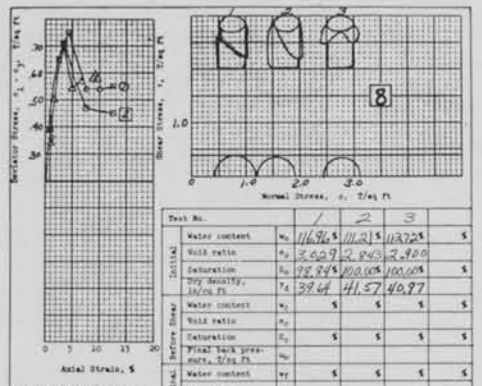
Test No.		1	2	3	
Initial: Water content	w_o	81.47%	79.20%	77.22%	%
Void ratio	e_o	2.191	2.143	2.121	
Saturation	S_o	97.12%	97.20%	[illegible]%	%
Dry density, lb/cu ft	γ_d	52.02	52.80	53.09	
Before Shear: Water content	w_c	%	%	%	%
Void ratio	e_c				
Saturation	S_c	%	%	%	%
Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.14	0.50	1.00	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.25	0.30	0.18	
Time to failure, min	t_f	4.90	12.16	11.87	
Rate of strain, percent/min		0.69	0.27	0.28	
Wet density, lb/cu ft		94.41	94.61	94.08	
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 5" Undisturbed
Classification vSo (Gr)CH4;lns&slt thin lys ML&SM;sl&slf;org;stks
LL 93 PL 24 PI 69 UCT-N/T G_s 2.6627
Remarks NOD Testing Section
Project Grand Isle, La. & Vicinity Hurricane Protection
Area Sta. 502+60 30'L.S. C.L. Levee
Boring No. 19-AUW Sample No. 6-B
Depth 20.8 El -17.8 Date 30 Sept 69
TRIAXIAL COMPRESSION TEST REPORT Q7H
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



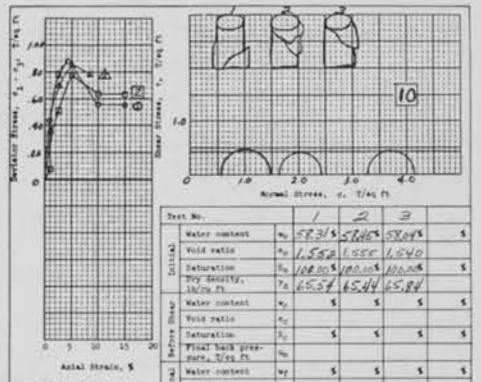
Test No.		1	2	3	
Initial: Water content	w_o	68.42%	68.77%	68.99%	%
Void ratio	e_o	1.778	1.804	1.811	
Saturation	S_o	100.00%	100.00%	100.00%	%
Dry density, lb/cu ft	γ_d	58.96	59.43	59.27	
Before Shear: Water content	w_c	%	%	%	%
Void ratio	e_c				
Saturation	S_c	%	%	%	%
Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.29	0.79	1.57	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.50	0.50	0.54	
Time to failure, min	t_f	5.10	15.36	16.4[illegible]	
Rate of strain, percent/min		0.68	0.27	0.27	
Wet density, lb/cu ft		100.99	100.89	100.17	
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.	D_o	1.40	1.40	1.40	
Initial height, in.	H_o	3.00	3.00	3.00	

Shear Strength Parameters
φ = 0°
tan φ = 0
c = 0.253 T/sq ft
Method of saturation
☐ Controlled stress
☒ Controlled strain
Type of test "Q" Type of specimen 5" Undisturbed
Classification So(Gr)CH4;lns&few thin lys ML;org stks&few slf;spks dw
LL 84 PL 27 PI 57 UCT-467 G_s 2.6662
Remarks NOD Testing Section
Project Grand Isle,La. & Vicinity Hurricane Protection
Area Sta. 502+60 30'L.S. C/L Levee
Boring No. 19-AUW Sample No. 9-D
Depth 35.0 El -32.0 Date 30 Sept 69
TRIAXIAL COMPRESSION TEST REPORT Q7H
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



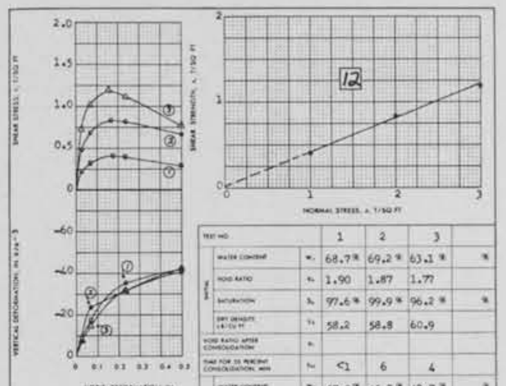
Test No.		1	2	3	
Initial: Water content	w_o	116.96%	111.21%	112.72%	%
Void ratio	e_o	3.029	2.843	2.900	
Saturation	S_o	98.84%	100.00%	100.00%	%
Dry density, lb/cu ft	γ_d	39.64	41.57	40.97	
Before Shear: Water content	w_c	%	%	%	%
Void ratio	e_c				
Saturation	S_c	%	%	%	%
Final back pressure, T/sq ft	u_o				
Final: Water content	w_f	%	%	%	%
Void ratio	e_f				
Minor principal stress, T/sq ft	σ_3	0.43	1.21	2.43	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.75	0.71	0.69	
Time to failure, min	t_f	8.03	14.7[illegible]	13.03	
Rate of strain, percent/min		0.70	0.25	0.26	
Wet density, lb/cu ft		86.01	87.80	87.56	
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 = 0.375 T/sq ft
Method of saturation
☐ Controlled stress
☒ Controlled strain
Type of test "Q" Type of specimen 5" Undisturbed
Classification M(Gr & Br) CH4-OA;lns&few thin lys ML; dw;rt;few slf
LL 170 PL 53 PI 117 UCT-986 G_s 2.5583
Remarks NOD Testing Section
Project Grand Isle,La. & Vicinity Hurricane Protection
Area Sta. 502 + 60 - 30' L.S. C/L Levee
Boring No. 19-AUW Sample No. 15-D
Depth 57.2 El -54.2 Date 30 Sept 69
TRIAXIAL COMPRESSION TEST REPORT Q7H
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



Test No.		1	2	3	
Initial: Water content	w_o	58.31%	58.45%	58.04%	%
Void ratio	e_o	1.552	1.555	1.540	
Saturation	S_o	100.00%	100.00%	100.00%	%
Dry density, lb/cu ft	γ_d	65.54	65.44	65.84	
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	0.57	1.64	3.29	
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$	0.88	0.78	0.95	
Time to failure, min	t_f	6.77	19.52	17.54	
Rate of strain, percent/min		0.65	0.26	0.26	
Wet density, lb/cu ft		103.74	103.70	104.05	
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 = 0.418 T/sq ft
Method of saturation
☐ Controlled stress
☒ Controlled strain
Type of test "Q" Type of specimen 5" Undisturbed
Classification M(Gr)CH4;lns&slt lys ML;cc;org;stks
LL 82 PL 23 PI 59 UCT-NT G_s 2.6825
Remarks NOD Testing Section
Project Grand Isle, La. & Vicinity Hurricane Protection
Area STa. 502+ 60 - 30'L.S. C/L Levee
Boring No. 19-AUW Sample No. 21-D
Depth 81.5 El -78.5 Date 30 Sept 69
TRIAXIAL COMPRESSION TEST REPORT Q7H
ENG FORM 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



TEST NO.		1	2	3	
Initial: Water content	w_o	68.7 %	69.2 %	63.1 %	%
Void ratio	e_o	1.90	1.87	1.77	
Saturation	S_o	97.6 %	99.9 %	96.2 %	%
Dry density, lb/cu ft	γ_d	58.2	58.8	60.9	
Void ratio after consolidation	e_c				
Time for 50 percent consolidation, min	t_{50}	<1	6	4	
Final: Water content	w_f	57.0 %	45.3 %	42.7 %	%
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}	0.40	0.83	1.19	
Actual time to failure, min	t_f	1020	960	900	
Rate of strain, in./min		.00018	.00018	.00018	
Ultimate shear stress, T/sq ft	τ_{ult}				

SHEAR STRENGTH PARAMETERS
φ = 22°
tan φ = 0.404
c = 0.03 T/sq ft
☐ CONTROLLED STRESS
☒ CONTROLLED STRAIN
TYPE OF SPECIMEN UNDISTURBED 3.00 in SQUARE 0.557 in THICK
CLASSIFICATION PLASTIC CLAY (CH), gray
LL 86 PL 25 PI 61 G_s 2.70
REMARKS
PROJECT HURRICANE PROTECTION - 1969
GRAND ISLE & VICINITY (CHECK BORINGS)
AREA
BORING NO. 19-AUW SAMPLE NO. 8-D
DEPTH EL -28.0 DATE 19 August 1969
JHMo DIRECT SHEAR TEST REPORT
ENG FORM 1 JUN 65 2092 (EM 1110-2-1906) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT [illegible] SOILS TEST SECTION

NOTE:

- 3 Indicates reference number shown under shear data on Plate 68
- (Q) Unconsolidated - undrained triaxial compression test.
- (R) Consolidated - undrained triaxial compression test.
- (S) Consolidated - drained direct shear test.

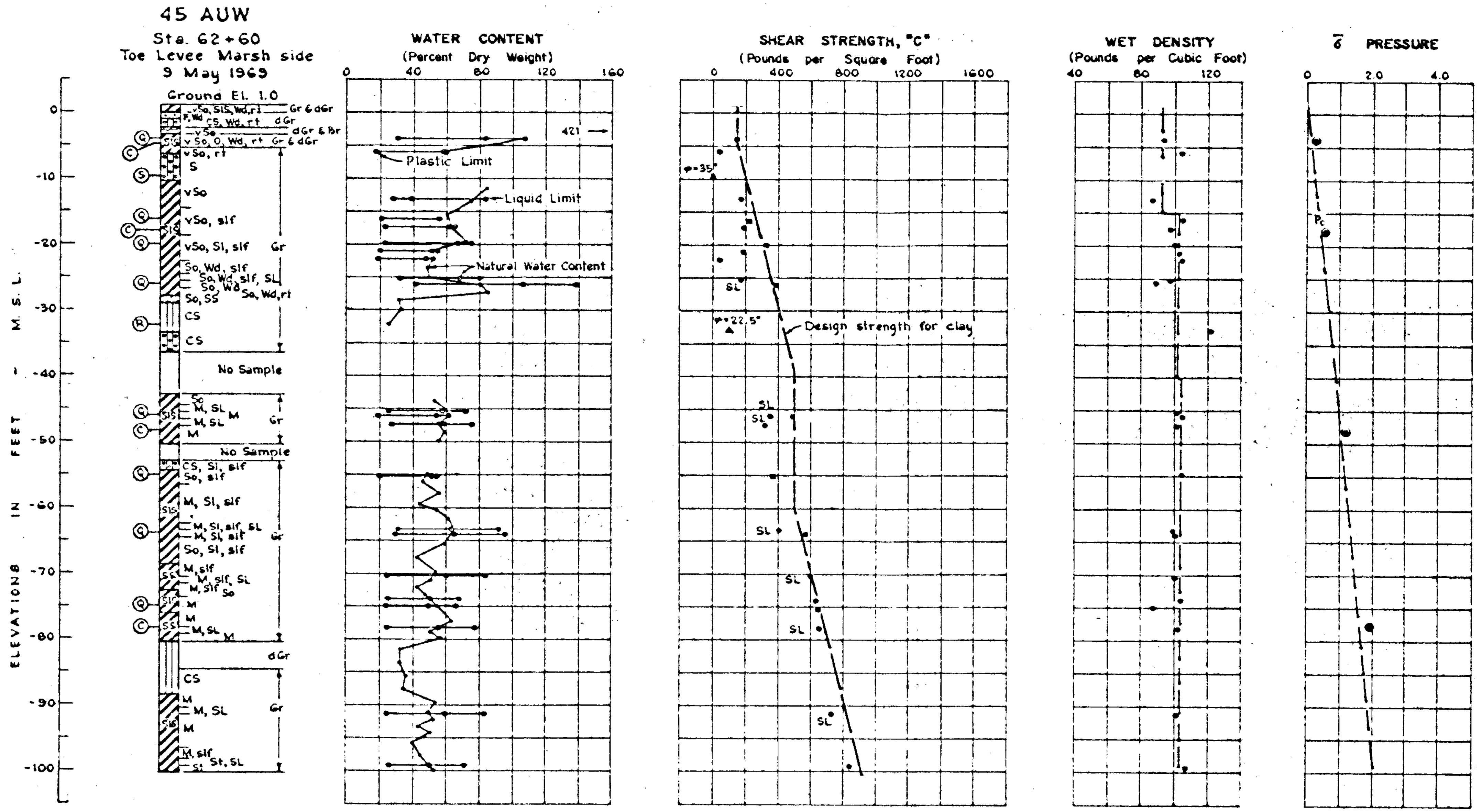
GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

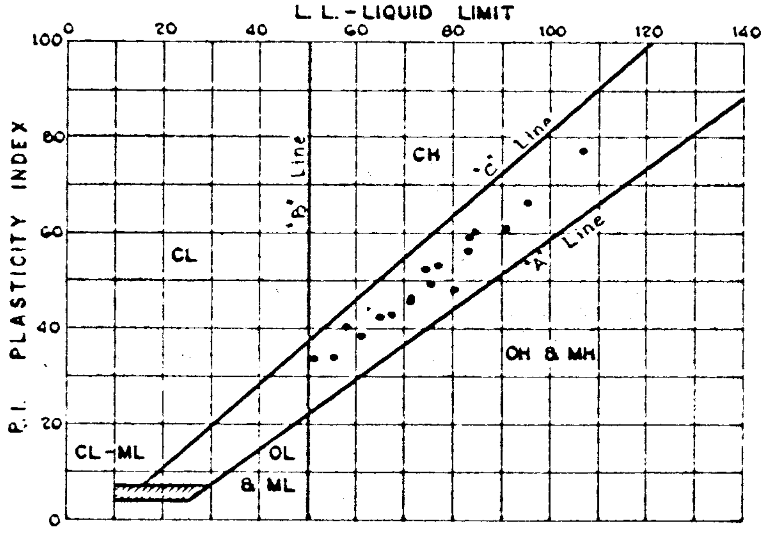
DETAIL SHEAR STRENGTH DATA BORING 19 AUW

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

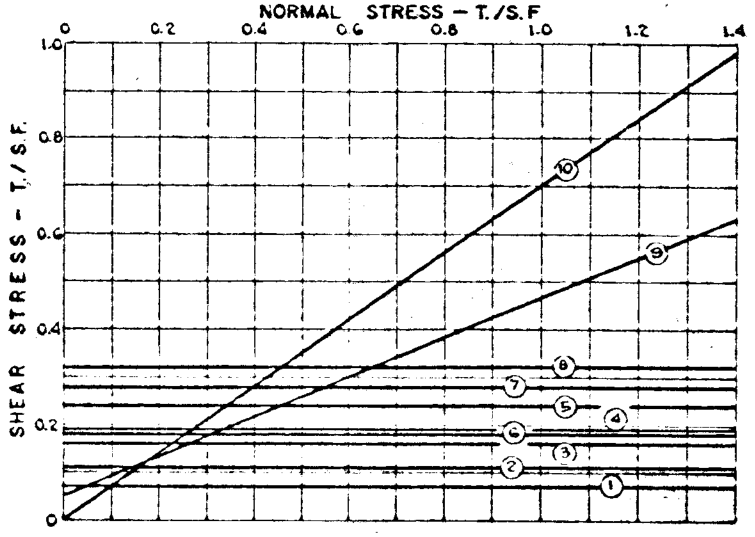
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

DATE: MARCH, 1972
FILE NO. H-2-24314





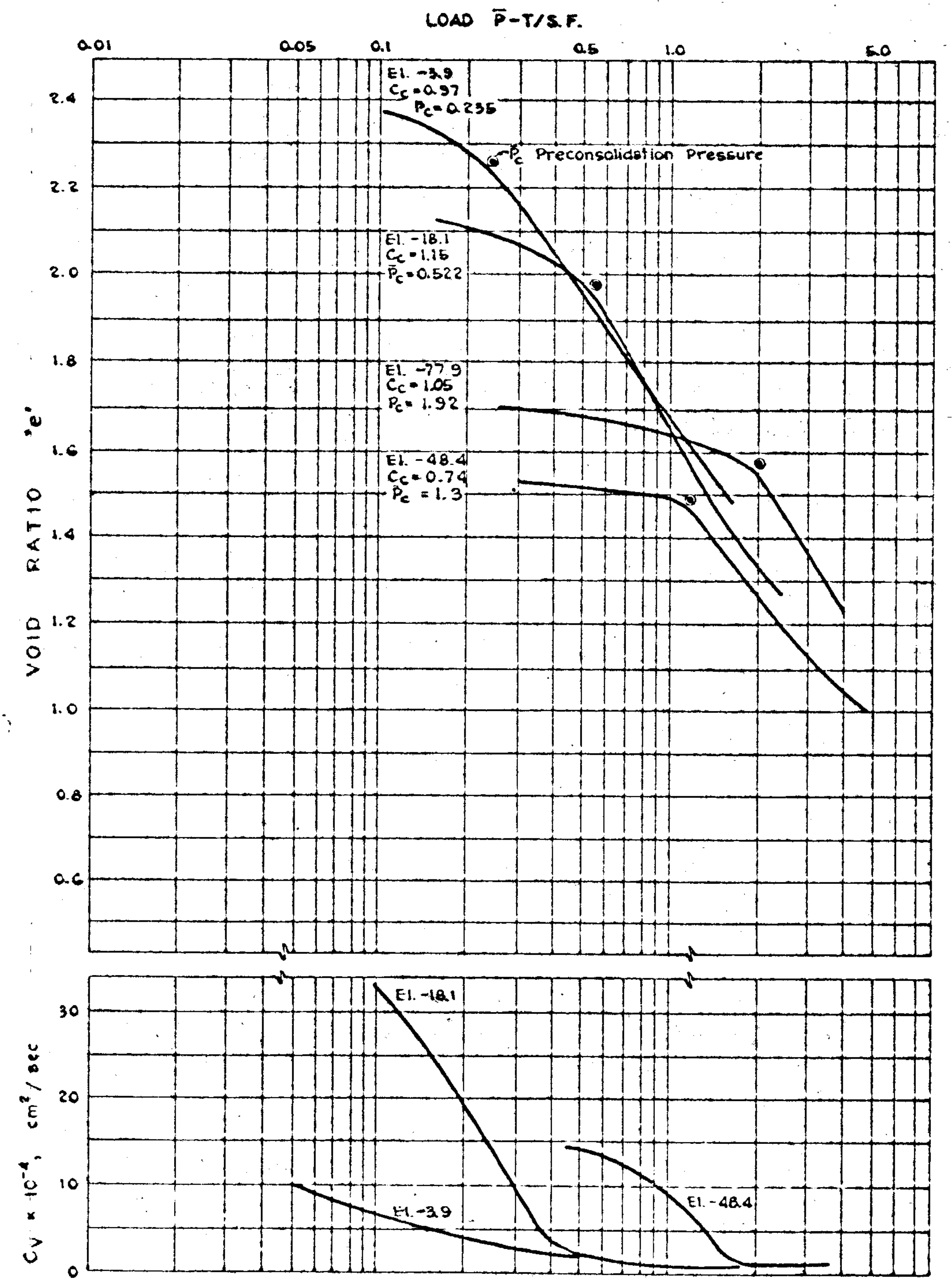
PLASTICITY CHART



ENVELOPE		TYPE	STRENGTH		CLASS
NO.	EL.		φ	c t.s.f.	
1	-3.9	Q	0	0.07	CH
2	-16.3			0.11	
3	-20.0			0.16	
4	-26.0			0.19	
5	-45.0			0.24	
6	-55.0			0.18	
7	-64.0			0.28	
8	-75.2			0.32	
9	-32.5	* R	22.5°	0.05	ML
10	-9.7	S	35°	0	SP

*Based on deviator stress at maximum pore pressure.

SHEAR STRENGTH DATA



CONSOLIDATION DATA

For general notes see plate 46
For detail shear strength data see plate 71
For location of boring see plate 15

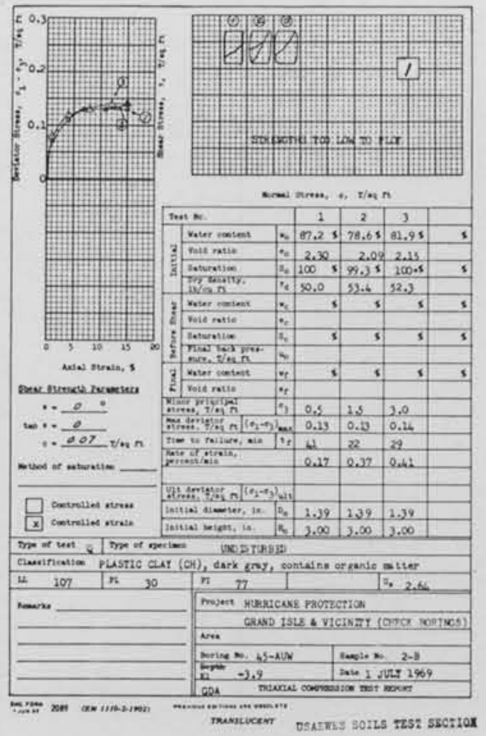
GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

SOIL BORING 45 AUW DATA

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE: MARCH 1972
FILE NO. H-2-24314

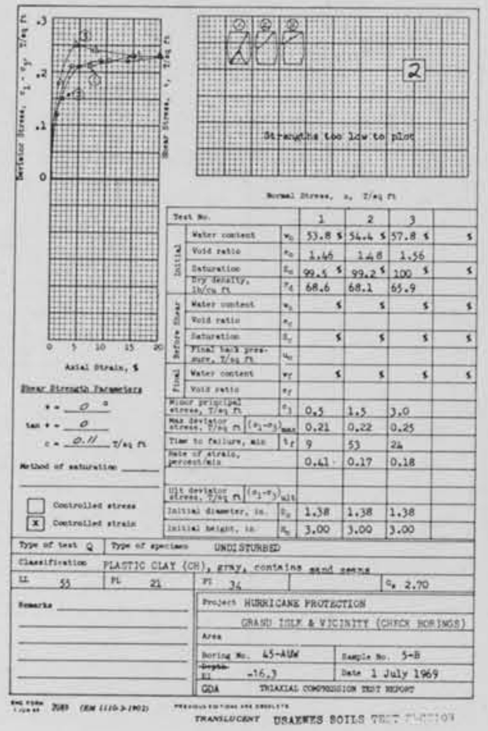


Test No.			1	2	3	
Initial	Water content	w_o	87.2 %	78.6 %	81.9 %	%
	Void ratio	e_o	2.30	2.09	2.15	
	Saturation	S_o	100 %	99.3 %	100+%	%
	Dry density, lb/cu ft	γ_d	50.0	53.4	52.3	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_o				
Final	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		$(\sigma_1-\sigma_3)_{max}$	0.13	0.13	0.14	
Time to failure, min		t_f	41	22	29	
Rate of strain, percent/min			0.17	0.37	0.41	
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 = 0.07 T/sq ft
Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED
Classification PLASTIC CLAY (CH), dark gray, contains organic matter
LL 107 | PL 30 | PI 77 | G_s 2.64
Remarks
Project HURRICANE PROTECTION
GRAND ISLE & VICINITY (CHECK BORINGS)
Area
Boring No. 45-AUW | Sample No. 2-B
~~Depth~~ El -3.9 | Date 1 JULY 1969
GDA TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 1 JUN 65 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE
TRANSLUCENT
USAEWES SOILS TEST SECTION

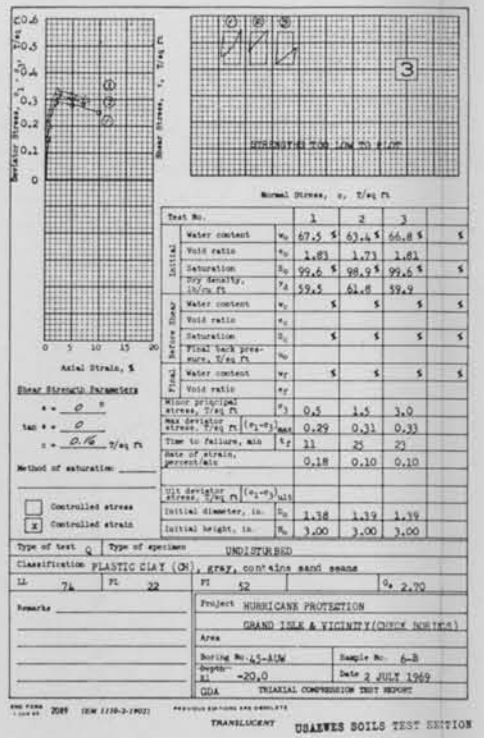


Test No.			1	2	3	
Initial	Water content	w_o	53.8 %	54.4 %	57.8 %	%
	Void ratio	e_o	1.46	1.48	1.56	
	Saturation	S_o	99.5 %	99.2 %	100 %	%
	Dry density, lb/cu ft	γ_d	68.6	68.1	65.9	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_o				
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		$(\sigma_1-\sigma_3)_{max}$	0.21	0.22	0.25	
Time to failure, min		t_f	9	53	24	
Rate of strain, percent/min			0.41	0.17	0.18	
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 PLASTIC CLAY (CH), gray, contains sand seams
LL 55 | PL 21 | PI 34 | G_s 2.70
Remarks
Project HURRICANE PROTECTION
GRAND ISLE & VICINITY (CHECK BORINGS)
Area
Boring No. 45-AUW | Sample No. 5-B
~~Depth~~ El -16.3 | Date 1 July 1969
GDA TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 1 JUN 65 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE
TRANSLUCENT
USAEWES SOILS TEST SECTION

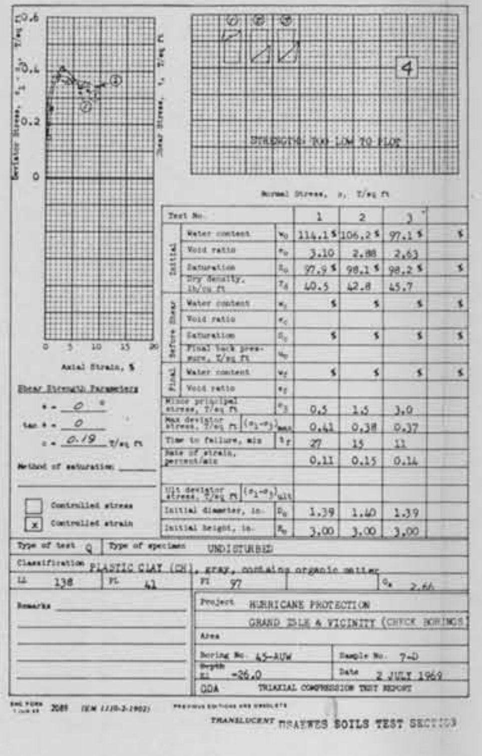


Test No.			1	2	3	
Initial	Water content	w_o	67.5 %	63.4 %	66.8 %	%
	Void ratio	e_o	1.83	1.73	1.81	
	Saturation	S_o	99.6 %	98.9 %	99.6 %	%
	Dry density, lb/cu ft	γ_d	59.5	61.8	59.9	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_o				
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		$(\sigma_1-\sigma_3)_{max}$	0.29	0.31	0.33	
Time to failure, min		t_f	11	25	23	
Rate of strain, percent/min			0.18	0.10	0.10	
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 = 0.16 T/sq ft
Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED
Classification PLASTIC CLAY (CH), gray, contains sand seams
LL 74 | PL 22 | PI 52 | G_s 2.70
Remarks
Project HURRICANE PROTECTION
GRAND ISLE & VICINITY (CHECK BORINGS)
Area
Boring No. 45-AUW | Sample No. 6-B
~~Depth~~ El -20.0 | Date 2 JULY 1969
GDA TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 1 JUN 65 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE
TRANSLUCENT
USAEWES SOILS TEST SECTION

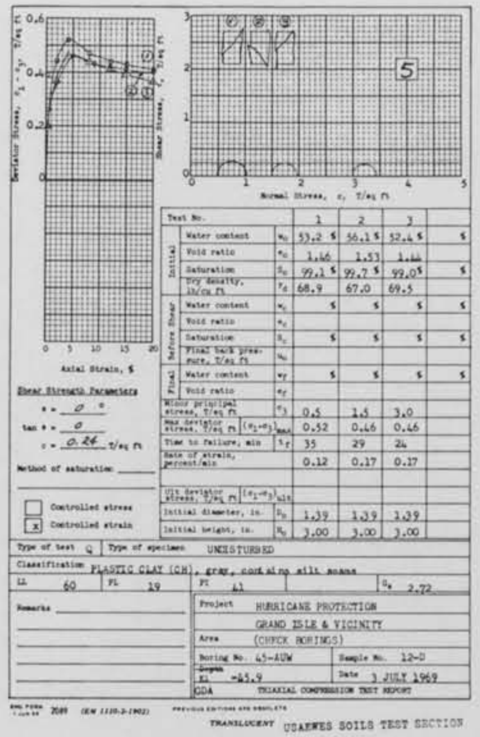


Test No.			1	2	3	
Initial	Water content	w_o	114.1 %	106.2 %	97.1 %	%
	Void ratio	e_o	3.10	2.88	2.63	
	Saturation	S_o	97.9 %	98.1 %	98.2 %	%
	Dry density, lb/cu ft	γ_d	40.5	42.8	45.7	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_o				
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		$(\sigma_1-\sigma_3)_{max}$	0.41	0.38	0.37	
Time to failure, min		t_f	27	15	11	
Rate of strain, percent/min			0.11	0.15	0.14	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.39	1.40	1.39	
Initial height, in.		H_o	3.00	3.00	3.00	

Shear Strength Parameters
φ = 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 PLASTIC CLAY (CH), gray, contains organic matter
LL 138 | PL 41 | PI 97 | G_s 2.66
Remarks
Project HURRICANE PROTECTION
GRAND ISLE & VICINITY (CHECK BORINGS)
Area
Boring No. 45-AUW | Sample No. 7-D
~~Depth~~ El -26.0 | Date 2 JULY 1969
GDA TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 1 JUN 65 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE
TRANSLUCENT
USAEWES SOILS TEST SECTION

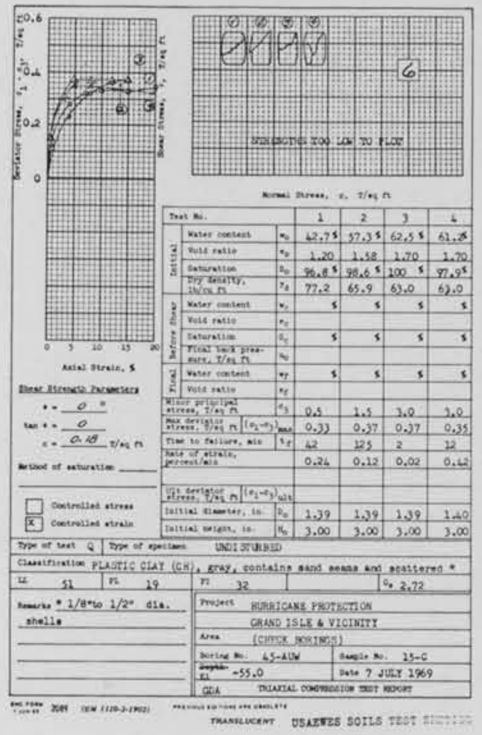


Test No.			1	2	3	
Initial	Water content	w_o	53.2 %	56.1 %	52.4 %	%
	Void ratio	e_o	1.46	1.53	1.44	
	Saturation	S_o	99.1 %	99.7 %	99.0 %	%
	Dry density, lb/cu ft	γ_d	68.9	67.0	69.5	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_o				
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		$(\sigma_1-\sigma_3)_{max}$	0.52	0.46	0.46	
Time to failure, min		t_f	35	29	24	
Rate of strain, percent/min			0.12	0.17	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 = 0.24 T/sq ft
Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED
Classification PLASTIC CLAY (CH), gray, contains silt seams
LL 60 | PL 19 | PI 41 | G_s 2.72
Remarks
Project HURRICANE PROTECTION
GRAND ISLE & VICINITY
Area (CHECK BORINGS)
Boring No. 45-AUW | Sample No. 12-D
~~Depth~~ El -45.9 | Date 3 JULY 1969
GDA TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 1 JUN 65 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE
TRANSLUCENT
USAEWES SOILS TEST SECTION

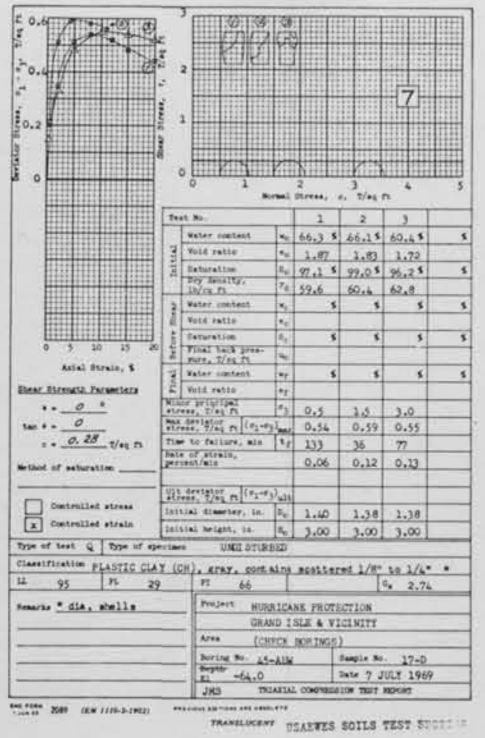


Test No.			1	2	3	4
Initial	Water content	w_o	42.7 %	57.3 %	62.5 %	61.2 %
	Void ratio	e_o	1.20	1.58	1.70	1.70
	Saturation	S_o	96.8 %	98.6 %	100 %	97.9 %
	Dry density, lb/cu ft	γ_d	77.2	65.9	63.0	63.0
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, 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	3.0
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.33	0.37	0.37	0.35
Time to failure, min		t_f	42	125	2	12
Rate of strain, percent/min			0.24	0.12	0.02	0.42
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.39	1.39	1.39	1.40
Initial height, in.		H_o	3.00	3.00	3.00	3.00

Shear Strength Parameters
φ = 0 °
tan φ = 0
c = 0.18 T/sq ft
Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED
Classification PLASTIC CLAY (CH), gray, contains sand seams and scattered *
LL 51 | PL 19 | PI 32 | G_s 2.72
Remarks * 1/8"to 1/2" dia. shells
Project HURRICANE PROTECTION
GRAND ISLE & VICINITY
Area (CHECK BORINGS)
Boring No. 45-AUW | Sample No. 15-C
~~Depth~~ El -55.0 | Date 7 JULY 1969
GDA TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 1 JUN 65 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE
TRANSLUCENT
USAEWES SOILS TEST SECTION

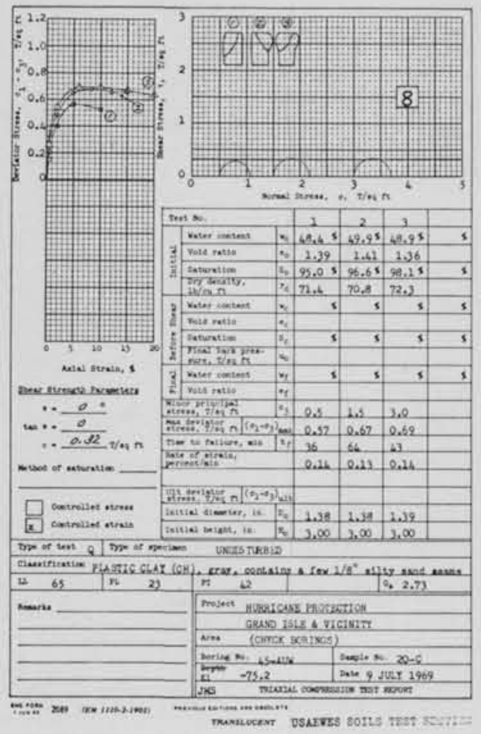


Test No.			1	2	3	
Initial	Water content	w_o	66.3 %	66.1 %	60.4 %	%
	Void ratio	e_o	1.87	1.83	1.72	
	Saturation	S_o	97.1 %	99.0 %	96.2 %	%
	Dry density, lb/cu ft	γ_d	59.6	60.4	62.8	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_o				
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		$(\sigma_1-\sigma_3)_{max}$	0.54	0.59	0.55	
Time to failure, min		t_f	133	36	77	
Rate of strain, percent/min			0.06	0.12	0.13	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.40	1.38	1.38	
Initial height, in.		H_o	3.00	3.00	3.00	

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

☐ Controlled stress
☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED
Classification PLASTIC CLAY (CH), gray, contains scattered 1/8" to 1/4" *
LL 95 | PL 29 | PI 66 | G_s 2.74
Remarks * dia. shells
Project HURRICANE PROTECTION
GRAND ISLE & VICINITY
Area (CHECK BORINGS)
Boring No. 45-AUW | Sample No. 17-D
~~Depth~~ El -64.0 | Date 7 JULY 1969
JMS TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 1 JUN 65 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE
TRANSLUCENT
USAEWES SOILS TEST SECTION

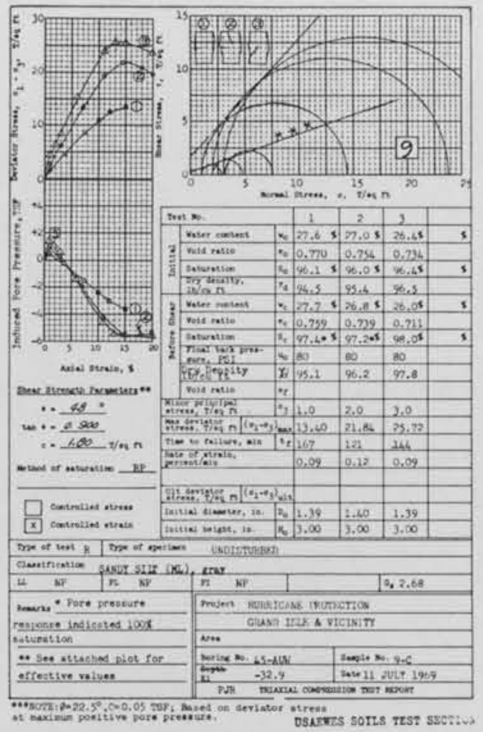


Test No.			1	2	3	
Initial	Water content	w_o	48.4 %	49.9 %	48.9 %	%
	Void ratio	e_o	1.39	1.41	1.36	
	Saturation	S_o	95.0 %	96.6 %	98.1 %	%
	Dry density, lb/cu ft	γ_d	71.4	70.8	72.3	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_o				
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		$(\sigma_1-\sigma_3)_{max}$	0.57	0.67	0.69	
Time to failure, min		t_f	36	64	43	
Rate of strain, percent/min			0.14	0.13	0.14	
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 = 0.32 T/sq ft
Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED
Classification PLASTIC CLAY (CH), gray, contains a few 1/8" silty sand seams
LL 65 | PL 23 | PI 42 | G_s 2.73
Remarks
Project HURRICANE PROTECTION
GRAND ISLE & VICINITY
Area (CHECK BORINGS)
Boring No. 45-AUW | Sample No. 20-C
~~Depth~~ El -75.2 | Date 9 JULY 1969
JMS TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 1 JUN 65 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE
TRANSLUCENT
USAEWES SOILS TEST SECTION



Test No.			1	2	3	
Initial	Water content	w_o	27.6 %	27.0 %	26.4 %	%
	Void ratio	e_o	0.770	0.754	0.734	
	Saturation	S_o	96.1 %	96.0 %	96.4 %	%
	Dry density, lb/cu ft	γ_d	94.5	95.4	96.5	
Before Shear	Water content	w_c	27.7 %	26.8 %	26.0 %	%
	Void ratio	e_c	0.759	0.739	0.711	
	Saturation	S_c	97.4* %	97.2* %	98.0 %	%
	Final back pressure, PSI	u_o	80	80	80	
	Dry Density, lb/cu ft	γ_d	95.1	96.2	97.8	
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	1.0	2.0	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	13.40	21.84	25.72	
Time to failure, min		t_f	167	121	144	
Rate of strain, percent/min			0.09	0.12	0.09	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.39	1.40	1.39	
Initial height, in.		H_o	3.00	3.00	3.00	

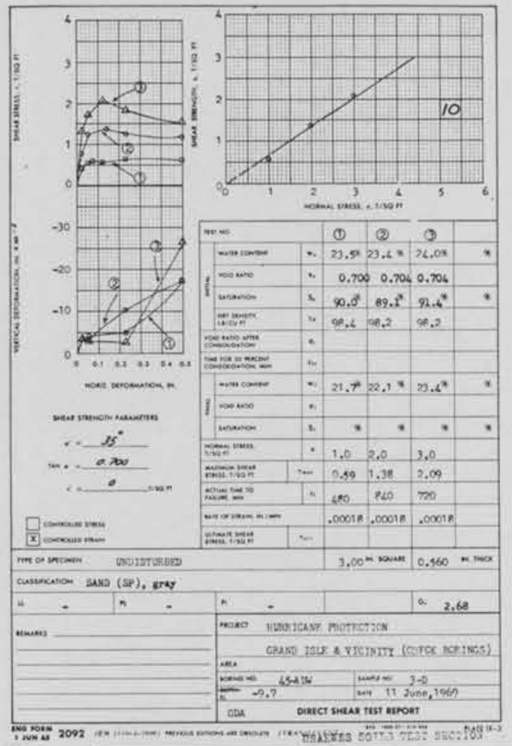
Shear Strength Parameters**
φ = 48 °
tan φ = 0.900
c = 1.80 T/sq ft
Method of saturation BP

☐ Controlled stress
☒ Controlled strain

Type of test R | Type of specimen UNDISTURBED
Classification SANDY SILT (ML), gray
LL NP | PL NP | PI NP | G_s 2.68
Remarks * Pore pressure response indicated 100% saturation
** See attached plot for effective values
Project HURRICANE PROTECTION
GRAND ISLE & VICINITY
Area
Boring No. 45-AUW | Sample No. 9-C
~~Depth~~ El -32.9 | Date 11 JULY 1969
PJR TRIAXIAL COMPRESSION TEST REPORT

***NOTE: φ=22.5°, C=0.05 TSF; Based on deviator stress at maximum positive pore pressure.

USAEWES SOILS TEST SECTION



TEST NO.			①	②	③	
INITIAL	WATER CONTENT	w_o	23.5%	23.4 %	24.0%	%
	VOID RATIO	e_o	0.700	0.704	0.704	
	SATURATION	S_o	90.0%	89.1%	91.4%	%
	DRY DENSITY, LB/CU FT	γ_d	98.4	98.2	98.2	
VOID RATIO AFTER CONSOLIDATION		e_c				
TIME FOR 50 PERCENT CONSOLIDATION, MIN		t_{50}				
FINAL	WATER CONTENT	w_f	21.7%	22.1 %	23.4%	%
	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}	0.59	1.38	2.09	
ACTUAL TIME TO FAILURE, MIN		t_f	480	840	720	
RATE OF STRAIN, IN./MIN			.00018	.00018	.00018	
ULTIMATE SHEAR STRESS, T/SQ FT		τ_{ult}				

SHEAR STRENGTH PARAMETERS
φ = 35°
TAN φ = 0.700
c = 0 T/SQ FT

☐ CONTROLLED STRESS
☒ CONTROLLED STRAIN

TYPE OF SPECIMEN UNDISTURBED | 3.00 IN. SQUARE | 0.560 IN. THICK
CLASSIFICATION SAND (SP), gray
LL - | PL - | PI - | G_s 2.68
REMARKS
PROJECT HURRICANE PROTECTION
GRAND ISLE & VICINITY (CHECK BORINGS)
AREA
BORING NO. 45-AUW | SAMPLE NO. 3-D
~~DEPTH~~ EL -9.7 | DATE 11 June,1969
GDA DIRECT SHEAR TEST REPORT
ENG FORM 1 JUN 65 2092 PREVIOUS EDITIONS ARE OBSOLETE
USAEWES SOILS TEST SECTION

NOTE:

3 Indicates reference number shown under shear data on Plate 69
(Q) Unconsolidated - undrained triaxial compression test.
(R) Consolidated - undrained triaxial compression test.
(S) Consolidated - drained direct shear test.

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)

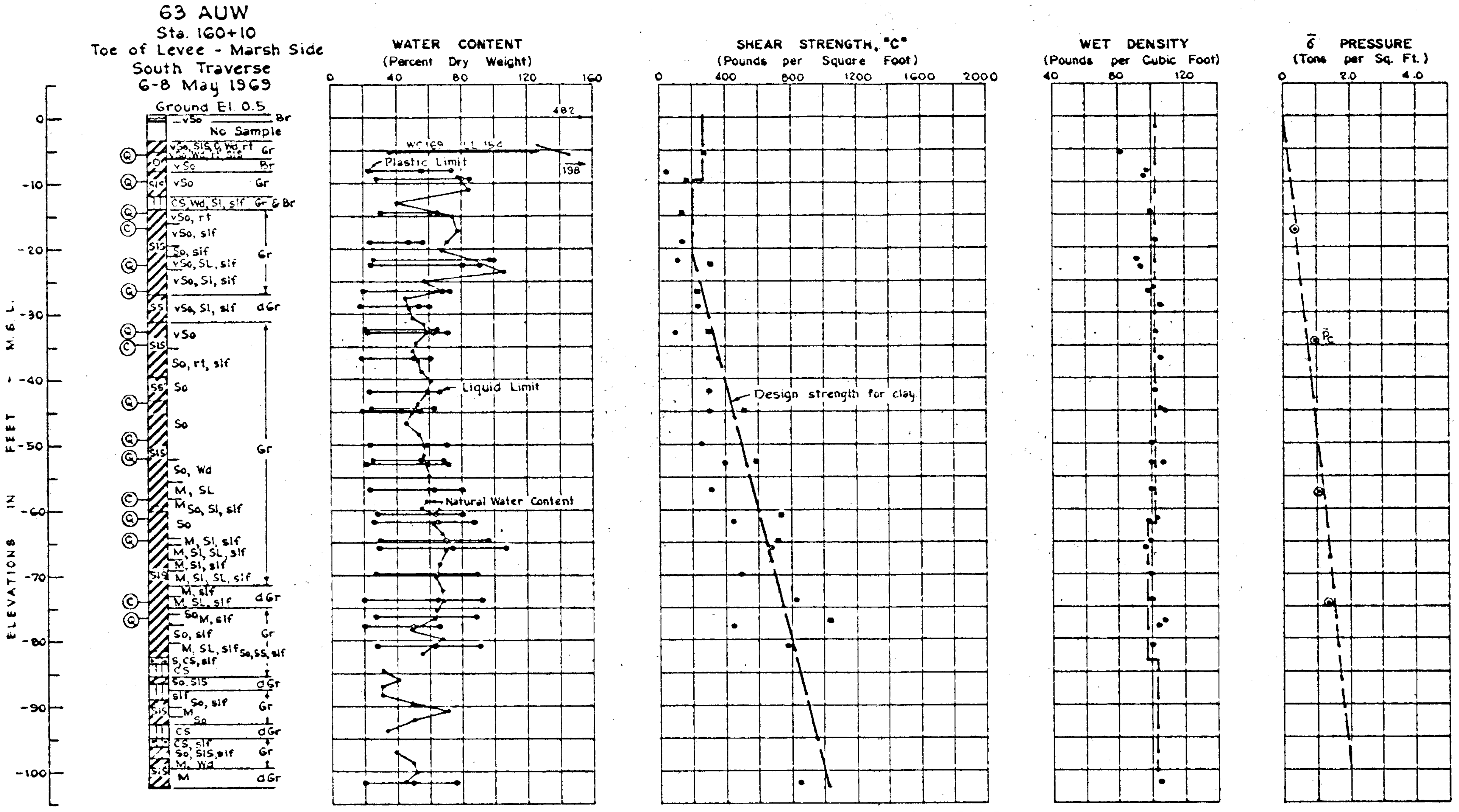
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

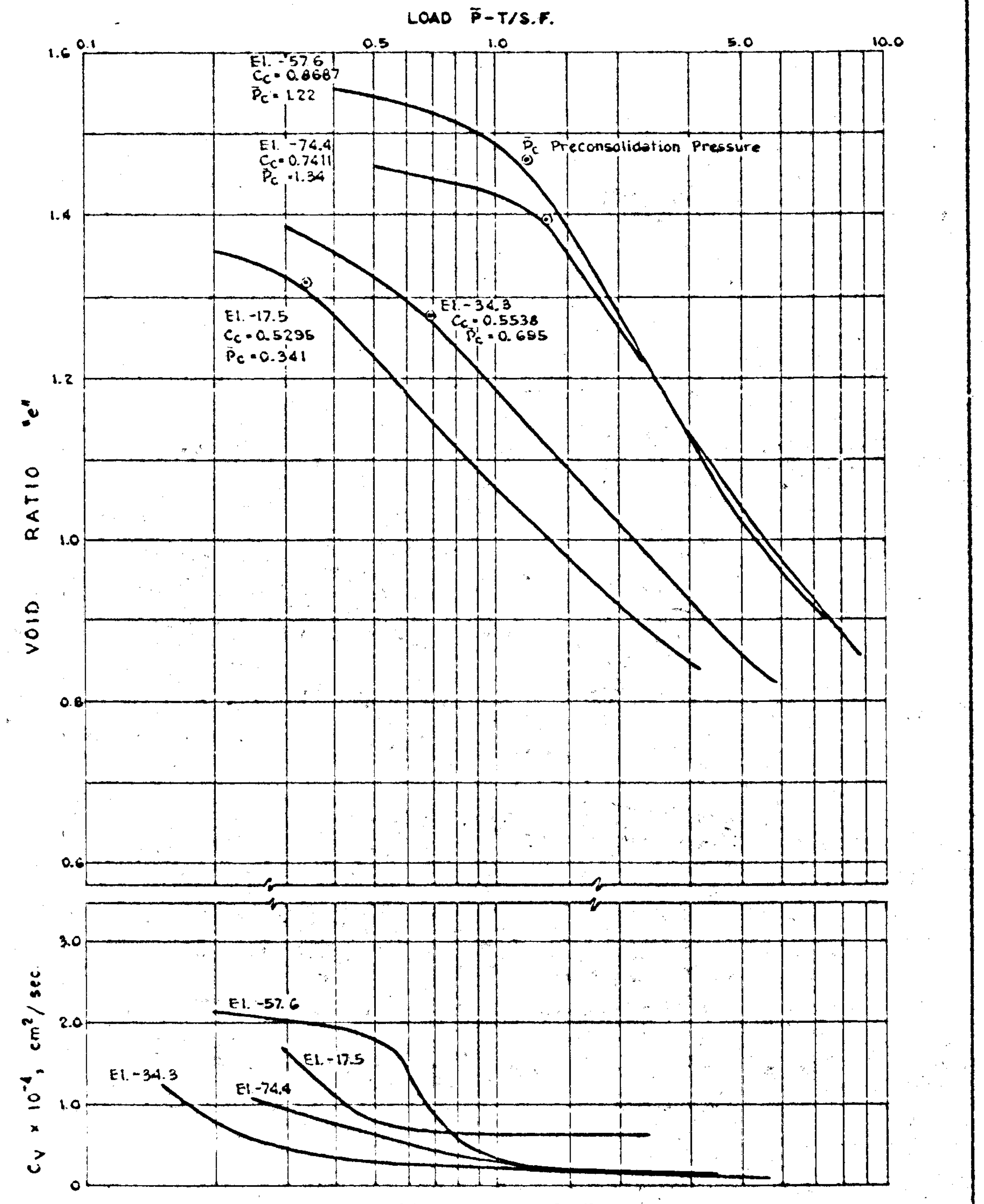
DETAIL SHEAR STRENGTH DATA BORING 45 AUW

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

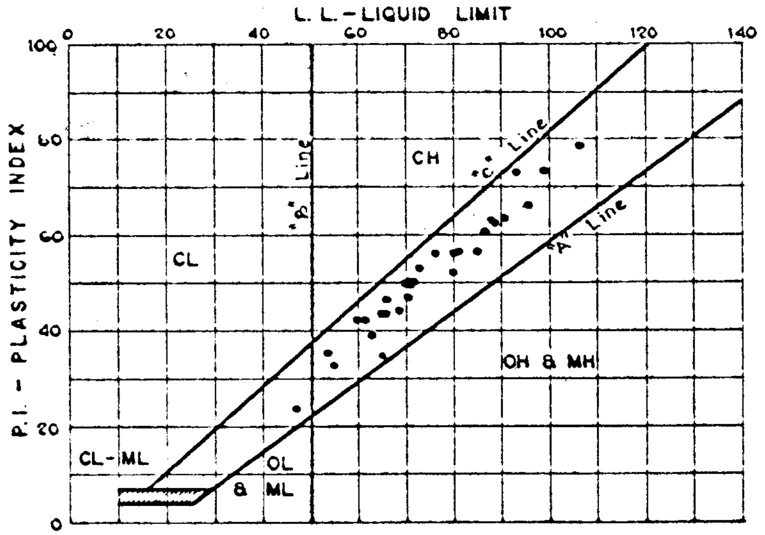
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

DATE: MARCH, 1972
FILE NO. H-2-24314

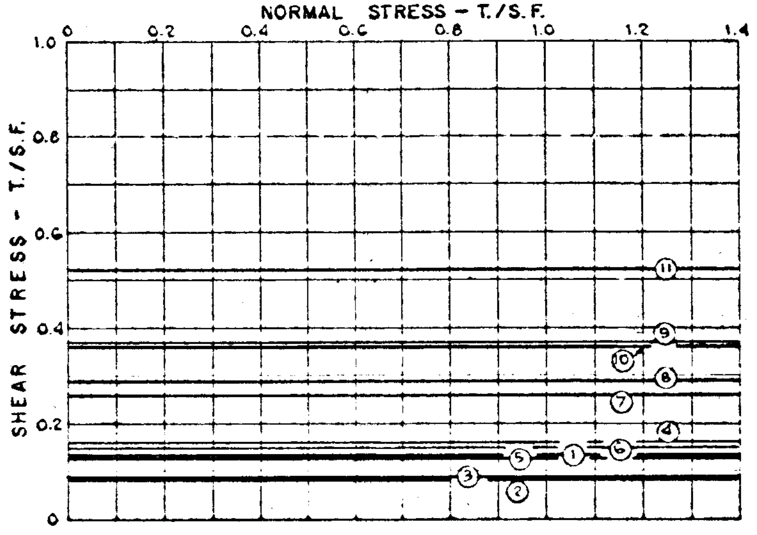




CONSOLIDATION DATA



PLASTICITY CHART



SHEAR STRENGTH DATA

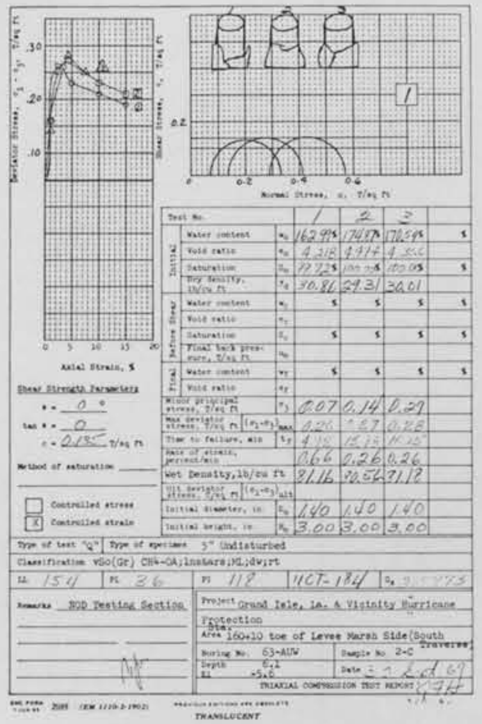
ENVELOPE		TYPE	STRENGTH		CLASS
NO.	EL.		φ	c T.S.F.	
1	-5.6	Q	0	.135	CH
2	-9.7			.085	
3	-14.3			.088	
4	-22.4			.160	
5	-26.3			.130	
6	-32.5			.150	
7	-44.6			.260	
8	-57.5			.290	
9	-60.7			.370	
10	-64.6			.360	
11	-76.7			.520	

For general notes see plate 46
For detail shear strength data see plate 73
For location of boring see plate 15

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

SOIL BORING 63 AUW DATA

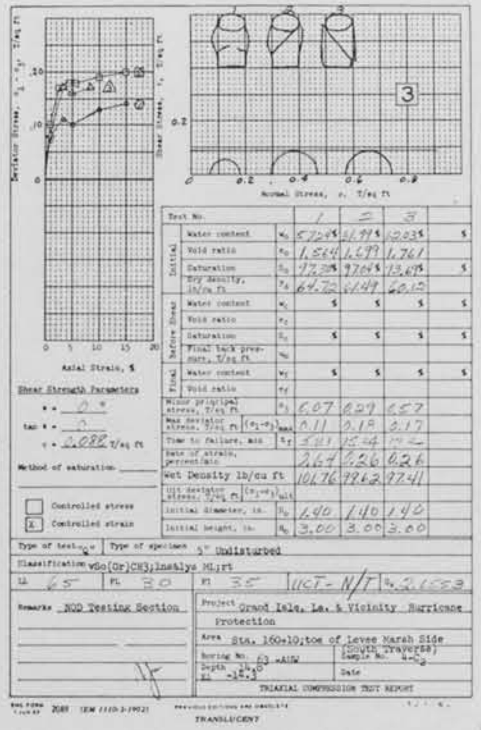
BARNARD AND BURK, INC. CONSULTING ENGINEERS BATON ROUGE, LA.	U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS
DATE: MARCH 1972	FILE NO. H-2-24314



Test No.			1	2	3	
Initial	Water content	w_o	162.99%	174.87%	170.59%	%
	Void ratio	e_o	4.218	4.414	[illegible]	
	Saturation	S_o	97.72%	[illegible]	100.0%	%
	Dry density, lb/cu ft	γ_d	30.81	29.31	30.01	
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	0.07	0.14	0.27	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.26	0.27	0.28	
Time to failure, min		t_f	[illegible]	[illegible]	11.25	
Rate of strain, percent/min			0.66	0.26	0.26	
Wet Density, lb/cu ft			81.16	80.56	81.18	
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 = 0.135 T/sq ft
Method of saturation ______
☐ Controlled stress
☒ Controlled strain

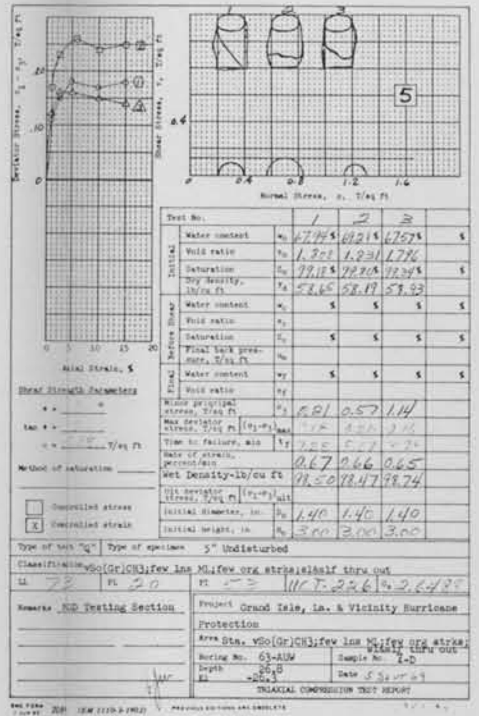
Type of test "Q" | Type of specimen 5" Undisturbed
Classification vSo(Gr) CH4-OA;lns&ars;ML;dw;rt
LL 154 | PL 36 | PI 118 | UCT-184 | G_s [illegible]
Remarks NOD Testing Section
Project Grand Isle, La. & Vicinity Hurricane Protection
Area Sta. 160+10 toe of Levee Marsh Side (South Traverse)
Boring No. 63-AUW | Sample No. 2-C
Depth 6.1 El -5.6 | Date [illegible] Sept 69
TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 1 JUN 65 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



Test No.			1	2	3	
Initial	Water content	w_o	57.24%	61.99%	62.03%	%
	Void ratio	e_o	1.564	1.699	1.761	
	Saturation	S_o	97.30%	97.64%	[illegible]	%
	Dry density, lb/cu ft	γ_d	64.72	61.49	60.12	
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	0.07	0.29	0.57	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.11	0.18	0.17	
Time to failure, min		t_f	[illegible]	15.44	[illegible]	
Rate of strain, percent/min			2.64	0.26	0.26	
Wet Density lb/cu ft			101.76	99.62	97.41	
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 = 0.088 T/sq ft
Method of saturation ______
☐ Controlled stress
☒ Controlled strain

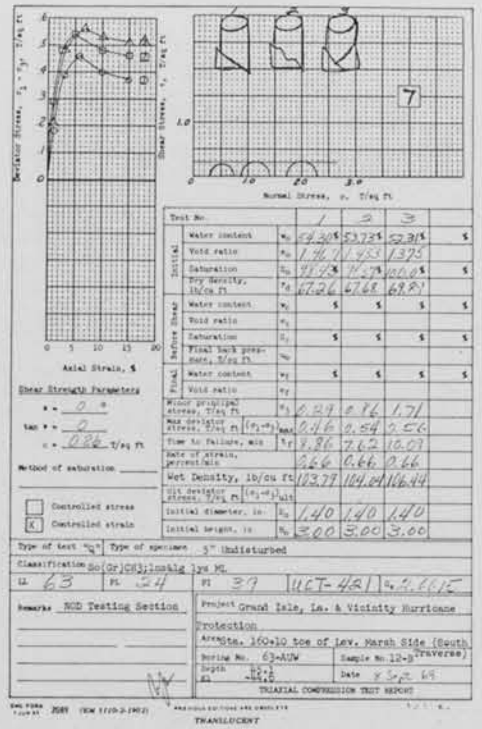
Type of test "Q" | Type of specimen 5" Undisturbed
Classification vSo(Gr)CH3;lns&lys ML;rt
LL 65 | PL 30 | PI 35 | UCT-N/T | G_s 2.6553
Remarks NOD Testing Section
Project Grand Isle, La. & Vicinity Hurricane Protection
Area Sta. 160+10;toe of Levee Marsh Side (South Traverse)
Boring No. 63-AUW | Sample No. 4-C
Depth 14.0 El -13.5 | Date
TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 1 JUN 65 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



Test No.			1	2	3	
Initial	Water content	w_o	67.94%	69.21%	67.57%	%
	Void ratio	e_o	1.801	1.831	1.796	
	Saturation	S_o	99.18%	99.70%	99.34%	%
	Dry density, lb/cu ft	γ_d	57.65	58.19	57.93	
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	0.21	0.57	1.14	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	[illegible]	[illegible]	[illegible]	
Time to failure, min		t_f	[illegible]	[illegible]	[illegible]	
Rate of strain, percent/min			0.67	0.66	0.65	
Wet Density-lb/cu ft			98.50	98.47	98.74	
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 = ______°
tan φ = ______
c = [illegible] T/sq ft
Method of saturation ______
☐ Controlled stress
☒ Controlled strain

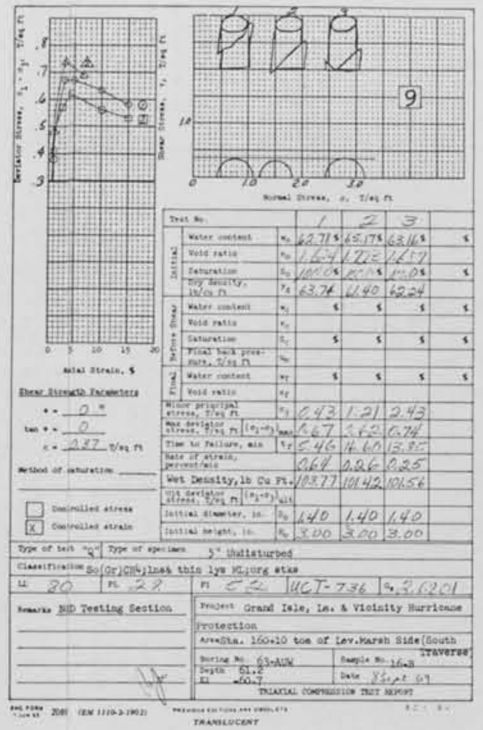
Type of test "Q" | Type of specimen 5" Undisturbed
Classification vSo(Gr)CH3;few lns ML;few org strks;sl&slf thru out
LL 72 | PL 20 | PI [illegible] | UCT-226 | G_s 2.6485
Remarks NOD Testing Section
Project Grand Isle, La. & Vicinity Hurricane Protection
Area Sta. vSo(Gr)CH3;few lns ML;few org strks; sl&slf thru out
Boring No. 63-AUW | Sample No. 7-D
Depth 26.8 El -26.3 | Date 5 Sept 69
TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 1 JUN 65 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



Test No.			1	2	3	
Initial	Water content	w_o	54.30%	53.73%	52.31%	%
	Void ratio	e_o	1.467	1.453	1.375	
	Saturation	S_o	98.43%	[illegible]	100.0%	%
	Dry density, lb/cu ft	γ_d	67.26	67.68	69.81	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_o				
Final	Water content	w_f	%	%	%	%
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	0.29	0.86	1.71	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.46	0.54	0.56	
Time to failure, min		t_f	8.86	7.62	10.07	
Rate of strain, percent/min			0.66	0.66	0.66	
Wet Density, lb/cu ft			103.79	104.04	106.44	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.40	1.40	1.40	
Initial height, in.		H_o	3.00	3.00	3.00	

Shear Strength Parameters
φ = 0°
tan φ = 0
c = 0.26 T/sq ft
Method of saturation ______
☐ Controlled stress
☒ Controlled strain

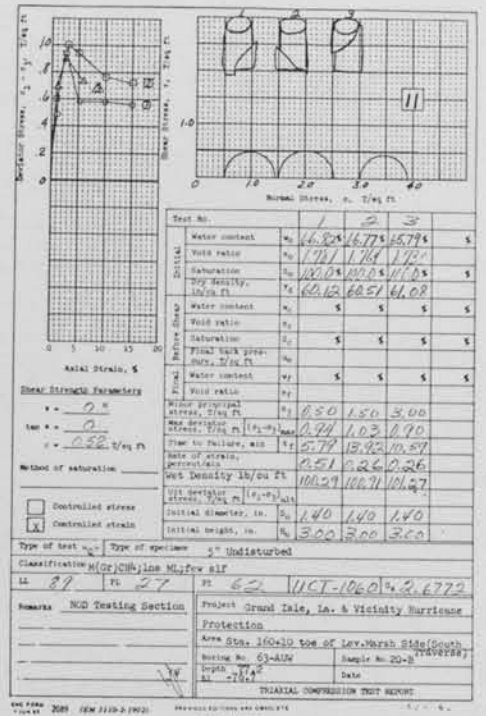
Type of test "Q" | Type of specimen 5" Undisturbed
Classification So(Gr)CH3;lns&lg lys ML
LL 63 | PL 24 | PI 39 | UCT-481 | G_s 2.6615
Remarks NOD Testing Section
Project Grand Isle, La. & Vicinity Hurricane Protection
Area Sta. 160+10 toe of Lev. Marsh Side (South Traverse)
Boring No. 63-AUW | Sample No. 12-B
Depth 45.1 El -44.6 | Date 8 Sept 69
TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 1 JUN 65 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



Test No.			1	2	3	
Initial	Water content	w_o	62.71%	65.17%	63.16%	%
	Void ratio	e_o	1.624	1.722	1.657	
	Saturation	S_o	100.0%	[illegible]	100.0%	%
	Dry density, lb/cu ft	γ_d	63.74	61.40	62.24	
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	0.43	1.21	2.43	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.67	0.62	0.74	
Time to failure, min		t_f	5.46	14.60	13.85	
Rate of strain, percent/min			0.64	0.26	0.25	
Wet Density, lb Cu Ft.			103.77	101.42	101.56	
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 = 0.37 T/sq ft
Method of saturation ______
☐ Controlled stress
☒ Controlled strain

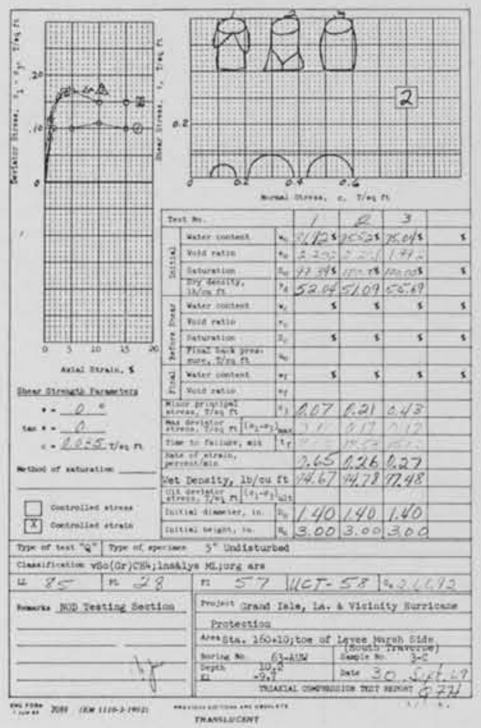
Type of test "Q" | Type of specimen 5" Undisturbed
Classification So(Gr)CH4;lns& thin lys ML;org stks
LL 80 | PL 28 | PI 52 | UCT-736 | G_s 2.6201
Remarks NOD Testing Section
Project Grand Isle, La. & Vicinity Hurricane Protection
Area Sta. 160+10 toe of Lev.Marsh Side (South Traverse)
Boring No. 63-AUW | Sample No. 16-B
Depth 61.2 El -60.7 | Date 8 Sept 69
TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 1 JUN 65 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



Test No.			1	2	3	
Initial	Water content	w_o	66.82%	66.77%	65.79%	%
	Void ratio	e_o	1.781	1.761	1.730	
	Saturation	S_o	100.0%	100.0%	100.0%	%
	Dry density, lb/cu ft	γ_d	60.12	60.51	61.08	
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		$(\sigma_1-\sigma_3)_{max}$	0.94	1.03	0.90	
Time to failure, min		t_f	5.79	13.93	10.59	
Rate of strain, percent/min			0.51	0.26	0.26	
Wet Density lb/cu ft			100.29	100.91	101.27	
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 = 0.52 T/sq ft
Method of saturation ______
☐ Controlled stress
☒ Controlled strain

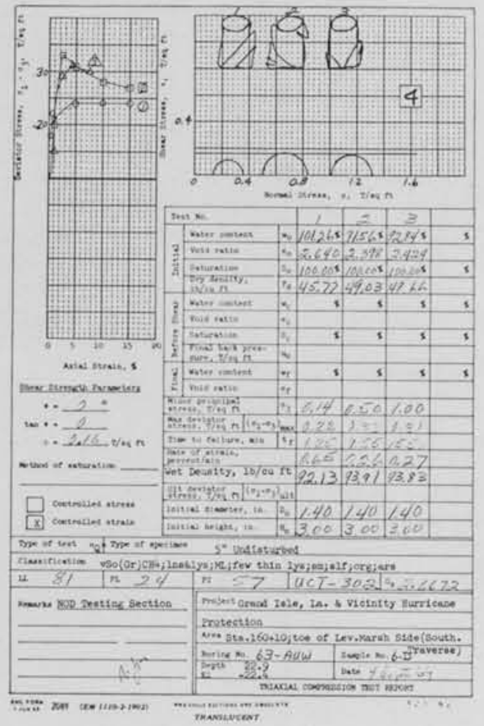
Type of test "Q" | Type of specimen 5" Undisturbed
Classification M(Gr)CH4;lns ML;few slf
LL 89 | PL 27 | PI 62 | UCT-1060 | G_s 2.6772
Remarks NOD Testing Section
Project Grand Isle, La. & Vicinity Hurricane Protection
Area Sta. 160+10 toe of Lev.Marsh Side (South Traverse)
Boring No. 63-AUW | Sample No. 20-B
Depth 77.2 El -76.7 | Date
TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 1 JUN 65 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



Test No.			1	2	3	
Initial	Water content	w_o	81.12%	85.52%	75.04%	%
	Void ratio	e_o	[illegible]	[illegible]	[illegible]	
	Saturation	S_o	99.39%	[illegible]	100.00%	%
	Dry density, lb/cu ft	γ_d	52.04	51.09	55.69	
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	0.07	0.21	0.43	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	[illegible]	0.17	0.12	
Time to failure, min		t_f	[illegible]	[illegible]	[illegible]	
Rate of strain, percent/min			0.65	0.26	0.27	
Wet Density, lb/cu ft			94.67	94.78	97.48	
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 = 0.055 T/sq ft
Method of saturation ______
☐ Controlled stress
☒ Controlled strain

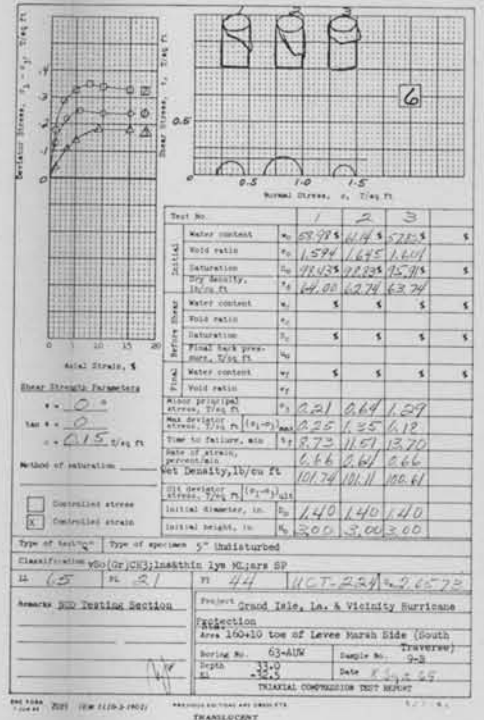
Type of test "Q" | Type of specimen 5" Undisturbed
Classification vSo(Gr)CH4;lns&lys ML;org ars
LL 85 | PL 28 | PI 57 | UCT-58 | G_s [illegible]
Remarks NOD Testing Section
Project Grand Isle, La. & Vicinity Hurricane Protection
Area Sta. 160+10;toe of Levee Marsh Side (South Traverse)
Boring No. 63-AUW | Sample No. 3-C
Depth 10.2 El -9.7 | Date 30 Sept 69
TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 1 JUN 65 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



Test No.			1	2	3	
Initial	Water content	w_o	101.26%	91.56%	92.84%	%
	Void ratio	e_o	2.640	2.398	2.424	
	Saturation	S_o	100.00%	100.00%	100.00%	%
	Dry density, lb/cu ft	γ_d	45.77	49.03	47.66	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_o				
Final	Water content	w_f	%	%	%	%
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	0.14	0.50	1.00	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.22	[illegible]	[illegible]	
Time to failure, min		t_f	[illegible]	[illegible]	[illegible]	
Rate of strain, percent/min			0.65	0.26	0.27	
Wet Density, lb/cu ft			92.13	93.91	93.83	
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 = 0.16 T/sq ft
Method of saturation ______
☐ Controlled stress
☒ Controlled strain

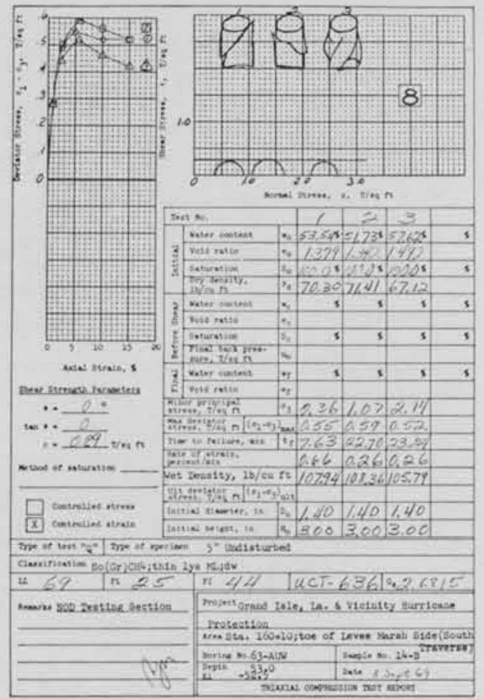
Type of test "Q" | Type of specimen 5" Undisturbed
Classification vSo(Gr)CH4;lns&lys;ML;few thin lys;sm;slf;org;ars
LL 81 | PL 24 | PI 57 | UCT-302 | G_s 2.6672
Remarks NOD Testing Section
Project Grand Isle, La. & Vicinity Hurricane Protection
Area Sta.160+10;toe of Lev.Marsh Side(South. Traverse)
Boring No. 63-AUW | Sample No. 6-B
Depth 22.9 El -22.4 | Date 4 Sept 69
TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 1 JUN 65 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



Test No.			1	2	3	
Initial	Water content	w_o	58.98%	61.14%	57.85%	%
	Void ratio	e_o	1.594	1.645	1.601	
	Saturation	S_o	98.43%	98.83%	95.91%	%
	Dry density, lb/cu ft	γ_d	64.00	62.74	63.74	
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	0.21	0.64	1.29	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.25	0.35	0.12	
Time to failure, min		t_f	8.73	11.51	13.70	
Rate of strain, percent/min			0.66	0.61	0.66	
Wet Density, lb/cu ft			101.74	101.11	100.61	
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 = 0.15 T/sq ft
Method of saturation ______
☐ Controlled stress
☒ Controlled strain

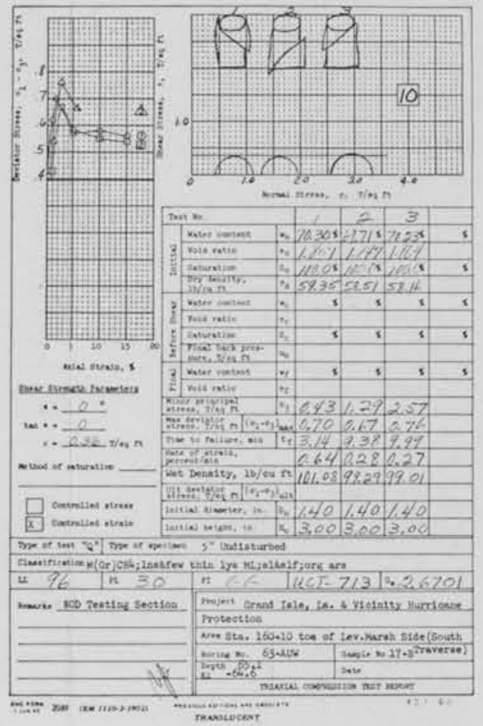
Type of test "Q" | Type of specimen 5" Undisturbed
Classification vSo(Gr)CH3;lns&thin lys ML;ars SP
LL 65 | PL 21 | PI 44 | UCT-224 | G_s 2.6572
Remarks NOD Testing Section
Project Grand Isle, La. & Vicinity Hurricane Protection
Area Sta. 160+10 toe of Levee Marsh Side (South Traverse)
Boring No. 63-AUW | Sample No. 9-B
Depth 33.0 El -32.5 | Date 8 Sept 69
TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 1 JUN 65 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



Test No.			1	2	3	
Initial	Water content	w_o	53.54%	51.73%	57.62%	%
	Void ratio	e_o	1.379	[illegible]	[illegible]	
	Saturation	S_o	100.0%	[illegible]	100.0%	%
	Dry density, lb/cu ft	γ_d	70.30	71.41	67.12	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_o				
Final	Water content	w_f	%	%	%	%
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	0.36	1.07	2.14	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.55	0.59	0.52	
Time to failure, min		t_f	7.63	22.70	23.94	
Rate of strain, percent/min			0.66	0.26	0.26	
Wet Density, lb/cu ft			107.94	108.36	105.79	
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$				
Initial diameter, in.		D_o	1.40	1.40	1.40	
Initial height, in.		H_o	3.00	3.00	3.00	

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 5" Undisturbed
Classification So(Gr)CH4;thin lys ML;dw
LL 69 | PL 25 | PI 44 | UCT-636 | G_s 2.6815
Remarks NOD Testing Section
Project Grand Isle, La. & Vicinity Hurricane Protection
Area Sta. 160+10;toe of Levee Marsh Side (South Traverse)
Boring No. 63-AUW | Sample No. 14-B
Depth 53.0 El -52.5 | Date 8 Sept 69
TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 1 JUN 65 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT



Test No.			1	2	3	
Initial	Water content	w_o	70.30%	67.71%	71.23%	%
	Void ratio	e_o	[illegible]	[illegible]	[illegible]	
	Saturation	S_o	100.0%	[illegible]	[illegible]	%
	Dry density, lb/cu ft	γ_d	59.35	58.51	58.14	
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	0.43	1.29	2.57	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.70	0.67	0.76	
Time to failure, min		t_f	3.14	9.38	9.94	
Rate of strain, percent/min			0.64	0.28	0.27	
Wet Density, lb/cu ft			101.08	99.29	99.01	
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 = 0.32 T/sq ft
Method of saturation ______
☐ Controlled stress
☒ Controlled strain

Type of test "Q" | Type of specimen 5" Undisturbed
Classification M(Gr)CH4;lns&few thin lys ML;sl&slf;org ars
LL 96 | PL 30 | PI 66 | UCT-713 | G_s 2.6701
Remarks NOD Testing Section
Project Grand Isle, La. & Vicinity Hurricane Protection
Area Sta. 160+10 toe of Lev.Marsh Side (South Traverse)
Boring No. 63-AUW | Sample No. 17-B
Depth 65.1 El -64.6 | Date
TRIAXIAL COMPRESSION TEST REPORT
ENG FORM 1 JUN 65 2089 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT

NOTE:

[3] Indicates reference number shown under shear data on Plate 72
(Q) Unconsolidated - undrained triaxial compression test.
(R) Consolidated - undrained triaxial compression test.
(S) Consolidated - drained direct shear test.

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

DETAIL SHEAR STRENGTH DATA
BORING 63 AUW

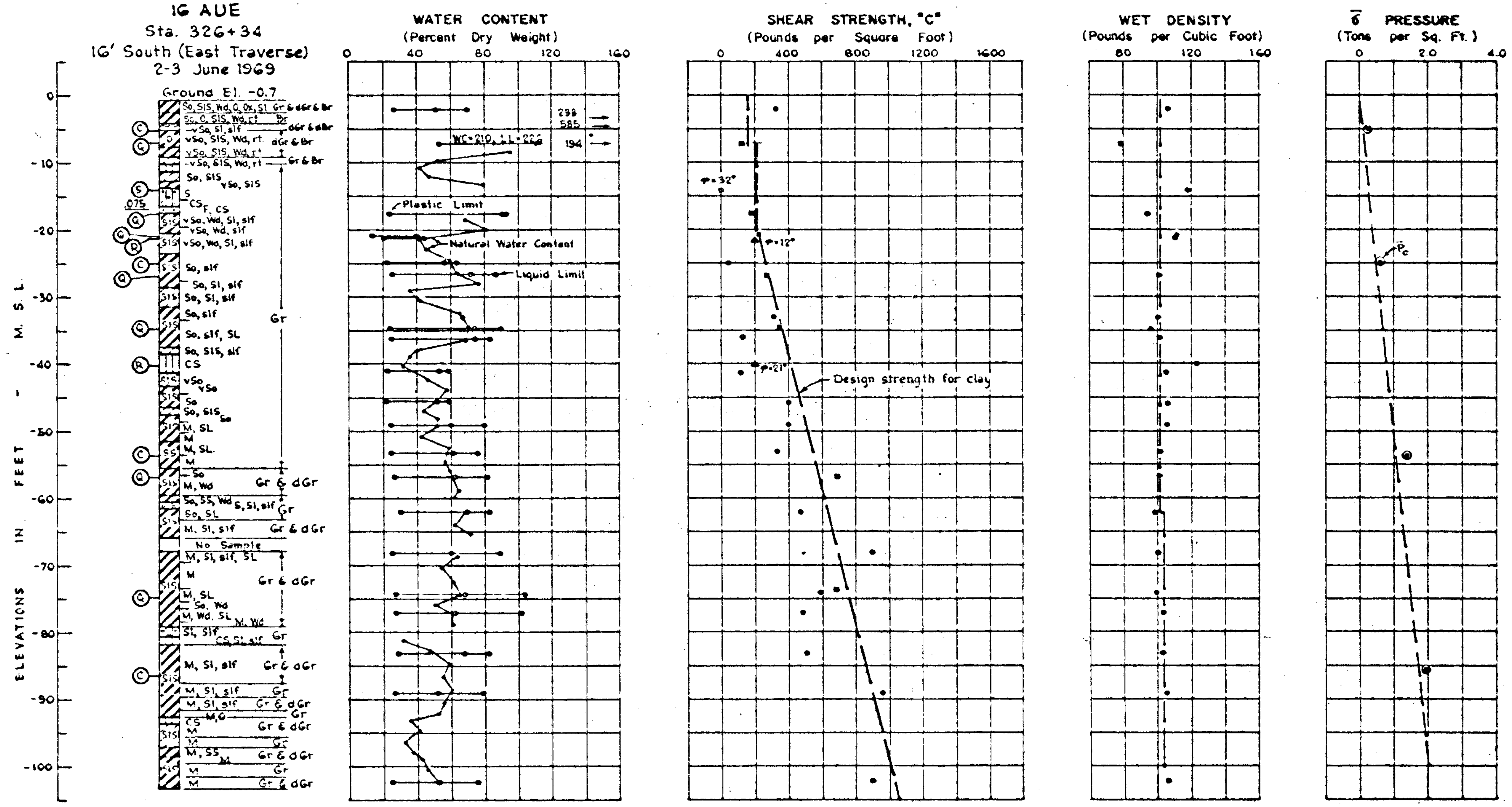
BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

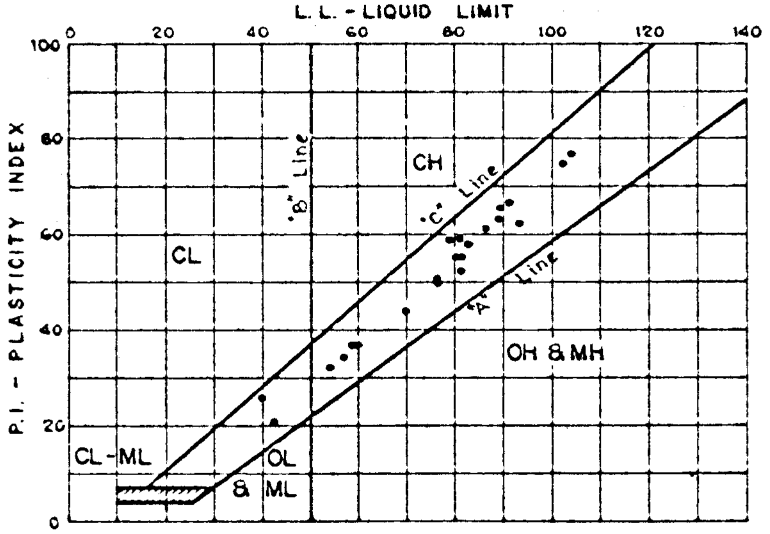
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

DATE: MARCH, 1972
FILE NO. H-2-24314

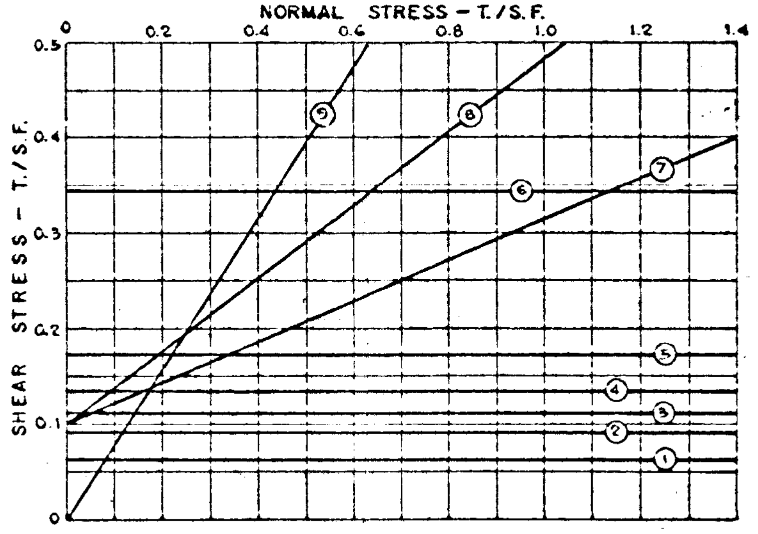
PLATE 73

16 AUE
Sta. 326+34
16′ South (East Traverse)
2-3 June 1969





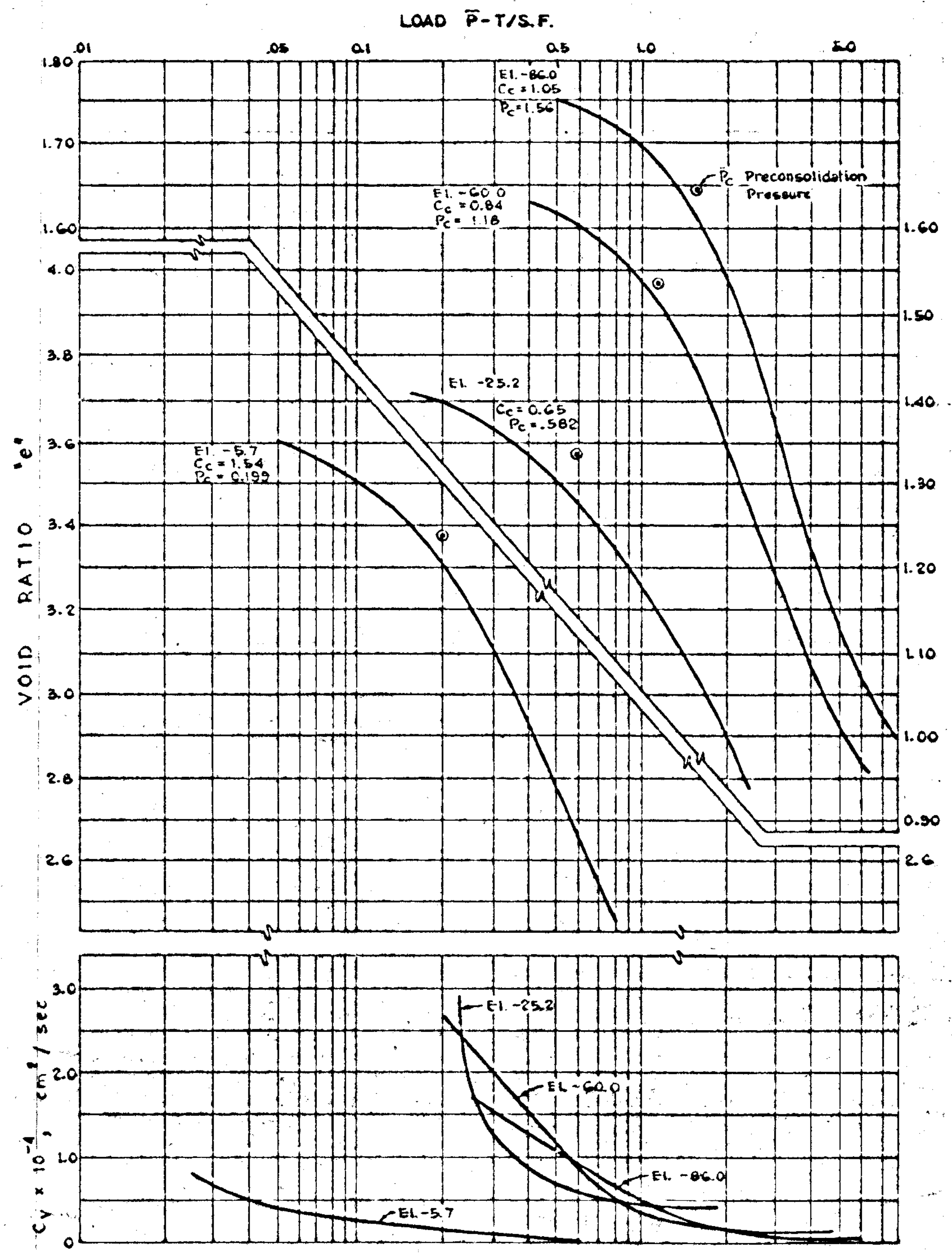
PLASTICITY CHART



SHEAR STRENGTH DATA

ENVELOPE		TYPE	STRENGTH		CLASS.
NO.	EL.		φ	c t.s.f.	
1	-7.2	Q	0	0.063	CH
2	-17.8			0.052	
3	-20.9			0.112	
4	-26.7			0.135	
5	-34.5			0.173	
6	-56.7			0.345	
7	-21.2	R	12°	0.100	CL
8	-40.0*		21°	0.100	ML
9	-14.1	S	32°	0	SM

*Based on deviator stress at maximum pore pressure.



CONSOLIDATION DATA

For general notes see plate 46
For detail shear strength data see plate 75
For location of boring see plate 5

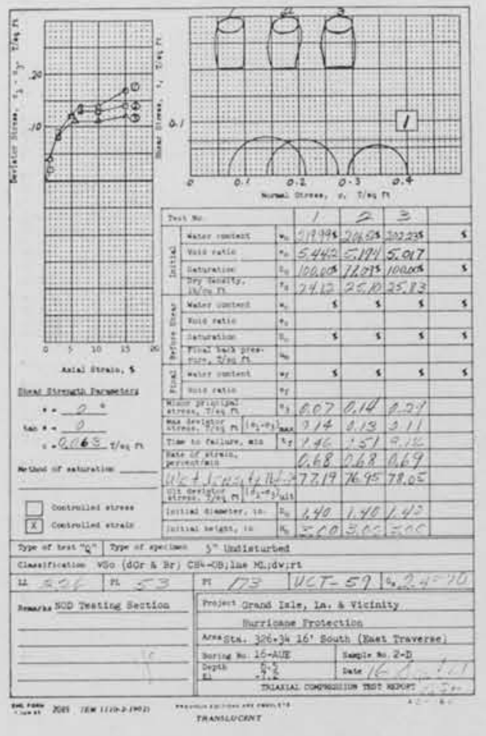
GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

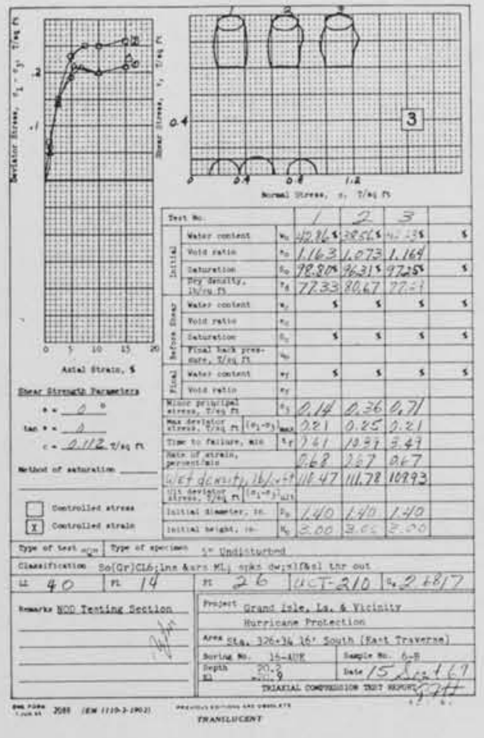
SOIL BORING 16 AUE DATA

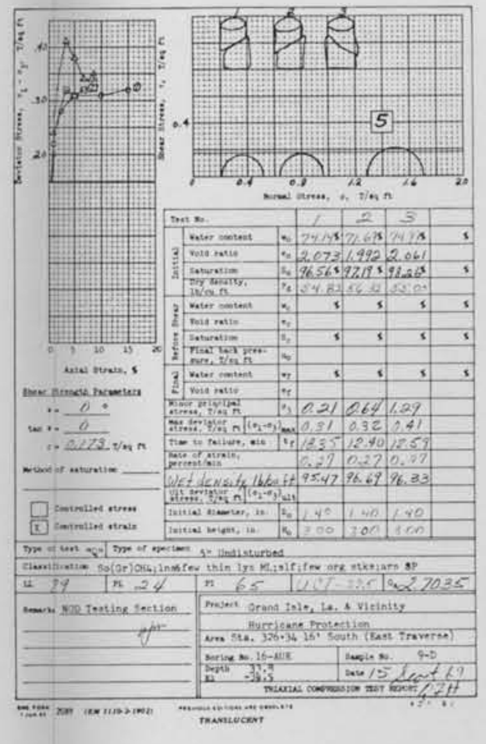
BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

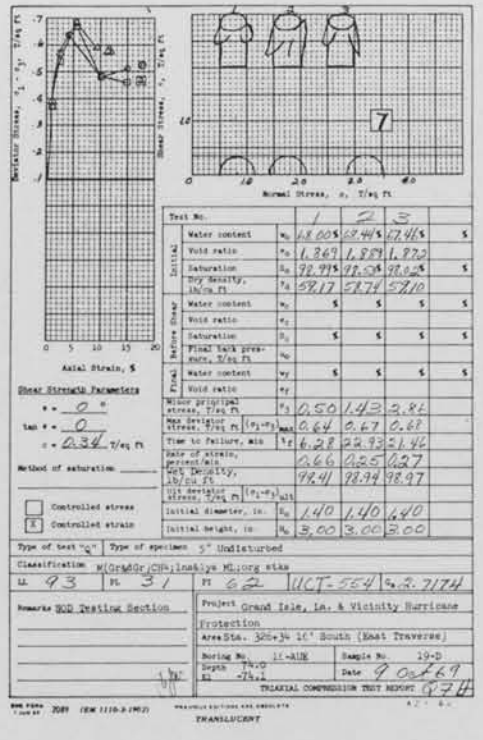
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

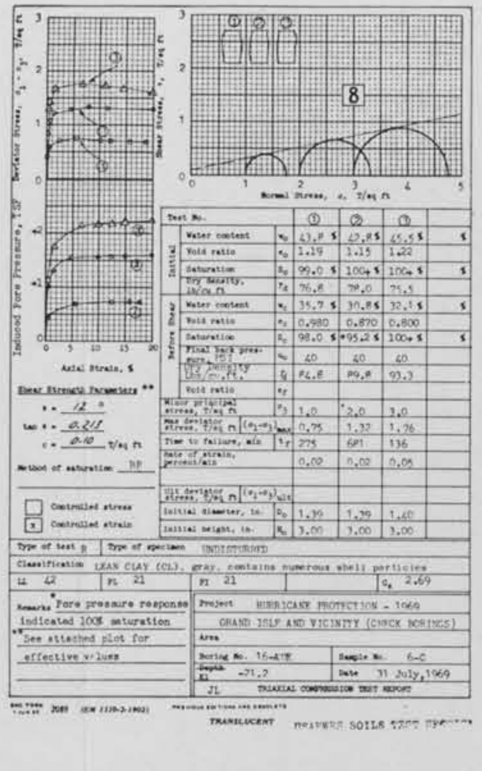
DATE: MARCH 1972
FILE NO. H-2-24314

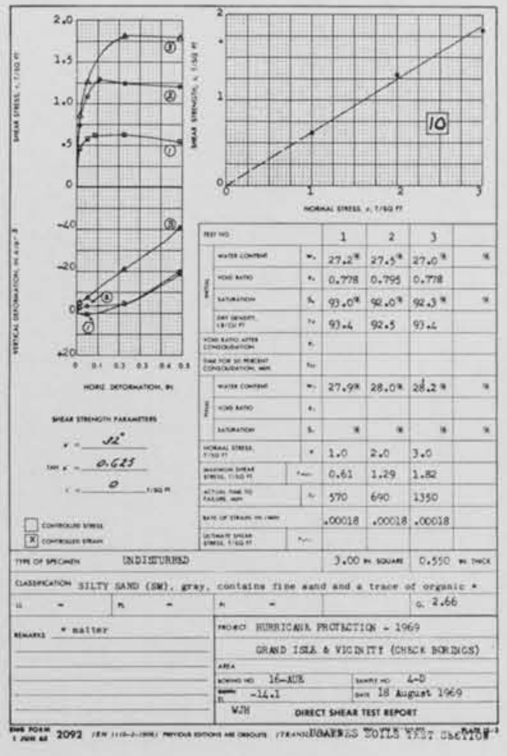


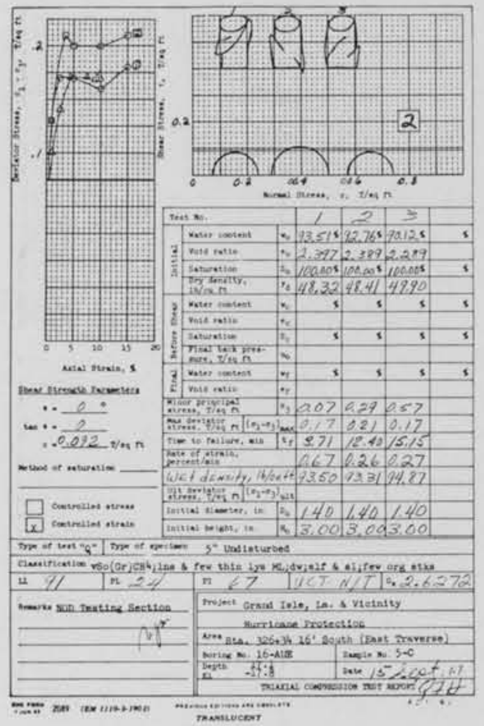


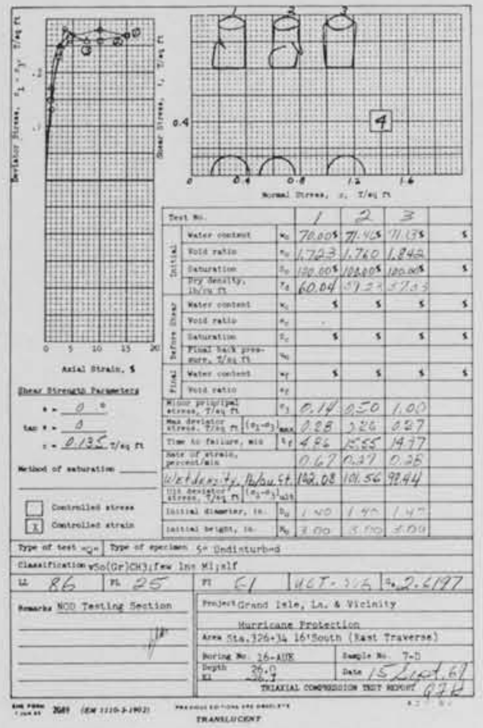


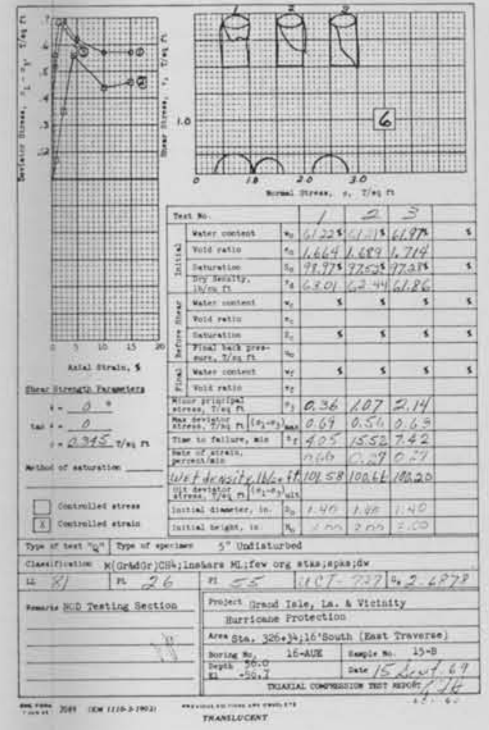


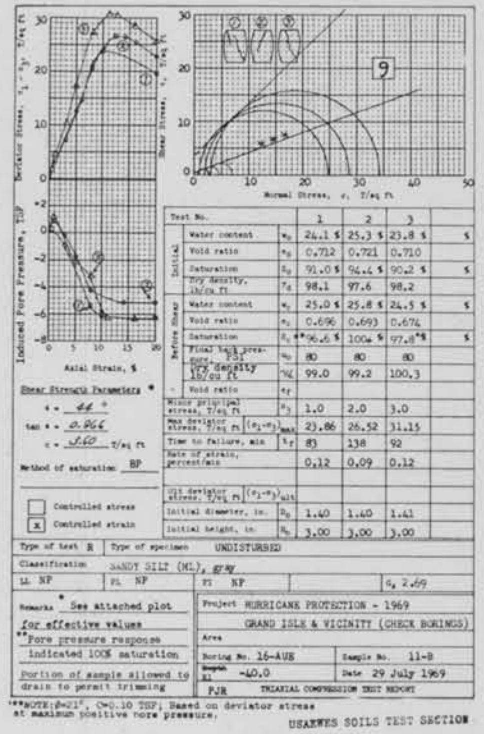












NOTE:

- [3] Indicates reference number shown under shear data on Plate 74
- (Q) Unconsolidated - undrained triaxial compression test.
- (R) Consolidated - undrained triaxial compression test.
- (S) Consolidated - drained direct shear test.

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)

DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

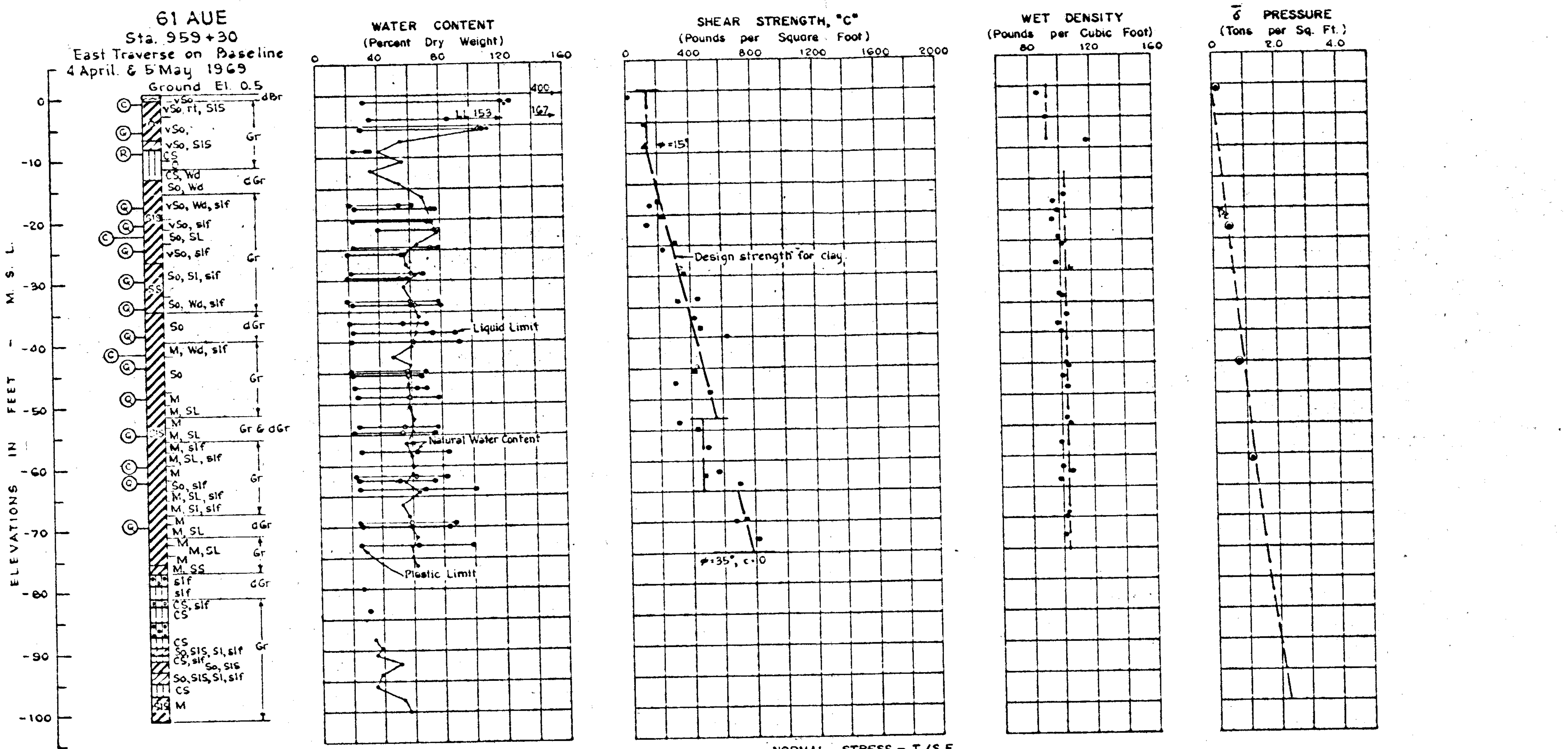
DETAIL SHEAR STRENGTH DATA BORING 16 AUE

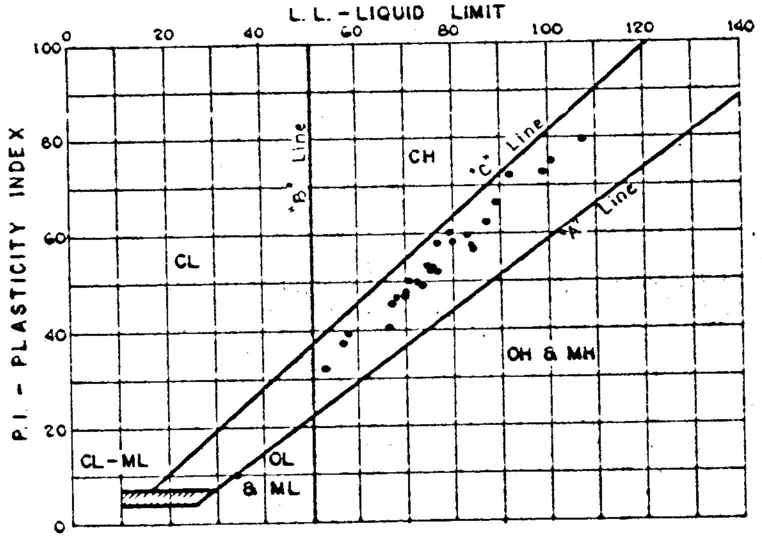
BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

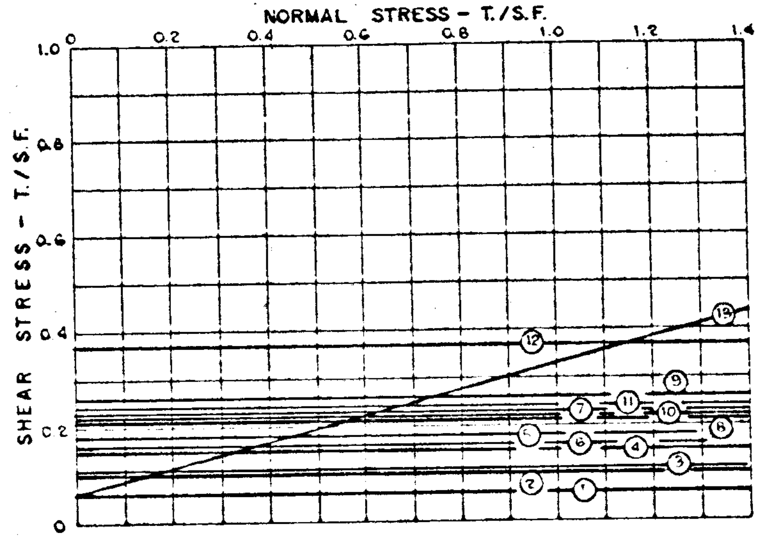
DATE: MARCH, 1972

FILE NO. H-2-24314





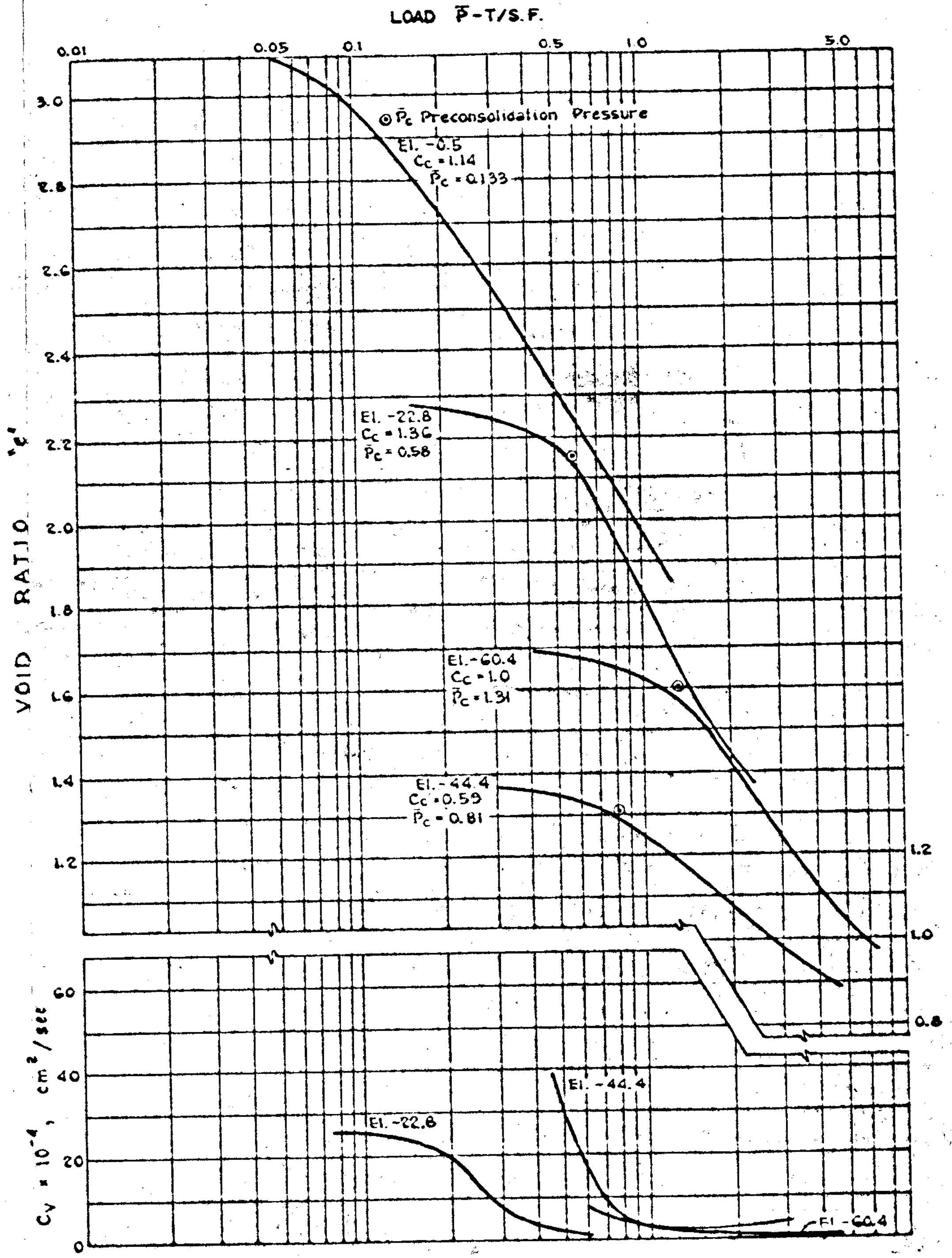
PLASTICITY CHART



ENVELOPE		TYPE	STRENGTH		CLASS
NO.	EL.		φ	c t.s.f.	
1	-5.0	Q	0	0.06	CH
2	-17.6			0.10	
3	-20.7			0.11	
4	-24.3			0.13	
5	-29.7			0.18	
6	-34.1			0.16	
7	-38.4			0.23	
8	-45.6			0.21	
9	-48.6			0.26	
10	-54.5			0.22	
11	-62.3			0.24	
12	-65.3			0.37	
13	-8.7	*R	15°	0.06	ML

*Based on deviator stress at maximum pore pressure

SHEAR STRENGTH DATA



CONSOLIDATION DATA

For general notes see plate 46
For detail shear strength data see plate 77
For location of boring see plate 10

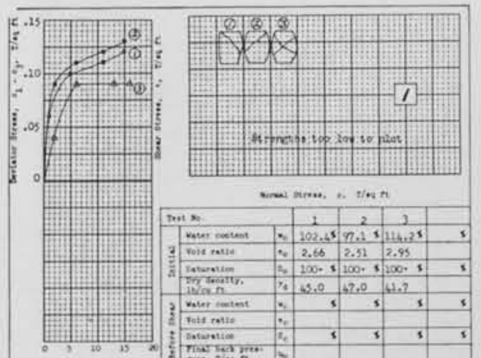
GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

SOIL BORING 61 AUE DATA

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE: MARCH 1972
FILE NO. H-2-24314



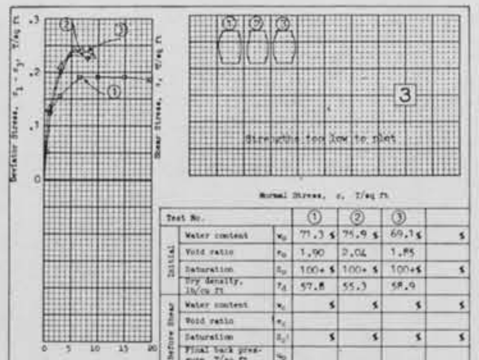
Test No.			1	2	3	
Initial	Water content	w_o	102.4%	97.1%	114.2%	%
	Void ratio	e_o	2.66	2.51	2.95	
	Saturation	S_o	100+%	100+%	100+%	%
	Dry density, lb/cu ft	γ_d	45.0	47.0	41.7	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_o				
Final	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		$(\sigma_1-\sigma_3)_{max}$	0.12	0.13	0.09	
Time to failure, min		t_f	40	62	17	
Rate of strain, percent/min			0.38	0.24	0.35	
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 = 0.06 T/sq ft
Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED
Classification PLASTIC CLAY (CH), gray, contains organic matter
LL 107 | PL 28 | PI 79 | G_s 2.64
Remarks
Project HURRICANE PROTECTION
GRAND ISLE & VICINITY (CHECK BORINGS)
Area
Boring No. 61-AUE | Sample No. 2-C
El -5.6 | Date 10 July 1969
GDA TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 2089 1 JUN 65 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT USAEWES SOILS TEST SECT



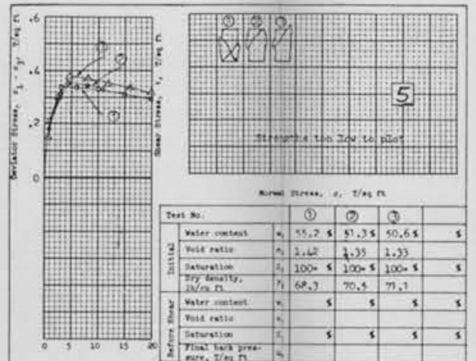
Test No.			①	②	③	
Initial	Water content	w_o	71.3%	75.9%	69.1%	%
	Void ratio	e_o	1.90	2.04	1.85	
	Saturation	S_o	100+%	100+%	100+%	%
	Dry density, lb/cu ft	γ_d	57.8	55.3	58.9	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_o				
Final	Water content	w_f	%	%	%	%
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	0.5	1.5	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.19	0.23	0.24	
Time to failure, min		t_f	65	20	36	
Rate of strain, percent/min			0.10	0.24	0.15	
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 PLASTIC CLAY (CH), gray, contains a few silty sand lenses *
LL 73 | PL 23 | PI 50 | G_s 2.69
Remarks * and scattered 1/8" dia. shells
Project HURRICANE PROTECTION
GRAND ISLE & VICINITY (CHECK BORINGS)
Area
Boring No. 61-AUE | Sample No. 6-B
El -20.7 | Date 23 July, 1969
JMS TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 2089 1 JUN 65 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT USAEWES SOILS TEST SEC



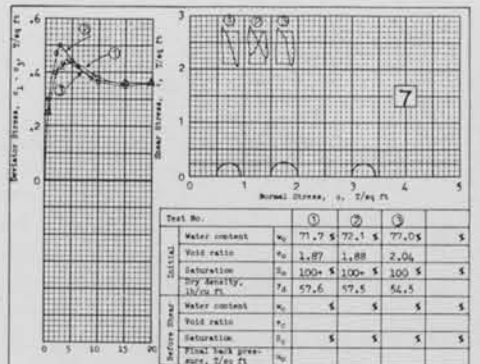
Test No.			①	②	③	
Initial	Water content	w_o	55.2%	51.3%	50.6%	%
	Void ratio	e_o	1.42	1.35	1.33	
	Saturation	S_o	100+%	100+%	100+%	%
	Dry density, lb/cu ft	γ_d	68.3	70.5	71.1	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_o				
Final	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		$(\sigma_1-\sigma_3)_{max}$	0.34	0.35	0.38	
Time to failure, min		t_f	9	26	29	
Rate of strain, percent/min			0.34	0.17	0.16	
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 = 0.18 T/sq ft
Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED
Classification PLASTIC CLAY (CH), gray, contains a few sea shell fragments
LL 58 | PL 19 | PI 39 | G_s 2.65
Remarks
Project HURRICANE PROTECTION
GRAND ISLE & VICINITY (CHECK BORINGS)
Area
Boring No. 61-AUE | Sample No. 8-C
El -29.7 | Date 24 July, 1969
FAM TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 2089 1 JUN 65 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT USAEWES SOILS TEST S



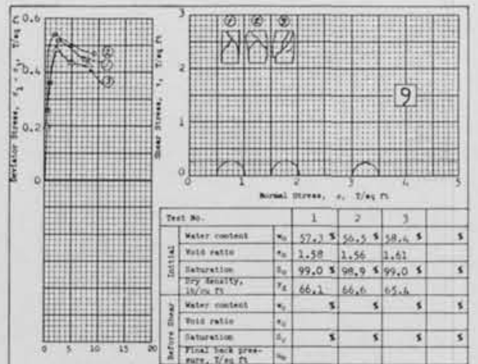
Test No.			①	②	③	
Initial	Water content	w_o	71.7%	72.1%	77.0%	%
	Void ratio	e_o	1.87	1.88	2.04	
	Saturation	S_o	100+%	100+%	100%	%
	Dry density, lb/cu ft	γ_d	57.6	57.5	54.3	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_o				
Final	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		$(\sigma_1-\sigma_3)_{max}$	0.44	0.50	0.44	
Time to failure, min		t_f	25	14	7	
Rate of strain, percent/min			0.20	0.18	0.59	
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 = 0.23 T/sq ft
Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED
Classification PLASTIC CLAY (CH), gray, homogeneous
LL 89 | PL 23 | PI 66 | G_s 2.65
Remarks
Project HURRICANE PROTECTION
GRAND ISLE & VICINITY (CHECK BORINGS)
Area
Boring No. 61-AUE | Sample No. 10-D
El -38.4 | Date 25 July, 1969
FAM TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 2089 1 JUN 65 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT USAEWES SOILS TEST SECTION



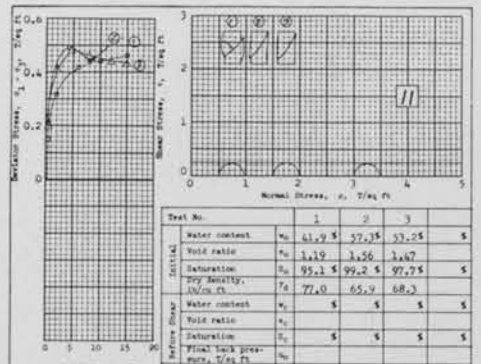
Test No.			1	2	3	
Initial	Water content	w_o	57.3%	56.5%	58.4%	%
	Void ratio	e_o	1.58	1.56	1.61	
	Saturation	S_o	99.0%	98.9%	99.0%	%
	Dry density, lb/cu ft	γ_d	66.1	66.6	65.4	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_o				
Final	Water content	w_f	%	%	%	%
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	0.5	1.5	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.52	0.56	0.49	
Time to failure, min		t_f	18	71	26	
Rate of strain, percent/min			0.14	0.09	0.08	
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 = 0.26 T/sq ft
Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED
Classification PLASTIC CLAY (CH), gray, contains 1/8" silty sand seams
LL 77 | PL 25 | PI 52 | G_s 2.73
Remarks Specimens 2 & 3 trimmed from second level
Project HURRICANE PROTECTION
GRAND ISLE & VICINITY (CHECK BORINGS)
Area
Boring No. 61-AUE | Sample No. 13-B
El -48.6 | Date 5 AUGUST 1969
JMS TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 2089 1 JUN 65 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT USAEWES SOILS TEST SECTIO



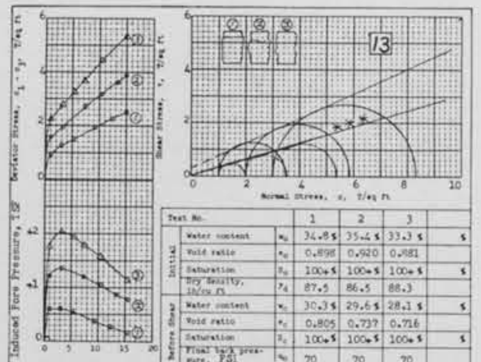
Test No.			1	2	3	
Initial	Water content	w_o	41.9%	57.3%	53.2%	%
	Void ratio	e_o	1.19	1.56	1.47	
	Saturation	S_o	95.1%	99.2%	97.7%	%
	Dry density, lb/cu ft	γ_d	77.0	65.9	68.3	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_o				
Final	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		$(\sigma_1-\sigma_3)_{max}$	0.46	0.49	0.48	
Time to failure, min		t_f	15	39	29	
Rate of strain, percent/min			0.12	0.11	0.16	
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 = 0.24 T/sq ft
Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED
Classification PLASTIC CLAY (CH), gray, contains scattered seams of silty *
LL 74 | PL 25 | PI 49 | G_s 2.70
Remarks * sand and shells up to 1/4"
Specimens 2 and 3 trimmed from second level
Project HURRICANE PROTECTION
GRAND ISLE & VICINITY (CHECK BORINGS)
Area
Boring No. 61-AUE | Sample No. 16-D
El -62.3 | Date 7 AUGUST 1969
JMS TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 2089 1 JUN 65 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT USAEWES SOILS TEST SE



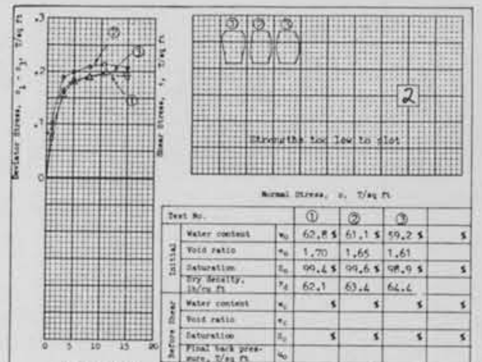
Test No.			1	2	3	
Initial	Water content	w_o	34.8%	35.4%	33.3%	%
	Void ratio	e_o	0.898	0.920	0.881	
	Saturation	S_o	100+%	100+%	100+%	%
	Dry density, lb/cu ft	γ_d	87.5	86.5	88.3	
Before Shear	Water content	w_c	30.3%	29.6%	28.1%	%
	Void ratio	e_c	0.805	0.737	0.716	
	Saturation	S_c	100+%	100+%	100+%	%
	Final back pressure, PSI	u_o	70	70	70	
Final	Dry density lb/cu ft		92.0	95.6	96.8	
	Void ratio	e_f				
Minor principal stress, T/sq ft		σ_3	1.0	2.0	3.0	
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	2.48	3.86	5.33	
Time to failure, min		t_f	115	136	136	
Rate of strain, percent/min			0.13	0.11	0.11	
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 = 25°
tan φ = 0.466
c = 0.32 T/sq ft
Method of saturation BP

☐ Controlled stress
☒ Controlled strain

Type of test R | Type of specimen UNDISTURBED
Classification SANDY SILT (ML), gray, contains two 1/16" horiz. layers of cla
LL 34 | PL 24 | PI 10 | G_s 2.66
Remarks * See attached plot for effective values
**(CL), & one 1/8" layer of fine sand.
Portion of sample allowed to drain to permit trimming
Project HURRICANE PROTECTION - 1969
GRAND ISLE & VICINITY (CHECK BORINGS)
Area
Boring No. 61-AUE | Sample No. 3-B
El -8.7 | Date 12 August 1969
PJR TRIAXIAL COMPRESSION TEST REPORT

**NOTE: φ=15°, C=0.06 TSF; Based on deviator stress at maximum pore pressure
TRANSLUCENT USAEWES SOILS TEST SECTION



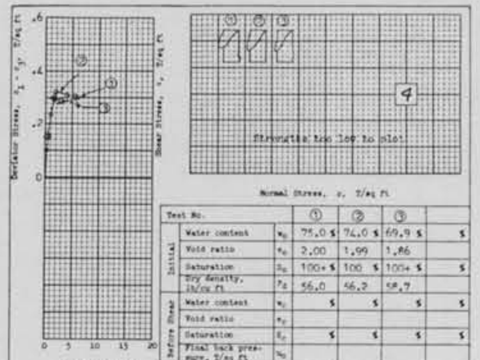
Test No.			①	②	③	
Initial	Water content	w_o	62.8%	61.1%	59.2%	%
	Void ratio	e_o	1.70	1.65	1.61	
	Saturation	S_o	99.4%	99.6%	98.9%	%
	Dry density, lb/cu ft	γ_d	62.1	63.4	64.6	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_o				
Final	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		$(\sigma_1-\sigma_3)_{max}$	0.19	0.21	0.20	
Time to failure, min		t_f	39	24	35	
Rate of strain, percent/min			0.36	0.45	0.31	
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 = 0.10 T/sq ft
Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED
Classification PLASTIC CLAY (CH), gray, contains numerous 1/8" sand silt *
LL 53 | PL 21 | PI 32 | G_s 2.69
Remarks * seams
Project HURRICANE PROTECTION
GRAND ISLE & VICINITY (CHECK BORINGS)
Area
Boring No. 61-AUE | Sample No. 5-C
El -17.6 | Date 11 July, 1969
JMS TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 2089 1 JUN 65 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT USAEWES SOILS TEST S



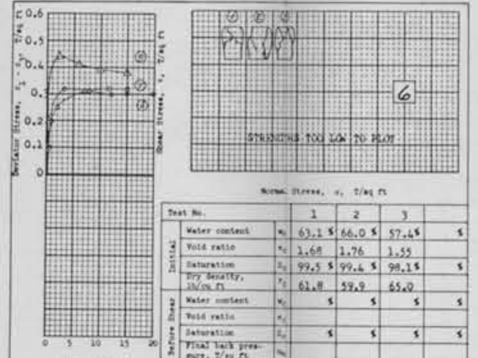
Test No.			①	②	③	
Initial	Water content	w_o	75.0%	74.0%	69.9%	%
	Void ratio	e_o	2.00	1.99	1.86	
	Saturation	S_o	100+%	100%	100+%	%
	Dry density, lb/cu ft	γ_d	56.0	56.2	58.7	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_o				
Final	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		$(\sigma_1-\sigma_3)_{max}$	0.30	0.32	0.30	
Time to failure, min		t_f	17	22	24	
Rate of strain, percent/min			0.11	0.09	0.07	
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 = 0.15 T/sq ft
Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED
Classification PLASTIC CLAY (CH), gray, contains 1/16" dia. shells
LL 76 | PL 23 | PI 53 | G_s 2.69
Remarks
Project HURRICANE PROTECTION
GRAND ISLE & VICINITY (CHECK BORINGS)
Area
Boring No. 61-AUE | Sample No. 7-B
El -24.3 | Date 24 July, 1969
JMS TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 2089 1 JUN 65 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT USAEWES SOILS TEST SE



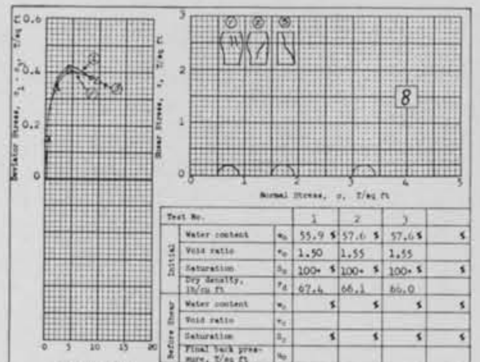
Test No.			1	2	3	
Initial	Water content	w_o	63.1%	66.0%	57.4%	%
	Void ratio	e_o	1.68	1.76	1.55	
	Saturation	S_o	99.5%	99.4%	98.1%	%
	Dry density, lb/cu ft	γ_d	61.8	59.9	65.0	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_o				
Final	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		$(\sigma_1-\sigma_3)_{max}$	0.32	0.32	0.44	
Time to failure, min		t_f	98	18	18	
Rate of strain, percent/min			0.12	0.18	0.13	
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 = 0.16 T/sq ft
Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED
Classification PLASTIC CLAY (CH), gray, contains numerous silty sand lenses*
LL 80 | PL 22 | PI 58 | G_s 2.65
Remarks * and a few 1/8" dia. shells
Specimen 3 trimmed from second level
Project HURRICANE PROTECTION
GRAND ISLE & VICINITY (CHECK BORINGS)
Area
Boring No. 61-AUE | Sample No. 9-C
El -34.1 | Date 25 JULY 1969
JMS TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 2089 1 JUN 65 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT USAEWES SOILS TEST SECTION



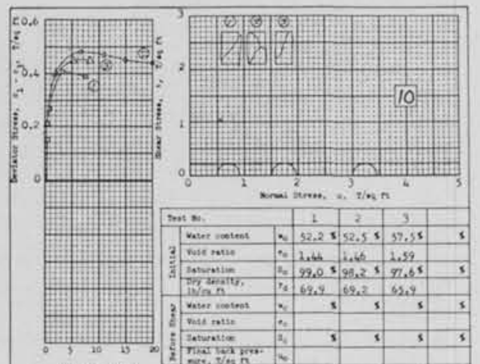
Test No.			1	2	3	
Initial	Water content	w_o	55.9%	57.6%	57.6%	%
	Void ratio	e_o	1.50	1.55	1.55	
	Saturation	S_o	100+%	100+%	100+%	%
	Dry density, lb/cu ft	γ_d	67.4	66.1	66.0	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_o				
Final	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		$(\sigma_1-\sigma_3)_{max}$	0.40	0.42	0.41	
Time to failure, min		t_f	29	38	26	
Rate of strain, percent/min			0.15	0.11	0.16	
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 = 0.21 T/sq ft
Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED
Classification PLASTIC CLAY (CH), gray, contains a few 1/8" silty sand *
LL 67 | PL 22 | PI 45 | G_s 2.70
Remarks * seams & silty sand lenses
Project HURRICANE PROTECTION
GRAND ISLE & VICINITY (CHECK BORINGS)
Area
Boring No. 61-AUE | Sample No. 12-C
El -45.6 | Date 4 AUGUST 1969
JMS TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 2089 1 JUN 65 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT USAEWES SOILS TEST SECTION



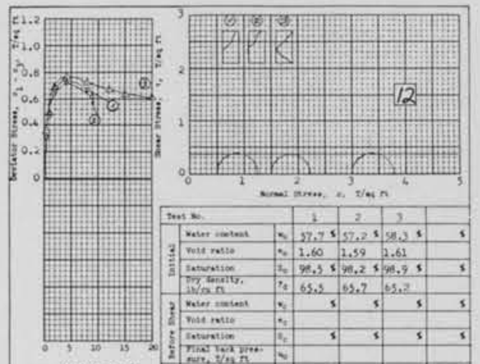
Test No.			1	2	3	
Initial	Water content	w_o	52.2%	52.5%	57.5%	%
	Void ratio	e_o	1.44	1.46	1.59	
	Saturation	S_o	99.0%	98.2%	97.6%	%
	Dry density, lb/cu ft	γ_d	69.9	69.2	65.9	
Before Shear	Water content	w_c	%	%	%	%
	Void ratio	e_c				
	Saturation	S_c	%	%	%	%
	Final back pressure, T/sq ft	u_o				
Final	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		$(\sigma_1-\sigma_3)_{max}$	0.41	0.48	0.45	
Time to failure, min		t_f	42	76	37	
Rate of strain, percent/min			0.08	0.09	0.14	
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 = 0.22 T/sq ft
Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED
Classification PLASTIC CLAY (CH), gray, contains a few silty sand lenses
LL 75 | PL 22 | PI 53 | G_s 2.73
Remarks
Project HURRICANE PROTECTION
GRAND ISLE & VICINITY (CHECK BORINGS)
Area
Boring No. 61-AUE | Sample No. 14-D
El -54.5 | Date 5 AUGUST 1969
JMS TRIAXIAL COMPRESSION TEST REPORT

ENG FORM 2089 1 JUN 65 (EM 1110-2-1902) PREVIOUS EDITIONS ARE OBSOLETE TRANSLUCENT USAEWES SOILS TEST SECTIO



Test No.			1	2	3	
Initial	Water content	w_o	57.7%	57.2%	58.3%	%
	Void ratio	e_o	1.60	1.59	1.61	
	Saturation	S_o	98.5%	98.2%	98.9%	%
	Dry density, lb/cu ft	γ_d	65.5	65.7	65.2	
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		$(\sigma_1-\sigma_3)_{max}$	0.75	0.72	0.77	
Time to failure, min		t_f	19	41	32	
Rate of strain, percent/min			0.20	0.10	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 = 0.37 T/sq ft
Method of saturation ______

☐ Controlled stress
☒ Controlled strain

Type of test Q | Type of specimen UNDISTURBED
Classification PLASTIC CLAY (CH), gray, contains very few lenses of silty sand
LL 87 | PL 25 | PI 62 | G_s 2.73
Remarks
Project HURRICANE PROTECTION
GRAND ISLE & VICINITY (CHECK BORINGS)
Area
Boring No. 61-AUE | Sample No. 18-C
El -69.3 | Date 7 AUGUST 1969
JMS TRIAXIAL COMPRESSION TEST REPORT

NOTE:

- [3] Indicates reference number shown under shear data on Plate 76
- (Q) Unconsolidated - undrained triaxial compression test.
- (R) Consolidated - undrained triaxial compression test.
- (S) Consolidated - drained direct shear test.

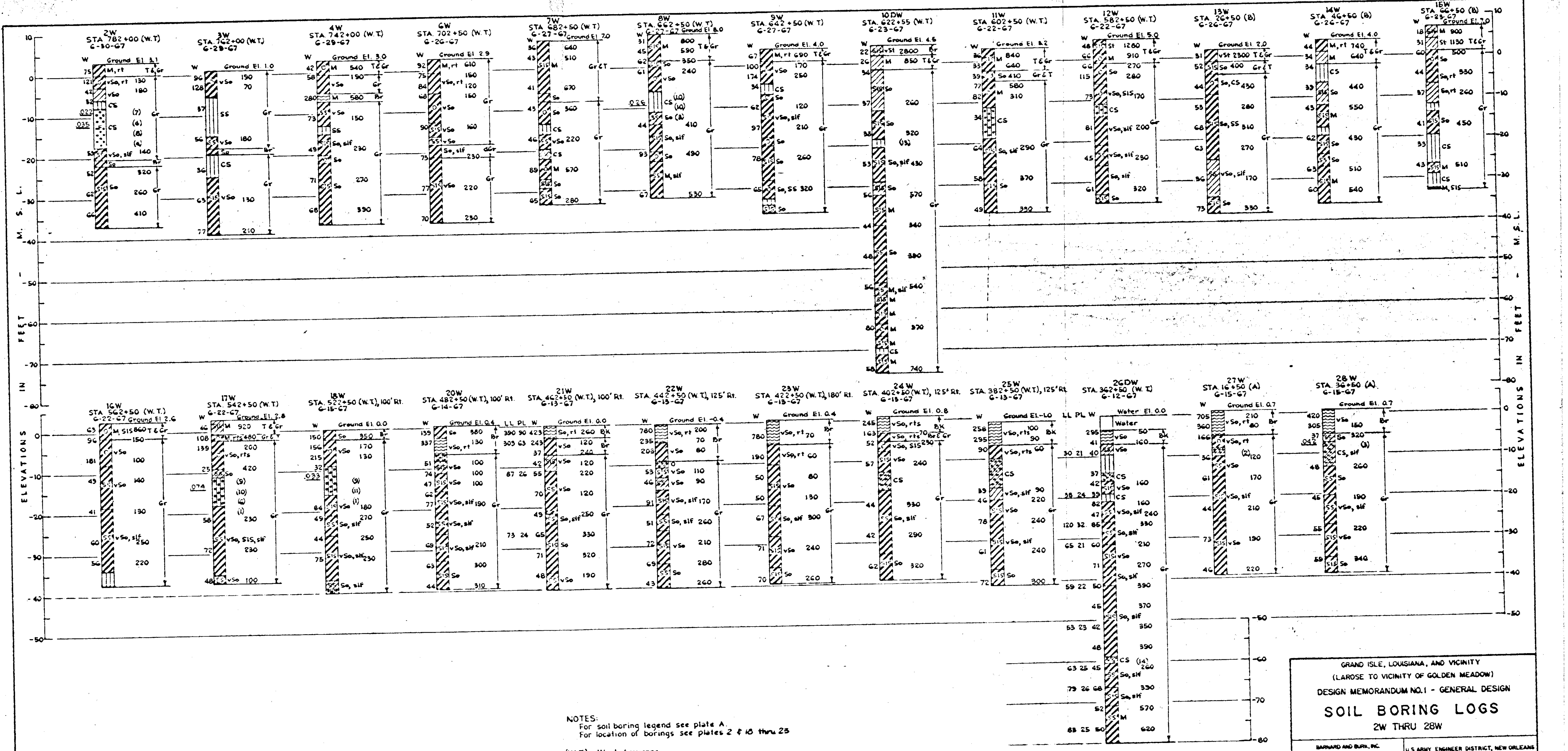
GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

DETAIL SHEAR STRENGTH DATA
BORING 61 AUE

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE: MARCH, 1972 | FILE NO. H-2-24314



NOTES:
For soil boring legend see plate A.
For location of borings see plates 2 & 18 thru 25

(W.T.) West traverse
(B) Lat. "B"
(A) Lat. "A"

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

SOIL BORING LOGS

2W THRU 28W

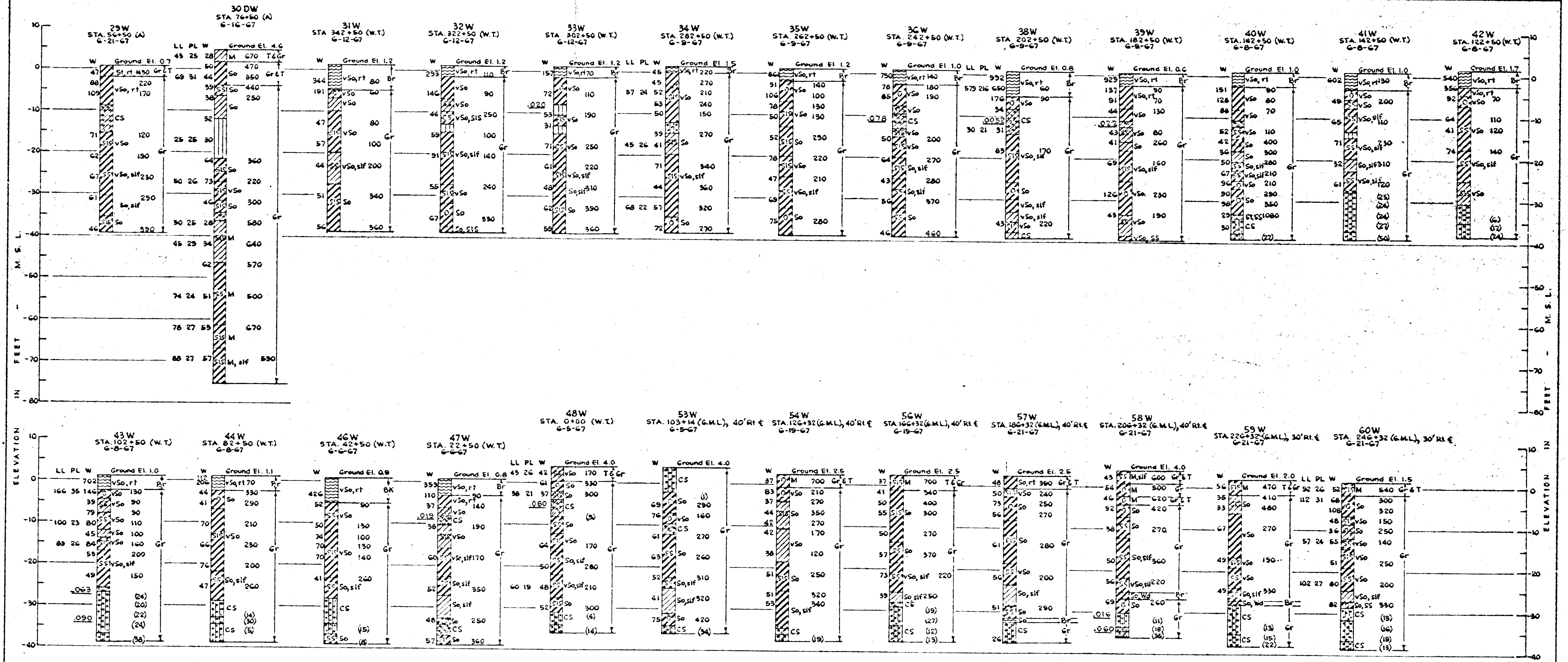
BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE: MARCH 1972

FILE NO. H-2-24314

PLATE 78



NOTES:
For soil boring legend see plate A.
For location of borings see plates 15 thru 18 and 23

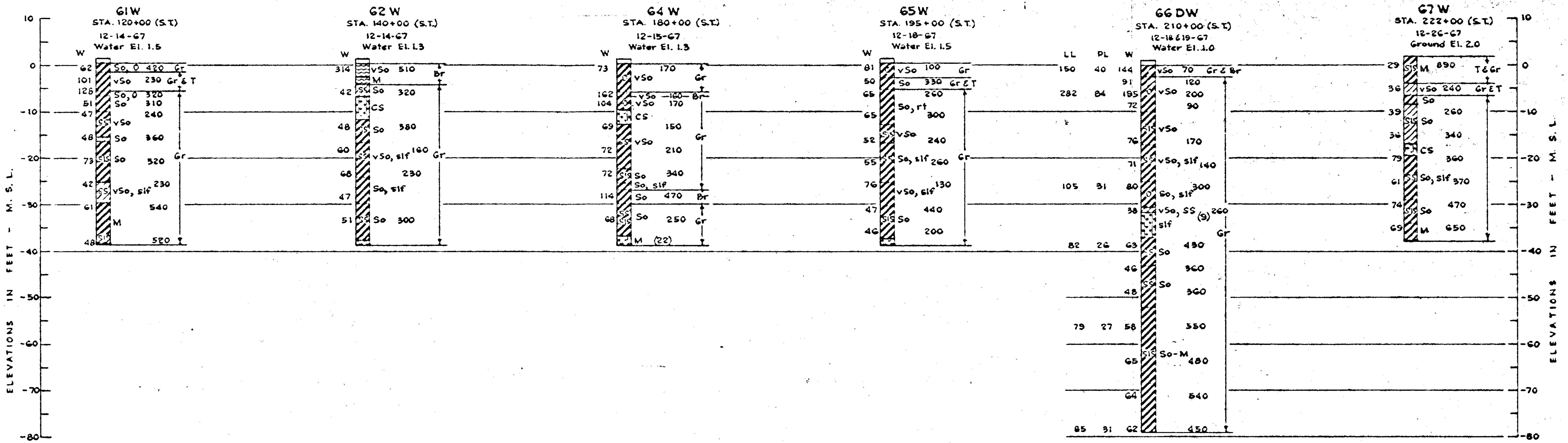
(A) Lat. "A"
(W.T.) West traverse
(G.M.L.) Golden Meadow levee - 1967 traverse

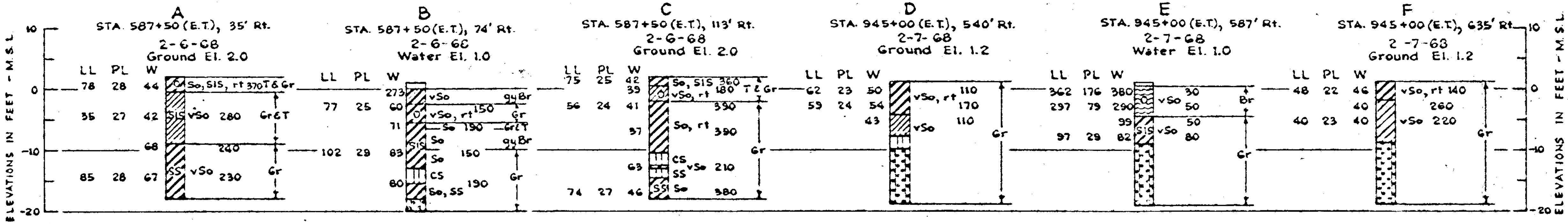
GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

SOIL BORING LOGS

29W THRU 60W

BARNARD AND BURK, INC. CONSULTING ENGINEERS, BATON ROUGE, LA.	U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS
DATE: MARCH 1972	FILE NO. H-2-24314





NOTES:
For soil boring legend see plate A.
For location of borings see plates 7, 10, 12 & 13

(S.T.) South traverse
(E.T.) East traverse

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I - GENERAL DESIGN

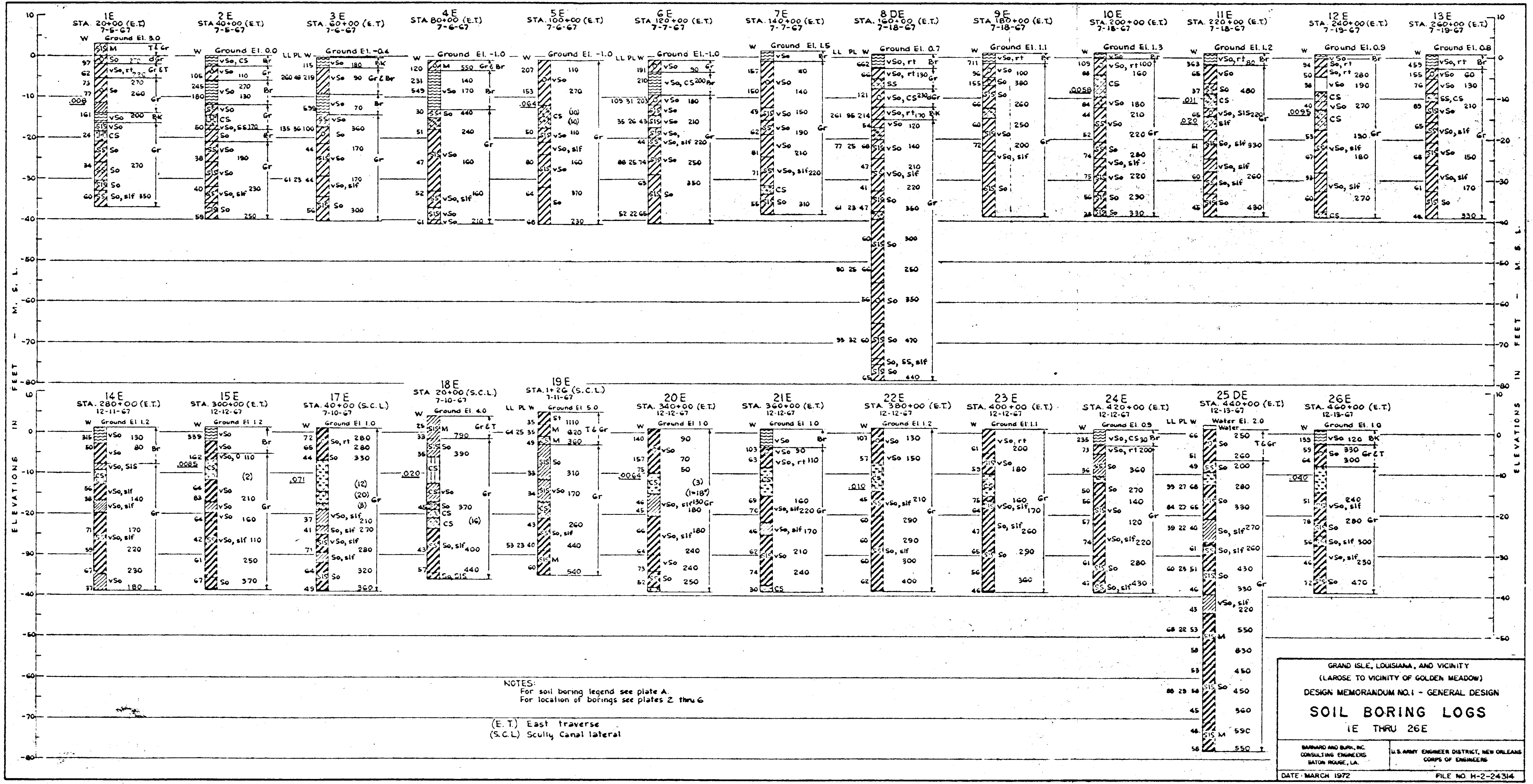
SOIL BORING LOGS

61W THRU 67W , A THRU F

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE: MARCH 1972
FILE NO. H-2-24314



NOTES:
For soil boring legend see plate A.
For location of borings see plates 2 thru 6

(E.T.) East traverse
(S.C.L.) Scully Canal lateral

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

SOIL BORING LOGS

1E THRU 26E

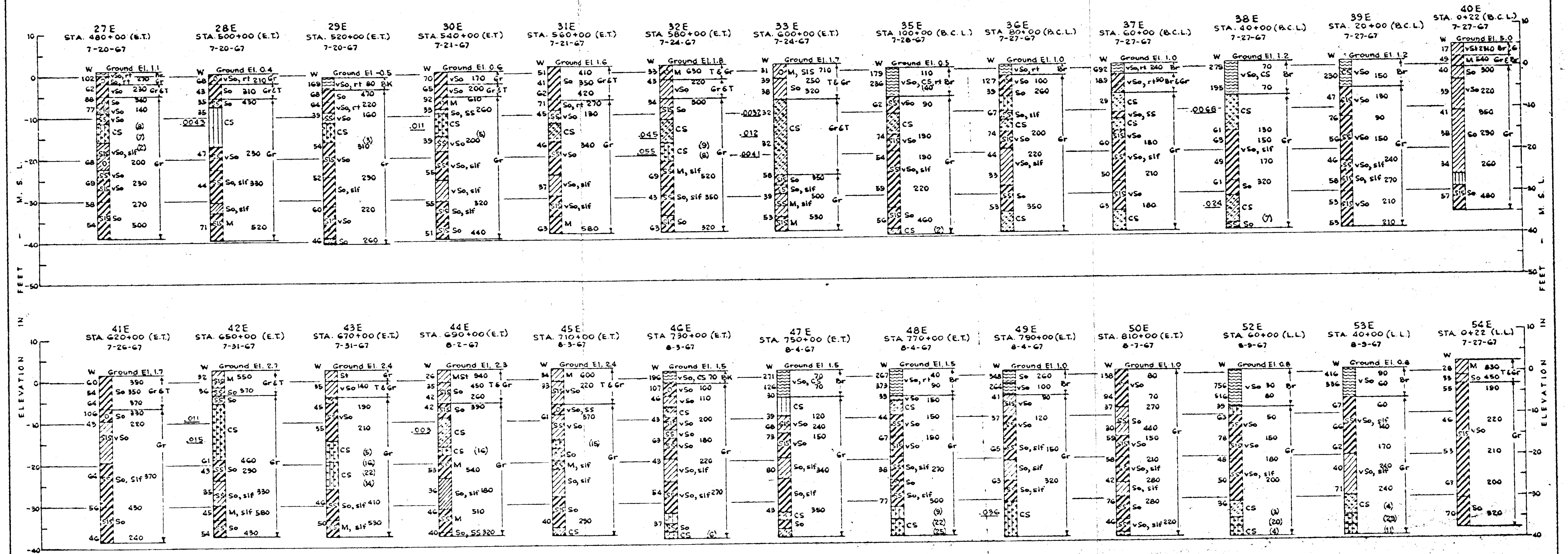
BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE: MARCH 1972

FILE NO. H-2-24314

PLATE 81



NOTES:
For soil boring legend see plate A.
For location of borings see plates 6 thru 9; 24 and 25

(E.T.) East traverse
(B.C.L.) Breton Canal lateral
(L.L.) Lower lateral

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

SOIL BORING LOGS

27 E THRU 54 E

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

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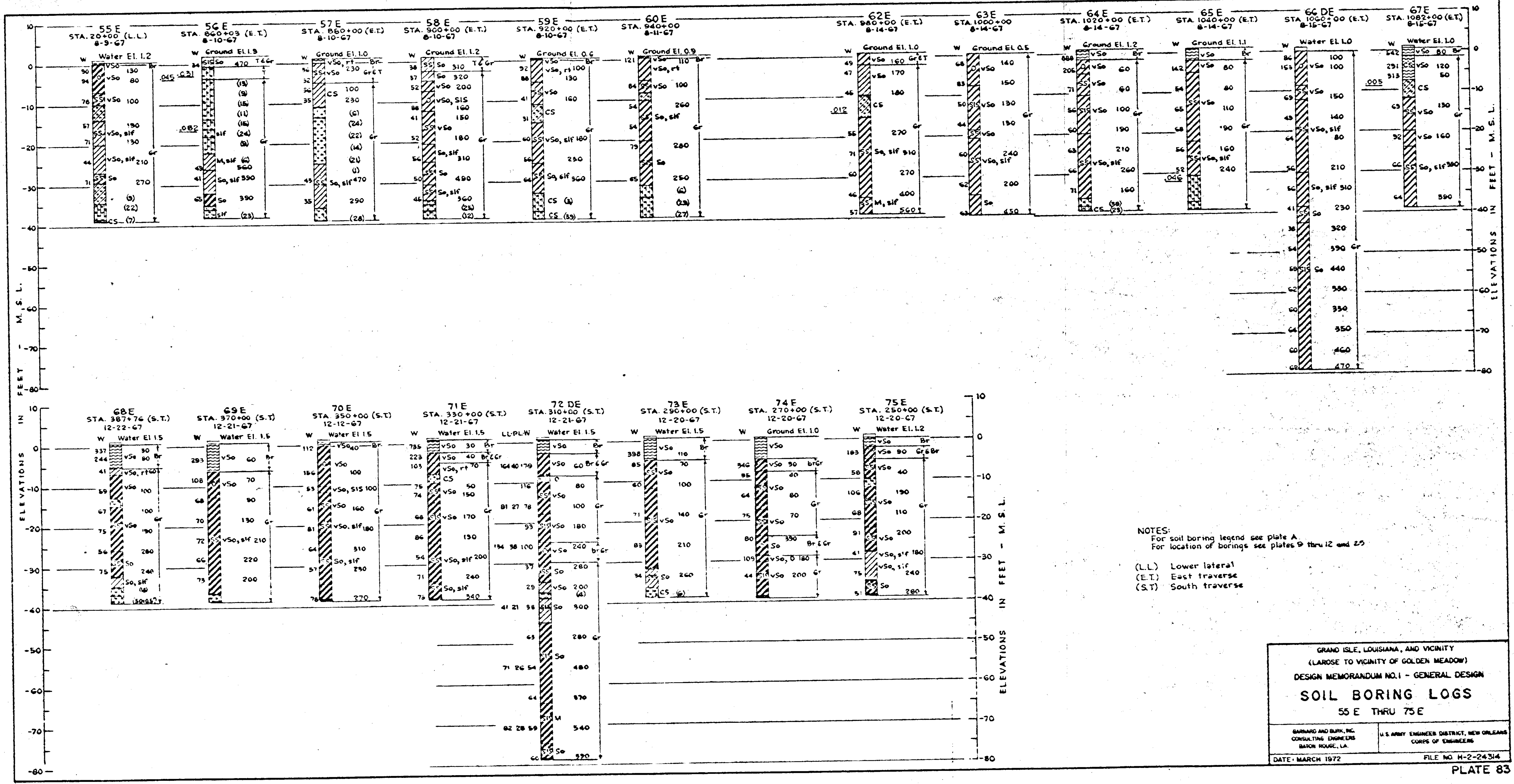
FILE NO H-2-24314

PLATE 82



NOTES:
For soil boring legend see plate A.
For location of borings see plates 9 thru 12 and 25

(L.L.) Lower lateral
(E.T.) East traverse
(S.T) South traverse

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I - GENERAL DESIGN

SOIL BORING LOGS

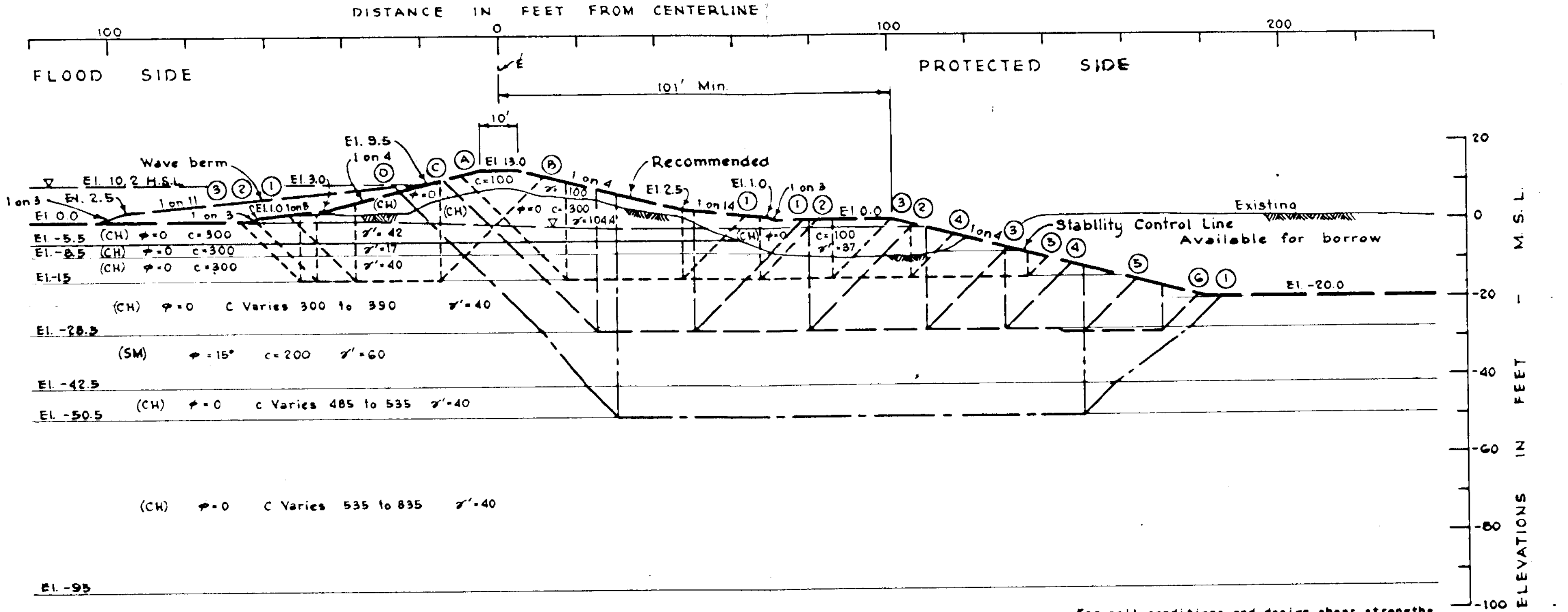
55 E THRU 75 E

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE: MARCH 1972

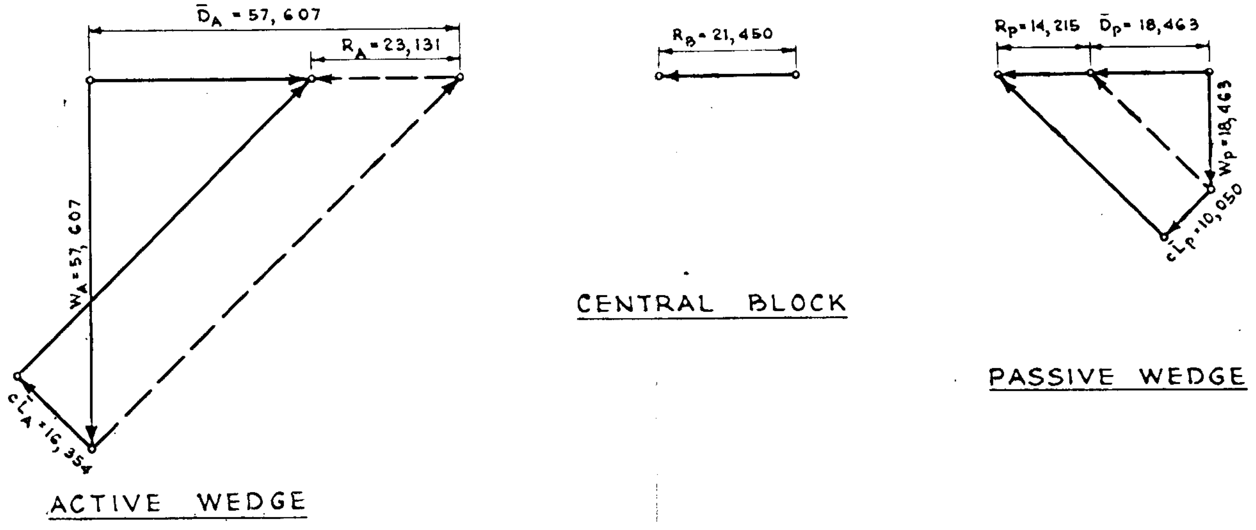
FILE NO. H-2-24314



For soil conditions and design shear strengths
See Borings 53 W through 59 W on Plates 44 and 79
and Boring 55 UW on Plate 54

LEVEE SECTION 1

STA. 246+32 TO STA. 86+00
(GOLDEN MEADOW RING LEVEE)
(1967 TRAVERSE)



$$F.S. = \frac{R_A + R_B + R_P}{\bar{D}_A - \bar{D}_P} = 1.50$$

SLIP SURFACE Ⓒ - ②

TYPICAL VECTOR ANALYSIS

LEVEE STATION	SLIP SURFACE			DRIVING			RESISTING				FACTOR OF SAFETY
	NUMBER		EL.	$+\bar{D}_A$	$-\bar{D}_P$	$\Sigma \bar{D}$	$+R_A$	$+R_B$	$+R_P$	ΣR	$\Sigma R / \Sigma D$
110+00 GOLDEN MEADOW RING LEVEE	A	1	-15	31686	8743	22943	14397	9000	7649	31046	1.35
		2			6179	25507		15000	5536	34933	1.37
		3			5966	25720		20700	5097	40194	1.56
		4			2921	28765		26700	4824	45921	1.60
		5			624	31062		35700	3000	53097	1.71
	B	1	-15	31474	9413	22061	14232	6600	9874	30706	1.39
		2			6885	24589		9600	9183	33015	1.34
		3			5897	25577		10800	9000	34032	1.33
	C	1	-28.5	57607	21312	36295	23131	9750	15024	47905	1.32
		2			18463	39144		21450	14215	58796	1.50
		3			10900	46707		33150	13815	70096	1.50
		4			7221	50386		40950	11415	75496	1.50
		5			4222	53385		48703	8970	80804	1.51
		6			2023	55584		55651	6210	84992	1.53
	D	1	-50.5	118010	27014	90996	49051	64200	30108	143159	1.57

GENERAL NOTES

(Q) Unconsolidated - undrained shear strength in pounds per sq. ft.
γ Unit weight of soil in pounds per cu. ft.
γ' Submerged unit weight of soil in pounds per cu. ft.
φ Angle of internal friction in degrees.
c Cohesion in pounds per sq. ft.
$\bar{D}$ Horizontal driving force in pounds.
R Horizontal resisting force in pounds.
F.S. Factor of safety with respect to (Q) shear strength.
H.S.L. Hurricane Stillwater Level.

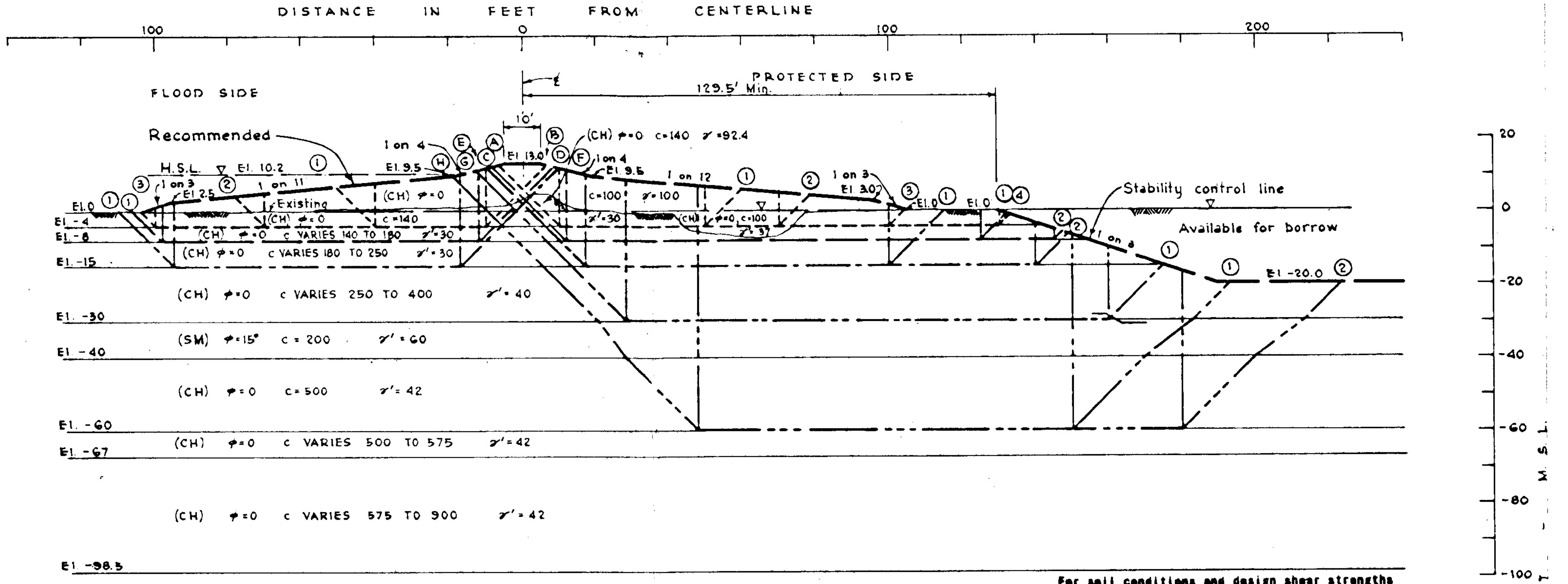
GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

LEVEE (Q) STABILITY
LEVEE SECTION 1

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

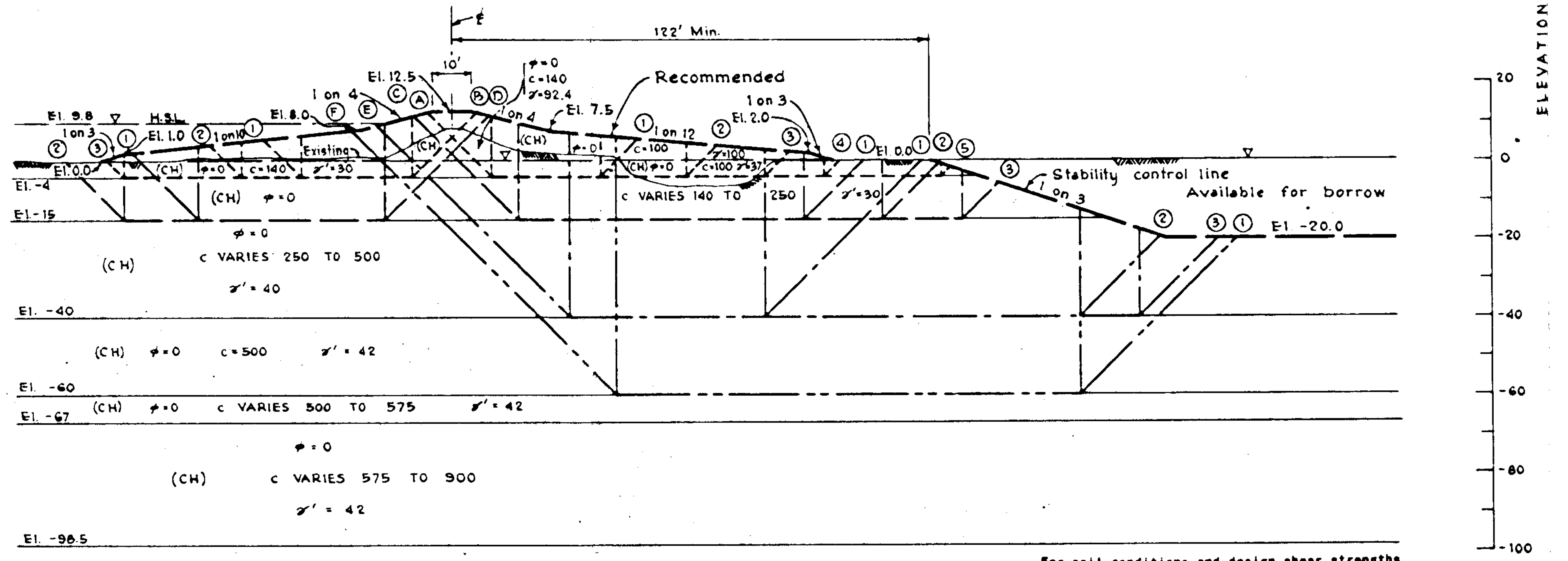
DATE: MARCH 1972
FILE NO. H-2-24314



LEVEE SECTION 2

STA. 0+11.9 TO STA. 162+50
(WEST TRAVERSE)

For soil conditions and design shear strengths See Borings 40 W through 48 W on Plates 44 and 79 and Boring 45AUW on Plate 70



LEVEE SECTION 3

STA. 172+50 TO STA. 232+50
(WEST TRAVERSE)

For soil conditions and design shear strengths See Borings 38 W and 35 W on Plates 44 and 79 and Boring 45AUW on Plate 70

LEVEE STATION	SLIP SURFACE			DRIVING			RESISTING				FACTOR OF SAFETY ΣR / ΣD
	NUMBER		EL.	$+\bar{D}_A$	$-\bar{D}_P$	$\Sigma\bar{D}$	$+R_A$	$+R_B$	$+R_P$	ΣR	
31+00 WEST TRAVERSE	A	1	- 4	13350	4933	8417	3987	5360	2003	11350	1.35
		2			3365	9985		7360	1690	13037	1.30
		3			574	12776		11400	1144	16531	1.29
		4			165	13185		15600	805	20392	1.55
	B	1	- 4	13494	5573	7921	3759	4200	2494	10453	1.32
		2			3033	10461		8400	1954	14113	1.35
		3			443	13051		12600	1120	17479	1.34
	C	1	- 8	18757	913	17844	5133	20340	2155	27628	1.55
		2			90	18667		23940	680	29753	1.59
	D	1	- 8	18943	1462	17481	5080	15480	2400	22960	1.31
	E	1	-15	28809	3711	25098	8010	20750	5410	34170	1.36
		2			1486	27323		30750	3530	42290	1.55
	F	1	-15	28967	4564	24403	8130	19500	5410	33040	1.35
	G	1	-30	54709	5547	49162	17493	52800	10156	80449	1.64
	H	1	-60	135592	46275	89317	48512	51000	37791	137303	1.54
		2			37994	97598		66000	36600	151112	1.55

LEVEE STATION	SLIP SURFACE			DRIVING			RESISTING				FACTOR OF SAFETY ΣR / ΣD
	NUMBER		EL.	$+\bar{D}_A$	$-\bar{D}_P$	$\Sigma\bar{D}$	$+R_A$	$+R_B$	$+R_P$	ΣR	
211+00 WEST TRAVERSE	A	1	- 4	12301	4415	7886	4200	3920	2279	10399	1.32
		2			2894	9407		6520	1585	12305	1.31
		3			1678	10623		8600	1505	14305	1.35
		4			307	11994		10700	1120	16020	1.34
		5			101	12200		14900	630	19730	1.62
	B	1	- 4	12324	4431	7893	4234	3920	2269	10423	1.32
		2			3102	9222		6020	1996	12250	1.33
		3			780	11544		10220	1230	15684	1.36
	C	1	-15	26991	4190	22801	8223	18250	5410	31883	1.40
		2			3339	23652		23250	5200	36673	1.55
		3			1710	25281		28250	3607	40080	1.58
	D	1	-15	27056	8297	18759	8320	11750	5886	25956	1.38
		2			3963	23093		16500	5410	30230	1.31
	E	1	-40	72882	30506	42376	26173	25000	24160	75333	1.78
		2			11120	61762		65000	15375	106548	1.72
		3			8323	64559		72500	15000	113673	1.76
	F	1	-60	125342	35537	89805	45745	59000	35000	139745	1.56

For general notes see plate 84

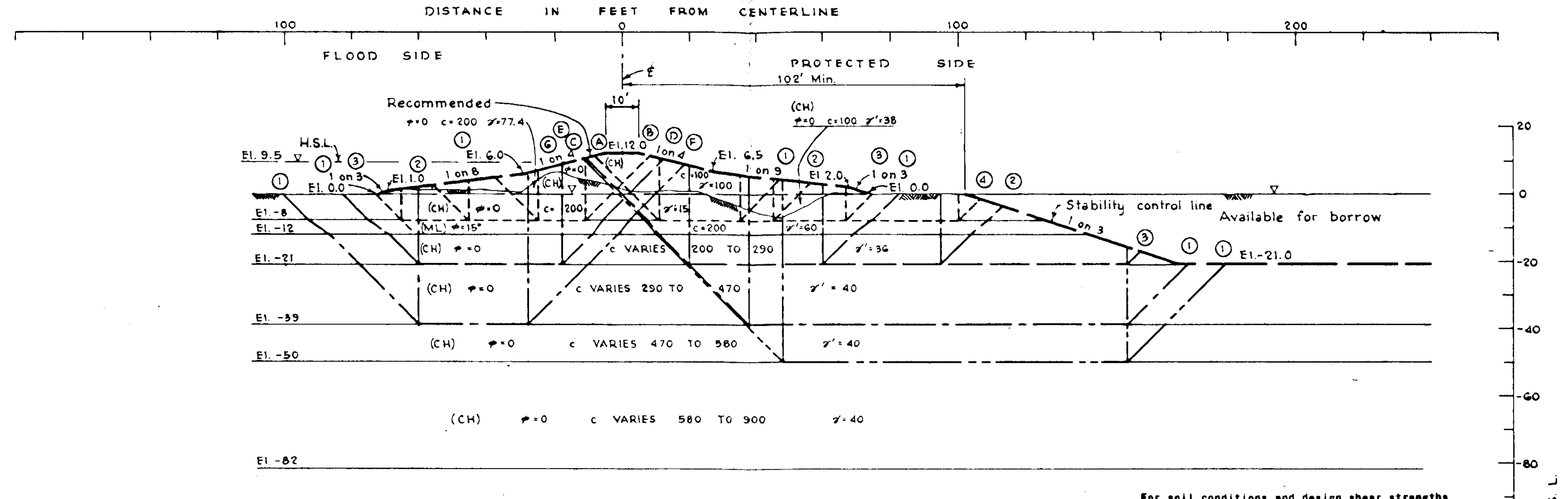
GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

LEVEE (Q) STABILITY
LEVEE SECTIONS 2 AND 3

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA

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

DATE: MARCH 1972
FILE NO. H-2-24314

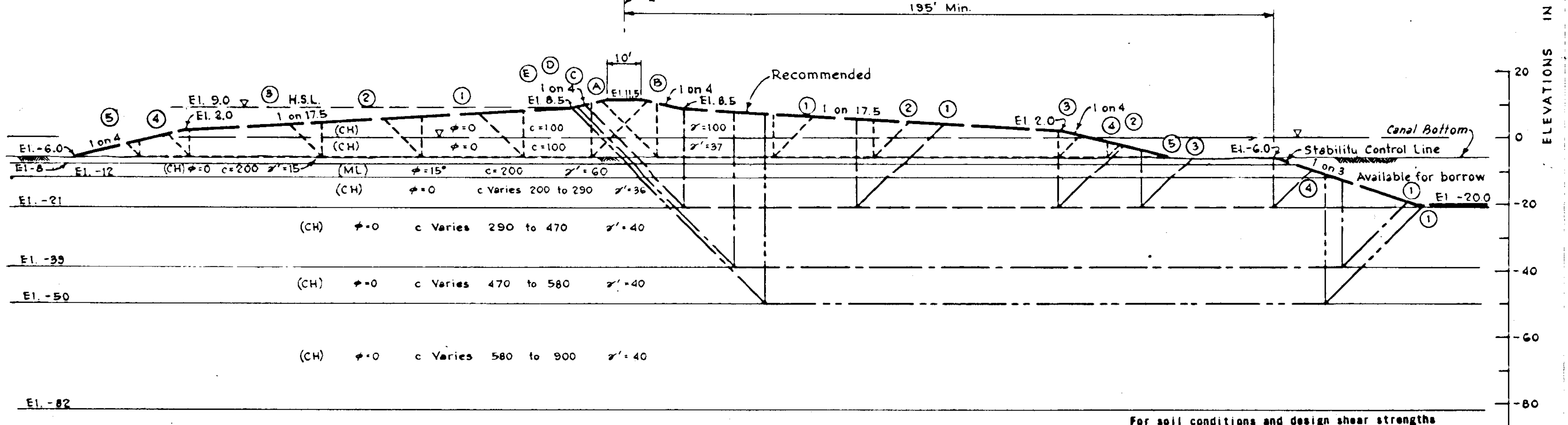


LEVEE SECTIONS 4 AND 5

STA. 242+50 TO STA. 351+50
(WEST TRAVERSE)

For soil conditions and design shear strengths
See Borings 31 W through 36W on Plates 44 and 79
and Boring 19AUW on Plate 68

LEVEE STATION	SLIP SURFACE		DRIVING			RESISTING				FACTOR OF SAFETY ΣR / ΣD
	NUMBER		EL.	$+\bar{D}_A$	$-\bar{D}_P$	$\Sigma \bar{D}$	$+R_A$	$+R_B$	$+R_P$	ΣR	
300+00 WEST TRAVERSE	A	1	- 8	16321	6220	10101	5572	4800	3025	13397	1.33
		2			5044	11277		6800	2265	14657	1.30
		3			1180	15141		11200	3200	19972	1.32
		4			412	15909		17800	2600	25972	1.63
	B	1	- 8	16172	6407	9765	5780	2800	4358	12938	1.32
		2			3451	12721		6800	3992	16572	1.30
		3			1064	15108		10800	3200	19780	1.31
	C	1	-21	34050	8494	25556	13402	11600	10546	35548	1,39
		2			5729	28321		21750	8779	43931	1.55
		3			337	33713		37700	1837	52939	1.57
	D	1	-21	34221	7489	26732	13166	12180	10449	35795	1.34
	E	1	-39	65191	7826	57365	27081	52640	13680	93401	1.63
	F	1	-39	66901	26314	40587	26656	15040	24045	65741	1.62
	G	1	-50	90300	18164	72136	38698	59160	25230	123088	1.71



For soil conditions and design shear strengths
See Borings 23 W through 26DW on Plates 44 and 78
and Boring 19AUW on Plate 68

CANAL CROSSINGS

(WEST TRAVERSE)

LEVEE STATION	SLIP SURFACE		DRIVING			RESISTING				FACTOR OF SAFETY ΣR / ΣD
	NUMBER		EL.	$+\bar{D}_A$	$-\bar{D}_P$	$\Sigma \bar{D}$	$+R_A$	$+R_B$	$+R_P$	ΣR	
CANAL CROSSINGS WEST TRAVERSE	A	1	- 6	13809	6733	7076	3400	3500	2441	9341	1.32
		2			4781	9028		6500	2116	12016	1.33
		3			1540	12269		12000	1310	16710	1.36
		4			291	13518		13500	710	17610	1.30
		5			0	13809		15275	0	18675	1.35
	B	1	- 6	13809	7813	5996	3400	2000	2603	8003	1.33
		2			5722	8087		5000	2278	10678	1.32
		3			3909	9900		8000	1954	13354	1.35
		4			1540	12269		12000	1310	16710	1.36
		5			291	13518		13500	710	17610	1.30
	C	1	-21	36390	19504	16886	11997	15080	11672	38749	2.30
		2			8823	27567		32480	8921	53398	1.94
		3			4793	31597		39730	7714	59441	1.88
		4			3804	32586		51330	5631	68958	2.12
	D	1	-39	72482	9946	62536	25652	85540	14507	125699	2.01
	E	1	-50	100109	22199	77910	37149	97150	25720	160019	2.05

For general notes see plate 84

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I - GENERAL DESIGN

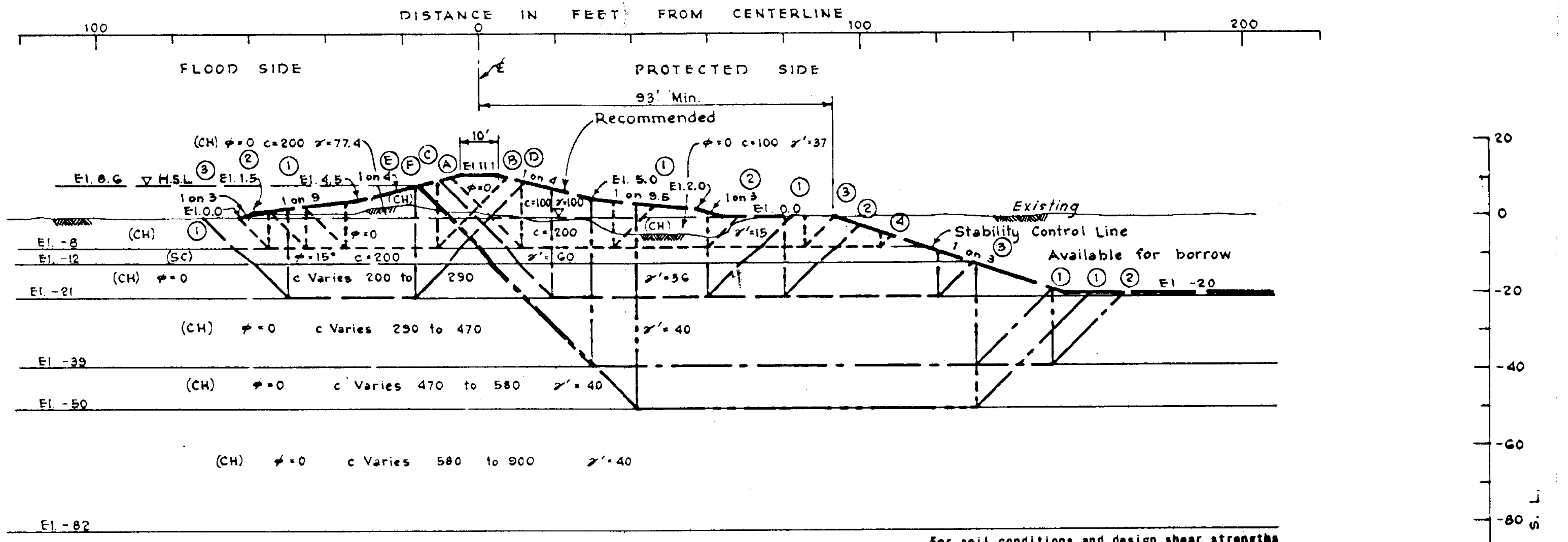
LEVEE (Q) STABILITY
LEVEE SECTIONS 4 AND 5 AND CANAL CROSSINGS (WEST TRAVERSE)

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA

U S ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

DATE: MARCH 1972
FILE NO. H-2-24314

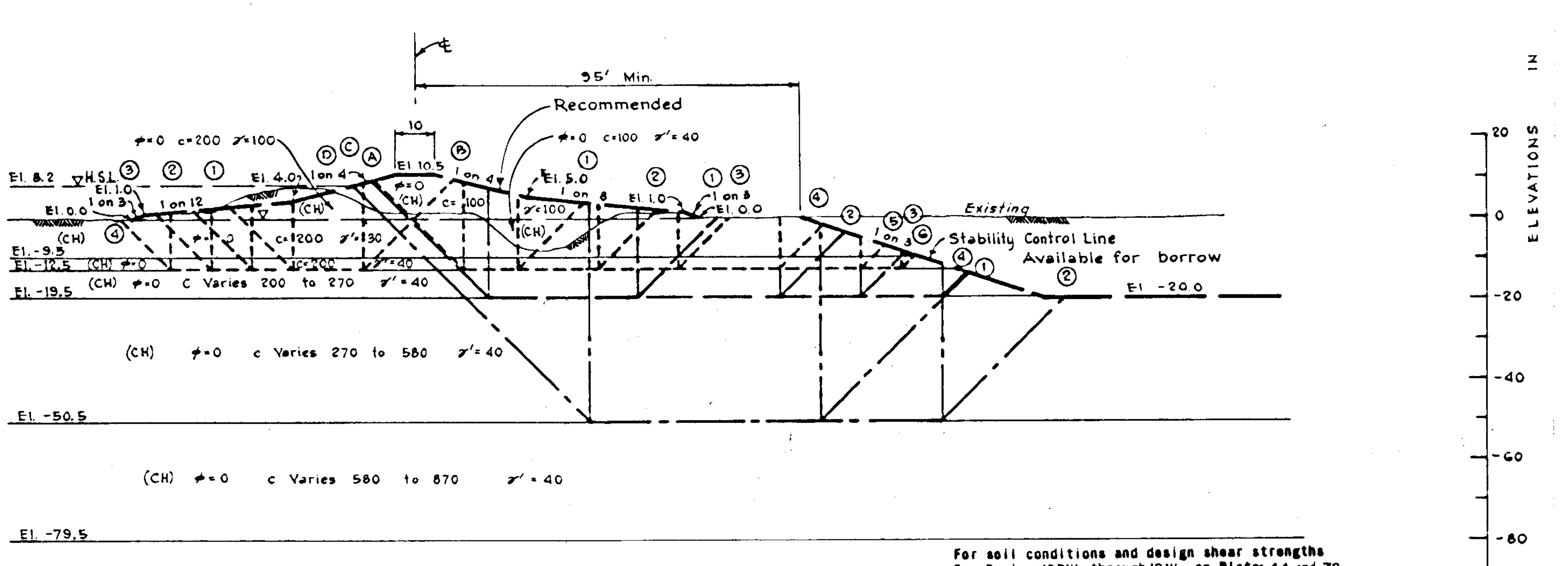
PLATE 86



LEVEE SECTION 6

STA. 443+00 TO STA. 562+50
(WEST TRAVERSE)

For soil conditions and design shear strengths
See Borings 16W through 21W on Plates 44 and 78
and Boring 19AUW on Plate 68



LEVEE SECTION 7

STA. 564+50 TO STA. 635+00
(WEST TRAVERSE)

For soil conditions and design shear strengths
See Borings 10DW through 12W on Plates 44 and 78
and Boring 19AUW on Plate 68

LEVEE STATION	SLIP SURFACE			DRIVING			RESISTING				FACTOR OF SAFETY $\Sigma R / \Sigma D$
	NUMBER		EL.	$+\bar{D}_A$	$-\bar{D}_P$	$\Sigma \bar{D}$	$+R_A$	$+R_B$	$+R_P$	ΣR	
466+00 WEST TRAVERSE	A	1	- 8	14884	4792	10092	5543	4800	2957	13300	1.32
		2			1355	13529		9800	2229	17572	1.30
		3			479	14405		14800	3190	23533	1.63
		4			88	14796		18800	1190	25533	1.73
	B	1	- 8	14680	3674	11006	5596	4800	3978	14374	1.31
		2			2520	12160		6800	3778	16174	1.33
		3			1290	13390		8800	3200	17596	1.31
	C	1	-21	32460	7203	25257	13141	11890	10403	35434	1.40
		2			5974	26486		17690	9431	40262	1.52
		3			2248	30212		29290	4398	46829	1.55
	D	1	-21	32111	7857	24254	12977	9570	10487	33034	1.36
	E	1	-39	64503	10220	54283	26626	47235	14648	88509	1.63
		2			7193	57310		56635	14170	97431	1.70
	F	1	-50	87889	21022	66867	38195	51620	25720	115535	1.73

LEVEE STATION	SLIP SURFACE			DRIVING			RESISTING				FACTOR OF SAFETY $\Sigma R / \Sigma D$
	NUMBER		EL.	$+\bar{D}_A$	$-\bar{D}_P$	$\Sigma \bar{D}$	$+R_A$	$+R_B$	$+R_P$	ΣR	
632+00 WEST TRAVERSE	A	1	-12.5	20059	9503	10556	7160	2600	4068	13828	1.31
		2			5806	14253		6600	5554	19314	1.35
		3			2756	17303		10600	5000	22760	1.31
		4			2176	17883		15600	4250	27010	1.51
		5			677	19382		19600	2250	29010	1.50
		6			240	19819		21600	1250	30010	1.51
	B	1	-12.5	19982	7273	12709	7200	3400	6123	16723	1.32
		2			6022	13960		5400	5708	18308	1.31
		3			4843	15139		7400	5508	20108	1.33
		4			3440	16542		9400	5000	21600	1.31
	C	1	-19.5	29605	8270	21335	10410	9990	8290	28690	1.34
		2			5412	24193		19440	6840	36690	1.52
		3			2863	26742		24840	4840	40090	1.50
		4			919	28686		30240	2761	43411	1.51
	D	1	-50.5	88942	34842	54100	36520	33060	28994	98574	1.82
		2			22765	66177		50460	25925	112905	1.71

For general notes see plate 84

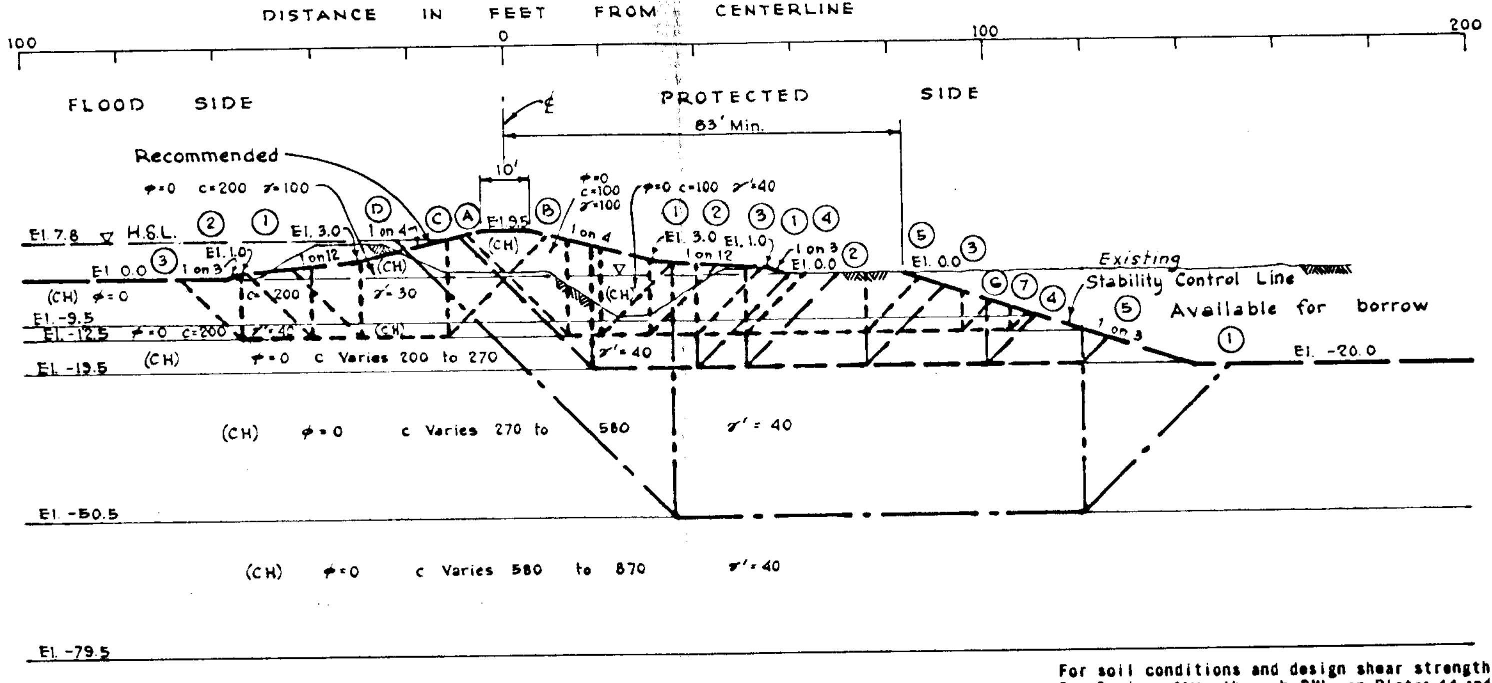
GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

LEVEE (Q) STABILITY
LEVEE SECTIONS 6 AND 7

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

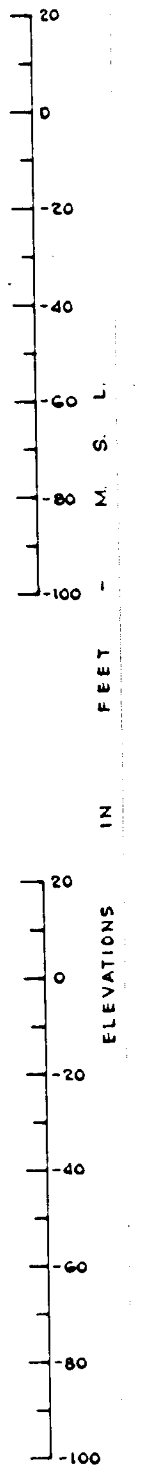
DATE: MARCH 1972
FILE NO. H-2-24314



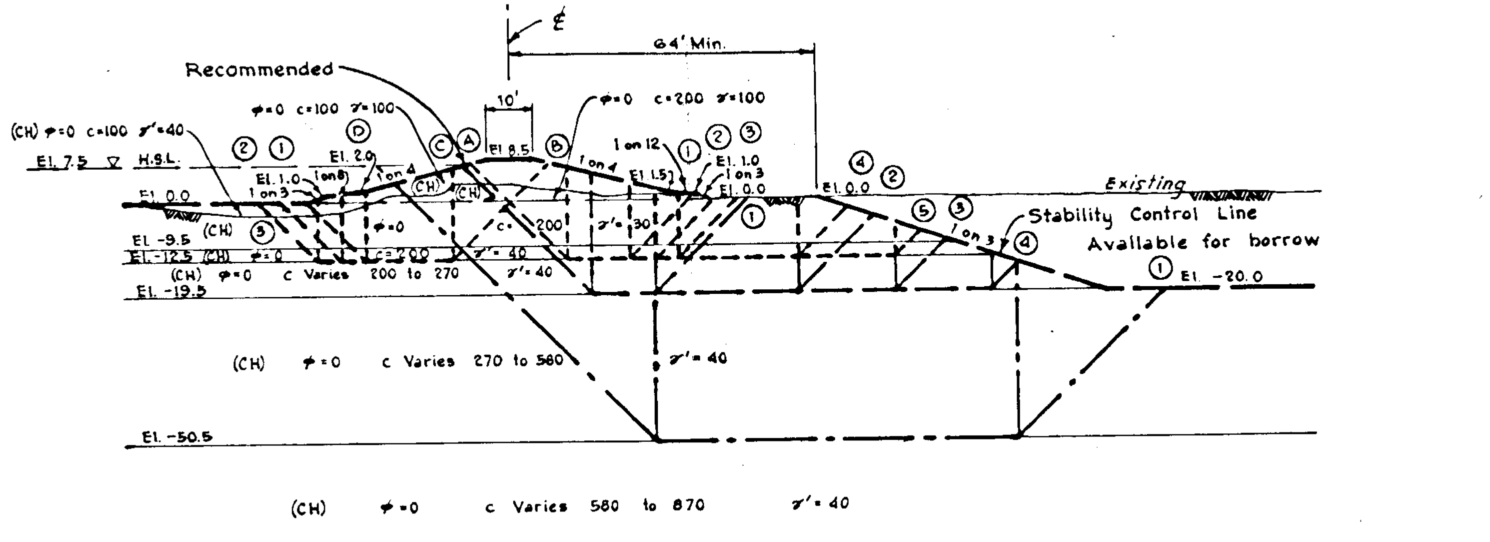
LEVEE SECTION 8

STA. 643+00 TO STA. 720+14
(WEST TRAVERSE)

For soil conditions and design shear strengths
See Borings 6W through 9W on Plates 44 and 78
and Boring 5UW on Plate 48



LEVEE STATION	SLIP SURFACE			DRIVING			RESISTING				FACTOR OF SAFETY ΣR / ΣD
	NUMBER		EL.	$+\bar{D}_A$	$-\bar{D}_P$	$\Sigma\bar{D}$	$+R_A$	$+R_B$	$+R_P$	ΣR	
714+00 WEST TRAVERSE	A	1	-12.5	17851	8691	9160	6900	1400	3831	12131	1.32
		2			6367	11484		3400	4913	15213	1.32
		3			4663	13188		5400	5423	17723	1.34
		4			3140	14711		7400	5000	19300	1.31
		5			2311	15540		12400	4550	23850	1.53
		6			857	16994		16400	2550	25850	1.52
		7			344	17507		18400	1550	26850	1.53
	B	1	-12.5	17919	5789	12130	6860	3600	5754	16214	1.34
		2			4615	13304		5600	5223	17683	1.33
		3			2537	15382		8600	5000	20460	1.33
	C	1	-19.5	26984	8836	18148	10110	5940	8290	24340	1.34
		2			6954	20030		8640	8290	27040	1.35
		3			5705	21279		15390	7140	32640	1.53
		4			2651	24333		22140	4640	36890	1.52
		5			769	26215		27540	2526	40176	1.53
	D	1	-50.5	86370	22125	64245	36567	49300	25925	111792	1.74



LEVEE SECTION 9

STA. 721+14 TO STA. 789+53
(WEST TRAVERSE)

For soil conditions and design shear strengths
See Borings 2W through 4W on Plates 44 and 78
and Boring 5UW on Plate 48

LEVEE STATION	SLIP SURFACE			DRIVING			RESISTING				FACTOR OF SAFETY ΣR / ΣD
	NUMBER		EL.	$+\bar{D}_A$	$-\bar{D}_P$	$\Sigma\bar{D}$	$+R_A$	$+R_B$	$+R_P$	ΣR	
757+00 WEST TRAVERSE	A	1	-12.5	15859	5034	10825	7240	2600	5358	15198	1.40
		2			3848	12011		3600	5000	15840	1.32
		3			3003	12856		4600	5000	16840	1.31
		4			2116	13743		9600	4150	20990	1.53
		5			622	15237		13600	2150	22990	1.51
	B	1	-12.5	15859	4168	11691	7136	3600	4494	15230	1.30
		2			3320	12539		4600	4440	16176	1.29
		3			2759	13100		5600	4440	17176	1.31
	C	1	-19.5	24243	7662	16581	10450	3510	8290	22250	1.34
		2			5300	18943		11610	6740	28800	1.52
		3			2756	21487		17010	4740	32200	1.50
		4			842	23401		22410	2644	35504	1.52
	D	1	-50.5	81886	21006	60880	35580	43500	25925	105005	1.72

For general notes see plate 84

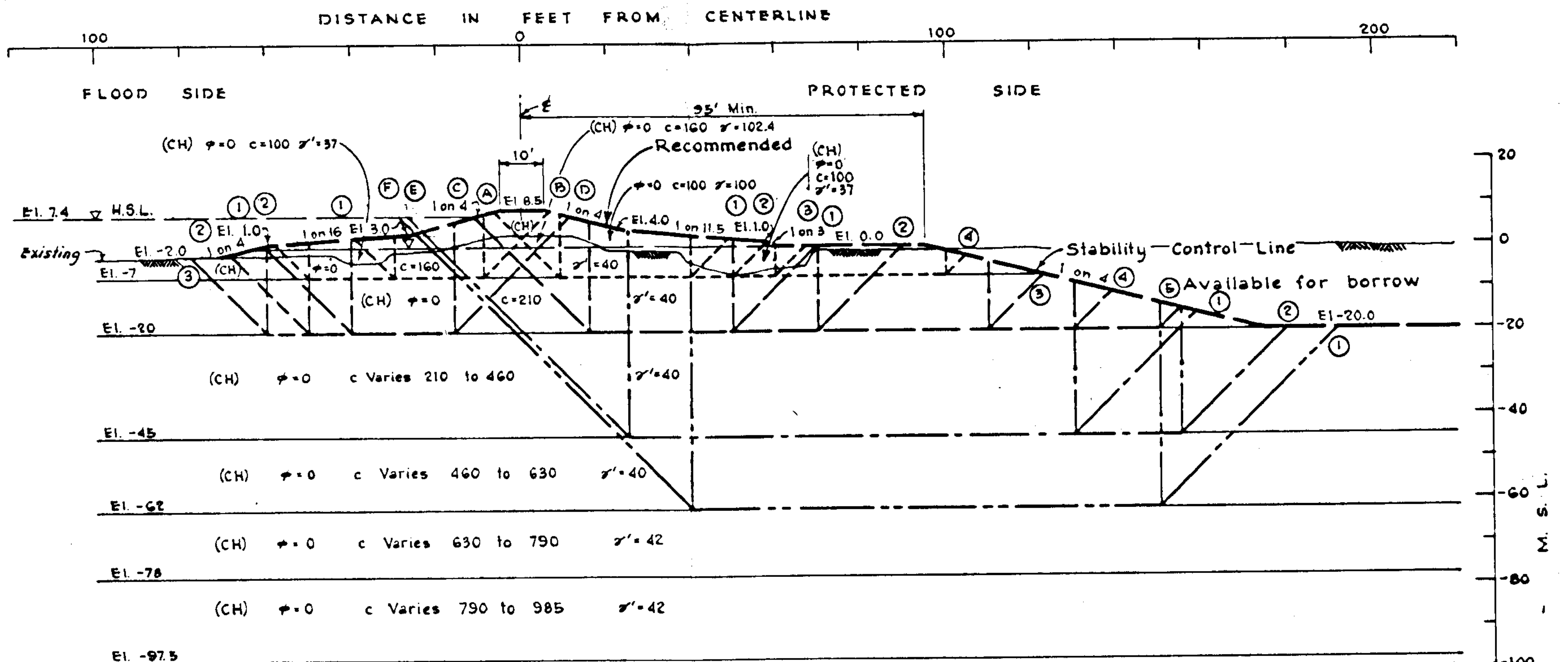
GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I - GENERAL DESIGN

LEVEE (Q) STABILITY
LEVEE SECTIONS 8 AND 9

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA

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

DATE: MARCH 1972
FILE NO. H-2-24314

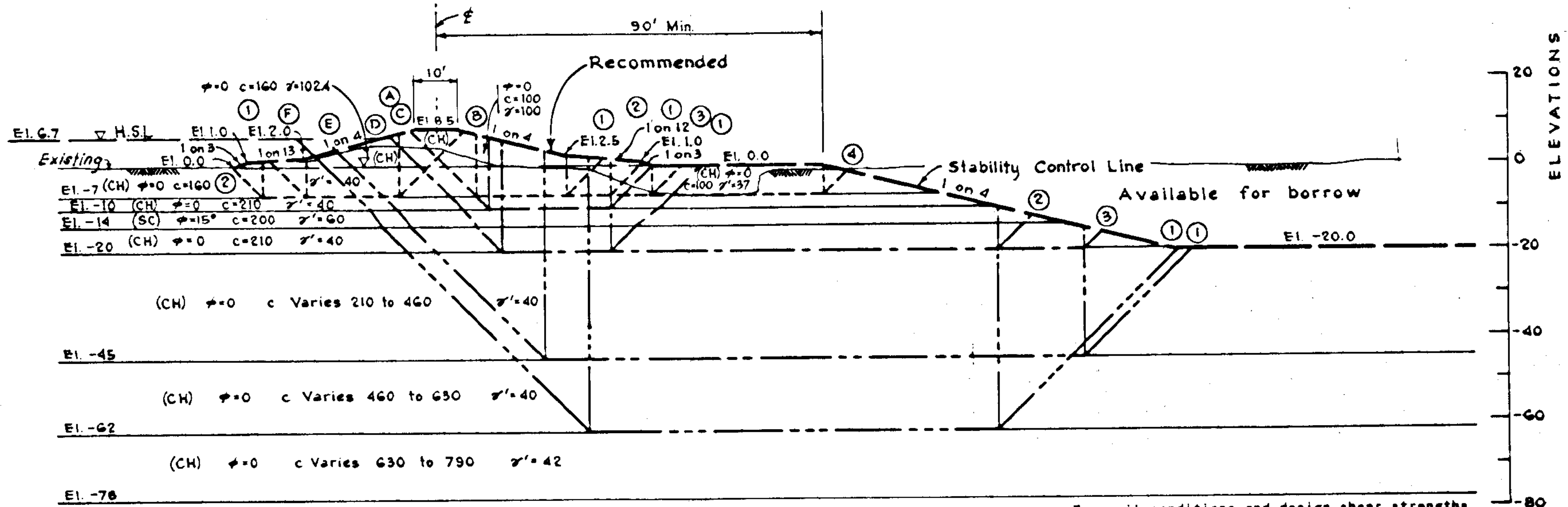


For soil conditions and design shear strengths
See Borings 2E through 8DE on Plates 45 and 81
and Boring 16AUE on Plate 74

LEVEE SECTION 10

STA. 26+49 TO STA. 165+00
(EAST TRAVERSE)

LEVEE STATION	SLIP SURFACE			DRIVING			RESISTING				FACTOR OF SAFETY ΣR / ΣD
	NUMBER		EL.	$+\bar{D}_A$	$-\bar{D}_P$	$\Sigma\bar{D}$	$+R_A$	$+R_B$	$+R_P$	ΣR	
115+00 EAST TRAVERSE	A	1	- 7	10374	2635	7739	4180	4960	2028	11168	1.44
		2			1896	8478		6560	1603	12343	1.46
		3			913	9461		8160	1594	13934	1.47
		4			528	9846		14560	1472	20212	2.05
	B	1	- 7	10372	3015	7357	4180	3360	2243	9783	1.33
		2			1945	8247		6560	2230	12970	1.54
	C	1	-20	26686	8839	17847	9388	7140	7081	23609	1.32
		2			7929	18757		11340	7564	28292	1.51
		3			4222	22464		19740	5460	34588	1.54
		4			2023	24663		23940	3780	37108	1.50
		5			624	26062		28140	2100	39628	1.52
	D	1	-20	26642	11020	15622	9400	5040	7593	22033	1.41
		2			9059	17583		7140	7176	23716	1.35
		3			7104	19538		9240	7039	25679	1.31
	E	1	-45	74046	21019	53027	25169	48300	18430	91899	1.73
		2			14495	59551		59800	16750	101719	1.71
	F	1	-62	116323	38397	77926	43644	69300	35280	148224	1.90



For soil conditions and design shear strengths
See Borings 9E through 15E, 20E through 23E on
Plates 45 & 81 and Boring 16AUE on Plate 74

LEVEE SECTION 11

STA. 170+00 TO STA. 405+00
(EAST TRAVERSE)

LEVEE STATION	SLIP SURFACE			DRIVING			RESISTING				FACTOR OF SAFETY ΣR / ΣD
	NUMBER		EL.	$+\bar{D}_A$	$-\bar{D}_P$	$\Sigma\bar{D}$	$+R_A$	$+R_B$	$+R_P$	ΣR	
208+00 EAST TRAVERSE	A	1	- 7	10390	2610	7780	4427	3360	2469	10256	1.32
		2			1869	8521		4960	1950	11337	1.33
		3			906	9484		6560	1492	12479	1.32
		4			776	9614		12960	1792	19179	2.00
	B	1	- 7	10425	2386	8039	4331	3360	2669	10360	1.29
		2			1603	8822		4960	2240	11531	1.31
	C	1	-10	13555	2964	10591	5687	5880	2961	14528	1.37
	D	1	-20	27527	9370	18157	11385	5250	8875	25510	1.40
		2			2029	25498		24150	3601	39136	1.53
		3			399	27128		28350	1680	41415	1.53
	E	1	-45	76324	14495	61829	27392	57500	16750	101642	1.64
	F	1	-62	120312	43911	76401	45209	59850	35280	140339	1.84

For general notes see plate 84

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I - GENERAL DESIGN

LEVEE (Q) STABILITY
LEVEE SECTIONS 10 AND 11

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

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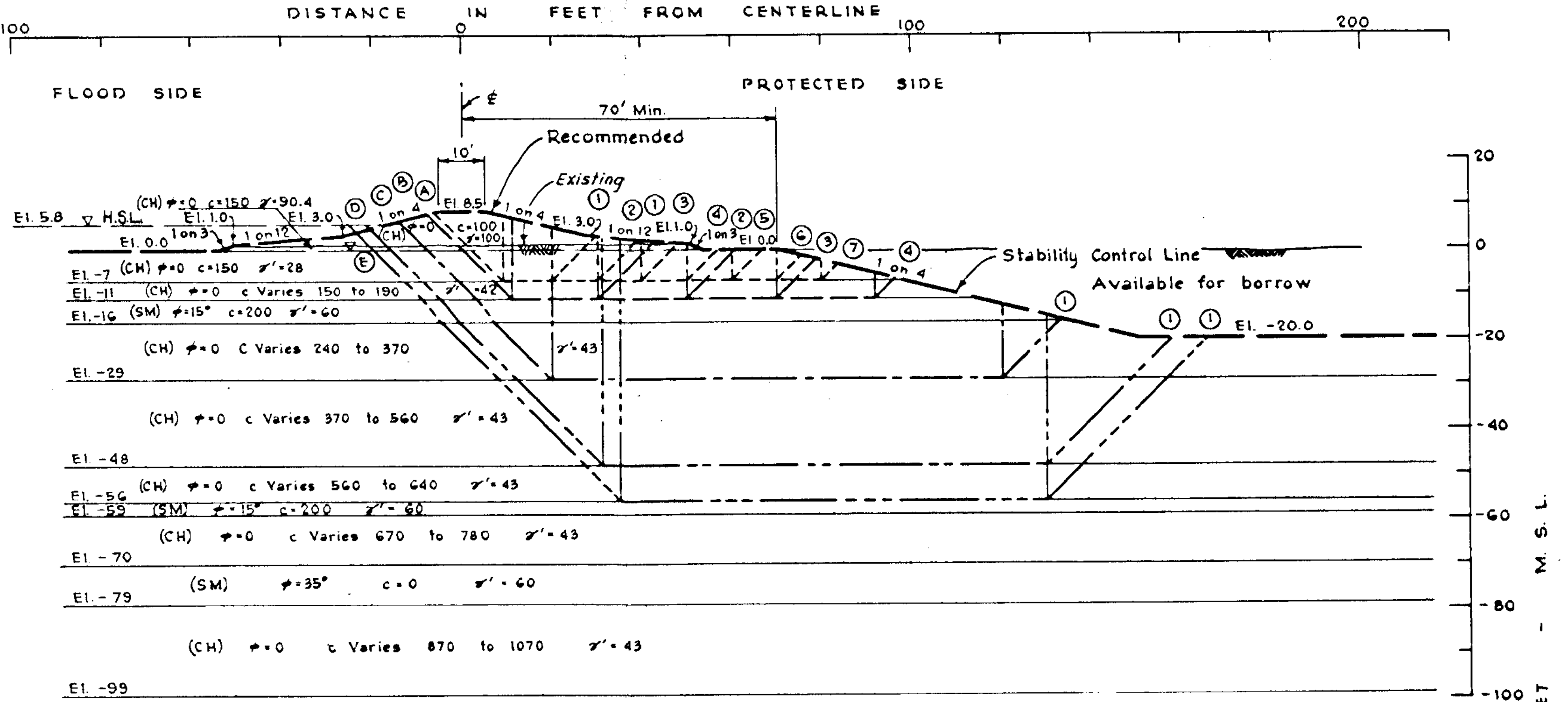
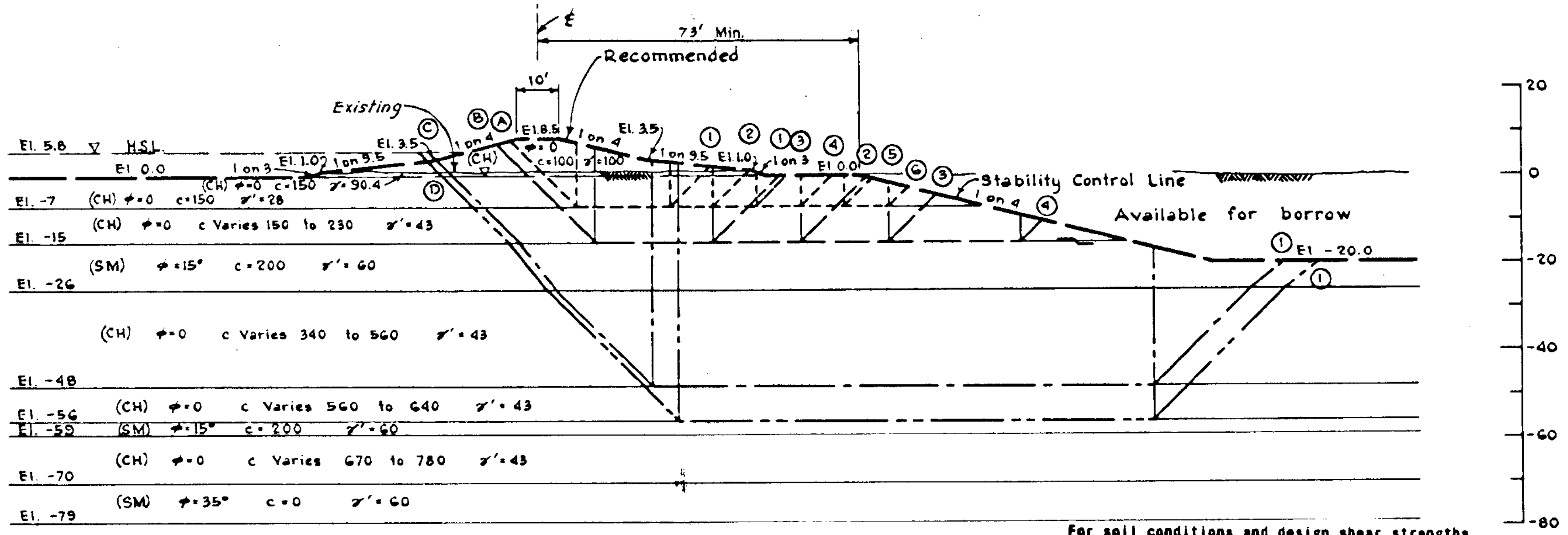


For soil conditions and design shear strengths
See Borings 24E through 33E and 41E on Plates 45,81, and 82
and Boring 34UE on Plate 60

LEVEE SECTION 12

STA. 410+00 TO STA. 635+00
(EAST TRAVERSE)

LEVEE STATION	SLIP SURFACE			DRIVING			RESISTING				FACTOR OF SAFETY ΣR/ΣD
	NUMBER		EL.	$+\bar{D}_A$	$-\bar{D}_P$	$\Sigma\bar{D}$	$+R_A$	$+R_B$	$+R_P$	ΣR	
460+00 EAST TRAVERSE	A	1	- 7	9958	3739	6219	3840	1650	2754	8244	1.33
		2			2549	7409		3150	2600	9590	1.29
		3			1832	8126		4650	2446	10936	1.35
		4			915	9043		6150	2100	12090	1.34
		5			685	9273		7650	2100	13590	1.47
		6			548	9410		9150	1680	14670	1.56
		7			226	9732		10650	1080	15570	1.60
	B	1	-11	14091	4369	9722	5120	3610	3898	12628	1.30
		2			2034	12057		7410	3460	15990	1.33
		3			1466	12625		11210	2800	19130	1.52
		4			514	13577		15010	1600	21730	1.60
	C	1	-29	40516	5094	35422	17030	37000	8029	62059	1.75
	D	1	-48	79755	19034	60721	34407	55440	23160	113007	1.86
	E	1	-56	100404	30041	70363	43748	60800	32760	137308	1.95



For soil conditions and design shear strengths
See Borings 42E through 45E on Plate 82
and Boring 34UE on Plate 60

LEVEE SECTION 13

STA. 640+00 TO STA. 715+00
(EAST TRAVERSE)

LEVEE STATION	SLIP SURFACE			DRIVING			RESISTING				FACTOR OF SAFETY ΣR/ΣD
	NUMBER		EL.	$+\bar{D}_A$	$-\bar{D}_P$	$\Sigma\bar{D}$	$+R_A$	$+R_B$	$+R_P$	ΣR	
645+00 EAST TRAVERSE	A	1	- 7	9958	2662	7296	3840	3150	2605	9595	1.31
		2			1763	8195		4650	2415	10905	1.33
		3			731	9227		6150	2100	12090	1.31
		4			685	9273		7650	2100	13590	1.47
		5			640	9318		9150	1860	14850	1.59
		6			308	9650		10650	1260	15750	1.63
	B	1	-15	18747	4956	13791	6720	6210	5140	18070	1.31
		2			3616	15131		10810	5020	22550	1.49
		3			2444	16303		15410	3820	25950	1.59
		4			568	18179		22310	1748	30778	1.69
	C	1	-48	83753	20668	63085	36937	63840	23681	124458	1.97
	D	1	-56	105064	32490	72574	46443	69120	33281	148844	2.05

For general notes see plate 84

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I - GENERAL DESIGN

LEVEE (Q) STABILITY
LEVEE SECTIONS 12 AND 13

BARNARD AND BURK, INC
CONSULTING ENGINEERS
BATON ROUGE, LA

U S ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

DATE · MARCH 1972
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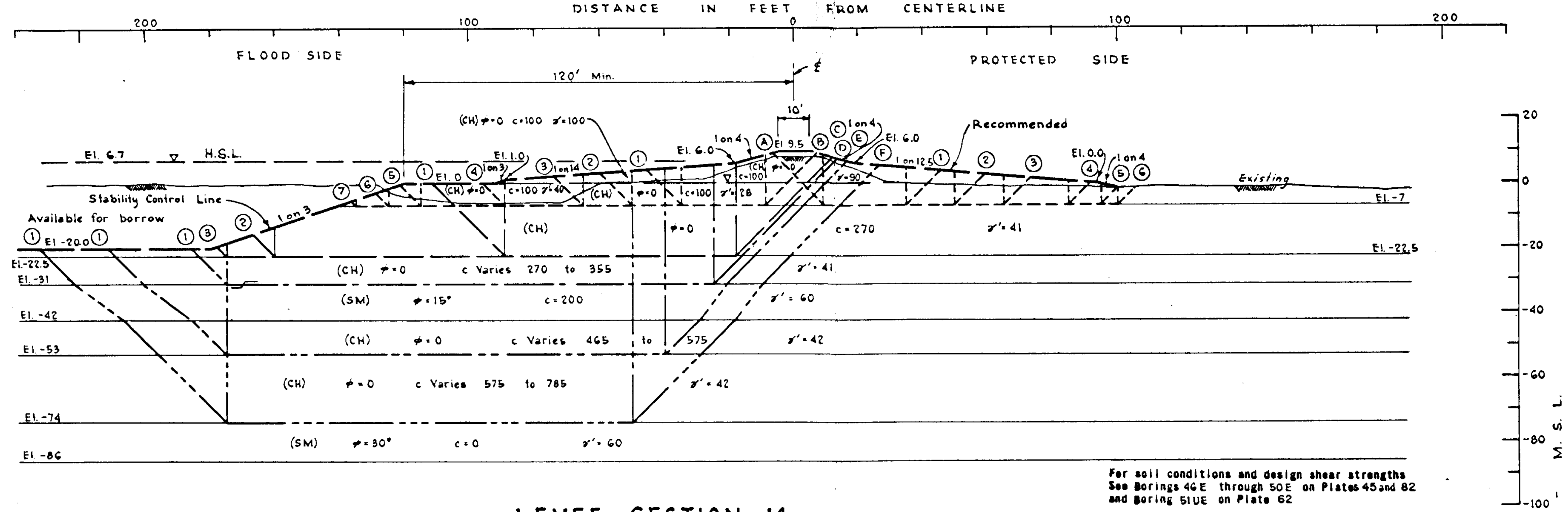
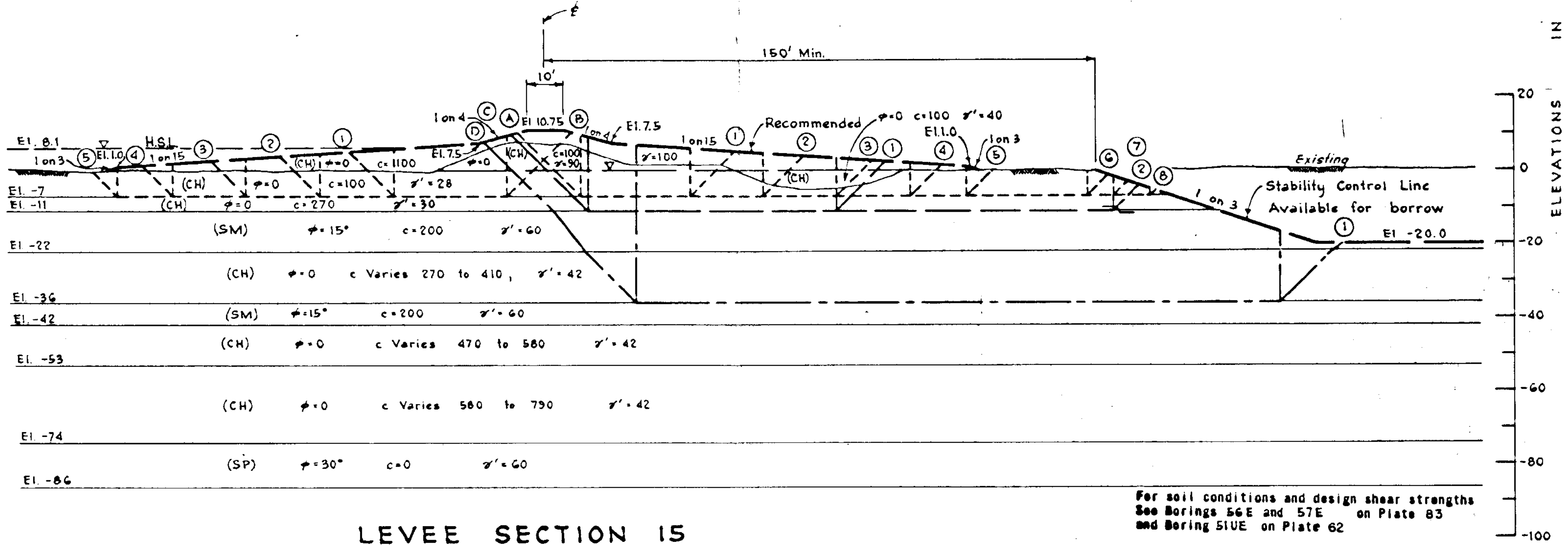


For soil conditions and design shear strengths
See Borings 46E through 50E on Plates 45 and 82
and Boring 51UE on Plate 62

LEVEE SECTION 14

STA. 720+00 TO STA. 845+00
(EAST TRAVERSE)

LEVEE STATION	SLIP SURFACE			DRIVING			RESISTING				FACTOR OF SAFETY ΣR/ΣD
	NUMBER		EL.	$+\bar{D}_A$	$-\bar{D}_P$	$\Sigma\bar{D}$	$+R_A$	$+R_B$	$+R_P$	ΣR	
805+00 EAST TRAVERSE	A	1	- 7	10712	4801	5911	3200	2600	2186	7986	1.35
		2			3832	6880		4100	1971	9271	1.35
		3			2942	7770		5600	1757	10557	1.36
		4			1824	8888		7600	1471	12271	1.38
		5			1125	9587		8600	1200	13000	1.36
		6			535	10177		9100	1100	13400	1.32
	B	1	- 7	10717	4720	5997	3200	2600	2213	8013	1.34
		2			3641	7076		4100	2013	9313	1.32
		3			2851	7866		5600	1813	10613	1.35
		4			1122	9595		8000	1400	12600	1.31
		5			922	9795		10600	1300	15100	1.54
		6			303	10414		11600	800	15600	1.50
		7			42	10675		12600	300	16100	1.51
	C	1	-22.5	29715	10181	19534	11310	19170	9770	40250	2.06
		2			1290	28425		38340	3712	53362	1.88
		3			266	29449		42390	1688	55388	1.88
	D	1	-31	43137	2649	40488	16563	53216	6663	76442	1.89
	E	1	-53	94078	25998	68080	40446	77625	29835	147906	2.17
	F	1	-74	161878	68289	93589	69343	98125	58395	225863	2.41



For soil conditions and design shear strengths
See Borings 56E and 57E on Plate 83
and Boring 51UE on Plate 62

LEVEE SECTION 15

STA. 850+00 TO STA. 890+00
(EAST TRAVERSE)

LEVEE STATION	SLIP SURFACE			DRIVING			RESISTING				FACTOR OF SAFETY ΣR/ΣD
	NUMBER		EL.	$+\bar{D}_A$	$-\bar{D}_P$	$\Sigma\bar{D}$	$+R_A$	$+R_B$	$+R_P$	ΣR	
890+00 EAST TRAVERSE	A	1	- 7	12817	6081	6736	3440	3000	2444	8884	1.32
		2			4887	7930		5000	2194	10634	1.34
		3			3542	9275		7000	1944	12384	1.34
		4			2059	10758		9000	1694	14134	1.31
		5			886	11931		10500	1400	15340	1.29
		6			598	12219		13800	1150	18390	1.50
		7			298	12519		14500	800	18740	1.50
		8			42	12775		15500	300	19240	1.51
	B	1	- 7	12800	6195	6605	3440	3000	2444	8884	1.34
		2			4650	8150		5000	2194	10634	1.30
		3			3271	9529		7000	1944	12384	1.30
		4			2059	10741		9000	1694	14134	1.32
		5			886	11914		10500	1400	15340	1.29
	C	1	-11	17421	5827	11594	5520	18360	4054	27934	2.41
		2			929	16492		38610	2760	46890	2.84
	D	1	-36	62052	6912	55140	25260	71750	10646	107656	1.95

For general notes see plate 84

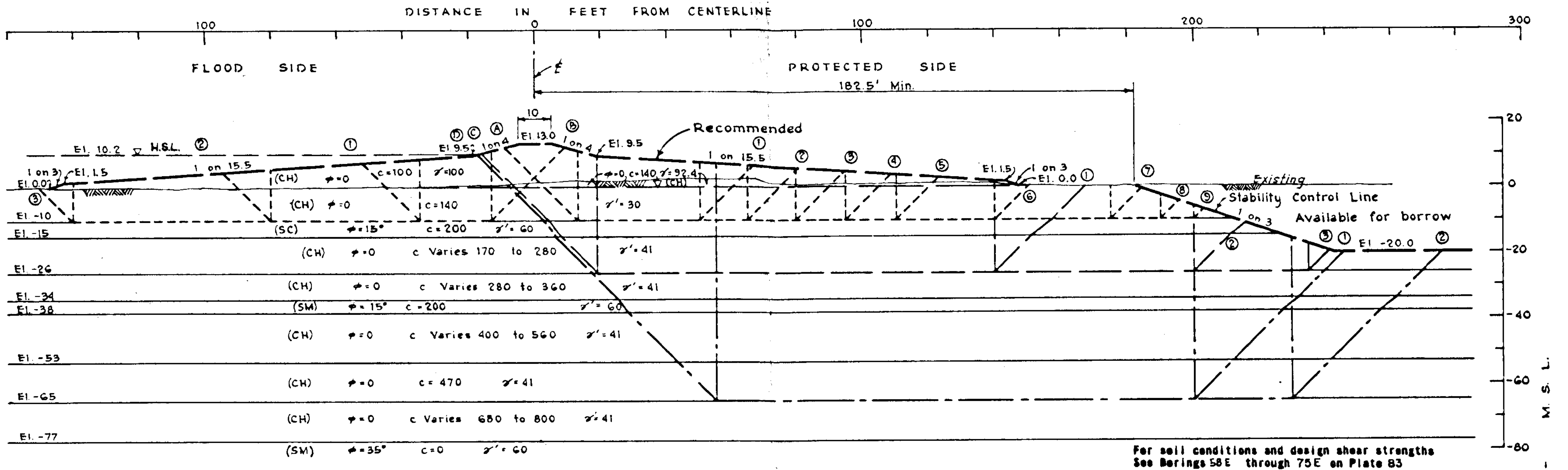
GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

LEVEE (Q) STABILITY
LEVEE SECTIONS 14 AND 15

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE: MARCH 1972
FILE NO. H-2-24314

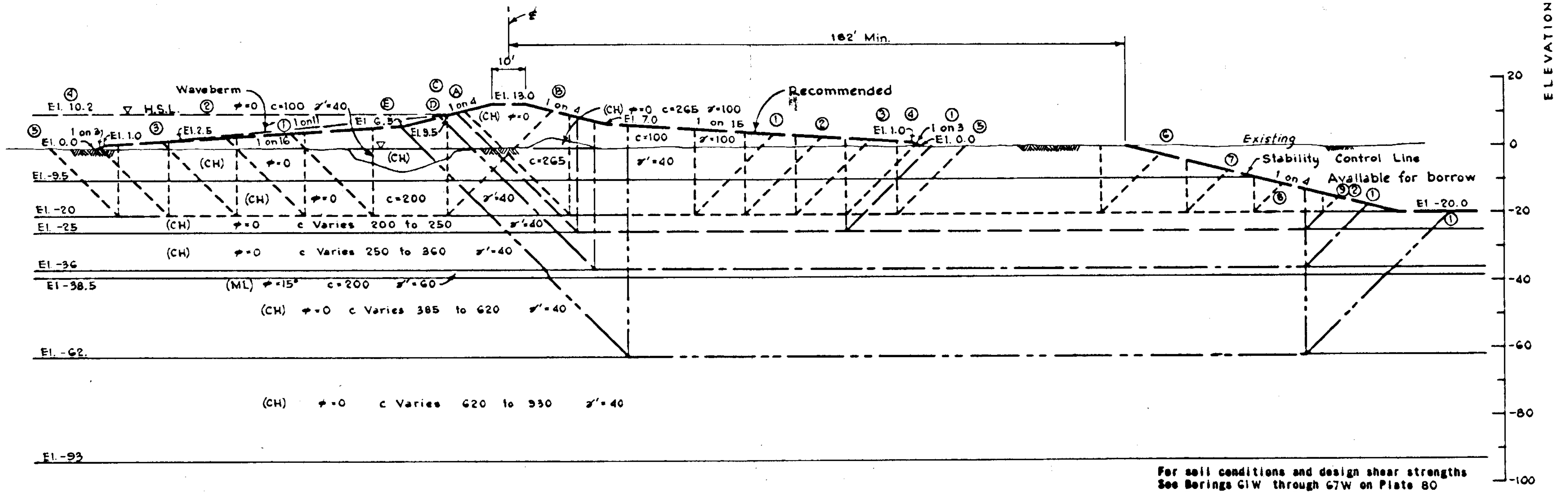


For soil conditions and design shear strengths
See Borings 58E through 75E on Plate 83
and Boring 61AUE on Plate 76

LEVEE SECTION 16

STA. 895+00 TO STA. 1025+00 (EAST TRAVERSE)
STA. 387+00 TO STA. 235+00 (SOUTH TRAVERSE)

LEVEE STATION	SLIP SURFACE			DRIVING			RESISTING				FACTOR OF SAFETY ΣR/ΣD
	NUMBER		EL.	$+\bar{D}_A$	$-\bar{D}_P$	$\Sigma\bar{D}$	$+R_A$	$+R_B$	$+R_P$	ΣR	
960+00 EAST TRAVERSE	A	1	-10	21773	10679	11094	5322	5180	4283	14785	1.33
		2			9207	12566		7280	3967	16569	1.32
		3			7832	13941		9380	3773	18475	1.32
		4			6448	15325		11480	3604	20406	1.33
		5			5152	16621		13580	3435	22337	1.34
		6			2286	19487		17780	2800	25902	1.33
		7			1475	20298		22680	2625	30627	1.51
		8			632	21141		24780	1575	31677	1.50
		9			195	21578		26180	875	32377	1.50
	B	1	-10	21823	12489	9334	5312	3080	4293	12685	1.36
		2			7874	13949		9380	3724	18416	1.32
		3			2314	19509		17780	2800	25892	1.33
	C	1	-26	50374	13614	36760	14930	33880	11927	60737	1.65
		2			7171	43203		50680	7384	72994	1.69
		3			1109	49265		60480	2869	78279	1.59
	D	1	-65	157133	57449	99684	50845	68150	38016	157011	1.58
		2			44776	112357		82250	37523	170618	1.52



For soil conditions and design shear strengths
See Borings 61W through 67W on Plate 80
and Boring 63AUW on Plate 72

LEVEE SECTION 17

STA. 235+00 TO STA. 100+00
(SOUTH TRAVERSE)

LEVEE STATION	SLIP SURFACE			DRIVING			RESISTING				FACTOR OF SAFETY ΣR/ΣD
	NUMBER		EL.	$+\bar{D}_A$	$-\bar{D}_P$	$\Sigma\bar{D}$	$+R_A$	$+R_B$	$+R_P$	ΣR	
175+00 SOUTH TRAVERSE	A	1	-20	39346	17919	21427	11435	7400	9972	28807	1.34
		2			15598	23748		10400	9785	31620	1.33
		3			13370	25976		13400	9598	34433	1.33
		4			11199	28147		16400	9335	37170	1.32
		5			8599	30747		19400	9235	40070	1.30
		6			7321	32025		31400	7857	50692	1.58
		7			3841	35505		36400	5207	53042	1.49
		8			1762	37584		40400	3360	55195	1.47
		9			483	38863		44400	1760	57595	1.48
	B	1	-20	39346	19653	19693	11435	4400	10117	25952	1.32
		2			16676	22670		8400	9882	29717	1.31
		3			13845	25501		12400	9647	33482	1.31
		4			11124	28222		16400	9335	37170	1.32
		5			8596	30750		19400	9235	40070	1.30
	C	1	-25	48956	15748	33208	13565	20000	11485	45050	1.36
		2			2207	46749		53750	4010	71325	1.53
	D	1	-36	72726	8277	64449	19885	75600	9840	105325	1.63
	E	1	-62	147278	40140	107138	45398	124000	35161	204559	1.91

For general notes see plate 84

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

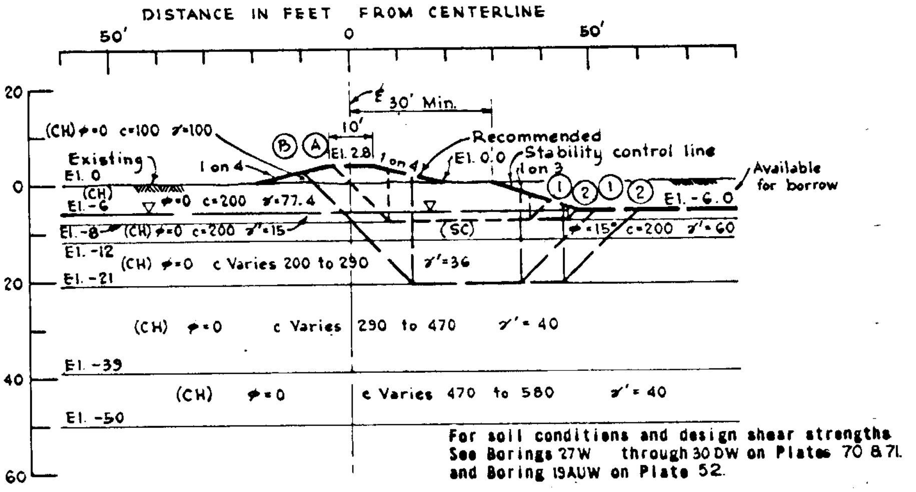
LEVEE (Q) STABILITY
LEVEE SECTIONS 16 AND 17

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA

U S ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

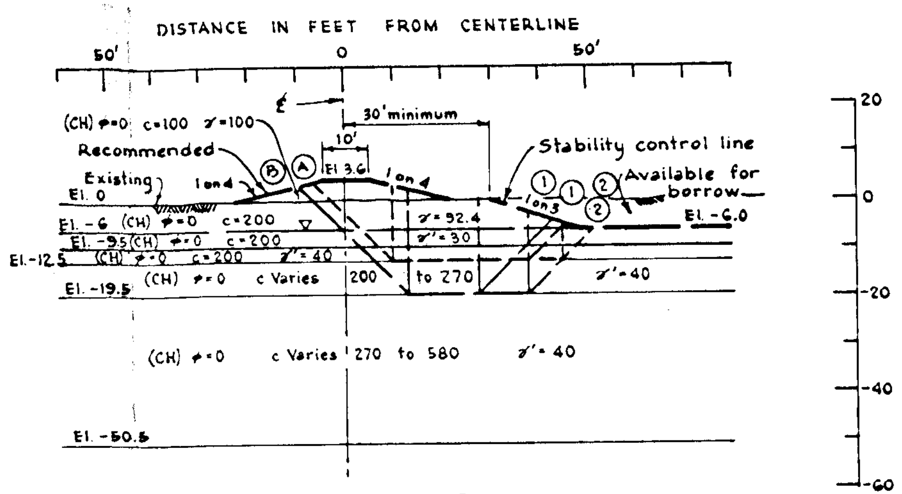
DATE MARCH 1972
FILE NO H-2-24314

PLATE 92



For soil conditions and design shear strengths See Borings 27W through 30DW on Plates 70 & 71 and Boring 19AUW on Plate 52.

LATERAL A

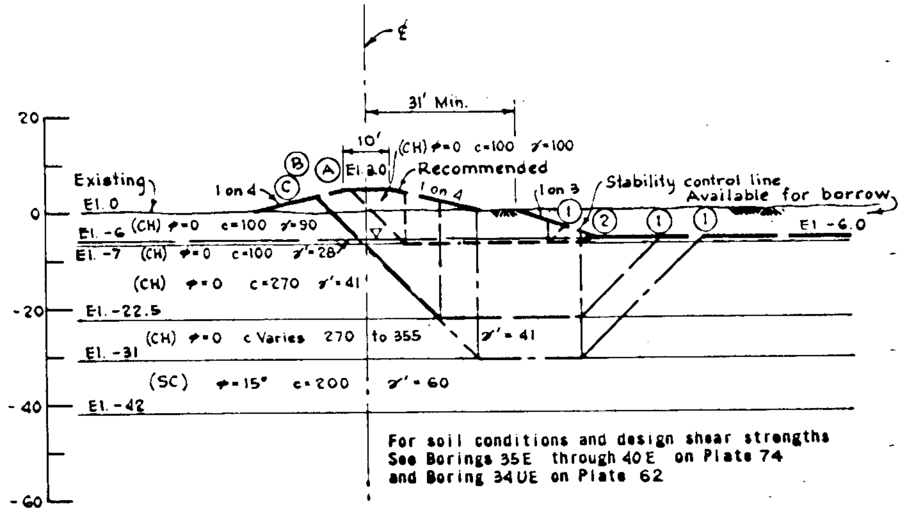


LATERAL B

For soil conditions and design shear strengths See Borings 13W through 15W on Plate 78 and Boring 15AUW on Plate 50

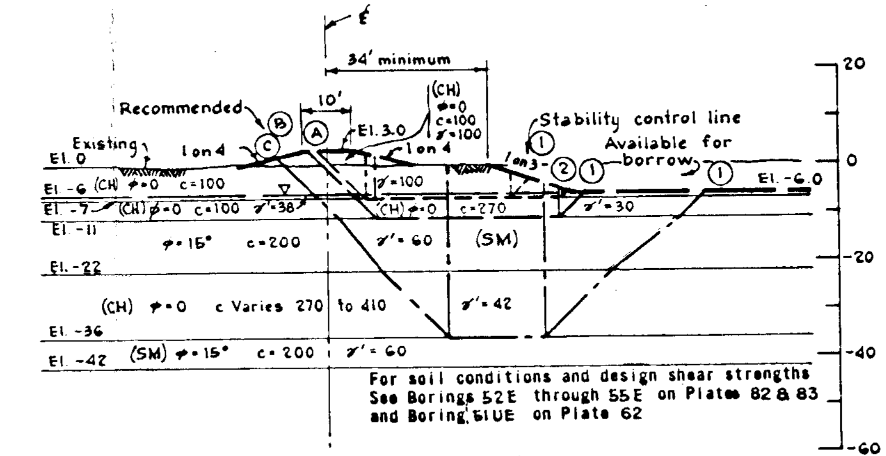
ELEVATIONS IN FEET - M.S.L.

LEVEE STATION	SLIP SURFACE			DRIVING			RESISTING				FACTOR OF SAFETY ΣR/ΣD
	NUMBER		EL.	$+\bar{D}_A$	$-\bar{D}_P$	$\Sigma \bar{D}$	$+R_A$	$+R_B$	$+R_P$	ΣR	
40+00 LATERAL "A"	A	1	- 8.0	4,875	700	4,175	3,760	6,000	1,600	11,360	2.72
		2			81	4,794		7,600	800	12,160	2.54
	B	1	-21.0	18,118	6,345	11,773	10,675	6,670	7,775	25,120	2.13
		2			4,631	13,487		9,280	7,714	27,669	2.05
2+00 LATERAL "B"	A	1	-12.5	10,854	2,075	8,779	5,636	5,800	2,950	14,386	1.64
		2			816	10,038		7,200	2,600	15,436	1.54
	B	1	-19.5	19,070	8,839	10,231	8,766	4,320	6,540	19,626	1.92
		2			4,770	14,300		7,020	5,890	21,676	1.52
102+00 BRETON CANAL LATERAL	A	1	- 7.0	4,615	702	3,913	2,000	3,000	700	5,700	1.46
		2			103	4,512		3,800	300	6,100	1.35
	B	1	-22.5	21,556	5,610	15,946	10,150	8,100	8,570	26,820	1.68
	C	1	-31.0	33,411	12,729	20,682	15,443	7,810	13,882	37,135	1.80
75+00 LOWER LATERAL	A	1	- 7.0	4,860	1,171	3,689	2,000	3,000	850	5,850	1.59
		2			118	4,742		4,100	300	6,400	1.35
	B	1	-11.0	8,653	676	7,977	4,160	10,260	2,360	16,780	2.10
	C	1	-36.0	47,656	22,157	25,499	22,837	8,200	21,362	52,399	2.06



For soil conditions and design shear strengths See Borings 35E through 40E on Plate 74 and Boring 34UE on Plate 62

BRETON CANAL LATERAL



For soil conditions and design shear strengths See Borings 52E through 55E on Plates 82 & 83 and Boring 51UE on Plate 62

LOWER LATERAL

ELEVATIONS IN FEET - M.S.L.

For general notes see plate 84

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I - GENERAL DESIGN

LEVEE (Q) STABILITY

LATERALS A, B, BRETON CANAL & LOWER

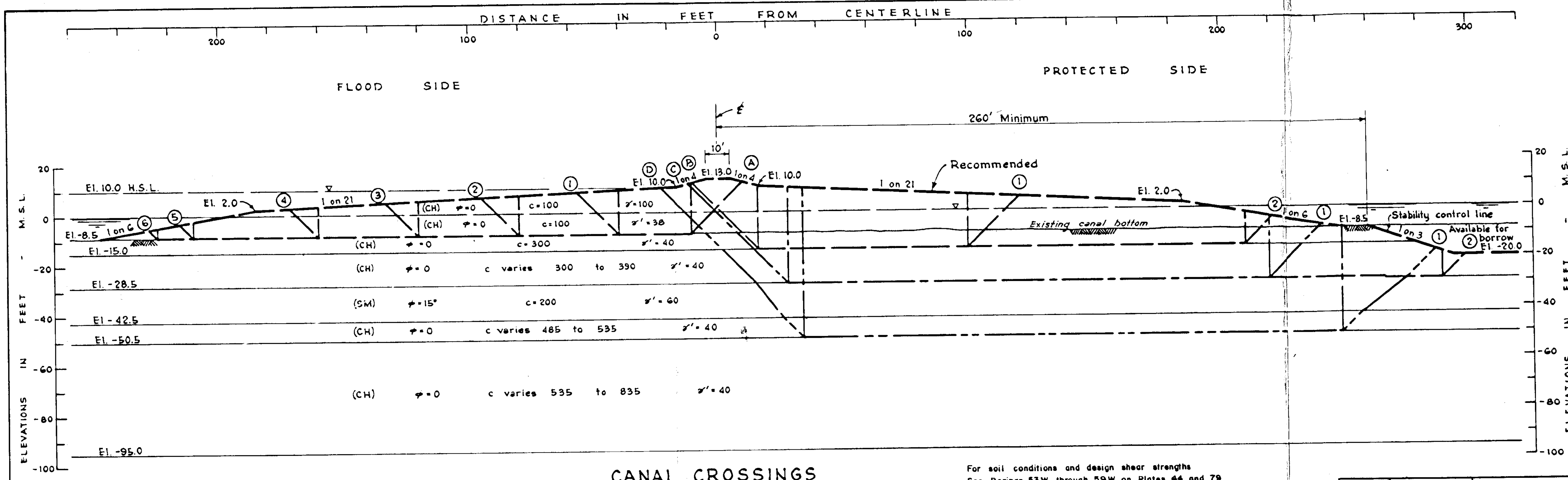
BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

U S ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

DATE: MARCH 1972

FILE NO. H-2-24314

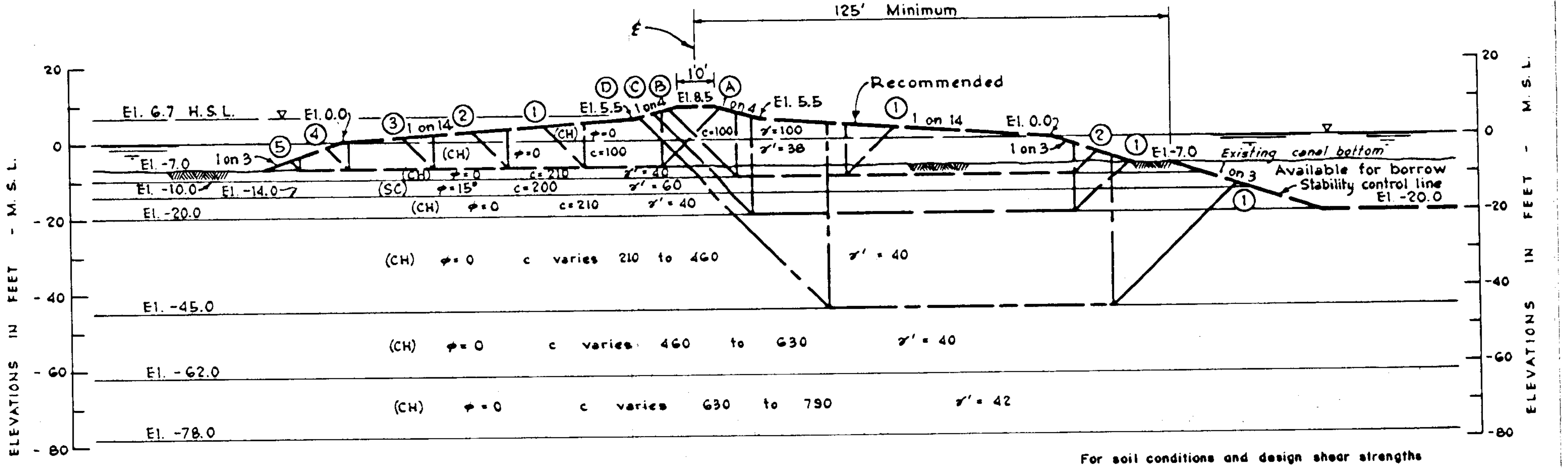
PLATE 93



CANAL CROSSINGS

GOLDEN MEADOW RING LEVEE
(1967 TRAVERSE)

For soil conditions and design shear strengths See Borings 53W through 59W on Plates 44 and 79 and Borings 55UW on Plate 54



CANAL CROSSINGS

STA. 26+49 TO STA. 715+00
(EAST TRAVERSE)

For soil conditions and design shear strengths See Borings 9E through 15E, 20E through 23E on Plates 45 & 81 and Boring 16AUE on Plate 74

LEVEE STATION	SLIP SURFACE			DRIVING			RESISTING				FACTOR OF SAFETY ΣR/ΣD
	NUMBER		EL.	$+\bar{D}_A$	$-\bar{D}_P$	$\Sigma\bar{D}$	$+R_A$	$+R_B$	$+R_P$	ΣR	
CANAL CROSSINGS GOLDEN MEADOW RING TRAVERSE	A	1	-8.5	20,127	12,213	7,914	4,080	2,900	3,323	10,303	1.30
		2			9,222	10,904		6,900	2,959	13,939	1.28
		3			6,578	13,549		10,900	2,596	17,576	1.30
		4			4,280	15,847		14,900	2,232	21,212	1.34
		5			652	19,475		19,900	1,086	25,066	1.29
		6			239	19,888		21,400	657	26,137	1.31
	B	1	-15.0	30,272	14,205	16,067	7,920	25,200	6,618	39,738	2.47
		2			2,722	27,550		58,200	4,800	70,920	2.57
	C	1	-28.5	55,232	10,305	44,927	17,175	74,880	13,444	105,499	2.35
		2			1,578	53,654		101,220	5,865	124,260	2.32
	D	1	-50.5	115,766	33,314	82,452	43,874	115,560	33,989	193,423	2.35
CANAL CROSSINGS STA. 26+49 TO STA. 715+00 EAST TRAVERSE	A	1	-7	10,276	4,726	5,550	3,040	2,100	2,160	7,300	1.31
		2			3,280	6,996		4,100	1,893	9,033	1.29
		3			2,023	8,253		6,100	1,627	10,767	1.30
		4			825	9,451		8,300	1,150	12,490	1.32
		5			158	10,118		9,600	500	13,140	1.30
	B	1	-10	13,514	5,867	7,647	4,260	6,090	3,247	13,597	1.78
		2			920	12,594		18,690	1,860	24,810	1.97
	C	1	-20	27,148	5,341	21,807	9,934	17,850	6,801	34,585	1.59
	D	1	-45	74,575	28,720	45,855	26,886	34,800	19,316	81,002	1.77

For general notes see plate 84

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

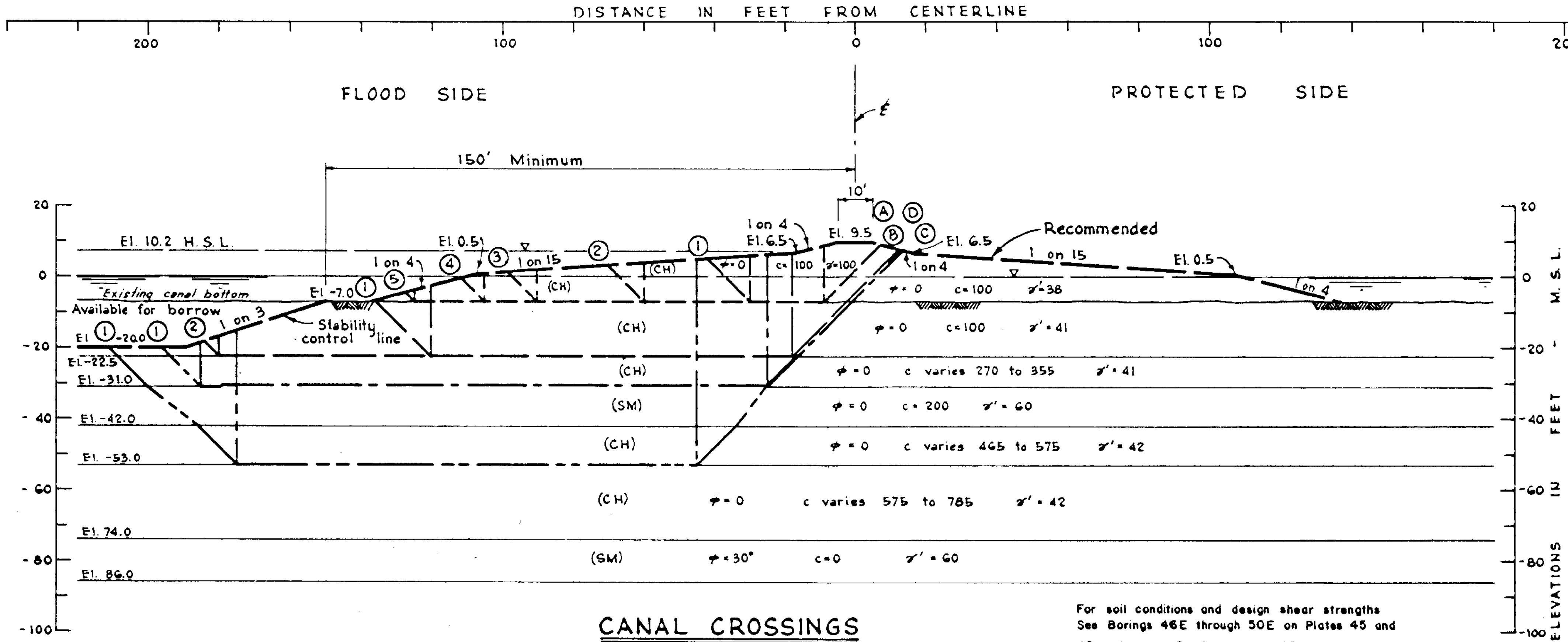
LEVEE (Q) STABILITY
CANAL CROSSINGS (GOLDEN MEADOW RING LEVEE 1967 TRAVERSE AND EAST TRAVERSE)

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA

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

DATE MARCH 1972

FILE NO. H-2-24314



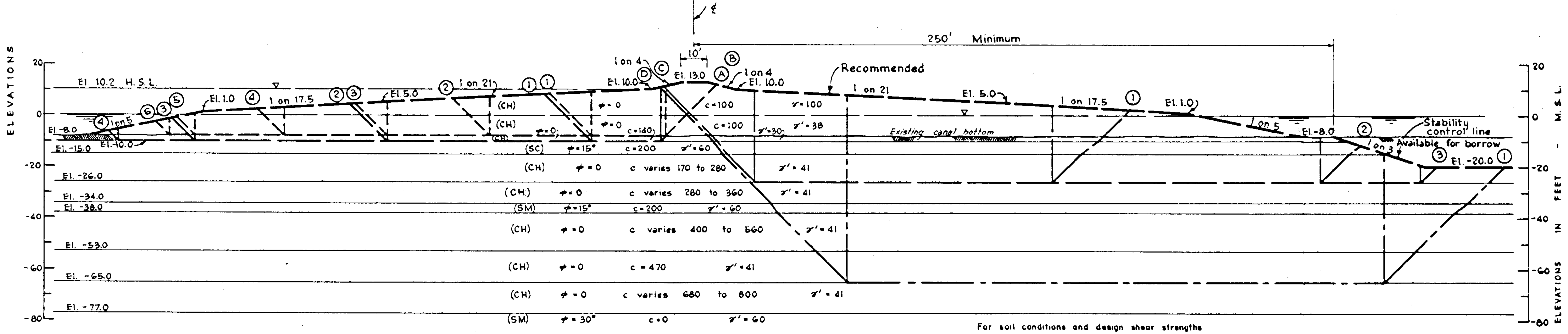
CANAL CROSSINGS

STA. 720+00 TO STA. 845+00
(EAST TRAVERSE)

For soil conditions and design shear strengths See Borings 46E through 50E on Plates 45 and 82 and Boring 51UE on Plate 62

LEVEE STATION	SLIP SURFACE			DRIVING			RESISTING				FACTOR OF SAFETY ΣR / ΣD
	NUMBER		EL.	$+\bar{D}_A$	$-\bar{D}_P$	$\Sigma\bar{D}$	$+R_A$	$+R_B$	$+R_P$	ΣR	
CANAL CROSSINGS STA. 720+00 TO STA. 845+00 EAST TRAVERSE	A	1	-7.0	11,836	5,958	5,878	3,200	2,100	2,369	7,669	1.30
		2			3,778	8,058		5,100	1,994	10,294	1.28
		3			1,973	9,863		8,100	1,619	12,919	1.31
		4			1,059	10,777		9,600	1,280	14,080	1.31
		5			136	11,700		11,600	480	15,280	1.31
	B	1	-22.5	32,960	6,286	26,674	11,310	27,540	8,430	47,280	1.77
		2			464	32,496		43,740	2,228	57,278	1.76
	C	1	-31.0	47,578	2,588	44,990	16,563	56,748	6,662	79,973	1.78
	D	1	-53.0	100,143	27,152	72,991	41,104	74,750	29,868	145,722	2.00

LEVEE STATION	SLIP SURFACE			DRIVING			RESISTING				FACTOR OF SAFETY ΣR / ΣD
	NUMBER		EL.	$+\bar{D}_A$	$-\bar{D}_P$	$\Sigma\bar{D}$	$+R_A$	$+R_B$	$+R_P$	ΣR	
CANAL CROSSINGS STA. 895+00 TO STA. 1025+00 EAST TRAVERSE AND STA. 387+00 TO STA. 235+00 SOUTH TRAVERSE	A	1	-8	19,373	11,650	7,723	4,000	2,900	3,227	10,127	1.31
		2			8,750	10,623		6,900	2,864	13,764	1.30
		3			6,145	13,228		10,900	2,481	17,381	1.31
		4			3,560	15,813		14,900	2,049	20,949	1.32
		5			1,141	18,232		18,400	1,400	23,800	1.30
		6			648	18,725		19,400	1,067	24,467	1.31
	B	1	-10	22,291	13,936	8,355	4,560	3,780	3,769	12,109	1.45
		2			7,683	14,608		14,980	3,020	22,560	1.54
		3			1,720	20,571		25,480	1,893	31,933	1.55
		4			290	22,001		29,680	893	35,133	1.60
	C	1	-26	51,524	22,791	28,733	14,309	32,480	13,067	59,856	2.08
		2			6,780	44,744		61,880	7,131	83,320	1.86
		3			764	50,760		72,880	2,700	89,889	1.77
	D	1	-65	163,323	45,460	117,863	50,463	98,700	37,523	186,686	1.58



CANAL CROSSINGS

STA. 895+00 TO STA. 1025+00 (EAST TRAVERSE)
STA. 387+00 TO STA. 235+00 (SOUTH TRAVERSE)

For soil conditions and design shear strengths See Borings 58E through 75E on Plate 83 and Boring 61 AUE on Plate 76

For general notes see plate 84

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

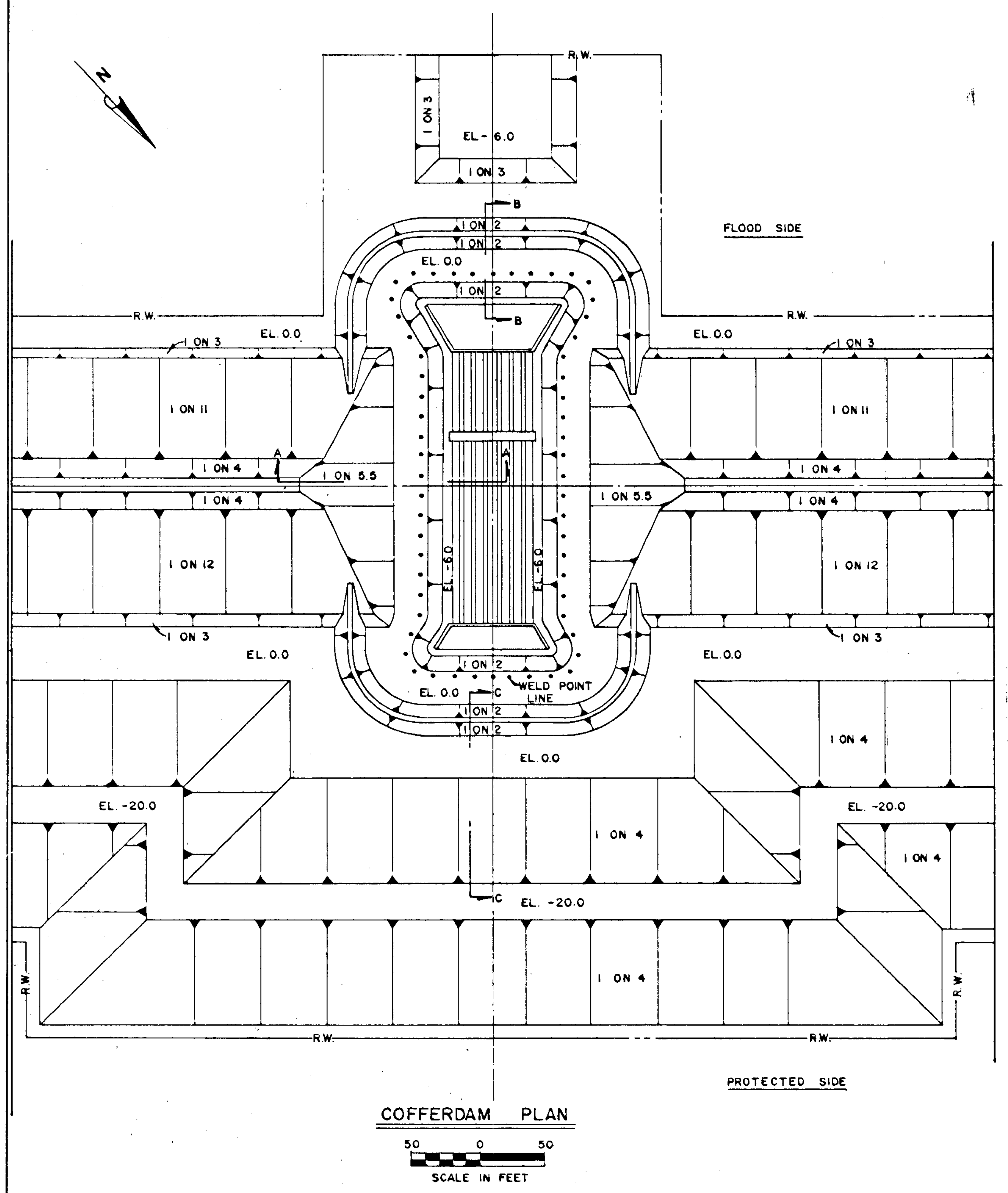
LEVEE (Q) STABILITY
CANAL CROSSINGS
(EAST TRAVERSE AND SOUTH TRAVERSE)

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA

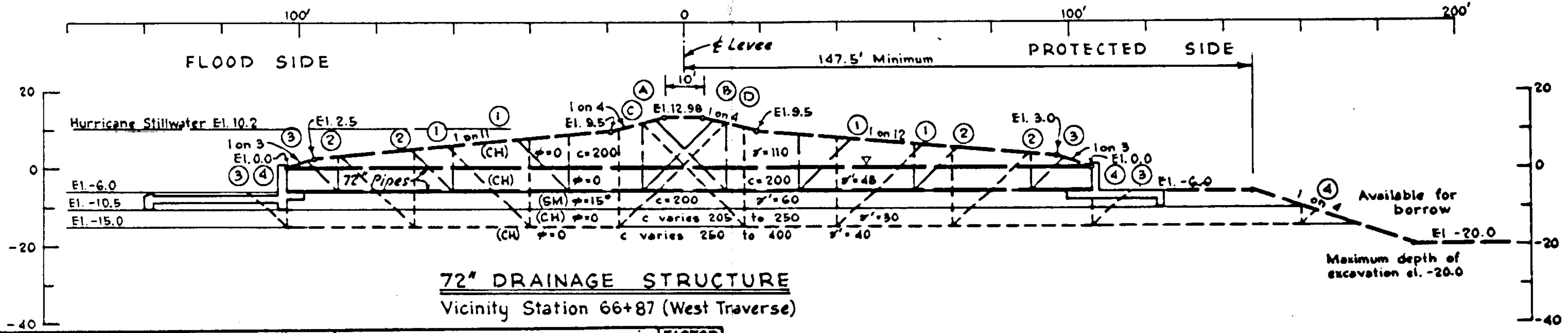
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

DATE: MARCH 1972
FILE NO. H-2-24314

PLATE 95



COFFERDAM PLAN



72" DRAINAGE STRUCTURE

Vicinity Station 66+87 (West Traverse)

LEVEE FEATURE	SLIP SURFACE NUMBER		SLIP SURFACE EL.	DRIVING $+\bar{D}_A$	DRIVING $-\bar{D}_P$	DRIVING $\Sigma\bar{D}$	RESISTING $+R_A$	RESISTING $+R_B$	RESISTING $+R_P$	RESISTING ΣR	RESISTING $+R_s^*$	FACTOR OF SAFETY $\Sigma R/\Sigma D$
DRAINAGE STRUCTURE SECTION	A	1	-6	17,971	9,532	8,439	7,355	3,800	5,385	16,540		1.96
		2			6,149	11,822		9,800	4,462	21,617		1.83
		3			3,361	14,610		15,800	3,398	26,553		1.82
		4			0	17,971		19,000	0	26,355		1.47
	B	1	-6	17,971	9,335	8,636	7,355	3,800	5,317	16,472		1.91
		2			5,724	12,247		9,800	4,317	21,472		1.75
		3			2,804	15,167		15,800	3,147	26,302		1.73
		4			0	17,971		18,500	0	25,855		1.44
	C	1	-15	33,522	18,724	14,798	13,644	6,000	12,794	32,438		2.19
		2			13,296	20,226		13,500	11,007	38,151		1.89
		3			2,125	31,397		22,500	4,817	40,961		1.30
		4			236	33,286		36,000	1,500	51,144		1.54
	D	1	-15	33,522	18,166	15,356	13,644	6,000	12,600	32,243		2.10
		2			12,364	21,158		13,500	10,657	37,800		1.79
		3			2,125	31,397		21,875	4,817	40,335		1.29
SECTION A-A	A	1	-4	8,164	1,321	6,843	2,920	4,900	1,289	9,109	43,680	1.38
		2			47	8,117		10,500	233	13,653	84,980	1.77
	B	1	-6	10,885	2,379	8,506	3,480	5,600	1,788	10,868	70,360	1.35
		2			19	10,866		12,800	147	16,427	135,640	1.61
	C	1	-15	25,327	9,513	15,814	9,516	7,500	8,151	25,167	330,855	1.77
		2			2,182	23,145		18,750	4,615	32,881	594,466	1.64
SECTION B-B	A	1	-4	3,763	734	3,029	1,920	1,120	1,120	4,160		1.37
		2			0	3,763		5,740	0	7,660		2.04
	B	1	-6	5,496	1,654	3,842	2,320	1,440	1,720	5,480		1.43
		2			0	5,496		7,360	0	9,680		1.76
	C	1	-15	16,036	2,216	13,820	7,616	10,250	4,817	22,683		1.64

LEVEE FEATURE	SLIP SURFACE NUMBER		SLIP SURFACE EL.	DRIVING $+\bar{D}_A$	DRIVING $-\bar{D}_P$	DRIVING $\Sigma\bar{D}$	RESISTING $+R_A$	RESISTING $+R_B$	RESISTING $+R_P$	RESISTING ΣR	RESISTING $+R_s^*$	FACTOR OF SAFETY $\Sigma R/\Sigma D$
SECTION C-C	A	1	-4	3,076	101	3,055	1,787	4,340	630	6,757		2.27
	B	1	-6	4,100	125	3,975	2,547	4,960	700	8,207		2.06
	C	1	-15	10,762	422	10,340	6,748	12,750	1,743	21,241		2.05

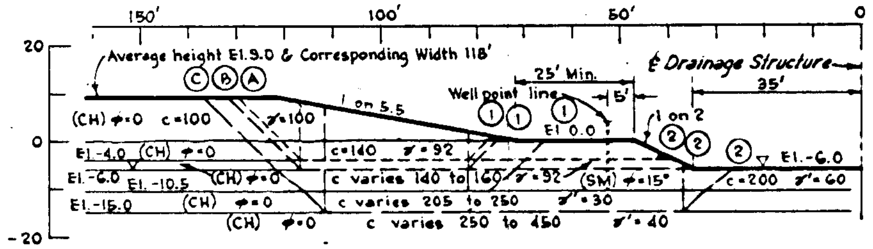
For general notes see plate 76.
For Drainage Structure details see plate 38.
For soil conditions and design shear strengths see boring 45 AUW on plate 69C.

* MASS STABILITY ANALYSES BASED ON AVERAGE HEIGHT AND CORRESPONDING WIDTH.

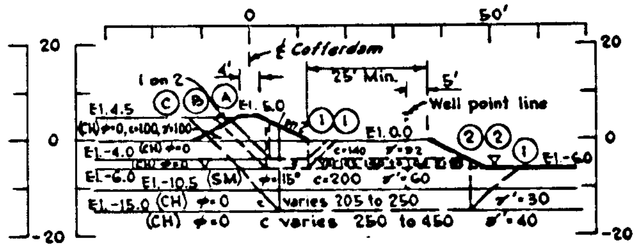
BY THE EQUATION $FS(MASS) = \frac{X\Sigma R}{X\Sigma D} + \frac{RS}{X\Sigma D}$

WHERE X = CORRESPONDING WIDTH.
RS = SIDE EFFECTS IN FOUNDATION SOILS.

SIDE EFFECTS IN FILL NOT INCLUDED.



SECTION A-A



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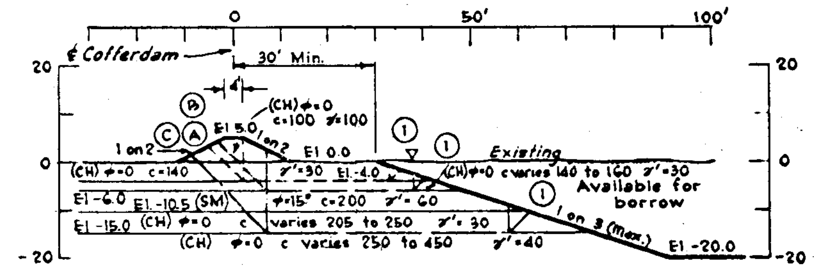


SECTION C-C

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I - GENERAL DESIGN

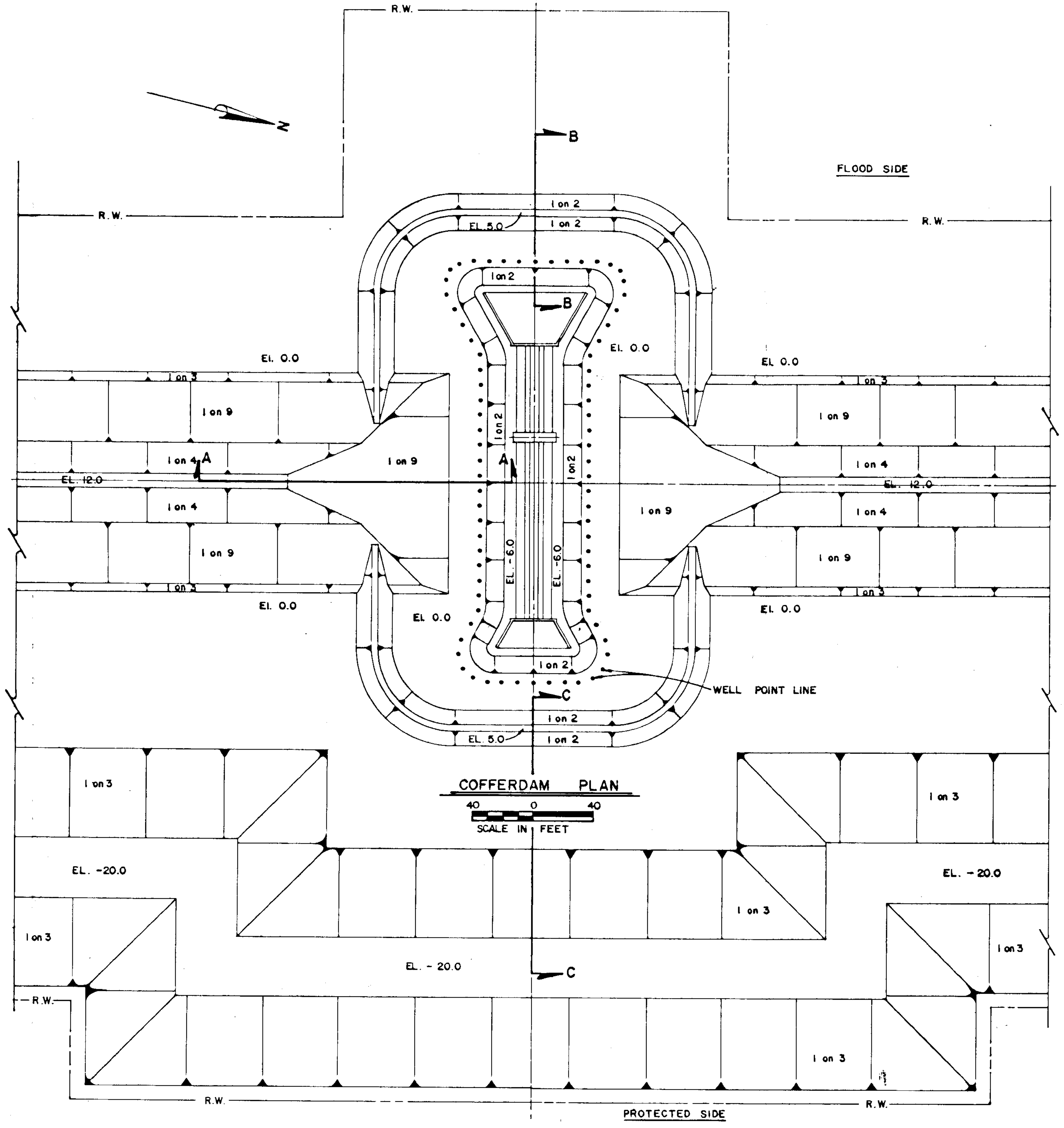
EXCAVATION PLAN AND (Q) STABILITY ANALYSIS
DRAINAGE STRUCTURE NO. 1
WEST TRAVERSE AT STA. 66+87

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

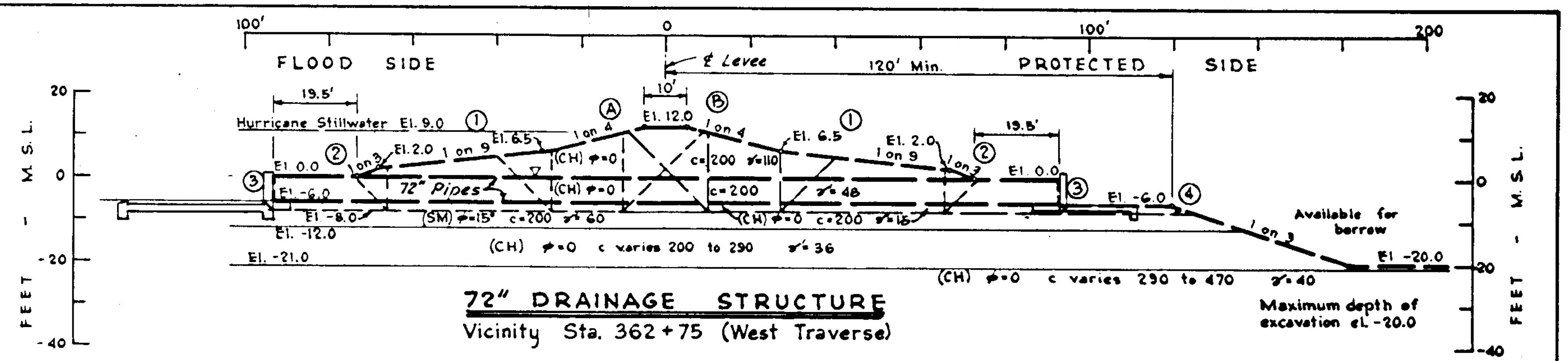
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

DATE:

FILE NO. H-2-24314



COFFERDAM PLAN



72" DRAINAGE STRUCTURE

Vicinity Sta. 362 + 75 (West Traverse)

LEVEE FEATURE	SLIP SURFACE			DRIVING			RESISTING					FACTOR OF SAFETY ΣR/ΣD
	NUMBER		EL.	$+\bar{D}_A$	$-\bar{D}_P$	$\Sigma\bar{D}$	$+R_A$	$+R_B$	$+R_P$	ΣR	$+R_S$*	
DRAINAGE STRUCTURE SECTION	A	1 2 3 4	- 8	19,307	7,757 2,464 43 16	11,550 16,843 19,264 19,291	7,600	3,400 11,200 16,600 22,200	5,097 3,003 800 500	16,097 21,803 25,000 30,300		1.39 1.30 1.30 1.57
	B	1 2 3	- 8	19,307	7,757 2,464 43	11,550 16,843 19,264	7,600	3,400 11,200 16,600	5,097 3,003 800	16,097 21,803 25,000		1.39 1.30 1.30
SECTION A-A	A	1 2	- 8	10,208	3,386 504	6,822 9,704	4,500	9,000 17,000	3,200 1,200	16,700 22,700	185,600 286,800	2.66 2.57
	B	1 2	-21	30,527	15,671 5,140	14,856 25,387	12,438	11,600 23,200	11,790 7,714	35,828 43,352	651,767 1,041,875	2.75 2.03
SECTION B-B	A	1 2	- 8	7,595	3,027 607	4,568 6,988	3,867	1,200 7,400	3,200 1,305	8,267 12,572		1.81 1.80
	B	1	-21	23,783	5,345	18,438	11,090	9,280	7,714	28,084		1.52
SECTION C-C	A	1	- 8	5,531	359	5,172	3,933	6,200	1,600	11,733		2.27
	B	1	-21	15,826	936	14,890	10,531	16,240	3,063	29,834		2.00

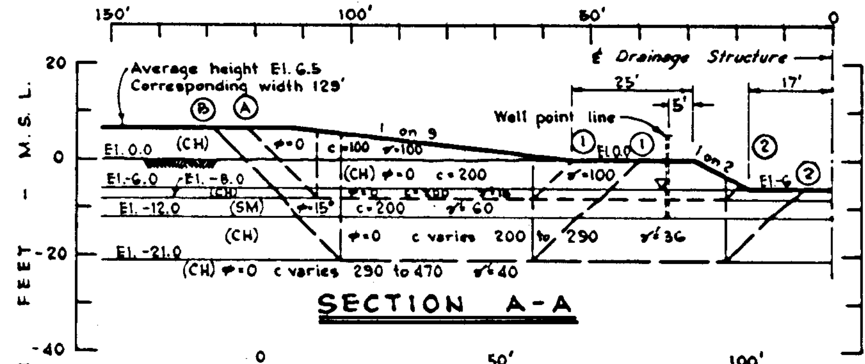
*MASS STABILITY ANALYSES BASED ON AVERAGE HEIGHT AND CORRESPONDING WIDTH,

BY THE EQUATION $FS(MASS) = \frac{X\Sigma R}{X\Sigma D} + \frac{RS}{X\Sigma D}$

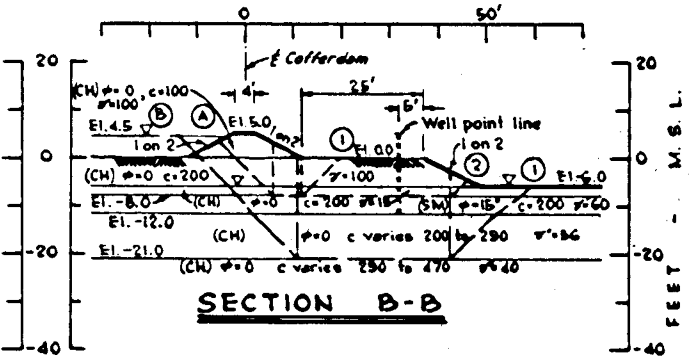
WHERE X = CORRESPONDING WIDTH.
RS = SIDE EFFECTS IN FOUNDATION SOILS.

SIDE EFFECTS IN FILL NOT INCLUDED.

For general notes see plate 76.
For "Drainage Structure details see plate 39.
For soil conditions and design shear strengths see boring 26DW on plate 70.



SECTION A-A



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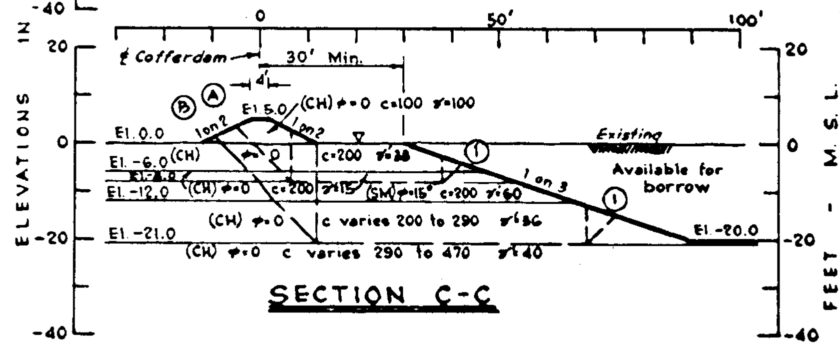


SECTION C-C

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)

DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

EXCAVATION PLAN AND (Q) STABILITY ANALYSIS DRAINAGE STRUCTURE NO. 2 WEST TRAVERSE AT STA. 362+75

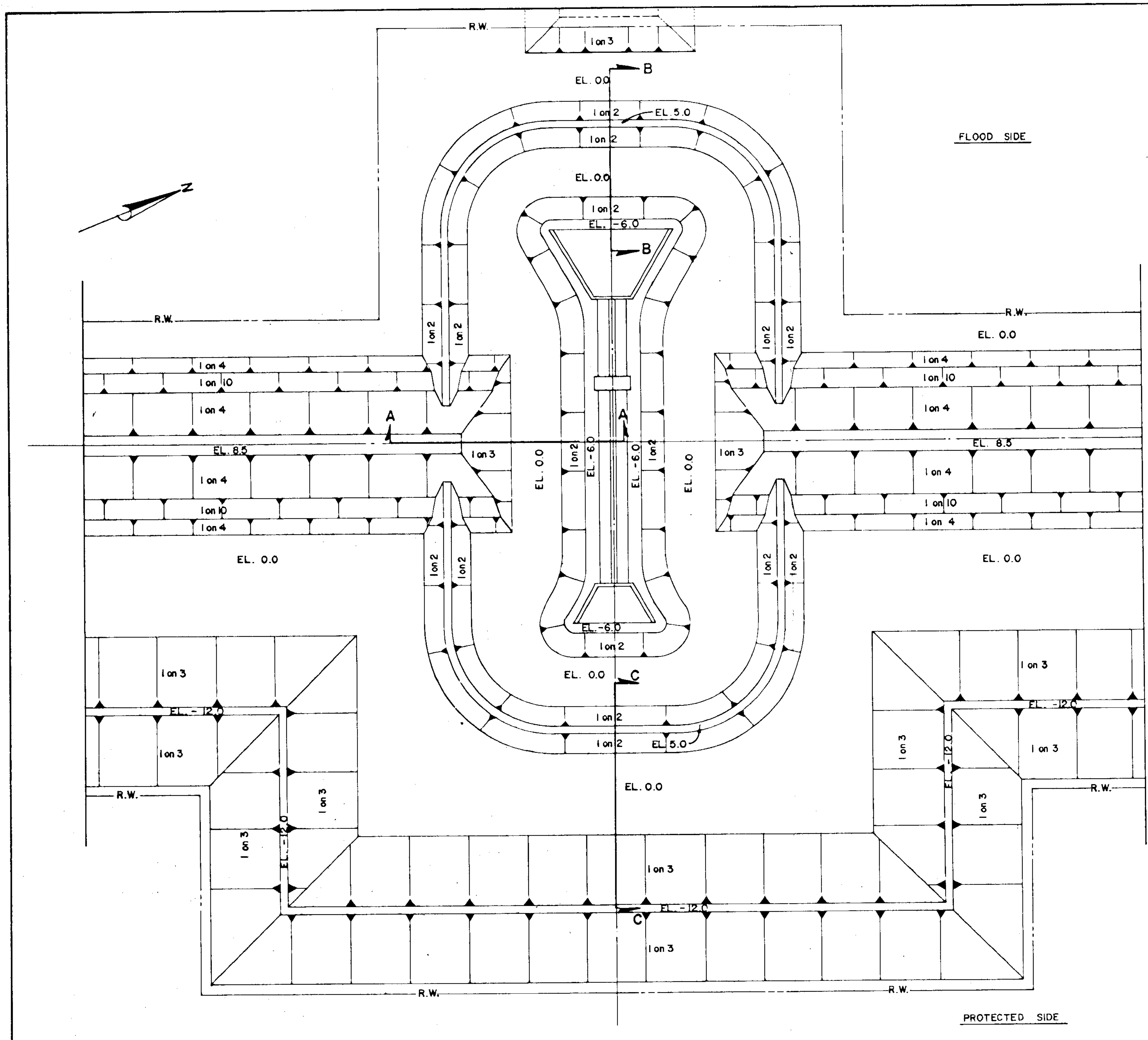
BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE:

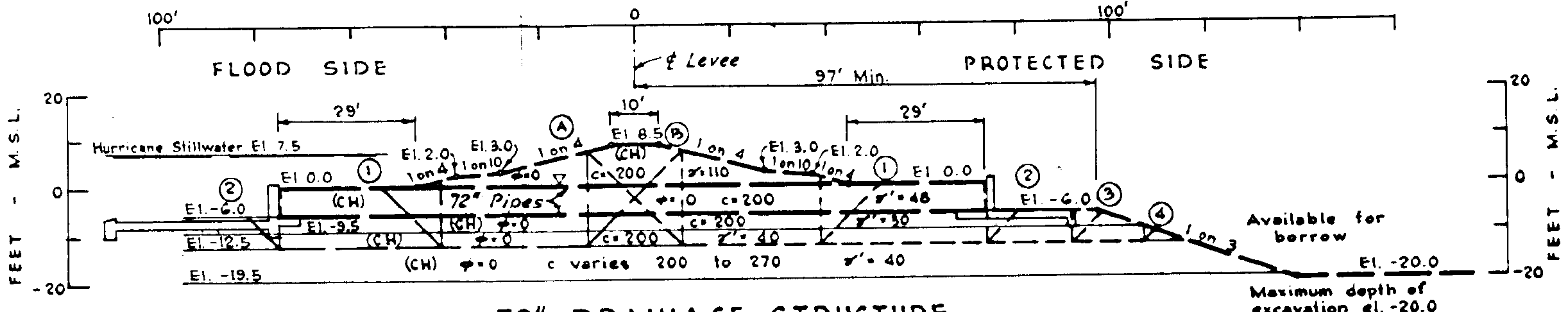
FILE NO. H-2-24314

PLATE 97



COFFERDAM PLAN

30 0 30
SCALE IN FEET



72" DRAINAGE STRUCTURE

Vicinity Sta. 722+64 (West Traverse)

LEVEE FEATURE	SLIP SURFACE NUMBER		SLIP SURFACE EL.	DRIVING +$\bar{D}_A$	DRIVING −$\bar{D}_P$	DRIVING $\Sigma\bar{D}$	RESISTING +R_A	RESISTING +R_B	RESISTING +R_P	RESISTING ΣR	+R_S*	FACTOR OF SAFETY ΣR / ΣD
DRAINAGE STRUCTURE SECTION	A	1	-12.5	18,348	3,907	14,441	7,920	5,800	5,000	18,720		1.30
		2			691	17,657		12,800	2,600	23,320		1.32
		3			669	17,679		16,400	2,450	26,770		1.51
		4			150	18,198		19,400	950	28,270		1.56
	B	1	-12.5	18,342	3,907	14,435	7,920	5,800	5,000	18,720		1.30
		2			691	17,651		12,800	2,600	23,320		1.32
SECTION A-A	A	1	-12.5	13,611	5,919	7,692	6,100	2,000	5,000	13,100	112,500	1.92
		2			769	12,842		9,000	2,600	17,700	254,700	1.68
	B	1	-19.5	23,881	3,323	20,558	9,390	12,150	5,890	27,430	478,980	1.68
SECTION B-B	A	1	-12.5	11,598	5,919	5,679	5,433	3,000	5,000	13,433		2.37
		2			769	10,829		8,000	2,600	16,033		1.48
	B	1	-19.5	19,009	3,323	15,686	8,590	9,450	5,890	23,930		1.53
	C	2	-12.5	5,926	769	5,157	5,000	2,000	2,600	9,600		1.86
SECTION C-C	A	1	-12.5	8,063	622	7,441	5,433	7,800	2,150	15,383		2.07
	B	1	-19.5	12,869	843	12,026	8,590	14,580	2,644	25,814		2.14

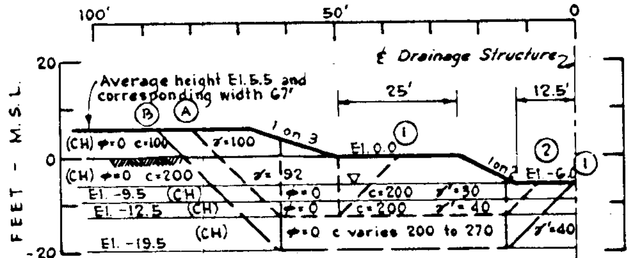
For general notes see plate 76.
For Drainage Structure details see plate 40.
For soil conditions and design shear strengths see boring 5UW on plate 50.

* MASS STABILITY ANALYSES BASED ON AVERAGE HEIGHT AND CORRESPONDING WIDTH.

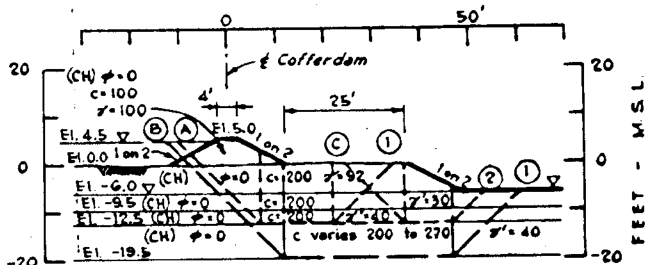
BY THE EQUATION $FS(MASS) = \frac{X\Sigma R}{X\Sigma D} + \frac{RS}{X\Sigma D}$

WHERE X = CORRESPONDING WIDTH.
RS = SIDE EFFECTS IN FOUNDATION SOILS.

SIDE EFFECTS IN FILL NOT INCLUDED.



SECTION A-A



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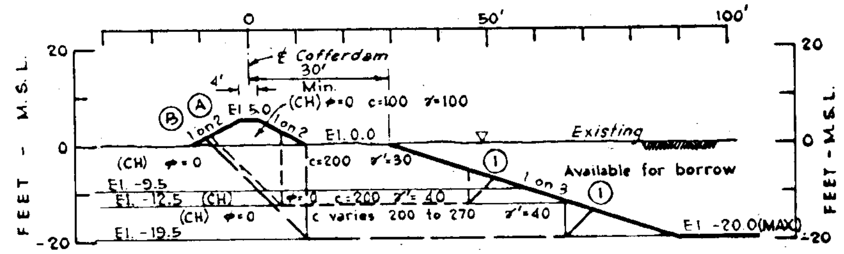


SECTION C-C

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)

DESIGN MEMORANDUM NO. I - GENERAL DESIGN

EXCAVATION PLAN AND (Q) STABILITY ANALYSIS

DRAINAGE STRUCTURE NO. 3
WEST TRAVERSE AT STA. 722+64

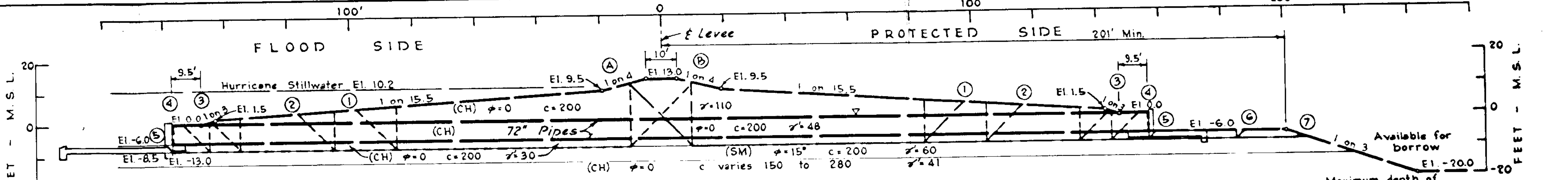
BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE:

FILE NO. H-2-24314

PLATE 98



72" DRAINAGE STRUCTURE

Vicinity Sta. 960+ 60 (East Traverse)

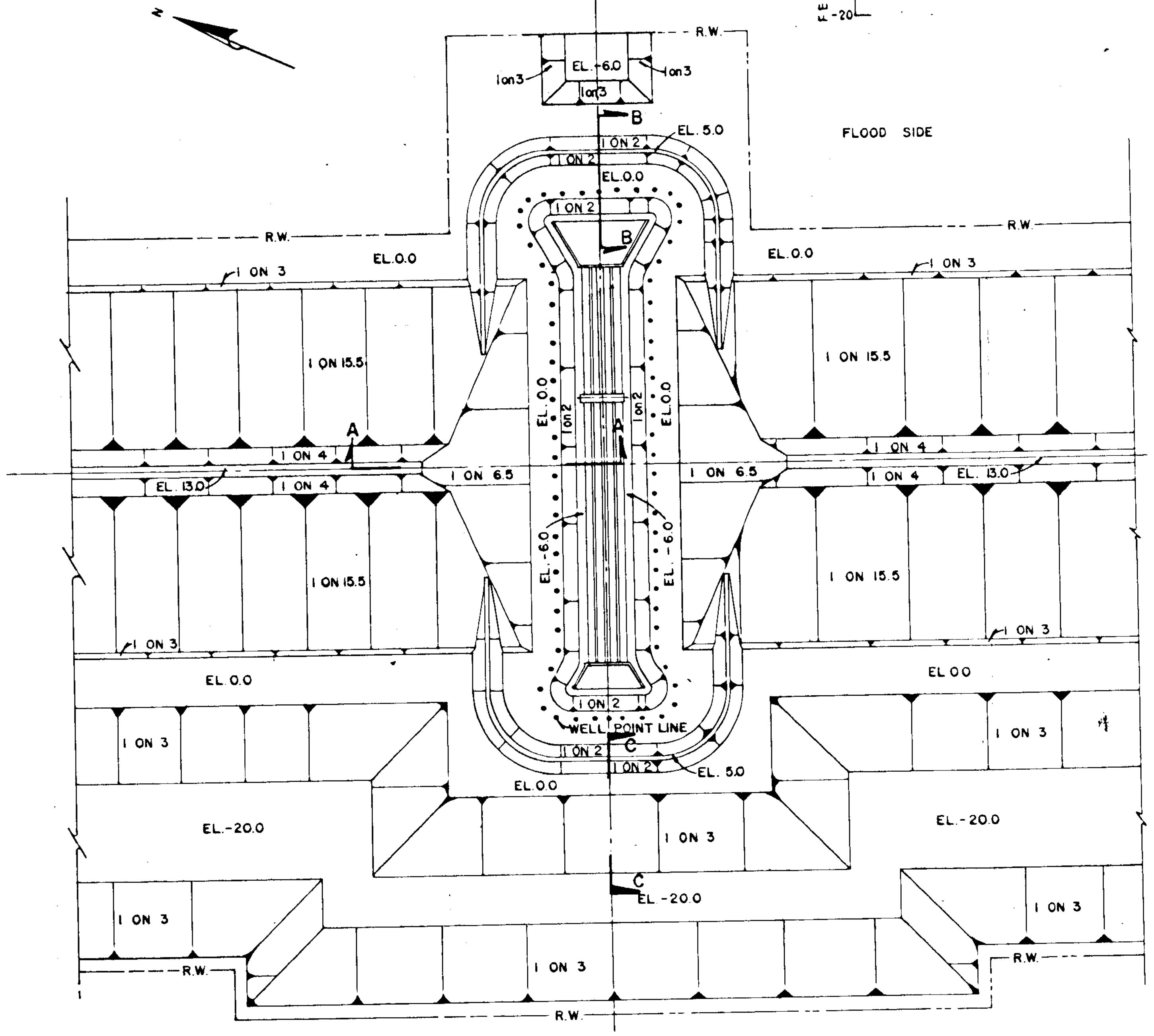
LEVEE FEATURE	SLIP SURFACE NUMBER		SLIP SURFACE EL.	DRIVING $+\bar{D}_A$	DRIVING $-\bar{D}_P$	DRIVING $\Sigma\bar{D}$	RESISTING $+R_A$	RESISTING $+R_B$	RESISTING $+R_P$	RESISTING ΣR	RESISTING $+R_S^*$	FACTOR OF SAFETY $\Sigma R/\Sigma D$
DRAINAGE STRUCTURE SECTION	A	1	- 8.5	22,327	7,457	14,870	7,780	10,500	4,864	23,144		1.56
		2			5,711	16,616		13,300	4,379	25,459		1.53
		3			3,374	18,953		17,500	3,500	28,780		1.52
		4			1,790	20,537		18,900	3,100	29,780		1.45
		5			107	22,220		20,580	700	29,060		1.31
		6			93	22,234		24,500	700	32,980		1.48
		7			13	22,314		27,300	221	35,301		1.58
	B	1	- 8.5	22,327	7,457	14,870	7,780	10,500	4,864	23,144		1.56
		2			5,711	16,616		13,300	4,379	25,459		1.53
		3			3,374	18,953		17,500	3,510	28,780		1.52
		4			1,790	20,537		18,900	3,100	29,780		1.45
		5			107	22,220		20,580	700	29,060		1.31
SECTION A-A	A	1	- 8.5	12,944	3,503	9,441	3,980	5,600	2,380	11,960	115,430	1.33
		2			426	12,518		11,200	840	16,020	192,200	1.35
	B	1	-26.0	43,954	22,055	21,899	13,826	8,400	12,710	34,936	637,474	1.71
		2			9,352	34,602		19,600	9,295	42,721	1,060,618	1.39
SECTION B-B	A	1	- 8.5	7,990	3,127	4,863	3,080	840	2,380	6,300		1.30
		2			185	7,805		6,440	700	9,520		1.31
	B	1	-26.0	31,582	9,076	22,506	11,664	11,200	9,295	32,159		1.43
	C	2	- 8.5	2,934	185	2,749	2,380	1,120	700	4,200		1.53
SECTION C-C	A	1	- 8.5	5,624	300	5,324	3,080	4,620	1,085	8,785		1.65
	B	1	-26.0	20,353	2,212	18,141	11,215	15,400	3,870	30,485		1.68

For general notes see plate 76.
For Drainage Structure details see plate 40
For soil conditions and design shear strengths see boring 61 AUE on plate 63K

* MASS STABILITY ANALYSES BASED ON AVERAGE HEIGHT AND CORRESPONDING WIDTH. BY THE EQUATION $FS(MASS)=\frac{X\Sigma R}{X\Sigma D}+\frac{RS}{X\Sigma D}$

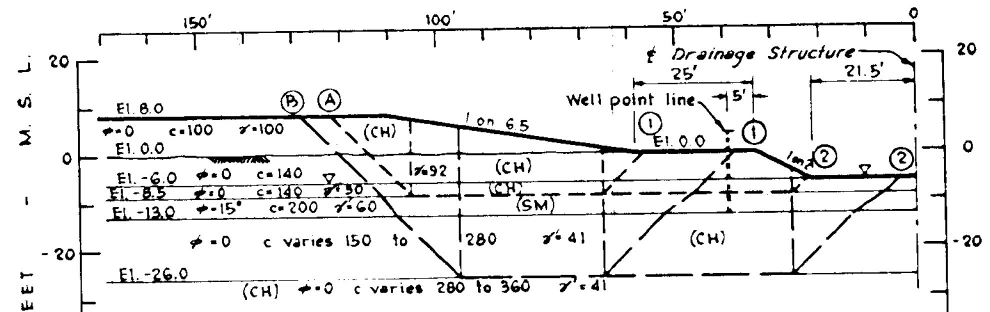
WHERE X = CORRESPONDING WIDTH.
RS = SIDE EFFECTS IN FOUNDATION SOILS.

SIDE EFFECTS IN FILL NOT INCLUDED.

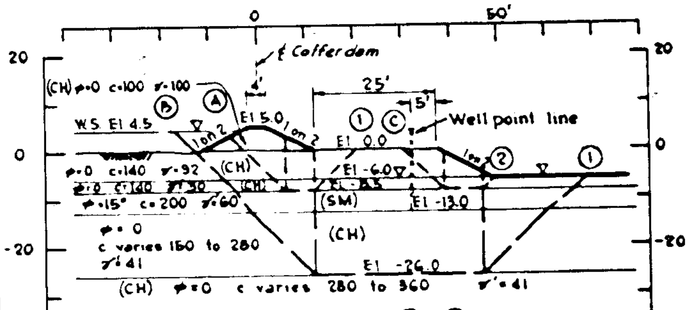


COFFERDAM PLAN

60 0 60
SCALE IN FEET



SECTION A-A



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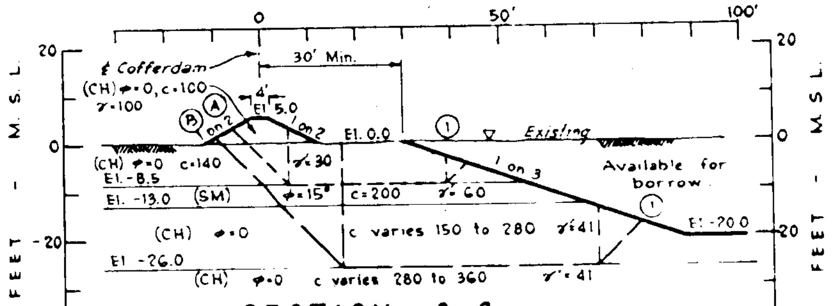


SECTION C-C

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

EXCAVATION PLAN AND (Q) STABILITY ANALYSIS

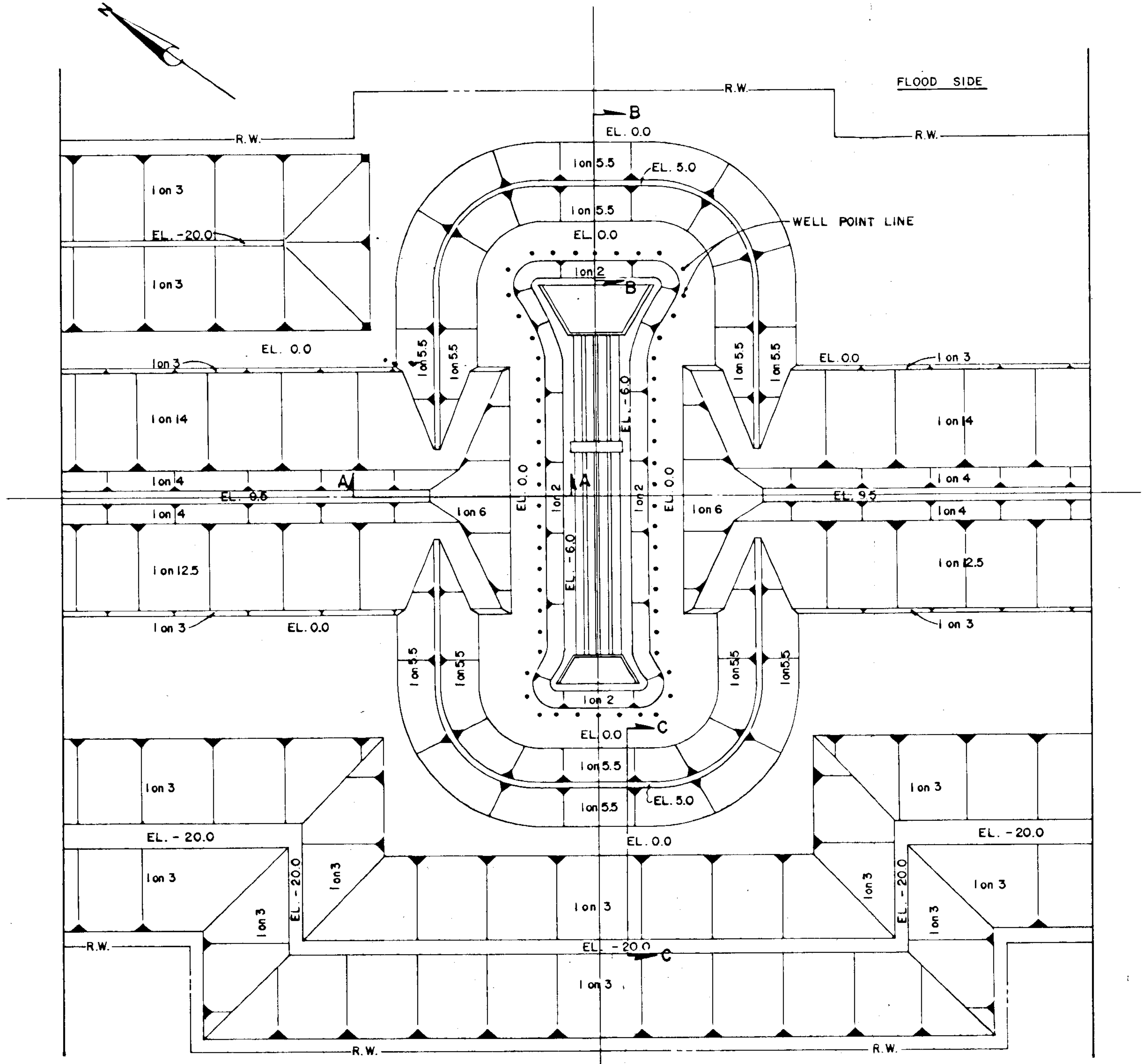
DRAINAGE STRUCTURE NO. 4
EAST TRAVERSE AT STA. 960+60

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA

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

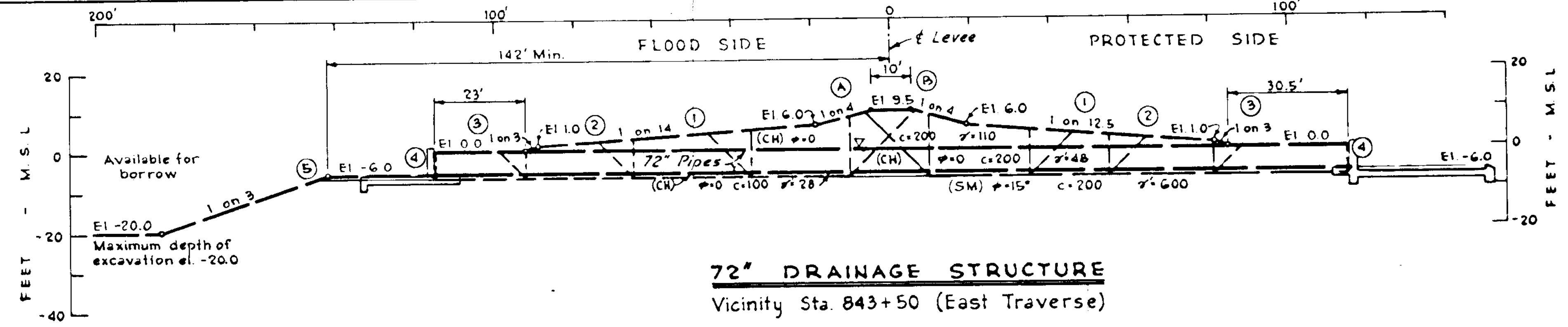
DATE

FILE NO H-2-24314



COFFERDAM PLAN

50 0 50
SCALE IN FEET



72" DRAINAGE STRUCTURE

Vicinity Sta. 843+50 (East Traverse)

LEVEE FEATURE	SLIP SURFACE NUMBER		SLIP SURFACE EL.	DRIVING $+\bar{D}_A$	DRIVING $-\bar{D}_P$	$\Sigma \bar{D}$	RESISTING $+R_A$	RESISTING $+R_B$	RESISTING $+R_P$	RESISTING ΣR	RESISTING $+R_S^*$	FACTOR OF SAFETY $\Sigma R / \Sigma D$
DRAINAGE STRUCTURE SECTION	A	1	- 7.0	13,082	5,463	7,619	6,280	2,500	4,141	12,921		1.70
		2			3,684	9,398		4,500	3,548	14,328		1.53
		3			1,238	11,844		7,150	2,600	16,030		1.35
		4			14	13,068		10,460	200	16,940		1.30
	B	1	- 7.0	13,082	5,684	7,397	6,280	2,500	4,227	13,007		1.76
		2			3,313	9,769		5,500	3,427	15,207		1.56
		3			1,165	11,917		8,200	2,600	17,080		1.43
		4			14	13,068		10,460	200	16,940		1.30
		5			0	13,082		13,360	0	19,640		1.50
SECTION A-A	A	1	- 7.0	7,333	2,380	4,953	2,500	2,300	1,400	6,200	41,400	1.32
		2			335	6,997		6,000	467	8,967	87,299	1.38
	B	1	-22.5	30,826	7,167	23,659	12,313	16,200	9,097	37,610	848,588	1.88
SECTION B-B	A	1	- 7.0	6,577	2,317	4,260	2,285	800	1,400	5,485		1.29
		2			36	6,541		6,100	200	8,585		1.31
SECTION C-C	A	1	- 7.0	5,116	298	4,818	2,323	4,300	800	7,423		1.54
		2			42	5,074		5,300	300	7,923		1.56

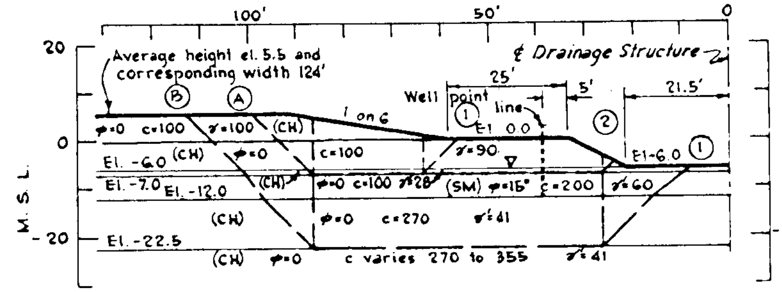
For general notes see plate 76.
For Drainage Structure details see plate 41.
For soil conditions and design shear strengths see boring 51UE on plate 65.

* MASS STABILITY ANALYSES BASED ON AVERAGE HEIGHT AND CORRESPONDING WIDTH.

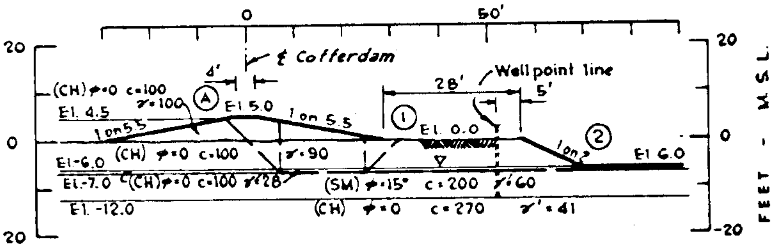
BY THE EQUATION $FS(MASS) = \frac{X\Sigma R}{X\Sigma D} + \frac{RS}{X\Sigma D}$

WHERE X = CORRESPONDING WIDTH.
RS = SIDE EFFECTS IN FOUNDATION SOILS.

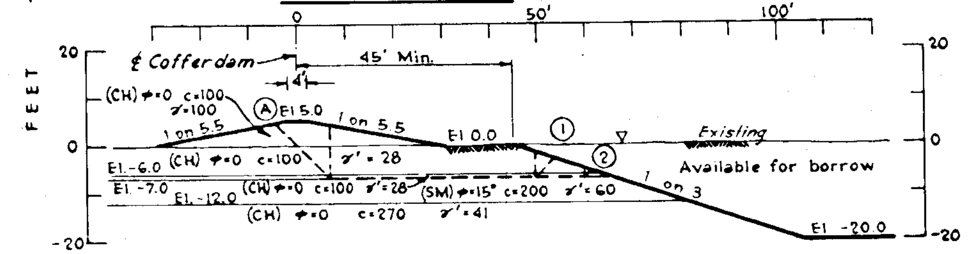
SIDE EFFECTS IN FILL NOT INCLUDED.



SECTION A-A



SECTION B-B



SECTION C-C

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

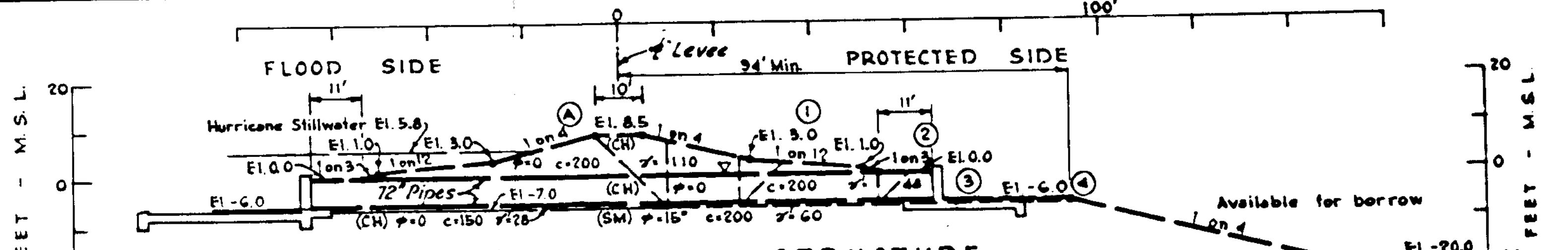
EXCAVATION PLAN AND (Q) STABILITY ANALYSIS

DRAINAGE STRUCTURE NO. 5
EAST TRAVERSE AT STA. 842 + 82

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

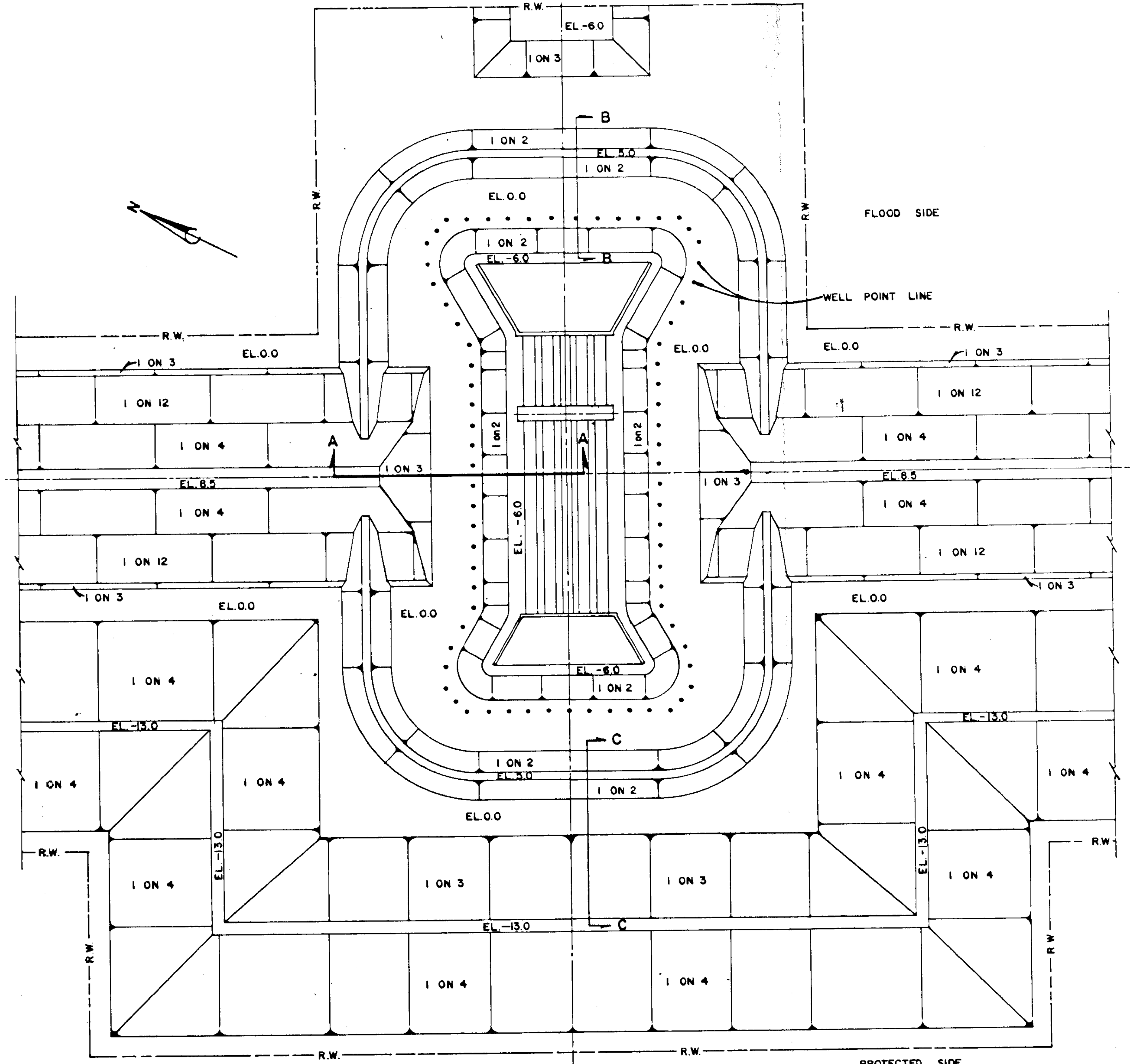
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

DATE:
FILE NO. H-2-24314



72" DRAINAGE STRUCTURE

Vicinity Sta. 634+75 (East Traverse)



COFFERDAM PLAN

30 0 30

SCALE IN FEET

LEVEE FEATURE	SLIP SURFACE		DRIVING			RESISTING					FACTOR OF SAFETY ΣR/ΣD
	NUMBER	EL.	$+\bar{D}_A$	$-\bar{D}_P$	$\Sigma\bar{D}$	$+R_A$	$+R_B$	$+R_P$	ΣR	$+R_S^*$	
DRAINAGE STRUCTURE SECTION	A 1	-7	11,343	3,752	7,591	6,060	2,250	3,654	11,964		1.58
	2			1,165	10,179		6,600	2,700	15,360		1.51
	3			14	11,329		8,265	300	14,625		1.29
	4			6	11,337		12,750	180	18,990		1.68
SECTION A-A	A 1	-7	6,511	2,321	4,190	3,100	1,050	2,100	6,250	29,400	1.58
	2			89	6,422		6,750	400	10,250	94,649	1.78
SECTION B-B	A 1	-7	6,176	2,172	4,004	2,900	750	2,100	5,750		1.44
	2			36	6,140		6,150	300	9,350		1.52
SECTION C-C	A 1	-7	4,663	197	4,466	2,900	4,650	975	8,525		1.91

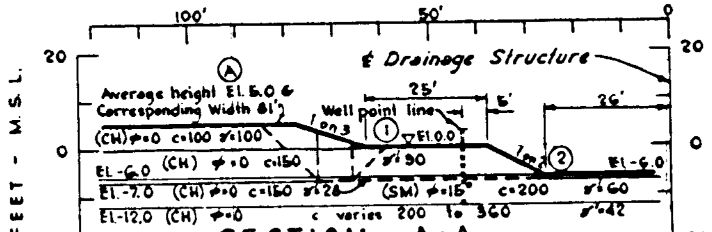
* MASS STABILITY ANALYSES BASED ON AVERAGE HEIGHT AND CORRESPONDING WIDTH.

BY THE EQUATION $FS(MASS)=\frac{X\Sigma R}{X\Sigma D}+\frac{RS}{X\Sigma D}$

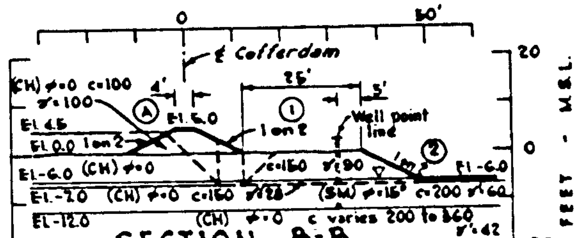
WHERE X = CORRESPONDING WIDTH.
RS = SIDE EFFECTS IN FOUNDATION SOILS.

SIDE EFFECTS IN FILL NOT INCLUDED.

For general notes see plate 76.
For Drainage Structure details see plate 40.
For soil conditions and design shear strengths see boring 34UE on plate 62.



SECTION A-A



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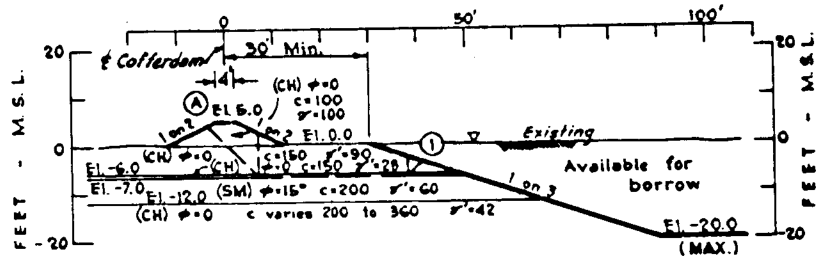


SECTION C-C

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

EXCAVATION PLAN AND (Q) STABILITY ANALYSIS

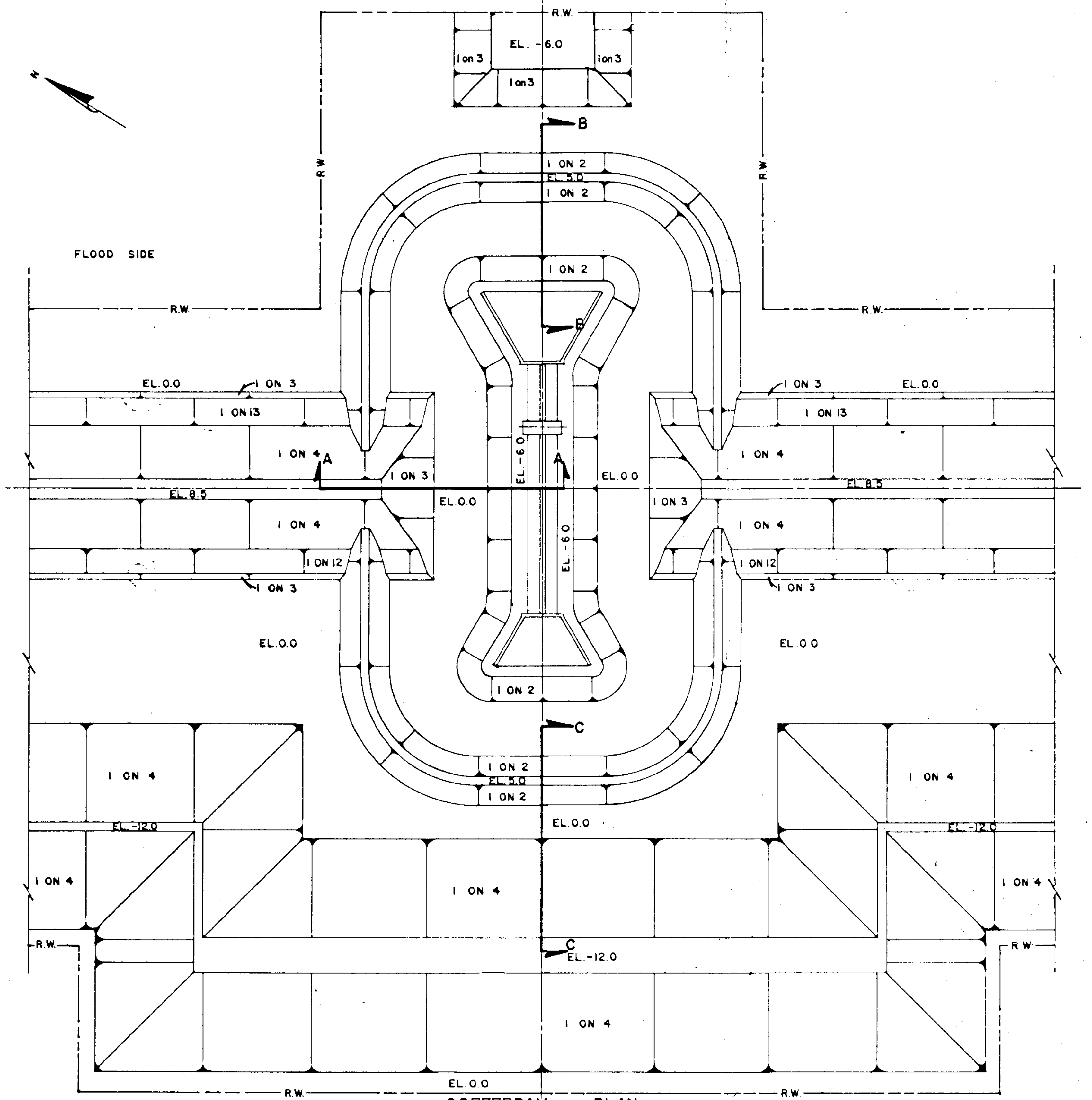
DRAINAGE STRUCTURE NO. 6
EAST TRAVERSE AT STA. 634+75

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA

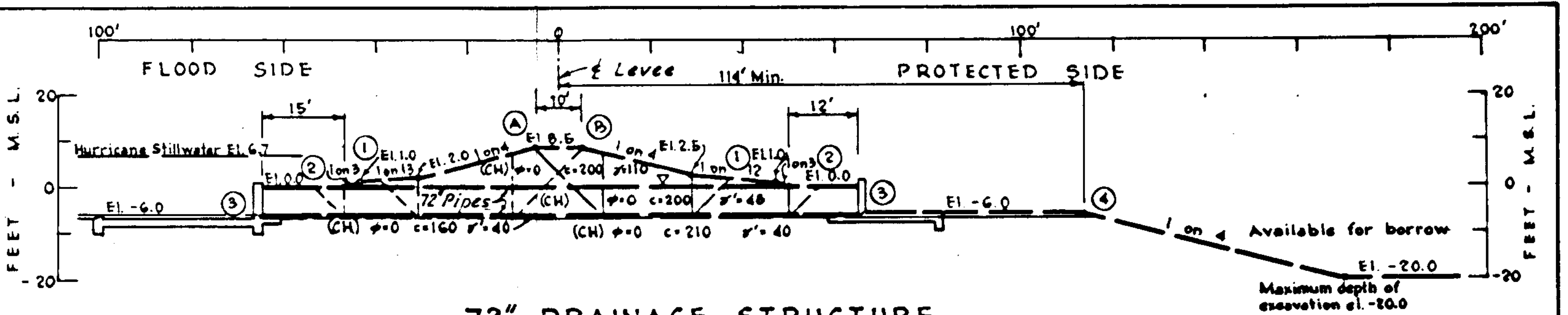
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

DATE:

FILE NO. H-2-24314



COFFERDAM PLAN



72" DRAINAGE STRUCTURE

Vicinity Station 325+00 (East Traverse)

LEVEE FEATURE	SLIP SURFACE			DRIVING			RESISTING					FACTOR OF SAFETY ΣR/ΣD
	NUMBER		EL.	$+\bar{D}_A$	$-\bar{D}_P$	$\Sigma\bar{D}$	$+R_A$	$+R_B$	$+R_P$	ΣR	$+R_S^*$	
DRAINAGE STRUCTURE SECTION	A	1	- 7	11,349	3,056	8,293	6,077	3,040	3,427	12,544		1.51
		2			1,171	10,178		6,400	2,720	15,197		1.49
		3			20	11,329		8,376	320	14,773		1.30
		4			9	11,340		16,800	192	23,069		2.03
	B	1	- 7	11,349	2,611	8,738	6,080	3,360	3,263	12,703		1.45
		2			1,171	10,178		5,920	2,720	14,720		1.45
		3			20	11,329		8,376	320	14,776		1.30
SECTION A-A	A	1	- 7	6,806	2,615	4,191	3,240	1,120	2,240	6,600	30,400	1.67
		2			104	6,702		7,200	427	10,867	100,806	1.82
	B	1	-14	14,727	2,195	12,532	5,513	7,560	3,260	16,333	271,696	1.86
SECTION B-B	A	1	- 7	6,470	2,465	4,005	3,040	800	2,240	6,080		1.52
		2			45	6,425		6,560	320	9,920		1.54
	B	1	-14	14,727	2,195	12,532	5,513	7,560	3,260	16,333		1.30
SECTION C-C	A	1	- 7	4,957	281	4,676	3,040	4,960	1,040	9,040		1.93
	B	2	- 7	5,033	979	4,054	2,840	1,280	2,240	6,360		1.57
	C	1	-14	9,882	601	9,281	5,513	9,660	1,995	17,168		1.85

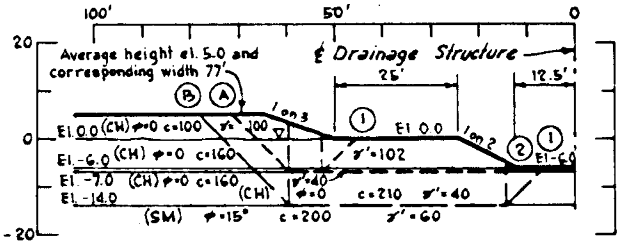
* MASS STABILITY ANALYSES BASED ON AVERAGE HEIGHT AND CORRESPONDING WIDTH.

BY THE EQUATION $FS(MASS) = \frac{X\Sigma R}{X\Sigma D} + \frac{RS}{X\Sigma D}$

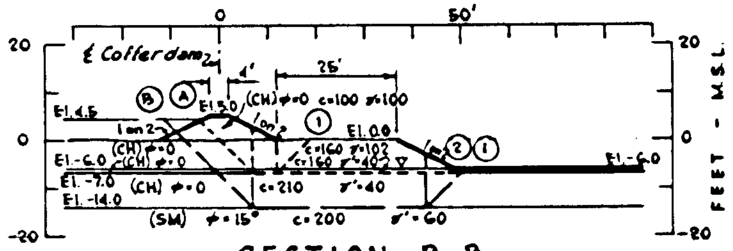
WHERE X = CORRESPONDING WIDTH.
RS = SIDE EFFECTS IN FOUNDATION SOILS.

SIDE EFFECTS IN FILL NOT INCLUDED.

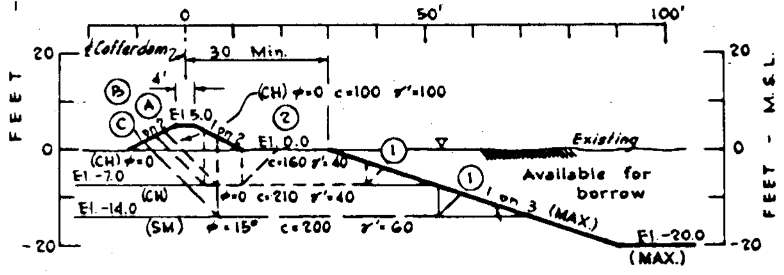
For general notes see plate 76.
For Drainage Structure details see plate 40.
For soil conditions and design shear strengths see boring 16 AUE on plate 69 H



SECTION A-A



SECTION B-B



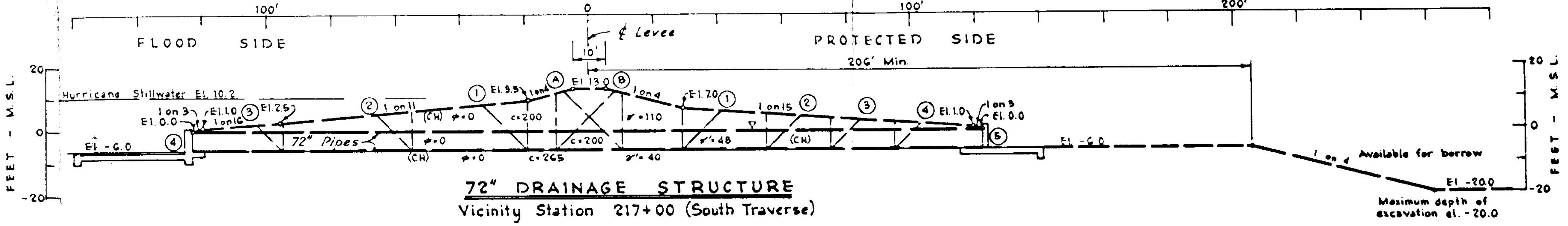
SECTION C-C

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)

DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

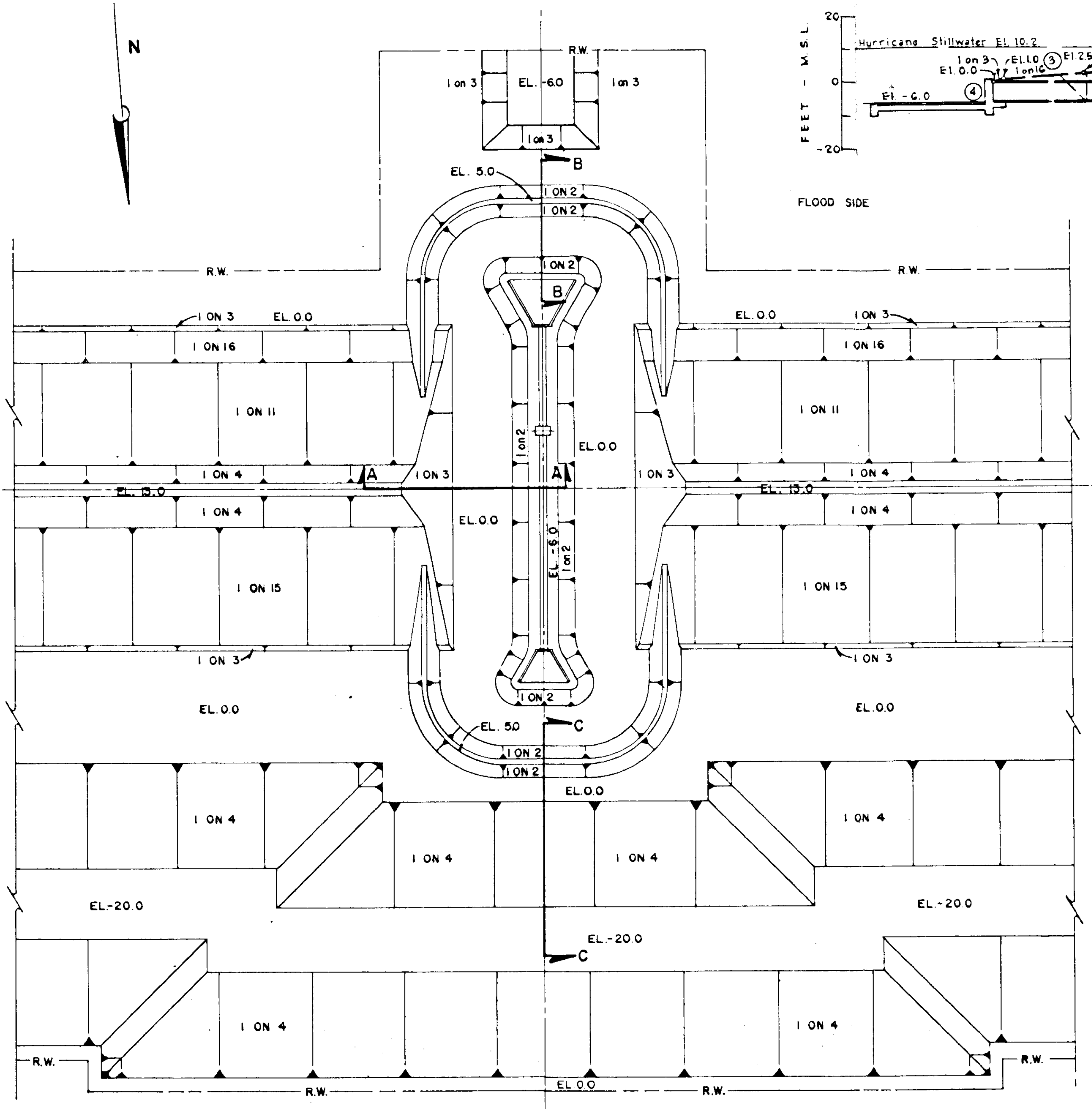
EXCAVATION PLAN AND
(Q) STABILITY ANALYSIS
DRAINAGE STRUCTURE NO. 7
EAST TRAVERSE AT STA. 325+00

BARNARD AND BURK, INC. CONSULTING ENGINEERS BATON ROUGE, LA.	U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS
DATE:	FILE NO. H-2-24314



72" DRAINAGE STRUCTURE

Vicinity Station 217+00 (South Traverse)



COFFERDAM PLAN

50 0 50
SCALE IN FEET

PROTECTED SIDE

LEVEE FEATURE	SLIP SURFACE			DRIVING			RESISTING					FACTOR OF SAFETY ΣR/ΣD
	NUMBER		EL.	$+\bar{D}_A$	$-\bar{D}_P$	$\Sigma\bar{D}$	$+R_A$	$+R_B$	$+R_P$	ΣR	$+R_S^*$	
DRAINAGE STRUCTURE SECTION	A	1	- 6.0	18,226	7,593	10,638	7,280	3,800	4,875	15,955		1.50
		2			5,426	12,800		9,000	4,225	20,505		1.60
		3			3,969	14,258		13,000	3,725	24,005		1.68
		4			2,695	15,531		17,000	3,225	27,505		1.77
		5			0	18,226		22,420	0	29,700		1.63
	B	1	- 6.0	18,226	10,991	7,235	7,280	1,800	5,683	14,763		2.04
		2			6,417	11,809		9,000	4,483	20,763		1.76
		3			2,678	15,548		17,000	3,224	27,504		1.77
		4			0	18,226		22,620	0	29,900		1.64
SECTION A-A	A	1	- 9.5	13,750	4,327	9,423	6,535	3,000	5,035	14,570	123,358	1.63
		2			743	13,007		14,000	2,032	22,567	365,911	1.90
	B	1	-20.0	31,728	14,423	17,305	10,735	3,000	9,235	22,970	336,193	1.45
		2			4,433	27,295		1,400	6,055	30,790	786,251	1.31
	C	3	- 9.5	4,066	403	3,663	5,035	1,400	1,855	8,290		2.26
	D	3	-20.0	14,169	4,076	10,093	9,235	1,400	6,055	16,690		1.65
SECTION B-B	A	1	- 9.5	9,265	4,220	5,045	5,668	1,000	5,035	11,703		2.32
		2			270	8,995		9,200	1,855	16,723		1.86
	B	1	-20.0	22,713	3,943	18,770	9,302	8,800	6,055	24,157		1.29
SECTION C-C	A	1	- 9.5	6,679	1,803	4,876	5,668	1,000	5,035	11,703		2.04
		2			183	6,496		8,200	1,391	15,259		2.35
	B	1	-20.0	14,737	805	13,932	9,502	11,200	2,200	22,902		1.64

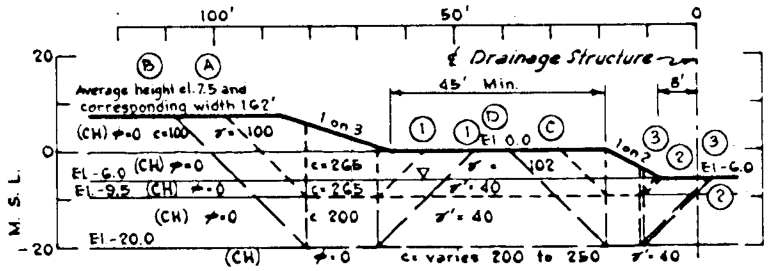
For general notes see plate 76.
For Drainage Structure details see plate 40.
For soil conditions and design shear strengths see boring 66DW on plate 72.

* MASS STABILITY ANALYSES BASED ON AVERAGE HEIGHT AND CORRESPONDING WIDTH.

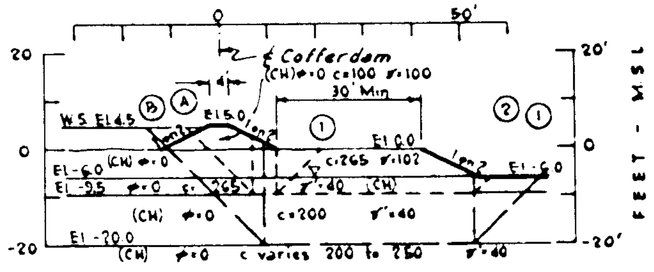
BY THE EQUATION $FS(MASS)=\frac{X\Sigma R}{X\Sigma D}+\frac{RS}{X\Sigma D}$

WHERE X = CORRESPONDING WIDTH.
RS = SIDE EFFECTS IN FOUNDATION SOILS.

SIDE EFFECTS IN FILL NOT INCLUDED.



SECTION A-A



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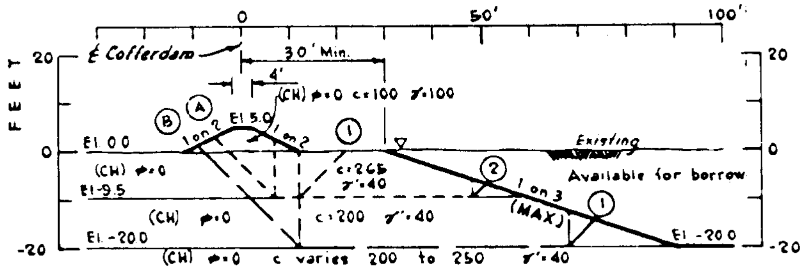


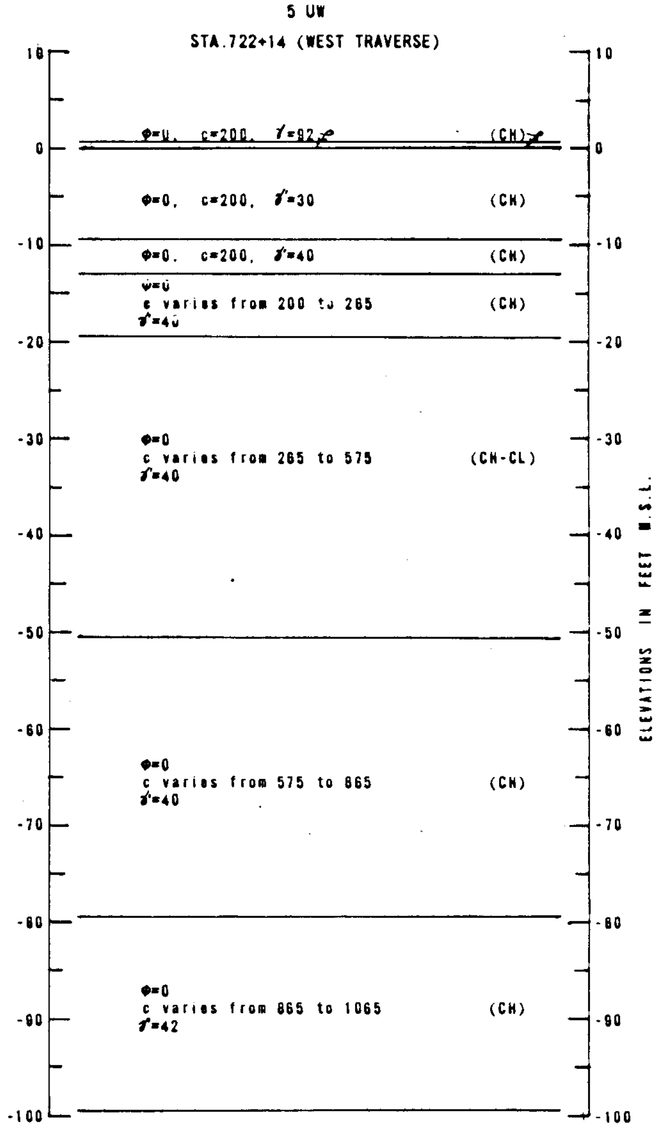
SECTION C-C

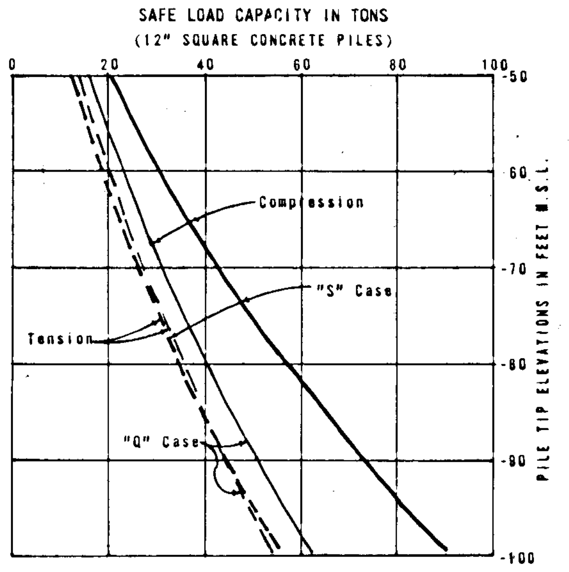
GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN
EXCAVATION PLAN AND
(Q) STABILITY ANALYSIS
DRAINAGE STRUCTURE NO. 8
SOUTH TRAVERSE AT STA. 217+00

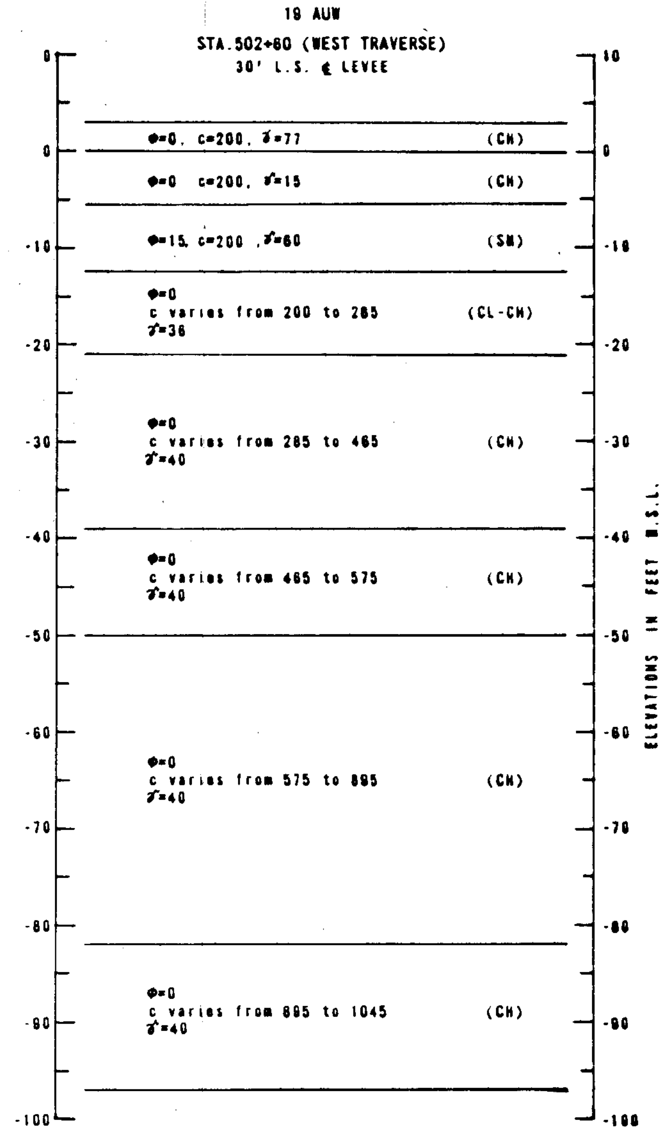
BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA

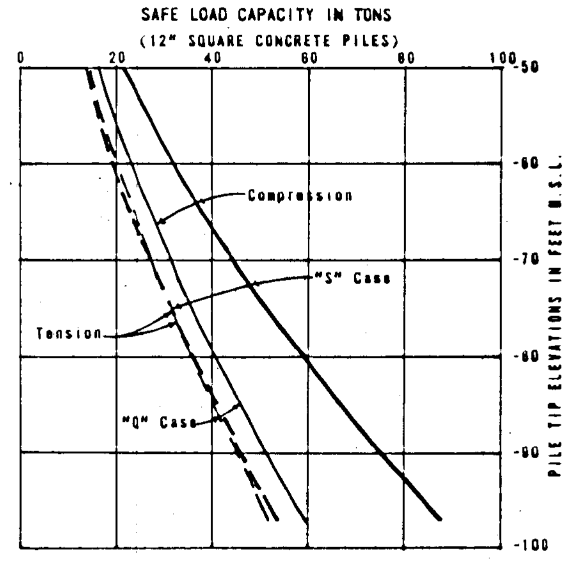
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

DATE
FILE NO H-2-24314









GENERAL NOTES

- (Q) Unconsolidated-undrained shear strength in pounds per sq. ft.
- (S) Consolidated-drained shear strength in pounds per sq. ft.
- γ Unit weight of soil in pounds per cu. ft.
- γ' Submerged unit weight of soil in pounds per cu. ft.
- φ - Angle of internal friction in degrees.
- c Cohesion in pounds per sq. ft.

Butt elevation of piles assumed at elev. 0.0

SHEAR STRENGTH DESIGN DATA

Applied factors of safety; 1.75 in compression and 2.0 in tension.

Applied conjugate stress ratios K: 1.0 in compression and 0.7 in tension.

(Q) strength as shown for each boring.

(S) strenghts:
Clay (CH)(CL): φ=23°, c=0
Silty Sand (SM) and Clayey Sand (SC): φ=33°, c=0.

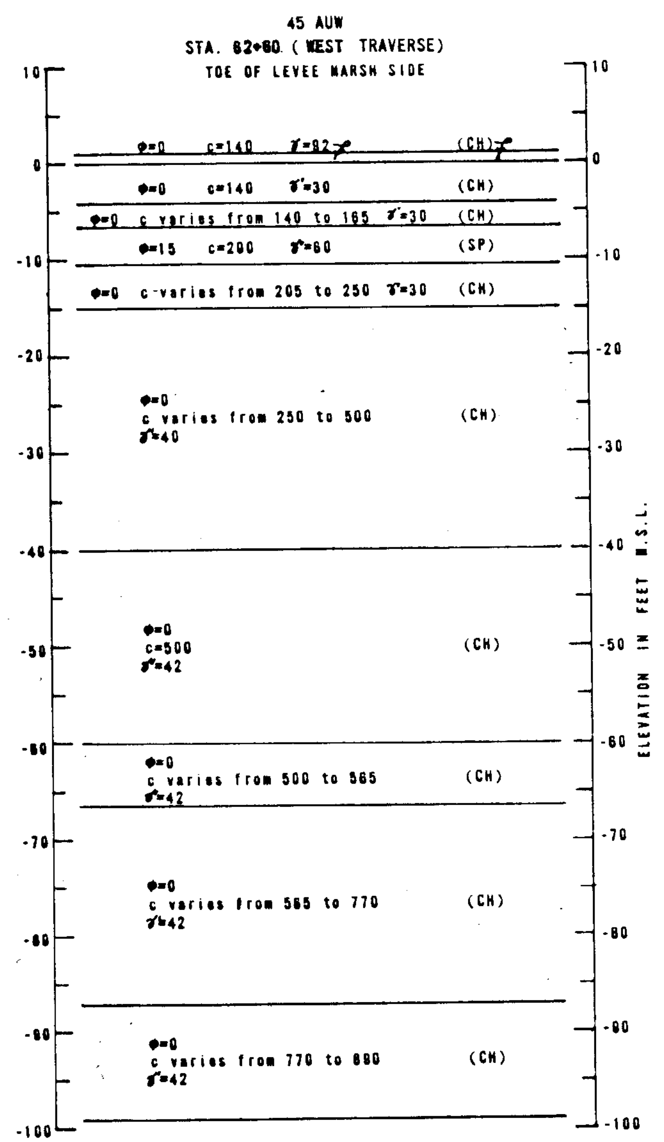
Skin friction disregarded above elev. -15.0 m.s.l.

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I - GENERAL DESIGN

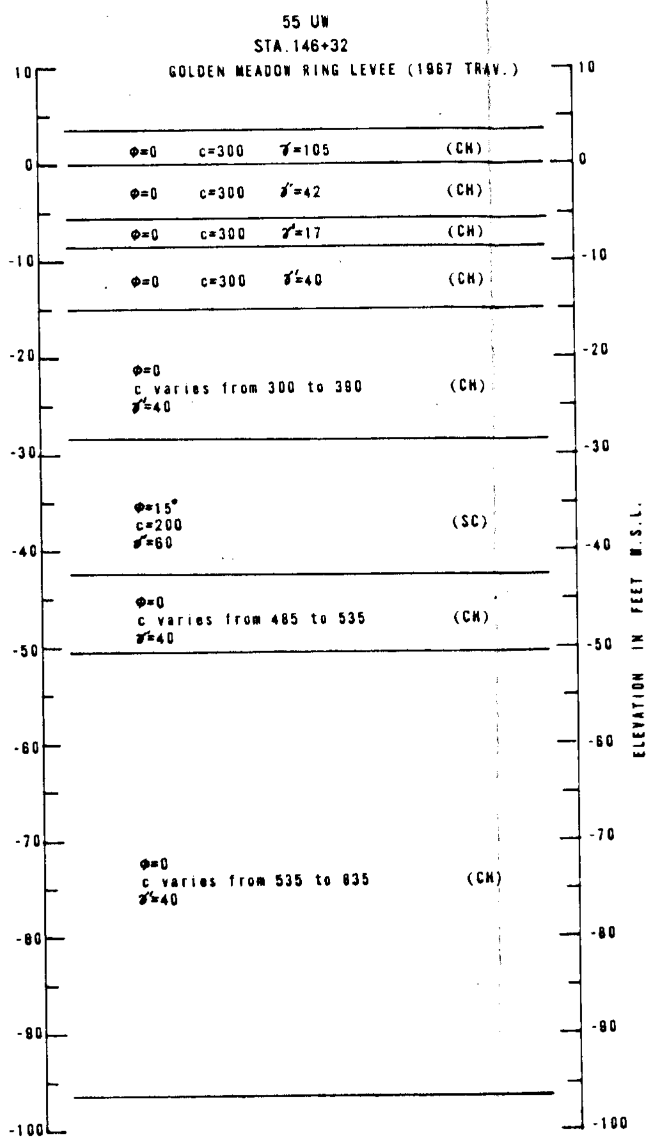
PILE DESIGN LOAD VS. TIP ELEVATION
5UW, 19AUW

BARNARD AND BURK, INC. CONSULTING ENGINEERS BATON ROUGE, LA.	U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS
DATE: MARCH 1972	FILE NO. H-2-24314

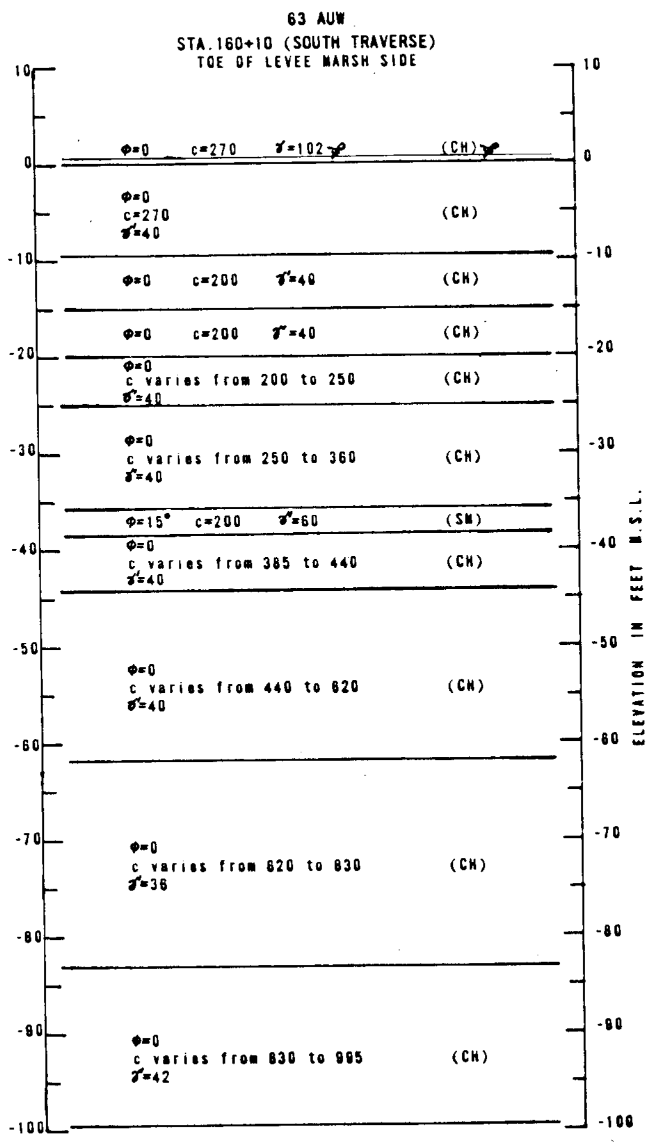
PLATE 104



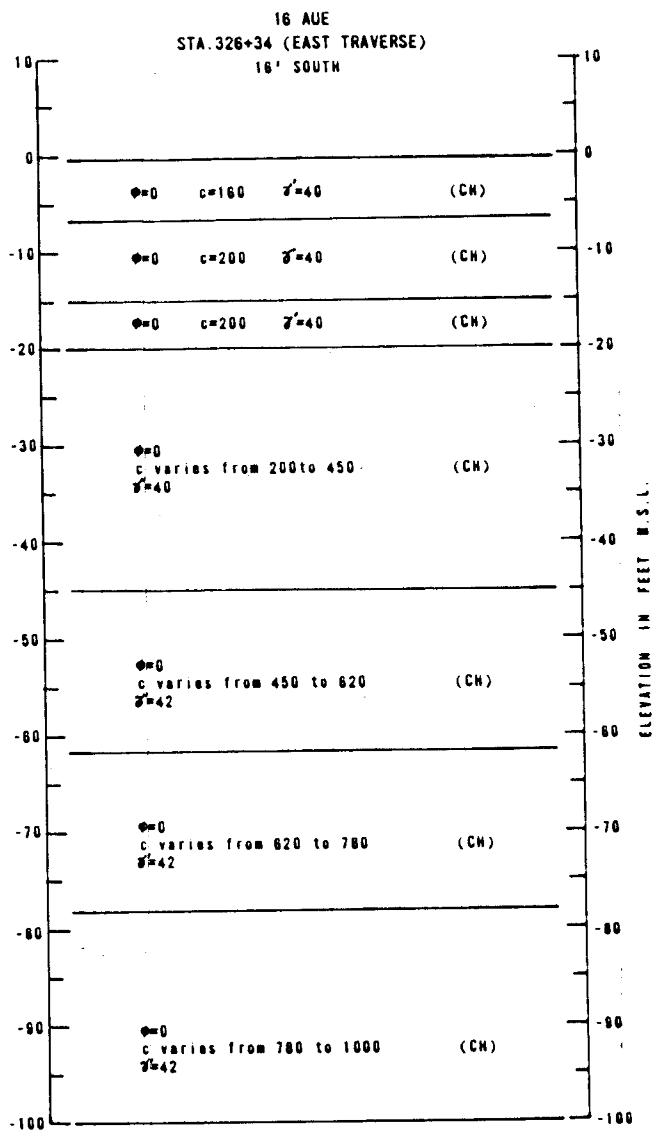
45 AUW
STA. 82+60 (WEST TRAVERSE)
TOE OF LEVEE MARSH SIDE



55 UW
STA.146+32
GOLDEN MEADOW RING LEVEE (1967 TRAV.)

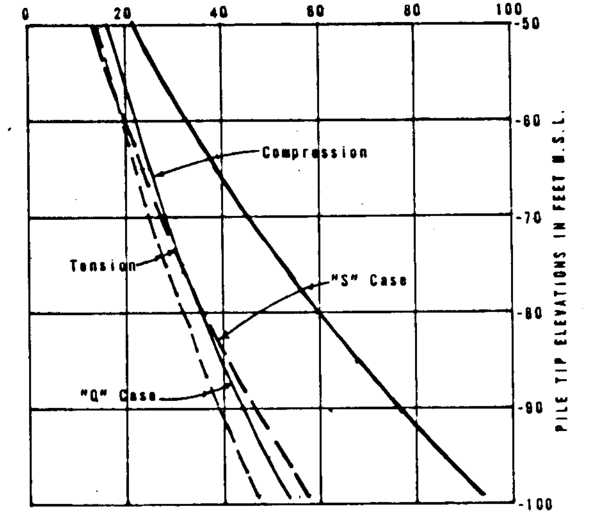


63 AUW
STA.160+10 (SOUTH TRAVERSE)
TOE OF LEVEE MARSH SIDE

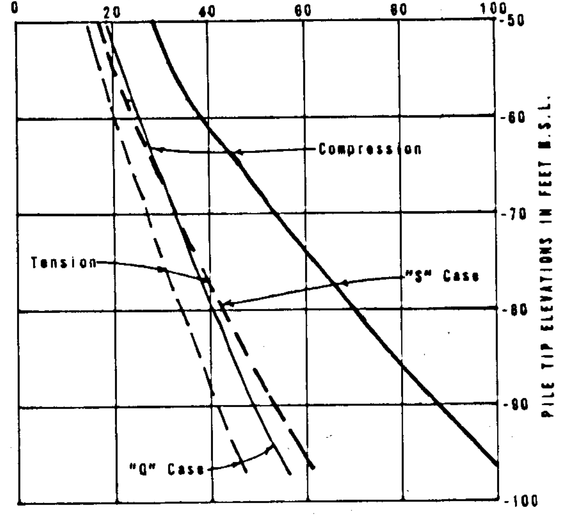


16 AUE
STA.326+34 (EAST TRAVERSE)
16' SOUTH

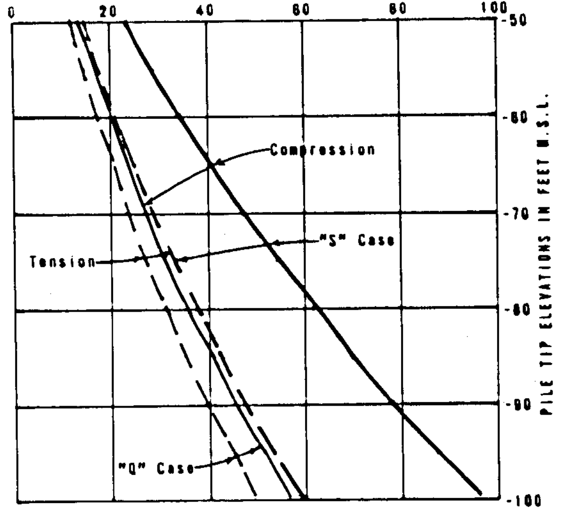
SAFE LOAD CAPACITY IN TONS
(12" SQUARE CONCRETE PILES)



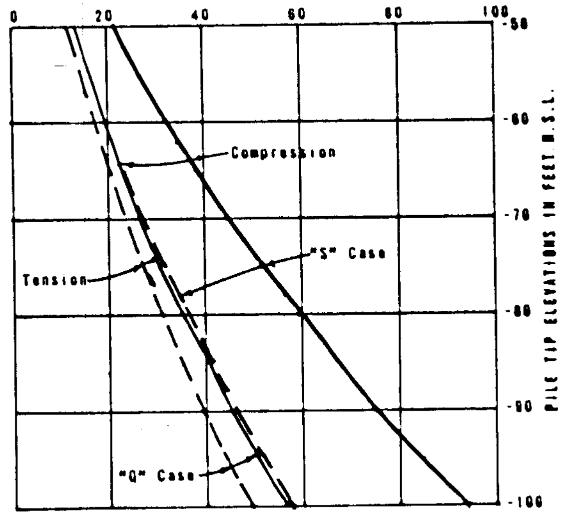
SAFE LOAD CAPACITY IN TONS
(12" SQUARE CONCRETE PILES)



SAFE LOAD CAPACITY IN TONS
(12" SQUARE CONCRETE PILES)



SAFE LOAD CAPACITY IN TONS
(12" SQUARE CONCRETE PILES)



For general notes & shear strength design data see plate 104

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO.1 - GENERAL DESIGN

PILE DESIGN LOAD VS. TIP ELEVATION

45AUW, 55 UW, 63AUW, 16AUE

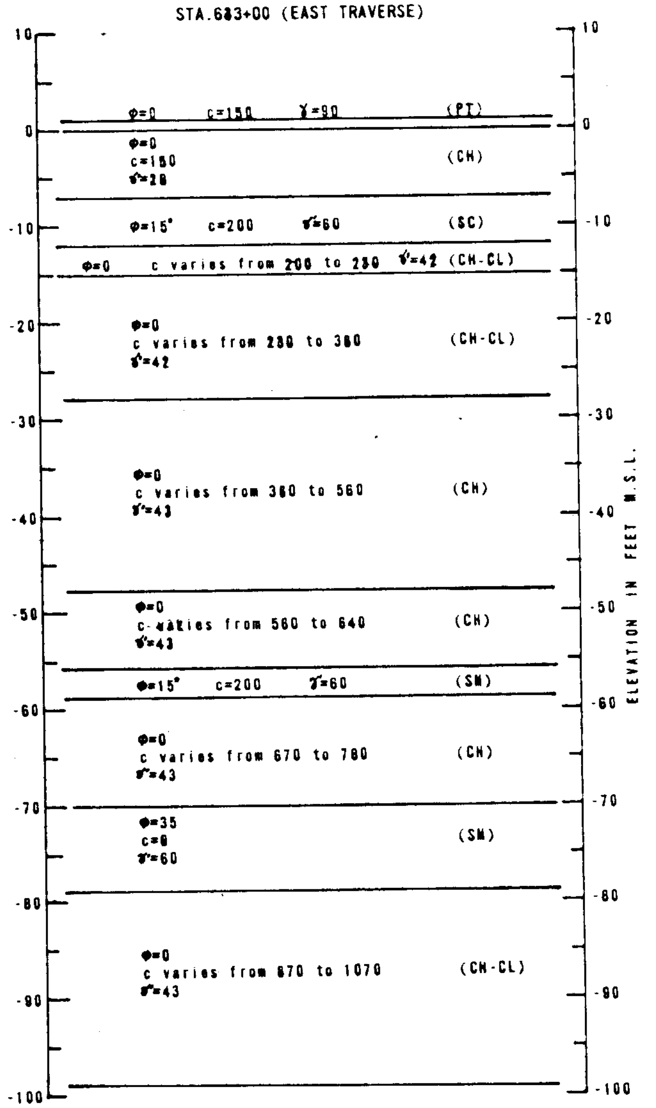
BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA

U S ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

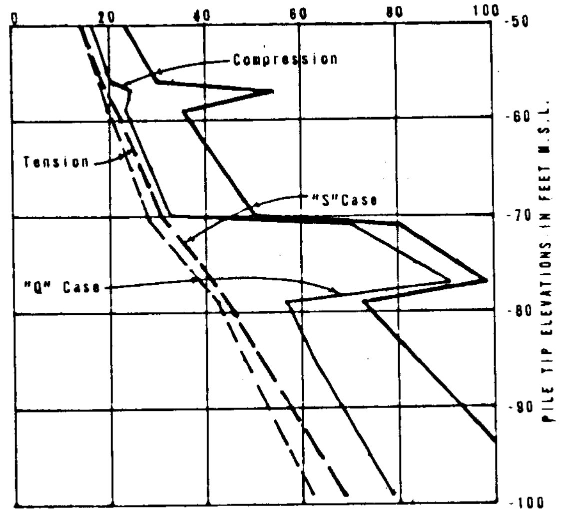
DATE MARCH 1972
FILE NO H-2-24314

PLATE 105

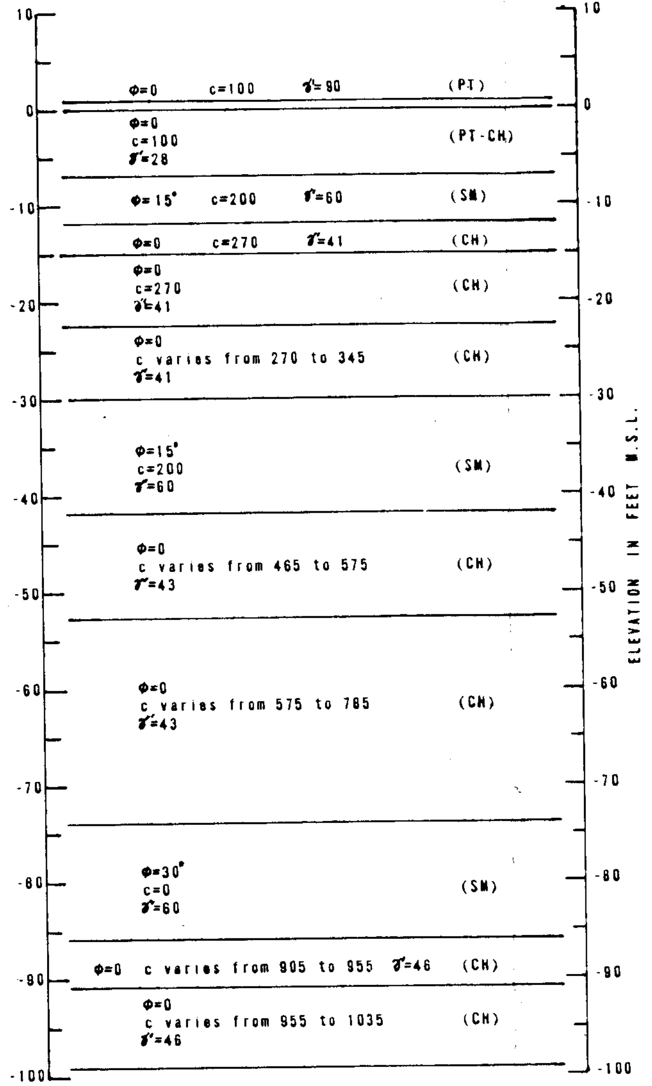
34 UE
STA.683+00 (EAST TRAVERSE)



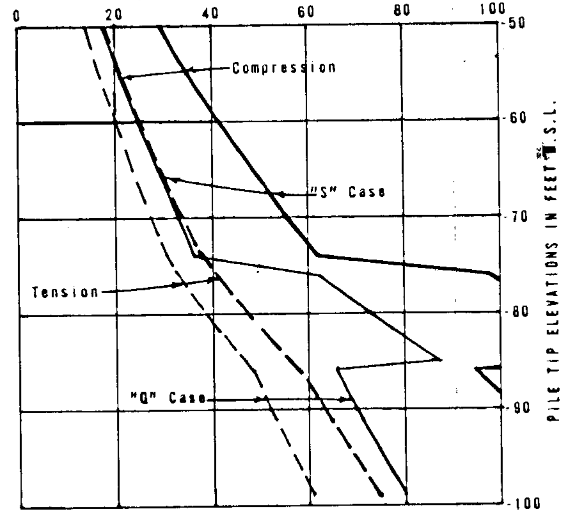
SAFE LOAD CAPACITY IN TONS
(12" SQUARE CONCRETE PILE)



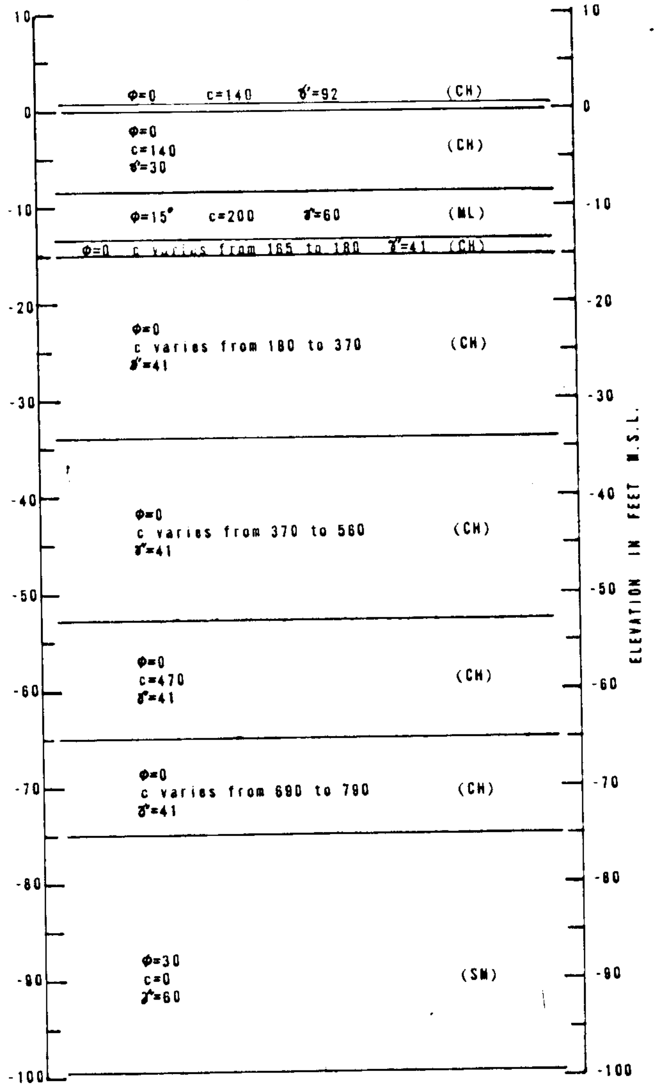
51 UE
STA.838+85 (EAST TRAVERSE)



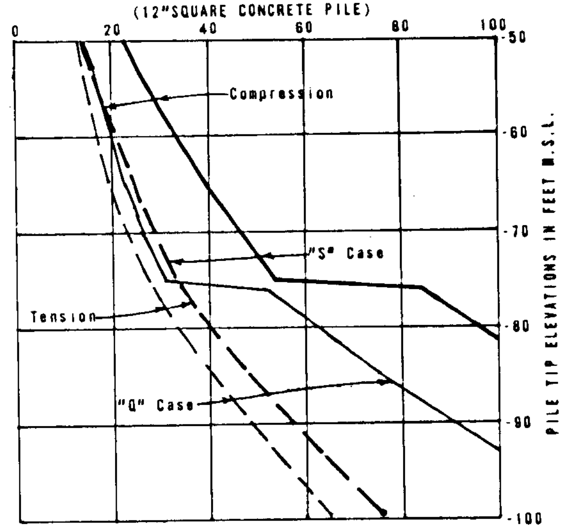
SAFE LOAD CAPACITY IN TONS
(12" SQUARE CONCRETE PILE)



61 AUE
STA.859+30 (EAST TRAVERSE ON B/L)



SAFE LOAD CAPACITY IN TONS
(12"SQUARE CONCRETE PILE)



For general notes & shear strength design data see plate 104

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I - GENERAL DESIGN

PILE DESIGN LOAD VS. TIP ELEVATION

34UE, 51UE, 61AUE

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE: MARCH 1972

FILE NO. H-2-24314

PLATE 106

GRAND ISLE, LOUISIANA AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1, GENERAL DESIGN

APPENDIX A

HYDROLOGY AND HYDRAULIC ANALYSIS

GRAND ISLE, LOUISIANA AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1, GENERAL DESIGN

APPENDIX A
HYDROLOGY AND HYDRAULIC ANALYSES

TABLE OF CONTENTS

APPENDIX A (CONT'D)
HYDROLOGY AND HYDRAULIC ANALYSES

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TABLE OF CONTENTS (cont'd)

TABLES

PLATES

GLOSSARY

ASTRONOMICAL TIDE - See PREDICTED NORMAL TIDE

ATMOSPHERIC PRESSURE ANOMALY: The difference between atmospheric pressure at any point within the hurricane and normal pressure at the periphery of the hurricane.

BUILDUP: The increase, in feet, over that from other causes, of water surface elevation in a body of water resulting from:

1. Convergence in depth or width
2. Construction of a barrier
3. Ponding

CENTRAL PRESSURE: The minimum atmospheric pressure within the hurricane at any specific time.

FETCH: The continuous area of water over which the wind blows in essentially a constant direction. Often used synonymously with FETCH LENGTH.

FETCH LENGTH: The distance over which the wind from a fixed direction may have unobstructed contact with the water surface.

HURRICANE: A cyclonic storm, usually of tropical origin, containing winds of 75 miles per hour or more.

a. DESIGN HURRICANE: That hurricane selected by the reporting office as a basis for design of the proposed plan of improvement.

b. STANDARD PROJECT HURRICANE: A hurricane that may be expected from the most severe combination of meteorological conditions that are considered characteristic of the region involved.

c. PROBABLE MAXIMUM HURRICANE: The hurricane that may be expected from the most severe combination of meteorological conditions that are reasonably possible in the region.

d. MODERATE HURRICANE: A hurricane that may be expected from a combination of meteorological conditions that are frequently experienced in the region.

GLOSSARY (cont'd)

e. TRANSPOSED HURRICANE: A storm transferred from actually observed location to another location for the purpose of study, with appropriate changes in storm characteristics.

HURRICANE PATH (OR TRACK): The line connecting successive locations of central pressure of the hurricane.

HURRICANE SPEED: The rate of forward movement.

HURRICANE SURGE: The mass of water causing an increase in elevation of the water surface at the time of a hurricane.

HURRICANE SURGE HEIGHT: The elevation of the still water level at a given point resulting from hurricane surge action. It may be the result of one or more of the following components:

1. Predicted normal tide
2. Pressure setup
3. Wind setup
4. Buildup

HURRICANE TIDE: The elevation of the still water level at a given point during a hurricane. It is the sum of hurricane surge height and additional local wind setup.

ISOVEL: Line drawn through locations having the same wind velocity at a given time.

KNOT: A velocity equal to one nautical mile (6,080 feet) per hour, or about 1.15 statute miles per hour.

LANDFALL: The arrival of a hurricane center at the coastline.

PREDICTED NORMAL TIDE: The periodic rising and falling of the water that results from gravitational attraction of the moon and sun acting upon the rotating earth.

PRESSURE SETUP: The conversion of atmospheric pressure anomaly to equivalent height of water and adjusted for its dynamic effects as a part of the total hurricane surge.

RANGE: A narrow fetch over which the hurricane surge height is computed.

RUNUP: The vertical elevation above still water level to which water rises on the face of the structure as a result of wave action.

SIGNIFICANT WAVE: A statistical term denoting waves having the average height and period of the highest one-third waves of a given wave train.

STORM SURGE: Same as HURRICANE SURGE, except that it may be caused by storms not of hurricane characteristics as well as by hurricanes.

SURGE: Same as HURRICANE SURGE.

SURGE HEIGHT: Same as HURRICANE SURGE HEIGHT.

SURGE REFERENCE LINE: The locus of points where the maximum surge height would be observed along fetches normal to the general coast.

WAVE HEIGHT: The vertical distance between the crest and the preceding trough. (Referenced to significant wave height in this report.)

WIND SETUP: The vertical rise in the still water level (above that which would occur without wind action) caused by wind stresses on the surface of the water. (Wind setup is a component of storm surge height.)

GRAND ISLE, LOUISIANA AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1, GENERAL DESIGN

APPENDIX A
HYDROLOGY AND HYDRAULIC ANALYSES

SECTION I - CLIMATOLOGY AND HYDROLOGY

1. Climatology.

a. Climate. The climate of this area is semitropical in nature. It is influenced by the proximity of the Gulf of Mexico with water temperatures along the Louisiana shore averaging from 57°F. in February to 83°F. in August. Southerly winds produce afternoon thundershowers in summer while winter storms are of the frontal type in which showers generally last the duration of the storm.

b. Temperature. Temperature records are available for 10 locations, with periods of record from 39 to 99 years, in or adjacent to the study area. The normal annual temperature for this area is 70° F., monthly normals range from 82° F. in July and August to 57° F. in January. The maximum recorded temperature of 104° occurred at Houma on 22 June 1915, while a minimum 5° F. was recorded on 13 February 1899 at the same location. In the period subsequent to 1949, Grand Isle experienced a maximum of 101° F. on 30 August 1954 and a minimum of 19° F. on 3 February 1951. Table A-1 lists recorded maximum and minimum temperature and seasonal normals for stations at Burrwood, Delta Farms, Houma, New Orleans, and Grand Isle. Table A-2 presents mean monthly and mean annual temperatures for the stations at Burrwood, Houma, and New Orleans.

TABLE A-1

TEMPERATURE DATA (DEGREES FAHRENHEIT)

	Burrwood	Delta Farms	Houma	New Orleans	Grand Isle
Maximum recorded	99	101	104	102	101
Minimum recorded	10	16	5	7	19
Seasonal normals	Spring 68.9	Summer 82.1	Fall 71.6	Winter 57.7	

Note: Locations are shown on plate A-1.

TABLE A-2
TEMPERATURES NORMALS (degrees Fahrenheit)

Station[1]	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
1. Mean monthly													Mean
Burrwood	57.5	58.2	61.5	67.9	75.1	81.1	82.7	82.8	80.5	74.3	65.1	59.7	70.5
Houma	56.5	58.6	62.4	68.9	75.1	80.2	81.6	81.6	78.3	70.4	61.0	57.2	69.3
New Orleans	56.0	58.2	62.8	69.7	76.8	82.3	83.4	83.5	80.2	72.6	62.0	57.1	70.4
2. Maximum monthly													Maximum
Burrwood	64.9	65.7	68.9	74.5	81.8	87.3	88.7	88.6	85.7	80.0	71.3	66.7	77.0
Houma[2]	66.4	69.4	73.0	79.3	84.8	89.7	90.7	91.2	88.2	82.2	72.5	67.1	79.5
New Orleans	63.8	66.2	71.0	77.7	84.5	89.8	90.6	90.6	86.9	80.0	69.8	64.7	78.0
3. Minimum monthly													Minimum
Burrwood	50.0	50.7	54.0	61.3	68.8	74.9	76.7	77.0	75.2	68.6	58.8	52.6	64.1
Houma[2]	46.1	48.2	52.2	58.4	64.1	70.1	71.8	71.4	68.5	58.7	49.4	46.5	58.8
New Orleans	48.2	50.1	54.5	61.6	69.0	74.7	75.2	76.4	73.4	65.2	54.2	49.4	62.7

[1] Locations shown on plate A-1.
[2] 1921-1950 data used.

c. Precipitation. Rainfall is generally heavy with greatest falls recorded during the summer months due to frequent afternoon thundershowers. The average annual rainfall for the area is 62.8 inches with monthly averages ranging from 3.5 inches in October to 7.5 inches in July. This is based on records of 52 to 76 years at U. S. Weather Bureau stations in or adjacent to the study area. A maximum monthly rainfall of 21.1 inches was recorded at Burrwood in September 1957, while Grand Isle experienced 9.6 inches during the same period. The maximum monthly rainfall of 20.9 inches at Grand Isle occurred in September 1946. Burrwood rainfall during the same period was 16.8 inches. Measurable snow occurs infrequently. The last fall of consequence produced a maximum depth of 2.8 inches on 12 February 1958 at Grand Isle while other locations in the area reported smaller depths. Rainfall and other climatological data for this area are published in monthly and annual pamphlets by the U. S. Department of Commerce, Weather Bureau (now National Weather Service), titled "Climatological Data for Louisiana." Table A-3 presents mean monthly and mean annual precipitation data while table A-4 lists the period of records for temperature and precipitation stations. Location of hydrologic stations is shown on plate A-1.

2. Hydrology.

a. Tides. The normal tide along the Louisiana coast is diurnal and has an average range of about 1 foot, with a maximum range of about 1.5 feet. Normal tidal effects are observed as far inland as Lake Salvador and to the vicinity of Golden Meadow on Bayou Lafourche. Hurricane tides reach elevations in excess of 10 feet m.s.l.[1] on the coast, and strong northerly winds in the winter depress gulf levels as much as 2 feet below mean low gulf level, a datum which is about 0.8 foot below mean sea level. Typical tidal cycles for the Gulf of Mexico adjacent to the project area are shown on plate A-2.

b. Stages. Water surface elevations were obtained from automatic recording and staff gages and high water pipe indicators at locations and for the period of record as shown in table A-5. Table A-6 lists maximum high water elevations which occurred in the project area during hurricanes Flossy, September 1956; Carla, September 1961; Hilda, October 1964; and Betsy, September 1965. (See plate A-1 for location of gaging stations.)

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[1] Mean sea level, the datum to which all elevations in this appendix are referenced, unless otherwise indicated.

TABLE A-3
PRECIPITATION DATA IN INCHES

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual normal
1. Mean monthly													Mean
Burrwood	4.08	4.31	4.22	4.01	4.08	4.25	6.69	7.52	7.67	3.40	4.15	3.97	58.35
Houma	4.11	4.09	5.27	4.48	4.81	6.39	8.43	7.62	6.63	3.76	3.99	4.81	64.39
Paradis	4.84	5.23	6.21	5.07	5.36	6.01	7.44	6.50	5.96	3.35	4.07	5.54	65.58
2. Maximum monthly													Maximu
Burrwood	14.81	12.98	10.87	14.81	17.57	14.62	15.51	18.99	21.06	15.97	16.17	11.04	86.01
Houma	12.36	10.87	16.49	10.64	15.44	15.00	19.71	15.20	18.70	11.62	17.53	13.62	87.53
Paradis	13.45	13.06	16.40	12.97	18.00	18.00	14.64	12.17	16.40	16.15	13.85	13.65	19.10
3. Minimum monthly													Minimu
Burrwood	0.63	0.41	0.40	T[1]	T	0.02	0.59	1.51	0.16	0.0	0.08	0.92	33.34
Houma	0.45	0.05	T	0.0	0.15	0.10	0.21	2.29	0.30	0.0	0.16	0.06	33.03
Paradis	1.37	1.12	0.25	0.0	0.46	0.0	2.24	0.79	0.0	0.0	0.25	0.30	36.20
Average seasonal				Spring		Summer		Autumn		Winter			
				14.50		20.28		14.32		14.0			

[1] T = Trace

TABLE A-4
TEMPERATURE AND PRECIPITATION RECORDS

Station Louisiana	Map index No.[1]	Period of Record as of 1966		Collecting agency	Closed
		Precipitation	Temperature		
Alvin Callender Field	2	1956 to 1959	1956 to 1959	U.S.Weather Bureau	2/1960
Buras	2A	1945 to date	1945 to date	"	
Burrwood	9	1907 to 1964	1907 to 1964	"	2/1965
Boothville	9A	1965 to date	1965 to date	"	
Delta Farms	5	1911 to 1944	1911 to 1944	"	
Diamond	6	1891 to 1919	1891 to 1919	"	
Diamond 4 NW		1959 to date	1959 to date	"	9/1958
Golden Meadow	7	1954 to 1958	1954 to 1958	"	9/1958
Golden Meadow 9 NW		1959 to date	1959 to date	"	
Grand Isle	8	1940 to date	1949 to date	"	
Houma	4	1890 to date	1889 to date	"	
New Orleans W.B.Office New Orleans W.B.New Fed.	1	1836 to date	1871 to date	"	
Paradis	3	1911 to 1953		"	
Paradis 7S		1954 to date	1954 to date	"	
Port Sulphur	16	1935 to 1964	1935 to 1964	"	1/1965

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[1] See plate A-1

TABLE A-5
TIDE GAGING STATIONS

Location	Map index No.[1]	Period of record	Type gage	Gage zero feet m.s.l.	Collecting agency
Bayou Lafourche					
Leeville, La.	12	1955 to date	Recording	0.0	NOD
		Installed in 1956	H.W.P.	4.16	NOD
Bayou Barataria	11	1963 to date	Recording	0.0	NOD
Lafitte, La.		1955 to date	Staff	0.0	NOD
		Installed in 1956	H.W.P.	3.54	NOD
Bayou Barataria	10	Installed in 1957	H.W.P.	4.37	NOD
Barataria, La.		1950 to date	Recording	-0.78	NOD
Bayou Rigaud					
Grand Isle,La.	15	1947 to date	Recording	-4.70	USC&GS

LEGEND

[1] Plate A-1

H.W.P. = High water pipe

NOD = U. S. Army Engineer District, New Orleans

USC&GS = U. S. Coast and Geodetic Survey (now National Ocean Survey)

TABLE A-6
RECORD HIGH WATER

Location of gage	Water surface elevation in feet above mean sea level			
	Hurricane Flossy Sept 1956	Hurricane Carla Sept 1961	Hurricane Hilda Oct 1964	Hurricane Betsy Sept 1965
Bayou Lafourche				
Leeville	3.2	4.0	5.5	5.4
Bayou Rigaud				
Grand Isle	4.6	3.7	5.9 estimated	7.5[1]
Bayou Barataria				
Lafitte	2.0	-	4.0	3.4
Barataria	2.0	3.3	3.6	3.5

[1] The hurricane tide gage located at the U. S. Coast Guard Station near the center of Grand Isle recorded a maximum of 8.8 feet.

SECTION II - TIDAL HYDRAULIC DESIGN

3. Description and verification of procedures.

a. Hurricane memorandums. The Hydrometeorological Branch (HMB), U. S. Weather Bureau, cooperated in the development of hurricane criteria for experienced and potential hurricanes in the project area. Memorandums prepared by the HMB provided isovel patterns, hurricane tracks, pressure profiles, rainfall estimates, frequency data, and various other parameters required for the hydraulic computations. A reevaluation of historic meteorologic and hydrologic data was the basis for memorandums relative to experienced hurricanes. Those relative to potential hurricanes were developed through the use of generalized estimates of hurricane parameters based on the latest research and concepts of hurricane theory. Memorandums applicable to the project area are listed in Section IV, Bibliography.

b. Historical storms used for verification. Two observed storms, with known parameters and effects, were used to establish and verify procedures and relationships for determining hurricane surge heights. These storms occurred in September of 1915 and 1956. Isovel patterns for the hurricanes of 1915(1)[2], and 1956(2) are shown on plates A-3 and A-4, respectively.

(1) The hurricane of 29 September 1915 had a central pressure index (CPI) of 27.87 inches, an average forward speed of 10 knots, and a maximum windspeed of 99 m.p.h. at a radius of 27 nautical miles. This hurricane approached the mainland from the south. Grand Isle and Leeville experienced tides up to 9 feet while Golden Meadow had tides up to 5 feet.

(2) Hurricane Flossy, 23 September 1956, had a CPI of 28.76 inches, an average forward speed of 10 knots, and a maximum windspeed of 80 m.p.h. at a radius of 30 nautical miles. Flossy approached the mainland from the southwest. A surge height of 8 feet occurred at Grand Isle, and only unfavorable wind direction prevented serious flooding in the Larose-Golden Meadow area.

c. Synthetic storms. Computed hurricane surge heights, resulting from synthetic storms, are necessary for frequency and design computations. Parameters for certain synthetic storms and methods for derivation of others were furnished by the National Weather Service. The standard project hurricane (SPH) for the Louisiana coast was used as the base hurricane since other hurricanes could be derived from it. The probable maximum hurricane (PMH) and moderate

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[2] Numbers in parentheses indicate references in Section IV of this appendix.

hurricane (Mod H) were derived from the SPH and differ from it only in wind velocity and CPI's.

(1) The SPH used in the "Interim Survey Report, Grand Isle, Louisiana and Vicinity," was derived by the National Weather Service from a study of 42 hurricanes that occurred in the region over a period of 57 years. Based on later studies, the National Weather Service revised the original SPH windfield patterns (3)(4). However, subsequent studies(5) which utilized 48 hurricanes that occurred in the region over a period of 69 years determined that a slight change in the CPI should be made. The hurricane track critical to Golden Meadow and the SPH isovel patterns at the critical hour are shown on plate A-5 and the track and pattern critical for Larose and vicinity are shown on plate A-6.

(a) The SPH has a return frequency of once in 100 years for the Louisiana coastal region. The CPI that corresponds to this frequency is 27.5 inches. CPI probabilities are based on the following relationship(6):

$$P = \frac{100\ (M-0.5)}{Y}$$

where P = percent chance of occurrence per year
M = number of the event (rank)
Y = number of years of record

(b) Radius of maximum winds is an index of hurricane size. The average radius of 12 hurricanes occurring in the vicinity of the project area is 36 nautical miles. From relationships of CPI and radius of maximum winds of gulf coast hurricanes(6), a radius of 30 nautical miles is considered representative for an SPH having a CPI of 27.5 inches.

(c) Different forward speeds are necessary to produce maximum design hurricane stages at various locations. An average forward speed of 10 knots was used for hurricanes critical to the project area.

(d) Maximum theoretical gradient wind(6) is expressed as follows:

$$V_{gx} = 73 \quad P_n-P_o - R\ (0.575f)$$

where V_{gx} = maximum gradient windspeed in miles per hour

P_n = asymptotic pressure in inches

P_o = central pressure in inches

R = radius of maximum winds in nautical miles

f = Coriolis parameter in units of hour^{-1}

The estimated windspeed (30 feet above surface level) (v_x)(7) in the region of the highest speeds is obtained as follows:

$$V_x = 0.885\ V_{gx} + 0.5T$$

where T = forward speed in miles per hour. From these relationships, a windspeed of approximately 100 m.p.h.[3] was obtained for the SPH.

(2) A CPI of 26.9 inches was recommended for the PMH by the National Weather Service.(5)(8)(9) A hurricane with this CPI actually occurred at 33° N. latitude. Other synthetic storms of different frequencies and CPI's are derived from the SPH. With the exception of the PMH, other CPI's for desired frequencies are obtained from the graph shown on plate A-7. V_{gx}'s corresponding to any other CPI are determined similarly by use of the method described for the SPH. Variations in CPI's of historic storms were accomplished by the same procedure(6). Characteristics of synthetic storms critical to the project area and some historic storms are listed in table A-7.

TABLE A-7

HURRICANE CHARACTERISTICS

Hurricane[1]	CPI inches	Radius of Max. winds nautical miles	Forward speed knots	V_x m.p.h.
Sept 1915	27.87	29	10	99
Sept 1956	28.76	30	10	80
Sept 1965	27.79	32	17	122
Track B PMH	26.9	30	10	114
Track B SPH	27.5	30	10	100
Track B Mod H	28.3	30	10	83

[1] Tracks are shown on plate A-8.

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[3] Windspeeds represent a 5-minute average, 30 feet above surface level.

d. Surges.

(1) Maximum hurricane surge heights along the gulf shore were determined from computations made for ranges extending from the shore out to the continental shelf by use of a general wind tide formula that is based on the steady state conception of water superelevation(10)(11)(12). In order to reach agreement between computed maximum surge heights and observed high water marks, it was necessary to introduce a calibration coefficient or surge adjustment factor into the general equation which, in its modified form, is:

$$S = 1.165 \times 10^{-3} \frac{V^2F}{D} N\ Z\ \mathrm{Cos}\ \theta$$

where S = wind setup in feet
V = windspeed in statute miles per hour
F = fetch length in statute miles
D = average depth of fetch in feet
θ = angle between direction of wind and the fetch
N = planform factor, generally equal to unity
Z = surge adjustment factor

(2) Water surface elevations along a range were determined by incremental summation of wind setup above the water elevation at the gulf end of the range. The marshland between the gulf and the project area was considered submerged prior to the time of maximum elevation at the surge reference line. Initial elevation at the beginning of each range was determined from the predicted normal tide and the setup due to atmospheric pressure anomaly. Typical tidal cycles for the project area are shown on plate A-2. An adjustment was made at the shoreward end of the range to compensate for the difference in pressure setup between the ends of the range. This procedure for the determination of surge height at the coastline was developed for an area along the Mississippi gulf coast where reliable data were available at several locations for more than one severe hurricane. The procedure was then used for the entire Louisiana coastal region. Due to dissimilar shoreline configurations and offshore depths, different surge adjustment factors were required at each location, but identical factors were used at a particular location for each storm. The value of the factor is apparently a function of the distance between the shoreline and deep water and varies inversely with this distance. Comparative computed maximum elevations and observed high-water elevations for the 1915 and 1947 hurricanes at the locations that were used in the development of the procedure are shown in table A-8.

TABLE A-8

HURRICANE SURGE HEIGHTS

Location	Surge adjustment factor(Z)	1915		1947	
		Observed	Computed	Observed	Computed
		feet m.s.l.		feet m.s.l.	
Bay St. Louis, Miss.	0.46	11.8	11.8	15.2	15.1
Gulfport, Miss.	0.60	10.2[1]	9.9	14.1	14.3
Biloxi, Miss.	0.65	10.1[1]	9.8	12.2[1]	12.6

[1] Average of several high water marks.

(3) The incremental step computation was used to check experienced maximum hurricane surge heights at several locations in and near the project area. Verification of these surge heights and the surge adjustment factors used in the computations are shown in table A-9.

TABLE A-9

VERIFICATION OF HURRICANE SURGE HEIGHTS

Location	Sep.1915		Sep.1956 (Flossy)		Surge adjustment factor(Z)
	Observed	Computed	Observed	Computed	
Grand Isle					
Flooding from front	9.0	8.8	3.9	4.1	0.80(a)
Flooding from rear	-	-	8.0	7.8	0.80(a) 0.48(b)
Manila	8.0	8.5	-	5.1	0.48(b)
Leeville	9.0	8.6	-	-	0.50(c)
Golden Meadow	5.5	6.1	-	-	0.50(c)

(a) In Gulf of Mexico
(b) In Barataria Bay
(c) Through Timbalier Bay

(4) Surge heights were computed for hurricane Betsy, September 1965, at Grand Isle within the study area where reliable observed surge heights were available. Using the same Z factors as shown in table A-9, the computed surge heights averaged about 0.8 foot higher than the observed surge heights. This apparently was the effect of the higher forward speed of Betsy. A fast-moving hurricane does not allow enough time for the surge heights to approach the steady state of water superelevation(10)(11)(12). In addition,

the computed surge heights were based on the assumption that the island was high enough to prevent overtopping and thus allow generation of maximum surge heights. During Betsy, most of the island was overtopped and this caused the observed surge heights to be lower than if levees were in existence and high enough to prevent overtopping. However, it was determined that the Z factors derived from the slow-moving hurricanes should be used for design purposes since this type of hurricane is more typical in the project area.

(5) The storms under consideration are accompanied by strong winds. For each surge computation, the average windspeed and average depth were determined from isovel and hydrographic charts, respectively. The storm isovel patterns were furnished by the Weather Service(13)(14).

(6) Marshlands fringe the coastline and are inundated for considerable distances inland by hurricane surges that approach the shores. The limit of overland surge penetration is dependent upon the height of the surge and the duration of high stages at the coast. The surge height at the coastline depends primarily on the direction and intensity of winds and the hurricane velocity of translation. Bays are prevalent in the project area and influence surge heights at inland locations. The routing of these surges overland by conventional methods was complicated by the undefinable effect of high windspeeds on flow, such that the procedures yielded questionable results when applied to different experienced hurricanes in a given location. Attempts to correlate hurricane translation speeds, surge hydrographs at the coastline, and surge heights at inland locations also yielded inconsistent and therefore unusable relationships. A study of available observed high water marks at the coastline and inland indicates a consistent simple relation between the maximum surge height and the distance inland from the coast, as shown on plate A-9. This relationship exists independently of the speed of hurricane translation, windspeed, or direction. The data indicate that the weighted mean decrease in surge heights inland is at the rate of 1.0 foot per 2.75 miles. This relationship remains true even in the western portion of Louisiana where relatively high chenieres, or wooded ridges, parallel the coast. Efforts to establish time lags between the crest surge heights at the coast and at inland locations were unsuccessful because of inadequate basic data.

(7) For the purpose of surge routing procedures, the coastline is defined as the locus of points where the maximum surge heights would be observed along fetches normal to the general coast. This synthetic coastline has been designated the surge reference line (SRL) and is shown on plate A-1. In order to determine maximum surge heights at inland locations it was necessary to compute maximum surge heights at the SRL, and then reduce these computed elevations at the rate of 1.0 foot per 2.75 miles to the location of interest. The procedure has given satisfactory results in the project area, and has verified the observed data in other areas of study.

(8) An example of the setup computation for one increment (Δ F) along a range radiating from the surge reference line in the vicinity of Golden Meadow for an SPH along Track B at +6 hours (forward speed = 10 knots) landfall of the hurricane is as follows:

(a) Initial elevation:

Normal pressure = 30.14 inches of mercury
Pressure at beginning of range 107 miles from center = 29.36 inches of mercury
Deviation from normal pressure = 0.78 inch of mercury
Pressure setup 0.78 x 1.14 feet = 0.89 foot of water
Normal predicted tide = 0.93 foot above mean low water (m.l.w.)
Initial elevation = 1.82 feet m.l.w.

(b) Incremental setup (for setup between adjacent stations on range):

Sta. Mi.	F Mi.	V m.p.h.	Cos θ	V^2 Cos θ	Average V^2 Cos θ	Normal depth in ft.[1] m.l.w.	D = ΣS+ Av.Nor.D+1.82 +Δ S/2 ft.	Δ S ft.	Σ S ft.
5.0		90	1.000	8100		3.0			9.23
	5.0				7922		13.41	1.72	
0.0		88	1.000	7744		0.0			10.95

$$S = 1.165 \times 10^{-3} \times \frac{7922 \times 5.0}{13.41} \times 1 \times 0.50 = 1.72'$$

(c) Setup for pressure differential:

Normal pressure = 30.14 inches of mercury
Pressure at end of range, 26 miles from center = 28.45 inches of mercury
Deviation from normal = 1.69 inches of mercury
(1.69x1.14 feet) = 1.93 feet of water
Deviation at beginning = -0.89 foot of water
Differential setup = 1.04 feet

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[1] Normal depths are positive below mean low water datum for this computation.

(d) Surge height at surge reference line:

Pressure setup at beginning of range = 0.89 foot
Normal predicted tide = 0.93 foot m.l.w.
Correction m.l.w. to m.s.l. =-0.60 foot
S (wind setup) =10.95 feet
Pressure differential setup = 1.04 feet
Surge height at surge reference line =13.21 feet m.s.l.

(e) Final surge height:

Since the surge height was computed for the SRL and the lower portion of the area to be protected is located 3 miles above, an adjustment was necessary to determine the surge height at the lower end of the area.

The adjustment was accomplished as follows:

$\frac{3 \text{ miles}}{1 \text{ ft}/2.75 \text{ mi.}}$ = 1.09 ft. dropoff (see par.3.d.(6) and (7)).

Therefore, the surge height for the SPH at the lower end of the project area is (13.21-1.09) 12.1 feet. This procedure was used also to determine surge heights for the other locations of the project area.

e. <u>Wave runup</u>.

(1) Wave runup on a protective structure depends on the characteristics of the structure (i.e., configuration and surface roughness), the depth of water at the structure, and wave generating forces over the fetch. The vertical height to which water from a breaking wave will run up on a given protective structure determines the top elevation to which the structure must be built to prevent wave overtopping.

(2) Computations were made to determine wave runup for protective systems along the project alignment. The protective system along the alignment consists almost exclusively of levees. For economic reasons, a vertical wall will be constructed adjacent to the navigation floodgate located at the lower end of the project. Overtopping volume of flow from the design hurricane will be negligible and no flooding of consequence will be experienced within the protected area.

(3) In order to compute wave runup on a protective structure, the significant wave height (H_s) and wave period (T) in the vicinity of the structure must be known. They were determined according to Bretschneider(15) and as described in paragraph 1.25 of reference(10). The windspeed and depth used in determining H_s and T were average values over a 5-mile fetch. Data used to determine wave characteristics in the vicinity of the proposed protective levee at Golden Meadow are shown in table A-10.

TABLE A-10

DATA USED TO DETERMINE WAVE CHARACTERISTICS

DESIGN HURRICANE

Pertinent factors	Golden Meadow Levee
F - Length of fetch, miles	5
U - Windspeed, m.p.h.	77
s.w.l. - Stillwater elevation, feet	10.2
d - Average depth of fetch, feet	7.2

(4) Wave runup was calculated by use of model study data developed by Saville(16)(17)(18)(19) which relate relative runup (R/H_o'), wave steepness (H_o'/T^2), and relative depth (d/H_o'). The average depth (d) of the 5-mile fetch is shown in table A-10, and the significant wave height (H_s) and wave period (T) can be determined from the data in table A-10. The equivalent deep water wave height (H_o') can be determined from table D-1 of reference (9) which relates d/L_o to H/H_b. The deep water wave length (L_o is determined from the equation:

$$L_o = 5.12\ T^2$$

When determining runup from the significant wave, H in the term H/H_o' is equal to H_s. Wave characteristics used in computing runup from the significant wave at Golden Meadow are shown in table A-11.

TABLE A-11

WAVE CHARACTERISTICS

DESIGN HURRICANE

Characteristics	Golden Meadow Levee
H_s - Significant wave height, feet	3.30
T - Wave period, seconds	4.40
L_o - Deepwater wave length, feet	99.12
d/L_o - Relative depth	0.07264
H_s/H_o' - Shoaling coefficient	0.9665
H_o' - Deepwater wave height, feet	3.41
H_o'/T^2 - Wave steepness	0.176

(5) With the terms d/H_o' and H_o'/T^2 known, runup on a protective structure can be computed if the slope of the structure is known. The levee configurations used in these computations had stabilizing berms on the water side. These berms broke the continuity of the levee slope and Saville's(19) method of determining wave runup on composite slopes was used (see plate A-10). In using this method, the actual composite slope is replaced by a hypothetical single constant slope. This hypothetical slope is computed by estimating a value of wave runup and then determining the slope of a line from the point where the wave breaks to the estimated point of runup. The breaking depth is determined from the equation:

$$d_b = \frac{0.667H_o'}{(H_o'/T^2)\ 1/3}$$

Using the slope of this line, which is the hypothetical slope, a value of runup is determined. If the value of runup determined is different from the estimated runup, the process is then repeated using the new value of runup to obtain a new hypothetical slope, which, in turn, determines a new value of runup. This process is repeated until the estimated value of runup agrees with the computed value of runup.

(6) Protective levees exposed to wave runup will be constructed to an elevation that is sufficient to prevent all overflow from the significant wave and waves smaller than the significant wave accompanying the design hurricane. Waves larger than the significant wave will be allowed to overtop the protective structures but such overtopping will not endanger the security of the protective structures or cause excessive interior flooding. During the time of maximum hurricane surge height the berms on the water side of the levees become submerged and waves of lesser height than the significant wave, but of the same period, break farther up the levee slope. Sometimes runup

from these smaller waves reaches an elevation higher than that from the significant wave; therefore, runup resulting from these smaller waves must also be computed. The equivalent deepwater wave height for the smaller waves breaking on the berms was computed by the equation:

$$H_o' = \frac{1.84}{T} (d_b)^{3/2}$$

Runup was computed for the significant wave and for smaller waves breaking on each berm and the required levee height was determined by adding the highest computed runup value to the maximum still-water elevation. Design runup values and proposed elevations of the proposed protective levee at Golden Meadow are shown in table A-12. The elevation of levees not exposed to wave runup will be approximately 1 foot higher than the maximum surge height for the design hurricane. Floodwalls constitute a minute portion of the overall protective structures and slight overtopping of the walls would occur in the event of the occurrence of a design hurricane. However, such overtopping would be minimal and no serious flooding would result.

TABLE A-12

DESIGN WAVE RUNUP AND DESIGN ELEVATIONS OF PROTECTIVE LEVEE

DESIGN HURRICANE

Location	Av. depth ft.	Surge height ft.m.s.l.	Design runup ft.	Design elevation protective levee ft.m.s.l.
Golden Meadow	8.2	10.2	2.8	13.0

f. Residual flooding. Protective structures, except for the vertical wall near the Golden Meadow Floodgate, were designed to prevent wave overtopping from the significant or any lower wave that would be experienced during an occurrence of the design hurricane. However, 14 percent of the waves in a spectrum are higher than the significant wave and the maximum wave height to be expected is about 1.87 times the significant wave height. Thus, the protective structures herein may be overtopped by those waves of the spectrum which exceed the significant wave. Studies indicate that no significant flooding will result from such overtopping.

4. Frequency estimates.

a. Procedure.

(1) In order to properly design protective works, it was necessary to develop a hurricane stage-frequency relationship. However, in the area under consideraton, though there have been numerous hurricanes, specific information related to surge heights

and high-water elevation are not available in sufficient quantity to develop frequencies from actual observed hurricane data. Therefore, it was necessary to use synthetic hurricanes to derive the data necessary to develop frequencies. It has been shown in recent studies that there is a close agreement between a frequency derived from known events and a frequency computed using synthetic hurricanes. Because of this agreement, computations from the synthetic hurricanes were used to determine the stage-frequencies for the project area. The procedure used for the development of these relationships is discussed in the following paragraphs.

(2) Prior to 1900, information of record dealt primarily with loss of life and damage in the more densely populated areas, with practically no reference to water surface elevations caused by hurricanes. Only since 1900 has detailed information been available on flooding in coastal Louisiana and adjacent areas. Subsequent to the widely destructive September 1915 hurricane, Charles W. Okey(20), Senior Drainage Engineer, Office of Public Roads and Rural Engineering, U. S. Department of Agriculture, made a thorough survey of the coastal areas between Biloxi, Mississippi and Palacios, Texas. The 1915 investigation is the only known area-wide study containing reliable stages prior to the investigation of hurricane Flossy, September 1956. The data indicated that no one locality along the Louisiana coast is more prone to hurricane attack than another.

(3) The first requirement in the development of synthetic frequency relationships for localities within the project area was to select representative critical hurricane tracks for the particular locale in question. Track B, approaching from a southerly direction, was selected as being most critical for the area and is shown on plates A-5, A-6, and A-8. Track F, approaching from an easterly direction, was selected as a secondary track and is shown on plate A-8.

(4) Surge heights were then developed for at least three storms of different CPI values for each selected track. Each hurricane selected was assumed to have the same radius of maximum winds, the same speed of translation, and the same adjustment for any land effects. Conversion of wind fields of hurricanes of different CPI's requisite to computing surge heights is covered in paragraph 3.c.(2). Surge elevations for storms with other CPI values were obtained graphically by plotting the above data and reading from the resulting curves.

(5) Hurricane characteristics of area-representative storms were developed in cooperation with the Weather Service.

This agency made a generalized study of hurricane frequencies for a 400-mile zone along the central gulf coast, Zone B, from Cameron, La., to Pensacola, Fla., and presented in memorandums(5)(6). Frequencies for hurricane central pressure indexes that were presented in the report,(5) as shown on plate A-7, reflect the probability of hurricane recurrence from any direction in the midgulf coastal area. In order to establish frequencies for the localities under study, it was assumed that a hurricane whose track is perpendicular to the coast will ordinarily cause high tides and inundation for a distance of about 50 miles along the coast. Thus, the number of occurrences in the 50-mile subzone would be 12.5 percent of the number of occurrences in the 400-mile zone, provided that all hurricanes traveled in a direction normal to the coast. However, the usual hurricane track is oblique to the shoreline as shown in table 2 of the HMB memorandum(6). The average projection along the coast of this 50-mile swath for the azimuths of 48 Zone B hurricanes is 80 miles. Since this is 1.6 times the width of the normal 50-mile strip affected by a hurricane, the probability of occurrence of any hurricane in the 50-mile subzone would be 1.6 times the 12.5 percent, or 20 percent of the probability for the entire midgulf Zone B. Thus, 20 percent of the Zone B frequencies shown in table B(5) (updated) was used to represent CPI frequencies in the 50-mile subzone that is critical for each study locality.

(6) The azimuths of tracks observed in the vicinity of landfall were divided into quadrants corresponding to the four cardinal points. In Zone B, 32 tracks were from the south and west and 16 were from the east. Hurricanes with tracks having major components from south or west are more critical relative to surge heights in the Larose-Golden Meadow area than hurricanes from other directions. Hurricanes from the south and west constitute approximately two-thirds of all hurricanes experienced in the area, and those from the east, one-third of all hurricanes. The average azimuth of tracks from the south was 180°. Tracks from the east had an average azimuth of 117°. Approximately these azimuths were used for the model hurricanes in computing surges. Further adjustment of the probability of occurrence was made by using two-thirds of the probability for stages computed for hurricanes approaching from the south and the west and one-third of the probability for stages computed for hurricanes approaching from the east. The probability of equal stages for both groups of tracks were then added arithmetically to develop a curve representing a synthetic probability of stages for hurricanes from all directions.

(7) Table A-13 illustrates the synthetic frequency computation for surges from the gulf for the Golden Meadow area. Computations for the other locations in the project area (Larose east and Larose west) are similar in nature except for variation in surge heights.

TABLE A-13
STAGE-FREQUENCY COMPUTATION
GOLDEN MEADOW, LA.

	ZONE B		80-MILE SUBZONE						
CPI	Probability		Probability All tracks	SOUTH TRACKS		EAST TRACKS		SOUTH & EAST TRACKS[1]	
in. Hg.	yrs.	occ/100 years	occ/100 years	Stage feet m.s.l.	Probability occ/100 years	Stage feet m.s.l.	Probability occ/100 years	Stage feet m.s.l.	Probability occ/100 years
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
29.0	2.5	40	8.0	5.6	5.33	5.1	2.67	6.0	6.70
28.3	10.0	10	2.0	9.5	1.33	8.5	0.67	8.0	3.34
28.0	20.0	5	1.0	10.5	0.67	9.4	0.33	9.0	2.14
27.8	50.0	2	0.4	11.5	0.27	10.3	0.13	10.5	0.78
27.6	100.0	1	0.2	12.1	0.13	10.8	0.07	12.1	0.13

Col. (4) - 20 percent of Col. (3)
Col. (6) - 2/3 of Col. (4)
Col. (8) - 1/3 of Col. (4)
Col. (10)- Curves (A) + (B) of plate A-13

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[1] Independent of CPI in Col. (1)

b. Relationships. Based on the procedures described above, stage frequency relationships were established under existing conditions for flooding by hurricane surges. Stage-frequency curves for Golden Meadow are shown on plate A-11 and stage frequency curves for areas east and west of Larose are shown on plate A-12.

5. Design hurricane.

a. Selection of the design hurricane. Since the project area is sparsely populated, the hurricane that would produce the 100-year stage was selected as the design hurricane (Des H). A design hurricane of lesser intensity which would indicate a lower levee grade and increased frequency would expose the protected areas to hazards to life and property that would be disastrous in the event a hurricane with the intensity and destructive capability of the Des H or the SPH occurred.

b. Characteristics. The Des H for the Larose-Golden Meadow area has a CPI of 28.1 inches and a maximum windspeed of 89 m.p.h. at a radius of 30 nautical miles. The forward speed of the hurricane is 10 knots. The hurricane parameters listed above were determined for the time the storms generated critical surge heights for the project area.

c. Normal predicted tide. The range of normal predicted tides in the project area is 1 foot and the mean tide is 0.3 foot m.s.l. The difference in height of hurricane surge heights for an occurrence of the Des H at high or low tides is only a few tenths of a foot. In determining the elevation of design surge heights, it was assumed that mean normal predicted tide occurs at the initial period of surges.

d. Design tide. The hurricane surge height is the maximum stillwater surface elevation experienced at a given location during the passage of a hurricane. It reflects the combined effects of the hurricane surge and the overland flow of the surge. Design hurricane surge heights were computed for conditions reflecting authorized protective works or improvements. Profiles showing design levee heights and maximum highwater profiles which would be experienced during the Des H along the authorized project levee alignment are shown on plate A-13.

SECTION III - HYDRAULIC DESIGN FOR INTERIOR DRAINAGE

6. General. The project area at the time of the survey study was drained by gravity through open channels with the exception of the Golden Meadow area which is ringed with approximately 3 miles of levee and drained by a pumping station. Accordingly the drainage plan presented in the survey report and the project document consists of modification to the Golden Meadow pumping station and installation of gravity drainage structures in the new levees.

Subsequent to completion of the survey report, local interests constructed low levees generally along the same alinement as that of the authorized hurricane protection levees. On the east side of Bayou Lafourche these levees extend from Larose to Yankee Canal, station 960+60. On the west side of Bayou Lafourche these levees are continuous throughout the project reach except between approximate stations 362+75 and 440+00. These levees were constructed for the development of agricultural lands, not for hurricane protection. Pumping stations consisting of lo-lift pumps driven by diesel engines and housed within a wooden frame building were provided to drain the areas.

Local interests have expressed their desire to have pumping stations installed as part of the hurricane protection project. The types of pumping stations installed by local interests subsequent to completion of the survey report are not adaptable to the hurricane protection project. Authority to construct pumping stations as part of the hurricane protection project does not exist. However, it is possible that local interests could be given credit toward developing a pumping system provided that the pumping system fulfills the drainage requirements established for the gravity system. The amount of credit that could be allowed to local interests would be equal to the Federal costs of the gravity system. Since the project area is divided into several drainage areas, pumping stations could be used for some of these areas and gravity drainage structures for the remaining areas.

The system developed for this design memorandum is based on the drainage system presented in the project document .

7. Description of drainage areas. The area to be included within the hurricane protection levee lies within the alluvial valley of the Mississippi River. The land consists primarily of low marshes created when Bayou Lafourche was a natural distributary of the Mississippi River and formed the Lafourche Delta. Ridges are apparent adjacent to the bayou which vary in height from nil on the coast to 6 feet at Larose, Louisiana.

8. Proposed plan of improvement. Levees will be constructed to enclose an area adjacent to and on either side of Bayou Lafourche from Larose to a point approximately 3 miles south of Golden Meadow. Interior levees will be constructed and existing canal connections with Bayou Lafourche will be closed by dikes to create eight separate and isolated gravity drainage areas. The levees will be constructed from material taken from borrow pits located principally within the area to be protected. These borrow pits will be continuous within each area and will carry storm runoff to the drainage structures. The drainage structures will consist of varying numbers of 6 foot diameter corrugated metal culvert pipes passing through the exterior levee. These culverts will be equipped with flap gates to allow passage of interior storm drainage and to prevent inflow of water from outside the levees during hurricanes. Slide gates will be provided to be used in the event that the flap gates become inoperative. Headwalls will be provided at all drainage structures on both the flood side and the protected side for erosion prevention and hydraulic efficiency.

9. Runoff losses. The only runoff loss which was considered in hydrologic computations is the loss due to infiltration of storm runoff into the soil. The loss due to infiltration of 0.10 inches per hour is normally used by the New Orleans District in areas where clayey soils predominate. This value is equivalent to a runoff factor of 0.70 for the 5 year-24 hour design storm, 0.79 for the 25 year-24 hour design storm, and 0.82 for the 100 year-24 hour design storm.

10. Design storm and inflow hydrographs.

a. Synthetic design storm data. Design storms for a duration of 24 hours and frequencies of 5, 25, and 100 years were synthetically produced by using the total rainfall for the given storm (as taken from U. S. Weather Bureau Technical Paper Number 40) and distributing this rainfall over a 24 hour period. Graphs of this rainfall distribution for the 5, 25,and 100 year storms are shown on plate A-14 with values of total rainfall and rainfall excess given. Also shown on plate A-14 is a curve of time in hours versus accumulated percent of rainfall prepared to obtain rainfall distribution for the desired period of time.

b. Bayou Lafourche stage data. Curves plotted from observed data showing daily high and low stages of Bayou Lafourche near its mouth versus percent of time at or above indicated times are shown on plate A-14. The tidal conditions at this location are considered typical of those at the outlets of the drainage structures. For design purposes, the 5-, 25-, and 100-year frequency storms, having total rainfalls of 7.90, 10.85 and 13.70 inches respectively, were assumed to occur when the stage outside the subject area (assumed equal to the stage of Bayou Lafourche near its mouth) was at 1.0 foot mean sea level. As can be seen from the stage duration curves for Bayou Lafourche, this water surface elevation has not been equalled or exceeded, on the average, more than 50 percent of the time.

c. Inflow hydrographs. Hydrographs of inflow were developed for each of the eight drainage areas by the application of the method of synthetic unit hydrographs to hourly rainfall excesses obtained from the design storms. Hydrographs of the 24-hour and 5-, 25-, and 100- year storms for the eight drainage areas are shown on plates A-15 through A-22.

11. Design of drainage structures.

a. Design criteria. Design of the drainage structures was based on the following three criteria:

(1) Duration of overflow on agricultural land should not exceed 24 hours for the 24-hour 5-year frequency storm. This criterion is based on the assumption that crops will not be permanently damaged as a result of temporary flooding of this duration. This criterion also insures that, since the agricultural lands are lower than residential areas, flooding of residential lands will not occur for the most frequent floods.

(2) The peak sump for the 24 hour 25-year frequency storm should be held about one-half to one foot below the elevation of populated areas. This restriction provides a safety factor for the most critical area - that being areas where flooding would be disastrous to both lives and property. This reserve depth would provide a storage volume for protection of the area against additional flooding which might result from rainfall occurring subsequent to the design storm. It also would provide for local drainage during and immediately after the design storm.

(3) Storage equivalent to 3 inches of runoff should be available below the minimum elevation of the improved land within 24 hours after the cessation of inflow from the design storm. It is considered that this available storage provides adequate protection against additional flooding from any rainfall which might reasonably be assumed to occur subsequent to the design storm.

(4) To preclude oversaturation of the soil, runoff from the design storm should be completely evacuated within 7 days after cessation of inflow.

(5) The stilling basins located at the outfall end of each drainage structure would be designed based on the peak discharge and velocity occurring as a result of the 24-hour 100 year frequency storm.

b. Drainage structure selection. Selection of the drainage structures was based on outflows as determined by flood routing procedures. This procedure requires the manipulation of three working curves: storage curves, discharge curves, and routing curves.

(1) Storage curves represent the storage characteristics of each drainage area and indicates the volume of storage which is available for a given stage in each particular drainage area. Storage curves are shown on plates A-15 through A-22.

(2) Discharge curves represent the quantity of water which will be passed by a given number of 6' diameter corrugated metal culverts when subjected to a given head. Computations of discharge were based on the assumption that the total head loss through a culvert is equal to the sum of the entrance loss, friction loss through

the pipe, and an exit loss. For the determination of entrance and exit losses, val es of 20% and 100% of the velocity head with the culvert flowing full were used, respectively. Friction losses were computed according to Manning's Equation using a roughness coefficient of 0.021 for corrugated metal and lengths which were established by levee stability analysis.

(3) Routing curves were developed using working values determined from storage and discharge values for a given stage and time intervals which were considered desirable to produce suitable curves.

c. Drainage Structure Descriptions. The water surface elevations at the outlets of the drainage structures vary with the tide. These structures will contain asbestos bonded corrugated metal culverts with paved inverts which will be equipped with flap gates and vertical slide gates. Under normal conditions of operations, the flap gates will automatically open or close to release intercepted runoff or to preclude inflows from the gulfside in accordance with stage differentials at the structure site. The vertical slide gates will be installed in operating towers and will insure against undesirable over flow in the event of failure of positive closure of the flap gates. The conduits will normally be fully submerged.

12. Results of routings. A trial procedure using the method of flood routings was used to obtain inflow, outflow, and sump pool elevation curves for the three design storms over each of the eight drainage areas and to select the appropriate number of 6 foot diameter corrugated metal culverts required to discharge the storm water and satisfy the criteria as set forth in article 11a above. These curves, with the peak for each indicated, are shown on plates A-15 through A-22. Other data pertinent to design are shown in table A-14 which follows.

13. Interior levee grades. The grades of the interior levees should provide 1 foot of freeboard above the maximum sump pool stages from the 24-hour 25-year storm occurring in conjunction with the flood side stage of +1.0 foot mean sea level.

TABLE A-14
STRUCTURE DESIGN STORM PERTINENT DATA

	AREA NO.							
	1	2	3	4	5	6	7	8
Drainage area, acres	5466	3027	3283	4544	5005	7808	3270	448
Min. elev. residential areas	4.0	3.0	4.0	3.0	3.0	3.0	4.0	3.0
Min. elev. cleared lands, ft.m.s.l.	1.3	2.2	3.0	2.0	2.0	3.0	2.0	2.0
Rainfall (25 yr. storm), inches	10.85	10.85	10.85	10.85	10.85	10.85	10.85	10.85
Infiltration loss (25 yr. storm), in/hr.	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Total infiltration loss (25 yr. storm), inches	2.27	2.27	2.27	2.27	2.27	2.27	2.27	2.27
Rainfall excess (25 yr. storm), inches	8.58	8.58	8.58	8.58	8.58	8.58	8.58	8.58
Time of concentration, hours	10	7	6	6	8	10	9	3
Number of 6'0 C.M.P. required	7	3	2	4	4	5	2	1
Gate opening below el. 0.0 m.s.l. ft.^{2}	197.9	84.8	56.5	113.1	113.1	141.4	56.5	28.3
Maximum inflow (25 yr. storm), c.f.s.	3763	2779	3411	4722	4128	5374	2449	799
Maximum outflow (25 yr. storm), c.f.s.	747	359	370	400	506	715	303	102
Maximum sump stage (25 yr. storm), ft. m.s.l.	1.61	1.76	2.58	1.72	1.94	1.96	2.02	1.65
Maximum head on structure (25 yr. storm), ft.	0.61	0.76	1.58	0.72	0.94	0.96	1.02	0.65
Maximum outflow (100 yr. storm), c.f.s.	853	408	404	451	577	804	342	117
Maximum velocity in culverts (100 yr. storm), f.p.s.	4.31	4.31	7.15	3.99	5.10	5.69	6.05	4.13
No. hrs. cleared land is inundated (5 yr. storm)	19	0	0	0	0	0	0	0
Time of complete evacuation of in. flow. after cessation of runoff, (25 yr. storm), hrs.	91	106	103	152	130	156	147	36
Storage available below min. elev. of cleared land 24 hrs. after cessation of runoff (25 yr. storm) in. runoff	1.0	6.0	6.9	5.5	3.6	12.4	3.0	8.4

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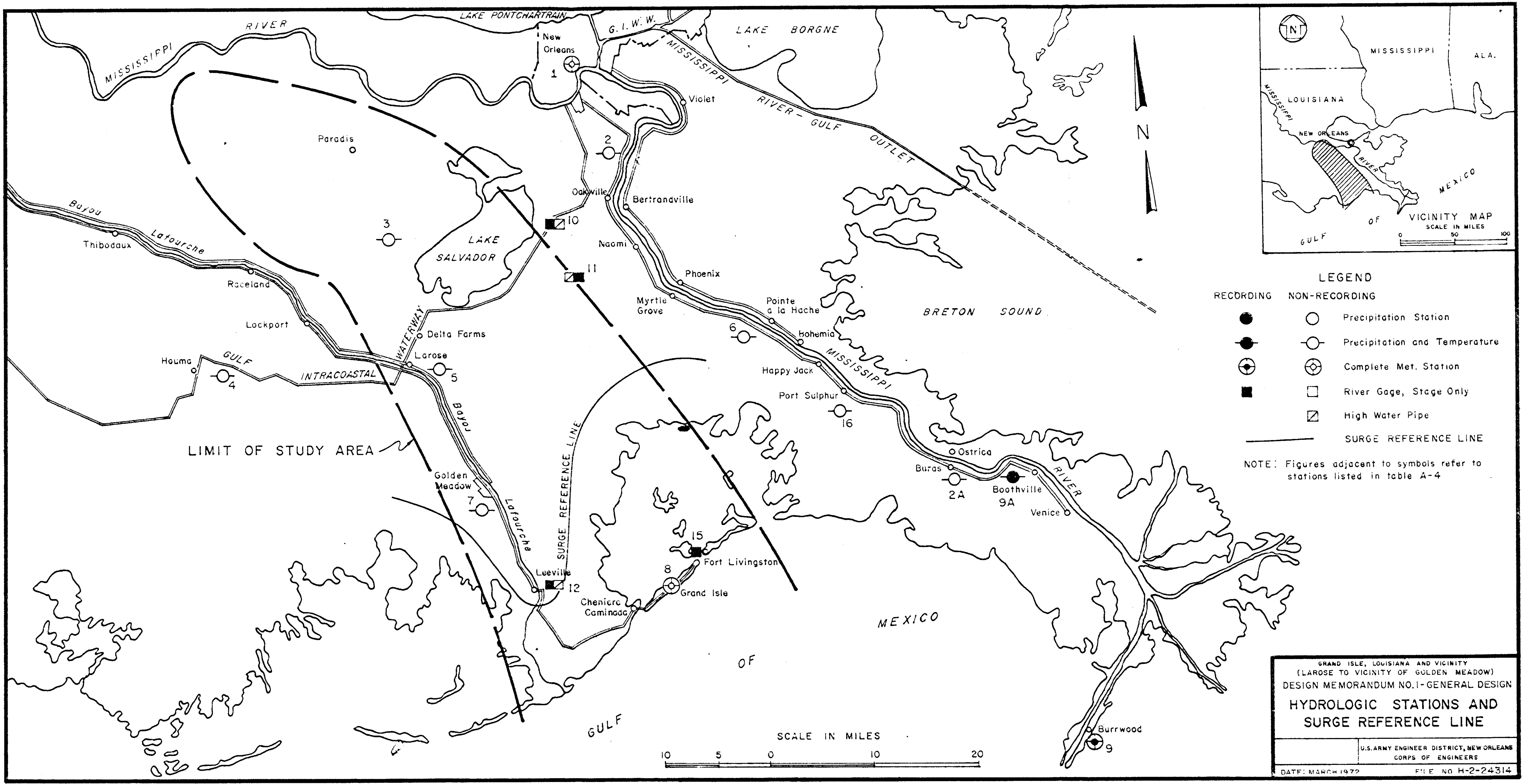
(28) University of California, "Effect of Bottom Roughness on Wind Tide in Shallow Water," Beach Erosion Board Technical Memorandum No. 95, May 1957.

(29) U. S. Weather Bureau, "Rainfall Frequency Atlas of the United States," Technical Paper No. 40, May 1961.



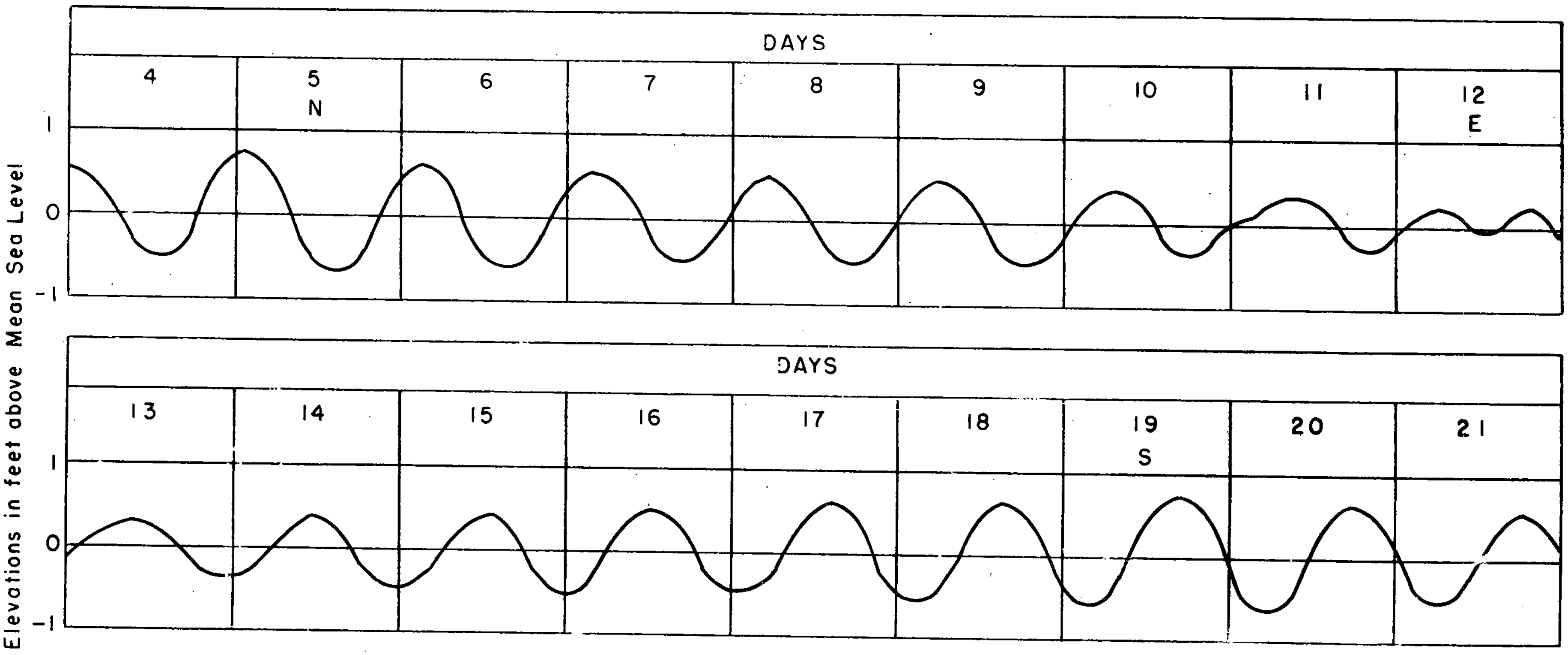
GRAND ISLE, LOUISIANA AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1-GENERAL DESIGN

HYDROLOGIC STATIONS AND SURGE REFERENCE LINE

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

DATE: MARCH 1972
FILE NO H-2-24314

PLATE A-1



LEGEND

E, moon on the equator
N, S, moon farthest north
or south of the equator

GRAND ISLE, LOUISIANA AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I-GENERAL DESIGN

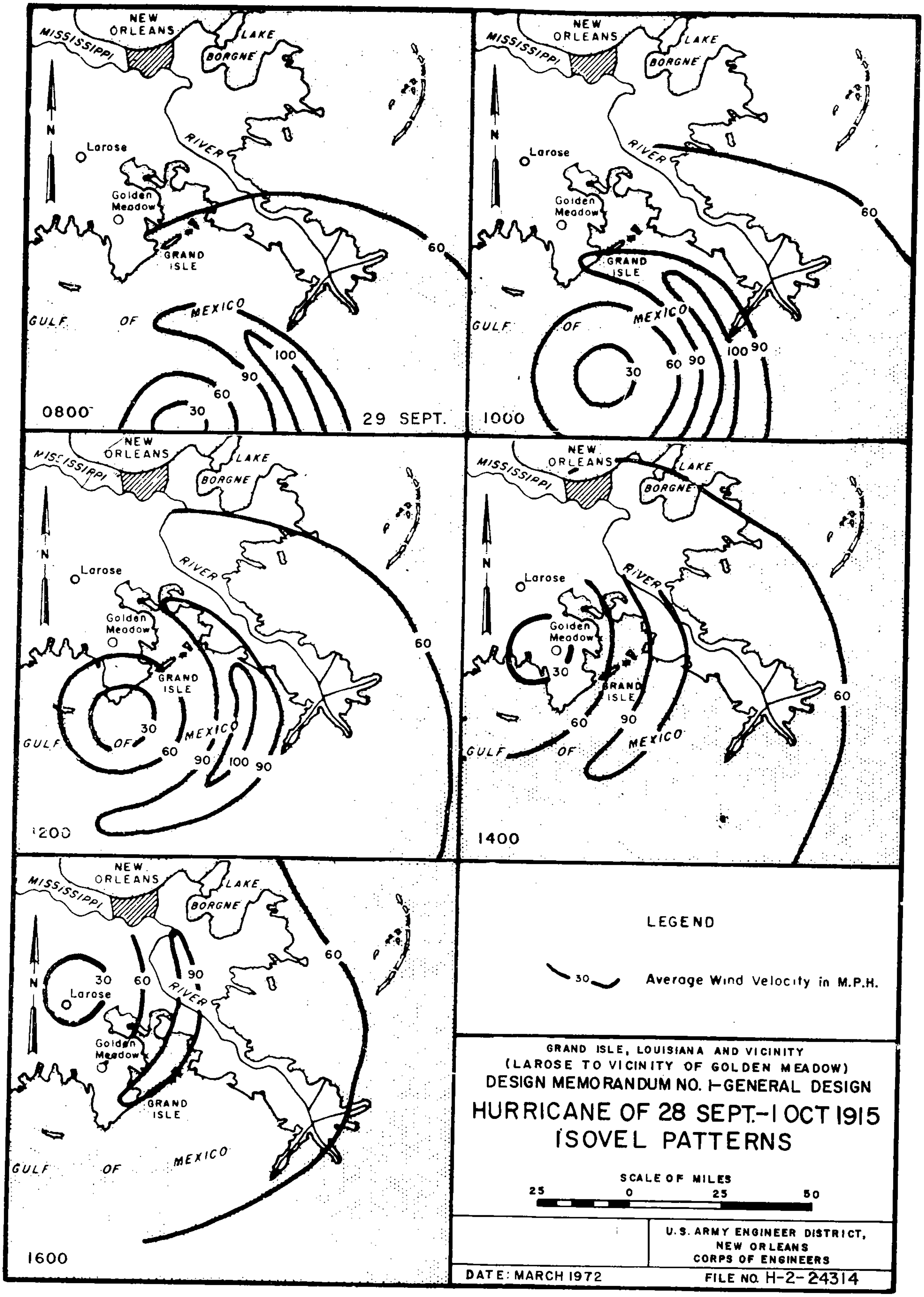
TYPICAL TIDAL CYCLES

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

DATE MARCH 1972

FILE NO. H-2-24314

PLATE A-2



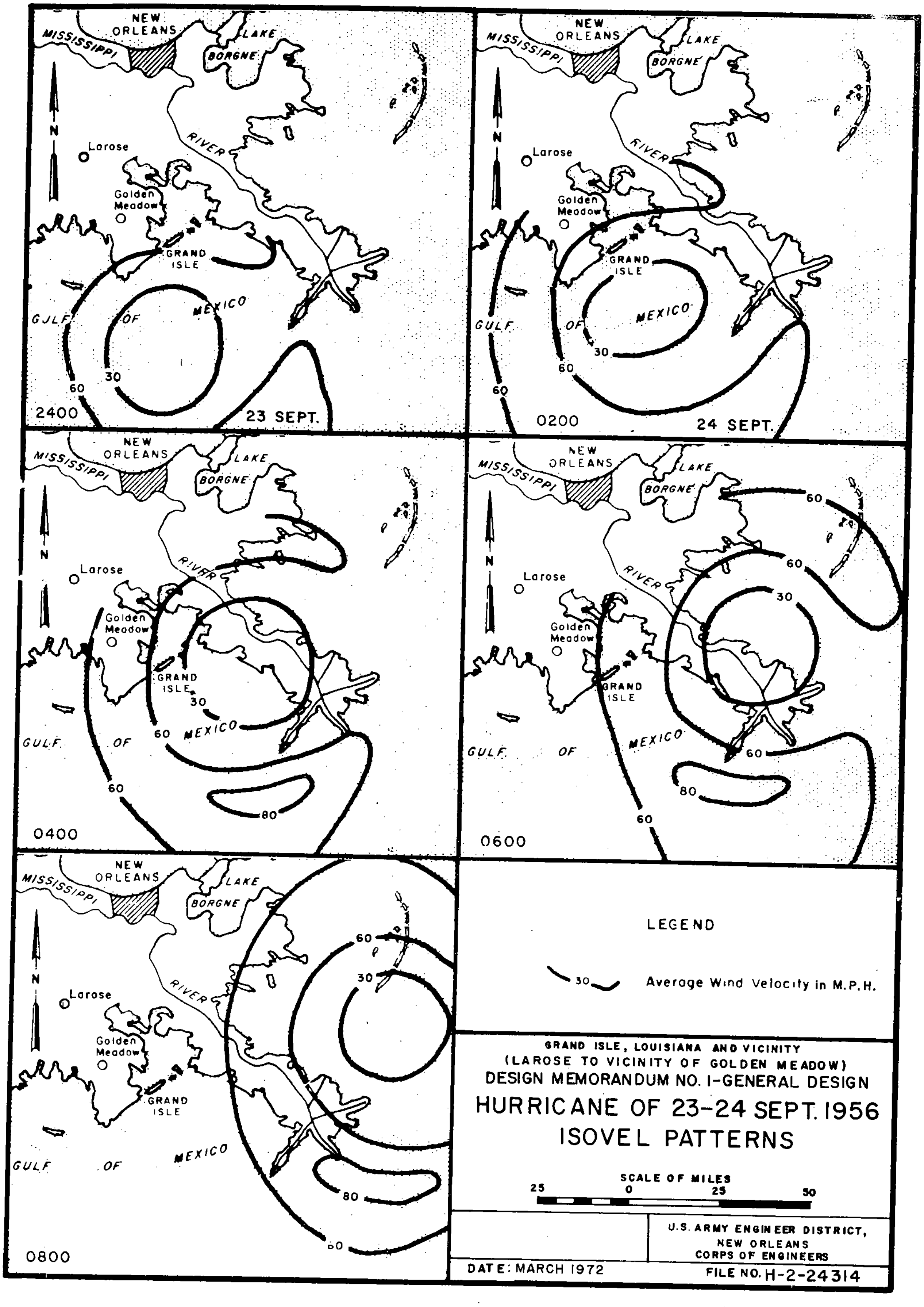
GRAND ISLE, LOUISIANA AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1-GENERAL DESIGN

HURRICANE OF 28 SEPT.-1 OCT 1915
ISOVEL PATTERNS

SCALE OF MILES
25 0 25 50

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

DATE: MARCH 1972
FILE NO. H-2-24314



LEGEND

30 Average Wind Velocity in M.P.H.

GRAND ISLE, LOUISIANA AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I-GENERAL DESIGN

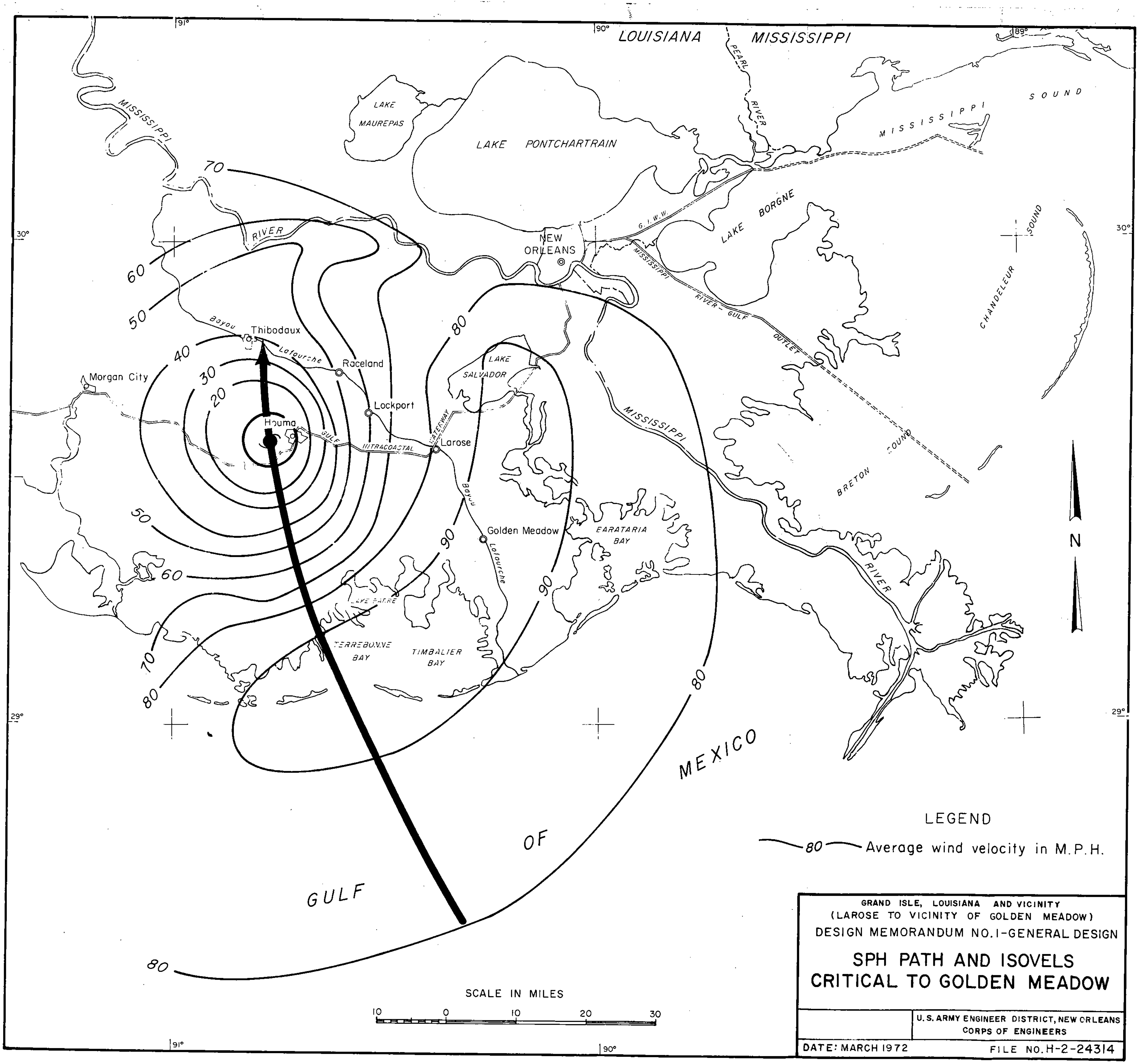
HURRICANE OF 23-24 SEPT. 1956
ISOVEL PATTERNS

SCALE OF MILES
25 0 25 50

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

DATE: MARCH 1972

FILE NO. H-2-24314



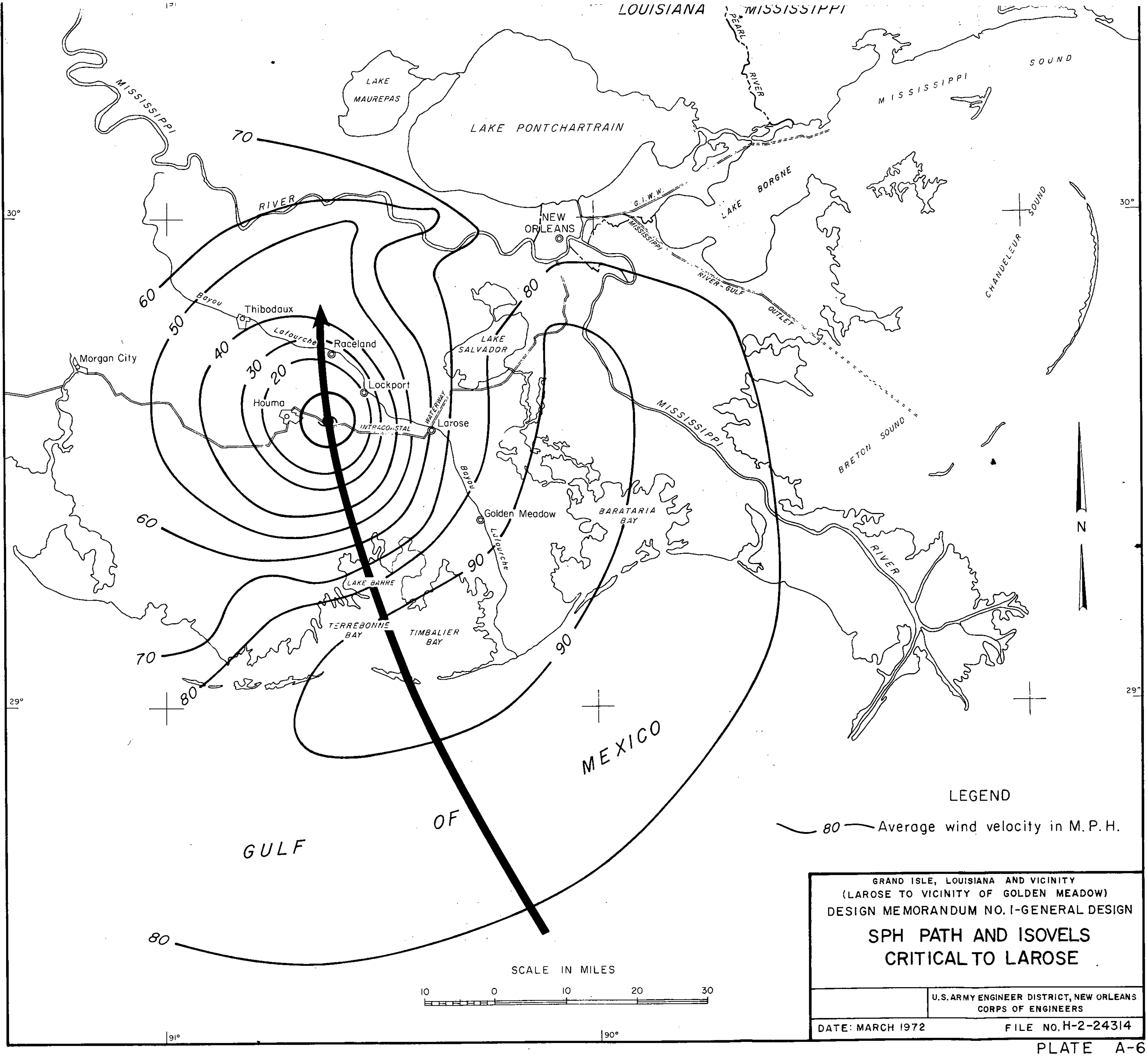
GRAND ISLE, LOUISIANA AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I-GENERAL DESIGN

SPH PATH AND ISOVELS CRITICAL TO GOLDEN MEADOW

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

DATE: MARCH 1972
FILE NO. H-2-24314

PLATE A-5



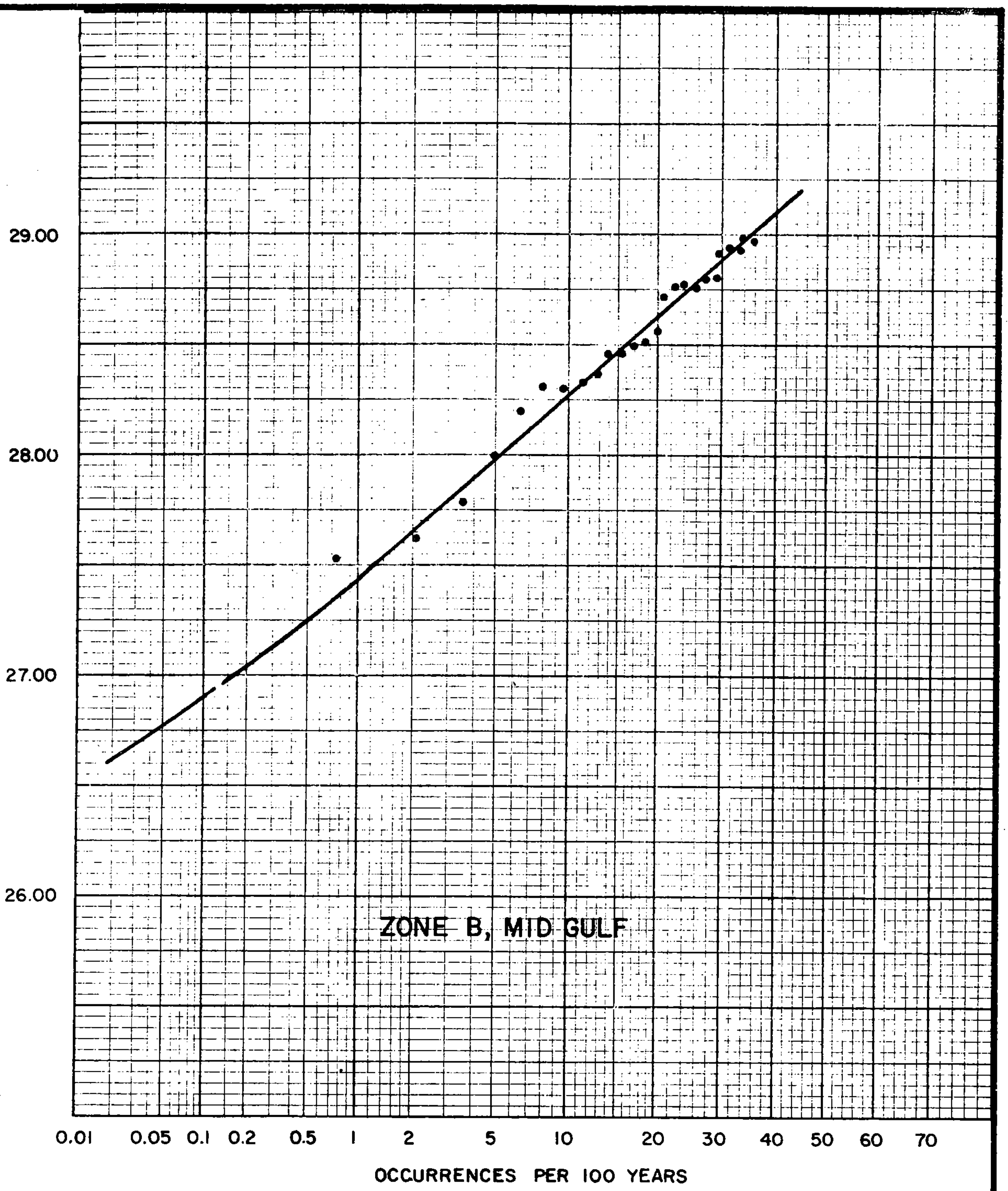
GRAND ISLE, LOUISIANA AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I-GENERAL DESIGN

SPH PATH AND ISOVELS CRITICAL TO LAROSE

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

DATE: MARCH 1972 FILE NO. H-2-24314

PLATE A-6

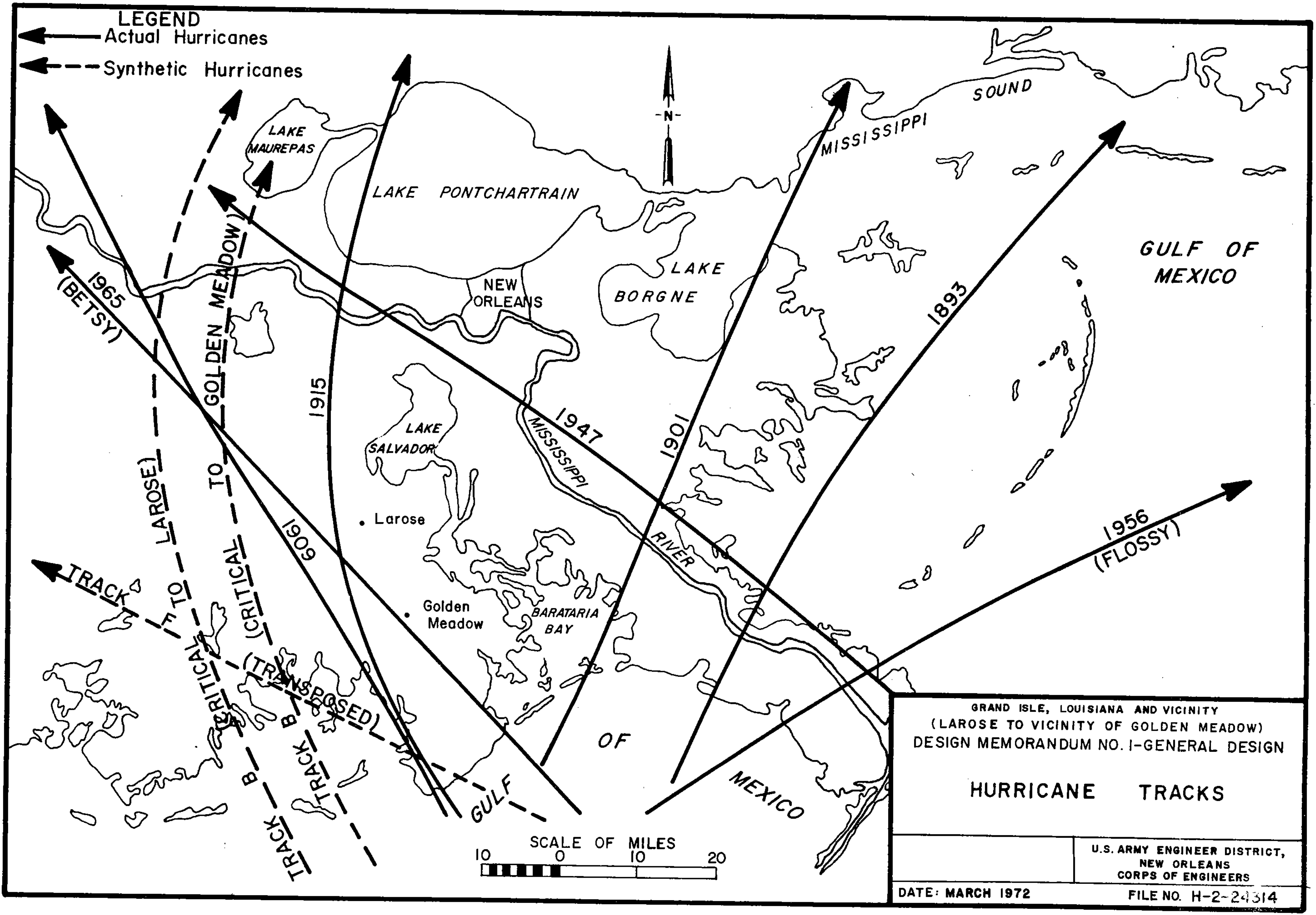


GRAND ISLE, LOUISIANA AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I-GENERAL DESIGN

FREQUENCY OF HURRICANE CENTRAL PRESSURES ZONE B, MID GULF

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

DATE: MARCH 1972 **FILE NO.** H-2-24314



GRAND ISLE, LOUISIANA AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I-GENERAL DESIGN

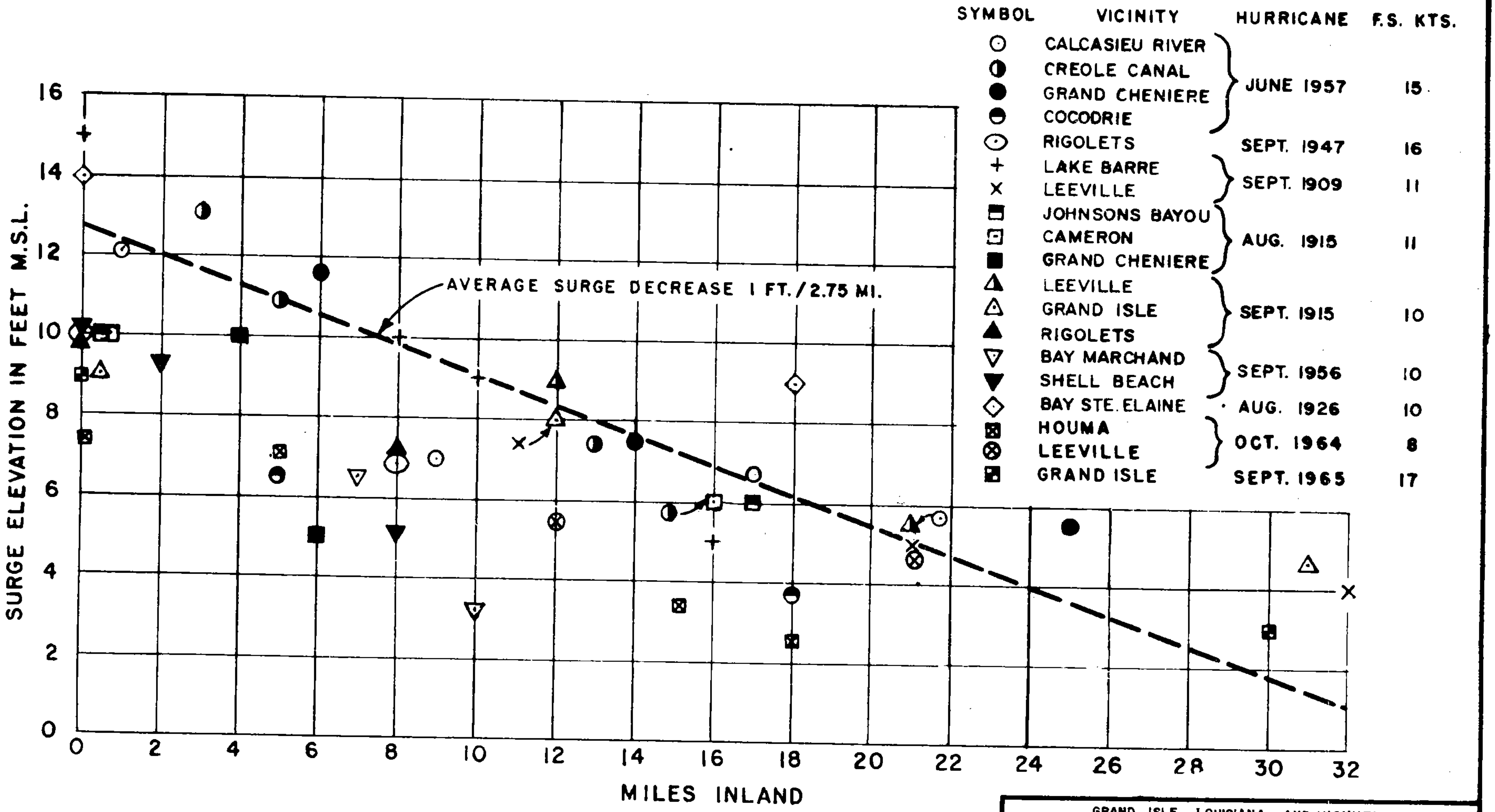
HURRICANE TRACKS

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

DATE: MARCH 1972

FILE NO. H-2-24314

PLATE A-8



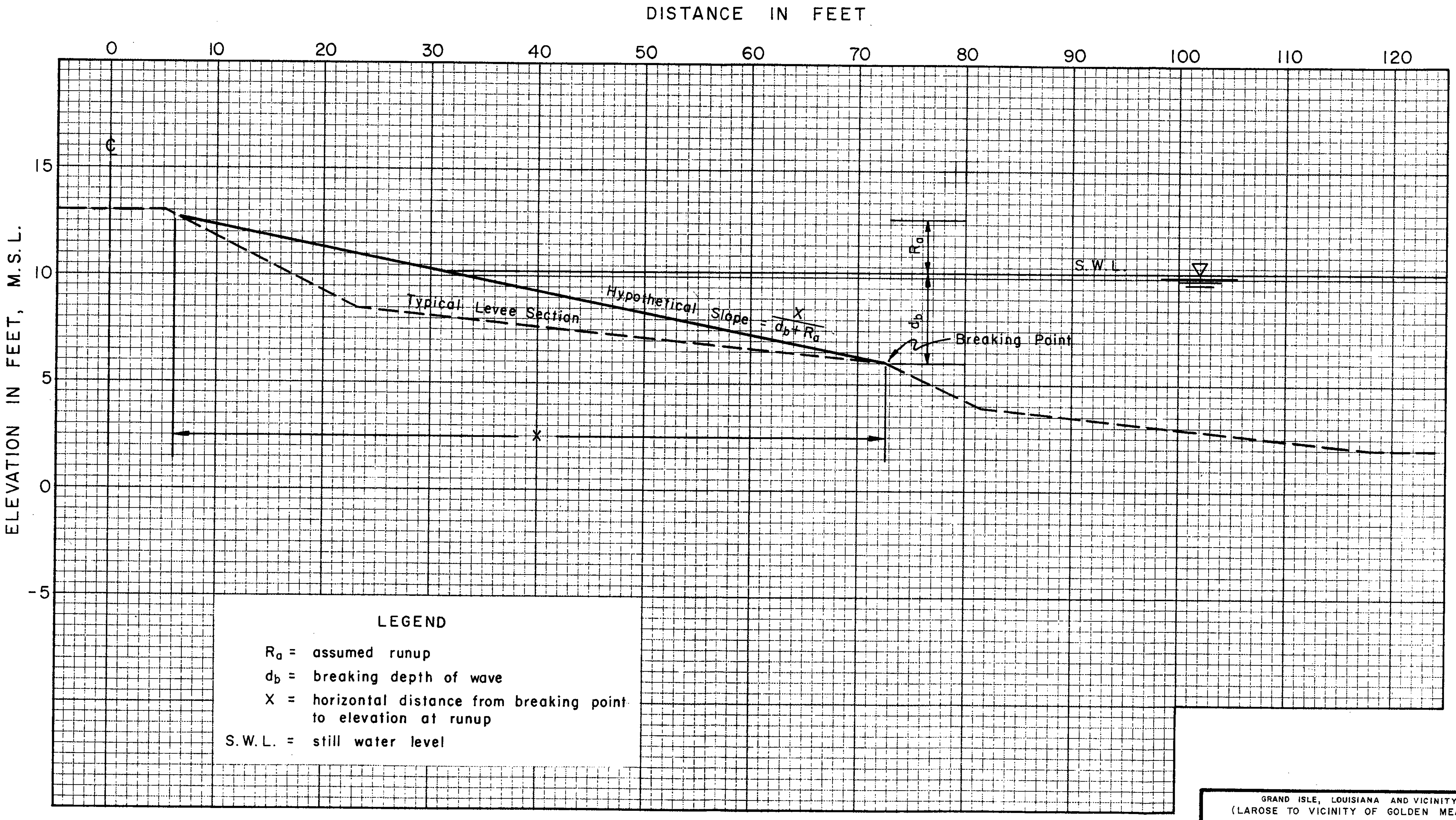
GRAND ISLE, LOUISIANA AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I-GENERAL DESIGN

OVERLAND SURGE ELEVATIONS
COASTAL LOUISIANA

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

DATE: MARCH 1972

FILE NO. H-2-[illegible]314



LEGEND

R_a = assumed runup

d_b = breaking depth of wave

X = horizontal distance from breaking point to elevation at runup

S.W.L. = still water level

GRAND ISLE, LOUISIANA AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1-GENERAL DESIGN

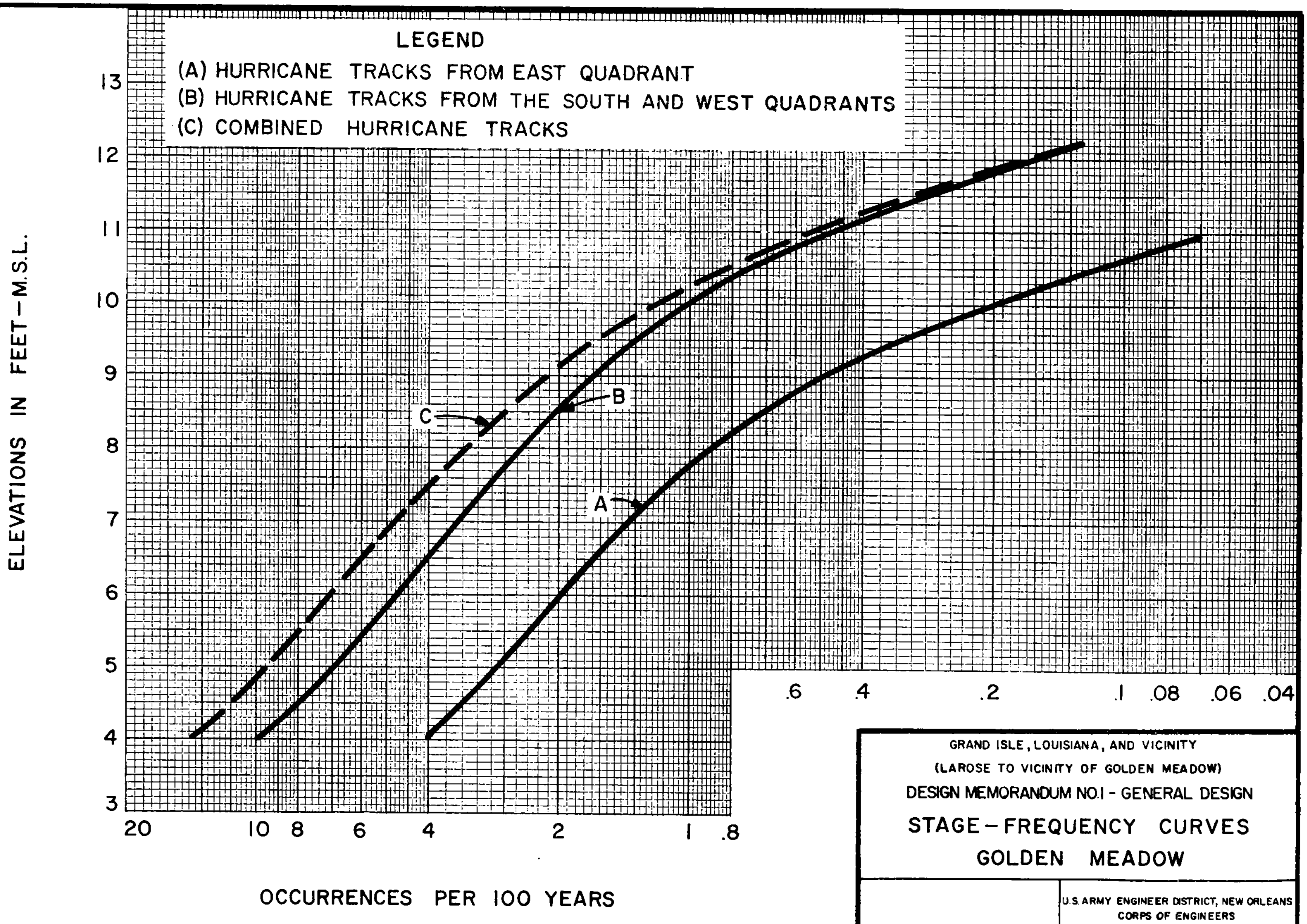
DETERMINATION OF HYPOTHETICAL
SLOPE FOR TYPICAL LEVEE
SECTION AT GOLDEN MEADOW

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

DATE: MARCH 1972

FILE NO. H-2-24314

PLATE A-10



GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO.1 - GENERAL DESIGN

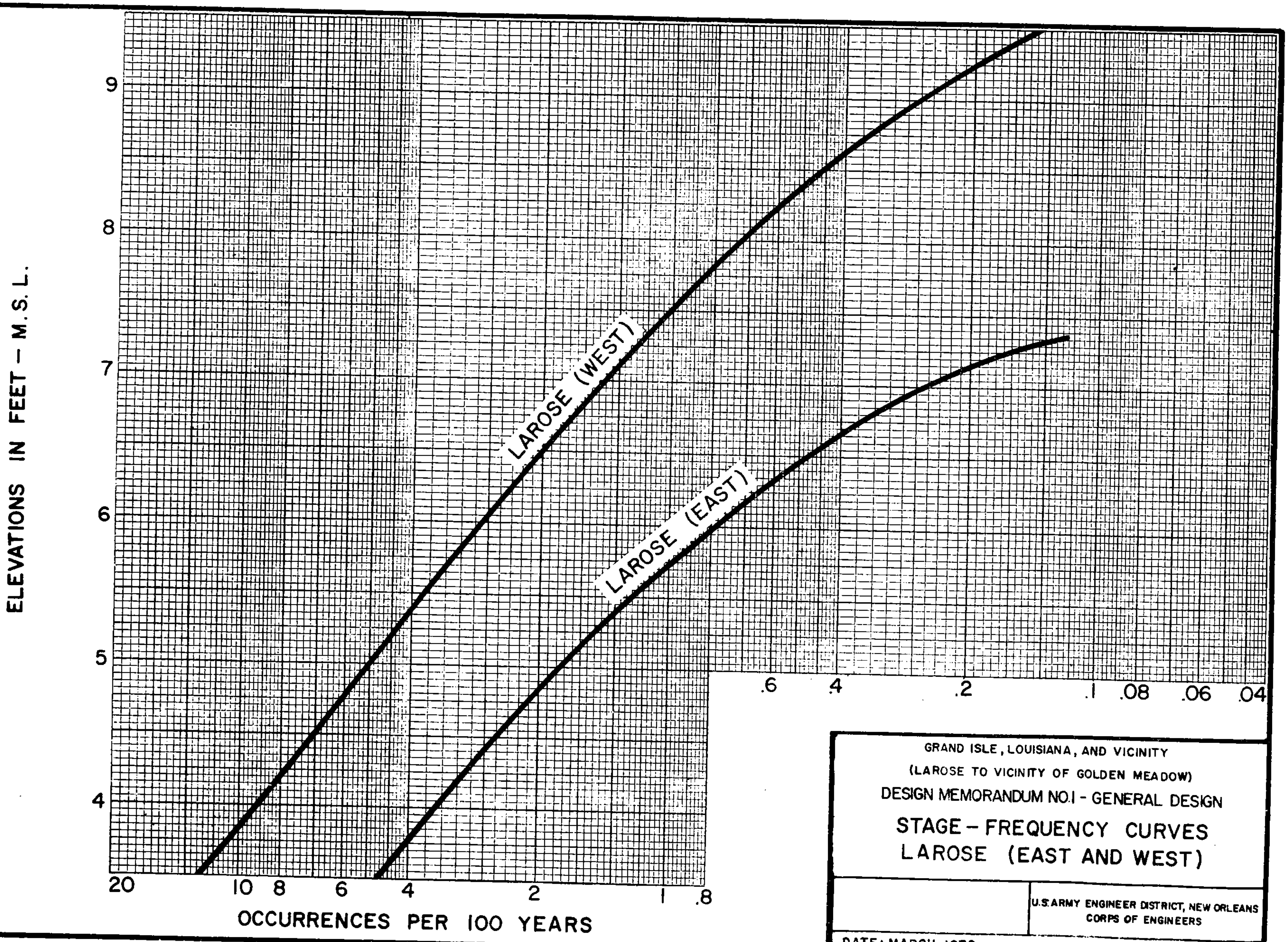
STAGE-FREQUENCY CURVES
GOLDEN MEADOW

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

DATE: MARCH 1972

FILE NO. H-2-243.4

PLATE A-11



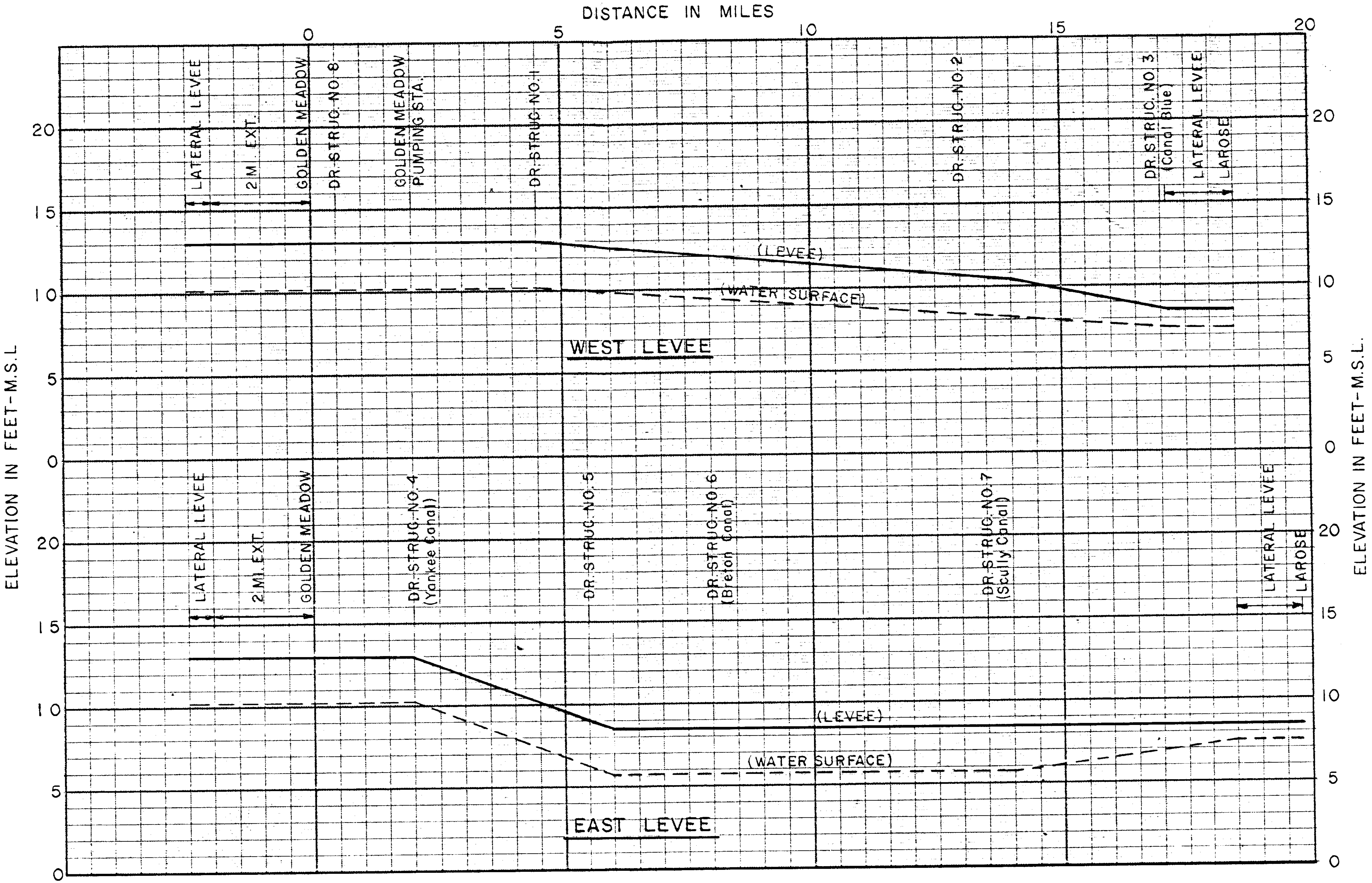
GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO.1 - GENERAL DESIGN

STAGE – FREQUENCY CURVES
LAROSE (EAST AND WEST)

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

DATE: MARCH 1972

FILE NO. H-2-24314



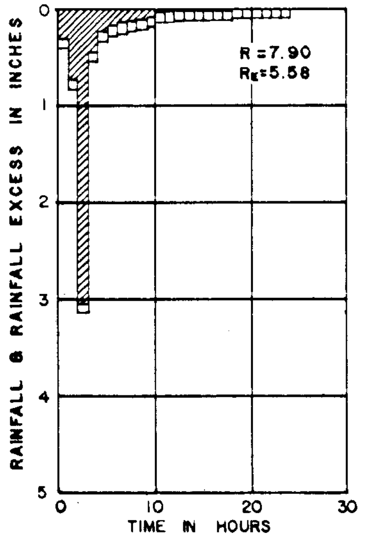
GRAND ISLE, LOUISIANA AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1-GENERAL DESIGN

LEVEE AND WATER SURFACE
PROFILES

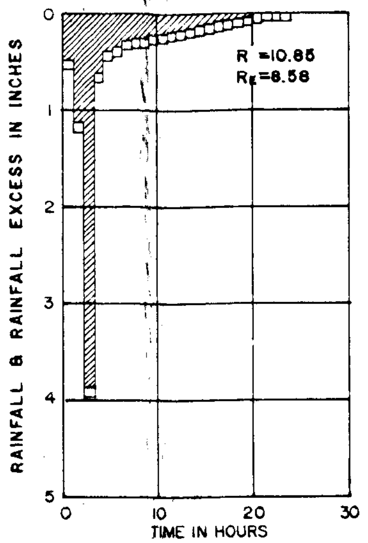
U.S. ARMY ENGINEER DISTRICT,
NEW ORLEANS
CORPS OF ENGINEERS

DATE: MARCH 1972
FILE NO. H-2-24314

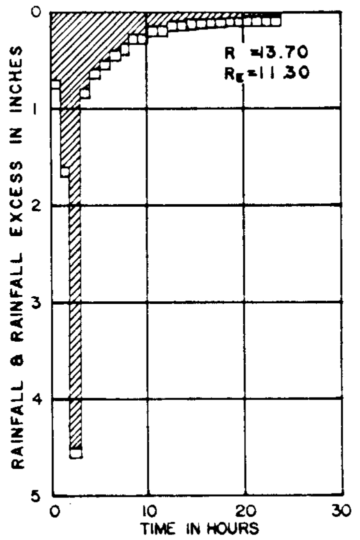
PLATE A-13



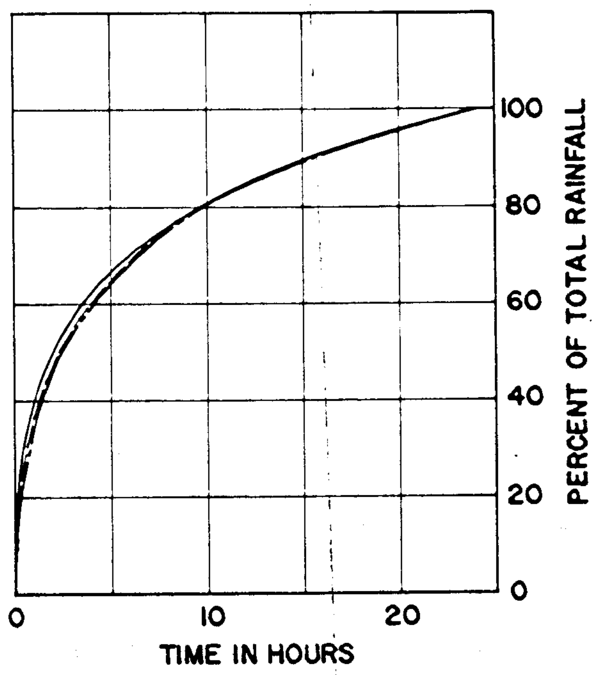
5-YEAR RAINFALL



25-YEAR RAINFALL



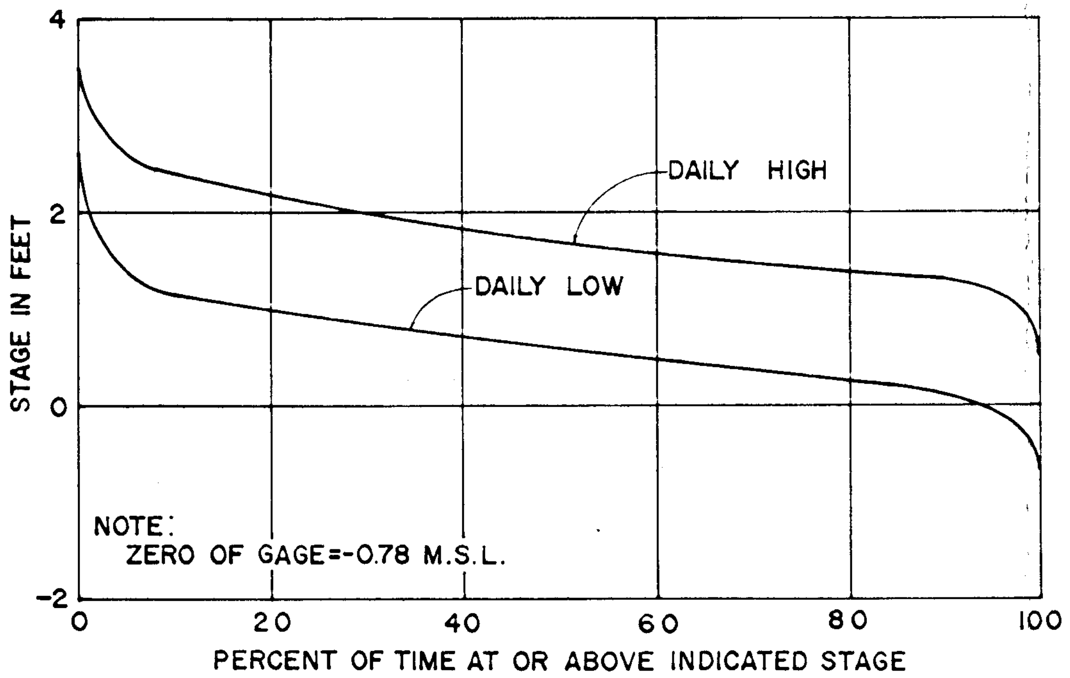
100-YEAR RAINFALL



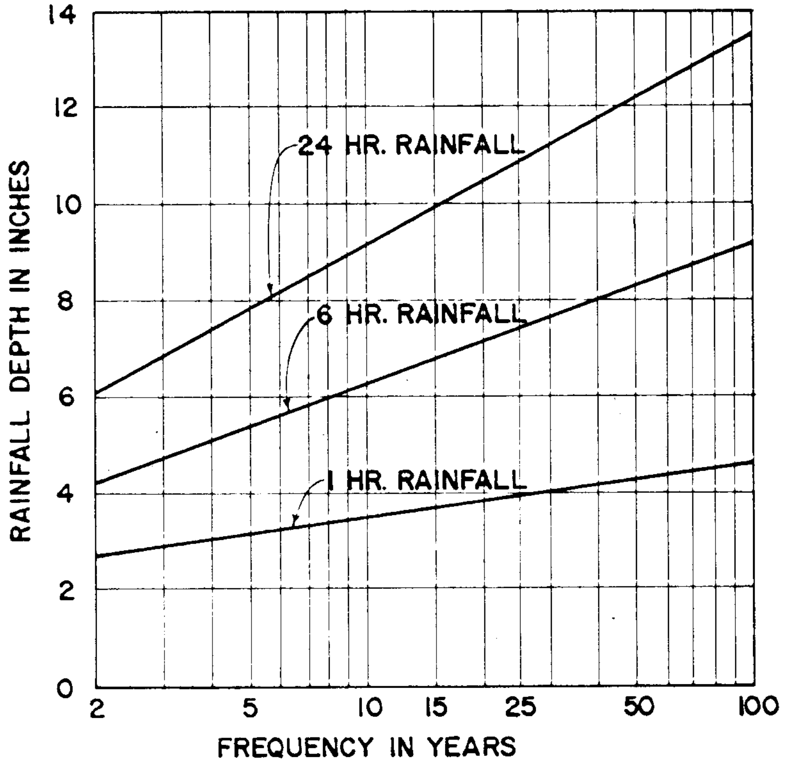
DISTRIBUTION OF RAINFALL
24 HR. STORMS

LEGEND

———— 5-YEAR STORM
– – – – 25-YEAR STORM
—·—·— 100-YEAR STORM



STAGE DURATION
BAYOU LAFOURCHE NEAR MOUTH

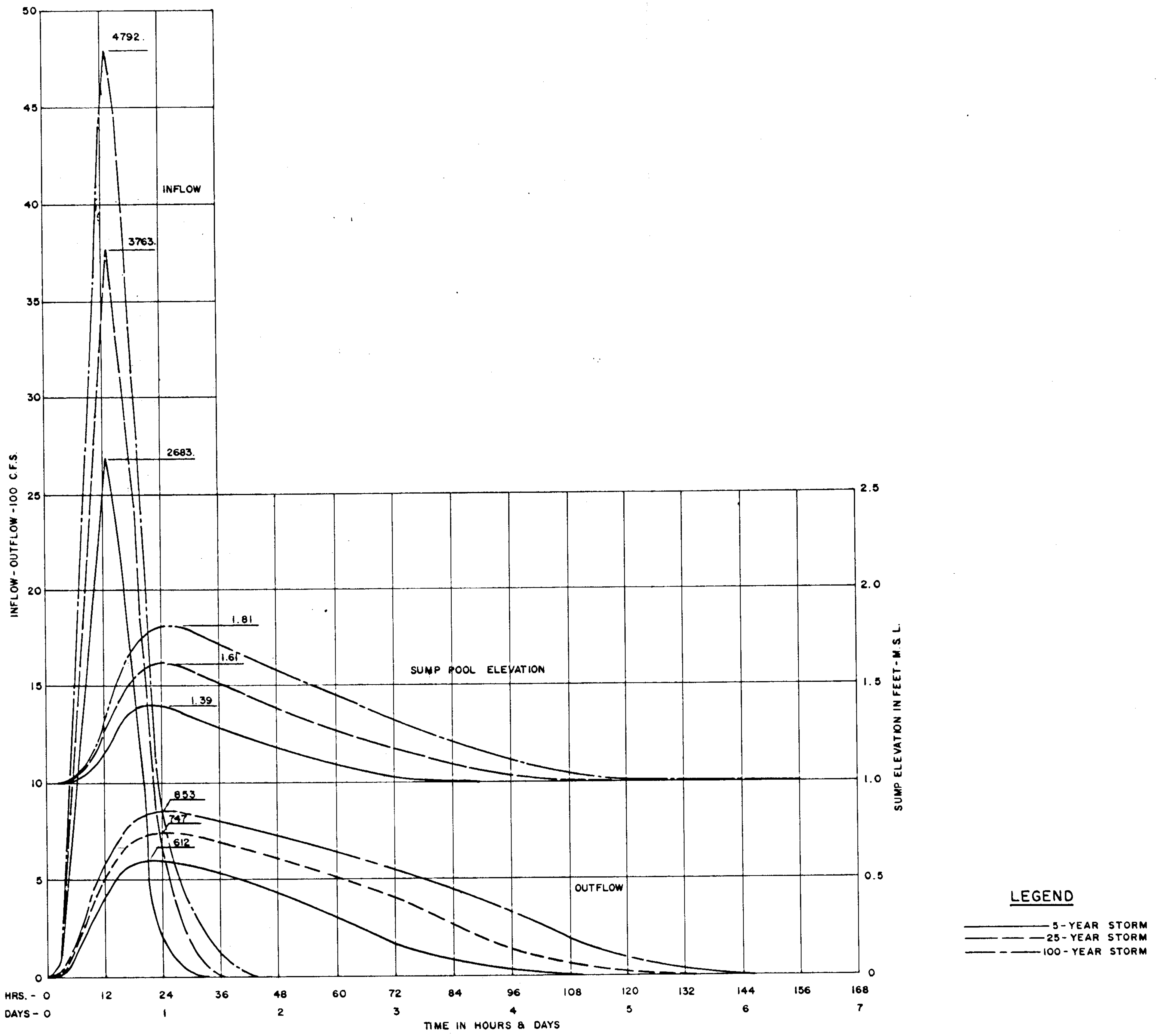


RAINFALL FREQUENCY CURVES
(NEW ORLEANS, LA.)

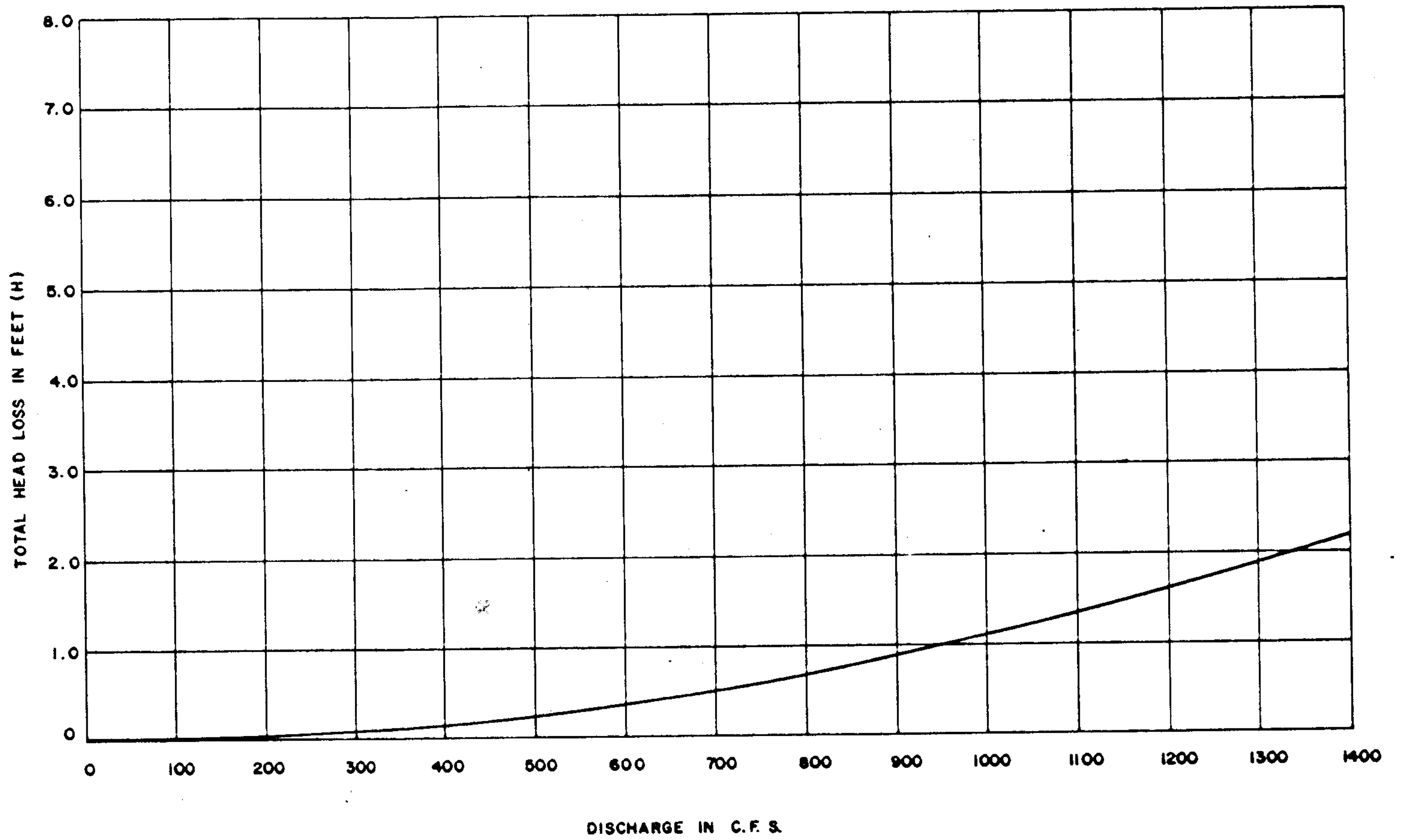
GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I - GENERAL DESIGN

RAINFALL AND STAGE DATA

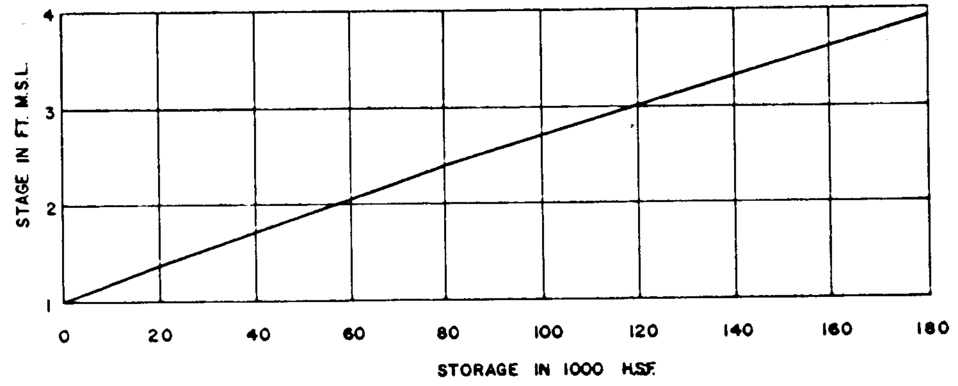
BARNARD AND BURK, INC. CONSULTING ENGINEERS BATON ROUGE, LA.	U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS
DATE: MARCH 1972	FILE NO. H-2-24314



DESIGN STORMS



DISCHARGE CURVE



VOLUME CURVE

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

HYDRAULIC DESIGN DATA
DRAINAGE STRUCTURE Nº 1

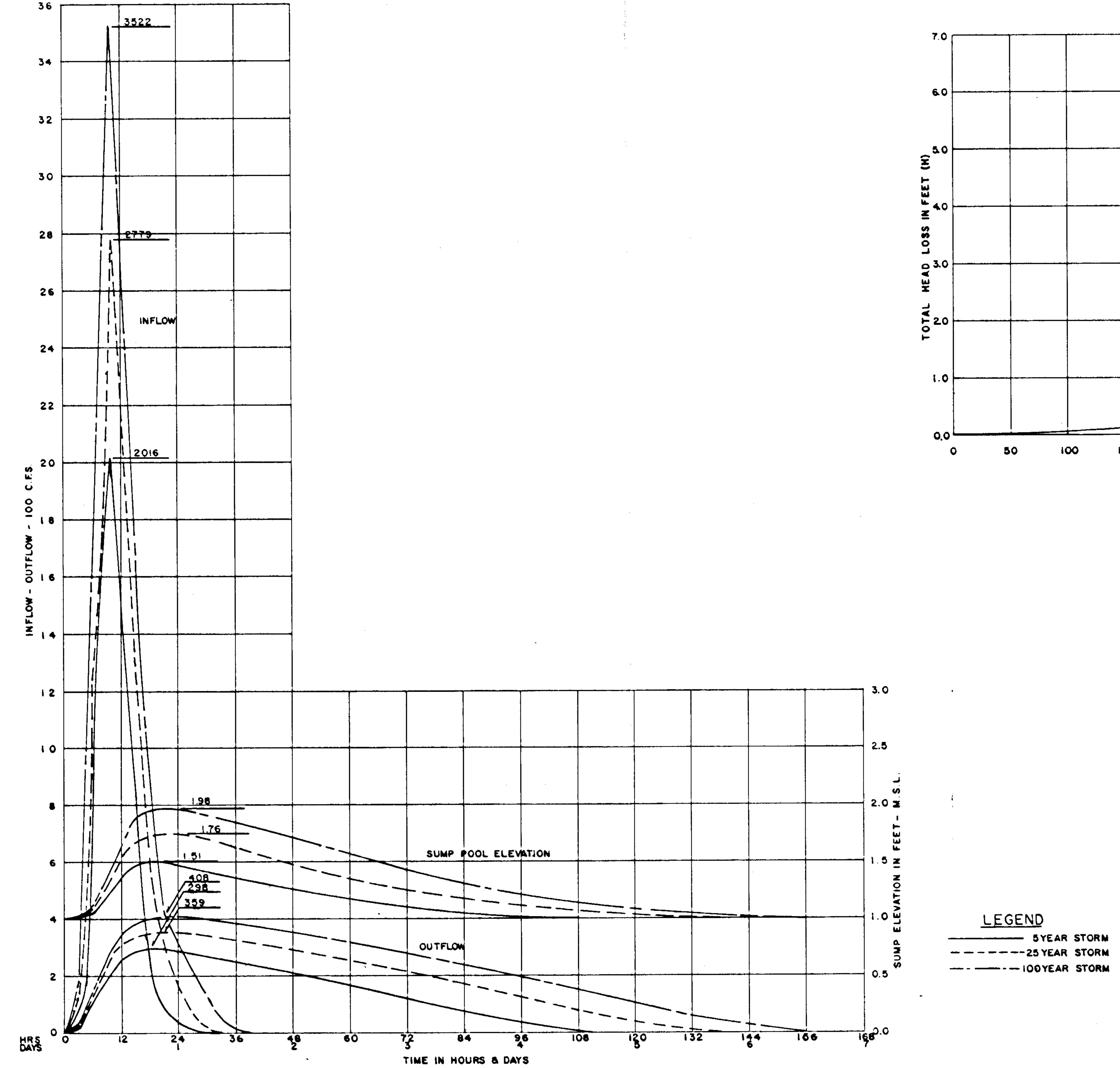
BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA

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

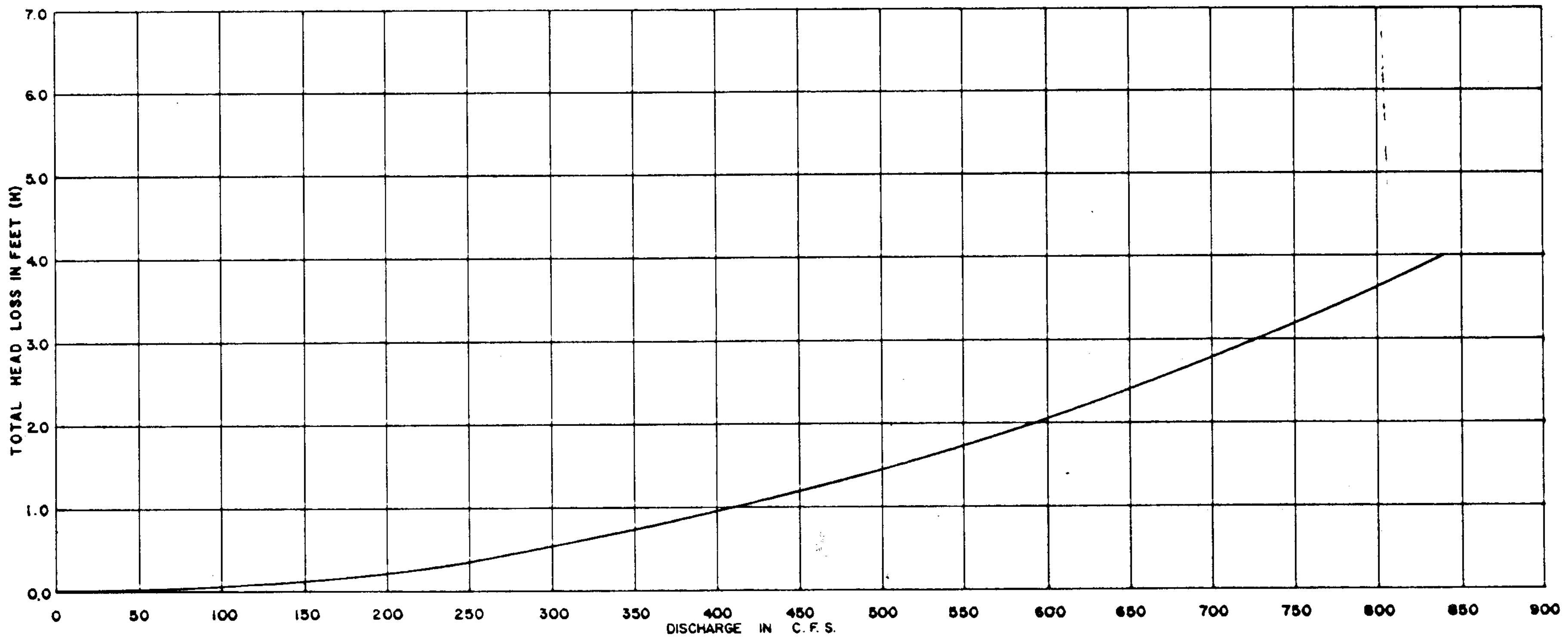
DATE: MARCH 1972
FILE NO. H-2-24314

DATE	REVISION	BY

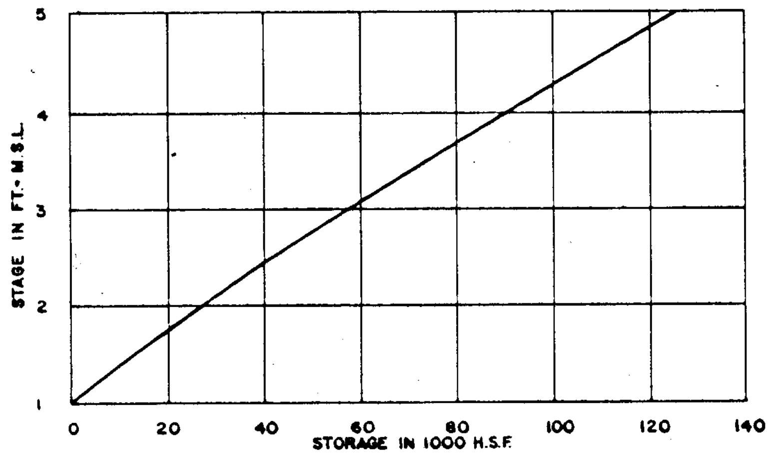
DESIGNED:
CHECKED:
DRAWN:
APPROVED:



DESIGN STORMS



DISCHARGE CURVE

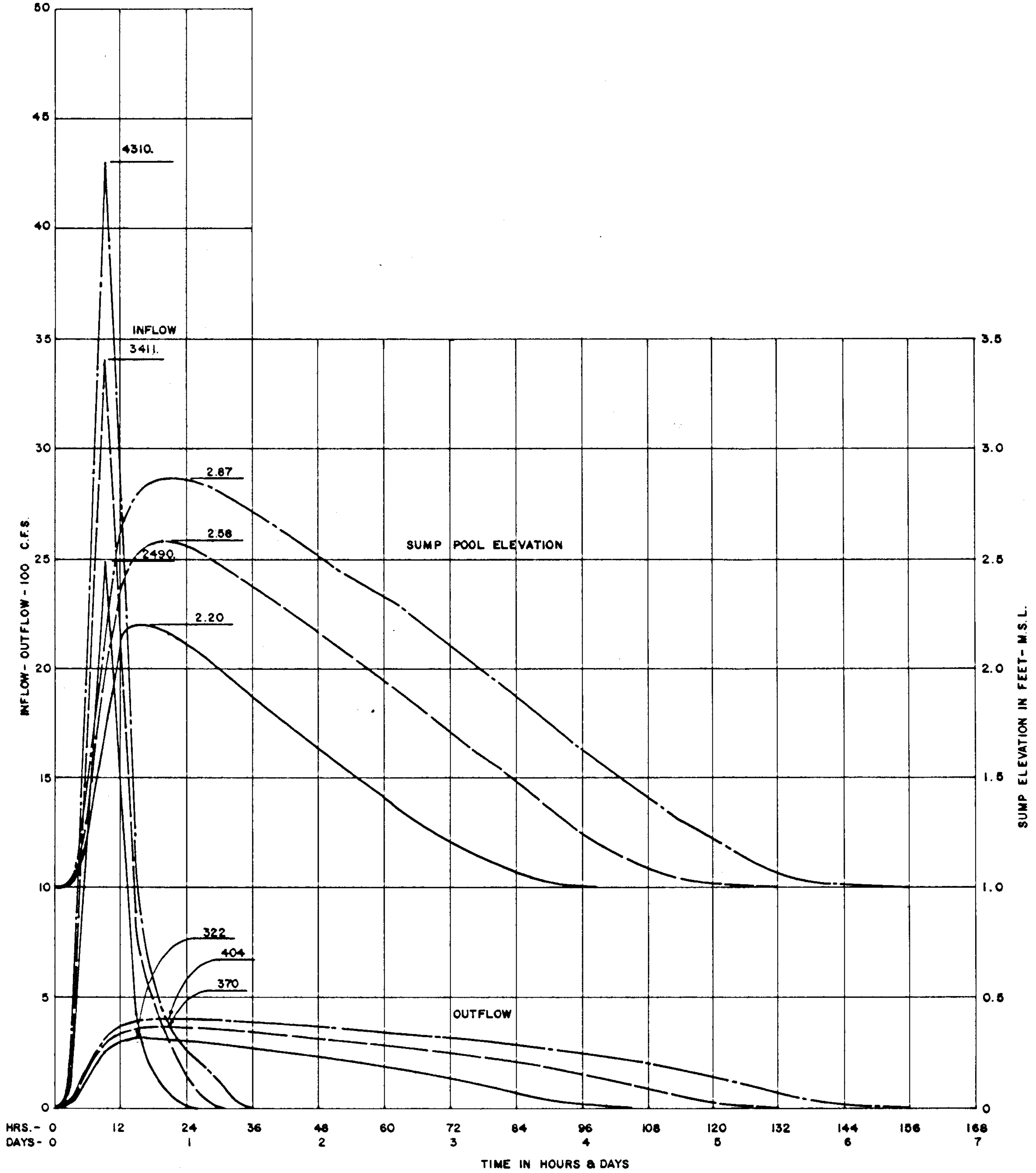


VOLUME CURVE

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I - GENERAL DESIGN

HYDRAULIC DESIGN DATA
DRAINAGE STRUCTURE Nº 2

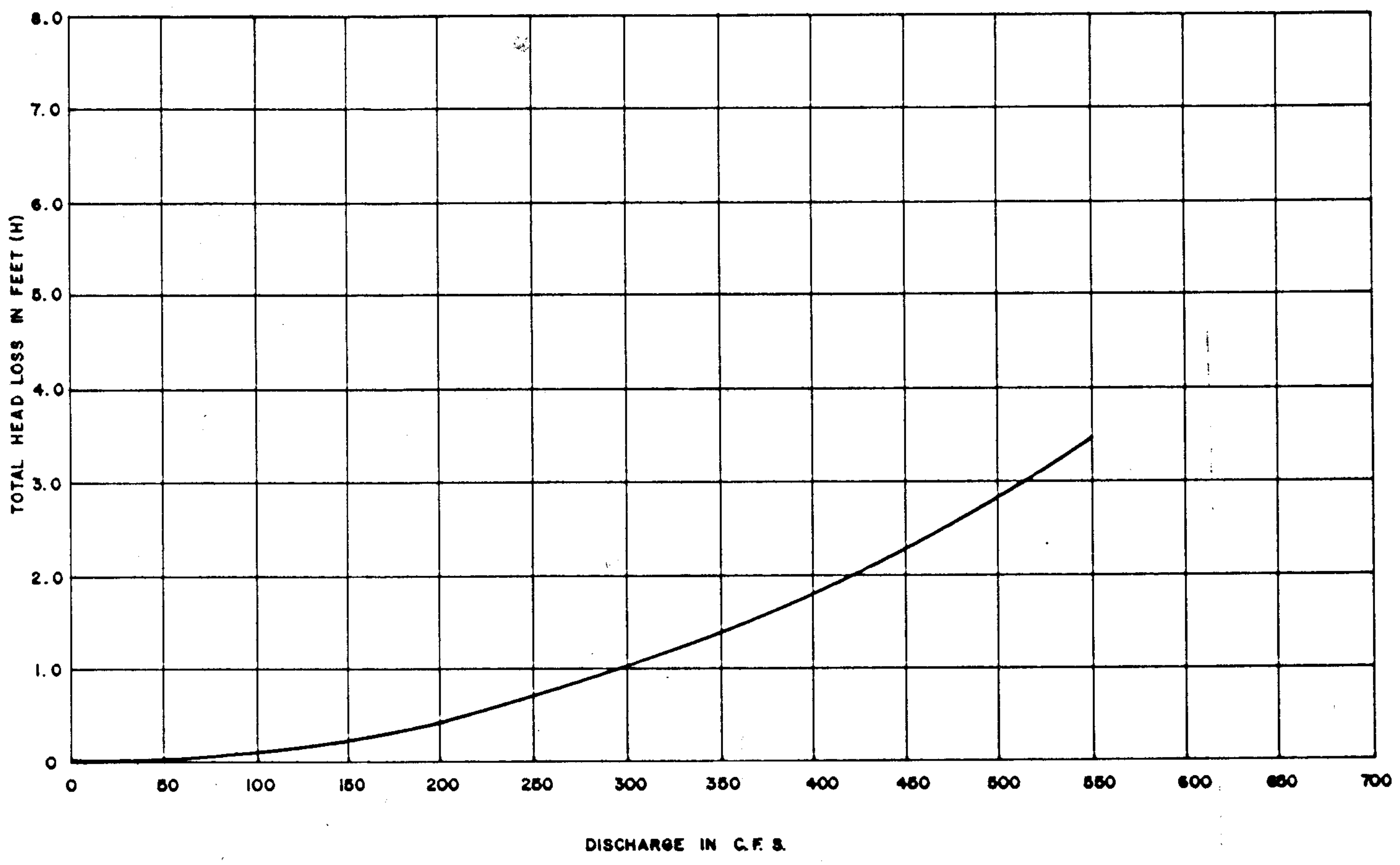
BARNARD AND BURK, INC. CONSULTING ENGINEERS BATON ROUGE, LA.	U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS
DATE · MARCH 1972	FILE NO. H-2-24314



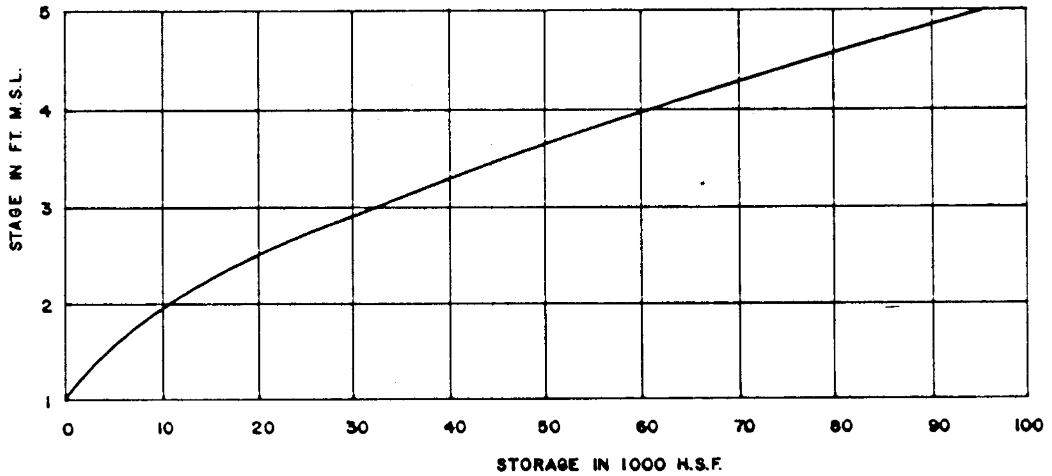
DESIGN STORMS

LEGEND

— 5-YEAR STORM
– – 25-YEAR STORM
–·– 100-YEAR STORM



DISCHARGE CURVE



VOLUME CURVE

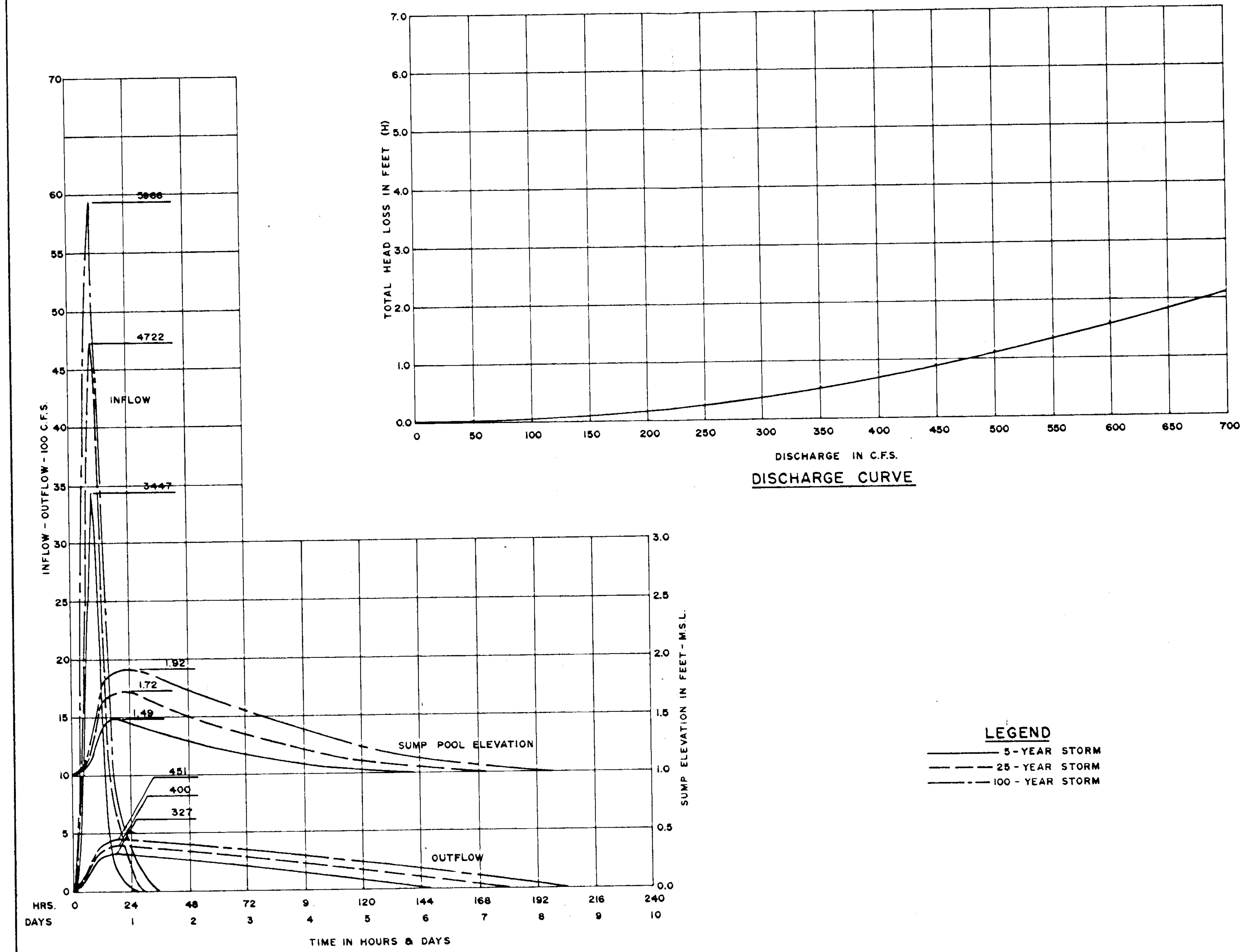
GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I - GENERAL DESIGN

HYDRAULIC DESIGN DATA
DRAINAGE STRUCTURE Nº 3

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

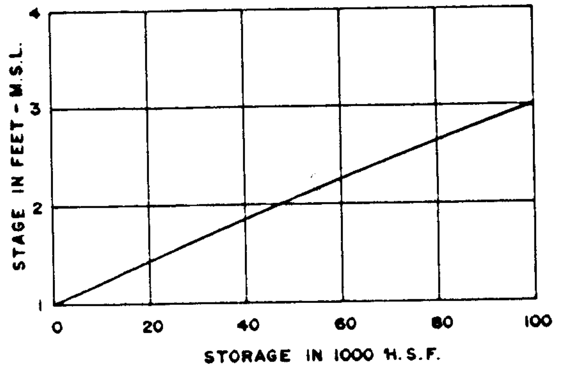
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

DATE: MARCH 1972
FILE NO. H-2-24314



DISCHARGE CURVE

DESIGN STORMS



VOLUME CURVE

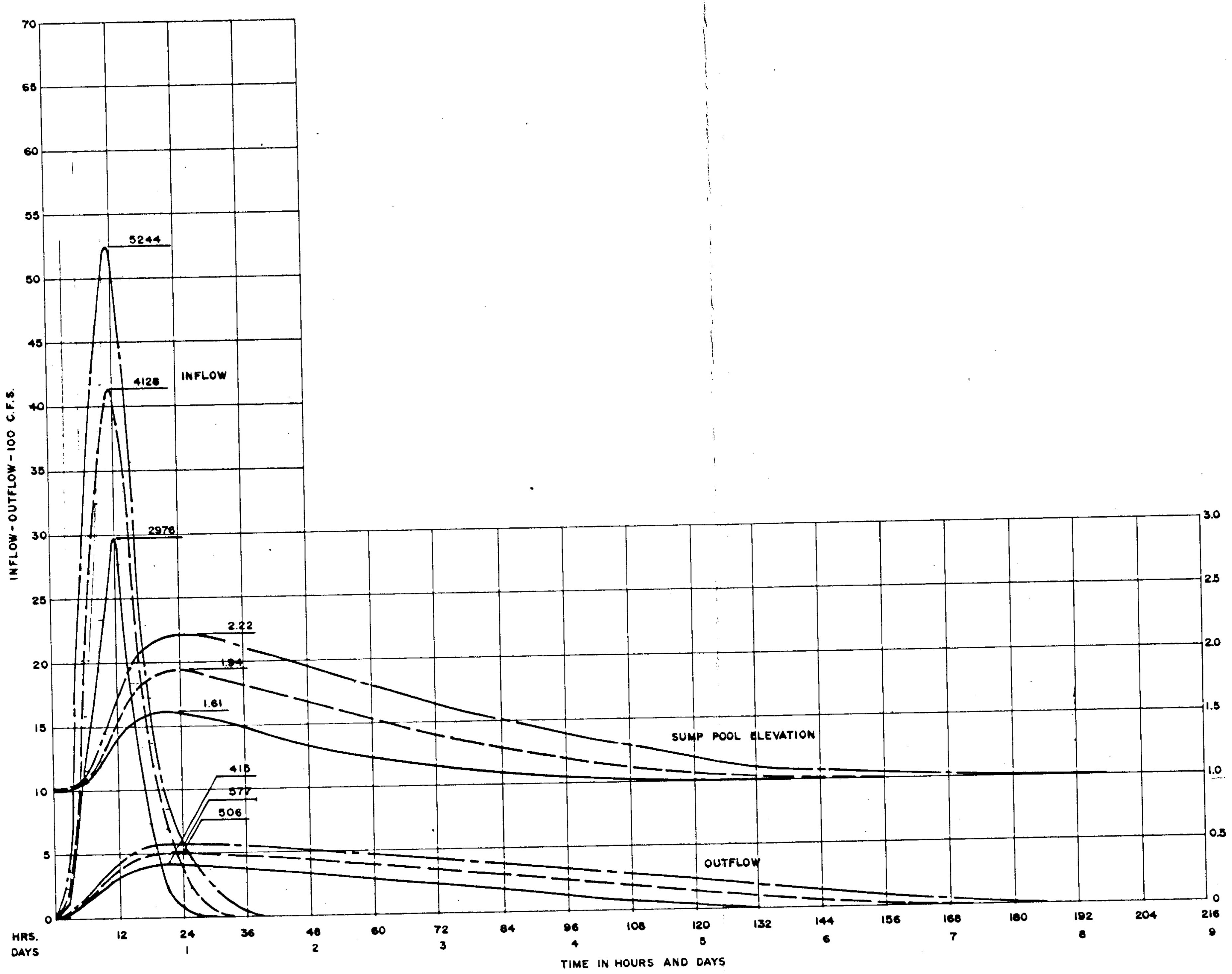
GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

HYDRAULIC DESIGN DATA
DRAINAGE STRUCTURE Nº 4

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

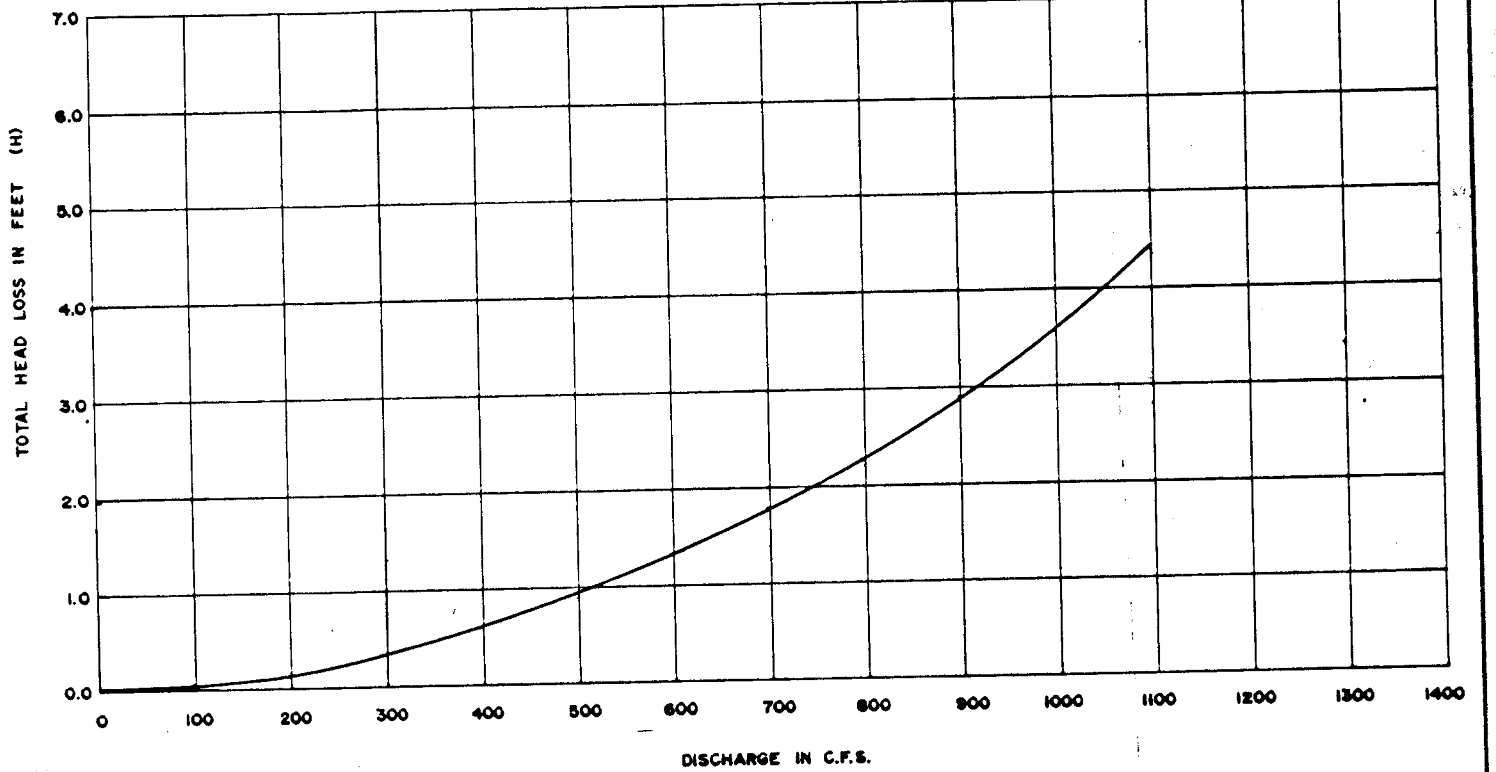
DATE: MARCH 1972
FILE NO. H-2-24314



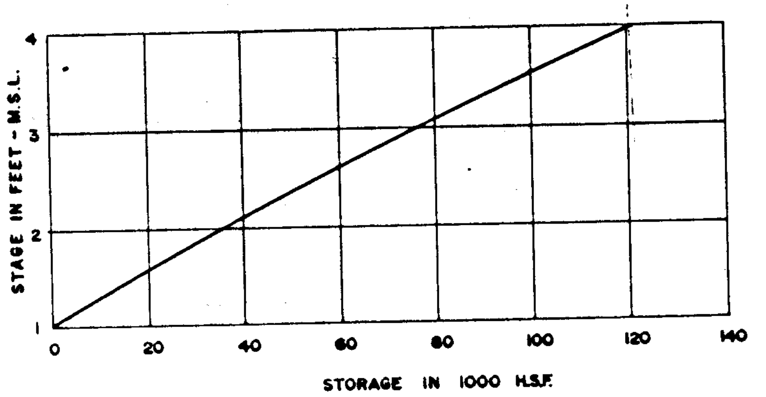
DESIGN STORMS

LEGEND

——— 5-YEAR STORM
– – – 25-YEAR STORM
–·–·– 100-YEAR STORM



DISCHARGE CURVE



VOLUME CURVE

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO.1 - GENERAL DESIGN

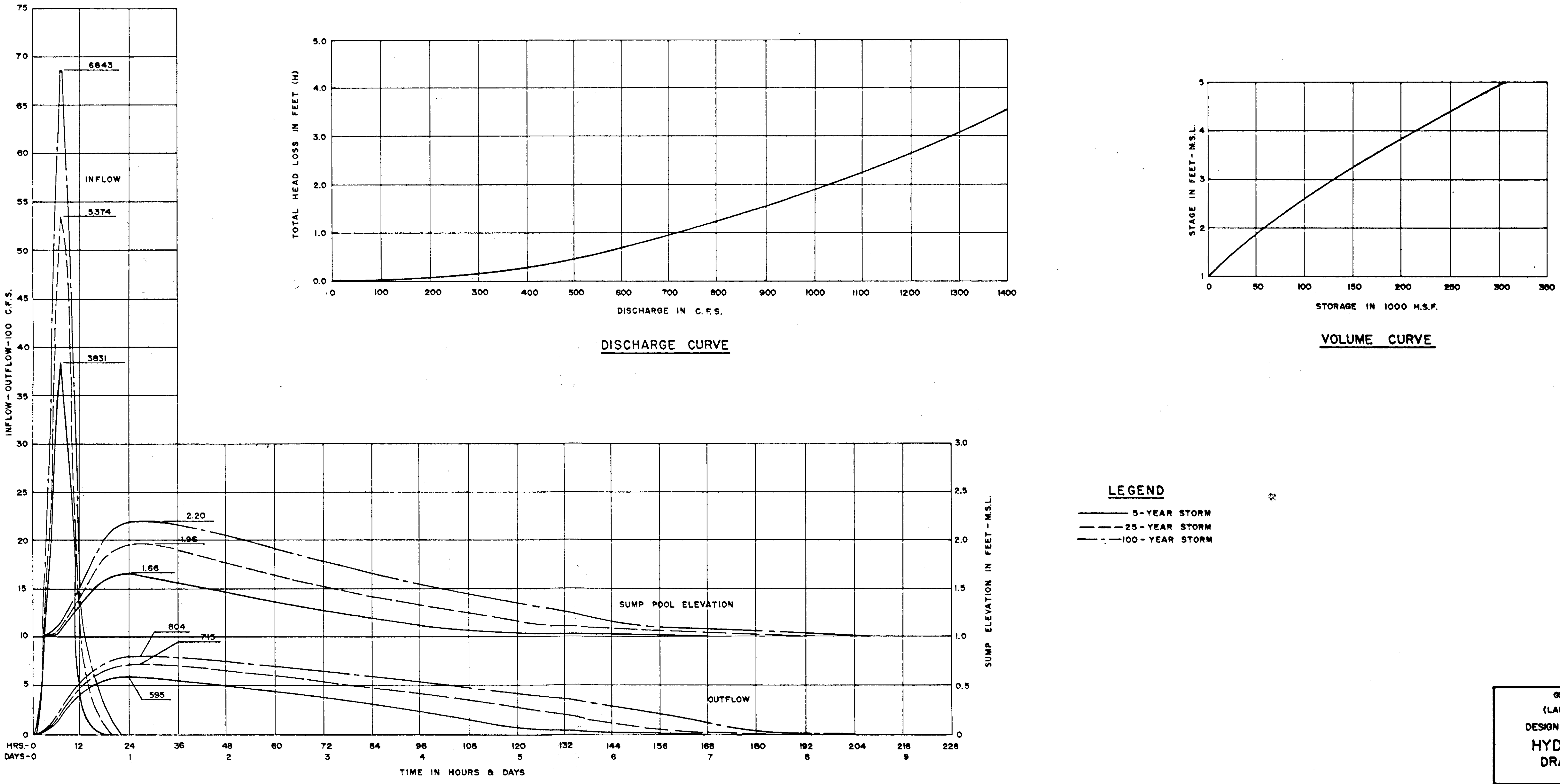
HYDRAULIC DESIGN DATA
DRAINAGE STRUCTURE Nº 5

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE: MARCH 1972
FILE NO. H-2-24314

PLATE A-19



DISCHARGE CURVE

VOLUME CURVE

DESIGN STORMS

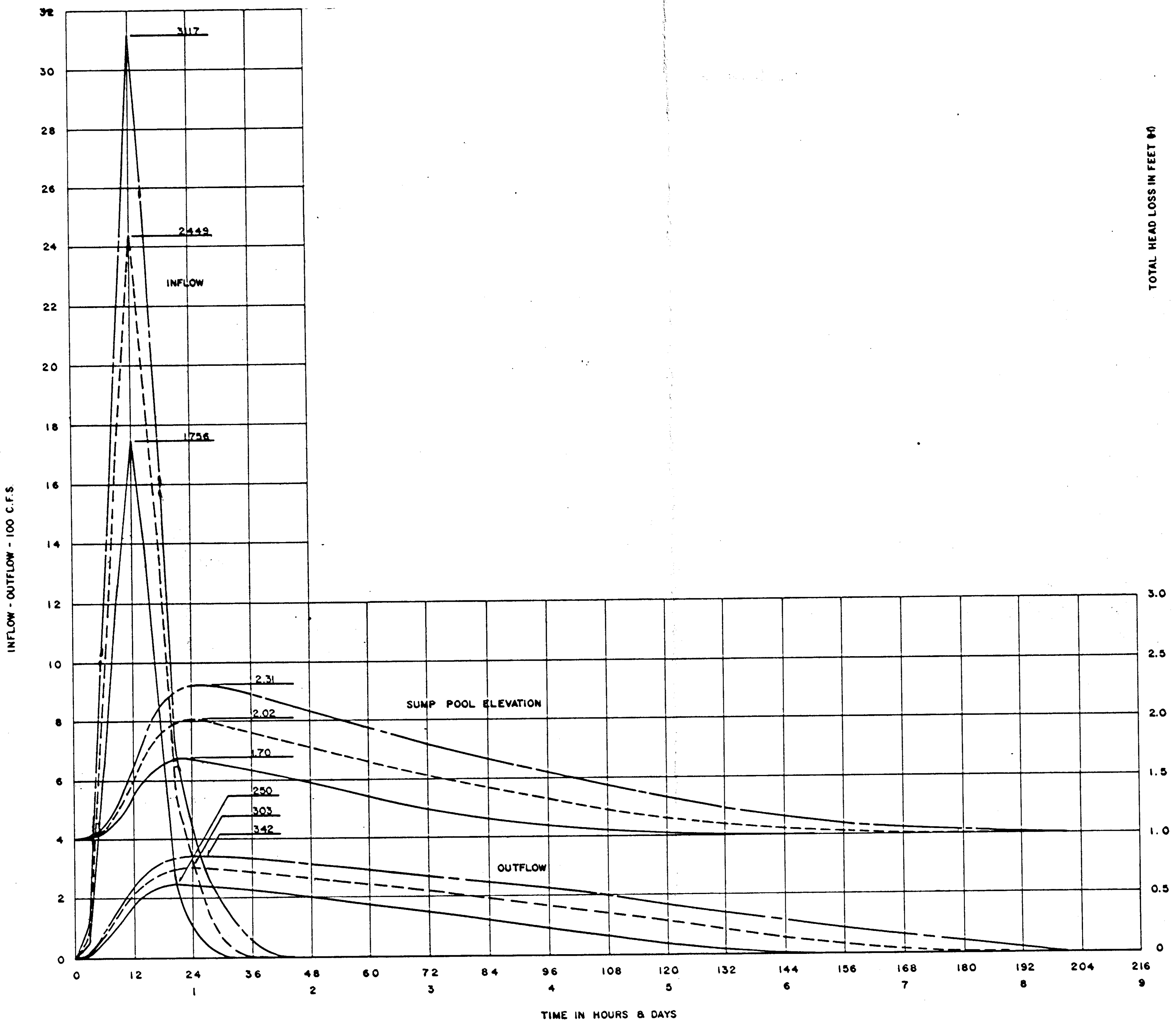
GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1 - GENERAL DESIGN

HYDRAULIC DESIGN DATA
DRAINAGE STRUCTURE Nº 6

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

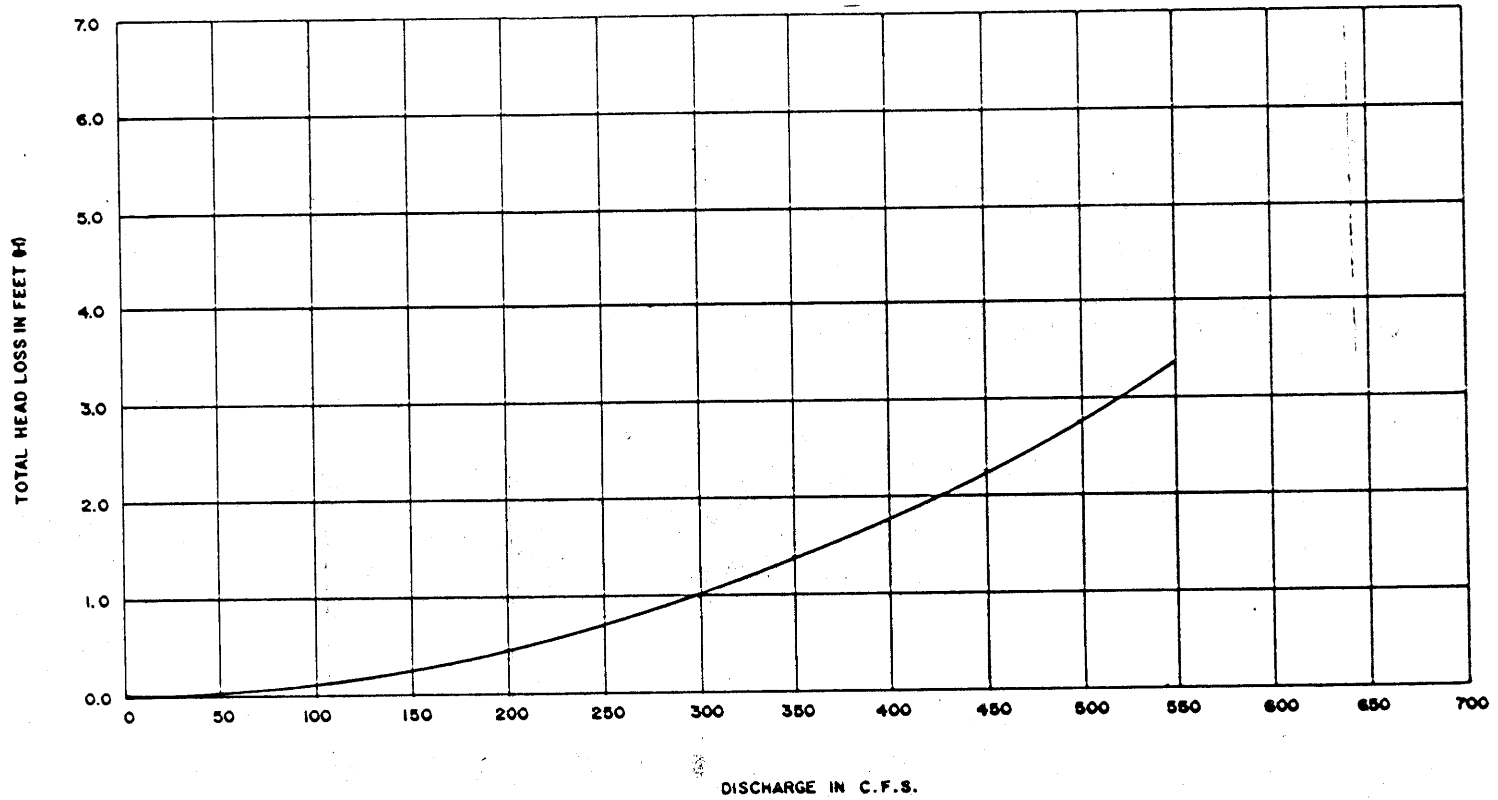
DATE: MARCH 1972
FILE NO. H-2-24314



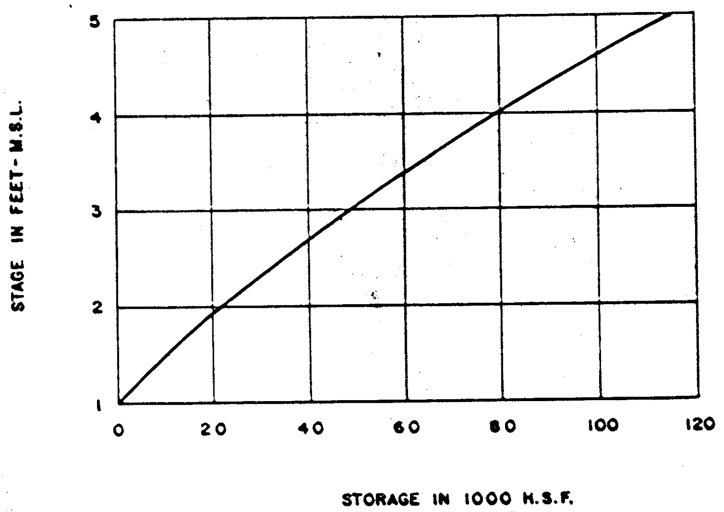
DESIGN STORMS

LEGEND

——————— 5-YEAR STORM
— — — — 25-YEAR STORM
—·—·—·— 100-YEAR STORM



DISCHARGE CURVE



VOLUME CURVE

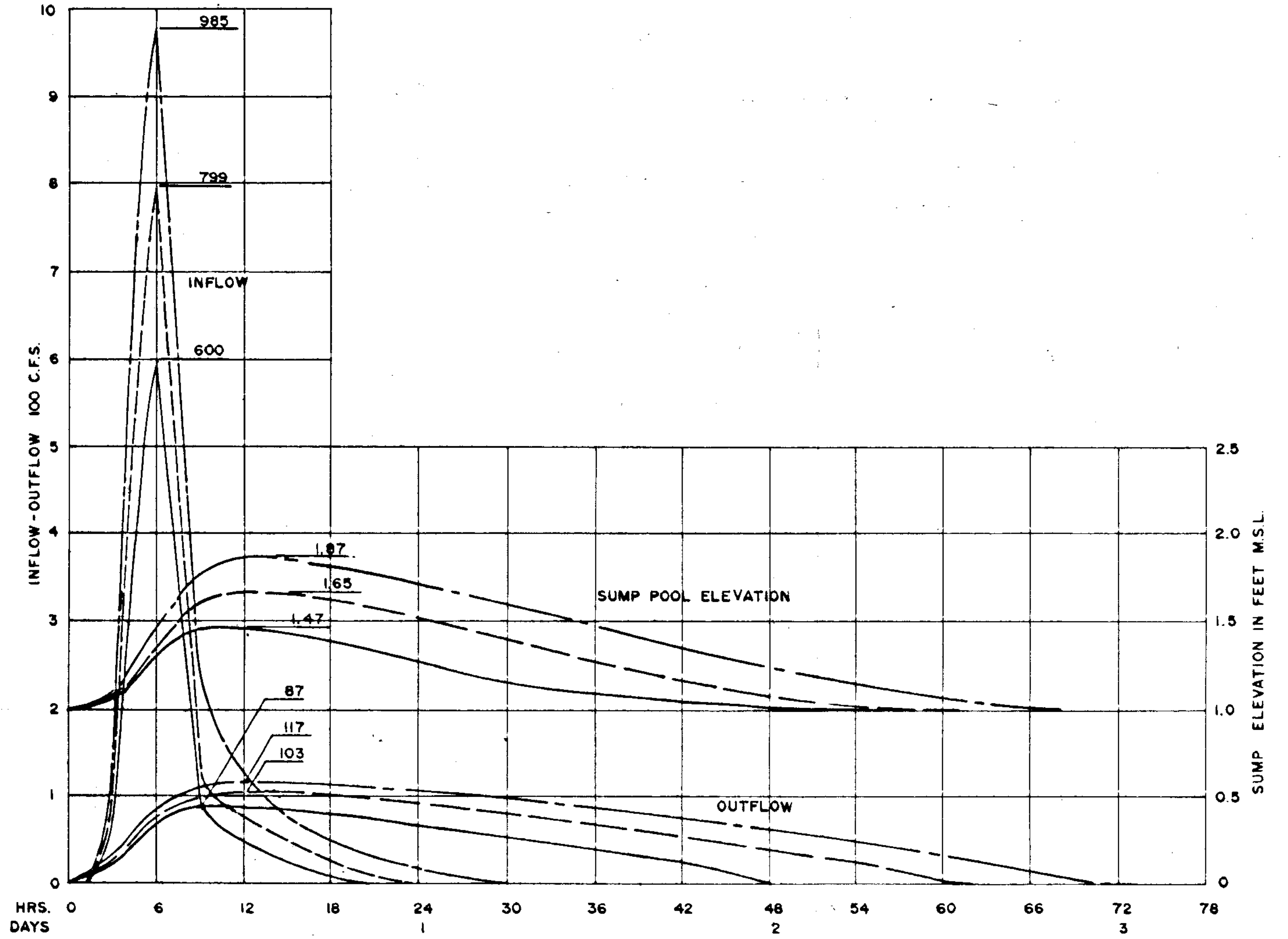
GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I - GENERAL DESIGN

HYDRAULIC DESIGN DATA
DRAINAGE STRUCTURE Nº 7

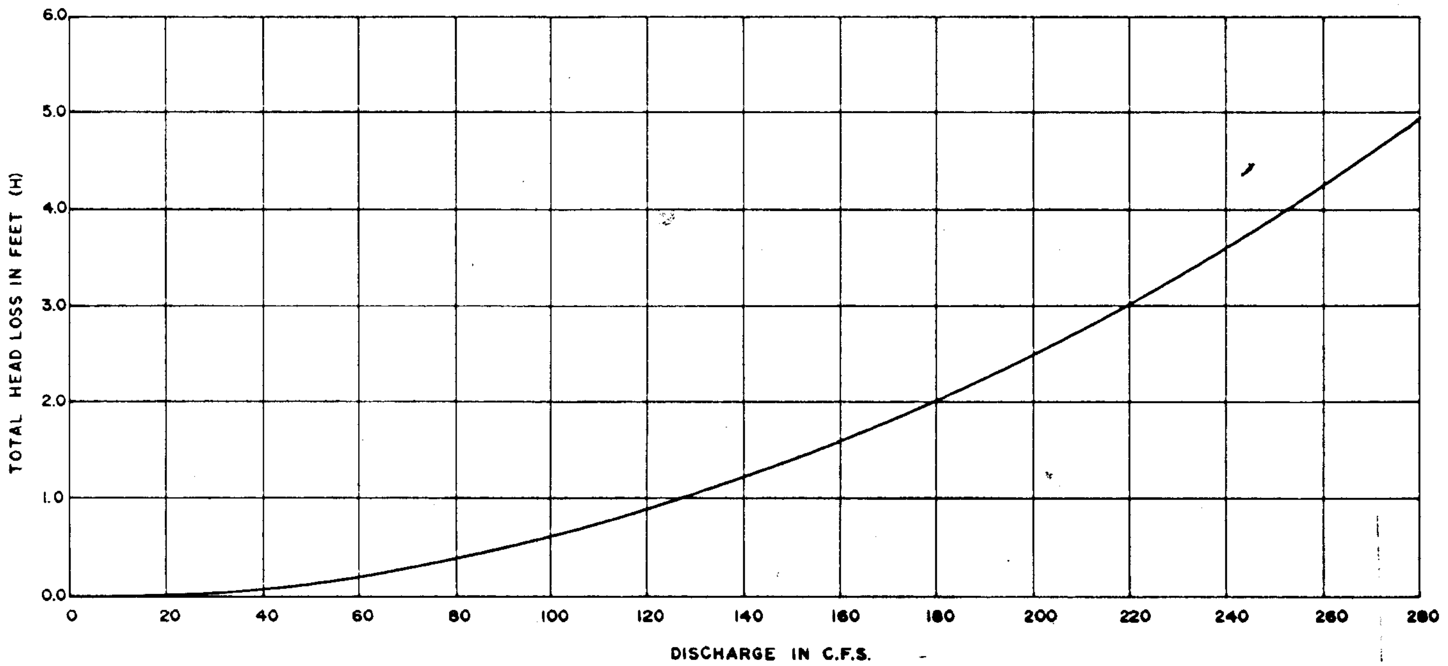
BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE · MARCH 1971
FILE NO. H-2-24314



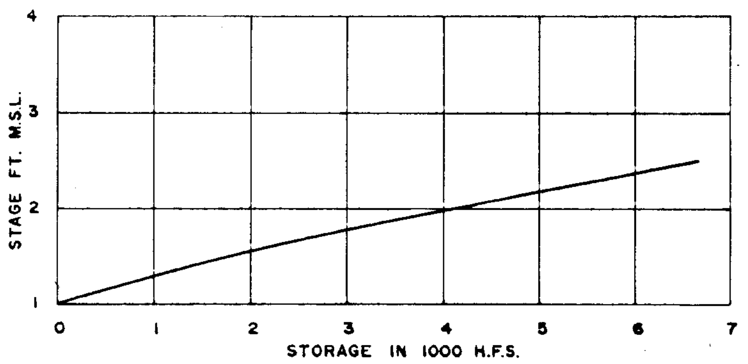
DESIGN STORMS



DISCHARGE CURVE

LEGEND

- ———— 5-YEAR STORM
- — — — 25-YEAR STORM
- —·—·— 100-YEAR STORM



VOLUME CURVE

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I - GENERAL DESIGN

HYDRAULIC DESIGN DATA

DRAINAGE STRUCTURE Nº 8

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE: MARCH 1972

FILE NO. H-2-24314

GRAND ISLE, LOUISIANA AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1, GENERAL DESIGN

APPENDIX B
ECONOMIC ANALYSES

GRAND ISLE, LOUISIANA AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1, GENERAL DESIGN

APPENDIX B
ECONOMIC ANALYSES

TABLE OF CONTENTS

TABLES

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PLATES

GRAND ISLE, LOUISIANA AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1, GENERAL DESIGN

APPENDIX B
ECONOMIC ANALYSES

1. Introduction.

a. A complete reanalysis of the benefits to be derived from construction of the project was made in March 1971. Such a reanalysis was considered appropriate in view of known significant changes in development within the project area. Detailed explanations of the benefit derivations and their results are included in subsequent paragraphs, along with comparisons to those benefits reported in House Document 184, 89th Congress, 1st Session, entitled "Grand Isle and Vicinity, Louisiana." Benefits are categorized by type; namely, flood damages prevented for both crop and non-crop items, and intensified land use. In this reanalysis, redevelopment, indirect, and social well-being benefits have been identified and evaluated.

b. Subsequent to the authorization of the project, a request was made by local interests to extend the levees beyond the town of Golden Meadow to incorporate into the protected area an additional 1,800 acres. The benefit reanalysis presented herein includes the benefits which will accrue to this area. In paragraph 5, page B-13, a summary of average annual benefits and a benefit-cost ratio are presented separately for the incremental extension below Golden Meadow.

2. Projected growth rates.

a. Flood damages prevented on future developments were determined by projecting future damages at rates equal to the projected population growth and bringing these amounts back to present value by applying a discount rate of 3 1/4 percent. Present values were then amortized for the life of the project to obtain average annual benefits on future damages prevented.

b. The authorized project area lies entirely in Ward 10 of Lafourche Parish and comprises about 96 percent of the existing population in that ward. Lafourche Parish lies entirely within the boundaries of Water Resource Subarea 0809 (WRS 0809). An analysis of the population statistics made available by the Office of Business Economics (OBE) for WRS 0809 was made, as were analyses of the statistics available from the Bureau of Census for Lafourche Parish and for Ward 10 of Lafourche Parish. These data are shown in the following table. Index values were computed and are also shown in the table. As Ward 10 encompasses the project area geographically and the project area accounts for 96 percent of the existing population for Ward 10, population growth in the project area will coincide with growth in Ward 10.

TABLE B-1
POPULATION DATA

	POPULATION				Index Values (1960=100)			
Year	WRS 0809[1]	New Orleans SMSA[2]	La-fourche Parish[2]	Ward 10[2]	WRS 0809	New Orleans SMSA	La-fourche Parish	Ward 10
1930	655,595	526,235	32,419	8,014	59	58	59	51
1940	726,783	575,868	38,615	10,054	66	63	70	65
1950	877,394	712,393	42,209	11,266	79	79	76	72
1960	1,104,954	907,123	55,381	15,596	100	100	100	100
1970	1,298,700	1,045,809	68,941	18,831	118	115	125	121

[1] Source of data: OBE Conditional Economic Forecasts
Lower Mississippi Region Comprehensive Study

[2] Source of data: Bureau of Census

c. Since population in the New Orleans Standard Metropolitan Statistical Area (New Orleans SMSA) is projected by OBE to grow at a rate slightly less than that for the overall WRS 0809, it follows that projected population growths in portions of WRS 0809 outside the New Orleans SMSA are expected to be higher than the growth projected by OBE for WRS 0809 as a whole.

d. The population and index values shown in table B-1 were analyzed and used as a basis for determining appropriate growth rates for Ward 10. The index values indicate a consistent trend of higher growth rates in Ward 10 than in WRS 0809 as a whole. An annual compound growth rate between 1970 and 2020 of 1 1/32 percent was selected on the basis that it fulfilled two conditions: (1) it approximates the 2020 population projection by an historical data-regression analysis; (2) it is slightly higher than the projected growth rate of WRS 0809. Comparisons of growth rates for WRS 0809 and for Ward 10 are shown below.

TABLE B-2
COMPARISONS OF PROJECTED ANNUAL GROWTH RATES

	OBE for WRS 0809			Ward 10		
Year	Population	Growth Rate	Growth Factor	Population	Growth Rate	Growth Factor
1970	1,298,700	31/32%	1.6108	18,831	1 1/32%	1.670
2020	2,091,900			31,447		

e. For the remaining years of the project life beyond the year 2020, it was assumed that population growth would follow an annual compound rate of 1 percent. By the year 2077, projected population for Ward 10 will reach approximately 48,000, indicating that a population of 46,100 will be reached in the project area within the life of the project.

3. Benefits.

a. General.

(1) The benefits discussed in the following paragraphs include flood damages prevented to crops, flood damages prevented--non-crop, intensified land use, area redevelopment, indirect, and social well-being. Benefits will be credited to the national and/or to the regional account.

(2) To qualify for inclusion in the national account, a benefit must accrue to the nation as a whole, and must reflect a net increase in the value of the nation's production. Such increases are derived from more efficient utilization of the national resources.

(3) The regional account is credited with all economic, social, and environmental benefits which accrue to the region as a whole. The project region of economic influence includes the Louisiana parishes of Ascension, Assumption, Lafourche, St. Charles, St. James, St. John the Baptist, and Terrebonne.

(4) A summary of benefits and a statement of the B/C ratio are given below in paragraph 4, page B-13.

b. Flood damages prevented--crop.

(1) The average annual damages prevented on crops computed for this reanalysis are essentially the same as those included in the authorizing document. Increases in crop yield and values per acre have offset reductions in cropland due to the conversions of agricultural areas to urban usage. The comparative values are shown below:

TABLE B-3
AVERAGE ANNUAL CROP DAMAGE PREVENTED

Interim Survey Report	Current Reanalysis
$7,100	$7,000

(2) These benefits will accrue to both the national and regional accounts.

c. Flood damages prevented--non-crop.

(1) For this reanalysis, a detailed reassessment of all residential, commercial, industrial, and other improvements in the project area was made by field survey during late 1970. Data acquired during this survey provided the bases for computing average annual non-crop flood damages and benefits. The values computed for these factors in this reanalysis reflect major increases over the corresponding values presented in the authorizing document. A number of factors account for these increases. These factors are discussed below.

(a) The ENR average price levels during the period 1960 to 1970 rose by approximately 68 percent.

(b) Residual damages in the amount of $114,000 ($112,000 of which were non-crop) were computed in the authorizing document. A current reassessment of the flood hazard indicates that residual damages in the project area will be negligible with the project in place.

(c) The field survey previously referred to disclosed that additional residential and commercial developments have taken place since the 1960 analysis on which the project authorization is based. This increase in development reflects the 21 percent population increase in the area between 1960 and 1970, and a clear trend toward reduction in the number of persons per dwelling. The average value of the homes in the area in 1960 has escalated in the ensuing years, and newly constructed homes in the period 1960-1970 are of substantially higher unit value than those existing in 1960. In the authorizing document the value of all residential and commercial facilities within the project area, excluding contents, was found to be about $17,250,000 whereas in this reanalysis the value was found to be some $52,250,000.

(d) Changes in stage-frequency curves also increased the benefits computed in this reanalysis. For instance, for the Golden Meadow area it is now estimated that stages in the range of 4 feet to 8 feet m.s.l. will occur with more than twice the frequency indicated in the authorizing document.

(e) The relationship between depth of flooding and percent damage of structures and contents used in the authorizing document was found to have significantly understated the damages. This finding was derived from detailed studies of flood damages in the coastal area of Louisiana for four hurricanes during the decade 1960-1970--Carla (1961), Hilda (1964), Betsy (1965), and Camille (1969). The in-depth studies of depth-damage relationships were made for flood insurance rate studies conducted by NOD for the Federal Insurance Administration.

(f) An area of some 1,800 acres lying just below Golden Meadow has been added to the project area since the original analysis. In this area there exists approximately $3,500,000 in additional improvements, including 117 houses, 24 mobile homes, 1 catfood producing plant, 18 commercial facilities, and 2 churches.

(2) As is shown on plate B-1, the project area has been divided into three hydrologically separate areas for damage computation purposes. Area "A" (upper end near Larose) is not subject to any significant wave action, whereas Area "B" (middle of the project area) is subject to moderate wave attack, and Area "C" (lower and western side of project area) is subject to wave attack that varies from moderate to heavy. Stage-damage curves (plates B-2 through B-4) were derived based on experienced historical damages and theoretical damages related to stages greater than those previously experienced. Flood damages were computed on existing development by integrating the stage-frequency curves (plates B-5 and B-6) with the appropriate stage-damage curves to obtain the damage-probability curves (plates B-7 through B-9). The areas under these latter curves represent the average annual damages. Based on 1970 conditions, the total average annual damages amount to $2,358,400, as is disaggregated below.

TABLE B-4
AVERAGE ANNUAL NON-CROP DAMAGES--EXISTING DEVELOPMENT

Area	Damages
A	$ 64,500
B	266,400
C	2,027,500
Total	$2,358,400

(a) Average annual damages were determined for projected conditions of development in the years 1977 (base year of project economic life), 2000, 2020, and 2077 (final year of project economic life). The values thus determined are tabulated below.

TABLE B-5
PROJECTED NON-CROP DAMAGES

Year	Average annual damage	Growth rate	Growth factor
1970	$2,358,400		
		1 1/32%	1.0745
1977	2,534,100		
		1 1/32%	1.5545
2020	3,939,300		
		1%	1.7633
2077	6,946,200		

(b) Computations of average annual flood damages expected to occur over the project economic life of 100 years (1977-2077) are shown below:

Computation of Average Annual Damages

1977-2077	Constant	$2,534,100
1977-2020	$\frac{\$3,939,300-\$2,534,100}{43\ yrs.}$x395.99156x.03388 =	438,429
2020-2077	($3,939,300-$2,534,100)x25.79892x.25277x.03388 =	310,462
2020-2077	$\frac{\$6,946,200-\$3,939,300}{57\ yrs}$x536.30125x.25277x.03388 =	242,282
		$3,525,273
	(Rounded)	$3,525,000

(c) Since the residual damage with the project in place will be negligible, average annual benefits for flood damages prevented are equal to the total average annual flood damages. The results are shown below and are compared with the corresponding data from the authorizing document.

TABLE B-6
ANNUAL NON-CROP DAMAGES PREVENTED

Item	Authorizing document	Current reanalysis
Flood damages prevented (base year)	$212,800	$2,534,100[1]
Flood damages prevented (future)	109,400	990,900[1]
Flood damages prevented (total)	$322,200	$3,525,000

[1] These benefits accrue to both the national and the regional accounts.

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d. Intensified land use.

(1) Annual intensified land-use benefits were computed as the net annual return derived from the increase in land values resulting from project construction. This amount was determined to be 6 percent of the difference in pre- and post-project values, an increase from the 5 percent rate previously used. Detailed appraisals of land values were made in the latter part of 1970 and the data

obtained were used as a basis for these benefits. The values reported in the authorizing document and in this reanalysis are shown in table B-7 below, and are significantly different.

(2) The final figures obtained in this reanalysis reflect major increases in the intensified land-use benefits. Several factors contribute to these increases: (a) the original pre- and post-project land value estimates appear to have been unduly conservative; (b) the area enhanced has increased from approximately 30,900 acres to 32,400 acres because of changes in the levee alinement, extension of the levees below Golden Meadow, and inclusion in the enhanced area that portion contained within the existing Golden Meadow ring levee; (c) a relatively greater proportion of the land total included is now in the urban classification; (d) additional development in the area has generated a scarcity of available building sites forcing land values upward; and (e) onshore and offshore oil operations in the munificent Louisiana fields have indirectly affected pre-project land values. The area inclosed by the existing Golden Meadow ring levee had been excluded from intensified land-use benefits consideration in the authorizing document; however, the passage of Hurricane Hilda caused floodwaters to flank the existing protective dikes and, in effect, render them useless. In view of the apparent low level of flood protection offered by the existing levee, it is considered proper that intensified land-use benefits in Golden Meadow be credited to the authorized project. A comparison of the annual benefits is contained in the following table.

TABLE B-7
ESTIMATED LAND VALUES

Item	Authorizing document	Current Reanalysis
Area benefited	30,900 ac.	32,400 ac.
Post-project land value	$13,785,000	$77,048,000
Pre-project land value	12,532,000	68,228,000
Increase in land value	$ 1,253,000	$ 8,820,000
Annual rate of return	x5%	x6%
Annual intensified land-use benefits	$ 62,650	$ 529,200
(Rounded)	$ 52,200[1]	$ 529,000

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[1] Intensified land-use benefits on 1,200 acres of agricultural land converted to residential and commercial use and discounted for a 50-year period of conversion result in a reduction of $10,450 in enhanced value. However, for the reanalysis, it was concluded that any higher land use accruing from change in land values at a time later than that when the project is completed is, in fact, too elusive for accurate evaluation and uncertain as to cause. Consequently, the intensified land-use benefits in this analysis were not discounted.

(3) The annual intensified land-use benefit of $529,000 will be credited to the national and regional accounts.

e. Area redevelopment benefits.

(1) The project area lies entirely within the boundaries of Ward 10 of Lafourche Parish. Economic activity in this area is influenced to a great extent by the level of petroleum exploration and production in this general region of Louisiana as well as, to a lesser degree, by the harvest of commercial fisheries in the gulf and coastal waters. A considerable portion of the total employment is seasonal and annual incomes are considerably below the national average. Although Lafourche Parish has not been designated by the Economic Development Administration as a parish that is economically depressed, it is within reasonable commuting distance of three parishes which have been so designated. These are Ascension, Assumption, and St. John the Baptist.

(2) Redevelopment benefits will accrue to the national account from construction expenditures to underemployed labor. Construction is expected to cost $16,698,000. About 30 percent of this amount will be spent for labor, of which 22 percent will represent otherwise underemployed labor. This figure was amortized over a period of 100 years at an interest rate of 3 1/4 percent $16,698,000 x .30 x .22 x .03388 = $37,300). The national account annual redevelopment benefit from construction is $37,300. Annual redevelopment benefits also will accrue to the national account from O&M expenditures. Annual O&M costs are $97,000. It is estimated that 50 percent will represent payments for labor wages; initially all labor hired will be from the ranks of underemployed labor. It is anticipated that employment of underemployed labor will decline at a uniform rate to a zero-level in 20 years. The present value of labor wages over a 20-year period was determined. This figure was amortized for 100 years at an interest rate of 3 1/4 percent ($97,000 x .50 ÷ 20 x 168.02012 x .03388 = $13,800). The total national account redevelopment benefits are $51,100.

(3) The regional account will be credited with redevelopment benefits to the extent that construction expenditures represent new regional income which will be spent within the region.[1] Of the construction costs of $16,698,000, 30 percent will be spent

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[1] The methodology followed is that developed in connection with the Whiteoak Dam and Reservoir water resources project. Development of Water Resources in Appalachia, Main Report Part III, Project Analyses Chapters 14 thru 16, Office of Appalachian Studies, Corps of Engineers, Department of the Army, 1969, p. III-14-149.

for labor, of which wages it is estimated that 60 percent will be spent within the region. The amount is amortized at an interest rate of 3 1/4 percent over a 100-year period($16,698,000 x .30 x .60 x .03388 = $101,800). The annual regional redevelopment benefit from construction is $101,800. O&M expenditures will also accrue as regional redevelopment benefits to the extent that O&M labor expenditures represent new income spent within the region. Annual O&M costs are $97,000. About 50 percent will accrue to labor. It is estimated that 80 percent of the labor wages will be spent within the region, and will represent a regional redevelopment benefit of $38,800 ($97,000 x .50 x .80= $38,800). Total regional redevelopment benefits are $140,600.

(4) Those redevelopment benefits common to both accounts are detailed below:

From construction expenditures:

$16,698,000 x .30 x .22 x .03388 = $37,300

From annual O&M expenditures:

$97,000 x .1423 = $13,800

f. Indirect benefits.

(1) Indirect benefits will accrue to the national account as a result of new net national income. New wages received from project construction will result in new consumption expenditures on the part of the recipients of the new income. As this new consumption expenditure is respent within the nation, there is a multiplier effect. Additional consumption induces added investment. This process is referred to as the accelerator effect. The total benefit to the national account is greater than the original figure as presented above in paragraph e. The Council of Economic Advisers to the President, in testifying before the 88th Congress of the United States in favor of the Kennedy tax cut, estimated that the combined multiplier-accelerator effect upon Gross National Product was a factor of 3 to 4. In this analysis, a multiplier-accelerator factor of 3 was applied to national construction redevelopment benefits. An incremental national indirect benefit results in an amount twice that of the redevelopment benefit, or $74,600.

(2) The regional account also will benefit indirectly from construction expenditures for labor. Community multipliers measure 1.6 to 3.0.[2] A factor of 2 was applied to the regional redevelopment

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[2] Edgar Z. Palmer, Editor, The Community Economic Base and Multiplier, the University of Nebraska, 1958, p. 101. Floyd K. Harmston and Richard E. Lund, Application of an Input-Output Framework to a Community Economic System, University of Missouri Press, 1967, pp. 16 and 17.

benefit from construction labor, resulting in an incremental regional indirect benefit equal to the regional redevelopment benefit ($101,800).

(3) Indirect benefits common to both accounts with the common factor are shown below:

$16,698,000 x .00447 = $74,600

g. Social well-being benefits.

(1) The economic data presented in the tables below clearly illustrate the extent to which the parishes in the project area of economic influence are afflicted with underemployment of productive resources.

TABLE B-8
MEDIAN FAMILY INCOME[1]

	1960	1965	1966	1967
	$	$	$	$
United States	5,620	6,957	N/A	7,974
Lafourche Parish	4,330	N/A	4,869	N/A
Ascension Parish	3,877	N/A	4,605	N/A
Assumption Parish	2,817	N/A	3,445	N/A
St. Charles Parish	5,289	N/A	5,560	N/A
St. James Parish	3,659	N/A	4,223	N/A
St. John the Baptist Parish	4,079	N/A	4,629	N/A
Terrebonne Parish	4,831	N/A	5,319	N/A

[1] Statistical Abstract of the United States 1970, U. S. Department of Commerce, Bureau of the Census, and Statistical Abstract of Louisiana 1969 and 1971, Division of Business and Economic Research, College of Business Administration, Louisiana State University in New Orleans.

TABLE B-9
PER CAPITA INCOME[1]

	1965	1966	1967	1968
	$	$	$	$
United States	2,765	N/A	N/A	3,421
Lafourche Parish	N/A	1,972	2,393	N/A
Ascension Parish	N/A	1,742	2,117	N/A
Assumption Parish	N/A	1,367	1,649	N/A
St. Charles Parish	N/A	1,792	1,938	N/A
St. James Parish	N/A	1,452	1,778	N/A
St. John the Baptist Parish	N/A	1,562	1,899	N/A
Terrebonne Parish	N/A	2,052	2,486	N/A

[1] See footnote 1, table B-8.

(2) In the parishes of project economic influence, a relatively high percentage of people residing therein are considered to be poor.

TABLE B-10
PERCENTAGE OF FAMILIES CLASSIFIED AS POOR, 1966[1]

	%
United States	17
Lafourche Parish	28
Ascension Parish	30
Assumption Parish	46
St. Charles Parish	24
St. James Parish	41
St. John the Baptist Parish	35
Terrebonne Parish	26

[1] See footnote 1, table B-8.

(3) The relatively lower average weekly wage rate in Lafourche Parish coupled with a fluctuating unemployment rate, which from January 1969 through June 1970 ranged from a low of 2.5 percent to a high of 5.3 percent, indicate an underemployed labor force and one which is subject to relative instability of employment.

(4) Lateral development extant along both banks of Bayou Lafourche is rapidly depleting currently available developable land. Completion of the project will stimulate economic activity in the immediate area. It is expected that protection from flooding will induce development of an adequate interior drainage system, making additional lands accessible for residential and commercial development. So-called strip development, as now exists in the project area, is conducive to neither efficient nor harmonious land use. Area development will be facilitated with the potential for economical and adequate utility services, better circulation of traffic, and amelioration of traffic hazards. The project area will be more attractive to commercial, industrial, and residential development, contributing to the stimulation of economic activities.

(5) In the category of commercial service establishments, analysis of data published by the Louisiana Department of Employment Security shows that for the State of Louisiana employment in these establishments in 1969 accounted for 12 percent of total state employment. In Lafourche Parish, employment in service establishments accounted for 7 percent of total employment. It is expected that the number of personal service establishments and the employment in these establishments, and the number of people engaged in professional services will grow at a more rapid rate with the project than without it.

(6) Completion of the project and relief from inundation will induce a greater concentration of industries engaged in seafood preparation and in commercial establishments producing animal food and other preparations from fish and related natural resources abundantly available in close proximity.

(7) Project completion and completion of the authorized Lafitte-to-Larose highway (providing a more direct route from metropolitan New Orleans) will encourage exploitation of the inherent attractiveness of the project area for tourism and recreational activities.

(8) With the elimination of the threat of flooding, construction financing will be more readily available, particularly in the lower portions of the area. A general upgrading or betterment of residential and commercial construction will ensue. The present average residential unit value in the project area is approximately $10,000. The median value of owner-occupied housing units in Lafourche Parish is, according to the 1970 Census Bureau figures, approximately $13,000, whereas for the State of Louisiana the median unit value of owner-occupied residences is approximately $15,000. There will be, subsequent to project completion, incentive for greater investment in commercial structures, stock, plant, and equipment.

(9) A relatively high population density exists in the project area. In 1960, Carter-Horan & Chapin, Planning Consultants, reported in The Comprehensive Plan, Lower Lafourche Region that the Golden Meadow area had a density of 18.1 persons per acre. Cultural attributes minimize the expection that multifamily housing will relieve the problem of the scarcity of land available for residential development. The depletion of available land restricts the development of adequate neighborhood parks and other recreational areas. Additional problems incidental to the existing strip development have been previously discussed. The social and economic costs accompanying high-density strip-development will be alleviated by project construction. More opportunities for employment, recreation, more and better living space, and an amenable social environment will result from project construction.

(10) Local public investment programs embracing plans for a more economical distribution of traffic and utilities will contribute toward this component of the social well-being objective.

(11) Improving conditions contributing to attainment of economic stability and fuller resource utilization will encourage economic progress and attainment of related and associated social well-being objectives.

(12) Positive effects resulting from project construction enhancing security of life and health through reduction of the risk of flooding are also considerations in any assessment of project effects on social well-being.

4. Summary of benefits and the B/C ratio.

a. The average annual benefits are presented below. Asterisks are used to indicate those national account benefits which enter into computation of the B/C ratio. A comparison is made with benefits as they were presented in the authorizing document.

TABLE B-11
AVERAGE ANNUAL BENEFITS

Category of benefits	Authorizing document	National account	Regional account	Common to both accounts
	$	$	$	$
Flood damages prevented:				
On crops	7,100	7,000*	7,000	7,000
Non-crop:				
Base year	212,800	2,534,100*	2,534,100	2,534,100
Future	109,400	990,900*	990,900	990,900
Intensified land use	52,200	529,000*	529,000	529,000
Area redevelopment:				
On construction		37,300*	101,800	37,300
On O&M		13,800*	38,800	13,800
Indirect		74,600	101,800	74,600
Social well-being	Not	Quantified		
Subtotal of national account benefits included in B/C ratio		4,112,100		
Totals	381,500	4,186,700	4,303,400	4,186,700

b. Total annual benefits are $4,112,100; total annual costs are $984,700. The B/C ratio is 4.2.

5. Benefits attributable to the incremental project below Golden Meadow.

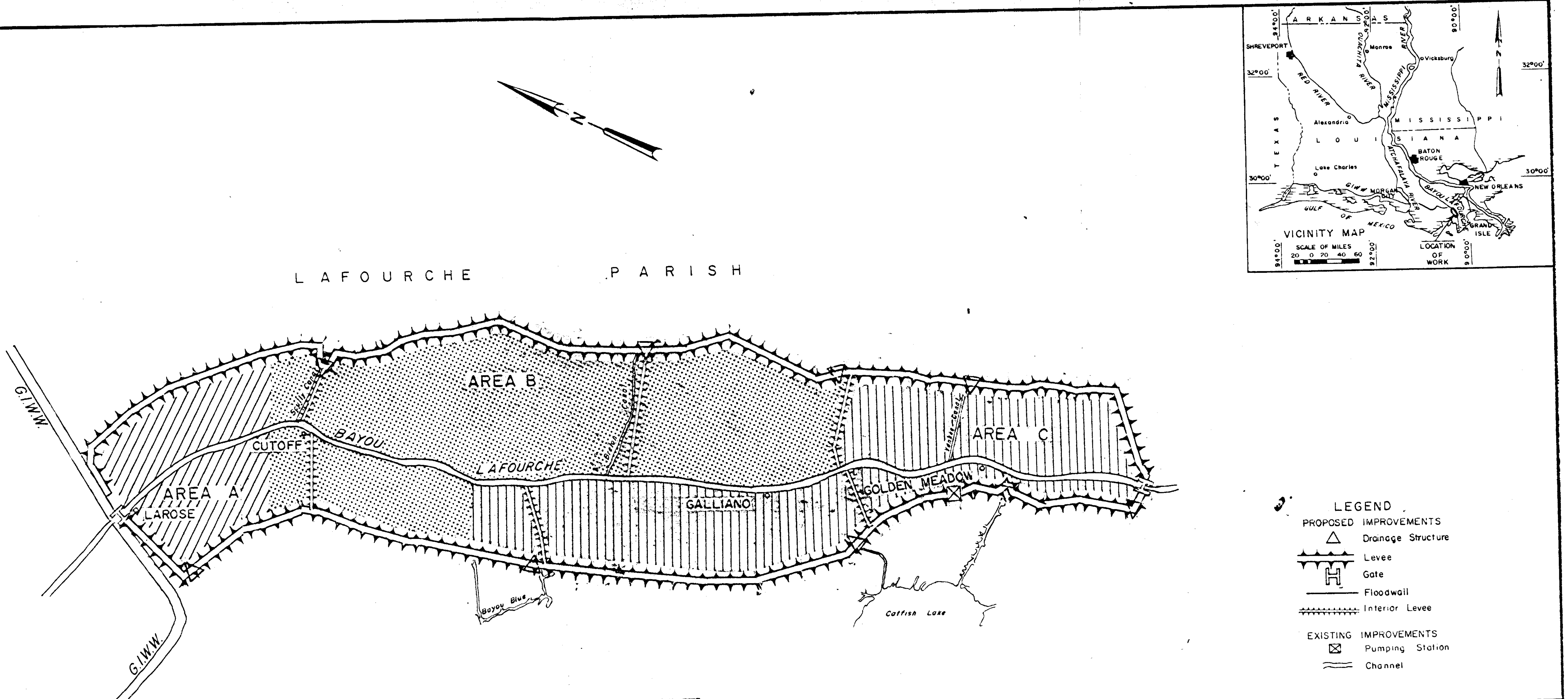
a. The benefits which are discussed in the previous paragraphs include benefits which will accrue from extension of the project to enclose an area of about 1,800 acres just below the town of Golden Meadow. In this area is located the largest single manufacturing facility in the entire project area--a catfood processing plant. The residents of the area are primarily members of a severely deprived racial minority group. It is anticipated that project construction will contribute significantly to the economic and social well-being of these residents. There will be greater incentive for home improvement and proper maintenance with liberation from the dread of recurring floods. It is expected that this portion of the project area will develop in accordance with the rates of projected growth discussed above in paragraph 2, page B-1.

b. A summary of the average annual benefits attributable to construction of the extension below Golden Meadow and the B/C ratio for that increment of the overall project follow. Asterisks are used to indicate those national account benefits which enter into computation of the B/C ratio.

TABLE B-12
AVERAGE ANNUAL BENEFITS PROJECT
BELOW GOLDEN MEADOW

Category of benefits	National account $	Regional account $	Common to both accounts $
Flood damages prevented:			
On crops	0	0	0
Non-crop:			
Base year	144,000*	144,000	144,000
Future	46,300*	46,300	46,300
Intensified land use	11,000*	11,000	11,000
Area redevelopment:			
On construction	3,500*	9,600	3,500
On O&M	600*	1,800	600
Indirect	7,000	9,600	7,000
Social well-being	Not	Quantified	
Subtotal of national account benefits included in B/C ratio	205,400		
Totals	212,400	222,300	212,400

c. Total annual benefits creditable to the National Account and accruing as a result of the project construction in the area below Golden Meadow are $205,400; total annual costs for this portion of the project are $77,900. The B/C ratio is 2.6.



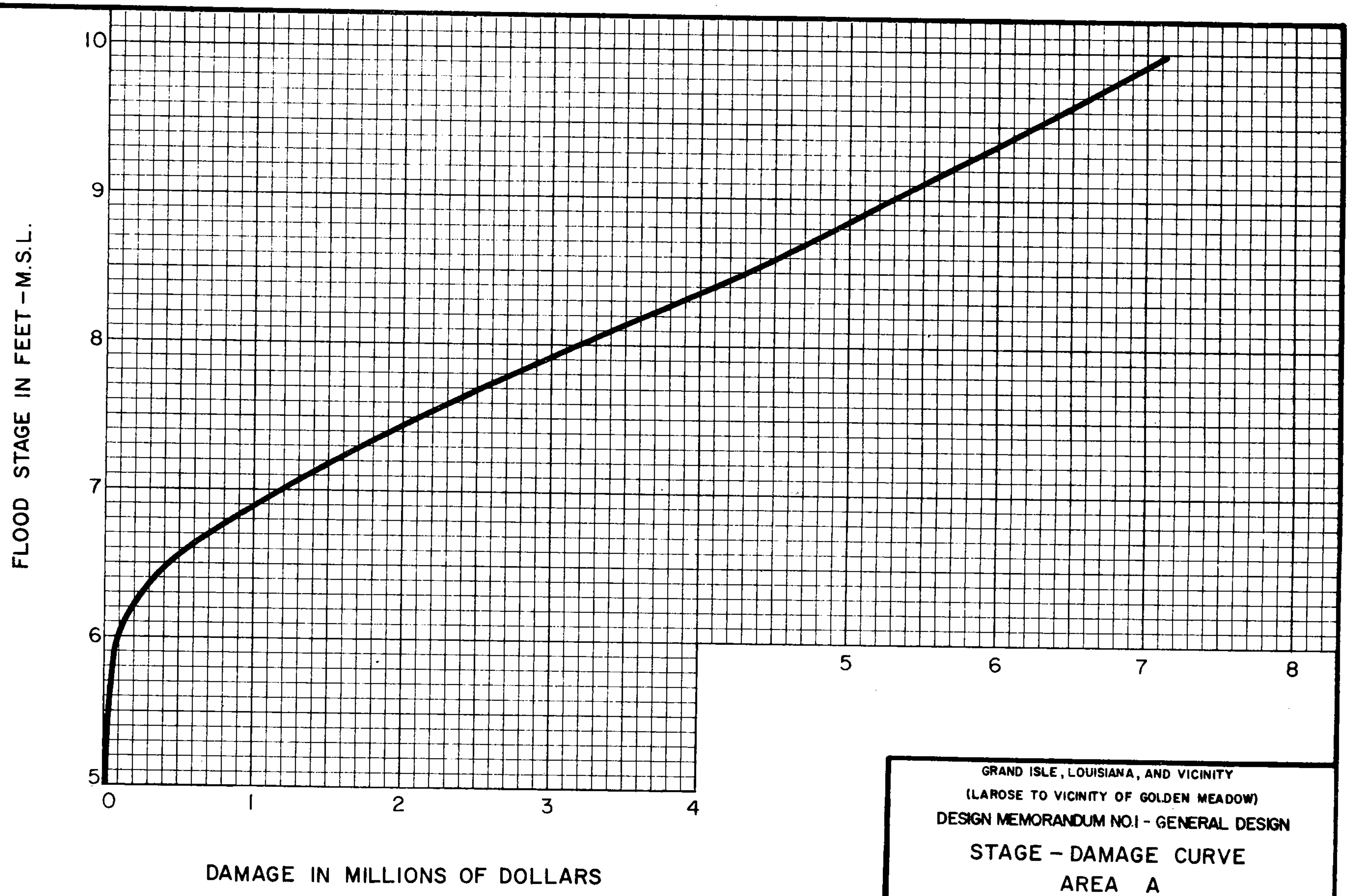
GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO.1 - GENERAL DESIGN

ECONOMIC STUDY AREAS AND VICINITY MAP

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

DATE: MARCH 1972
FILE NO. H-2-24314

PLATE B-1

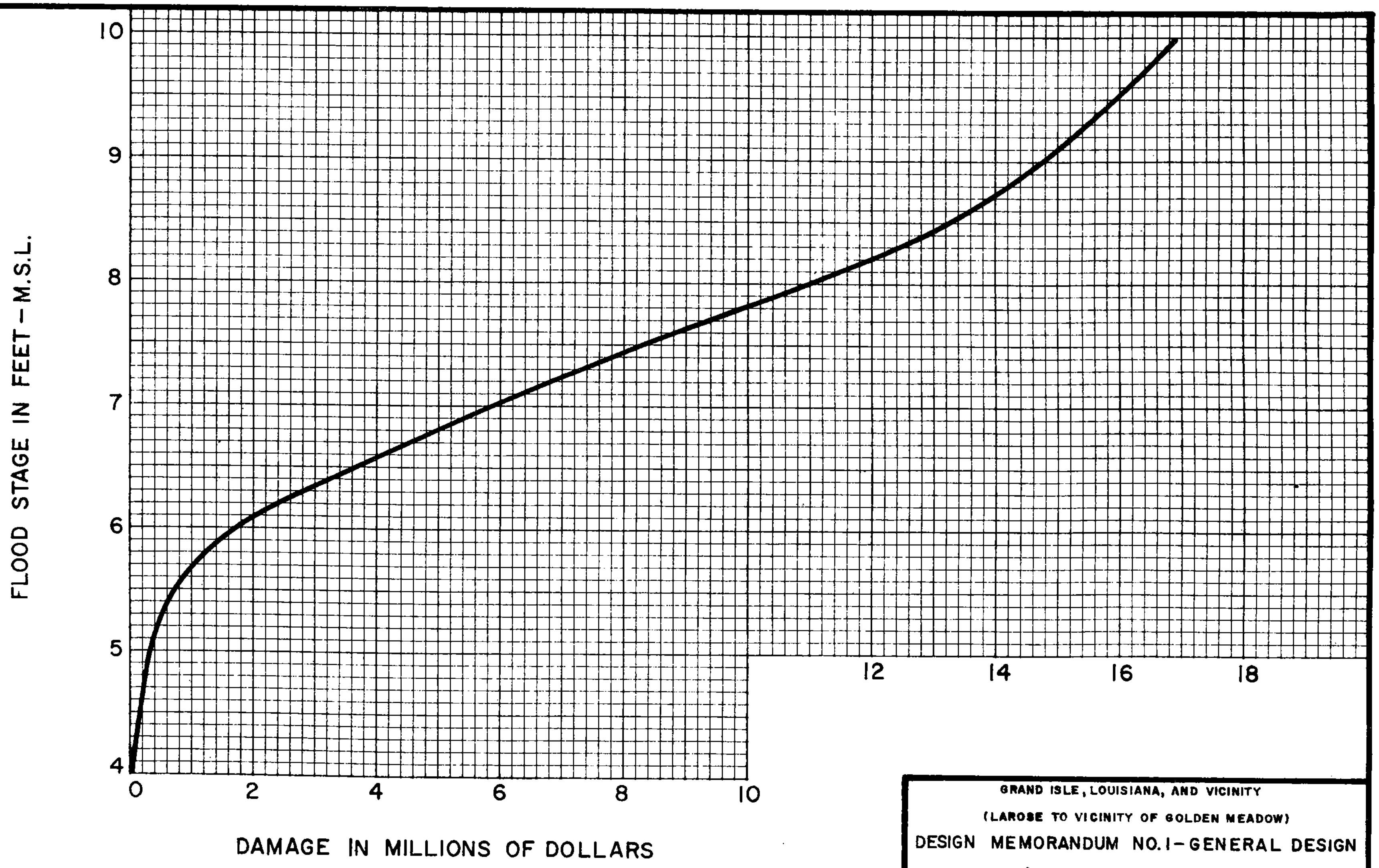


GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO.I - GENERAL DESIGN

STAGE - DAMAGE CURVE
AREA A

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

DATE: MARCH 1972
FILE NO. H-2-24314



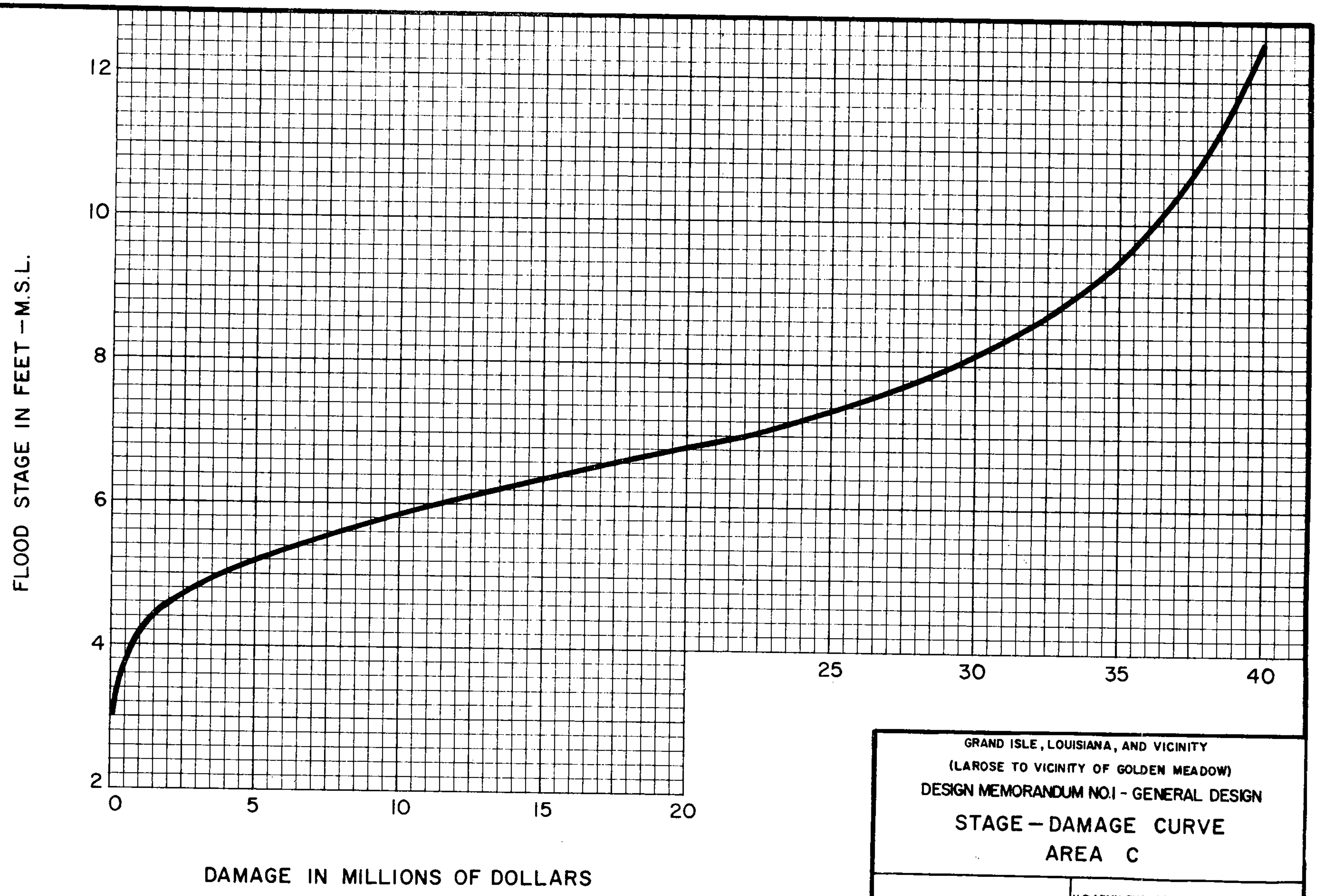
GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I – GENERAL DESIGN

STAGE – DAMAGE CURVE
AREA B

U.S. ARMY ENGINEER DIST., N.O. LA.
CORPS OF ENGINEERS

DATE : MARCH 1972

FILE NO. H-2-24314



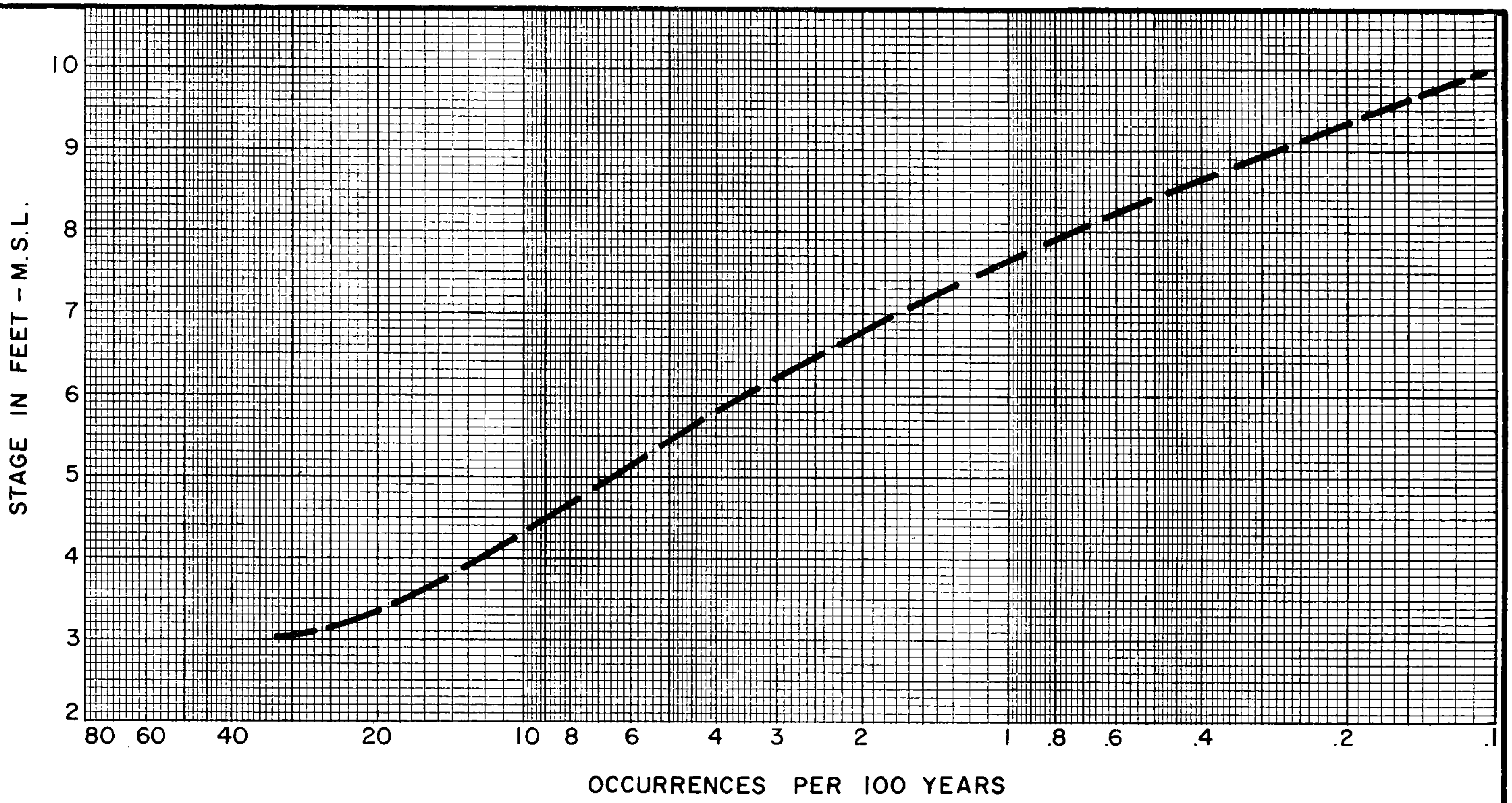
GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO.1 - GENERAL DESIGN

STAGE – DAMAGE CURVE
AREA C

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

DATE: MARCH 1972
FILE NO. H-2-2 314

PLATE B-4



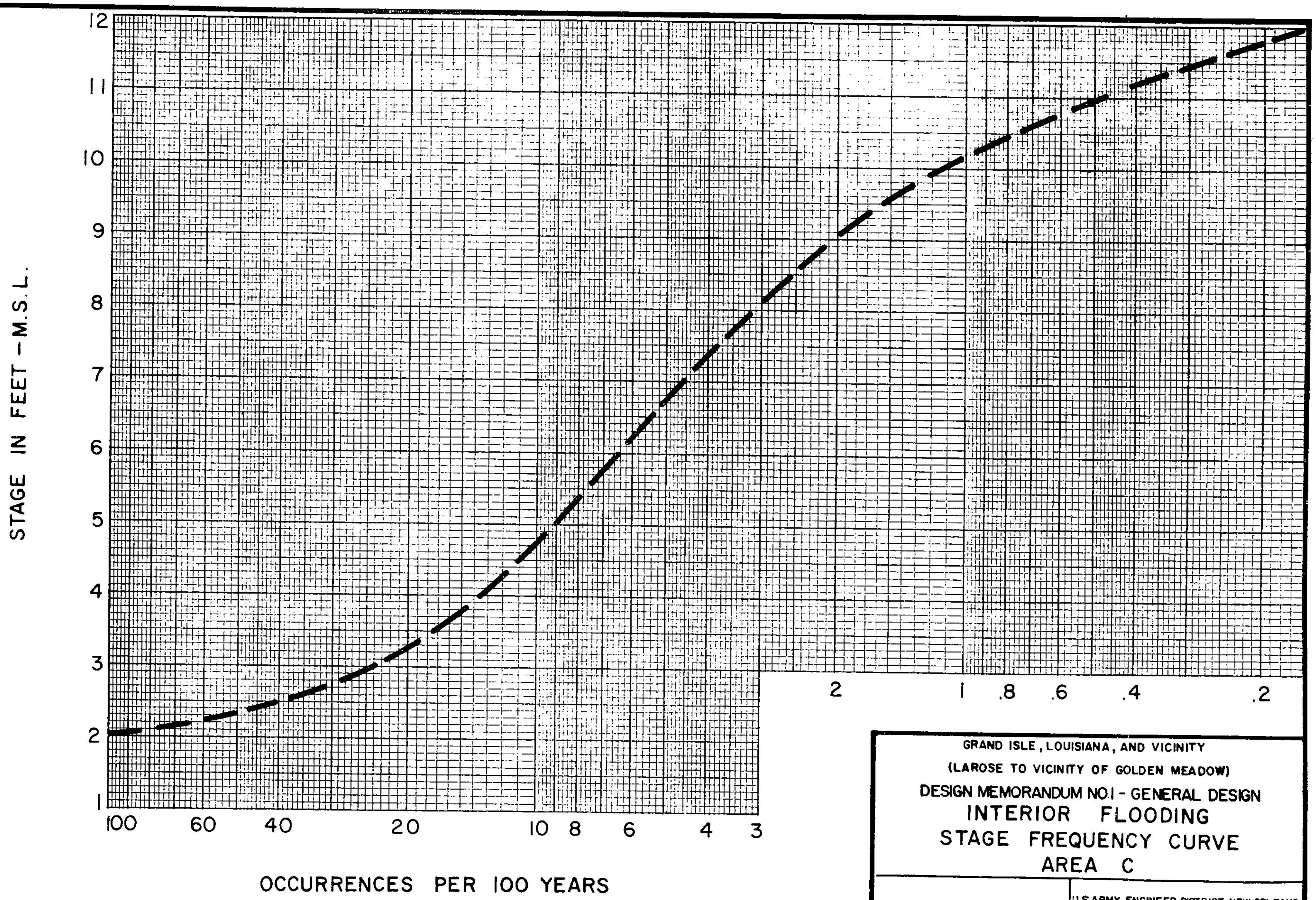
GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO.1 - GENERAL DESIGN

INTERIOR FLOODING
STAGE FREQUENCY CURVE
AREAS A AND B

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

DATE: MARCH 1972

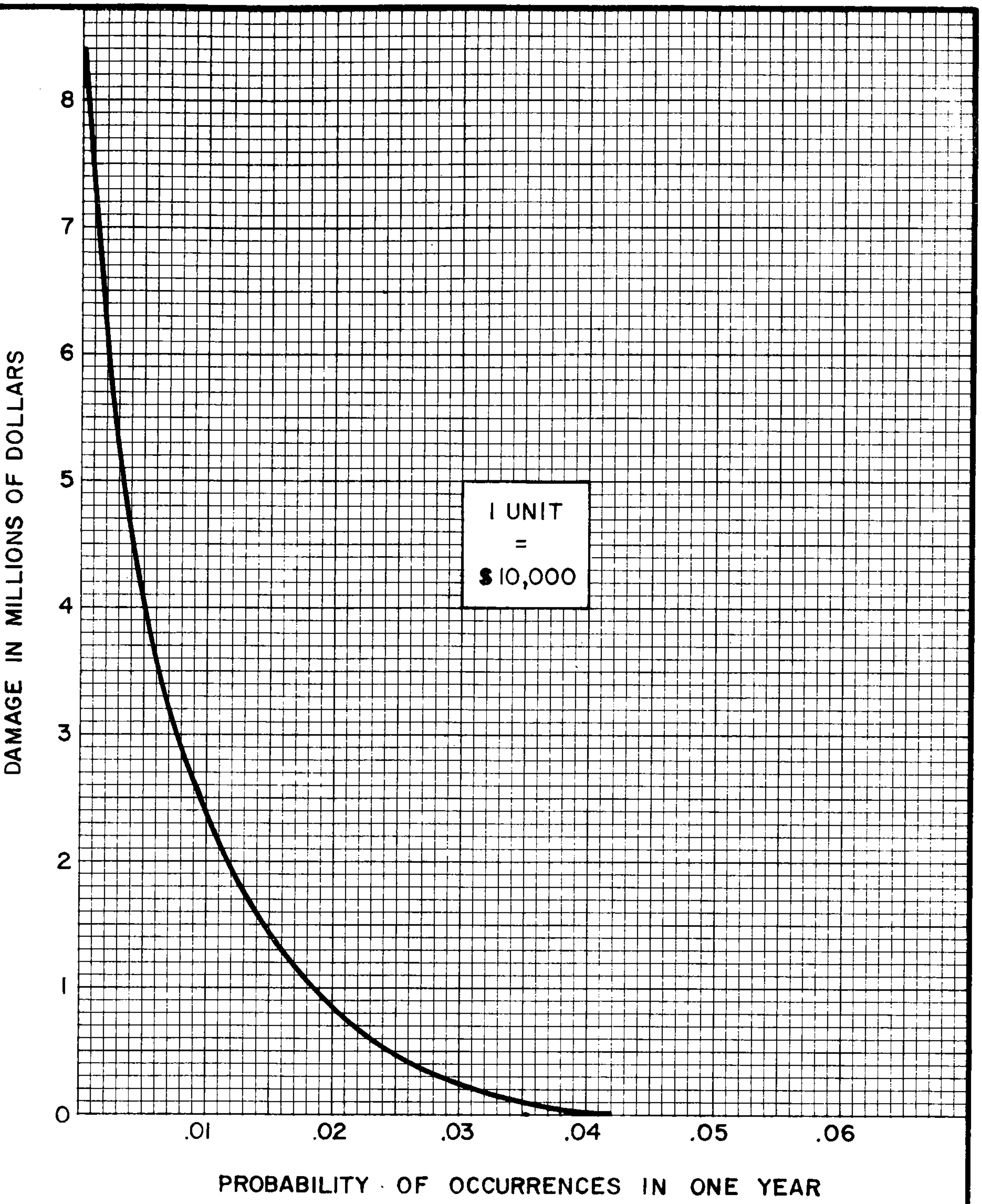
FILE NO. H-2-24314



GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO.1 - GENERAL DESIGN
INTERIOR FLOODING
STAGE FREQUENCY CURVE
AREA C

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

DATE: MARCH 1972
FILE NO. H-2-24314



AVERAGE ANNUAL DAMAGE:
6.45 ☐ X $ 10,000= $ 64,500

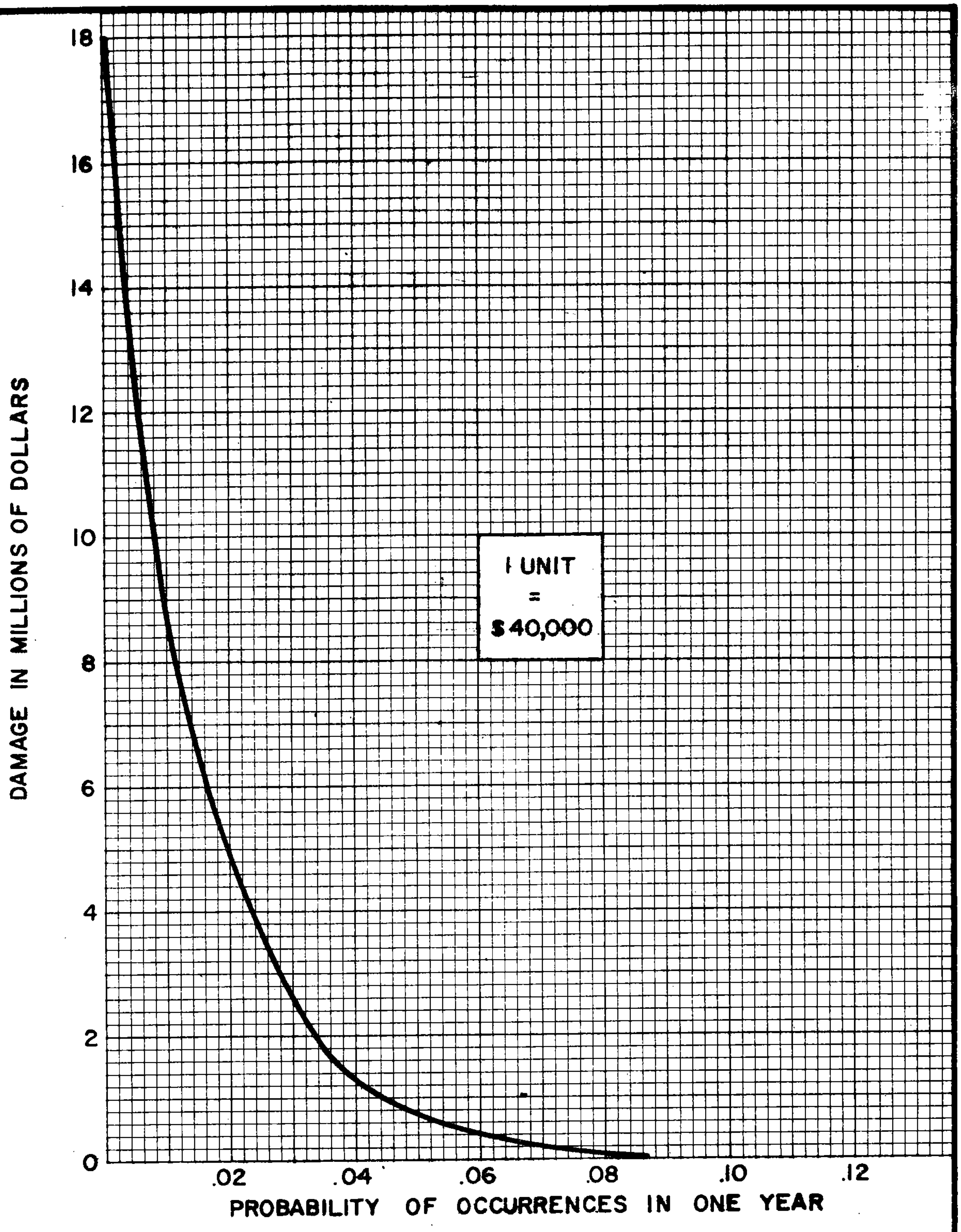
GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I – GENERAL DESIGN

DAMAGE – PROBABILITY CURVE
AREA A

U.S. ARMY ENGINEER DIST., N.O. LA.
CORPS OF ENGINEERS

DATE: MARCH 1972
FILE NO. H-2-24314

PLATE B-7



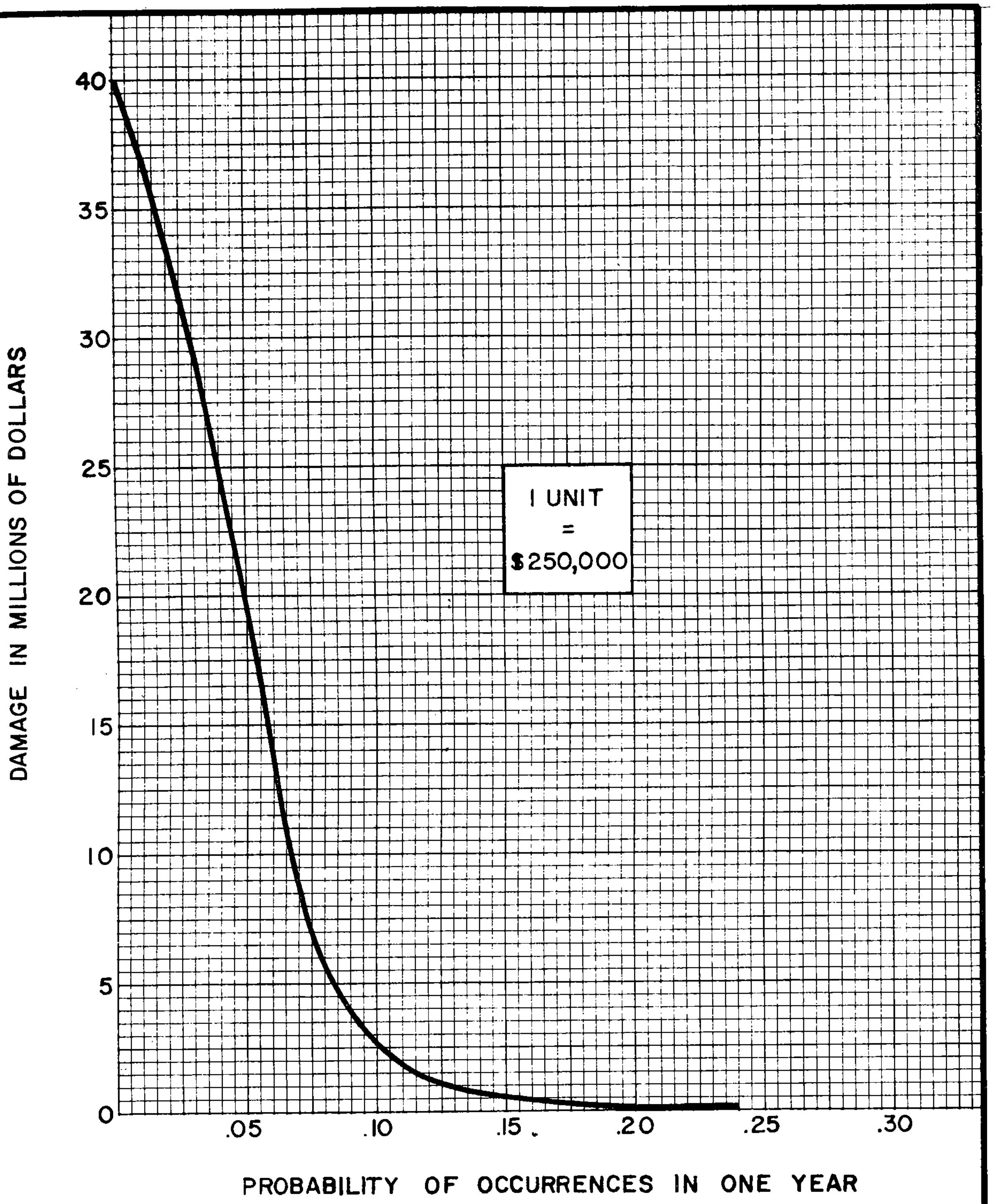
AVERAGE ANNUAL DAMAGE:
6.66 □ X $40,000= $266,400

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO.1—GENERAL DESIGN

DAMAGE—PROBABILITY CURVE
AREA B

U.S.ARMY ENGINEER DIST., N.O. LA.
CORPS OF ENGINEERS

DATE: MARCH 1972
FILE NO. H-2-24314



AVERAGE ANNUAL DAMAGE:
8.11□ X $ 250,000=$2,027,500

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO.1–GENERAL DESIGN

DAMAGE–PROBABILITY CURVE
AREA C

U.S. ARMY ENGINEER DIST., N.O. LA.
CORPS OF ENGINEERS

DATE: MARCH 1972

FILE NO. H-2-24314

GRAND ISLE, LOUISIANA AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1, GENERAL DESIGN

APPENDIX C

DETAILED COST ESTIMATES

GRAND ISLE, LOUISIANA AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1, GENERAL DESIGN

APPENDIX C
DETAILED COST ESTIMATES
TABLE OF CONTENTS

TABLE C-1
Detailed Estimate of First Cost

Cost acct. No.	Item	Quantity	Unit	Unit price	Cost
11	Levees and floodwalls				
1	Levees				
	First lift	6,798,669	cu.yd.	$ 0.80	$5,438,935
	Second lift	608,694	cu.yd.	0.65	395,651
	Third lift	445,683	cu.yd.	0.50	222,842
	Lateral levees	68,850	cu.yd.	0.65	44,752
	Clearing & grubbing for levees	237	acres	300.00	71,100
	Clearing for borrow	171	acres	150.00	25,650
	Seeding & fertilizing	1,153	acres	250.00	288,250
	Subtotal				$6,487,180
	Contingencies 20%±				1,298,019
	Subtotal				$7,785,200
30	Engineering & design 11%±				856,300
	Subtotal				$8,641,500
31	Supervision & administration 8%±				691,300
	Total				$9,332,800
2	Floodwalls				
	Larose-sta. 0+18 to sta. 26+54 (E.T.)				
	Concrete	1,155	cu.yd.	100.00	$ 115,500
	Portland cement	1,540	bbl.	5.50	8,470
	Reinforcing steel	115,500	lb.	0.18	20,790
	Sheet piling, Z-27	51,660	sq.ft.	6.40	330,624
	Sheet piling, MA-22	8,712	sq.ft.	5.80	50,530
	3x12 T&G timber	15	lin.ft.	5.00	75
	Structural excav.	988	cu.yd.	3.30	3,260
	Subtotal				$ 529,249
	Contingencies 20%±				105,851
	Subtotal (construction cost)				$ 635,100
30	Engineering & design 10%±				63,500
	Subtotal				$ 698,600
31	Supervision & administration 8.5%±				59,400
	Total				$ 758,000

TABLE C-1 (cont'd)

Cost acct. No.	Item	Quantity	Unit	Unit price	Cost
	3 Floodwalls & roadgates				
	a. Golden Meadow pumping station (sta. 138+30 to sta. 149+00)(R.L.)				
	(1) Floodwall				
	Concrete	496	cu.yd.	$100.00	$ 49,600
	Portland cement	660	bbl.	5.50	3,630
	Reinf. steel	49,600	lb.	0.18	8,928
	Sheet piling,Z-27	30,350	sq.ft.	6.40	194,240
	Structural excavation	245	cu.yd.	3.30	809
	(2) Roadgate No. 1				
	Concrete	59	cu.yd.	100.00	5,900
	Portland cement	79	bbl.	5.50	435
	Reinf. steel	7,620	lb.	0.18	1,372
	Struc. steel	7,100	lb.	0.65	4,615
	12" sq.precast prestressed conc. piles	1,040	lin.ft.	8.00	8,320
	Sheet piling MA-22	440	sq.ft.	5.80	2,552
	Hardware & misc. items	1	lump sum		1,300
	Subtotal				$ 281,701
	Contingencies 20%±				56,299
	Subtotal (construction cost)				$ 338,000
30	Engineering & design 10%±				33,900
	Subtotal				$ 371,900
31	Supervision & administration 8.5%±				32,100
	Total				$ 404,000

TABLE C-1 (cont'd)

Cost acct. No.	Item	Quantity	Unit	Unit price	Cost
	b. Golden Meadow area (sta. 211+68 to 202+42) (R.L.)				
	(1) Floodwall				
	Concrete	404	cu.yd.	$100.00	$ 40,400
	Portland cement	538	bbl.	5.50	2,959
	Reinf. steel	40,400	lb.	0.18	7,272
	Sheet piling Z-27	25,960	sq.ft.	6.40	166,144
	Structural excavation	196	cu.yd.	3.30	647
	(2) Roadgate No. 2				
	Concrete	82	cu.yd.	100.00	8,200
	Portland cement	109	bbl.	5.50	600
	Reinf. steel	9,400	lb.	0.18	1,692
	Struc. steel	11,000	lb.	0.65	7,150
	12" sq. precast prestressed conc. piles	1,560	lin.ft.	8.00	12,480
	MA-22 steel sheet piling	660	sq.ft.	5.80	3,828
	Hardware & misc. items	1	lump sum		1,000
	Subtotal				$ 252,372
	Contingencies 20%±				50,428
	Subtotal (construction cost)				$ 302,800
30	Engineering & design 10%±				30,300
	Subtotal				$ 333,100
31	Supervision & administration 8.5%±				27,900
	Total				$ 361,000
	4 Floodgates, floodwalls & roadgate				
	a. Larose-sta. 799+52 to 802+33 (W.T.)				
	(1) Floodgate				
	Structural excavation	8,350	cu.yd.	$ 3.30	$ 27,555
	Channel exc.	2,969	cu.yd.	0.50	1,484
	Dewatering & surface drainage	1	job		50,000
	Cellular cofferdam sheet piling, MP-101 (salvageable)	91,000	sq.ft.	4.50	409,500

TABLE C-1 (cont'd)

Cost acct. No.	Item	Quantity	Unit	Unit price	Cost
	Class "B" untreated timber piles	13,000	lin.ft.	$ 3.00	$ 39,000
	Concrete in base slab	1,335	cu.yd.	65.00	86,775
	Concrete in walls	1,038	cu.yd.	85.00	88,230
	Concrete in beams & slabs	20	cu.yd.	100.00	2,000
	Portland cement	3,200	bbl.	5.50	17,600
	Reinf. steel	239,300	lb.	0.18	43,074
	Misc. metalwork	35,000	lb.	0.80	28,000
	Steel in needle dams	35,000	lb.	0.80	28,000
	Control house	2	ea.	5,000.00	10,000
	Pipe handrail	500	lin.ft.	8.75	4,375
	Sector gate	115,300	lb.	0.75	86,475
	Operating machinery	1	job		30,000
	Electrical work	1	job		20,000
	Fire protection	1	job		10,000
	Cathodic protection	1	job		18,000
	Emergency power supply	1	job		15,000
	Navigation signals	1	job		2,500
	Treated timber	10.8	MFBM	800.00	8,640
	Timber guide wall	850	lin.ft.	230.00	195,500
	Riprap	2,470	tons	10.00	24,700
	Shell under base	765	cu.yd.	6.00	4,590
	Sand fill (cofferdam)	12,000	cu.yd.	6.00	72,000
	(2) Floodwalls				
	Structural excavation	43	cu.yd.	3.30	142
	Concrete	54	cu.yd.	100.00	5,400
	Portland cement	72	bbl.	5.50	396
	Reinf. steel	5,400	lb.	0.18	972
	Steel sheet piling, Z-27	3,720	sq.ft.	6.40	23,808
	Riprap	515	tons	10.00	5,150

TABLE C-1 (cont'd)

Cost acct. No.	Item	Quantity	Unit	Unit price	Cost
	Shell fill	427	cu.yd.	$ 6.00	$ 2,562
	Subtotal				$1,361,428
	Contingencies 20%±				272,272
	Subtotal (construction cost)				$1,633,700
30	Engineering & design 10%±				163,400
	Subtotal				$1,797,100
31	Supervision & administration 8.5%±				152,900
	Total				$1,950,000
	b. Golden Meadow-Sta. 223+60-sta. 233+75 (S.T.)				
	(1) Floodgate				
	Structural excav.	8,350	cu.yd.	$ 3.30	$ 27,555
	Channel excav.	14,240	cu.yd.	0.50	7,120
	Dewatering & surface drainage	1	job		50,000
	Steel sheet piling, MA-22	1,056	sq.ft.	5.80	6,125
	Cellular cofferdam sheet piling, MP-101 (salvageable)	91,000	sq.ft.	4.50	409,500
	Class "B" treated timber piles	13,890	lin.ft.	3.00	41,670
	Concrete in base slabs	1,484	cu.yd.	65.00	96,460
	Concrete in walls	1,349	cu.yd.	85.00	114,665
	Concrete in beams & slabs	20	cu.yd.	100.00	2,000
	Portland cement	3,800	bbl.	5.50	20,900
	Reinf. steel	285,300	lb.	0.18	51,354
	Misc. metalwork	35,000	lb.	0.80	28,000
	Steel in needle dams	35,000	lb.	0.80	28,000
	Control house	2	ea.	5,000.00	10,000
	Pipe handrail	500	lin.ft.	8.75	4,375
	Sector gate	132,600	lb.	0.75	99,450
	Fire protection	1	job		10,000
	Cathodic protection	1	job		18,000

TABLE C-1 (cont'd)

Cost acct. No.		Item	Quantity	Unit	Unit price	Cost
		Operating machinery	1	job		$ 30,000
		Elec. work	1	job		20,000
		Emergency power supply	1	job		15,000
		Navigation signals	1	job		2,500
		Treated timber	13.2	MFBM	$800.00	10,560
		Timber guide wall	800	lin.ft.	230.00	184,000
		Riprap	6,350	tons	10.00	63,500
		Shell under riprap	1,960	cu.yd.	6.00	11,760
		Levee borrow	44,300	cu.yd.	0.75	33,225
	(2)	Louisiana Highway 1 roadgate				
		Concrete	138	cu.yd.	$100.00	$ 13,800
		Portland cement	184	bbl.	5.50	1,012
		Reinf. steel	11,250	lb.	0.18	2,025
		Structural steel gate	18,333	lb.	0.65	11,916
		12" sq. prestressed concrete piles	2,700	lin.ft.	8.00	21,600
		MA-22 steel sheet piling	2,770	sq.ft.	5.80	16,066
		Shell under slab	50	cu.yd.	6.00	300
		Rails	196	lin.ft.	5.00	980
		Struc. excav.	130	cu.yd.	3.30	429
	(3)	Floodwalls				
		Concrete	367	cu.yd.	100.00	36,700
		Portland cement	488	bbl.	5.50	2,684
		Reinf. steel	36,700	lb.	0.18	6,606
		Shell fill	6,560	cu.yd.	6.00	39,360
		Sheet pile, Z-27	12,534	sq.ft.	6.40	80,218
		Sheet pile, MA-22	3,080	sq.ft.	5.80	17,864
		Struc. excav.	190	cu.yd.	3.30	627
		T&G precast prestressed conc. sheet piling: 8"x36" size	2,700	sq.ft.	4.60	12,420

TABLE C-1 (cont'd)

Cost acct. No.	Item	Quantity	Unit	Unit price	Cost
	12" sq. precast prestressed conc. piles	2,550	lin.ft.	$ 8.00	$ 20,400
	Riprap	1,745	tons	10.00	17,450
	Subtotal				$1,698,176
	Contingencies 20%±				339,624
	Subtotal (construction cost)				$2,037,800
30	Engineering & design 10%±				203,800
	Subtotal				$2,241,600
31	Supervision & administration 8.5%				188,400
	Total				$2,430,000
	5 Drainage structures				
	a. No. 1, sta. 66+87 (W.T.)				
	Pipe, G.M. asbestos bonded, 72"	1,432	lin.ft.	$ 84.00	$ 120,288
	Diaphragm, 72" pipe 10'x10'	49	ea.	600.00	29,400
	Excavation for cofferdam	18,210	cu.yd.	0.50	9,105
	Embankment for cofferdam	17,120	cu.yd.	0.80	13,768
	Excavation, str.	874	cu.yd.	5.50	4,807
	Backfill, struct.	3,229	cu.yd.	2.00	6,458
	Excavation, off-site drainage channel	140,000	cu.yd.	0.50	70,000
	Riprap	218	ton	10.00	2,180
	Shell	78	cu.yd.	6.00	468
	Concrete	513	cu.yd.	85.00	43,605
	Portland cement	680	bbl.	5.50	3,740
	Reinf. steel	64,040	lb.	0.18	11,527
	Handrail (bridge)	174	lin.ft.	8.75	1,523
	Steel grating (operating tower)	245	sq.ft.	2.00	490
	Concrete channel slab	19	lin.ft.	7.50	1,425
	Flap gate, 72"	7	ea.	7,800.00	54,600

TABLE C-1 (cont'd)

Cost acct. No.	Item	Quantity	Unit	Unit price	Cost
	Vertical lift gate	7	ea.	$12,400.00	$ 86,800
	Seeding & fertilizing	4	acre	250.00	1,000
	Dewatering	1	job		5,100
	Subtotal				$ 466,284
	Contingencies 20%				93,216
	Subtotal (construction cost)				$ 559,500
30	Engineering & design 10%				55,900
	Subtotal				$ 615,400
31	Supervision & administration 8.5%				52,600
	Total				$ 668,000
	b. No. 2-sta. 362+75 (W.T.)				
	Pipe, G.M. asbestos bonded, 72"	543	lin.ft.	$ 84.00	$ 45,612
	Diaphragm, 72" pipe 10'x10'	21	ea.	600.00	12,600
	Excavation for cofferdam	12,665	cu.yd.	0.50	6,333
	Embankment for cofferdam	15,035	cu.yd.	0.80	12,028
	Excavation, struct.	518	cu.yd.	5.50	2,849
	Backfill, struct.	2,220	cu.yd.	2.00	4,440
	Riprap	165	ton	10.00	1,650
	Shell	52	cu.yd.	6.00	312
	Concrete	282	cu.yd.	85.00	23,970
	Portland cement	374	bbl.	5.50	2,057
	Reinf. steel	35,134	lb.	0.18	6,324
	Handrail (bridge)	86	lin.ft.	8.75	753
	Steel grating (operating tower)	105	sq.ft.	2.00	210
	Concrete channel slab	11	lin.ft.	7.50	83
	Flap gate, 72"	3	ea.	7,800.00	23,400
	Vertical lift gate	3	ea.	12,400.00	37,200

TABLE C-1 (cont'd)

Cost acct. No.	Item	Quantity	Unit	Unit price	Cost
	Seeding & fertilizing	3	acre	$250.00	$ 750
	Dewatering	1	job		4,300
	Subtotal				$ 184,870
	Contingencies 20%				36,930
	Subtotal (construction cost)				$ 221,800
30	Engineering & design 10%				22,200
	Subtotal				$ 244,000
31	Supervision & administration 8.5%				21,000
	Total				$ 265,000
	c. No. 3-sta. 722+64 (W.T.)				
	Pipe, G.M. asbestos bonded, 72"	286	lin.ft.	$ 84.00	$ 24,024
	Diaphragm, 72" pipe, 10'x10'	8	ea.	600.00	4,800
	Excavation for cofferdam	6,340	cu.yd.	0.50	3,170
	Embankment for cofferdam	5,760	cu.yd.	0.80	4,608
	Excavation, struct.	665	cu.yd.	5.50	3,658
	Backfill, struct.	1,518	cu.yd.	2.00	3,036
	Riprap	153	ton	10.00	1,530
	Shell	52	cu.yd.	6.00	312
	Concrete	219	cu.yd.	85.00	18,615
	Portland cement	290	bbl.	5.50	1,595
	Reinf. steel	27,280	lb.	0.18	4,910
	Handrail (bridge)	68	lin.ft.	8.75	595
	Steel grating (operating tower)	70	sq.ft.	2.00	140
	Concrete channel slab	11	lin.ft.	7.50	83
	Flap gate, 72"	2	ea.	7,800.00	15,600
	Vertical lift gate	2	ea.	12,400.00	24,800

TABLE C-1 (cont'd)

Cost acct. No.	Item	Quantity	Unit	Unit price	Cost
	Seeding & fertilizing	2	acre	$250.00	$ 500
	Dewatering		lump sum		500
	Subtotal				$ 112,476
	Contingencies 20%				22,524
	Subtotal (construction cost)				$ 135,000
30	Engineering & design 10%				13,500
	Subtotal				$ 148,500
31	Supervision & administration 8.5%				12,500
	Total				$ 161,000
	d. No. 4-Sta. 960+60 (E.T.)				
	Pipe, G.M. asbestos bonded, 72 in.	1,236	lin.ft.	$ 84.00	$ 103,824
	Diaphragm, 72 in. pipe,10'x10'	32	ea.	600.00	19,200
	Excavation, for cofferdam	20,770	cu.yd.	0.50	10,385
	Embankment, for cofferdam	21,700	cu.yd.	0.80	17,360
	Excavation, struct.	618	cu.yd.	5.50	3,399
	Backfill, struct.	3,546	cu.yd.	2.00	7,092
	Riprap	179	ton	10.00	1,790
	Shell	62	cu.yd.	6.00	372
	Concrete	341	cu.yd.	85.00	28,985
	Portland cement	453	bbl.	5.50	2,492
	Reinforcing steel	42,590	lb.	0.18	7,666
	Handrail (bridge)	150	lin.ft.	8.75	1,313
	Steel grating (operating tower)	140	sq.ft.	2.00	280
	Concrete channel slab	34	lin.ft.	7.50	255
	Flap gate, 72 in.	4	ea.	7,800.00	31,200
	Vertical lift gate	4	ea.	12,400.00	49,600

TABLE C-1 (cont'd)

Cost acct. No.	Item	Quantity	Unit	Unit price	Cost
	Seeding and fertilizing	4	acre	$250.00	$ 1,000
	Dewatering	1	job		4,800
	Subtotal				$ 291,013
	Contingencies, 20%				58,187
	Subtotal (construction cost)				$ 349,200
30	Engineering and design, 10%				34,900
	Subtotal				$ 384,100
31	Supervision & administration, 8.5%				32,900
	Total				$ 417,000
	e. No. 5-Sta.842+82 (E.T.)				
	Pipe, G.M. asbestos bonded, 72 in.	900	lin.ft.	$ 84.00	$ 75,600
	Diaphragm, 72 in. pipe 10'x10'	16	ea.	600.00	9,600
	Excavation, for cofferdam	15,320	cu.yd.	0.50	7,660
	Embankment, for cofferdam	14,510	cu.yd.	0.80	11,608
	Excavation, struct.	575	cu.yd.	5.50	3,163
	Backfill, struct.	2,710	cu.yd.	2.00	5,420
	Riprap	179	ton	10.00	1,790
	Shell	62	cu.yd.	6.00	372
	Concrete	330	cu.yd.	85.00	28,050
	Portland cement	439	bbl.	5.50	2,415
	Reinforcing steel	41,226	lb.	0.18	7,421
	Handrail (bridge)	112	lin.ft.	8.75	980
	Steel grating (operating tower)	140	sq.ft.	2.00	280
	Concrete channel slab	15	lin.ft.	7.50	113
	Flap gate, 72 in.	4	ea.	7,800.00	31,200
	Vertical lift gate	4	ea.	12,400.00	49,600

TABLE C-1 (cont'd)

Cost acct. No.	Item	Quantity	Unit	Unit price	Cost
	Seeding and fertilizing	2	acre	$250.00	$ 500
	Dewatering	1	job		4,100
	Subtotal				$ 239,872
	Contingencies, 20%				47,928
	Subtotal (construction cost)				$ 287,800
30	Engineering and design, 10%				28,900
	Subtotal				$ 316,700
31	Supervision and administration, 8.5%				27,300
	Total				$ 344,000
	f. No. 6-Sta. 634+75 (E.T.)				
	Pipe, G.M. Asbestos bonded, 72 in.	625	lin.ft.	$ 84.00	$ 52,500
	Diaphragm, 72 in. pipe, 10'x10'	20	ea.	600.00	12,000
	Excavation, for cofferdam	8,090	cu.yd.	0.50	4,045
	Embankment, for cofferdam	6,950	cu.yd.	0.80	5,560
	Excavation, struct.	687	cu.yd.	5.50	3,779
	Backfill, struct.	2,420	cu.yd.	2.00	4,840
	Riprap	198	ton	10.00	1,980
	Shell	138	cu.yd.	6.00	828
	Concrete	408	cu.yd.	85.00	34,680
	Portland cement	542	bbl.	5.50	2,981
	Reinforcing steel	50,960	lb.	0.18	9,173
	Handrail (bridge)	122	lin.ft.	8.75	1,068
	Steel grating (operating tower)	175	sq.ft.	2.00	350
	Concrete channel slab	11	lin.ft.	7.50	83
	Flap gate, 72 in.	5	ea.	7,800.00	39,000
	Vertical lift gate	5	ea.	12,400.00	62,000

TABLE C-1 (cont d)

Cost acct. No.	Item	Quantity	Unit	Unit price	Cost
	Seeding and fertilizing	3	acre	$250.00	$ 750
	Dewatering	1	job		3,100
	Subtotal				$ 238,717
	Contingencies,20%				47,683
	Subtotal (construction cost)				$ 286,400
30	Engineering and design, 10%				28,600
	Subtotal				$ 315,000
31	Supervision and administration, 8.5%				27,000
	Total				$ 342,000
	g. No. 7-Sta. 325+00				
	Pipe, G.M. asbestos bonded, 72 in.	238	lin.ft.	$ 84.00	$ 19,992
	Diaphragm, 72 in. pipe, 10'x10'	8	ea.	600.00	4,800
	Excavation, for cofferdam	6,160	cu.yd.	0.50	3,080
	Embankment, for cofferdam	5,020	cu.yd.	0.80	4,016
	Excavation, struct.	435	cu.yd.	5.50	2,393
	Backfill, struct.	1,340	cu.yd.	2.00	2,680
	Riprap	159	ton	10.00	1,590
	Shell	54	cu.yd.	6.00	324
	Concrete	232	cu.yd.	85.00	19,720
	Portland cement	308	bbl.	5.50	1,694
	Reinforcing steel	28,970	lb.	0.18	5,215
	Handrail (bridge)	68	lin.ft.	8.75	595
	Steel grating (operating tower)	70	sq.ft.	2.00	140
	Concrete channel slab	11	lin.ft.	7.50	83
	Flap gate, 72 in.	2	ea.	7,800.00	15,600
	Vertical lift gate	2	ea.	12,400.00	24,800

TABLE C-1 (cont'd)

Cost acct. No.	Item	Quantity	Unit	Unit price	Cost
	Seeding and fertilizing	3	acre	$250.00	$ 750
	Dewatering	1	job		500
	Subtotal				$ 107,972
	Contingencies, 20%				21,628
	Subtotal (construction cost)				$ 129,600
30	Engineering and design, 10%				13,000
	Subtotal				$ 142,600
31	Supervision and administration, 8.5%				12,400
	Total				$ 155,000
	h. No. 8-Sta. 217+00 (S.T.)				
	Pipe, G.M. asbestos bonded, 72 in.	240	lin.ft.	$ 84.00	$ 20,160
	Diaphragm, 72 in. pipe, 10'x10'	8	ea.	600.00	4,800
	Excavation, for cofferdam	13,920	cu.yd.	0.50	6,960
	Embankment, for cofferdam	15,250	cu.yd.	0.80	12,200
	Excavation, struct.	355	cu.yd.	5.50	1,953
	Backfill, struct.	1,740	cu.yd.	2.00	3,480
	Excavation, off-site drainage channel	716,600	cu.yd.	0.50	358,300
	Riprap	293	ton	10.00	2,930
	Shell	54	cu.yd.	6.00	324
	Concrete	184	cu.yd.	85.00	15,640
	Portland cement	244	bbl.	5.50	1,342
	Reinforcing steel	22,970	lb.	0.18	4,135
	Handrail (bridge)	78	lin.ft.	8.75	683
	Steel grating (operating tower)	35	sq.ft.	2.00	70
	Concrete channel slab	25	lin.ft.	7.50	188
	Flap gate, 72 in.	1	ea.	7,800.00	7,800
	Vertical lift gate	1	ea.	12,400.00	12,400

TABLE C-1 (cont'd)

Cost acct. No.	Item	Quantity	Unit	Unit price	Cost
	Seeding and fertilizing	4	acre	$250.00	$ 1,000
	Dewatering	1	job		500
	Subtotal				$ 454,865
	Contingencies, 20%				91,135
	Subtotal (construction cost)				$ 546,000
30	Engineering and design, 10%				54,600
	Subtotal				$ 600,600
31	Supervision and administration, 8.5%				51,400
	Total				$ 652,000
01	<u>Lands and Damages</u>				
6	Lands & improvements				
	a. Levee and borrow area R/W				
	Homesite land	1	acre	$15,000.00	$ 15,000
	Homesite land	3	acre	6,000.00	18,000
	Homesite land	7	acre	5,000.00	35,000
	Homesite land	22	acre	4,000.00	88,000
	Brush land	6	acre	1,500.00	9,000
	Sugarcane land	6	acre	1,500.00	9,000
	Brush land	33	acre	1,000.00	33,000
	Pasture land	165	acre	750.00	123,750
	Woodland	9	acre	750.00	6,750
	Woodland	138	acre	500.00	69,000
	Woodland	372	acre	300.00	111,600
	Marsh land	69	acre	200.00	13,800
	Marsh land	1,105	acre	50.00	55,250
	Subtotal				$ 587,150
	Rounded to:				$ 600,000
	Severance:				$ 10,000
	Improvements:				40,000
	Subtotal				$ 650,000
	Contingencies (20%)				135,000
	Relocation assistance costs (P.L.91-646)				15,000
	Real estate hired labor costs (400 tracts)				20,000
	Acquisition costs by others (400 tracts)				300,000
	Total land and damages				$1,120,000

TABLE C-1 (cont'd)

Cost acct. No.	Item	Quantity	Unit	Unit price	Cost
7	Relocations				
	1" pipelines	500	lin.ft.	$ 7.50	$ 3,750
	2" pipelines	600	lin.ft.	15.00	9,000
	3" pipelines	8,700	lin.ft.	22.25	193,575
	4" pipelines	1,350	lin.ft.	30.00	40,500
	6" pipelines	5,530	lin.ft.	44.50	246,085
	8" pipelines	5,020	lin.ft.	60.00	301,200
	12" pipelines	1,400	lin.ft.	89.00	124,600
	16" pipelines	830	lin.ft.	130.00	107,900
	20" pipelines	800	lin.ft.	160.00	128,000
	Road crossings	6	ea.	4,000.00	24,000
	La. Hwy. 1 auxiliary bypass	1	ea.		6,750
	Roadgate temporary bypass at Golden Meadow ring levee	2	ea.	3,000.00	6,000
	14 overhead powerlines	1	job		14,000
	Golden Meadow pumping sta. discharge lines	1	job		3,000
	Subtotal				$1,208,360
	Contingencies 20%±				241,640
	Subtotal (construction cost)				$1,450,000
30	Engineering & design 10%±				145,000
	Subtotal				$1,595,000
31	Supervision & administration 8.5%±				135,000
	Total relocations				$1,730,000
	TOTAL PROJECT COST				$21,100,000

TABLE C-2
Estimate of Apportionment of Costs Between Federal and non-Federal Interests

1. Project first cost

Construction	$18,250,000
Lands, damages	1,120,000
Relocations	1,730,000
Total	$21,100,000

2. Apportionment of cost

	Federal 70%	Non-Federal 30%
	$14,770,000	$6,330,000
Less cost of lands, damages & relocations		2,850,000
Cash contribution		$3,480,000

TABLE C-3
Detailed Estimate of First Cost of Extending Levees Approximately 2 Miles South of Golden Meadow

Cost acct. No.	Item	Quantity	Unit	Unit price	Cost
1	Levees and floodwall				
	Levees				
	First lift	981,500	cu.yd.	$ 0.80	$ 785,200
	Second lift	48,589	cu.yd.	0.65	31,583
	Third lift	29,153	cu.yd.	0.50	14,577
	Clearing & grubbing for levees	28	acre	300.00	8,400
	Clearing for borrow	20	acre	150.00	3,000
	Seeding & fertilizing	73	acre	250.00	18,250
	Subtotal				$ 861,010
	Contingencies, 20%				172,190
	Subtotal (construction cost)				$1,033,200
	Engineering & design, 11%				133,700
	Subtotal				$1,146,900
	Supervision & administration, 8%				91,700
	Total levees				$1,238,600
2	Drainage structure No. 8[1]				
	Subtotal construction cost				$ 546,000
	Engineering and design				54,600
	Supervision and administration				51,400
	Total drainage structure				$ 652,000
3	Lands and damages				
	Levee and borrow area R/W	247	acre	varies	$ 44,100
	Contingencies, 20%±				8,800
	Market value				$ 52,900
	Improvements				700
	Contingencies, 20%±				100
	Acquisition costs				8,000
	Total lands and damages				$ 61,700
	Total for levee extension				$1,951,900

[1] Details of estimate are shown in Table 1.

NOTE: Only the north-south levees are included in the above table since it was assumed that the cost of the east-west closure levee would be the same in either location.

TABLE C-4
Detailed Estimate of First Cost of Golden Meadow Floodgate and Floodwalls from Sta. 223+60 to Sta. 233+75 Adjacent to Bayou Lafourche

Cost acct. No.	Item	Quantity	Unit	Unit price	Cost
11	Floodgate				
	Structural excavation	13,900	cu.yd.	$ 3.30	$ 45,870
	Channel excavation	185,000	cu.yd.	0.50	92,500
	Dewatering and surface drainage	1	job		50,000
	Sheet piling, MA-22	1,056	sq.ft.	5.80	6,125
	Cellular cofferdam sheet piling, MP-101 (salvageable)	91,000	sq.ft.	4.50*	409,500
	Class "B" untreated timber pile	13,890	lin.ft.	3.00	41,670
	Concrete in base slab	1,484	cu.yd.	65.00	96,460
	Concrete in walls	1,349	cu.yd.	85.00	114,665
	Concrete in beams and slabs	20	cu.yd.	100.00	2,000
	Portland cement	3,800	bbl.	5.50	20,900
	Reinforcing steel	285,300	lb.	0.18	51,354
	Miscellaneous metalwork	35,000	lb.	0.80	28,000
	Steel in needle dams	35,000	lb.	0.80	28,000
	Control house	2	ea.	5,000.00	10,000
	Pipe handrail	500	lin.ft.	8.75	4,375
	Sector gate	132,600	lb.	0.75	99,450
	Fire protection	1	job		10,000
	Cathodic protection	1	job		18,000
	Operating machinery	1	job		30,000
	Electrical work	1	job		20,000
	Emergency power supply	1	job		15,000
	Navigation signals	1	job		2,500
	Treated timber	13.2	MFBM	800.00	10,560
	Timber guide wall	800	lin.ft.	230.00	184,000
	Riprap	6,350	tons	10.00	63,500
	Shell under riprap	1,960	cu.yd.	6.00	11,760
	Levee borrow	44,300	cu.yd.	0.75	33,225

* Prices assume all sheet piles and bracing will be salvaged.

TABLE C-4 (cont'd)

Cost acct. No.	Item	Quantity	Unit	Unit price	Cost
11	<u>Louisiana Highway 1 Roadgate</u>				
	Concrete	138	cu.yd.	$100.00	$ 13,800
	Portland cement	184	bbl.	5.50	1,012
	Reinforcing steel	11,250	lb.	0.18	2,025
	Structural steel gate	18,333	lb.	0.65	11,916
	12" sq. concrete piles	2,700	lin.ft.	8.00	21,600
	Steel sheet piling, MA-22	2,770	sq.ft.	5.80	16,066
	Shell under slab	50	cu.yd.	6.00	300
	Rails	196	lin.ft.	5.00	980
	Structural excavation	130	cu.yd.	3.30	429
11	<u>Floodwalls</u>				
	Concrete	367	cu.yd.	100.00	36,700
	Portland cement	488	bbl.	5.50	2,684
	Reinforcing steel	36,700	lb.	0.18	6,606
	Shell fill	6,560	cu.yd.	6.00	39,360
	Sheet piling, Z-27	12,534	sq.ft.	6.40	80,218
	Steel sheet piling, MA-22	3,080	sq.ft.	5.80	17,864
	12" sq. concrete pile	2,550	lin.ft.	8.00	20,400
	Structural excavation	190	cu.yd.	3.30	627
	T&G conc. sheet piling 8"x36"	2,700	sq.ft.	4.60	12,420
	Riprap	1,745	tons	10.00	17,450
	Subtotal				$1,801,870
	Contingencies, 20%±				360,330
	Subtotal (construction cost)				$2,162,200
	Engineering and design, 10%±				216,200
	Subtotal				$2,378,400
	Supervision and administration, 8.5%±				202,200
	TOTAL				$2,580,600

The total estimated cost of the Golden Meadow floodgate, La. Hwy. 1 Roadgate, and floodwalls shown on plates 36, 36A and 37 is shown in Table C-1 to be $2,432,100.

GRAND ISLE, LOUISIANA AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1, GENERAL DESIGN

APPENDIX D

STRUCTURAL DESIGN ANALYSIS

APPENDIX D

GRAND ISLE, LOUISIANA AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1, GENERAL DESIGN

APPENDIX D
STRUCTURAL DESIGN
TABLE OF CONTENTS

APPENDIX D

STRUCTURAL DESIGN

1. General. Structural design has been accomplished in accordance with standard engineering practice and criteria set forth in Engineering Manuals for Civil Works Construction published by the Office, Chief of Engineers.

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

	Elevations	
	Larose	Others
a. Water elevations		
Still water level	7.7	10.2
Landside of floodwall	0.0	0.0*

* - 2.0 used for floodwalls vicinity ring traverse stas. 141+50 and 206+50 due to pumping operations

b. Floodwall gross grades	8.5	13.0

c. Unit weights

Item	Lb. per Cu. Ft.
Water	62.5
Concrete	150
Steel	490
Earth	See plates 46 through 83

d. Design loads

(1) Earth pressures (lateral) See figures D-55 through D-62

(2) Wind loads

(a) On walls	30 p.s.f.
(b) On overhead beams	50 p.s.f.

(3) Water loads. See figures D-55 through D-62

(4) Wave characteristics

(a) Wind speed, U	77 m.p.h.
(b) Fetch length, F	5 miles
(c) Significant wave height, H_s	3.30 feet
(d) Wave period, T	4.40 seconds
(e) Depth at toe of levee, d_t	varies
(f) Structural design wave height, H_1	5.69 feet
(g) Wave force on wall	See figure D-2

3. Allowable working stresses. The allowable working stresses for concrete and structural steel are in accordance with those recommended in "Working Stresses for Structural Design," EM 1110-1-2101 dated 1 November 1963. Concrete will be designated by basic minimum compressive strength 3000 p.s.i., except for prestressed concrete elements which shall be designated 5000 p.s.i. Steel for steel sheet piling will meet the requirements of ASTM A328-66, "Standard Specification for Steel Sheet Piling." For convenient reference, pertinent allowable stresses are tabulated below:

Reinforced concrete	Stress - p.s.i.
fc'	3,000
fc	1,050
v (without web reinforcement)	60
v (with web reinforcement)	274
fs	20,000
Minimum tensile steel	0.0025 bd
Shrinkage and temperature steel	0.0020 bt

Structural Steel (ASTM A-36)

Basic stress tensile stress = .5 FY = 18,000

Bending stress (symmetrical section) = .55 FY = 20,000

Bending stress (unsymmetrical section) = .5 FY = 18,000

4. Location and alignment. The floodwalls and structures will be located along the alignment shown on plates 2 through 25. The floodwall is described in "Description of Proposed Structures and Improvements," paragraphs 35 and 36.

5. Foundation. The results of subsurface exploration, soil test, and foundation studies are presented in paragraphs 22 through 34. The undisturbed boring data are shown on plates 46 through 77.

6. Floodwalls.

a. General. All floodwalls north of drainage structures no. 1 and no. 5 were designed for a stillwater level elevation of 7.7 on the floodside and a protected side ground water level of elevation 0.0 using a factor of safety of 1.5 in the soil. The floodwalls south of drainage structures no. 1 and no. 5 were designed for two conditions of loading. The first was designed with a stillwater level of 10.2 on the floodside and a ground or tailwater level elevation of 0.0 except for the floodwall in the vicinity of ring traverse station 206+50 where an elevation of -2.0 was used because of the pumping operations. A factor of safety of 1.5 in the soil was used for this loading. The second loading condition used was with the static water to top of broken wave elevation 13.0 and with the dynamic wave load from the broken wave using a factor of safety of 1.25 in the soil. The types of floodwall, location and design physical features are as follows:

b. Cantilevered I-walls. Cantilevered I-wall floodwalls consist of steel sheet piles driven to the required tip elevations for stability with top of sheet piles 1.5 feet above grade and capped with concrete to the required protection height. The concrete portion will encase the top 3 feet of the sheet pile. This type of wall was used at Larose near the cemetery, at the Golden Meadow pumping station, in the vicinity of ring levee station 206+50 and for a portion of the floodwalls required at the Golden Meadow gate. The I-wall at Larose was designed for an approximate average ground level elevation of 1.0. The I-walls at Golden Meadow pumping station and in the vicinity of ring levee station 206+50 were designed to project above a design levee section having a crown width of 8 feet at elevation 7.0 with equal side slopes of 1 on 3 to natural ground. The I-wall at the Golden Meadow gate was designed to project above an approximate ground level elevation of 5.0.

c. I-walls driven in shell levee fill. This type of floodwall consists of a typical I-wall, described in (b) above, driven in a small shell levee fill covered with riprap. This type of floodwall is used at the Golden Meadow floodgate for closure between the floodgate and the conventional earthen levee terminating east of the floodgate. This type of floodwall is used to reduce the unsupported height of the typical I-wall.

d. T-wall floodwalls. Inverted T-walls of reinforced concrete supported on concrete bearing piles were used for the storage bay of the road gate structures and for a portion of the floodwalls required at the Golden Meadow floodgate. A steel sheet pile cut-off wall was used beneath the T-wall footing. The top of the T-walls are at elevation 13.0 and the top of the 2.5 foot thick footing is at elevation 5.0. The batter pile foundation was designed using a computer program which utilizes the Hrennikoff and Vetter's method of analysis.

7. Concrete bearing piles. Based on economy, resistance to decay, resistance to corrosive soil and water conditions, high capacity, and fitness for driving, precast-prestressed concrete piles will be utilized as bearing piles. The concrete piles will meet the requirements of the Joint AASHO and PCI Committee Standard Specification for "Square Concrete Prestressed Piles." Allowable pile loads are as shown on plates 104 through 106.

8. Roadgates. The design of the roadgates are included in the design calculations which follow. The loading cases considered are as shown in the design calculations and allowable pile loads are as shown on plates 104 through 106.

9. Floodgates and floodwalls at floodgates. The floodgates and the floodwalls at the floodgates will be the subject of a Detail Design Memorandum and designs are therefore not included.

Sheet 1

TABLE 1

GOLDEN MEADOW FLOODGATE

DESIGN HURRICANE

DATA USED TO DETERMINE WAVE CHARACTERISTICS

F	- Length of fetch	5 miles
U	- Windspeed	77 m.p.h.
swl	- Stillwater level	10.2 ft., m.s.l.
d	- Average depth of fetch	7.2 ft.
d_t	- Depth at toe of structure	Varies

WAVE CHARACTERISTICS

H_s	- Significant wave height	3.30 ft.
T	- Wave period	4.40 sec.
L_o	- Deepwater wave length	99.12 ft.
d/L_o	- Relative depth	0.07264
H_s/H_o'	- Shoaling coefficient	0.09665
H_o'	- Deepwater wave height	3.41 ft.
H_o'/T^2	- Wave steepness	0.176
d_b	- H_o' breaking depth	4.07 ft.
H_{b_o}	- Wave height on breaking	3.17 ft.
H_{10}	- Average of highest 10% of all waves	4.33 ft.
H_1	- Average of highest 1% of all waves	5.69
	Total static wave height for H_{10}	12.37 ft. m.s.l.
	Total static wave height for H_1	13.05 ft. m.s.l.
L	- Shallow water wave length	61.80 ft.
d/L	- Relative depth, shallow water	0.1165

Figure D-1

BARNARD AND BURK, INC.

Job No. 4402 -900

Date 4-28-71

Prepared by PITRE

Checked by JMP 6/18/71

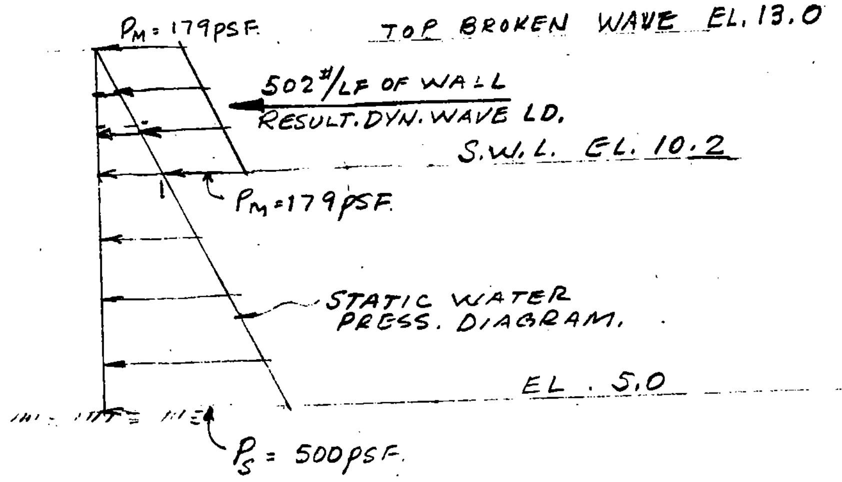
Sheet No. 2

Subject WAVE FORCES

NOTE : SEE TABLE 1 FOR WAVE CHARACTERISTICS.

TOTAL STATIC WAVE HEIGHT FOR H_1 = 13.05' M.S.L.

STILL WATER LEVEL = 10.2' M.S.L.



$d = 10.2 - 5.0 = 5.2$

d_b (H_0' BREAKING DEPTH) $= 0.67(H_0' T)^{2/3} = 0.67(3.41 \times 4.4)^{2/3} = 4.06'$

d_b (H_1' BREAKING DEPTH) $= 0.67(H_1' T)^{2/3} = 0.67(5.69 \times 4.4)^{2/3} = 5.72 > 5.2$

$\therefore$ WE HAVE BROKEN WAVE CONDITION

$H_b = .78 \times d = .78 \times 5.2 = 4.06$

$h_c = .7 \times H_b = 0.7 \times 4.06 = 2.84'$

DYNAMIC PART WAVE FORCE $= \frac{w_w (d_b)}{2} = \frac{62.5 \times 5.72}{2} = 179 \text{PSF} = P_M$

TOTAL DYNAMIC FORCE $= P_M \times h_c = 179 \times 2.80 = 502$#/L.F.

STATIC WATER PRESSURE @ BASE = 62.5 × 8 = 500PSF.

FIGURE D-2

REV. 12-29-71

BARNARD AND BURK, INC.

Job No. 4402-900

REW 1/20/72

Date 5-3-71

Prepared by PITRE

Checked by JMd 6/8/71

Sheet No. 3

Subject OVERHEAD ROLLER GATE NO. 1 - STA. 141+50, R.L. TRAV.

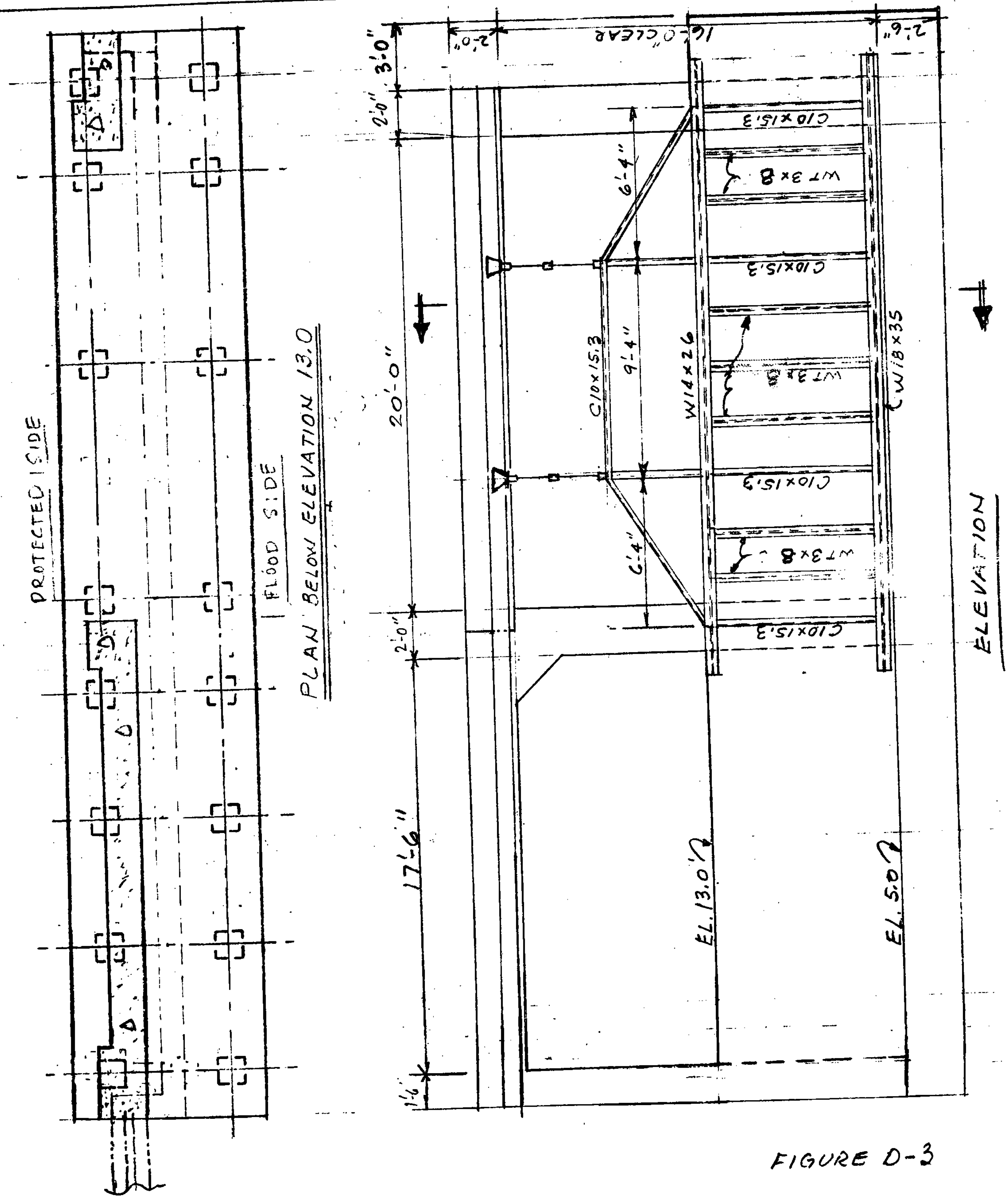


FIGURE D-3

REV. 12-28-71

BARNARD AND BURK, INC.

Job No. 4402-90D

Date 4-29-71

REW 1/20/72

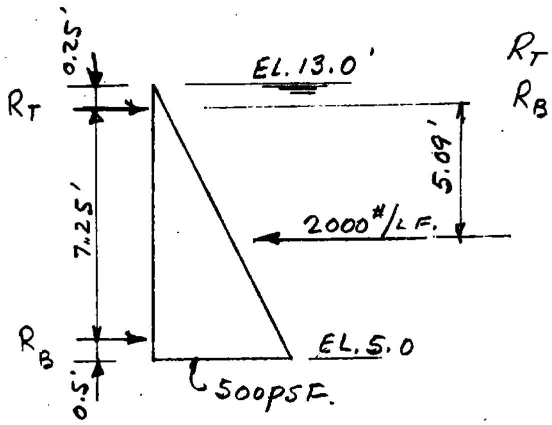
Prepared by PITRE

Checked by JmL 6/10/71

Sheet No. 4

Subject OVERHEAD ROLLER GATE NO.1-STA.141+50, R.L.TRAV.

CASE I WATER @ EL. 13.0, NO WAVE LOAD,



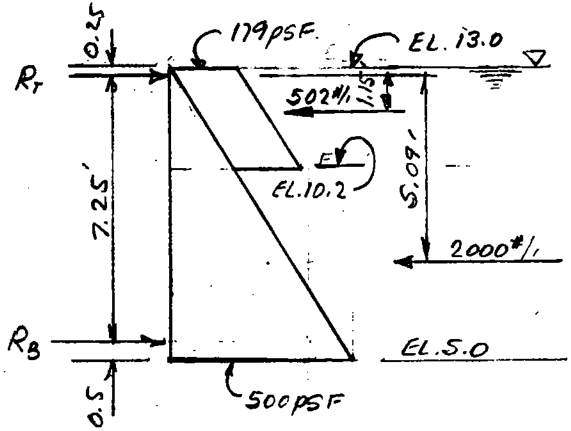
$R_T = 595\#/l$

$R_B = 1405\#/l$

$$F_b = 20{,}000 - 0.63\left(\frac{l}{r}\right)^2$$

CASE II – WATER TO EL. 13, WITH WAVE LOAD,

$$F_b = 1.33\left[20{,}000 - .63\left(\frac{l}{r}\right)^2\right]$$



$R_T = 2502 - 1485 = 1017$

$R_B = [502(1.15) + 2000(5.09)] \div 7.25 = 1485$

$1017 \div 1.33 = 764 > 595$ II CONTROLS.

$1485 \div 1.33 = 1120 < 1405$ I CONTROLS,

TOP GIRDER – SPAN = 21.08' $l_u = 9.33' = 112''$

$M = wl^2/8 = 764(21.08)^2/8 = 42.4^{1K}$

TRY W14×26 ; $F_b = 20{,}000 - .63\left(\frac{12\times 9.33}{1.29}\right)^2 = 15{,}250$ psi

$f_b = \frac{12\times 42.4}{35.1} = 14.5$ ksi < 15.25 ksi OK (BRACE FLG. @ HANGER PTS

$\boxed{\text{USE W14×26 – WITH BRACED FLG. AT HANGER PTS.}}$

BOTTOM GIRDER – SPAN = 21.08'

$M = \frac{1405}{780}(43.4) = 78.5$ $l_u = 9.33' = 112''$

TRY W18×35 ; $F_b = 20{,}000 - .63\left(\frac{112}{1.51}\right)^2 = 16{,}530$ psi

$f_b = \frac{12\times 78.5}{57.9} = 16{,}270$ psi $< 16{,}530$, OK.

$\boxed{\text{USE W18×35 – WITH BRACED FLG. AT HANGER PTS.}}$

FIGURE D-4

REV. 12-28-71

BARNARD AND BURK, INC.

Job No. 4402-900 REW 1/20/72 Date 4-29-71

Prepared by PITRE Checked by 6/18/71 Sheet No. 5

Subject O.H. ROLLER GATE NO. 1 - STA. 141+50, R.L. TRAV.

SKIN PLATE ; w: CASE I & II = 500 PLF.

F_b = 20,000 CASE I ; F_b = 26,500 CASE II ∴ CASE I GOVERNS

USE 5/16" PLATE (= 0.3125)

$$SM = \frac{bt^2}{6} = \frac{12(.3125)^2}{6} = 2(.0977) = 0.1955\ IN^3$$

F_b = 20,000 psi

$$M_{ALLOW} = SM \times F_b = 0.1955 \times 20,000 = 3910''\# = 326'\#$$

INT'R. SPAN :

$$M = \frac{wl^2}{12}$$

$$l^2 = \frac{12M}{w} = \frac{12(326)}{500} = 7.82$$

$$l_{MAX} = 2.80'$$

EXT. SPAN :

$$M = \frac{wl^2}{10}$$

$$l^2 = \frac{10(M)}{w} = \frac{10(326)}{500} = 6.52$$

$$l_{MAX} = 2.55'$$

USE SPACING AS FOLLOWS :

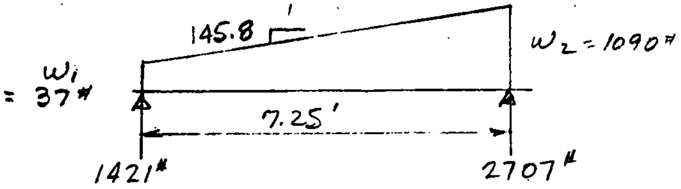
2@2'-0" = 4'-0", 6 @ 2'-4" = 14'-0", 2@2'-0" = 4'-0"

VERTICAL MEMBERS -

CASE I -

$w_1 = 2.33 \times 16 = 37$ PLF.

$w_2 = 2.33 \times 468 = 1090$ PLF.



$$V_x = 1421 - 37(x) - \frac{145.8(x)^2}{2} = 0$$

$$72.9x^2 + 37x = 1421$$

$$x^2 + .508x + (.259)^2 = 19.5 + .07 = 19.57$$

$$x + .259 = \pm 4.5$$

$$x = 4.24$$

$$M_{4.24} = 1421\overset{6030}{(4.24)} - 37\overset{333}{\frac{(4.24)^2}{2}} - \overset{1860}{\frac{145.8(4.24)^3}{6}} = 3837'\#$$

FIGURE D-5

REV. 12-28-71

BARNARD AND BURK, INC.

Job No. 4402-900 REV 1/21/72 Date 4-29-71

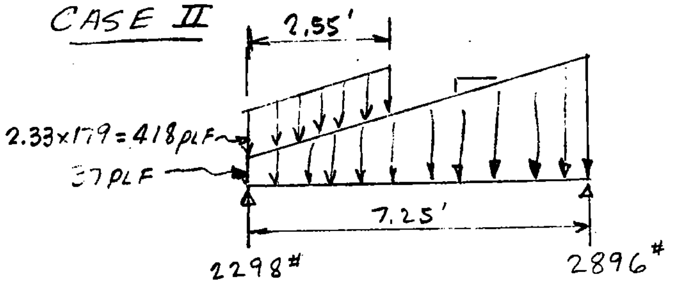
Prepared by PITRE Checked by 6/16/71 Sheet No. 6

Subject O.H. ROLLER GATE - NO. 1 - STA. 141+50, R.L. TRAV.

VERTICAL MEMBERS (CONT'D.)

CASE II

$2.55 \times 418 = 1066^{\#}$



$$V_x = 2298 - 1066 - 37x - \frac{145.8(x)^2}{2} = 1232 - 37x - 72.9x^2 = 0$$

$$72.9x^2 + 37x = 1232$$

$$x^2 + .508(x) + (.259)^2 = 16.90 + .07 = 16.97$$

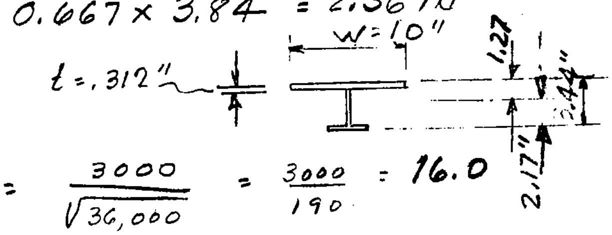
$$x + .259 = \pm 4.12$$

$$x = 3.86'$$

$$M_{3.86} = 2298(\overset{2880}{3.86}) - \overset{2750}{1066(2.58)} - 37\frac{\overset{276}{(3.86)^2}}{2} - \frac{145.8\overset{1000}{(3.86)^3}}{6} = 4454$$

$4454 \div 1.33 = 3350 < 3837$ CASE I CONTROLS.

REQ'D. SM = $0.667 \times 3.84 = 2.56 \text{ IN}^3$



r FOR FLG. & 1/6 WEB:

$I = .404(4.03)^3/12 = 2.21$

$A = .45(.26) + .404(4.03) = 1.75$

$r^2 = 2.21/1.75 = 1.26$

$r = 1.12$

$$\frac{W}{2t}(\text{MAX}) = \frac{3000}{\sqrt{F_y}} = \frac{3000}{\sqrt{36{,}000}} = \frac{3000}{190} = 16.0$$

$W(\text{MAX}) = 16.0 \times .312 \times 2 = 10"$

SECT.	A	y	Ay	$A\bar{y}^2$	I_o	I_{cg}
10"×.312	3.12	3.29	10.3	33.8	—	33.80
WT3×8	2.36	2.673	1.59	1.07	1.66	2.73
	5.48		11.89			36.53

$$\bar{y} = \frac{11.89}{5.48} = 2.17"$$

$-A\bar{y}^2 = -25.80$

$I_{cg} = 10.73$

$SM_T = 10.73 \div 1.27 = 8.45$

$SM_B = 10.73 \div 2.17 = 4.95$; $f_{B.T.} = M/S = 12(3837)/4.95 = 9300 \text{ psi}$

$F_b = 20{,}000 - .63\left(\frac{90}{1.12}\right)^2 = 15{,}900 \text{ psi} > 9300$ OK

∴ NO LAT. BRAC. REQ'D FOR COMPR. FLG.

{USE WT3×8 ACTING COMPOSITELY WITH 5/16" PLATE} FIGURE D-6

REV. 12-29-71

BARNARD AND BURK, INC.

Job No. 4402-900 REW 1/21/72 Date 4-30-71

Prepared by PITRE Checked by Sheet No. 7

Subject OVERHEAD ROLLER GATE NO. 1 - STA. 141+50, R.L. TRAV

WT. & CENTER OF GRAVITY OF GATE :

MEMBER	UNIT. WT.	LGTH.	WT.	"X"	MOM.
W14x26	26	26.2	681	7.32	4980
W18x35	35	26.2	917	9.32	8550
C 10x15.3	15.3	67.53	1040	5.32	5550
WT 3x8	8.0	56.0	448	2.77	1242
5/16" PL. x 8'	102.4#	22.0	2255	0.16	361
∠ 3x3x1/2	9.4	22.0	207	0.43	89
			$\Sigma = 5548$"		$\Sigma = 20,772$

$$\bar{X} = \frac{20,772}{5548} = 3.74''$$ (FROM O.S. FACE SKIN. PLATE)

TOTAL LOAD + 25% IMPACT = 1.25 x 5548 = 6950#

USE 2-C 10x15.3 HANGERS $f_a = \frac{3475}{4.47} = 776$ psi < 20,000 OK.

TROLLEYS :

USE 2 - 2 TON TROLLEYS.

FIGURE D-7

REV. 12-29-71

BARNARD AND BURK, INC.

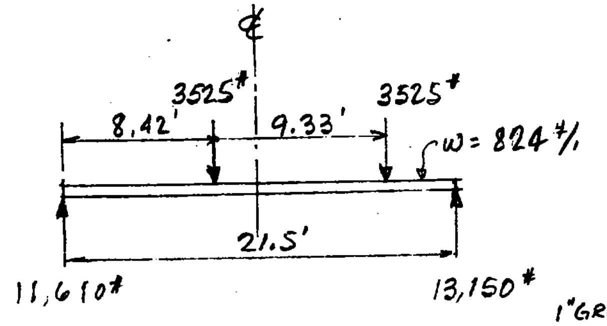
Job No. 4402-90D   REV 1/21/72 ✓   Date 4-30-71

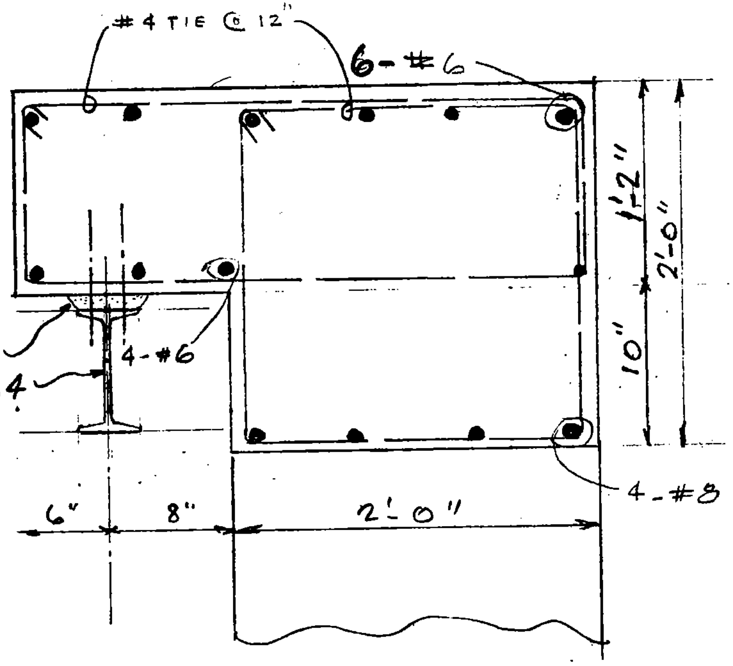
Prepared by PITRE   Checked by   Sheet No. 8

Subject OVERHEAD ROLLER GATE NO. 1 - STA. 141+50, R.L. TRAV.

REMOVABLE OVERHEAD CONCRETE BEAM

$f_c' = 3000 psi$; $f_s = 20,000$
$f_c = 1050$ $n = 9.2$





$MOM = 11.61(8.42) - .824\frac{\overset{29.2}{(8.42)^2}}{2} = 68.6^{'K}$

$MAX.\ V = 10.75(824) + 3525 + 3525\frac{(12.17)}{21.5}$

$V_{MAX} = 8850 + 3525 + 1995$

$V_{MAX} = 14,370\#$

$V_{ALLOW} = 24 \times 60 \times 21 = 30,250\#$

$d_M = \sqrt{\frac{12 \times 68.6}{.152 \times 24}} = \sqrt{226} = 15''$

$d_{FURN} = 24 - 2.5'' = 21.5'' > 15''$ OK

$A_S = \frac{68.6}{1.44 \times 21.5} = 2.22^{\square''}$

USE 4-#8 BOTTOM BARS
& 4-#6 TOP BARS

TORSION

$T_{LL} = 20''(3525)(1 + \overset{1.565}{\frac{12.17}{21.5}}) = 110.4$

$T_{DL} = 20(224)(\frac{21.5}{2}) = \underline{48.2^{''K}}$

$T = 158.6^{''K}$ @ END.

TORSIONAL SHEAR v_t :

$v_t = \frac{4.8T}{h^3} = \frac{4.8(158,600)}{24^3} = 55 psi$

BM. WT.:

$1.17 \times 1.17 = 1.37$

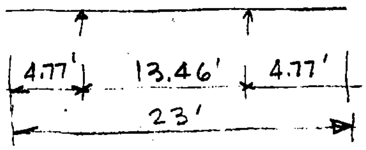
$2.0 \times 2.0 = \underline{4.0}$

$5.37 \times 150 = 805\#$

TROLLEY BM $= \underline{19}$

824

PICK-UP STRESSES:



$\pm M = .0214 w l^2 = .0214(.824)(23)^2$

$\pm M = 9.35^{'K}$

$A_s = \frac{9.35}{1.44 \times 21.5} = 0.3^{\square''}$

TORSION DL:

8I BM = 18.4#/'

CONC. BM. 1.37 × 150 = 205.6

224.0

FIG. D-8

BARNARD AND BURK, INC.

Job No. 4402-90D REW 1/21/72 Date 4-30-71

Prepared by PITRE Checked by M-B 6/[illegible]/71 Sheet No. 9

Subject OVERHEAD ROLLER GATE NO. 1 – STA. 141+50, R.L. TRAV.

OVERHEAD BEAM (CONT'D.)

COMBINED SHEAR DUE TO VERTICAL & TORSIONAL SHEAR :

$$v_v = \frac{14{,}370}{24 \times 21.5} = 27.9 \text{ psi}$$

$$v_t = \underline{55.0}$$

$$v = 82.9$$

$$v_c = \underline{60.0}$$

$$v' = 22.9$$

MAX. STIRRUP SPAC. $= S_{MAX} = \frac{A_v f_v}{v' b}$

WITH #4 ☐

$$S_{MAX} = \frac{8000}{22.9 \times 24} = 14.55''$$

USE #4 ☐ STIRRUPS @ 12" THRU-OUT

FIGURE D-9

Job No. 4402　Date 1-10-72

Prepared by PITRE　Checked by REW 1/21/72　Sheet No. 10

Subject ROAD GATE NO. 1

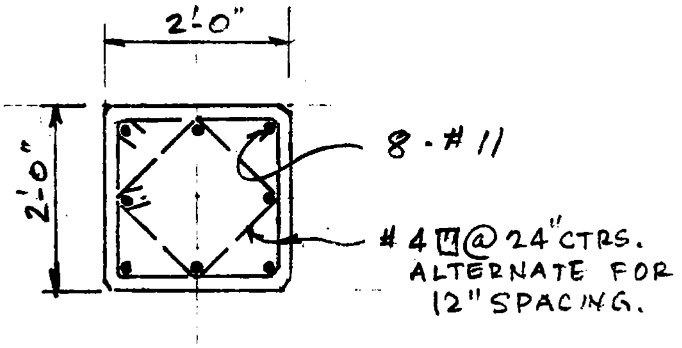
ROAD GATE COLUMNS -

CASE 2 LOADING :

ITEM	COMPUTATION	H	V	x	M
O.H. BM.	20.75(150)[2(2)+1.17(1.17)]	—	16,720	—	—
MONORAIL	20.75(18.4)	—	382	—	—
COL.	150(2)(2)(16)	—	9600	—	—
HORIZ. H_2O	12(2502)	30,000	—	3.45	103,500
TOTALS.		30,000	26,702		103,500

FROM COLUMN INTERACTION DIAGRAM FOR 24" SQUARE COL. WITH $f_c' = 3000$ psi AND $f_y = 40{,}000$ psi "WSD FOR CONCRETE COLUMNS - PART 7" BY ELI CZERNIAK PUB. IN AUG. 1965 EDITION OF "CONSULTING ENGINEER" PAGE 112

24" x 24" COL. OK,
USE 8-#11 BARS EQ. PLACED,



COL. SECTION

FIGURE D-10

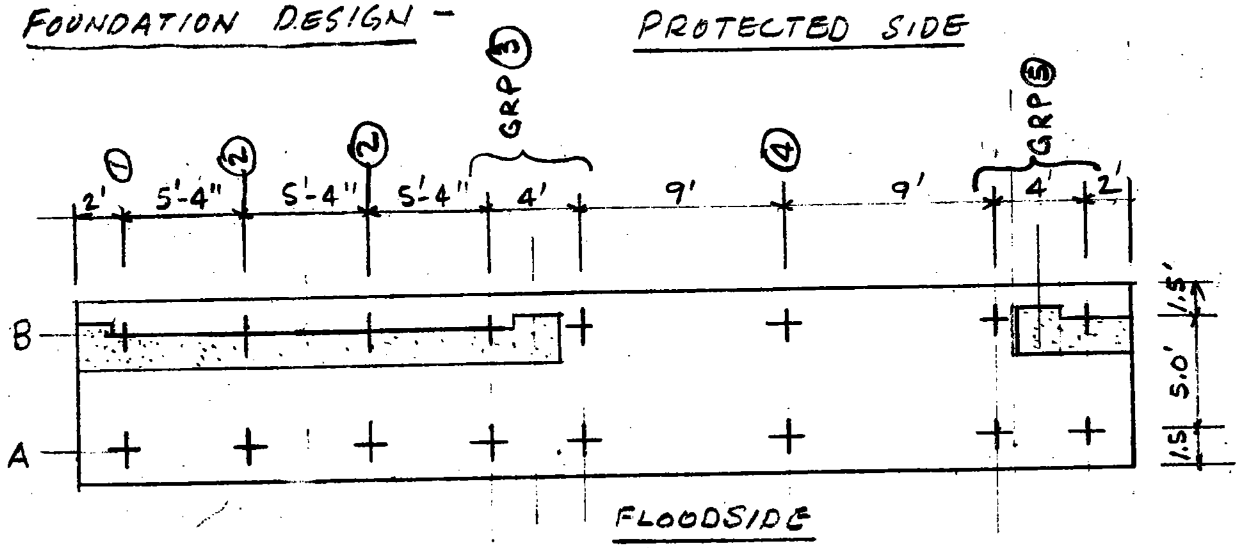
BARNARD AND BURK, INC.

Job No. 4402 Date 1-6-72

Prepared by PITRE Checked by REW 1/24/72 Sheet No. 11

Subject ROAD GATE NO. 1 - STA 141+50, R. L. TRAV.

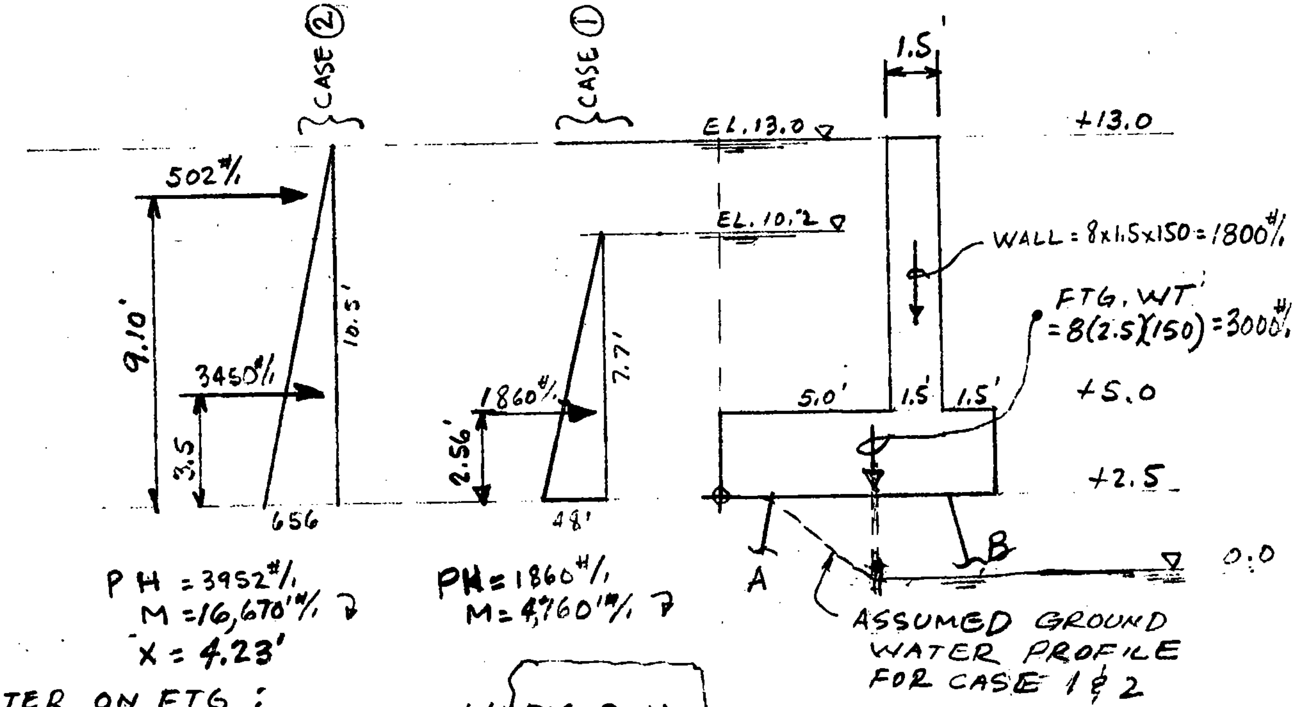
FOUNDATION DESIGN -



PILE LAYOUT GATE 1

NOTE PILE GROUP 4 ASSUMED TO CARRY ONLY VERTICAL LOADS FROM FTG. WT. & ROAD DEAD AND LIVE LOAD.

WATER LOADING TO GATE MONOLITH



PH = 3952#/'
M = 16,670'#/'
x = 4.23'

PH = 1860#/'
M = 4,760'#/'

WT. WATER ON FTG:
CASE ①&③ 5.2(62.5)(5) = 1625#/'
CASE ②&④ 8.0(62.5)(5) = 2500#/'

FIG. D-11

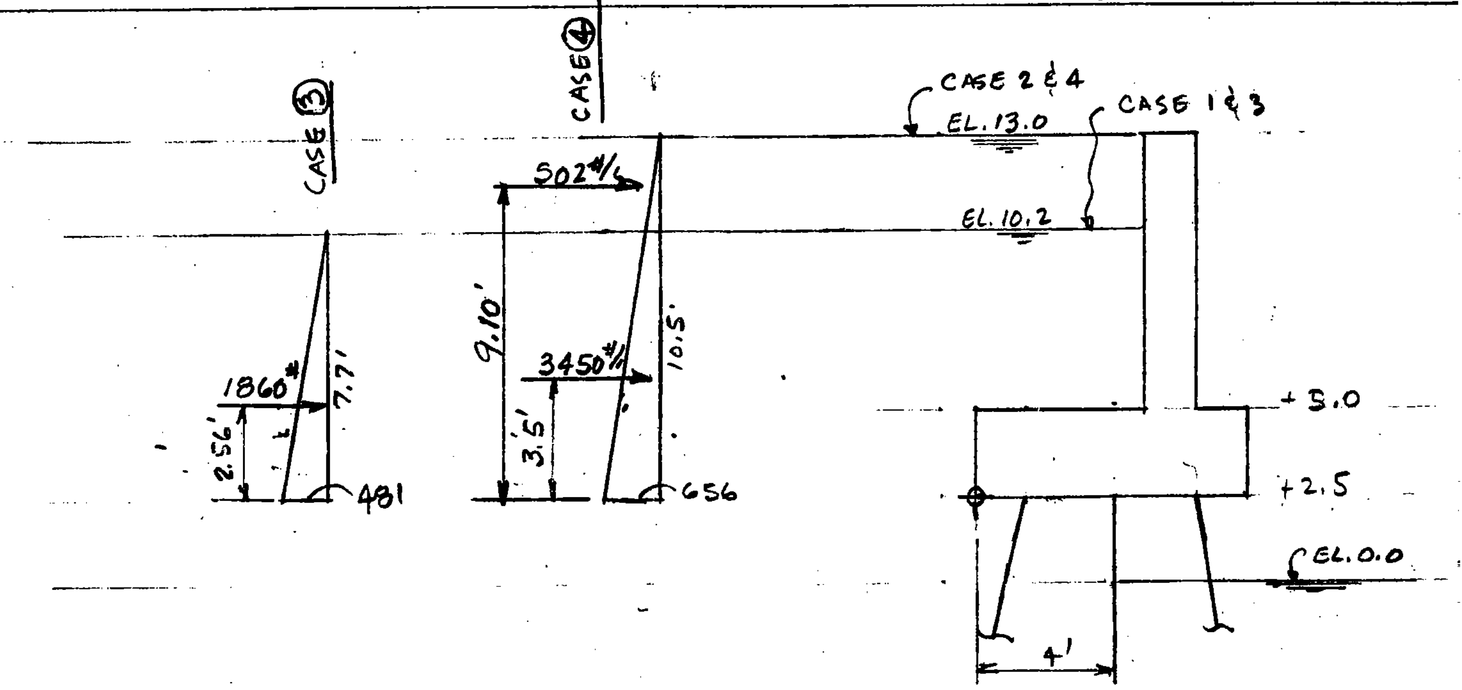
UPLIFT CONSIDERED NEGLIGIBLE AS A LIMITING CONDITION.

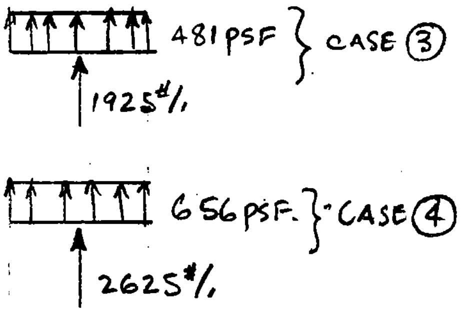
BARNARD AND BURK, INC.

Job No. 4402 Date 1-7-72

Prepared by PITRE Checked by REW 1/24/72 Sheet No. 12

Subject O.H. ROLLER GATE NO. 1 - STA. 141+50, R.L. TRAV.





CASE ③ WATER LOADING.

$PH = 1860\#/1 \rightarrow$

$PV_u = 1925\#/1 \uparrow$

CASE ④ WATER LOADING

$PH = 3450 + 502 = 3952\ \#/1 \rightarrow$

$PV_u = 2625\#/1 \uparrow$

$M = 502(9.1) + 3450(3.5) = 16,670$

$\bar{x} = 16,670 \div 3952 = 4.23'$

$M_u = 2625(2) = 5250'\#/1 \curvearrowleft$

FIGURE D-12

BARNARD AND BURK, INC.

Job No. 4402

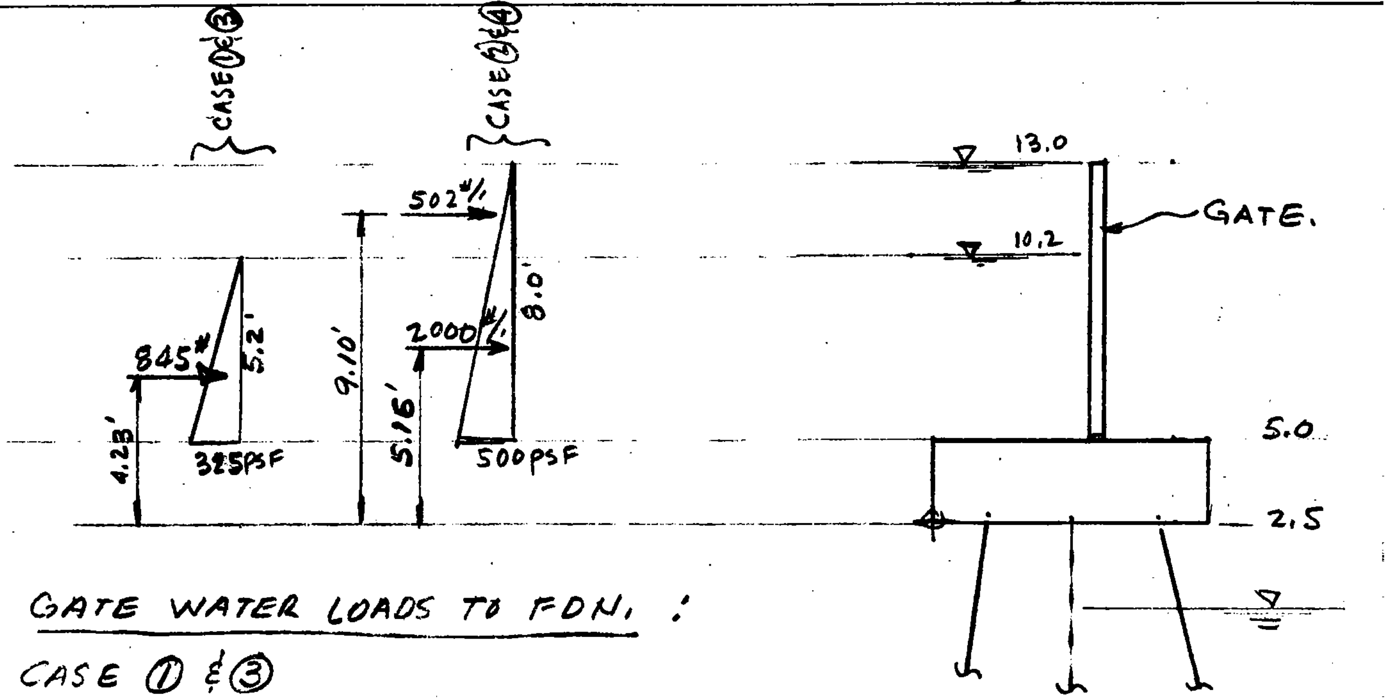
Date 1-7-72

Prepared by PITRE

Checked by REW 1/24/72

Sheet No. 13

Subject O.H. ROLLER GATE NO. 1 - STA. 141+50, R.L. TRAV.



GATE WATER LOADS TO FDN. :

CASE ① & ③

$PH = 845\#/ \rightarrow$

$M = 845(4.23) = 3580'\#/$ ↷

CASE ② & ④

$PH = 2000 + 502 = 2502\#/ \rightarrow$

$M = \overset{4570}{502(9.1)} + \overset{10,320}{2000(5.16)} = 14,890'\#/$

$\bar{y} = 14,890 \div 2502 = 5.95'$

FIGURE D-13

BARNARD AND BURK, INC.

Job No. 4402 Date 1-10-72

Prepared by PITRE Checked by REW 1/24/72 Sheet No. 14

Subject O.H. ROLLER GATE NO. 1 — STA. 141+50, R.L. TRAV.

PILE LINE ② - LOADS

ITEM	COMPUTATION	H	V	X	M	
WALL	5.33(1800)	—	9600	5.75	55,200	
FTG.	5.33(3000)	—	16000	4.0	64,000	
STRUCT.-WT.	—	—	25,600	—	119,200	
H_2O ON BASE	5.33(1625)	—	8,680	2.5	21,700	CASE ①
HORIZ. H_2O	5.33(1860)	9920	—	2.56	25,400	
CASE ① TOTALS		9920	34,280		166,300	(2000"K)
STRUCT. WT.	—	—	25,600	—	119,200	
H_2O ON BASE	5.33(2500)	—	13,330	2.5	33,300	CASE ②
HORIZ. H_2O	5.33(3952)	21,060	—	4.23	89,200	
CASE ② TOTALS		21,060	38,930	—	241,700	(2900"K)
STRUCT. WT.		—	25,600	—	119,200	
H_2O ON BASE	5.33(1625)	—	8,680	2.5	21,700	CASE ③
HORIZ. H_2O	5.33(1860)	9,920	—	2.56	25,400	
UPLIFT	5.33(-1925)	—	-10,270	2.0	-20,540	
CASE ③ TOTALS		9920	24,010	—	145,760	(1750"K)
STRUCT. WT.	—		25,600	—	119,200	
H_2O ON BASE	5.33(2500)	—	13,330	2.5	33,300	CASE ④
HORIZ. H_2O	5.33(3952)	21,060	—	4.23	89,200	
UPLIFT	5.33(-2625)	—	-14,000	2.0	-28,000	
CASE ④ TOTALS		21,060	24,930	—	213,700	(2560"K)

FIGURE D-14

BARNARD AND BURK, INC.

Job No. 4402

Date 1-11-72

Prepared by PITRE

Checked by REW 1/24/72

Sheet No. 15

Subject O.H. ROLLER GATE NO. 1 - STA. 141+50, R.L. TRAV.

PILE GROUP ③ - LOADS PER LINE OF PILES

ITEM	COMPUTATION	H	V	X	M	
O.H. BEAM.	1/2(20.75)(776#/')	—	8360	6.0	50,200	
MONORAIL	1/2(20.75)(18.4)	—	191	6.0	1145	
COL.	1/2(16)(600#/')	—	4800	6.0	28,800	
WALL	1/2(3.67)(1800#/')	—	3300	5.75	19,000	
FTG.	1/2(11.2)(3000#/')	—	16,900	4.0	67,200	
GATE	1/2(2924)	—	1462	4.61	6750	
STR. WT. (TOTAL.)		—	34,913	—	173,095	
H_2O ON BASE	1/2(11.2)(1625)	—	9100	2.5	22,800	CASE ①
HORIZ. H_2O	1/2(5.67)(1860)	5280	—	2.56	13,520	
" "	1/2(10)(845)	4230	—	4.23	17,900	
CASE ① TOTALS		9,510	44,013	—	227,315	(2720"K)
STRUCT. WT.	—	—	34,913	—	173,095	
H_2O ON BASE	1/2(11.2)(2500)	—	14,000	2.5	35,000	
HORIZ. H_2O	1/2(5.67)(3952)	11,200	—	4.23	47,500	CASE ②
" "	1/2(10)(2502)	12,500	—	5.95	74,500	
CASE ② TOTALS		23,700	48,913	—	330,095	(3960"K)
FROM ① ABOVE		9510	44013	—	227,315	CASE ③
UPLIFT.	1/2(11.2)(-1925)	—	-10,800	2.0	-21,600	
CASE ③ TOTALS.		9510	33,213		205,715	(2470"K)
FROM ② ABOVE		23,700	48,913	—	330,095	CASE ④
UPLIFT	1/2(11.2)(-2625)	—	-14,700	2.0	-29,400	
CASE ④ TOTALS		23,700	34,213		300,695	(3610"K)

FIGURE D-15

BARNARD AND BURK, INC.

Job No. 4402 Date 1-7-72

Prepared by PITRE Checked by REW 1/24/72 Sheet No. 16

Subject O.H. ROLLER GATE NO. 1 - STA. 141+50, R.L. TRAV.

PILE DESIGN LOADS FOR VARIOUS PILE LENGTHS FROM CHART FOR 55-UW FOR GATE NO. 1

PILE LENGTH	COMPRESSION	TENSION	
80' (960")	80^K	68^K	
73' (875")	70^K	58^K	
65' (780")	60^K	48^K	← USE 65' PILE
60' (720")	50^K	40^K	
52' (625")	40^K	32^K	

PILE TYPE - 12"□ PRECAST PRESTRESSED CONCRETE.

CONC. STRENGTH - 5000 PSI @ 28 DAYS,

F_a (TENS) = 700 PSI.

F_b (TENS) = 700 PSI

F_a (COMP.) = 910 PSI

F_b (COMP.) = 910 PSI

A = 144 □"

I = 1728 IN^4

S = 288 IN^3

E = 4290 KSI

TYPE PILE : SKIN FRICTION

AK = MODULUS OF HORIZONTAL SUBGRADE SOIL REACTION. WILL OBTAIN COMPUTER SOLUTION FOR THE FOLLOWING VALUES OF AK:

AK = 50, 100, 140, 180, 220.

FIGURE D-16

BARNARD AND BURK, INC.

Job No. 4402 Date 1-11-72

Prepared by PITRE Checked by REW 1/25/72 Sheet No. 17

Subject O.H. ROLLER GATE NO. 1 - STA. 141+50, R.L. TRAV.

RESULTS OF FOUNDATION ANALYSIS GATE NO. 1

PILE LINE NO. 2							
CASE	ROW	ACTUAL			ALLOWABLES		
		P	Q	y	P	Q	y
1	A	11.30^{K}	-0.16^{K}	.016"	60.00^{K}	3.55^{K}	0.338"
1	B	25.80	-0.08	.008	60.00	3.55	0.338
2	A	2.00	-1.45	.138	60.00	3.55	0.338
2	B	41.70	-1.46	.139	60.00	3.55	0.338
3	A	2.10	0.27	-.026	60.00	3.55	0.338
3	B	24.30	0.39	-.037	60.00	3.55	0.338
4	A	-10.50	-0.84	.080	-48.00	2.64	0.251
4	B	39.70	-0.80	.077	60.00	3.55	0.338

PILE LINE NO. 3 - PILE GRP. 3.							
CASE	ROW	ACTUAL			ALLOWABLES		
		P	Q	y	P	Q	y
1	A	12.30^{K}	1.97^{K}	-.187"	60.00^{K}	3.55^{K}	0.338"
1	B	34.70	2.30	-.219	60.00	3.55	0.338
2	A	-2.20	0.96	-.091	-48.00	2.64	0.251
2	B	56.70	1.24	-.118	60.00	3.55	0.338
3	A	2.40	2.50	-.238	60.00	3.55	0.338
3	B	33.40	2.87	-.274	60.00	3.55	0.338
4	A	-15.60	1.64	-.156	-48.00	2.64	0.251
4	B	54.80	1.97	-.187	60.00	3.55	0.338

FIGURE D-17

Job No. 4402
Date 1-11-72
Prepared by PITRE
Checked by REW 1/25/72
Sheet No. 18
Subject O.H. ROLLER GATE NO. 1-STA. 141+50, R.L. TRAV.

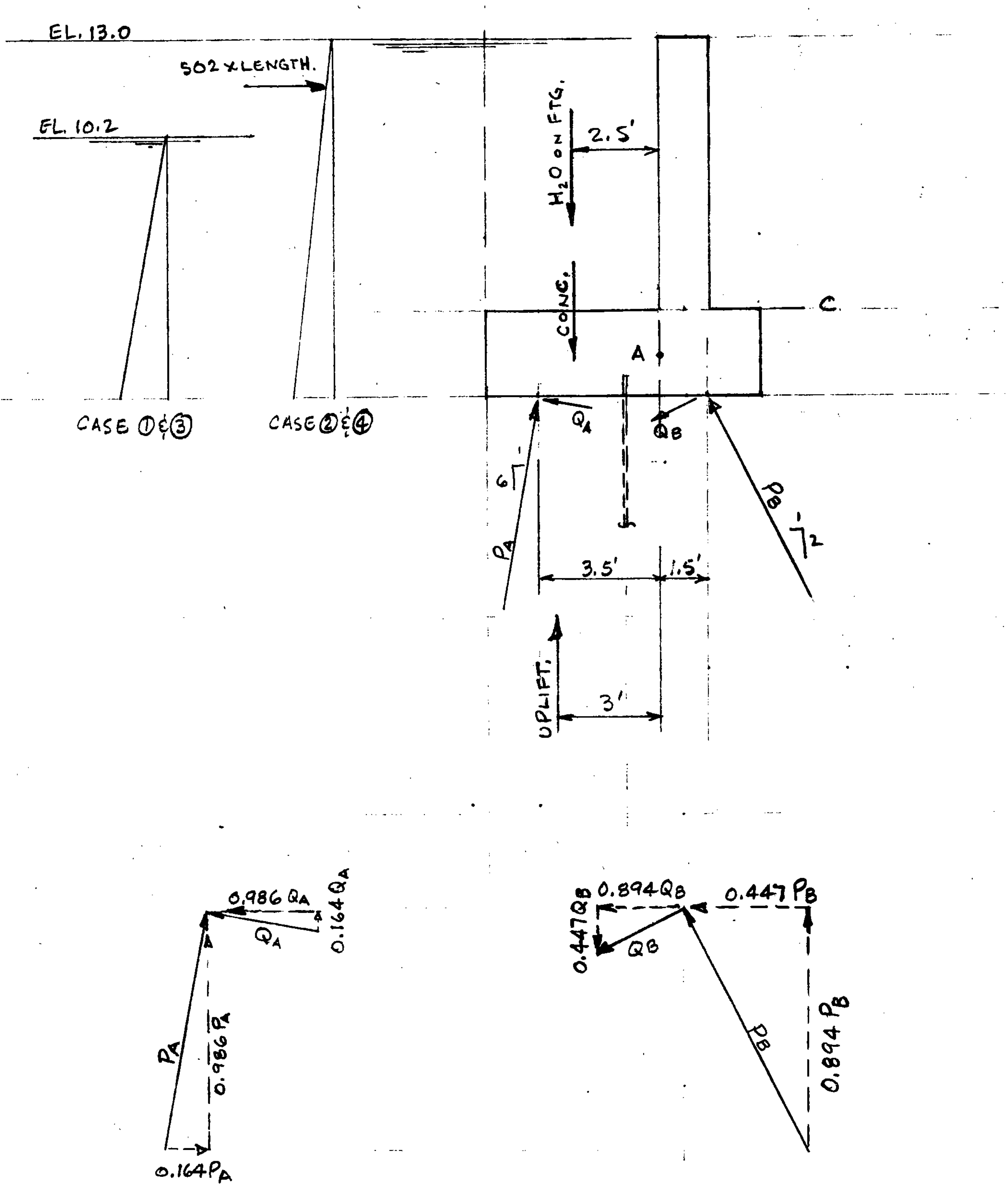


FIGURE D-18

BARNARD AND BURK, INC.

Job No. 4402 Date 1-12-72

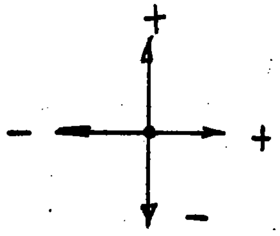
Prepared by PITRE Checked by REW 1/25/72 Sheet No. 19

Subject O.H. ROLLER GATE NO. 1 - STA. 141+50, R.L. TRAV.

PILE LOADS ON FOOTING
(FROM COMPUTER PRINT OUT FOR P_A, Q_A

PILE LINE 2				
PILE FORCES	CASE			
	1	2	3	4
P_A	11.30	2.00	2.10	-10.50
P_{AV}	11.15	1.97	2.07	-10.36
Q_A	-0.16	-1.45	0.27	-0.84
Q_{AV}	+0.03	+0.24	-0.04	+0.14

(5.33' LGTH FTG.)



SIGN CONVENTION

PILE LINE NO. 3 - PILE GRP 3				
PILE FORCES	CASE			
	1	2	3	4
P_A	12.30	-2.20	2.40	-15.60
P_{AV}	12.12	-2.17	2.37	-15.40
Q_A	1.97	0.96	2.50	1.64
Q_{AV}	-0.32	-0.16	-0.41	-0.27

(∽ 5.5' LGTH. FTG.)

FIGURE D-19

Job No. 4402 Date 1-12-72

Prepared by PITRE Checked by REW 1/25/72 Sheet No. 20

Subject O.H. ROLLER GATE NO. 1 – STA. 141+50, R.L. TRAV.

BASE DESIGN @ PILE LINE 2 – MOMENTS ABOUT A

CASE 1 & 3

CONC. – 5 × 2.5 × 150 = –1875 × 2.5 = – 4690 '#

H_2O = – 1625 × 2.5 = – 4070 '#

SUBTOTAL = –8,760

CASE ①

PILE = $(11.15 + .03)\frac{1}{5.33}$ = 2100 × 3.5 = 7,350

M_A① = –1,410 '#

CASE ③

PILE – (2070 – 40) ÷ 5.33 = 381 × 3.5 = 1,335

UPLIFT. = 1925 × 3.0 = 5,780

M_A③ = –1,655 '#

CASE ② & ④

CONC. – 5 × 2.5 × 150 = – 1875 × 2.5 = – 4690 '#

H_2O = – 2500 × 2.5 = – 6,250

SUBTOTAL = –10,940 '#

CASE ②

PILE – (1970 + 240) ÷ 5.33 = 414 × 3.5 = 1450

M_A② = –9,490

CASE ④

PILE – (–10,360 + 140) ÷ 5.33 = –1920 × 3.5 = – 6720 '#

UPLIFT – = 2625 × 3.0 = + 7870

M_A④ = – 9790 '#

FIGURE D-20

Job No. 4402 Date 1-12-72

Prepared by PITRE Checked by REW 1/25/72 Sheet No. 21

Subject O.H. ROLLER GATE NO. 1 - STA. 141+50, R.L. TRAV.

BASE DESIGN @ PILE LINE 3 - PILE GRP. 3. - MOMS. ABT. A.

CASE 1 & 3

CONC. - 5 × 2.5 × 150 -- = −1875 × 2.5 = −4690'#
H_2O - = −1625 × 2.5 = −4070
SUB-TOTAL = −8760'#

CASE ①

PILE = (12,120 − 320) ÷ 5.5 = 2140 × 3.5 = +7500
M_{A}① = −1260'#

CASE ③

PILE = (2370 − 410) ÷ 5.5 = 356 × 3.5 = 1246
UPLIFT = = 1925 × 3 = 5780
M_{A}③ = −1734

CASE ② & ④

CONC. = 5 × 2.5 × 150 = −1875 × 2.5 = −4690'#
H_2O = — — — — — — = −2500 × 2.5 = −6250
SUB-TOTAL = −10,940

CASE ②

PILE = (−2170 − 160) ÷ 5.5 = −424 × 3.5 = −1,485
M_{A}② = −12,425'#

CASE ④

PILE = (−15,400 − 270) ÷ 5.5 = −2850 × 3.5 = −9,970
UPLIFT = = 2625 × 3.0 = 7,870
M_{A}④ = −13,040

FIGURE D-21

BARNARD AND BURK, INC.

Job No. 4402 Date 1-12-72

Prepared by PITRG Checked by RSW 1/25/72 Sheet No. 22

Subject O.H. ROLLER GATE NO. 1 – STA. 141+50, R.L. TRAV.

FTG. TRANSVERE REINF : $d = 30 - 3.5 = 26.5''$

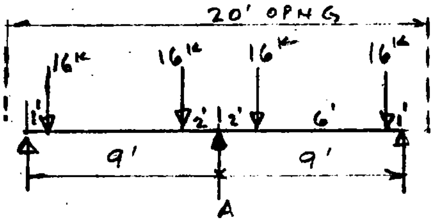
TOP $A_S = \frac{13.04}{1.44 \times 26.5} = 0.34\,\square''$ USE #8 @ 12" @ COLUMN & ALL OTHER LOCATIONS.

BOT. REINF. $A_S = \frac{9.555}{1.44 \times 25.5} = 0.26\,\square''$ USE #8 @ 12"

$MIN\ A_S = .0025(12)(26) = 0.78\,\square''$

FTG. LONGITUDIANAL REINF. –

DESIGN FOR HS20-44 TRUCK LIVE LOADING.



$-LLM @ A = .149(16)(9) = 21.5$

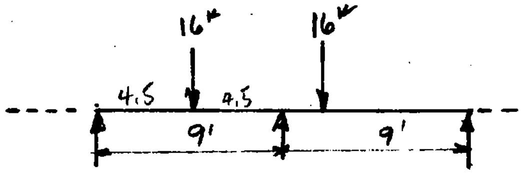
$-I\ (30\%) = 6.5$

$-DLM = \frac{1}{10}(3.0)(9)^2 = 24.3$

$-TLM = 52.3^{1k}$

$-TLM/FT = \frac{52.3}{8} = 6.55^{1k}$

TOP $A_S = \frac{6.55}{1.44 \times 26.5} = 0.17\,\square''$



ASSUME $LLM \cong \frac{8}{10} \times \frac{P\ell}{4} = \frac{2}{10} P\ell$ AND IGNORE REDUCING EFFECT OF 16^k LOAD IN SPAN ON RT.

$+LLM = 0.2(16)(9) = 28.8$

$+I\ (30\%) = 8.6$

$+DLM = \frac{1}{10}(3.0)(9)^2 = 24.3$

$+TLM = 61.7^{1k}$

$+TLM/FT = \frac{61.7}{8} = 7.72^{1k}$

BOT. $A_S = \frac{7.72}{1.44 \times 25.5} = 0.21\,\square''/FT.$

$MIN\ STL = .0025 \times 12 \times 26 = 0.78\,\square''$

USE #8 @ 12" TOP & BOT. LONGITUDINALLY.

FIGURE D-22

BARNARD AND BURK, INC.

Job No. 4402 Date 1-13-72

Prepared by PITRE Checked by REW 1/25/72 Sheet No. 23

Subject O.H. ROLLER GATE NO. 1 — STA. 141+50, R.L. TRAV.

STEM DESIGN —

$$M@_{BOT.} = \frac{wh^3}{6} + Pa = \frac{\overset{5330}{62.5(8)^3}}{6} + \overset{3310}{502(6.6)} = 8640\ ^{'\#}/_{'}$$

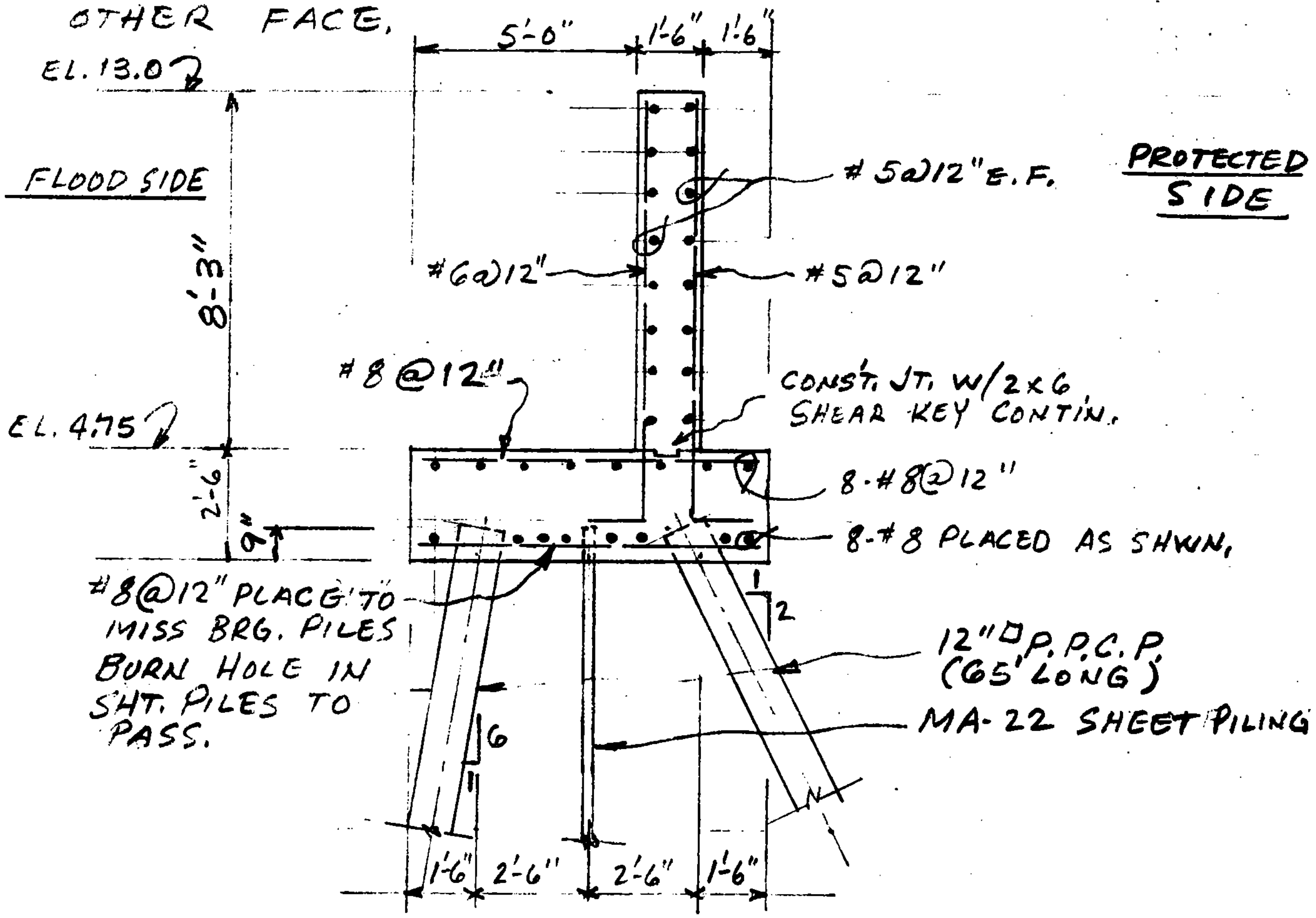
$$d = 18.0 - 2 = 16''$$

$$A_S = \frac{8.64}{1.44 \times 16} = 0.38^{\square''}$$

MIN. STL. EA. FACE:

$$A_S^{MIN.} = .001bh = .001 \times 12 \times 18 = 0.22$$

USE #6@12" VERT.
ON FLOODSIDE FACE
USE #5@12" VERT.
OTHER FACE.



TYPICAL SECTION, STORAGE BAY, GATE MONOLITH
SCALE 1/4" = 1'-0"

BARNARD AND BURK, INC.

Job No. 4402

Date 1/26/72

Prepared by R.E. White

Checked by GLP (1-31-72)

Sheet No. 24

Subject O.H. ROLLER GATE NO. 2 - STA. 206+50, R.L. TRAV.

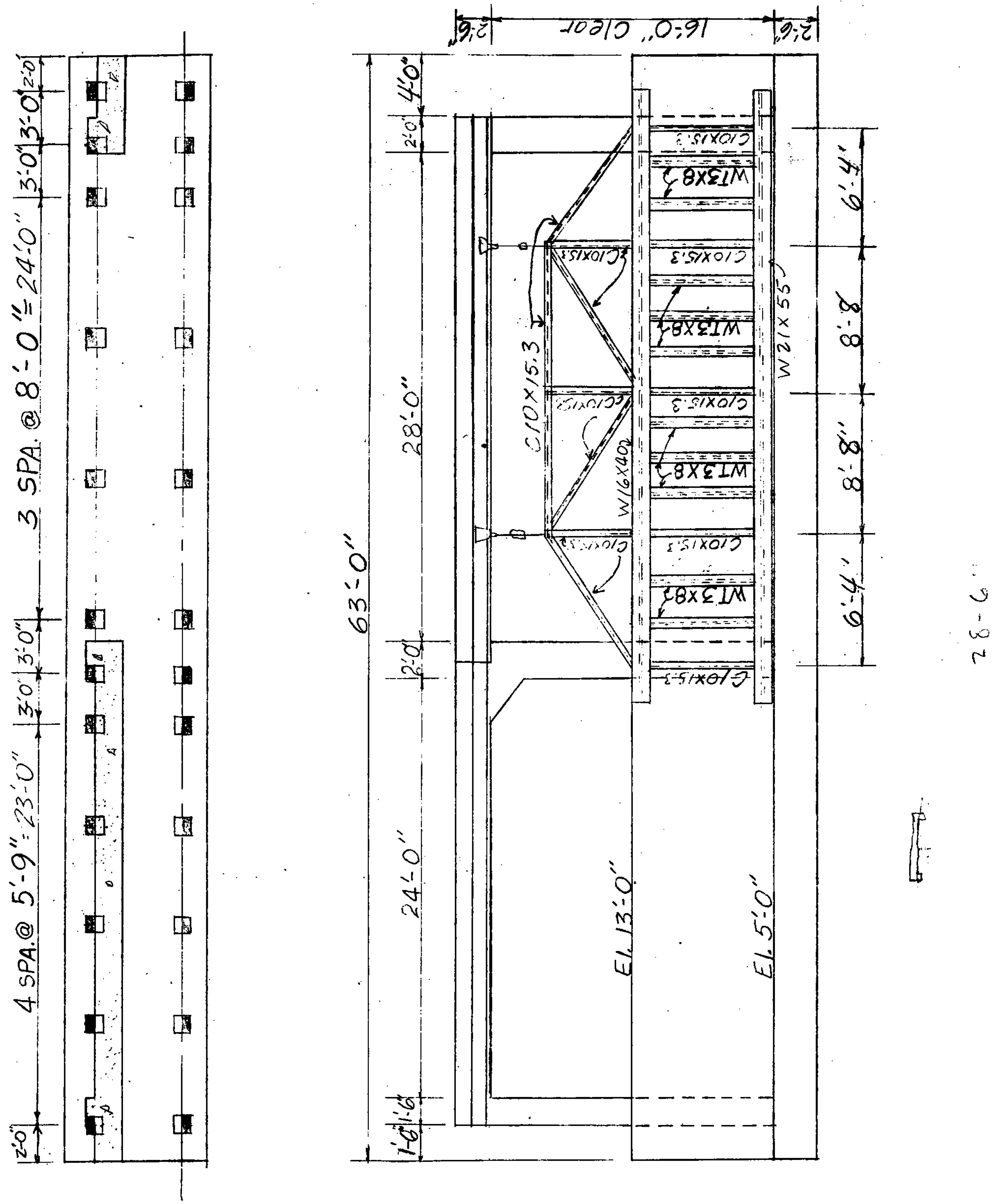


FIGURE D-24

Job No. 4402 Date 1/26/72

Prepared by R.E. White Checked by CLP (1-31-72) Sheet No. 25

Subject O.H. ROLLER GATE NO. 2 - STA. 206+50 R.L. TRAV.

For Dynamic & Static Water Pressure Loadings & Diagrams See Figures D-2 & D-4.

Top Girder

Span = 30.0′ $l_u = 8.67' = 104''$

$M = \frac{wl^2}{8} = 764(30)^2/8 = 86.0'^{K}$

W16X40 $F_b = 20{,}000 - .63\left(\frac{104}{1.84}\right)^2 = 17{,}980^{PSI} = 17.98^{KSI}$

$f_b = \frac{86(12)}{64.6} = 16^{KSI} < 17.98^{KSI} \therefore OK$

Use W16X40 With Flg's Braced at Mid Span & Hanger Pts.

Bottom Girder

Span = 30.0′ $l_u = 8.67' = 104''$

$M = \frac{wl^2}{8} = 1405(30)^2/8 = 158'^{K}$

1545

W21X55 $F_b = 20{,}000 - .63\left(\frac{104}{2.10}\right)^2 = 18{,}455^{PSI} = 18.46^{KSI}$

$f_b = 158(12)/110 = 17.23^{KSI} < 18.46^{KSI} \therefore OK$

Use W21X55 - With Flg's. Braced at Mid Span & Hanger Pts.

Skin Plate

Use 5/16″ PL with Following Rib Spacing:
3 @ 2′-1 5/16″ = 6′-4″, 8 @ 2′-2″ = 17′-4″, 3 @ 2′-1 5/16″ = 6′-4″

For Skin PL & Spacing Calc. See Figure D-5.

Vertical Members

Use WT3X8 - Acting Compositely With 5/16″ PL

For Calc. See Figure D-5 & D-6

FIGURE D-25

Job No. 4402 Date 11/26/72

Prepared by R.E. White Checked by GKP (1-31-72) Sheet No. 26

Subject O.H. ROLLER GATE NO. 2 - STA. 206+50, R.L. TR

Wt. & Center of Gravity of Gate

Member	Unit Wt. (#/ft)	Lgth. (ft)	Wt. (#)	"X" (in)	Mom. (in-#)
W 16x40	40.0	34.0	1360	8.32	11,310
W 21x55	55.0	34.0	1870	10.82	20,250
WT 3x8	8.0	80.0	640	2.77	1,770
5/16" PL x 8'	102.4	30.0	3080	0.16	492
∠3x3x1/2	9.4	30.0	282	0.43	121
C 10x15.3	15.3	108.4	1660	5.32	8,830
			Σ 8892		Σ 42,773

$\bar{X} = 42{,}773/8892 = 4.81''$ (From O.S. Face Skin PL)

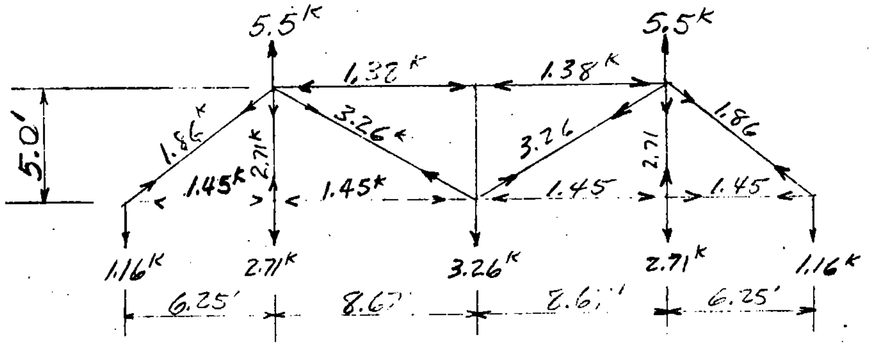
Total Load + 25% Impact = 1.25 (8892) = 11,100#

Trolleys

Use 2 - 3 Ton Trolleys

Truss

Load $w = 11{,}100/29.83 = 372\,^{\#}/_{ft} = .372\,^{K}/_{ft}$



For C 10X15.3

$f_{a(ten)} = \dfrac{3.26}{4.49} < 20^{KSI} \therefore OK$

$f_{a\,(comp)} = \dfrac{1.38}{4.49} = .308^{KSI}$

$F_a = 6.91^{KSI} > .308^{KSI}$ OK

Use C 10X15.3 Hangers

$l_{ux} = 17.33' = 208''$

$l_{uy} = 8.67' = 104''$

$l/r_x = \dfrac{208}{3.87} = 53.7$

$l/r_y = \dfrac{104}{.71} = 147 \Rightarrow$ Gover

FIGURE D-26

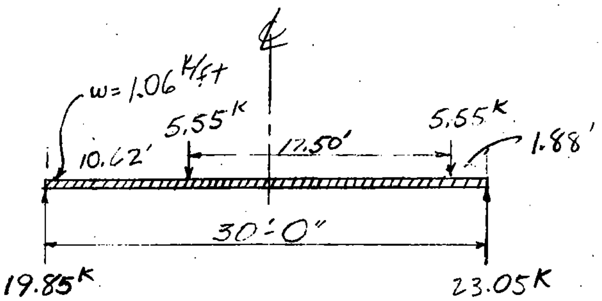
BARNARD AND BURK, INC.

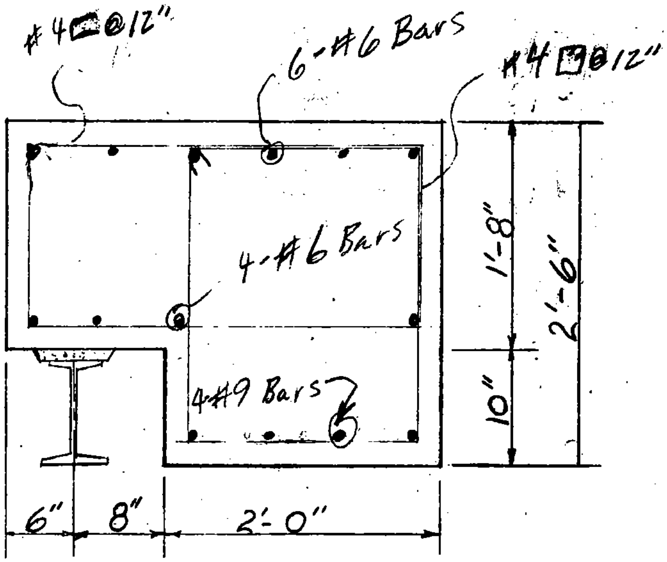
Job No. 4402 Date 1/26/72

Prepared by R.E. White Checked by UXP (1-31-72) Sheet No. 27

Subject O.H. ROLLER GATE NO. 2 - STA. 206+50, R.L. TRAV.

Removable Overhead Concrete Beam





$w = 2.5(\overset{.75}{2.0})(.15) + 1.67(\overset{.29}{1.17})(.15) + .02$

$w = 1.06\ ^{k}/_{ft}$

$M_{max} = 19.85\overset{212}{(10.67)} - 1.06\overset{61}{(10.67)^2}/2$

$M_{max} = 151$

$f'_c = 3000^{psi}$

$f_s = 20{,}000^{psi}$

$f_c = 1050^{psi}$

$n = 9.2$

$V_{max} = 1.06(15) + 5.55 + 5.55(12.5)/30.0$

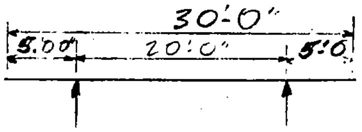
$V_{max} = 15.9 + 5.55 + 2.34 = 23.79^{k}$

$d_{req'd}\ \sqrt{\frac{151(12)}{.152(24)}} = 22.3''$

$d_{FURN.} = 30 - 2.5 = 27.5'' > 22.3''$ OK

$A_{s\,Req'd} = \frac{151}{1.44(27.5)} = 3.82^{\#} \Rightarrow$ 4-#9 Bars

Pick-Up Stress



Use 4-#9 Bars Bott
& 4-#6 Bars Top

$\pm M = 15.9(10) - 1.06\overset{15}{(15)^2}/2 = 39'^{k}$

$A_s = \frac{39}{1.44(27.5)} = .985^{\#} \Rightarrow$ 4-#6 Bars

FIGURE D-27

Job No. 4402 Date 1/26/72

Prepared by R.E. White Checked by URP (1-31-72) Sheet No. 28

Subject O.H. ROLLER GATE NO.2 – STA. 206+50, R.L. TRAY.

Removable Overhead Concrete Beam (cont.)

Torsion

$$T_{L.L.} = 20''(5.55^{K})(1+{}^{12.67}/_{30.0}) = 158$$

$$T_{D.L.} = 20''(.31)({}^{30}/_{2}) \qquad = 93$$

$$T = 251''^{K} \text{ @ End}$$

Torsional Shear

$$v_t = \frac{4.8T}{h^3} = \frac{4.8(251)}{30^3} = .046^{KSI}$$

Combined Shear Due To Vert. & Torsional Shear

$$v_v = \frac{23.79}{30(27.5)} = .029^{KSI}$$

$$v_t = .046^{KSI}$$

$$v = .075^{KSI}$$

$$v_c \quad .060$$

$$v' = .015 = 15^{PSI}$$

For #4 Stirrups

$$S_{max} \; \frac{8000}{15 \times 24} = 22.2''$$

Use #4 Stirrups @ 12" Full Length

FIGURE D-28

BARNARD AND BURK, INC.

Job No. 4402 Date 1/27/72

Prepared by R.E. White Checked by WKP (1-31-72) Sheet No. 29

Subject O.H. ROLLER GATE NO. 2 - STA. 206+50, R.L. TRAV.

Column Design

Case 2 Loading

Item	Computation	H	V	X	M
O.H. Beam	28.0 (1.06)		29.65	–	–
Col.	.15 (2)(2.0)(16)		19.60	–	–
Hor. H_2O	(2.50)(16)	40.00		3.45	138.0
	Σ	40.00^k	39.25		$138.0^{'k}$

From Column Interaction Diagram For 24" Square Column With $f_c' = 3000$ psi & $f_y = 40{,}000$ psi "WSD For Concrete Columns - Part 7" By Eli Czerniak Published in Aug. 1965 Edition of Consulting Engineer Page 112

24" X 24" Col OK

$\boxed{\text{Use 8-\#11 Bars Eq. Spaced*}}$

For Col. Cross Section See Figure D-10

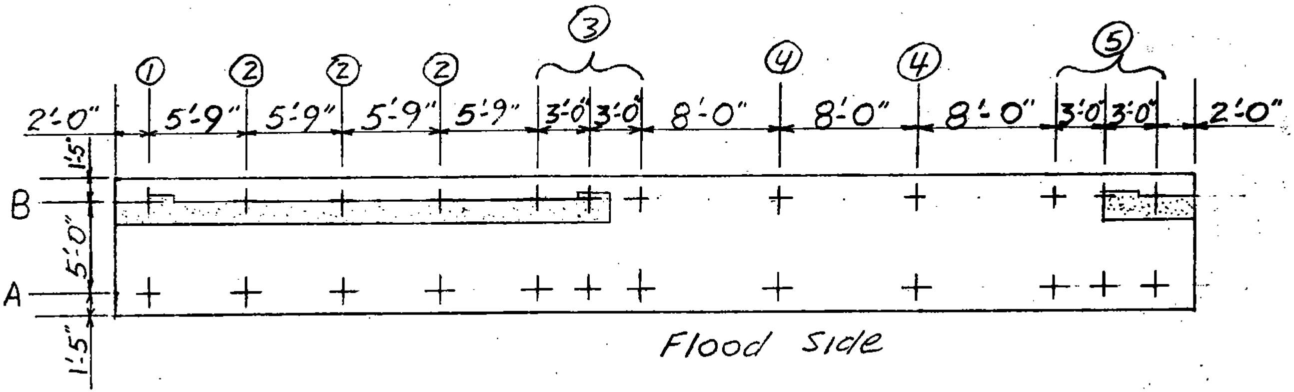
*Some Overstress Results But Neglect Due To Nature of Loading.

FIGURE D-29

BARNARD AND BURK, INC.

Job No. 4402
Date 1/27/72
Prepared by R.E. White
Checked by UXP (1-31-72)
Sheet No. 30
Subject O.H ROLLER GATE NO.2 - STA. 206+50, R.L. TRAV.

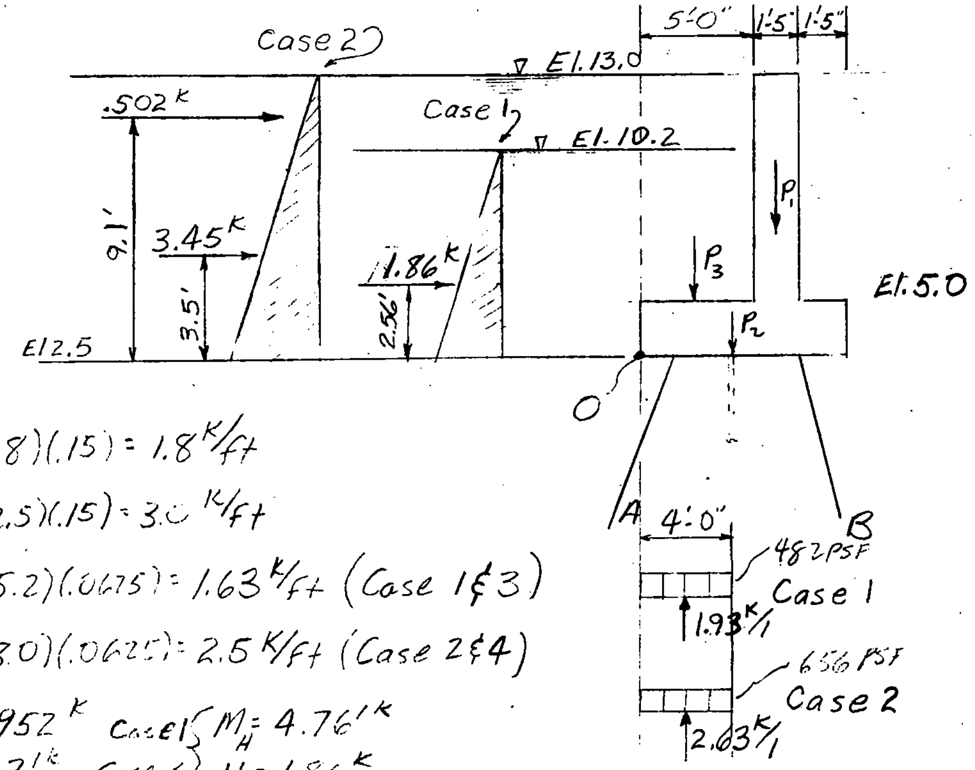
Foundation Design



Pile Layout Gate No. 2

Note: Pile Group ④ Assumed to Carry Vertical Loads Only. Loads From Ftg. Wt. & Hwy. Dead & Live Loads.

Water Loading To Gate Monolith



$P_1 = 1.5(8)(.15) = 1.8^{K}/ft$

$P_2 = 8(2.5)(.15) = 3.0^{K}/ft$

$P_3 = 5(5.2)(.0675) = 1.63^{K}/ft$ (Case 1 & 3)

$P_3 = 5(8.0)(.0625) = 2.5^{K}/ft$ (Case 2 & 4)

Case 2, Case 4: $\Sigma H = 3.952^{K}$, $M = 16.67^{\prime K}$, $X = 4.23'$

Case 1, Case 3: $M_H = 4.76^{\prime K}$, $H = 1.86^{K}$

FIGURE D-30

BARNARD AND BURK, INC.

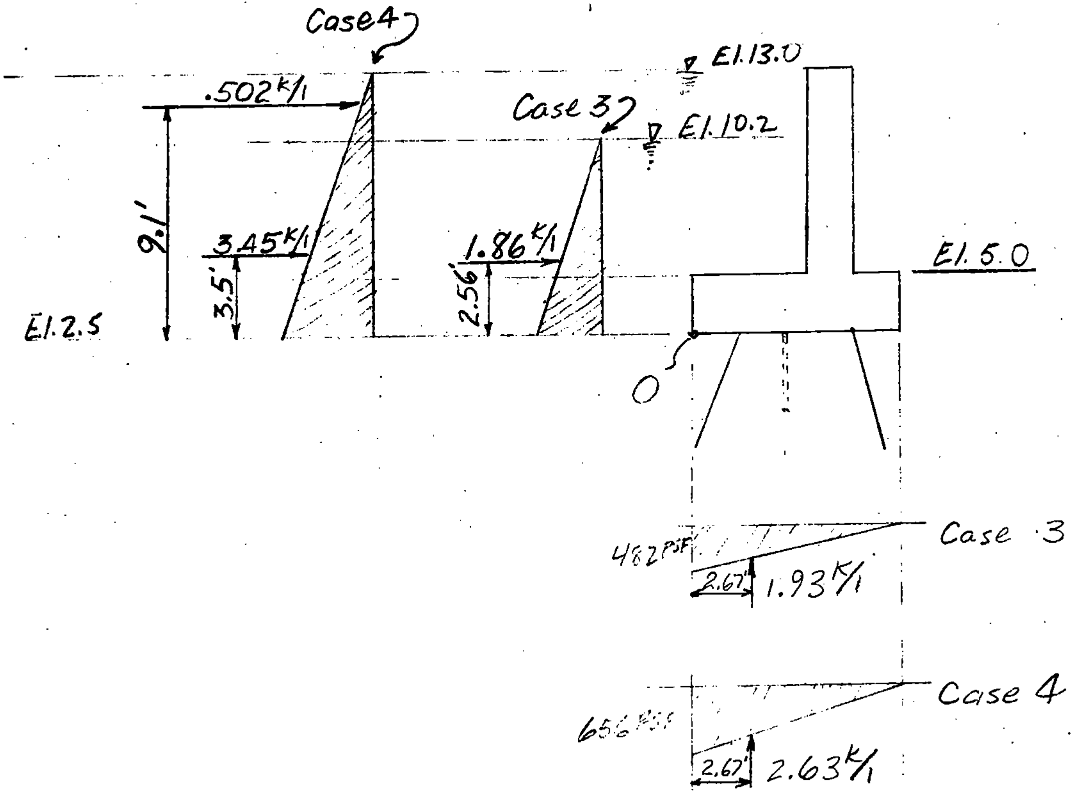
Job No. 4402 Date 1/27/72

Prepared by R.E. White Checked by GXP (1-31-72) Sheet No. 31

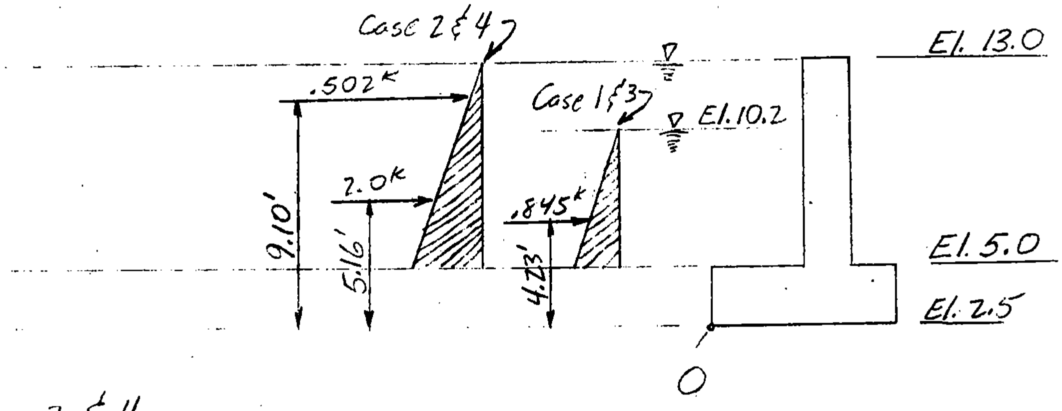
Subject O.H. ROLLER GATE NO. 2 - STA. 206+50, R.L. TRAV.

Foundation Design (cont.)

Water Loads on Gate Monolith



Water Loads on Gate



Case 2 & 4

$M = .502(9.1) + 2.0(5.16) = 14.89'^{k}/_{1}$

$X = \frac{14.89}{2.502} = 5.95'$

BARNARD AND BURK, INC.

Job No. 4402 Date 1/27/72

Prepared by R.E. White Checked by GLP (1-31-72) Sheet No. 32

Subject O.H. ROLLER GATE NO. 2 - STA. 206+50, R.L. TRAV.

Pile Line ② - Loads

Item	Computation	H	V	X	M_B	
Wall	5.75 (1.8)	—	10.35	5.75	59.5	
Ftg	5.75 (3.0)	—	17.25	4.0	69.0	
Struct Wt.			27.60		128.5	
H_2O on Base	5.75 (1.63)	—	9.39	2.5	23.45	
Horiz. H_2O	5.75 (1.86)	10.70	—	2.56	27.40	
Uplift	5.75 (-1.93)	—	-11.10	2.0	-22.20	
Case ①		10.70	25.89		157.15	= 1890"k
H_2O on Base	5.75 (2.5)	—	14.35	2.5	35.90	
Horiz. H_2O	5.75 (3.95)	22.70	—	4.23	96.00	
Uplift	5.75 (-2.63)	—	-15.11	2.0	-30.25	
Case ②		22.70	26.84		230.15	= 2780"k
H_2O on Base	5.75 (1.63)	—	9.39	2.5	23.45	
Horiz. H_2O	5.75 (1.86)	10.70	—	2.56	27.40	
Uplift	5.75 (-1.93)	—	-11.10	2.67	-29.65	
Case ③		10.70	25.89		149.70	= 1795"k
H_2O on Base	5.75 (2.5)	—	14.35	2.5	35.90	
Horiz. H_2O	5.75 (3.95)	22.70	—	4.23	96.00	
Uplift	5.75 (-2.63)	—	-15.11	2.67	-40.40	
Case (4)		22.70	26.84		220.00	= 2640"k

FIGURE D-32

BARNARD AND BURK, INC.

Job No. 4402　　Date 1/27/72

Prepared by RE White　　Checked by L.P (1-31-72)　　Sheet No. 33

Subject O.H. ROLLER GATE NO. 2 - STA. 206+50, R.L. TRAV.

Pile Group ③ - Loads/Pile Line

Item	Computation	H	V	X	M	
O.H. Beam	1/3 (28.75)(1.06)	—	10.15	6.0	61.00	
Col.	1/3 (.6)(16)	—	3.20	6.0	19.20	
Wall	1/3 (5.38)(1.8)	—	3.23	5.75	18.60	
Ftg.	1/3 (12.88) (3.0)	—	12.88	4.0	51.49	
Gate	1/3 (4.45)	—	1.48	4.67	6.91	
Struct. Wt.			30.94		157.20	
H_2O on Base	1/3 (12.88)(1.63)	—	7.00	2.5	17.50	
Horiz. H_2O	1/3 (6.88)(1.86)	4.27	—	2.56	10.91	
Horiz. H_2O	1/3 (14)(.845)	3.94	—	4.23	16.69	
Uplift	1/3 (12.88)(-1.93)	—	-8.29	2.0	-16.60	
Case ①		8.21	29.65		185.70	2230"K
H_2O on Base	1/3 (12.88) (2.5)	—	10.73	2.5	26.85	
Horiz. H_2O	1/3 (6.88) (3.95)	9.07	—	4.23	38.40	
Horiz. H_2O	1/3 (14) (2.50)	11.68	—	5.95	69.50	
Uplift	1/3 (12.88)(-2.63)	—	-11.30	2.0	-22.60	
Case ②		20.75	30.37		269.35	3230"K
H_2O on Base	1/3 (12.88) (1.63)	—	7.00	2.5	17.50	
Horiz. H_2O	1/3 (6.88) (1.86)	4.27	—	2.56	10.91	
Horiz. H_2O	1/3 (14) (.845)	3.94	—	4.23	16.69	
Uplift	1/3 (12.88) (-1.93)	—	-8.29	2.67	-22.10	
Case ③		8.21	29.65		180.20	2170"K
H_2O on Base	1/3 (12.88) (2.5)	—	10.73	2.5	26.85	
Horiz H_2O	1/3 (6.88) (3.95)	9.07	—	4.23	[illegible]	
Horiz H_2O	1/3 (14.0) (2.50)	11.68	—	5.95	69.50	
Uplift	1/3 (12.88) (-2.63)	—	-11.30	2.67	-30.20	
		20.75	30.37		261.75	3140"K

FIGURE D-33

Job No. 4402

Date 2/1/72

Prepared by R.E. White

Checked by UXP (2-3-72)

Sheet No. 34

Subject O.H. ROLLER GATE NO.2 - STA 206+50, R.L. TRAV.

For 12" Precast Prestressed Concrete Pile Properties & Allowable Loads In Compression & Tension For Various Pile Lengths See Figure D-16.

For Modulus of Horizontal Subgrade Soil Reactions (AK) To Be Used See Figure D-16.

Results of Foundation Analysis O.H. Roller Gate 2

<table>
<tr><th colspan="8">PILE LINE No. 2</th></tr>
<tr><th rowspan="2">Case</th><th rowspan="2">Row</th><th colspan="3">Actual</th><th colspan="3">Allowable</th></tr>
<tr><th>P</th><th>Q</th><th>y</th><th>P</th><th>Q</th><th>y</th></tr>
<tr><td>1</td><td>A</td><td>2.2</td><td>0.31</td><td>-0.029</td><td>60</td><td>3.54</td><td>0.338</td></tr>
<tr><td></td><td>B</td><td>26.3</td><td>0.43</td><td>-0.041</td><td>60</td><td>3.54</td><td>0.338</td></tr>
<tr><td>2</td><td>A</td><td>-11.7</td><td>-0.79</td><td>0.076</td><td>-48</td><td>2.64</td><td>0.251</td></tr>
<tr><td></td><td>B</td><td>43.1</td><td>-0.75</td><td>0.071</td><td>60</td><td>3.54</td><td>0.338</td></tr>
<tr><td>3</td><td>A</td><td>3.7</td><td>-0.15</td><td>0.014</td><td>60</td><td>3.54</td><td>0.338</td></tr>
<tr><td></td><td>B</td><td>24.8</td><td>-0.08</td><td>0.007</td><td>60</td><td>3.54</td><td>0.338</td></tr>
<tr><td>4</td><td>A</td><td>-9.4</td><td>-1.48</td><td>0.142</td><td>-48</td><td>2.64</td><td>0.251</td></tr>
<tr><td></td><td>B</td><td>40.9</td><td>-1.51</td><td>0.144</td><td>60</td><td>3.54</td><td>0.338</td></tr>
<tr><th colspan="8">PILE GROUP No. 3</th></tr>
<tr><td>1</td><td>A</td><td>1.6</td><td>2.40</td><td>-0.228</td><td>60</td><td>3.54</td><td>0.338</td></tr>
<tr><td></td><td>B</td><td>30.4</td><td>2.74</td><td>-0.262</td><td>60</td><td>3.54</td><td>0.338</td></tr>
<tr><td>2</td><td>A</td><td>-14.7</td><td>1.57</td><td>-0.150</td><td>-48</td><td>2.64</td><td>0.251</td></tr>
<tr><td></td><td>B</td><td>49.6</td><td>1.88</td><td>-0.179</td><td>60</td><td>3.54</td><td>0.338</td></tr>
<tr><td>3</td><td>A</td><td>2.6</td><td>2.07</td><td>-0.198</td><td>60</td><td>3.54</td><td>0.338</td></tr>
<tr><td></td><td>B</td><td>29.3</td><td>2.39</td><td>-0.228</td><td>60</td><td>3.54</td><td>0.338</td></tr>
<tr><td>4</td><td>A</td><td>-13.5</td><td>1.18</td><td>-0.112</td><td>48</td><td>2.64</td><td>0.251</td></tr>
<tr><td></td><td>B</td><td>48.3</td><td>1.44</td><td>-0.138</td><td>60</td><td>3.54</td><td>0.338</td></tr>
</table>

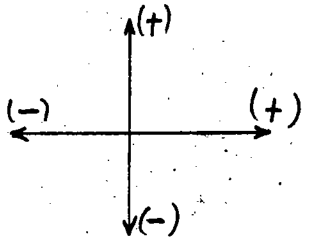
Job No. 4402 Date 2/1/72

Prepared by R.E. White Checked by U.L.P. (2-3-72) Sheet No. 35

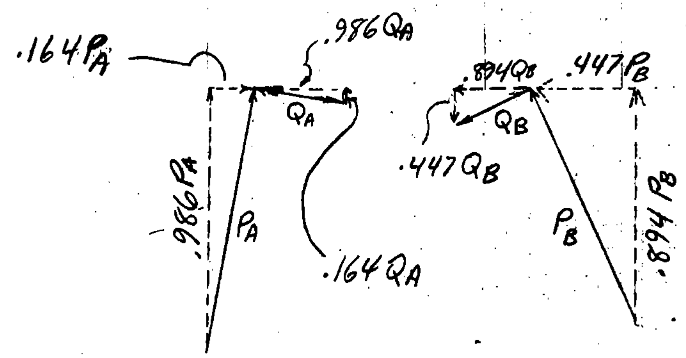
Subject O.H. ROLLER GATE NO. 2 - STA. 206+50, R.L. TRAV.

Pile Loads On Footing (From Computer Print Out)

Pile Line ②				
Pile Forces	Case			
	1	2	3	4
P_A	2.2	-11.7	3.7	-9.4
P_{AV}	2.17	-11.52	3.65	-9.26
P_B	26.3	43.1	24.8	40.9
P_{BV}	23.5	38.6	22.15	36.6
Q_A	0.31	-0.79	-0.15	-1.48
Q_{AV}	-0.05	0.13	0.02	0.24
Q_B	0.43	-0.75	-0.08	-1.51
Q_{BV}	0.19	-0.34	-0.04	-0.68
Pile Group ③				
P_A	1.6	-14.7	2.6	-13.5
P_{AV}	1.58	-14.50	2.56	-13.32
P_B	30.4	49.6	29.3	48.3
P_{BV}	27.2	44.5	26.2	43.2
Q_A	2.4	1.57	2.07	1.18
Q_{AV}	-0.39	-0.26	-0.34	-0.19
Q_B	2.74	1.88	2.39	1.44
Q_{BV}	1.23	0.84	1.07	0.64



Sign Convention For Forces



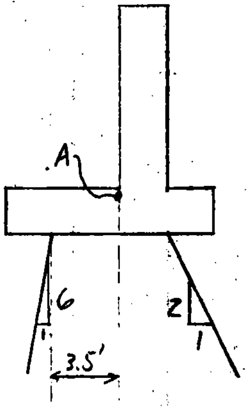


FIGURE D-35

BARNARD AND BURK, INC.

Job No. 4402

Date 2/1/72

Prepared by R.E. White

Checked by GLP (2-3-72)

Sheet No. 36

Subject O.H. ROLLER GATE NO. 2 - STA. 206+50, R.L. TRAV.

Base Design @ Pile Line 2 (Moment About A)

Case 1 & 3

Conc. = $-5.0(2.5)(.15)(2.5)$ = -4.70 'K

H_2O : $-1.63\ (2.5)$ = -4.08 'K

Subtotal = -8.78 'K

Case ①

Pile A = $(\overset{2.12}{2.17 - .05})(3.5)/5.75$ = 1.29 'K

Uplift : 1.93 (3.0) = 5.80 'K

M_{A-1} = -1.69 'K

Case ③

Pile A : $(\overset{3.67}{3.65 + .02})(3.5)/5.75$ = 2.23 'K

Uplift = (1.93)(2.33) = 4.50 'K

M_{A-3} = -2.05 'K

Case 2 & 4

Conc = $-5.0(2.5)(.15)(2.5)$ = -4.70 'K

H_2O = $-2.5\ (2.5)$ = -6.25 'K

Subtotal = -10.95 'K

Case ②

Pile A = $(\overset{3}{-11.52 + .13})(3.5)/5.75$ = -6.93 'K

Uplift = (2.63) (3.0) = 7.89 'K

M_{A-2} = -9.99 'K

Case ④

Pile A = $(\overset{-9.02}{-9.26 + 0.24})(3.5)/5.75$ = -5.50 'K

Uplift = 2.63 (2.33) = 6.14 'K

M_{A-4} = -10.31 'K

FIGURE D-36

BARNARD AND BURK, INC.

Job No. 4402 Date 2/1/72

Prepared by R.E. White Checked by G. X. P (2-3-72) Sheet No. 37

Subject O.H ROLLER GATE NO. 2 - STA. 206+50, R.L. TRAV.

Base Design @ Pile Group 3 (Moment About A)

Case 1 & 3

Conc = $-5.0(2.5)(.15)(2.5) = -4.70'^{k}$

$H_2O = -1.63(2.5) = -4.08'^{k}$

Subtotal $= -8.78'^{k}$

Case ①

Pile A = $\overset{1.19}{(1.58-.39)}(3.5)/4.25 = 0.98'^{k}$

Uplift = $1.93(3.0) = 5.80'^{k}$

$M_{A-1} = -2.00'^{k}$

Case ③

Pile A = $\overset{2.22}{(2.56-.34)}(3.5)/4.25 = 1.83'^{k}$

Uplift = $(1.93)(2.33) = 4.50'^{k}$

$M_{A-3} = -2.45'^{k}$

Case 2 & 4

Conc = $-5.0(2.5)(.15)(2.5) = -4.70'^{k}$

$H_2O = -2.5(2.5) = -6.25'^{k}$

Subtotal $= -10.95'^{k}$

Case 2

Pile A = $\overset{14.76}{(-14.50-.26)}(3.5)/4.25 = -12.15'^{k}$

Uplift = $(2.63)(3.0) = 7.89'^{k}$

$M_{A-2} = -15.27'^{k}$

Case ④

Pile A: $\overset{13.51}{(-13.32-.19)}(3.5)/4.25 = -11.12'^{k}$

Uplift: $(2.63)(2.33) = 6.14'^{k}$

$M_{A-4} = -15.93'^{k}$

FIGURE D-37

BARNARD AND BURK, INC.

Job No. 4402 Date 2/1/72

Prepared by R.E. White Checked by G.L.P (2-3-72) Sheet No. 38

Subject O.H. ROLLER GATE NO. 2 - STA. 206+50, R.L. TRAV.

Footing Transverse Reinf.

Pile Line 2

$d = 30.0 - 3.5 = 26.5$

Top $A_s : \frac{10.31}{1.44(26.5)} = .27$ #/ft

Min $A_s : .0025(12)(26) = 0.78$ #/ft $\Rightarrow$ Governs

$\boxed{\text{Use \#8 Bars @ 12" O.C. Top \& Bott.}}$

Pile Group 3

$d = 26.5"$

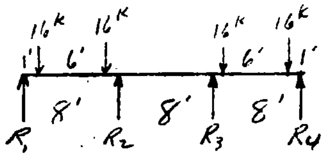
Top $A_s : \frac{15.93}{1.44(26.5)} : 0.42$ #/ft $\Rightarrow$ Use #8@12

Bott A_s : Min A_s : .78 #/ft $\Rightarrow$ #8 @ 12"

$\boxed{\text{Use \#8 @ 12" Top \& \#8 @ 12" Bott.}}$

Footing Longit. Reinf.

Design For HS 20-44 Truck Live Loading



$LLM_{R_2} = .109(16)(8) = 13.95'^K$

$I\ (30\%) \quad : 4.20'^K$

$DLM = \frac{1}{10}(3.0)(8)^2 \quad = 19.20'^K$

$\text{Total } M \quad : 37.35'^K$

$M/ft = \frac{37.35}{8} = 4.67$

$A_s = \frac{4.67}{1.44(26.5)} = .12$ #/ft

Min Steel = $.0025(12)(26) : .78$ #/ft

$\therefore$ .78 #/ft Top & Bott

Req'd, Use #8@12

FIGURE D-38

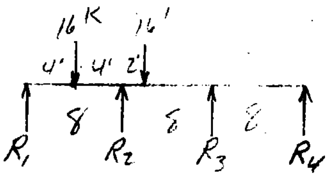
BARNARD AND BURK, INC.

Job No. 4402 Date 2/2/72

Prepared by R.E. White Checked by G.L.P (2-3-72) Sheet No. 39

Subject O.H ROLLER GATE NO. 2 - STA 206+50, R.L. TRAV.

Footing Longt. Reinf. (cont.)



$L.L.M \approx \frac{13}{64}\ 16(8) = 26.00'^k$

$I = 7.81'^k$

$D.L.M = 19.20'^k$

$\text{total} = 53.01'^k$

$M/ft = \frac{53.01}{8} = 6.62'^k/ft$

$A_s = \frac{6.62}{1.44(25.5)} = .18\ \#/ft < A_{s\,min}$

Use #8 Bars @ 12" Top & Bott.

Wall Design

$M @ Bott. = \frac{.0625(7)^3}{6} + .502(6.6) = 8.66'^k/ft$

$d = 18 - 2 = 16"$

$A_s = \frac{8.66}{1.44(16)} = .376\ \#/ft \Rightarrow \#6 @ 12"$

$A_{s\,min} = .001(12)(18) = .22\ \#/ft \Rightarrow \#5 @ 12"$

∴ Use #6 @ 12 Vert. Floodside
& #5 @ 12 Vert. Protected Side

Use #5 @ 12 Longt. Ea. Face

FIGURE D-39

BARNARD AND BURK, INC.

Job No. 4402

Date 2/7/72

Prepared by R.E. White

Checked by Y.L.P. (2-3-72)

Sheet No. 40

Subject O.H. ROLLER GATE NO. 2 - STA 206+50, R.L. TRAV.

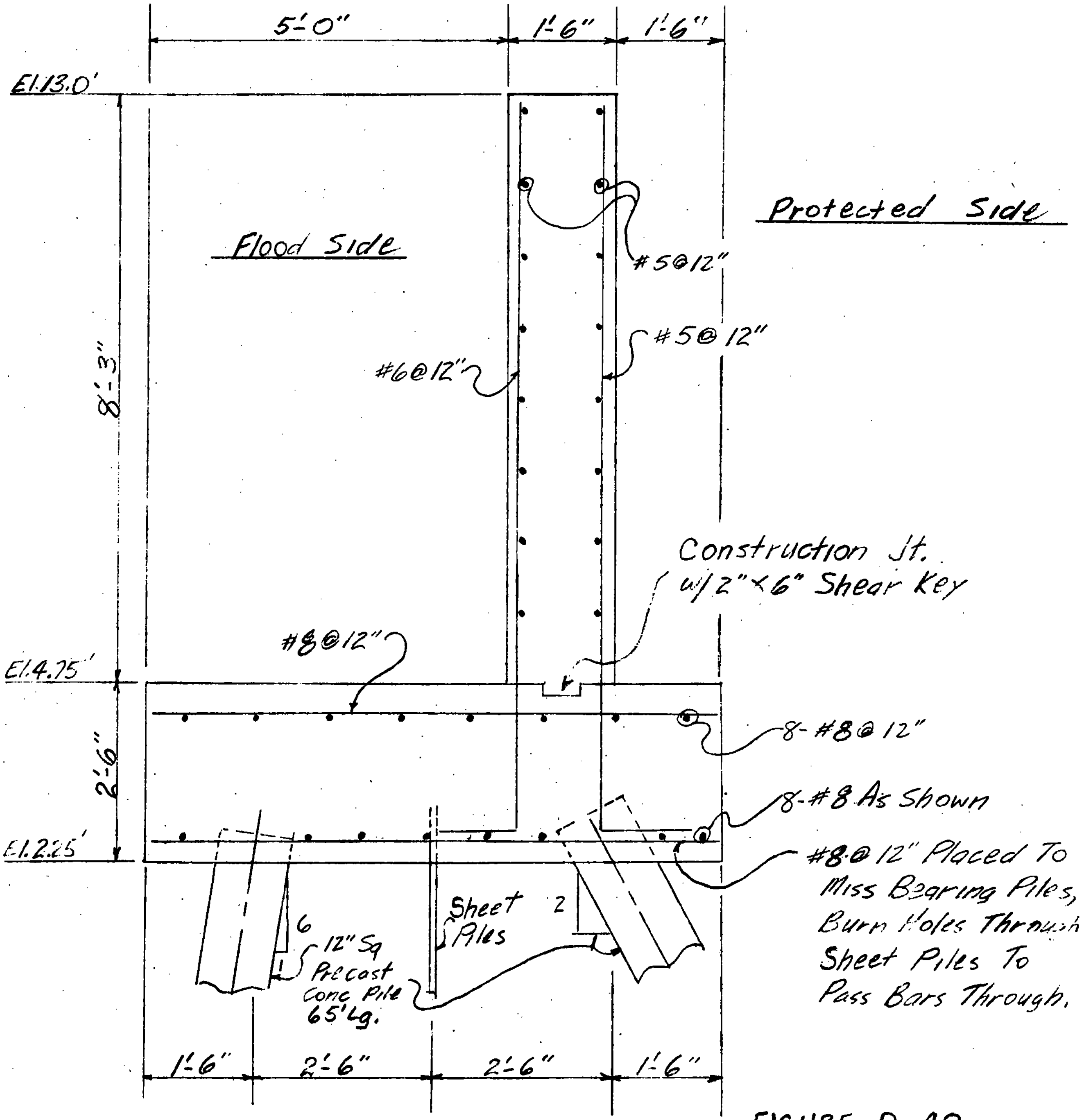


FIGURE D-40

BARNARD AND BURK, INC.

Job No. 4402 Date 6-19-68

Prepared by Louis Duclos Checked by ________ Sheet No. 41

Subject FLOODWALL - AT TOMBS IN LAROSE. TO STA. 8+50 APPROX.

SLAB BETWEEN TOMBS AND FENCE EL 5.6 TO 5.9 M.S.L.

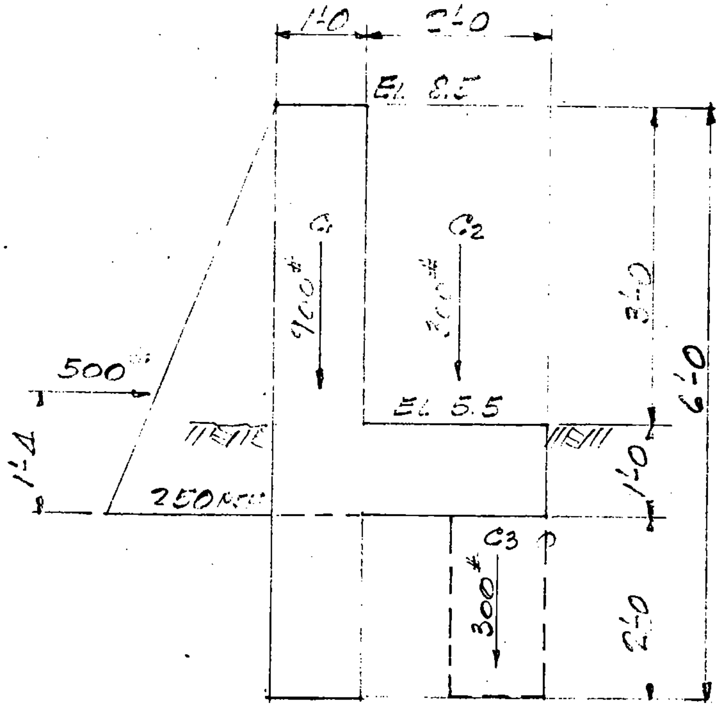
WILL ASSUME EL 5.5 FOR BASIS OF DESIGN.

BACK OF TOMBS TO FENCE IS NOT LESS THAN 5'-0. WILL MAKE BASE OF FLOODWALL 3'-0

H.W. EL. 7.7

TOP OF WALL EL 8.5

WILL DESIGN FOR HW EL 8.5



KEY AT HEEL - WATER EL 8.5

$M_o = 2550^{\#'} - 667^{\#'} = 1883^{\#'}$

$a = 1883^{\#} \div 1200^{\#} = 1.57'$

$e = 1.57' - 1.50' = 0.07'$

$P_{max} = \frac{1200}{3}\left(1 + \frac{6 \times 0.07}{3}\right) = 460$ PSF

$C_1 = 6.00' \times 150^{\#} = 900^{\#}$

$C_2 = 2.00' \times 150^{\#} = \underline{300^{\#}}$

$V = 1,200^{\#}$

$O.T.\ M_o = 500^{\#} \times 1.33' = 667^{\#'}$

$M_o = 900^{\#} \times 2.50' = 2,250^{\#'}$

$\underline{300^{\#}} \times 1.00' = \underline{300^{\#'}}$

$1200^{\#} \times 2.13' = 2550^{\#'}$

$F.S. = 2550 \div 667 = 3.82'$

No WATER

$e = 2.13' - 1.50' = 0.63$

$P = \frac{2 \times 1200^{\#}}{3 \times (3.00 - 2.13)} = 920$ PSF

MOVE KEY TO TOE

$C_1 = 4.00' \times 150^{\#} = 600^{\#}$

$C_2 = 2.00' \times 150^{\#} = 300^{\#}$

$C_3 = 2.00' \times 1.50^{\#} = \underline{300^{\#}}$

$V = 1200^{\#}$

$M_o = 600^{\#} \times 2.50' = 1500^{\#'}$

$300^{\#} \times 1.00' = 300^{\#'}$

$\underline{300^{\#}} \times 0.50' = \underline{150^{\#'}}$

$1200^{\#} \times 1.62' = 1,950^{\#'}$

$F.S. = 1,950 \div 667 = 2.92'$

No WATER

$e = 1.62' - 1.50' = 0.12'$

$P = \frac{1200}{3}\left(1 \pm \frac{6 \times 0.12}{3}\right) =$

$400(1 \pm 0.25) = 500$ PSF Max

WITH WATER

$M_o = 1200^{\#'} - 667^{\#'} = 533^{\#'}$

$a = 533 \div 1200 = 0.45'$

$e = 1.50' - 0.45' = 1.05'$

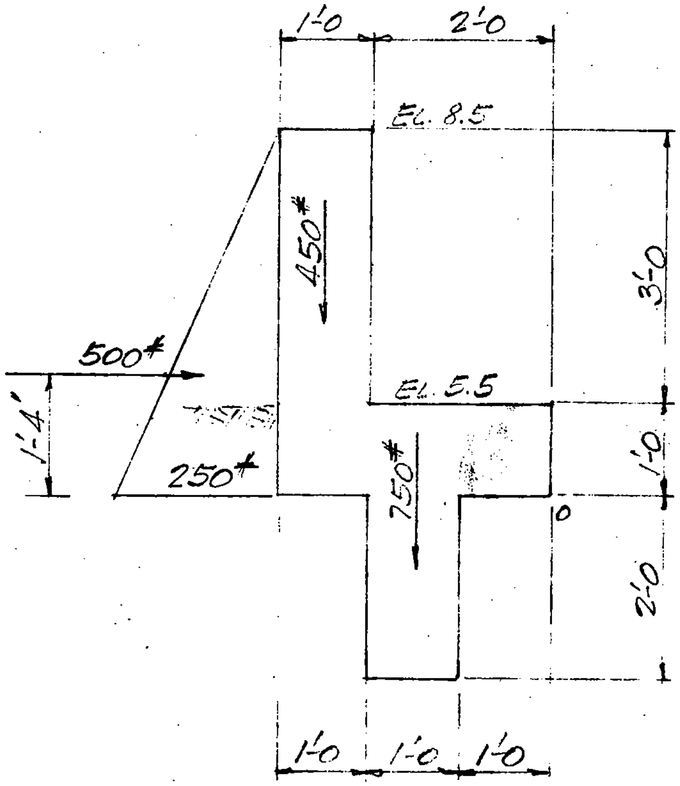
$P = \frac{2 \times 1200}{3 \times 0.45} = 1780$ PSF

FIGURE D-41

Job No. 4402 Date 6-24-68

Prepared by LOUIS DUCLOS Checked by ______ Sheet No. 42

Subject ______



M_0

450# × 2.50' = 1125#'

750# × 1.50' = 1125#'

1200# × 1.88' = 2250#'

OT M = 500# × [illegible] = 667#'

Σ = 1583#'

NO WATER

Soil P = $\frac{1200}{2}$ (1 ± $\frac{6 \times 0.38}{3}$) = 700 PSF

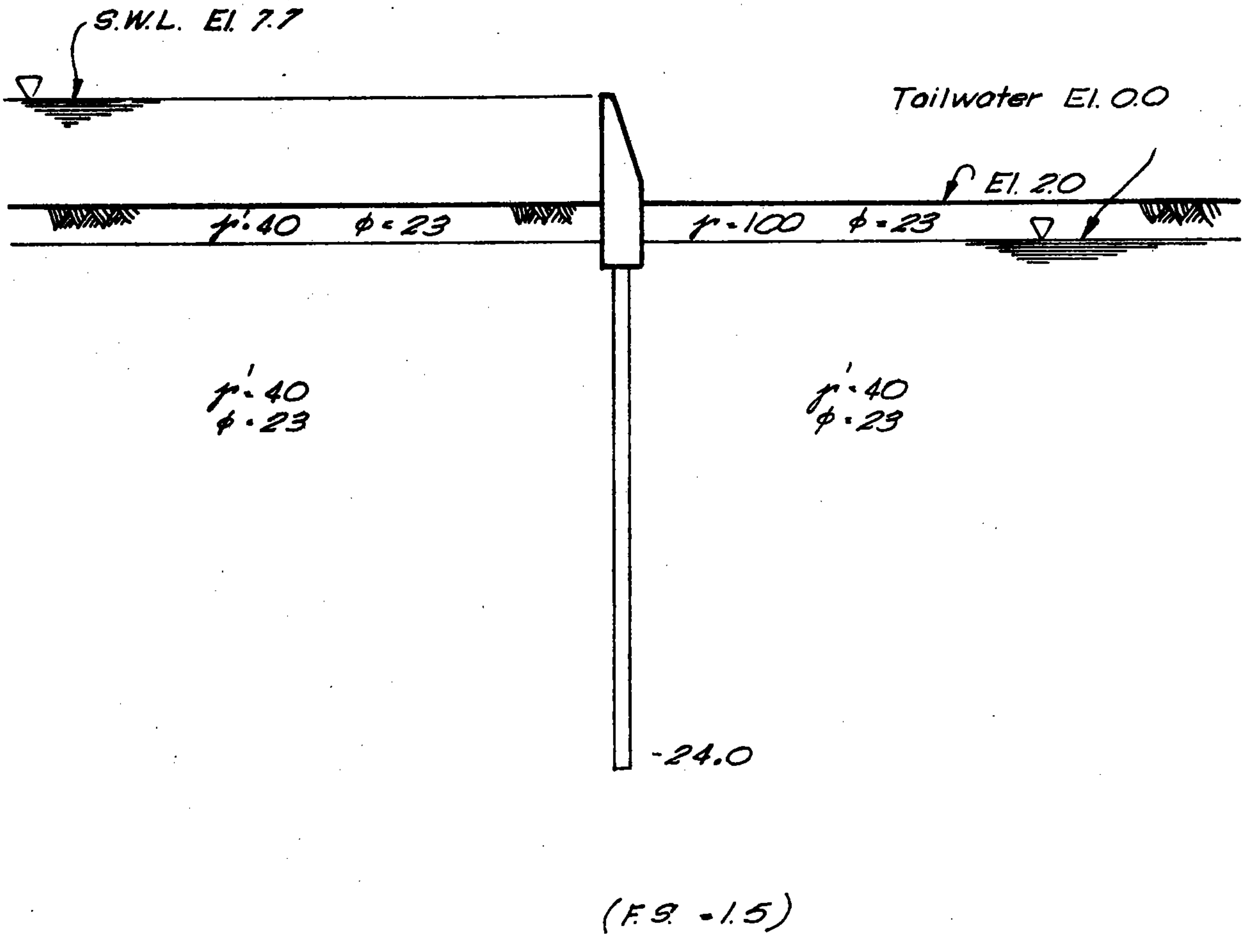
WATER AT EL 5.5

l = 1583#' ÷ 1200# = 1.32'

Soil P = $\frac{1200}{3}$ (1 ± $\frac{6 \times 0.18}{3}$) = 550 PSF

USE

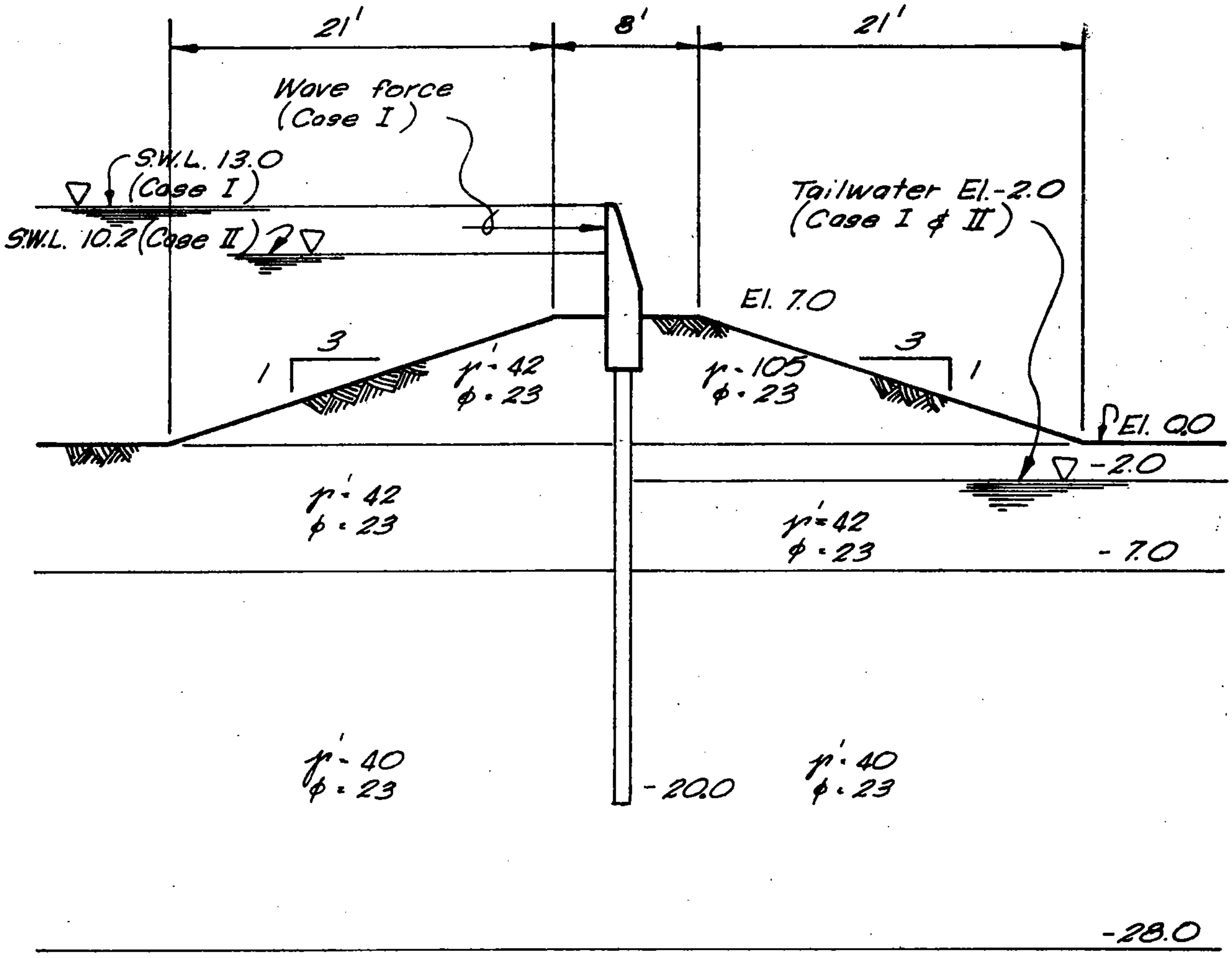
FIGURE D-42



DESIGN SECTION

5.7 FT. I WALL @ LAROSE

FIGURE D-43

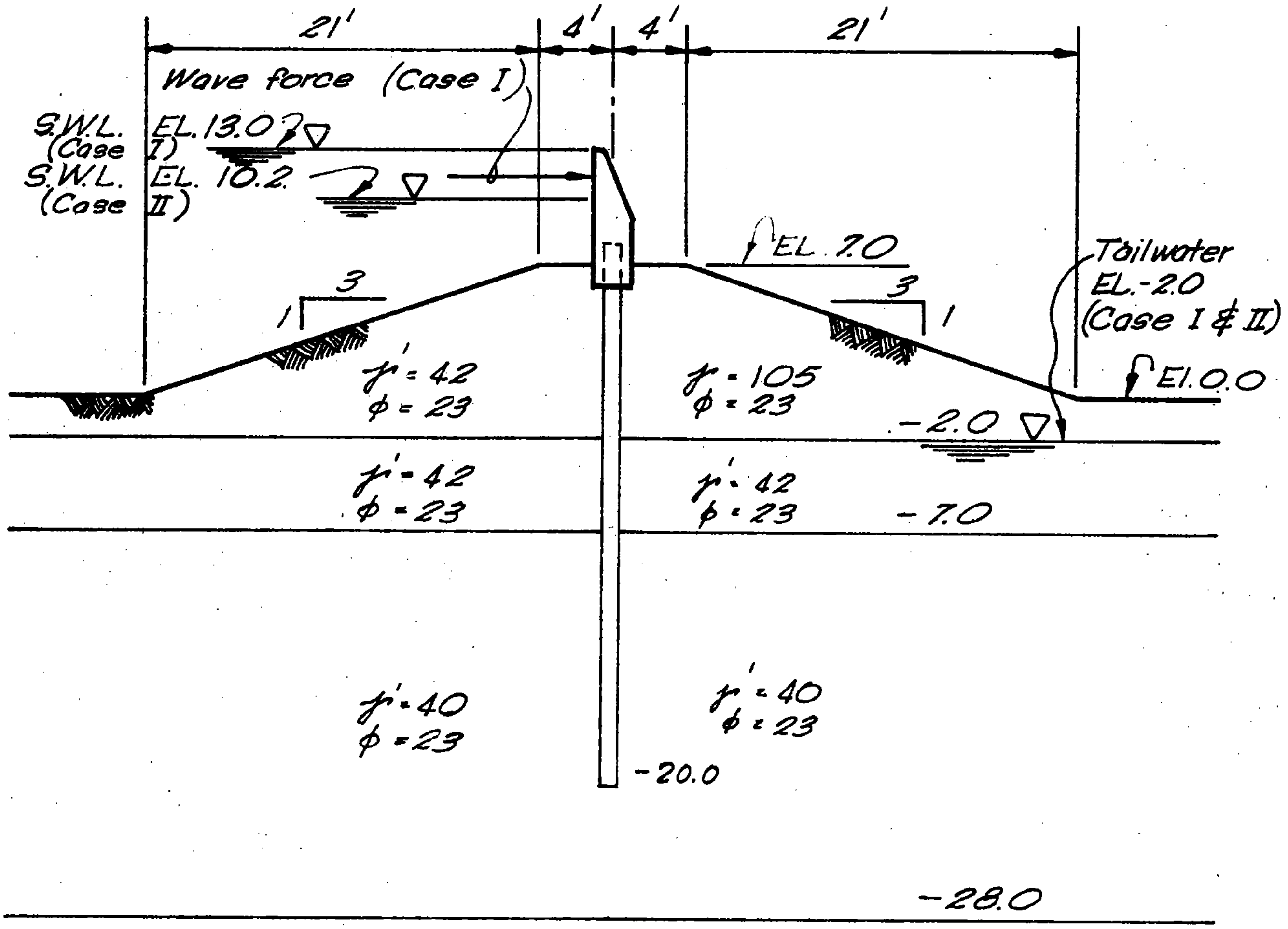


Case I : Dyn. wave force plus static water press. (F.S. = 1.25)
Case II : Static water press. (F.S. = 1.5)

DESIGN SECTION

6 FT I WALL AT G.M. PUMPING STATION

FIGURE D-44

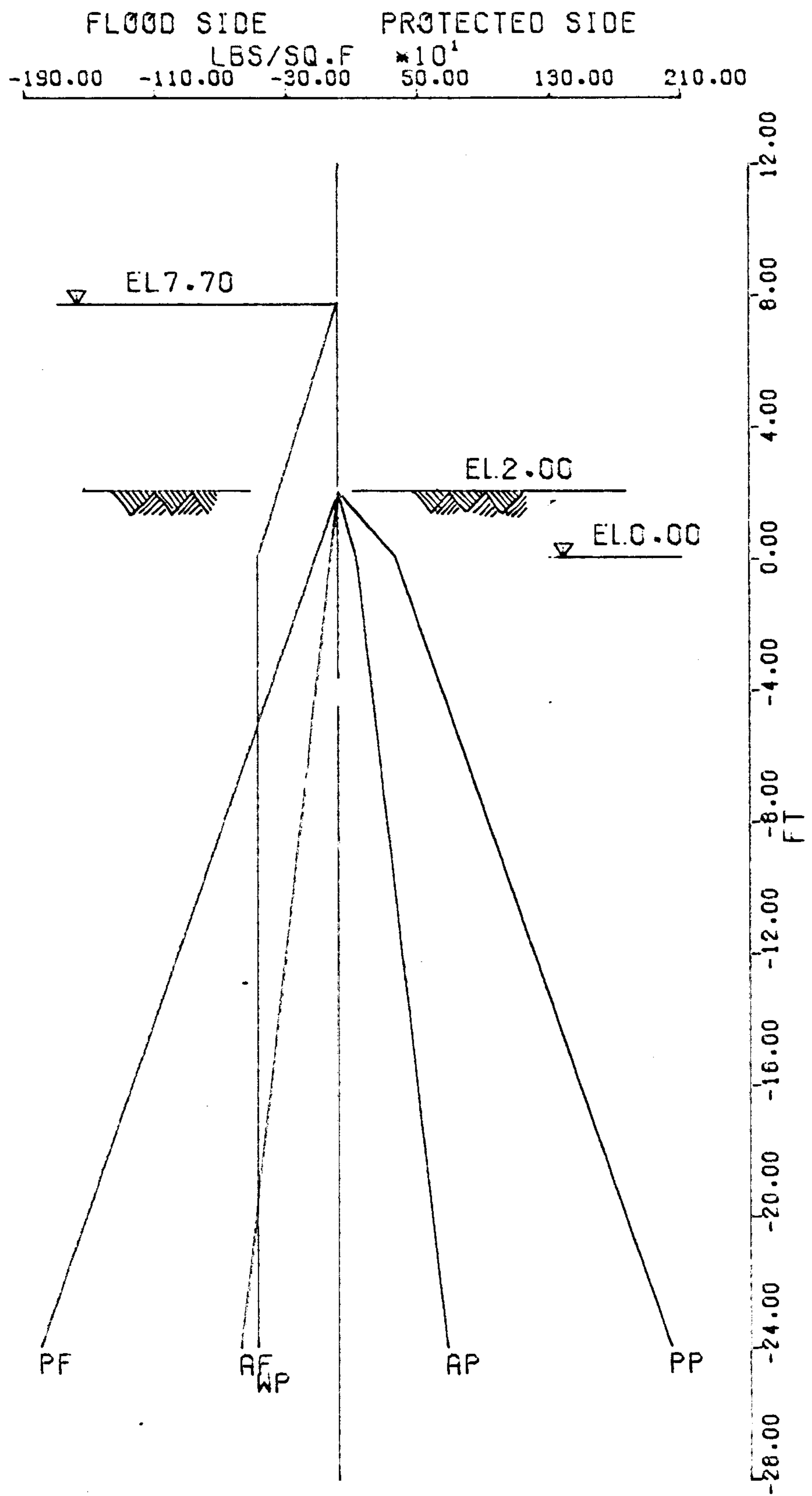


CASE I : Dyn. wave force plus static water press. (F.S. = 1.25)
CASE II : Static water press. (F.S. = 1.5)

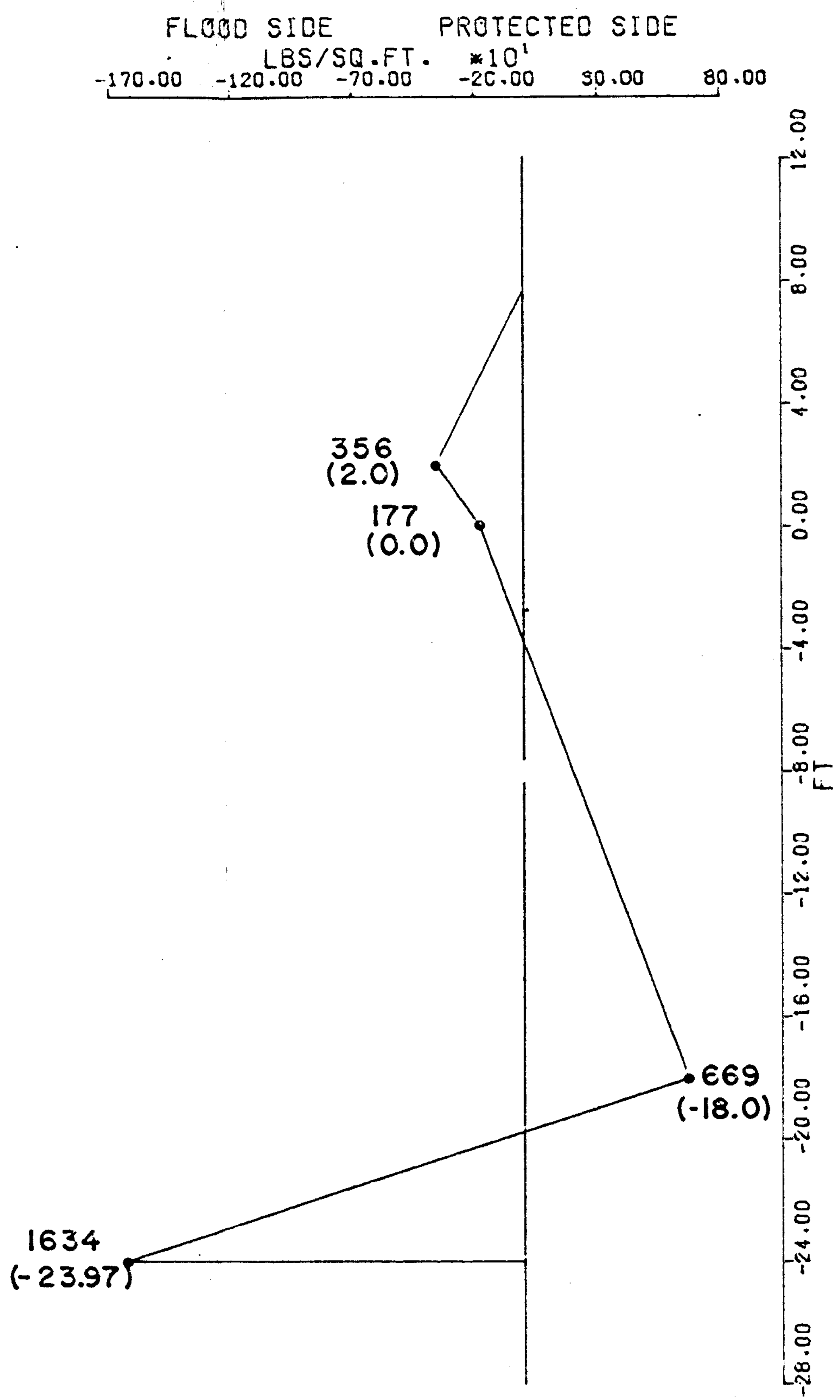
DESIGN SECTION

6 FT. I WALL AT RING LEVEE STA. 206+50

FIGURE D-45

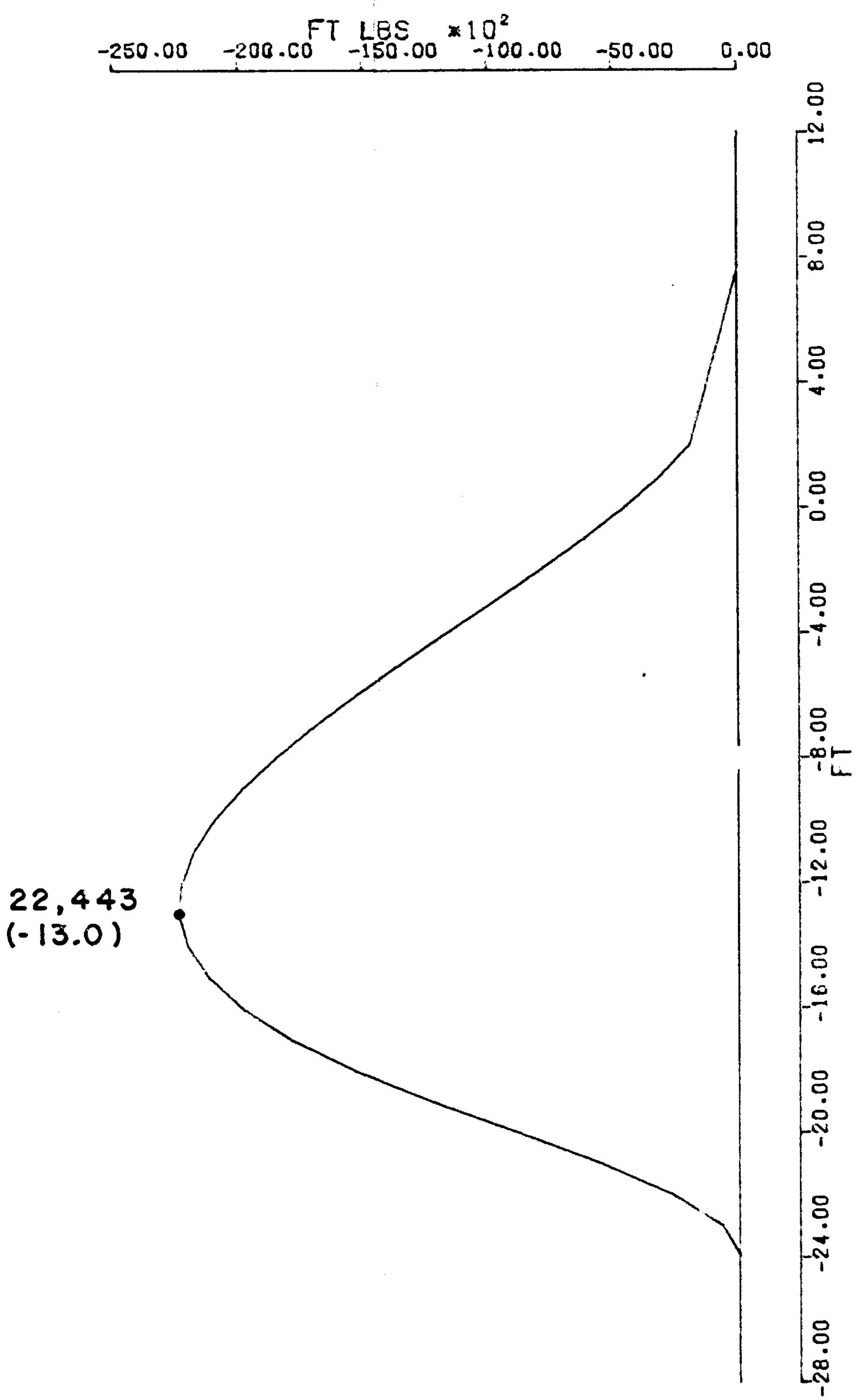


PRESSURE DIAGRAMS



NET PRESSURE DIAGRAM

F. S. = 1.5



MOMENT DIAGRAM

5.7 FT. I WALL AT LAROSE

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I - GENERAL DESIGN

CANTILEVER SHEET PILE
FLOODWALL (S) STABILITY

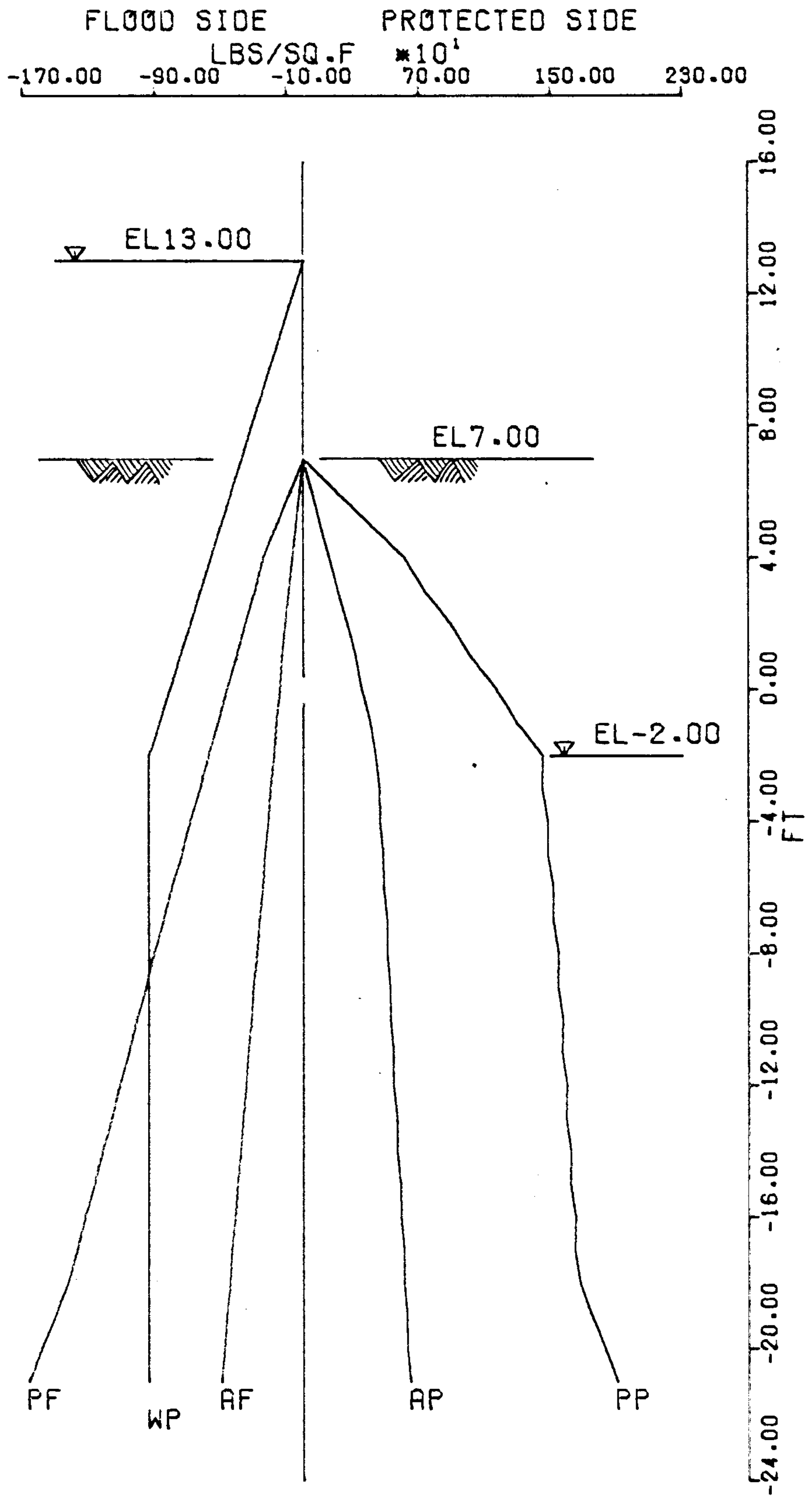
BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA

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

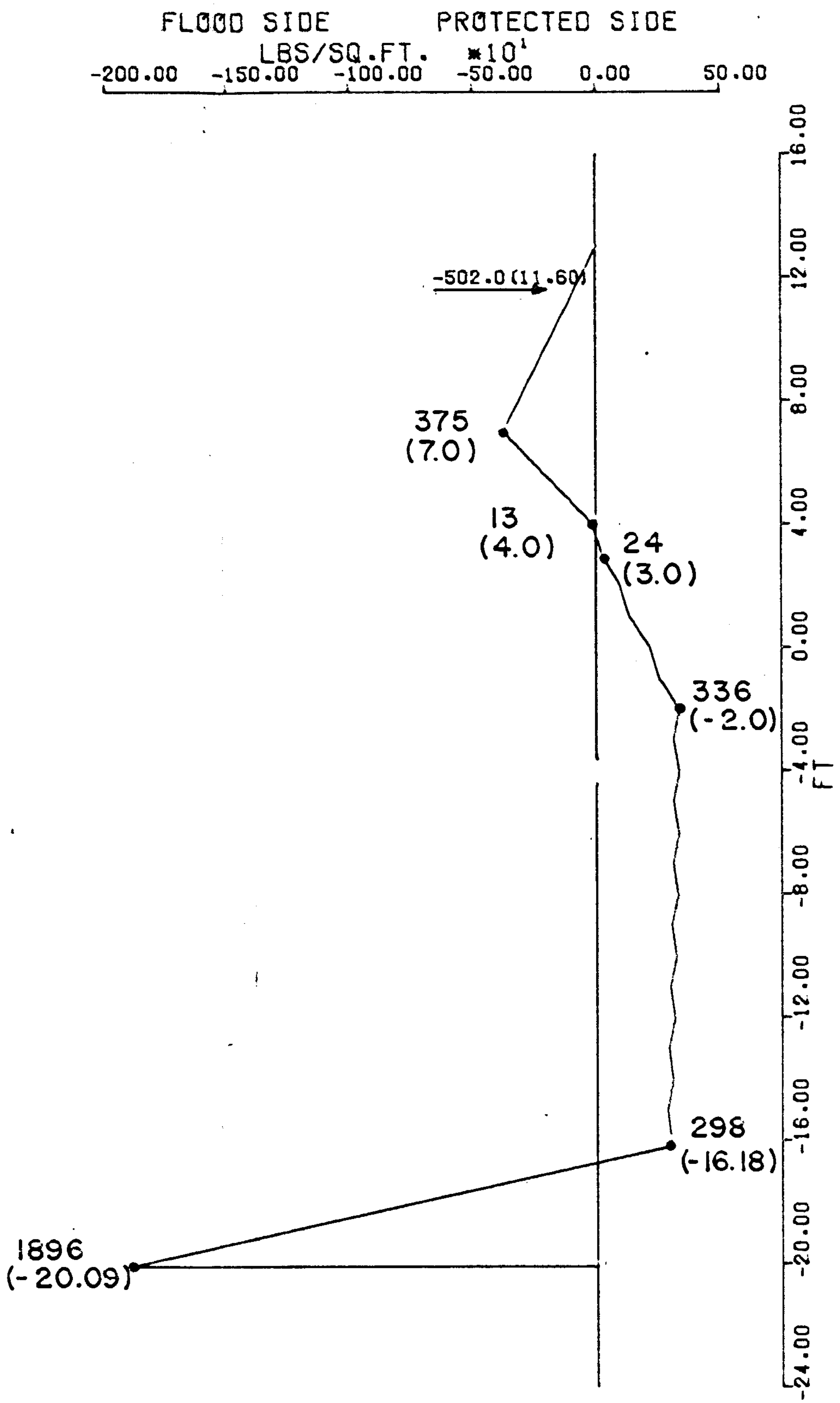
DATE: MARCH 1972

FILE NO. H-2-24314

FIGURE D-46

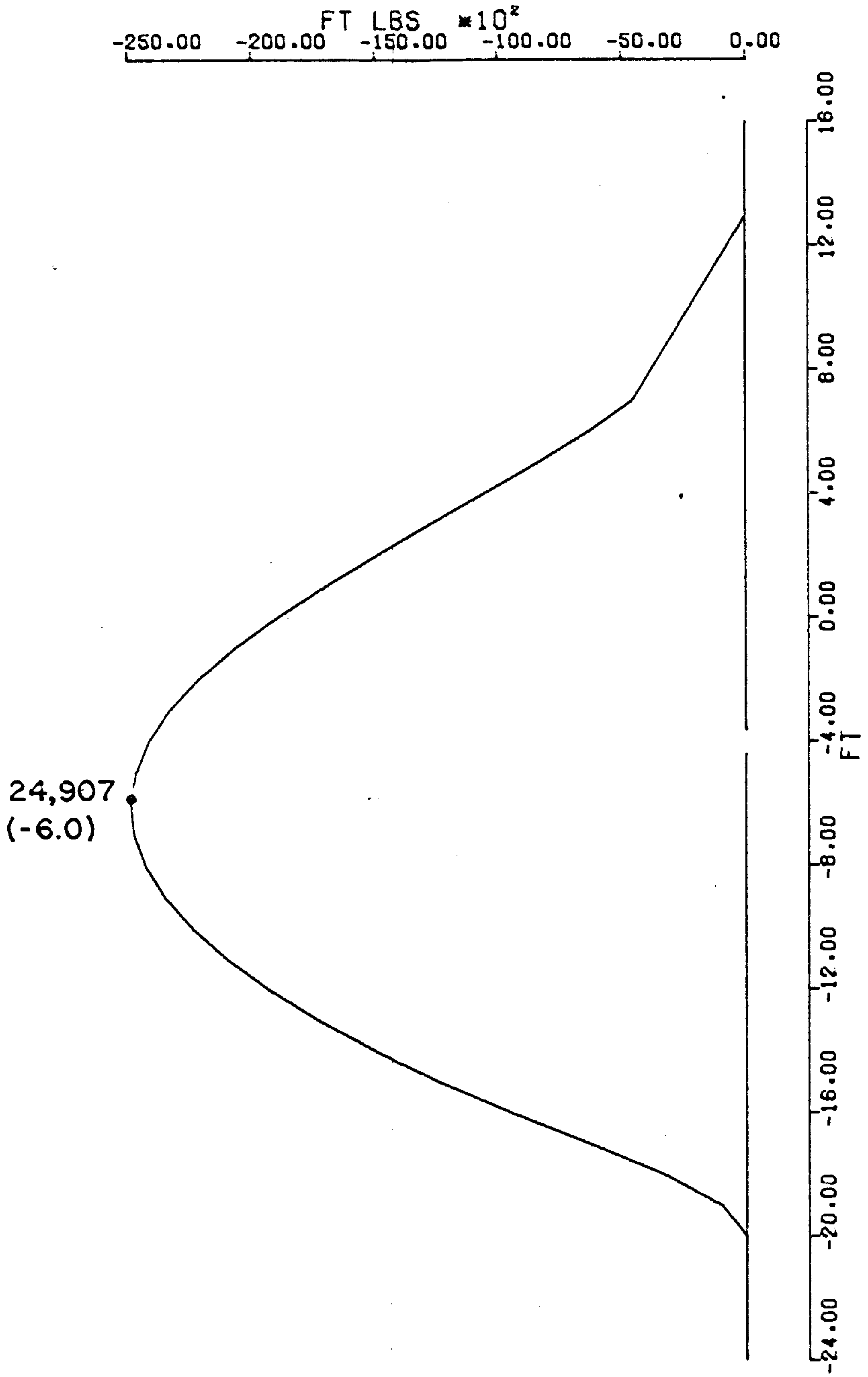


PRESSURE DIAGRAMS



NET PRESSURE DIAGRAM

F.S. = 1.25



MOMENT DIAGRAM

6 FT. I WALL AT GOLDEN
MEADOW PUMPING STATION
WITH WAVE FORCE

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO.1 - GENERAL DESIGN

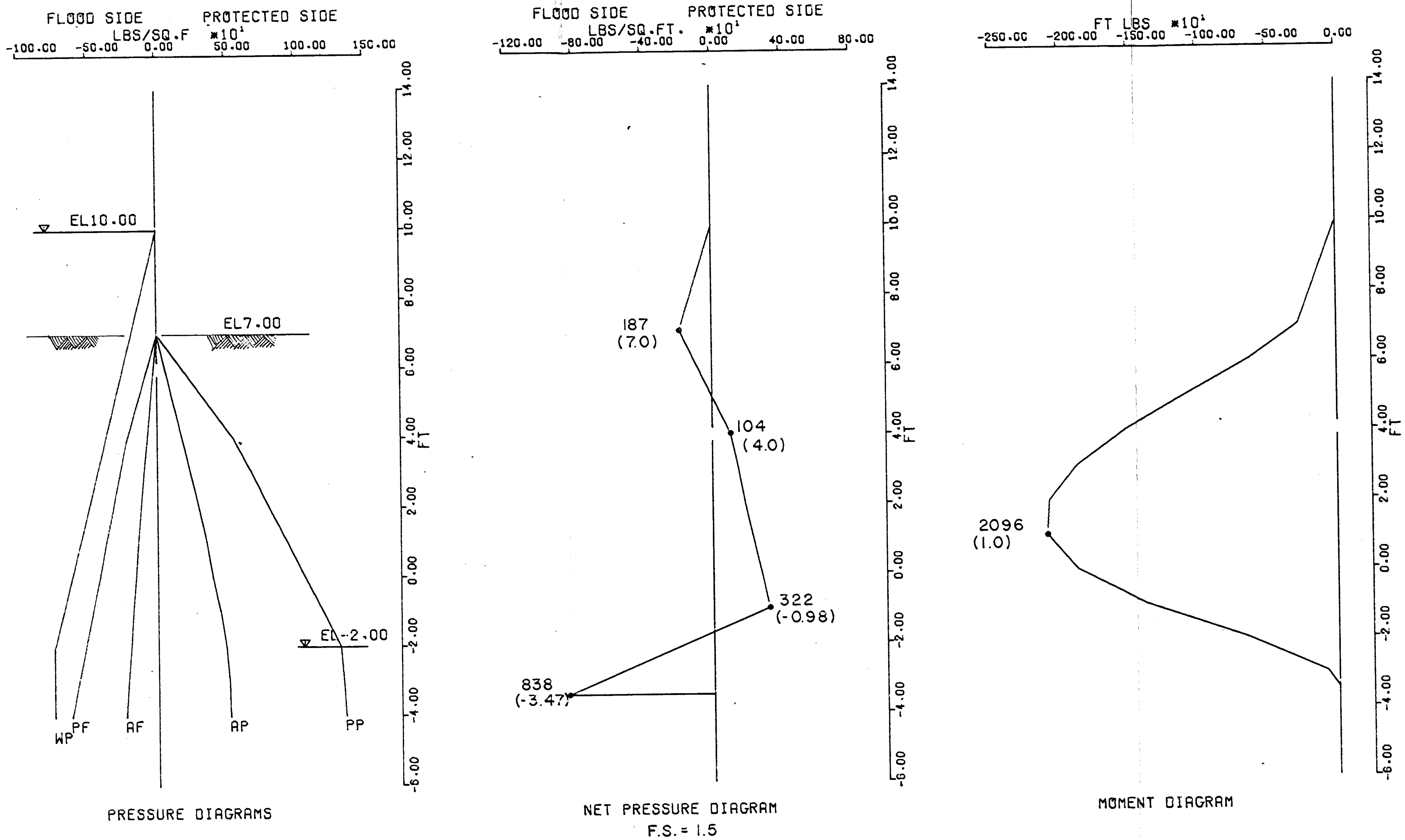
CANTILEVER SHEET PILE
FLOODWALL (S) STABILITY

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE: MARCH 1972
FILE NO. H-2-24314

FIGURE D-47



PRESSURE DIAGRAMS

NET PRESSURE DIAGRAM

F.S. = 1.5

MOMENT DIAGRAM

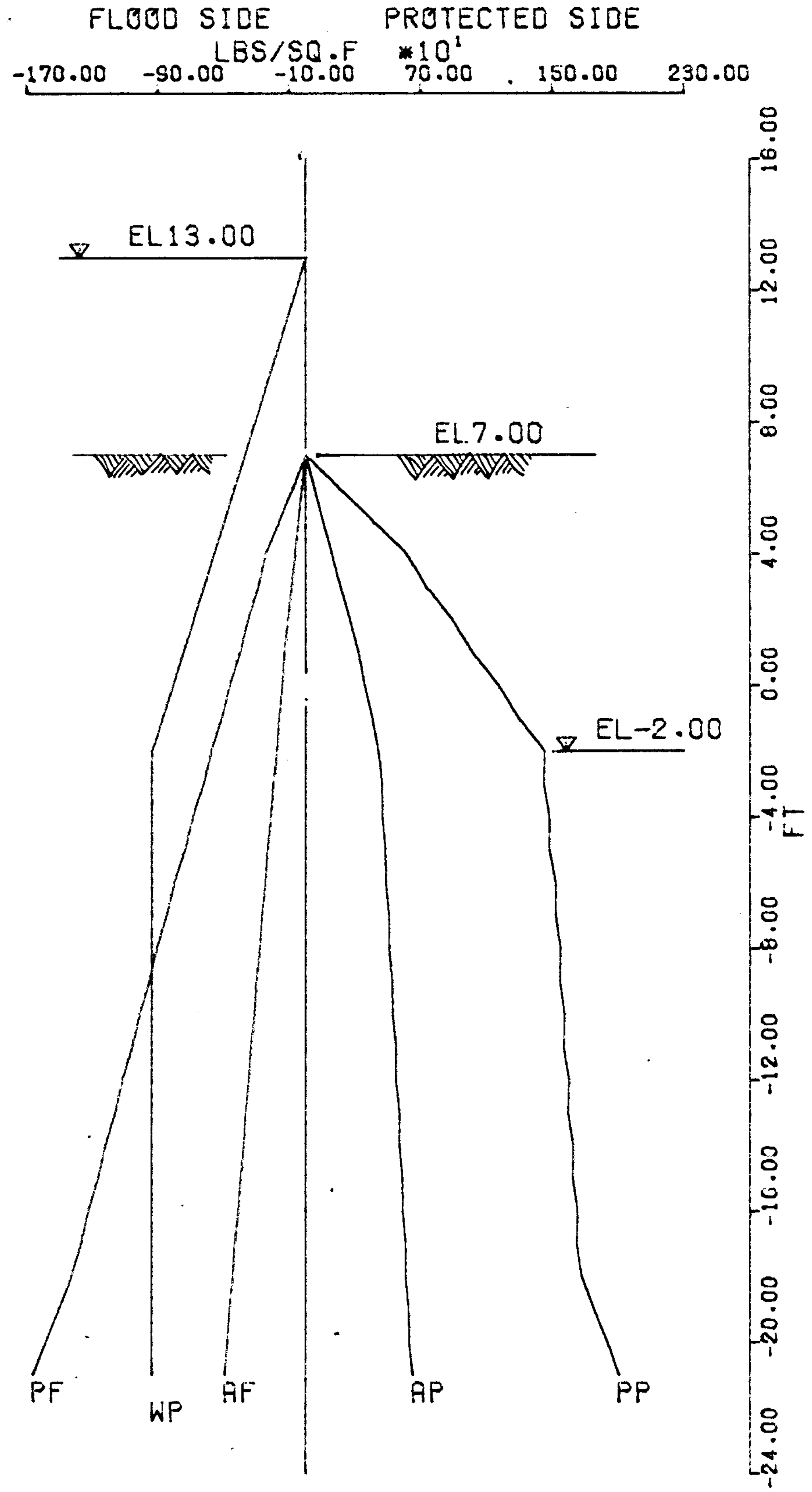
6 FT. I WALL AT GOLDEN MEADOW PUMPING STATION

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. I - GENERAL DESIGN

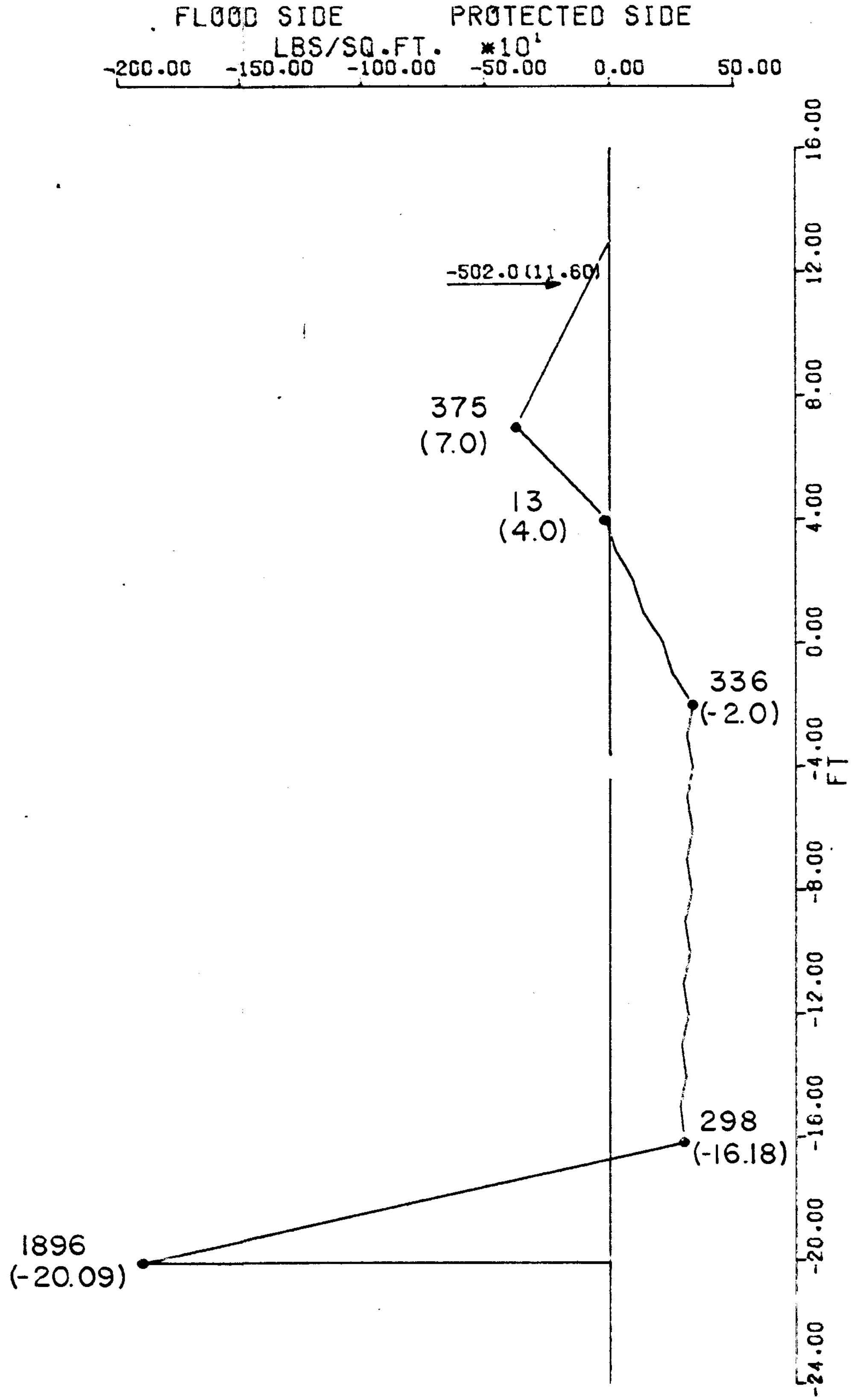
CANTILEVER SHEET PILE FLOODWALL (S) STABILITY

BARNARD AND BURK, INC. CONSULTING ENGINEERS BATON ROUGE, LA.	U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS CORPS OF ENGINEERS
DATE: MARCH 1972	FILE NO. H-2-24314

FIGURE D-48

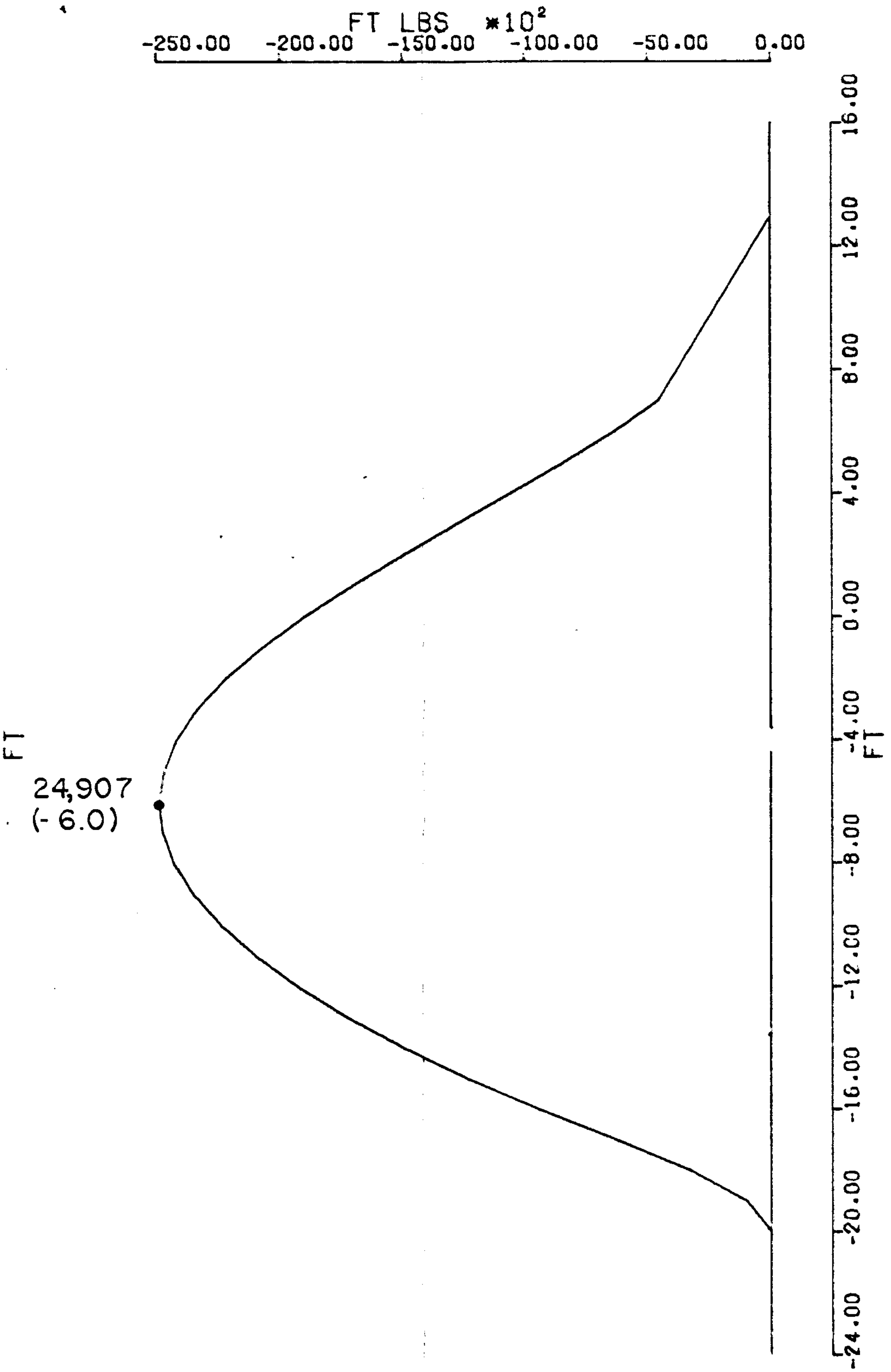


PRESSURE DIAGRAMS



NET PRESSURE DIAGRAM

F.S. = 1.25



MOMENT DIAGRAM

6 FT. I WALL AT RING LEVEE STA. 206+50 WITH WAVE FORCE.

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO.1 - GENERAL DESIGN

CANTILEVER SHEET PILE FLOODWALL (S) STABILITY

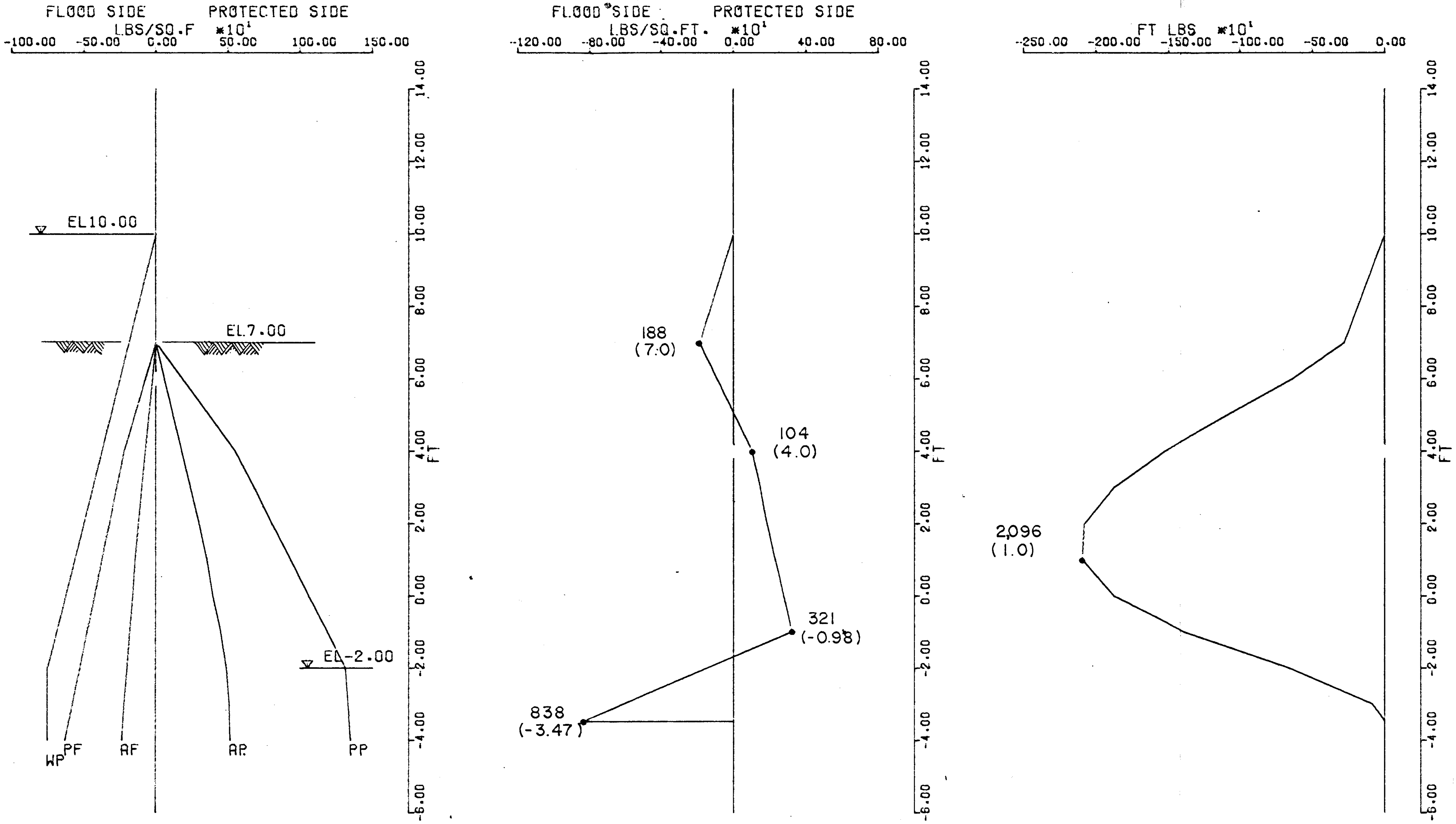
BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

U S ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

DATE: MARCH 1971

FILE NO. H-2-24314

FIGURE D-49



PRESSURE DIAGRAMS

NET PRESSURE DIAGRAM
F.S.= 1.5

MOMENT DIAGRAM

6 FT. I WALL ALL AT RING
LEVEE STA. 206+50

GRAND ISLE, LOUISIANA, AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO.1 - GENERAL DESIGN
CANTILEVER SHEET PILE
FLOODWALL (S) STABILITY

BARNARD AND BURK, INC.
CONSULTING ENGINEERS
BATON ROUGE, LA.

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

DATE: MARCH 1972
FILE NO. H-2-24314

FIGURE D-50

GRAND ISLE, LOUISIANA AND VICINITY
(LAROSE TO VICINITY OF GOLDEN MEADOW)
DESIGN MEMORANDUM NO. 1, GENERAL DESIGN

APPENDIX E

COMMENTS OF U. S. FISH AND WILDLIFE SERVICE
AND
LOUISIANA WILD LIFE AND FISHERIES COMMISSION
AND
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
(ENVIRONMENTAL PROTECTION AGENCY, WATER QUALITY OFFICE)

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
PEACHTREE-SEVENTH BUILDING
ATLANTA, GEORGIA 30323

January 16, 1968

District Engineer
U.S. Army, Corps of Engineers
P.O. Box 60267
New Orleans, Louisiana 70160

Dear Sir:

Reference is made to your letter of October 19, 1967, requesting our views and comments regarding a modification of the Grand Isle, Louisiana and Vicinity project.

The Bureau's findings concerning the portion of the project now authorized were submitted in our report of September 15, 1960. The original ring levee and the additional modified levee will protect an area that is primarily urban. Proposed construction will, therefore, have only minor local effects on fish and wildlife. Should the project be further modified, however, we request the opportunity for review and comment.

We appreciate the opportunity to provide these comments.

Sincerely yours,

C. Edward Carlson

C. Edward Carlson
Regional Director

LOUISIANA WILD LIFE AND FISHERIES COMMISSION
WILD LIFE AND FISHERIES BUILDING
400 ROYAL STREET
NEW ORLEANS, LOUISIANA 70130

December 28, 1967

Mr. George H. Hudson, Chief
Engineering Division
Department of the Army
New Orleans District
P. O. Box 60267
New Orleans, Louisiana 70160

Re: LMNED-PP

Dear Mr. Hudson:

This is in response to your letter of October 19, 1967, relative to authorized construction of hurricane protection improvements in the Grand Isle, Louisiana, and vicinity area, Lafourche Parish.

We have reviewed the proposed project features and the modification of the project plan, including the extension of levees approximately two miles below Golden Meadow. It would appear that this additional protection would be helpful to the people of that area and we have no further comments at this time. The opportunity to examine the detailed plans and specifications as they are prepared will be appreciated.

Sincerely yours,

Leslie L. Glasgow

Leslie L. Glasgow, Director

LLG:TBF/js

cc: (1) Chief, Division of Oysters,
    Water Bottoms and Seafoods
  (2) River Basins Studies Section,
    Fish and Game Division
  (3) Chief, Division of Water
    Pollution Control

UNITED STATES
DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
SOUTH CENTRAL REGION
1402 ELM STREET, 3RD FLOOR
DALLAS, TEXAS 75202

June 6, 1968

Your Ref: LMNED-PP

District Engineer
U. S. Army Engineer District, New Orleans
P. O. Box 60267
New Orleans, Louisiana 70160

Attn: Mr. Jerome C. Baehr, Chief
Engineering Division

Dear Sir:

Reference is made to your letter of May 15, 1968 requesting our review and comments of the report on an interim hurricane survey of Grand Isle and Vicinity, Louisiana. The report recommends hurricane protection of the developed areas along Bayou Lafourche between Golden Meadow and Larose by means of a loop levee along both banks of Bayou Lafourche, floodgates for navigation and hurricane protection in Bayou Lafourche at the upper and lower bayou crossings, multibarreled culverts controlled by flap gates, and low interior levees to regulate intercepted drainage.

We have reviewed the report in accordance with Executive Order 11288, Sections 1(3) and 1(7) in regard to water pollution control measures and find as follows:

> This proposed project should have little effect on the water quality with implementation of your current specifications for water pollution control, disposal of waste materials, and sanitary waste collection facilities during construction. However, all contractors should:
>
> a. Perform construction operations in a manner that will reduce turbidity to the lowest practicable level.
>
> b. Take precautions in the relocation of petroleum products pipelines to prevent accidental spillages of hazardous materials which would result in substantial harm to fish or shellfish.

It is desirable that the floodgates be constructed and operated so as to prevent changes in the present water quality and to ensure that ecological conditions remain unchanged.

Thank you for the opportunity to review the water pollution control aspects of this project and if we can be of further assistance please contact us.

Sincerely yours,

for WILLIAM C. GALEGAR
Regional Director

cc: Louisiana State Department of Health
Louisiana Stream Control Commission