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SHOALING PROBLEMS ON THE MISSISSIPPI RIVER-GULF OUTLET

February 1966

Report by: Brent M. Johnson

U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
NEW ORLEANS, LOUISIANA

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SHOALING PROBLEMS ON MISSISSIPPI RIVER-GULF OUTLET LOUISIANA

1. Purpose. The purpose of this report is to update written report "Construction Procedures and Shoaling Problems on the Mississippi River-Gulf Outlet," which was presented by Messrs. B. M. Johnson and G. A. Price, U. S. Army Engineer District, New Orleans, to the Committee on Tidal Hydraulics, Corps of Engineers, U. S. Army, at their 51st meeting in New Orleans, La., on 20-22 October 1964.

2. Project Authorization. The Mississippi River-Gulf Outlet, La., a modification of the existing project, "Mississippi River, Baton Rouge to the Gulf of Mexico," was authorized by the River and Harbor Act of 29 March 1956 (Public Law 455, 84th Congress, 2d Session), substantially in accordance with the report of the Chief of Engineers dated 5 May 1948 printed in House Document No. 245, 82d Congress, 1st Session.

3. Project Status.

a. Dredging of the project channel (-36 feet by 500 feet and -38 feet by 600 feet), as shown on plate 1 and table 4, was initiated 17 March 1958 and, except for the narrow restriction at Paris Road, was completed 22 July 1965, including a turning basin at the Inner Harbor Navigation Canal. An "interim channel" (-36 feet by 250 feet and -38 feet by 300 feet) usable for shipping was completed 5 July 1963 and dedicated 25 July 1963, at which time the first ship traveled from New Orleans to the Gulf of Mexico via the Mississippi River-Gulf Outlet. The narrow restriction at Paris Road will be removed upon completion of the high-level bridge which is a feature of the project scheduled for completion in December 1966.

b. Maintenance dredging during construction was initiated 4 September 1963 and completed 23 January 1966 (see table 5). Regular maintenance dredging, using operation and maintenance funds, was initiated 1 July 1965 and is currently in progress (see table 6). All spoil from construction and maintenance dredging, beyond the outer end of the existing dikes in Breton Sound, has been discharged not closer than 2,000 and 1,500 feet, respectively, to the project channel centerline. The greatest requirement for maintenance dredging has occurred in the Breton Sound area (see plates 2 and 5).

4. Shoaling History.

a. Predicted shoaling rates, as shown in the general design memorandum, were based on current measurements, suspended

TABLE 1

DERIVATION OF SHOALING RATE FROM NATURAL SOURCES - MILE 20.2 TO MILE 14.9[a]

Project channel mileage	20.2	14.9
Equivalent route "B" mileage	25.2	19.9
BEP predicted minimum shoaling rate, Cu. Yds/Yr/Mi	300,000	220,000
Avg. minimum shoaling rate, Cu.Yds/Yr/Mi	260,000	
Avg. maximum shoaling rate, Cu.Yds/Yr/Mi	520,000	
Shoaling for the 5.3-mile reach, CuYds/Yr	2,800,000	

[a] From Mississippi River-Gulf Outlet, Louisiana, Design Memorandum No. 2, General Design, Appendix I, Plate 13, Route "B" and Par. 14, p. 81. Beach Erosion Board (BEB) is now known as Coastal Engineering Research Center.

TABLE 2

TABULATION OF CURRENT DIRECTION AT TOWER # 2[a]

Record from 17 Jan 64 to 15 Jun 65

Direction in Degrees	Percent of Time Prevailing in Given Direction
18-62	9.48
63-107	11.29
108-152	10.58
153-197	11.37
198-241	5.42
242-287	12.03
288-332	15.09
333-17	12.18
Intermediate or no velocity	12.56

[a] Tower No. 2 located at Mile 16.4 on the natural sound bottom 700 feet southwest of the channel centerline.

sediment samples, and bottom samples collected in Breton Sound and the Gulf of Mexico, together with shoaling data obtained from a series of five test pits dredged to approximate depths of -30 feet. The test pit located in an original depth of less than -6 feet indicated the maximum shoaling rate and dictated the decision to construct dikes from the shoreline at mile 23.0 to the -6-foot contour at mile 20.2. However, surveys have indicated that the shallow area extends beyond mile 20.2 to mile 14.9. A profile run in December 1965 along the projection of the southwest dike indicated ground elevation of -6.5 at mile 15.3, a maximum elevation of -5.7 at mile 19.6, and a minimum elevation of -6.8 at mile 18.0.

b. Based on maintenance dredging performed to date, the highest shoaling rate has occurred in Breton Sound, extending several miles beyond the outer end of the existing dikes at mile 20.2 (see plate 2). The shoaling rates for the first and second maintenance dredging averaged 755,000 and 982,000 cubic yards per year per mile, respectively, for the reach from mile 20.2 to mile 14.9. The latter rate is 3.8 times higher than the average minimum rate of 260,000 cubic yards per year per mile estimated in the General Design Memorandum.

The shoaling rates are shown on plate 2, in three curves, representing the rates between completion of:

(1) construction and first maintenance dredging;

(2) first and second maintenance dredging; and

(3) second and third maintenance dredging.

These computed rates are based on actual end areas used for payments to the contractors tabulated at 2,000-foot intervals.

c. The shoaling rates stated above for the first and second maintenance dredging, converted to total cubic yards per year for the reach from mile 20.2 to mile 14.9, are 4.0 and 5.2 million cubic yards per year, respectively. Based on shoaling estimates made by the Beach Erosion Board in connection with the preparation of "Design Memorandum No. 2, General Design," the average maximum shoaling rate from natural sources; i.e., sources other than recirculation of spoil, amounts to 520,000 cubic yards per year per mile for the reach from mile 20.2 to mile 14.9. Determination of this value is shown on table 1. This rate, converted to total shoaling per year in the reach, is 2,800,000 cubic yards. Based on this premise, recirculation accounted for at least 1,200,000 cubic yards of shoaling in the reach between project construction and first maintenance dredging, and 2,400,000 cubic yards between the first and second maintenance dredging.

TABLE 3

MISSISSIPPI RIVER-GULF OUTLET - BED MATERIAL
Percent of material retained on U.S. 230 sieve(a)

1964 Observations

Channel mileage	4/13	4/27	5/11	5/26	6/8	6/22	7/21	8/18	Average
			1,000 feet northeast of channel centerline						
19.1	7.2	9.4	18.4	16.4	9.2	4.2	4.0	3.4	9.0
16.8	29.7	34.7	36.0	26.5	30.2	2.0	30.0	24.1	26.7
14.2	35.0	-	-	30.7	38.6	36.4	42.4	11.8	32.5
11.5	41.1	46.3	40.8	43.3	49.1	53.6	35.6	32.4	42.8
7.0	22.0	26.6	13.6	46.1	26.4	28.0	23.5	53.1	29.9
Average									28.2
			125 feet northeast of centerline						
19.1	2.8	3.0	1.3	3.3	1.0	2.7	2.2	3.4	2.5
16.8	4.6	2.3	1.7	18.6	2.6	32.0	1.7	5.0	8.6
14.2	6.7	-	-	4.7	1.3	3.0	1.7	1.7	3.2
11.5	6.0	3.7	4.4	18.0	1.7	0.7	0.7	29.3	8.1
7.0	6.7	3.0	0.7	3.0	26.9	1.7	1.3	4.6	6.0
Average									5.7
			125 feet southwest of centerline						
19.1	2.0	1.0	0.7	1.7	1.7	1.7	3.0	3.2	1.9
16.8	4.8	2.0	2.7	19.3	2.0	2.0	1.3	6.6	5.1
14.2	7.6	-	-	3.7	1.0	2.0	4.0	1.3	3.3
11.5	1.4	4.7	4.4	20.8	1.0	2.0	1.0	30.1	8.3
7.0	5.3	14.6	1.7	4.0	27.7	2.3	1.3	4.8	7.7
Average									5.3
			1,000 feet southwest of channel centerline						
19.1	2.8	2.0	2.0	4.2	3.4	2.0	6.6	7.8	3.9
16.8	2.7	13.4	9.2	9.2	9.6	8.4	4.4	8.3	8.1
14.2	6.0	-	-	2.0	1.8	2.0	2.0	1.3	2.5
11.5	18.4	33.3	4.6	25.3	1.0	2.7	0.7	1.3	10.9
7.0	1.6	4.0	3.2	2.7	1.0	2.8	1.3	3.4	2.5
Average									5.6

(a) The sand fraction is the material retained on the No. 230 sieve (0.062 mm). The silt fraction includes all of the fine material passing the No. 230 sieve.

5. Significant Observation Data.

a. Current observations made adjacent to the channel for the past 1-1/2 years indicate that there is no predominant direction of flow across the channel, but that they are about equally divided in time from the northeast and southwest side as shown in table 2.

b. Supply for shoaling from natural sources comes partly from in situ material in the shallow bed and bays of the sound, and partly from material contributed by the Mississippi River. This material is stirred from the bottom by wave action and is transported to the channel by tidal and wind-generated currents. This supply may be considered inexhaustible and if the dikes were not extended, shoaling rates for this material would remain constant within the reach in question for the life of the project.

c. Analyses of sediment samples in the spoil runoff area 1000 feet to the southwest of the channel centerline, and the natural sound bottom 1000 feet to the northeast indicate that the shoal material is being generated predominantly in the former area (see table 3). This is demonstrated by the fact that shoal material samples show a marked dissimilarity to samples from the northeast, insofar as concentration of sand is concerned. It will be noted that the average percent of material retained on U. S. 230 sieve for bed material samples taken 1000 feet southwest of channel centerline, in the channel (shoaled material), and 1000 feet northeast of channel centerline was 5.6, 5.5, and 28.2, respectively. Accordingly, it may be concluded that shoaled material in the channel is largely composed of recirculated spoil material.

6. Plan of Improvement for Reduction of Excessive Shoaling.

a. The plan for the reduction of excessive shoaling presented herein and shown on plate 3 consists of the extension of the southwest dike from mile 20.2 to mile 14.9, including a 1,000-foot flanking dike at the outer end, behind which all future adjacent dredged spoil from maintenance dredging would be deposited. This plan will largely overcome the problem of recirculation in this reach of the channel.

b. Settlement. It is estimated that settlement due to displacement and consolidation of the foundation will be approximately 1 foot during construction of the first stage, 1/2 foot between the first stage and the beginning of the second-stage construction, 1/2 foot during construction of the second stage, and 1 foot after the second stage is completed.

c. Method of Construction. The dike will be constructed, as shown on plate 4, of clamshells, riprap, and derrick stone. Because of the low shear strength of the foundation, the dike will be constructed in two stages. In the initial construction stage, the shell will be placed to elevation -1.0 foot m.l.g. and riprap will be placed to elevation 1.0 foot m.l.g. To prevent loss of shell during construction, the placement of the riprap will follow closely behind placement of the shell. To add to the stability of the dike and help retain the shell during construction, excavated material will be placed in the form of berms on both sides of the dike. In the second construction stage, derrick stone will be placed to elevation +3.0 feet m.l.g. with a crown 12 feet wide. The existing dikes were constructed to elevation +5.0 feet m.l.g.

d. Cost Estimate. The estimated cost for extending the southwest dike is $5,010,000, consisting of $4,674,000 for construction, $56,000 for engineering and design, and $280,000 for supervision and administration.

e. Schedule. The first stage work will be completed under two contracts over a period of 18 months with the first contract to be awarded in March 1966. The second stage work will be completed under two contracts 18 months after completion of the first stage. This schedule is contingent upon the availability of funds.

f. Reduction in Maintenance Dredging. With the proposed extension of the southwest dike and flanking dike in place, forming an effective spoil retention dike, it is anticipated that the annual shoaling rate will be reduced by at least 2,400,000 cubic yards. Other benefits would be the reduction in length of the floating discharge lines of dredges by at least 1,300 feet in the reach between mile 20.2 and mile 14.9, plus a semisheltered area for the dredges to operate.

g. Other Plans Considered. Consideration was given to reducing recirculation by increasing the distance between the channel centerline and the point of deposit of dredged spoil; by the use of hopper barges and rehandling the spoil therefrom to spoil areas on the shore; and the use of a self-unloading hopper dredge with discharge line behind existing dikes. However, because of the excessive costs involved, these plans are considered impractical. The self-unloading hopper dredge with discharge lines behind the extended rock retention dike, inshore from mile 14.9, will be further evaluated in determining the feasibility of further dike extension.

7. Current and Future Observation Program.

a. The analyses of the shoaling problems and its sources in the Breton Sound reach of the Mississippi River-Gulf Outlet project between mile 20.2 and mile 6.2 are being continued for tne

purpose of providing additional information required for an economic study to determine the feasibility of further dike extension. A dike across Breton Sound is authorized as a feature of the project if experience indicates that maintenance by dredging alone is more costly, impracticable or unduly obstructive to navigation. Therefore, investigations are warranted to determine whether further dike extension will reduce shoaling and save maintenance dredging cost in excess of the annual cost of the dike extension.

b. Future investigations are warranted to further define potential sources of shoal material and provide information as to the rate of shoaling, quantities of sediment in transport and probable sources of sediment. Investigations are to be conducted in the following three areas: the channel, the spoil deposit area southwest of the navigation channel, and the area adjacent to the northeast of the navigation channel.

(1) Channel Area. The reach where high shoaling occurs will be investigated to determine characteristics of the materials deposited, rate of deposit, characteristics of the currents transporting the material, salinity of the water and effects of salinity on the distribution of the currents and shoaling materials.

Immediately after dredging, periodic surveys will be taken to determine rate of shoaling deposits as influenced by maintenance dredging, and these surveys will be continued to determine seasonal changes, storm surges and other local factors on rate of shoaling.

Shoaling rates shown on plate 2 and rates to be computed after subsequent maintenance dredging are being standardized on the basis of computing end areas for a section having a bottom width of 900 feet at elevation -50.0 m.l.g. and side slopes of 50 feet on the vertical to 0.1 foot on the horizontal.

(2) Southwest Area Adjacent to Channel (Spoil Area). Past surveys have indicated erosion of the spoil deposit area southwest of the navigation channel. An investigation of the spoil deposit area to determine the density of the in situ material by the radioactive density probe accompanied by undisturbed borings is now in progress. Transport of the eroded material by currents and the velocity of the currents doing the transporting will be studied to determine its contribution to channel shoaling.

(3) Northeast Area Adjacent to Channel. The northeast area adjacent to the channel will be investigated to determine its potential contribution of channel shoaling. Investigations of the erosion of sediments from the bed and banks of the area and transportation of the material to the channel by currents will be conducted.

8. Discussion. Maintenance of the Breton Sound reach of the Mississippi River-Gulf Outlet has proven to be a most difficult task to meet the demands of shipping. The second maintenance dredging contract, extending from mile 23.3 to mile 2.0, was initiated and completed 9 December 1964 and 23 January 1966, respectively. The quantity of material to be dredged was revised by addendum during advertisement from 11,450,000 to 14,124,000 cubic yards, to reflect approximately 2 months of shoaling. The quantity was further revised to 23,338,000 cubic yards by modification of the contract to reflect additional shoaling. The extension of the southwest dike from mile 20.2 to mile 14.9 and flanking dike at mile 14.9 will alleviate this maintenance dredging problem.

9. Concluding Remark. In addition to the estimated reduction of shoaling, the extension of the southwest rock dike from mile 20.2 to mile 14.9 will serve as a prototype in the collection of data from future maintenance dredging experience to determine the justification for additional dike extension or alternates to reduce shoaling in the waterway.

TABLE 4

MISSISSIPPI RIVER-GULF OUTLET
Tabulation of Dredging Contracts

Contract Sequence No.	LOCATION C/L Stationing From	To	Mile From	To		Date Initiated	Date Completed(f)	Quantity of Material Dredged Cu. Yds.	Contract Cost (e)
					Phase No. 1 - Dredging 5.1 Miles of Project Channel - 36 by 500 feet (including 1/2 mile transition to 200 feet at IHNC				
1	0+00	130+00	66.0	63.5		17 Mar 58	29 Dec 58	9,518,999	$ 1,627,800
2	130+00	268+00	63.5	60.9	(Paris Rd.)	6 Jun 58	7 May 59	10,182,600	1,619,000
	Total Phase No. 1 - Project Channel Dredging							19,701,599	$ 3,246,800
					Phase No. 2 - Dredging 37.2 Miles of Access Channel - Gulf Intracoastal Waterway to Breton Sound - 18 by 140 feet				
3 (a)	301+20	683+78	60.3	53.1	(Bayou Dupre)	8 May 59	4 Feb 60	4,322,000	$ 1,041,200
4	683+78	1287+00	53.1	41.6	(Bayou Yscloskey)	5 Aug 59	28 Sep 60	9,241,000	1,601,000
5	1293+00	1561+70	41.5	36.4	(Bayou LaLoutre)	8 Feb 60	22 Sep 60	3,945,000	598,900
6	1561+70	1950+00	36.4	29.1	(Bayou Pointe en Pointe)	18 Apr 60	6 Feb 61	5,208,000	789,000
7 (b)	1950+00	2270+00	29.1	23.0	(Breton Sound)	24 May 60	27 Feb 61	4,646,000	702,600
	Total Phase No. 2 - Access Channel Dredging							27,362,000	$ 4,732,700
					Phase No. 3 - Dredging 69.9 Miles of Interim Channel - Paris Road to 38-foot Contour in Gulf of Mexico - 36 by 250 feet and 38 by 300 feet				
8 (c)	279+05	683+78	60.5	53.1	(Bayou Dupre)	28 Feb 60	27 Mar 61	14,312,900	$ 1,723,100
9	683+78	918+00	53.1	48.6		10 Aug 60	15 Jun 61	7,878,436	1,062,800
10	918+00	1235+50	48.6	42.6	(Pipeline Canal)	17 Oct 60	28 Sep 61	10,197,562	1,341,000
11 (d)	1235+50	1561+70	42.6	36.4	(Bayou LaLoutre)	26 Dec 60	22 Dec 61	10,908,169	1,067,300
13	1561+70	1809+80	36.4	31.7		7 Feb 61	3 Jul 61	8,375,024	779,100
14	1809+80	2049+40	31.7	27.2		11 Feb 61	5 Feb 62	7,699,664	639,300
15	2049+40	2270+00	27.2	23.0	(Breton Sound)	20 Mar 61	29 Mar 62	6,383,352	452,900
12	2270+00	2420+00	23.0	20.2	(Gulfward end of rock jetties)	4 Jan 61	29 Aug 61	5,902,855	681,100
16	2420+00	2800+00	20.2	13.0		2 Jun 61	27 Apr 62	12,356,047	715,200
17	2800+00	3160+00	13.0	6.1		22 Jun 61	22 Apr 62	9,613,928	793,400
18	3160+00	3380+00	6.1	2.0		15 Jul 61	21 Sep 62	5,697,826	723,600
19	3380+00	3830+00	2.0	-6.5		11 Nov 61	5 Jul 63	10,547,766	2,079,100
Hired Labor & U.S.Hopper Dredge	3830+00		-6.5	-9.4		(24 Nov 62 (6 Jun 63	25 Dec 62) 20 Jun 63)	1,331,000	199,700
	Total Phase No. - Interim Channel Dredging							111,204,529	$12,257,600

(Continued on Table 5)
Prepared: Oct. 64

TABLE 5

MISSISSIPPI RIVER-GULF OUTLET (cont'd)

Contract Sequence No.	LOCATION C/L Stationing From	To	Mile From	To		Date Initiated	Date Completed(f)	Quantity of Material Dredged Cu. Yds.	Contract Cost (e)
					Phase No. 4 - Dredging 70.3 Miles of Project Channel - Vicinity Paris Road to 38-foot Contour - 36 by 500 feet and 38 by 600 feet				
35	270+75	276+95	60.9	60.8		Dec 66 (Est.)	Dec 66 (Est.)	126,000	$ 25,000
20	270+75	279+05	60.9	60.7		2 Mar 61	21 Mar 61	347,634	76,300
21	291+00	370+60	60.5	59.0	(Bayou Bienvenue)	3 Aug 61	23 Nov 61	3,179,000	351,500
23	370+60	683+78	59.0	53.1	(Bayou Dupre)	22 Nov 63	14 Mar 65	11,241,808	1,218,500
30	683+78	918+00	53.1	48.6		13 Nov 62	15 Dec 63	8,862,760	1,230,100
27	918+00	1235+50	48.6	42.6	(Pipeline Canal)	26 Jun 63	28 May 64	12,676,000	1,496,500
25	1235+50	1561+70	42.6	36.4	(Bayou LaLoutre)	11 Jun 62	28 Dec 63	12,017,075	1,393,500
29	1561+70	1809+80	36.4	31.7		12 Nov 63	22 Oct 64	9,459,194	1,027,100
32	1809+80	1930+00	31.7	29.4		4 Apr 64	2 Mar 65	4,347,713	404,300
31	1930+00	2049+40	29.4	27.2		12 Feb 63	23 Oct 63	4,421,169	780,100
32	2049+40	2160+00	27.2	25.1		4 Apr 64	2 Mar 65	3,571,373	332,100
31	2160+00	2270+00	25.1	23.0	(Breton Sound)	12 Feb 63	23 Oct 63	3,803,002	671,000
22	2270+00	2420+00	23.0	20.2	(Gulfward end of rock dikes)	19 Dec 61	1 Apr 62	4,651,574	527,600
24	2420+00	2800+00	20.2	13.0		4 Jun 62	18 Apr 63	10,268,711	1,407,800
26	2800+00	3160+00	13.0	6.1		22 Jun 62	20 Dec 62	8,303,700	1,192,200
28	3160+00	3380+00	6.1	2.0		29 Aug 62	10 Nov 62	4,946,705	817,500
31	3380+00	3830+00	2.0	-6.5		13 Nov 62	23 Oct 63	8,988,420	1,588,500
Hired Labor & U.S.Hopper Dredge	3830+00		-6.5	-9.4		16 Jul 64	13 Aug 64	1,346,000	165,700
	Total Phase No. 4 - Project Channel Dredging							112,557,838	14,705,300
					Turning Basin Vicinity Inner Harbor Navigation Canal				
33			66.0	65.4		22 Jun 64	21 Jan 65	1,768,201	291,000
	Total New Work - Dredging							272,594,167	35,233,400
					Maintenance Dredging During Construction				
23	370+00	683+78	59.0	53.1	(Bayou Dupre)	21 Feb 64	14 Mar 65	1,487,648	161,200
32	683+78	795+00	53.1	50.9		17 Apr 64	2 Mar 65	529,574	54,000
32	1235+50	1287+00	42.6	41.6		7 May 64	2 Mar 65	229,888	23,400
23	1287+00	1365+00	41.6	40.1		18 Dec 63	8 Jan 64	585,456	64,000
32	1365+00	1561+70	40.1	36.4	(Bayou LaLoutre)	13 May 64	2 Mar 65	754,085	77,000
29	1561+70	1670+00	36.4	34.4		21 Nov 63	22 Oct 64	444,107	38,100
32	2049+40	2233+50	27.2	23.7		6 Jun 64	2 Mar 65	986,257	100,600
32	2238+00	2255+00	23.6	23.3		5 Jun 64	2 Mar 65	74,190	7,600
23	2255+00	2420+00	23.3	20.2		12 Nov 63	27 Dec 63	2,144,251	232,400
29	2420+00	3160+00	20.2	6.1		4 Sep 63	22 Oct 64	13,006,958	1,044,500
Leased Dredge Sea Lane			6.1	2.0		26 Feb 64	11 Mar 64	268,000	98,000
34	2255+00	3380+00	23.3	2.0		9 Dec 64	23 Jan 66	23,338,241	2,203,300
	Total Maintenance During Construction Dredging (g)							43,850,655	4,104,100
	Total New Work and Maintenance During Construction Dredging (g)							316,444,822	39,337,500

(a) Includes 300 feet - 36-by 500-foot Project Channel from Station 588+24 to Station 591+24
(b) Includes 450 feet - " " " " " 2233+50 to " 2238+00
(c) Includes 1195 feet- " " " " " 279+05 to " 291+00
(d) Includes 160 feet - " " " " " 1287+31 to " 1288+91
(e) To the nearest $100 and includes Mobilization, Demobilization, dike construction and other indirect construction costs.
(f) Completion date of contract
(g) See notes (c) and (d) Table 6.

Prepared: Oct 64
Revised: Feb 66

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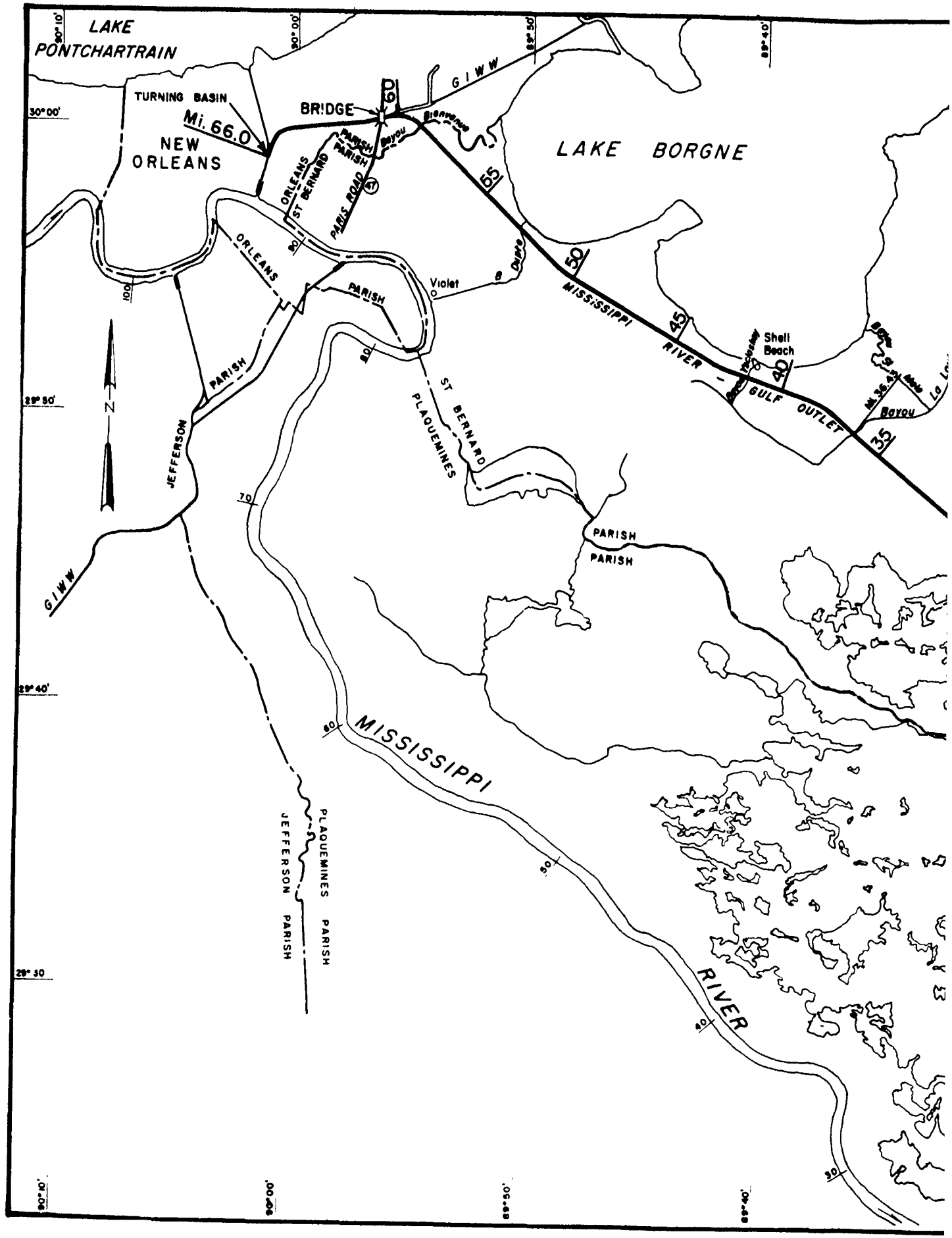
TABLE 6

Mississippi River-Gulf Outlet
O&M and Maintenance During Construction
Additional Maintenance Dredging to that shown on Table 5

Contract Sequence No.	Location of Dredging C/L Stationing From	To	C/L Stationing From	To	Date Initiated	Date Completed	Quantity of Mat'l Dredged Cu. Yds.	Contract Cost
Hired Labor & U. S. Hopper Dredge	3830+00	3980+00			1 Aug 64	13 Aug 64	605,397(f)	$ 67,800(c)(e)
1st leased pipeline Dredge Contract	0+25	70+70	441+50	448+85(a)	8 Apr 65	4 Aug 65	3,444,857	729,300(d)(e)
	70+70	86+90(a)	479+40	525+80				
	194+50	271+20	679+50	685+00(b)				
	299+80	376+20	685+00	711+10				
	401+45	409+00	711+10	715+60(a)				
2nd leased pipeline Dredge Contract	679+60	697+60(a)	1327+55	1343+25(b)	24 Apr 65	3 Oct 65	4,240,912	670,078(d)(e)
	697+60	710+50	1397+50	1419+00(b)				
	710+50	715+70(a)(i)	1471+50	1478+80(b)				
	710+55	721+70(h)	1487+50	1498+75(b)				
	721+70	748+25	1527+45	1562+50(a)				
	781+60	818+25	1671+75	1688+80(a)				
	907+60	912+40(a)	1741+30	1743+20(b)				
	930+40	938+50(a)	1743+20	1758+80(b)				
	1109+25	1126+40(a)	1777+70	1792+50				
	1191+20	1222+45(a)	1924+30	2045+20(b)				
	1241+35	1252+40(b)	2139+20	2159+80				
	1293+50	1302+50	2159+80	2252+50				
Hired Labor & U. S. Hopper Dredge	3385+00	3840+00			18 Aug 65	8 Sep 65	847,286(f)	126,000(e)(g)
3rd leased pipeline Dredge Contract	523+50	525+15(b)	1059+15	1110+60(a)	14 Oct 65	26 Feb 66 (Est.)	(j)	(j)
	525+15	680+40	1125+80	1133+40(a)				
	680+40	682+50(a)	1179+20	1189+15				
	709+90	711+45(b)	1228+50	1235+50(a)				
	711+45	747+50(a)	1302+80	1319+50(b)				
	747+50	767+50(a)	1313+50	1332+20(a)				
	817+85	825+60	Addl. dredging(j)					

(a) NE¼ of channel
(b) SW¼ of channel
(c) Construction general funds
(d) Construction general & O&M funds
(e) To the nearest $100 and includes mobilization, demobilization, dike construction, and other indirect construction costs
(f) Hauled yardage
(g) O&M funds
(h) 340 ft. cut on south side of channel
(i) 160 ft. cut on south side of channel
(j) Information on additional maintenance dredging not available for this report.

Prepared: 1 Feb 66


LAKE PONTCHARTRAIN
TURNING BASIN
Mi. 66.0
NEW ORLEANS
BRIDGE
D6
G I W W
LAKE BORGNE
ORLEANS PARISH
ST BERNARD PARISH
PARIS ROAD
ORLEANS PARISH
JEFFERSON PARISH
PLAQUEMINES PARISH
Violet
MISSISSIPPI RIVER
GULF OUTLET
Shell Beach
Bayou La Loutre
MISSISSIPPI RIVER
30° 00'
29° 50'
29° 40'
29° 30'
90° 10'
90° 00'
89° 50'
89° 40'
N

CHANDELEUR SOUND
CHANDELEUR ISLANDS
GULF OF MEX
BRETON SOUND
Gardner Island
Errol Shoal
Grand Gosier Island
Breton Island
25
20
15
10
5
Mi.0
-5
Mi.-9.75
AT LAT 29°47
SCALE OF MILE
1 0 1 2 3
MERCATOR PROJEC
MISSISSIPPI RIVER-GULF O
GENERAL
U S. ARMY ENGINEER DISTRICT,
CORPS OF ENGINEE
FEBRUARY 1966

30°00'

29°50'

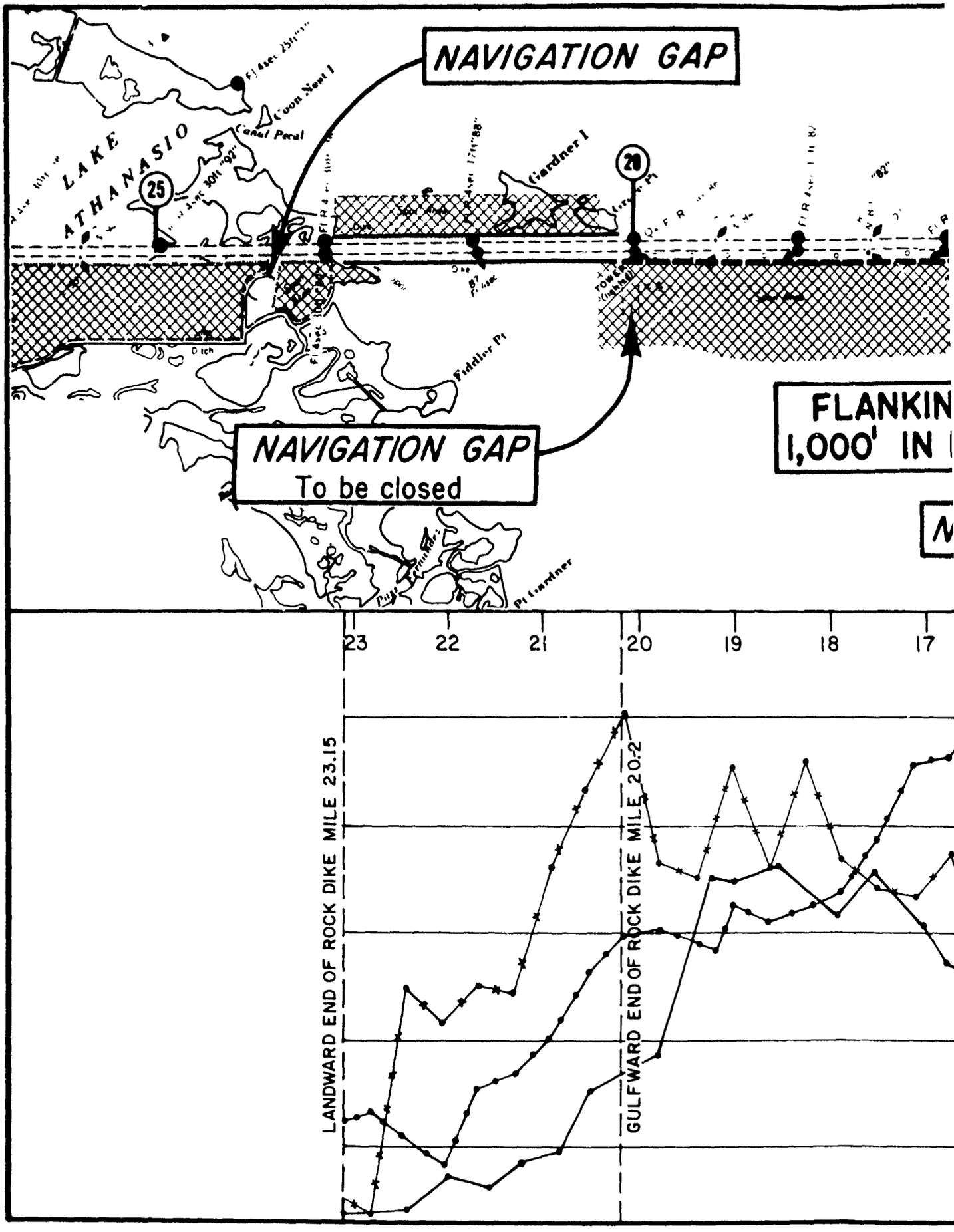
29°40'

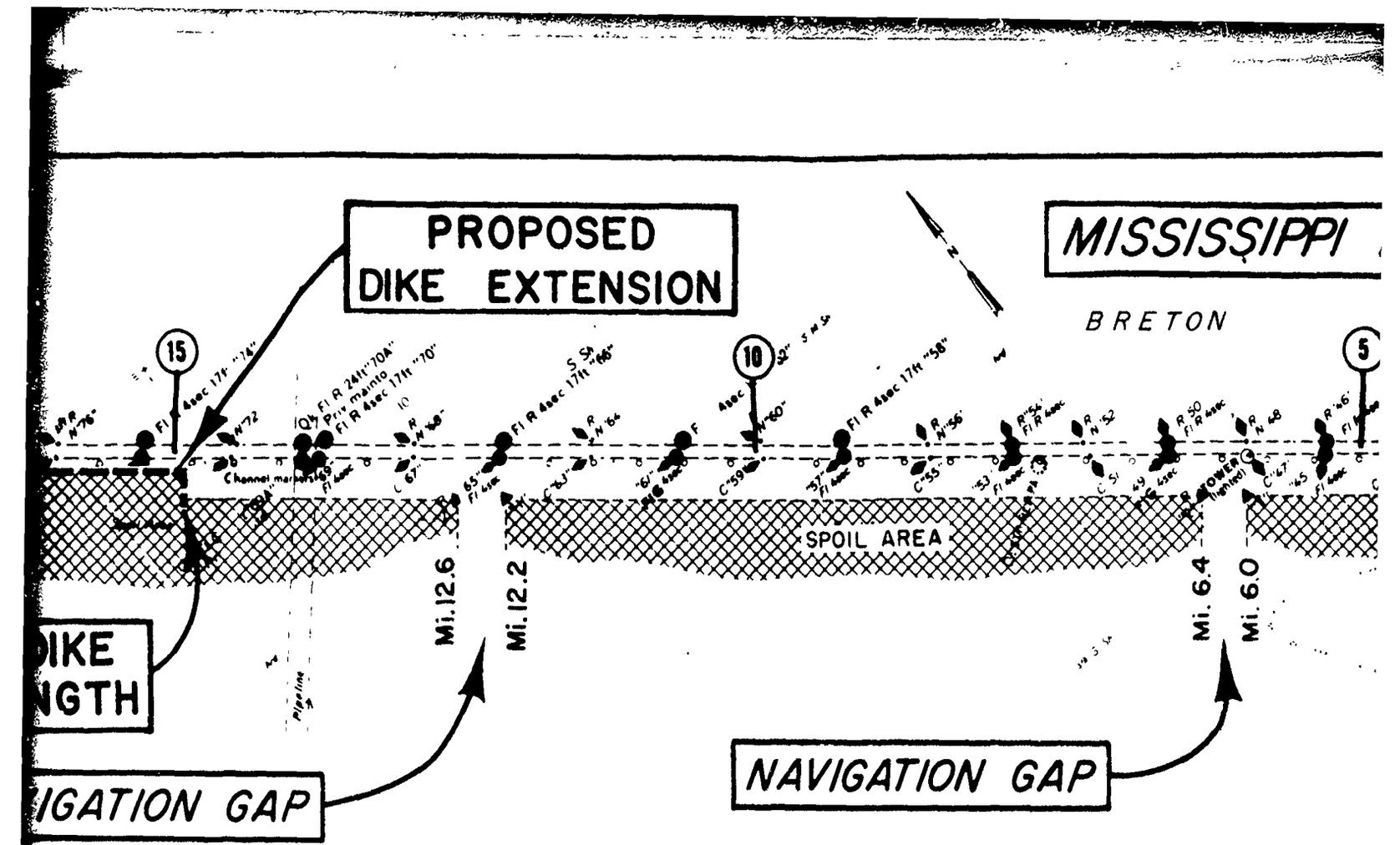
T, LA

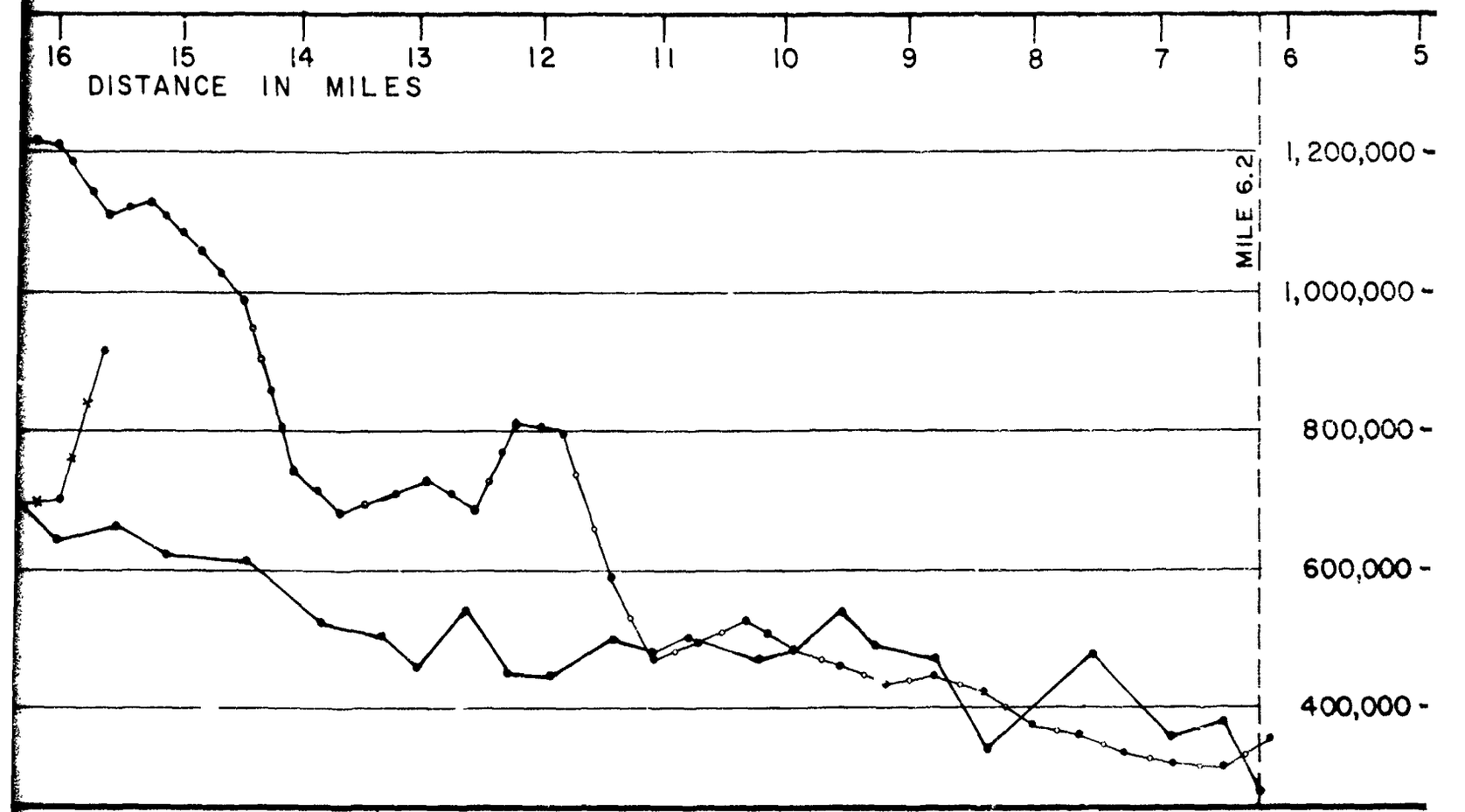
P

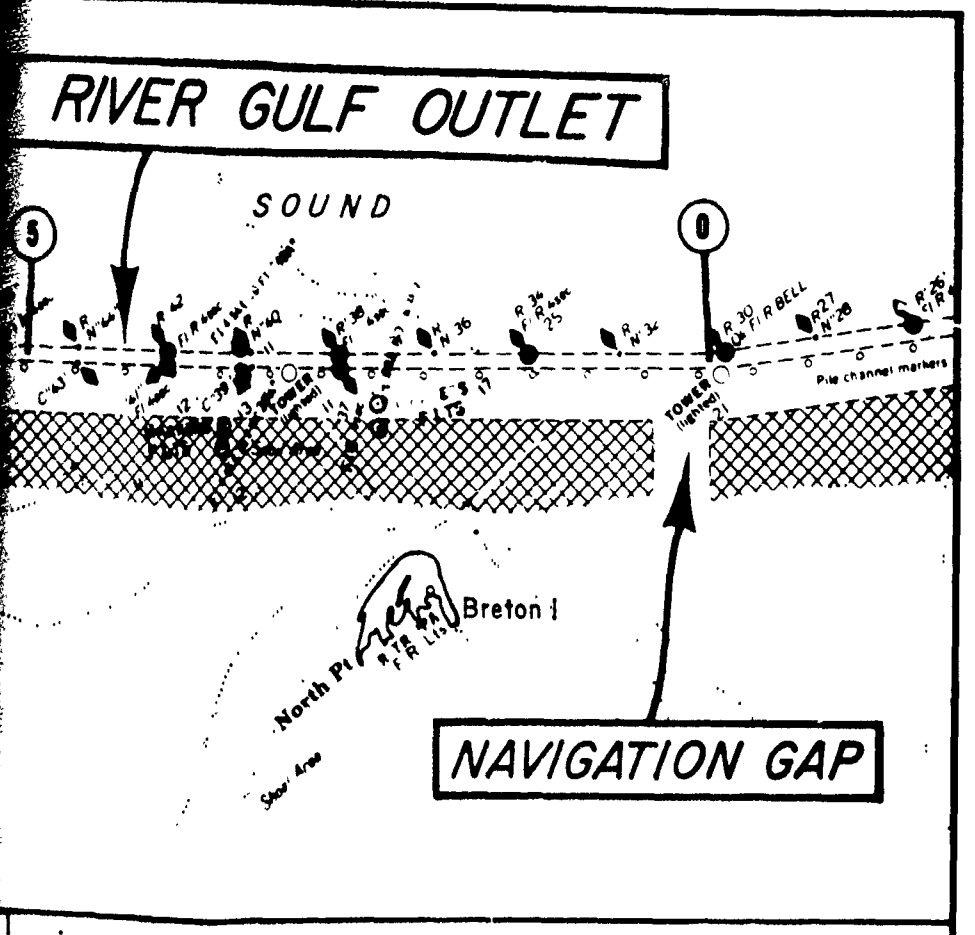
ORLEANS

PLATE 1 3


NAVIGATION GAP
LAKE ATHANASIO
Coon Nest I
Canal Perol
25
20
Gardner I
Fiddler Pt
NAVIGATION GAP
To be closed
Pt Gardner
FLANKIN
1,000' IN
N
23
22
21
20
19
18
17
LANDWARD END OF ROCK DIKE MILE 23.15
GULFWARD END OF ROCK DIKE MILE 20.2


PROPOSED
DIKE EXTENSION
MISSISSIPPI
BRETON
15
10
5
SPOIL AREA
Mi. 12.6
Mi. 12.2
Mi. 6.4
Mi. 6.0
IKE
NGTH
IGATION GAP
NAVIGATION GAP


16
15
14
13
12
11
10
9
8
7
6
5
DISTANCE IN MILES
MILE 6.2
1,200,000
1,000,000
800,000
600,000
400,000



NTENANCE DREDGING IN CU. YDS PER YEAR PER MI.

5

First maintenance dredging (first contract)
4 September 1963 to 22 October 1964

Second maintenance dredging (second contract)
9 December 1964 to 2 December 1965

Third maintenance dredging (second contract)
30 September 1964 to 23 January 1966

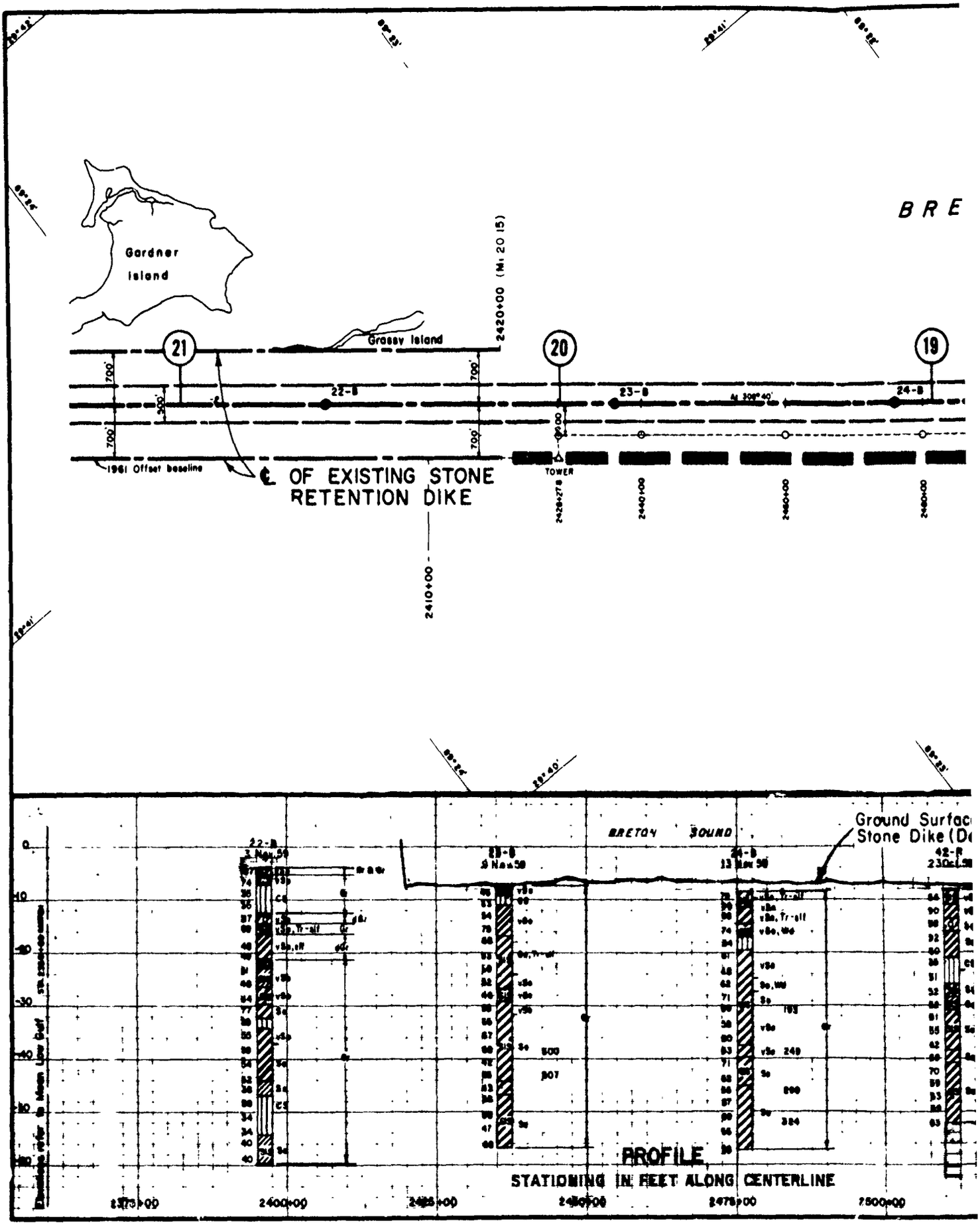
MISSISSIPPI RIVER-GULF OUTLET, LA

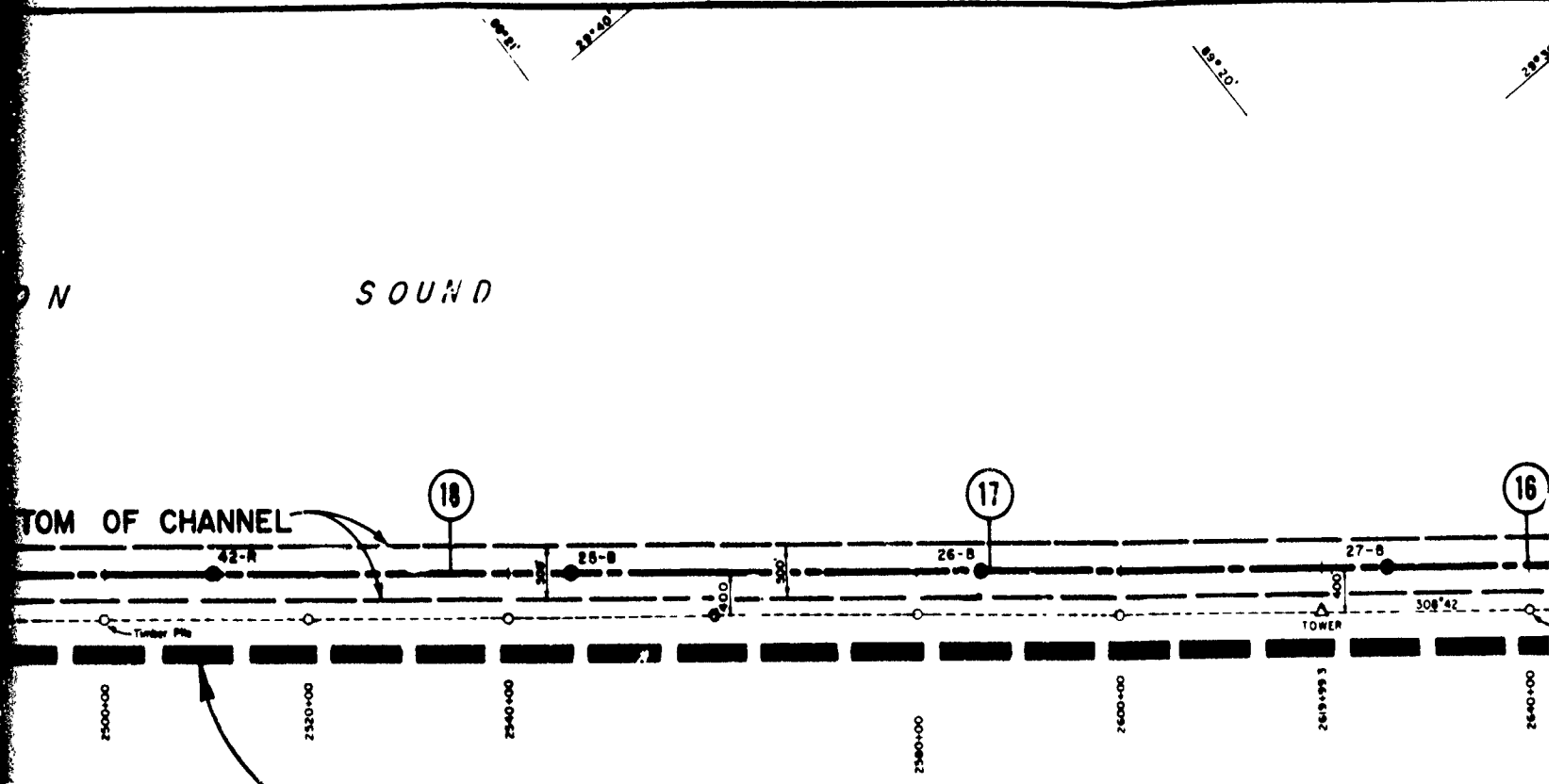
SHOALING RATES

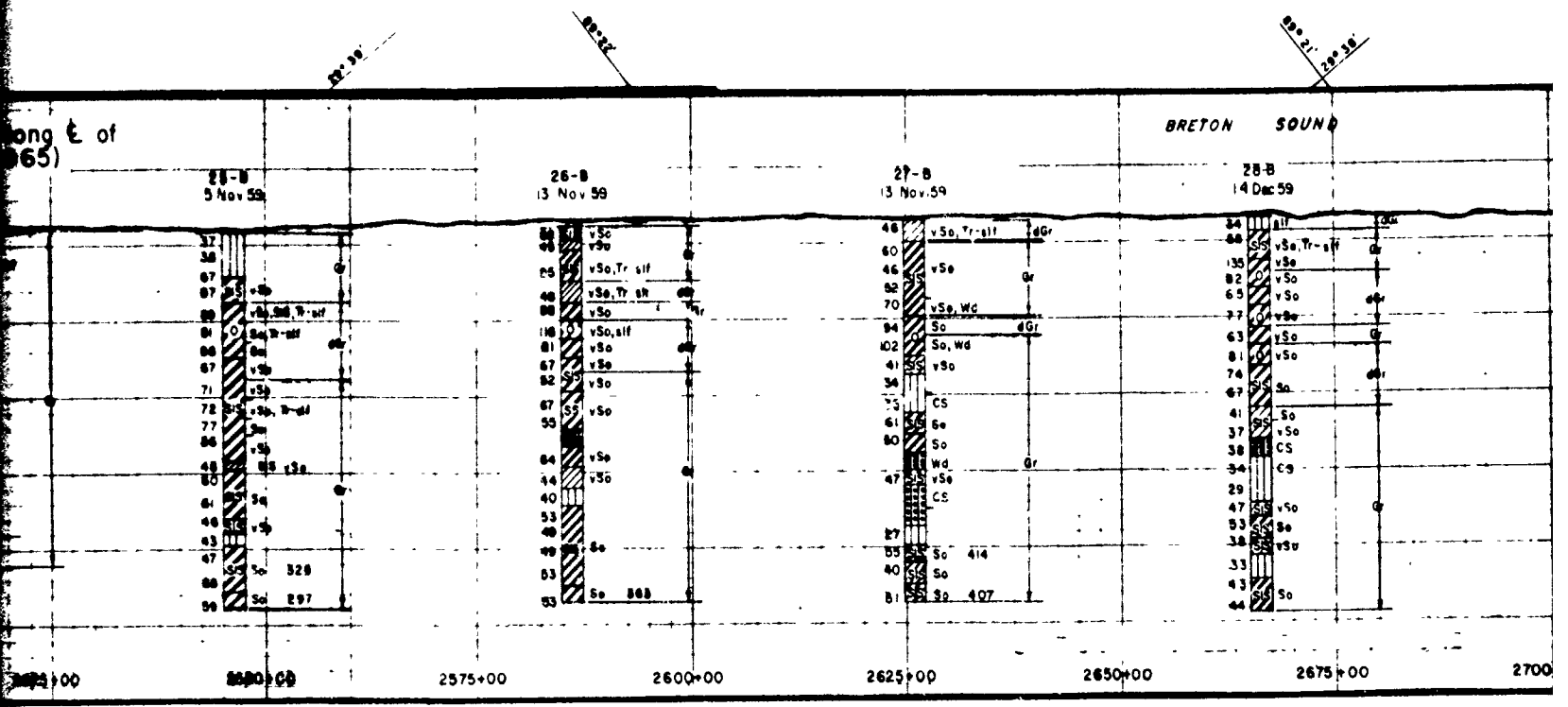
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

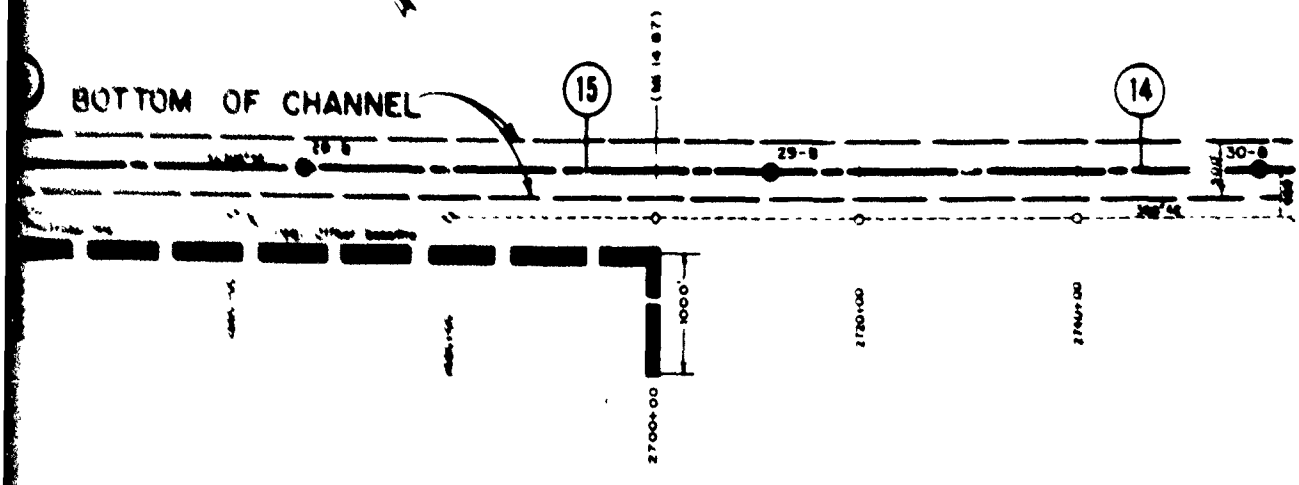
FEBRUARY 1965

PLATE 2


Gardner Island
Grassy Island
21
20
19
22-B
23-B
24-B
700'
300'
1961 Offset baseline
℄ OF EXISTING STONE RETENTION DIKE
TOWER
2420+00 (N: 20 15)
2410+00
2428+27.8
2440+00
2460+00
2480+00
BRETON SOUND
Ground Surface
Stone Dike (D
PROFILE
STATIONING IN FEET ALONG CENTERLINE
2400+00
2425+00
2450+00
2475+00
2500+00


N
SOUND
TOM OF CHANNEL
18
17
16
42-R
28-B
26-B
27-B
TOWER
Timber Pile
2500+00
2320+00
2540+00
2560+00
2580+00
2600+00
2619+99.3
2640+00
℄ OF AUTHORIZED STONE
RETENTION DIKE EXTENSION


ong ℄ of
65)
BRETON SOUND
28-B
5 Nov 59
26-B
13 Nov 59
27-B
13 Nov 59
28-B
14 Dec 59
2575+00
2600+00
2625+00
2650+00
2675+00
2700



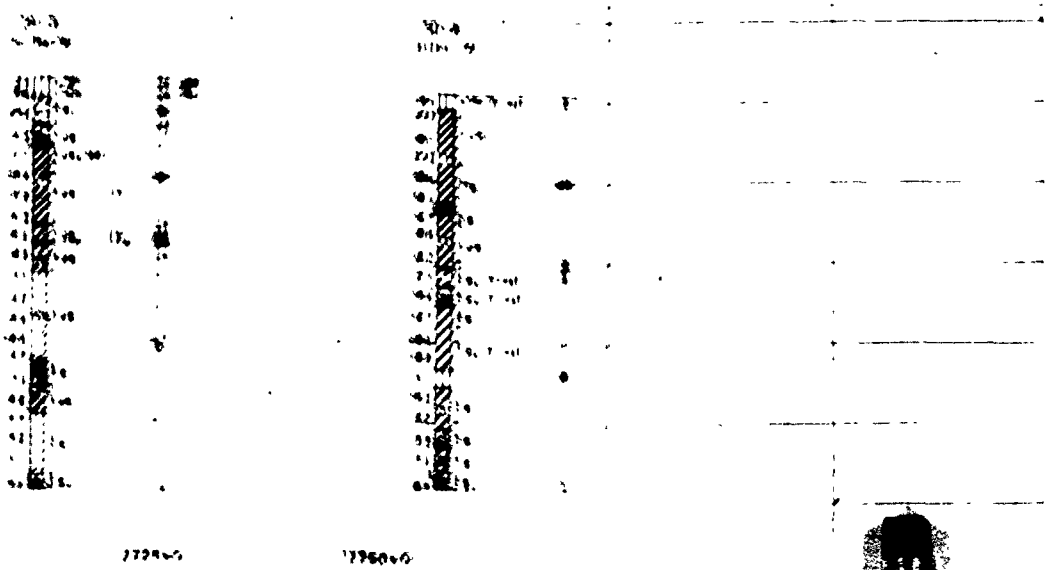
PLAN

Scale of Feet

0 300 600

Polyconic Projection—1927 North American D

25-B ● Location of Boring



NOTE

Elevations are in feet and refer to Mean Low Gulf Datum

(15) Distance in miles landward of Chandeleur Islands

MISSISSIPPI RIVER GULF OUTLET LA

STONE RETENTION DIKE EXTENSIO

PLAN AND PROFILE

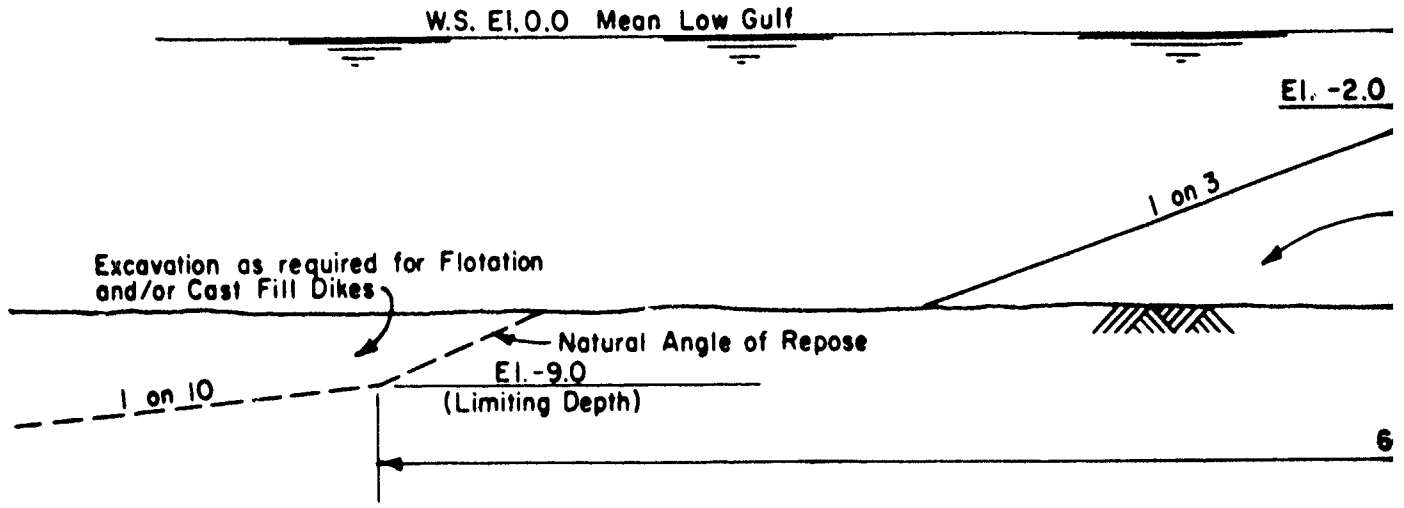
U S ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

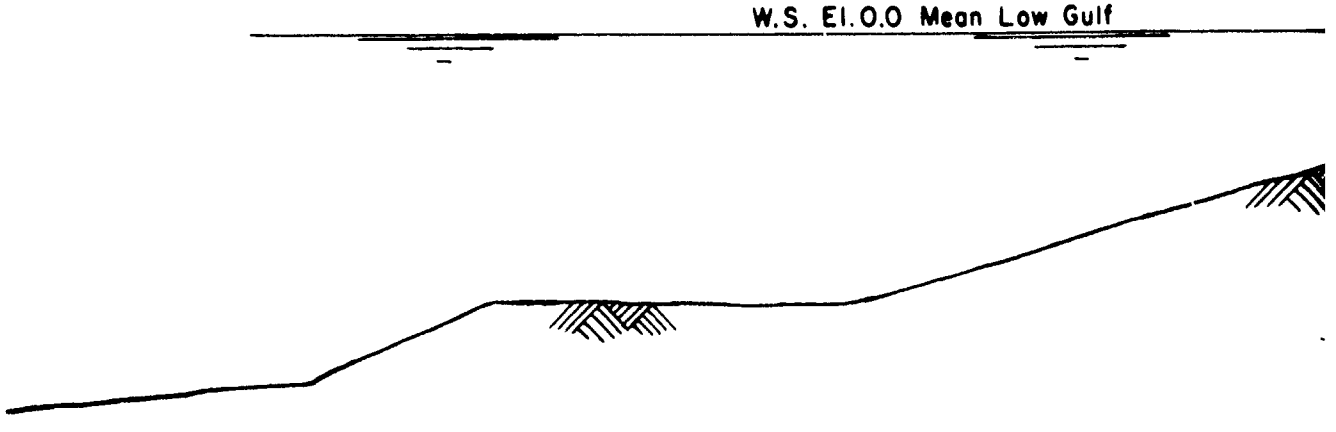
FEBRUARY 1966

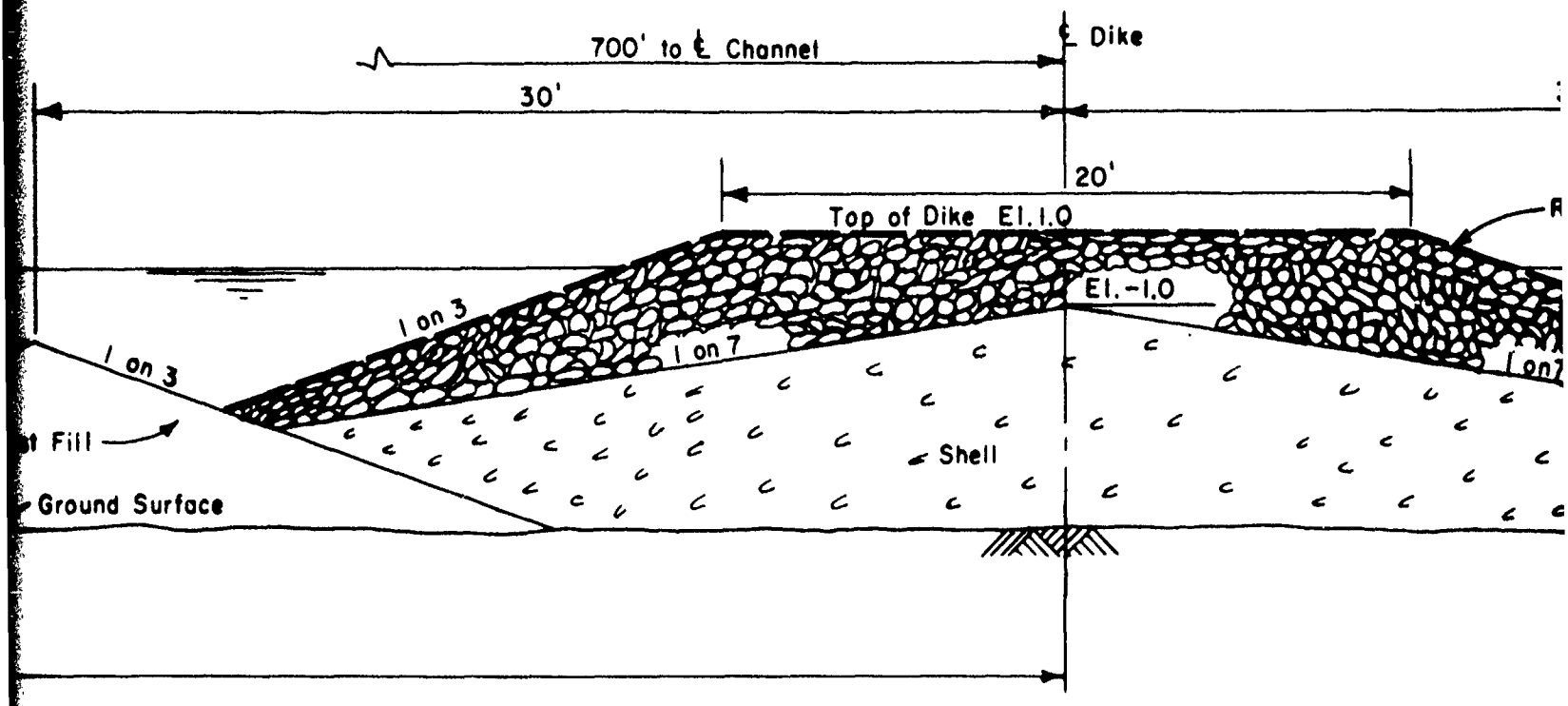
PLAT
2

4

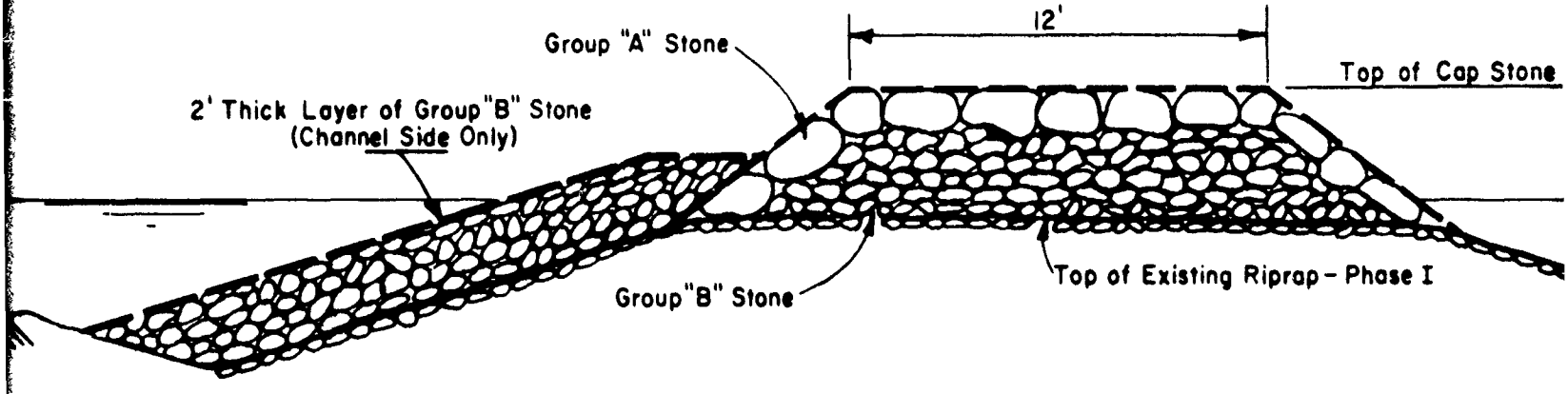
NORTH SIDE


W.S. El. 0.0 Mean Low Gulf
El. -2.0
1 on 3
Excavation as required for Flotation and/or Cast Fill Dikes
Natural Angle of Repose
El. -9.0
(Limiting Depth)
1 on 10
6


W.S. El. 0.0 Mean Low Gulf



PHASE I

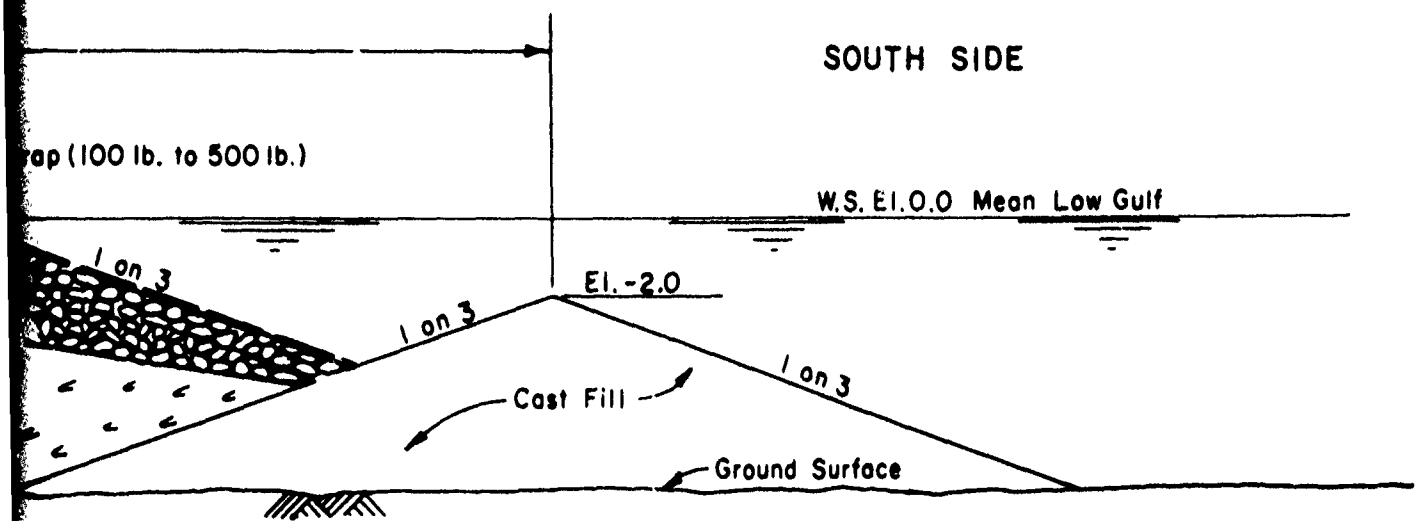


PHASE II

DESIGN SECTIONS

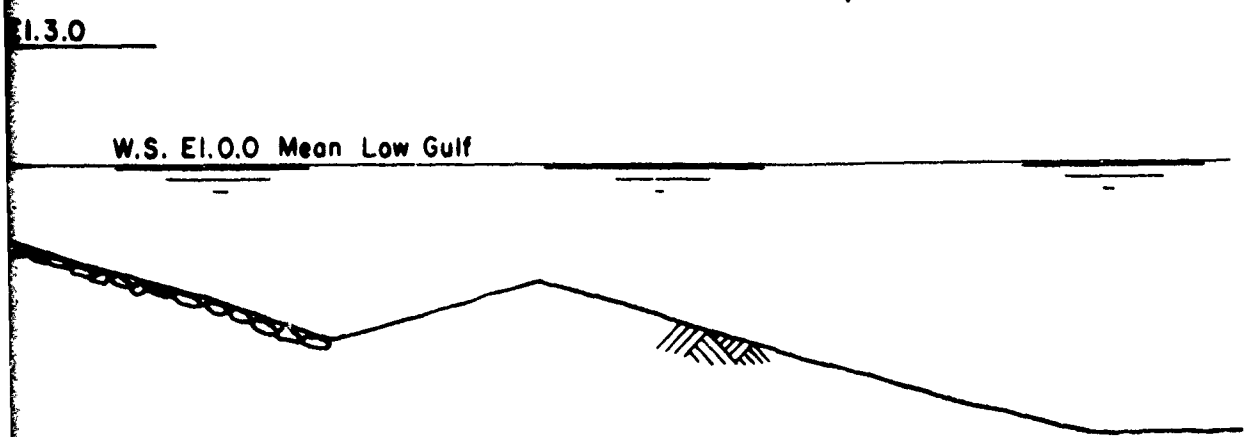
SCALE IN FEET

5 0 5



STONE SIZES

Group "A" Stone - 4 to 6 Tons
Group "B" Stone - 500 lbs. to 2 Tons



MISSISSIPPI RIVER-GULF OUTLET, LA

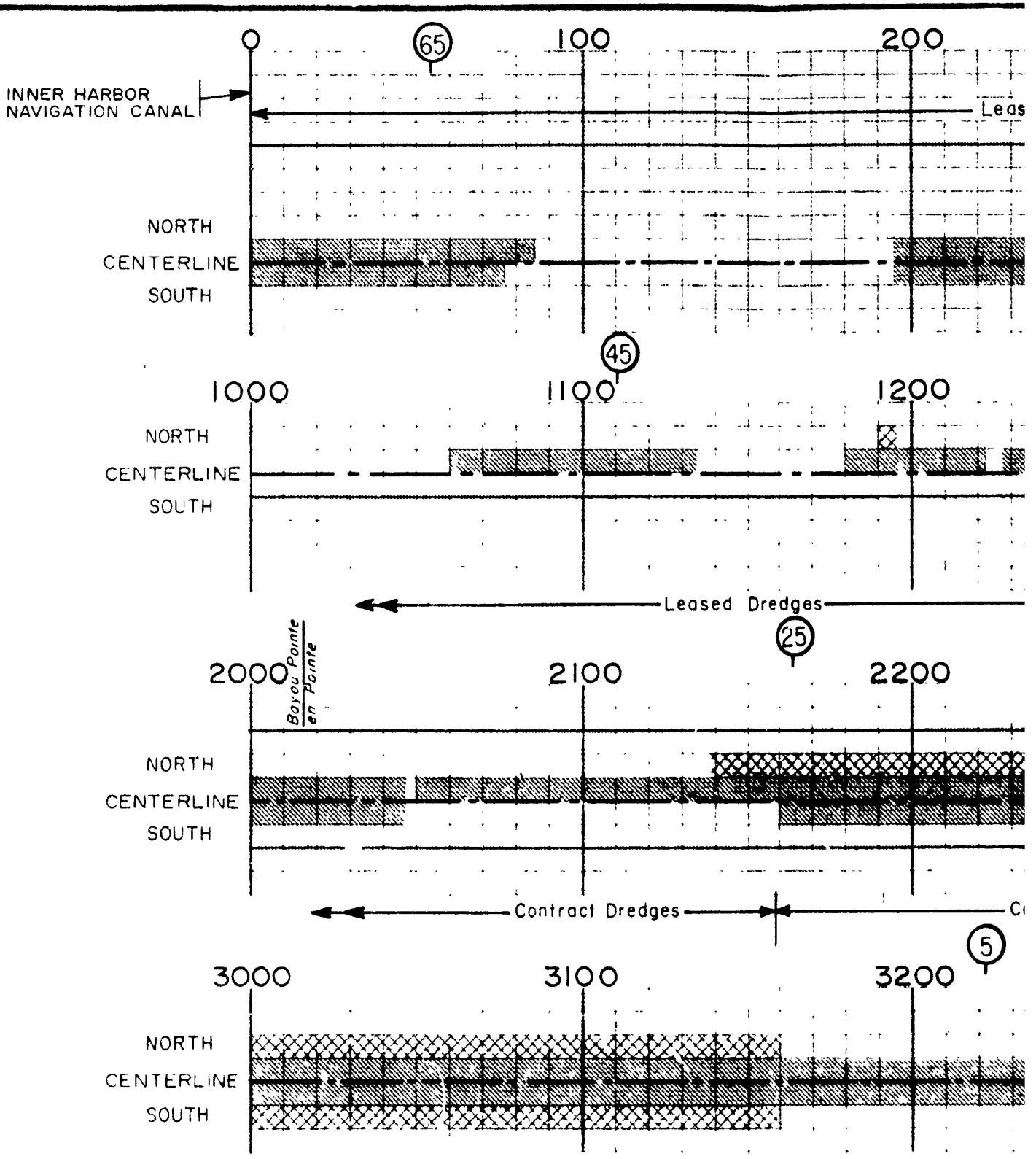
STONE RETENTION DIKE EXTENSION

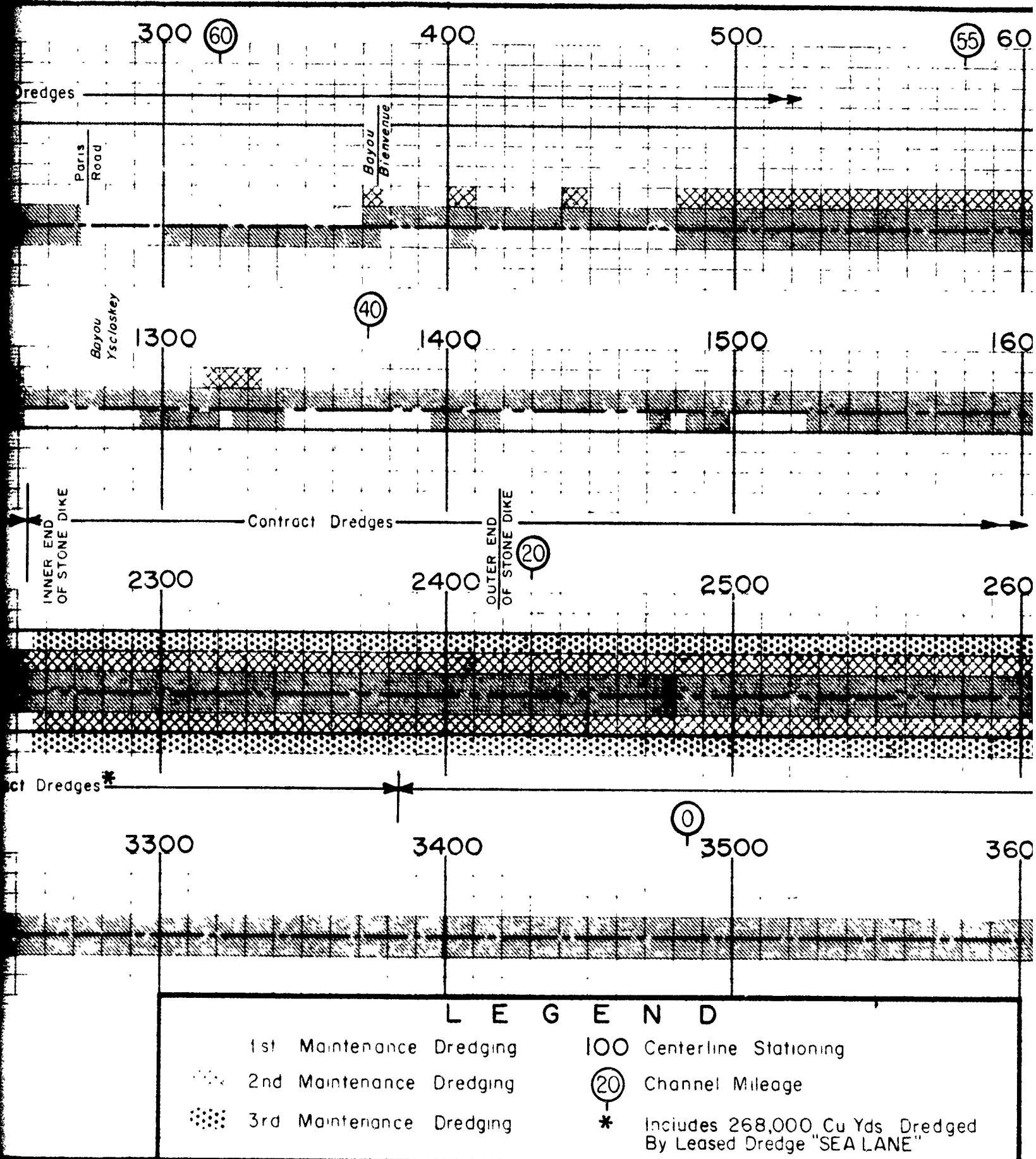
TYPICAL SECTIONS

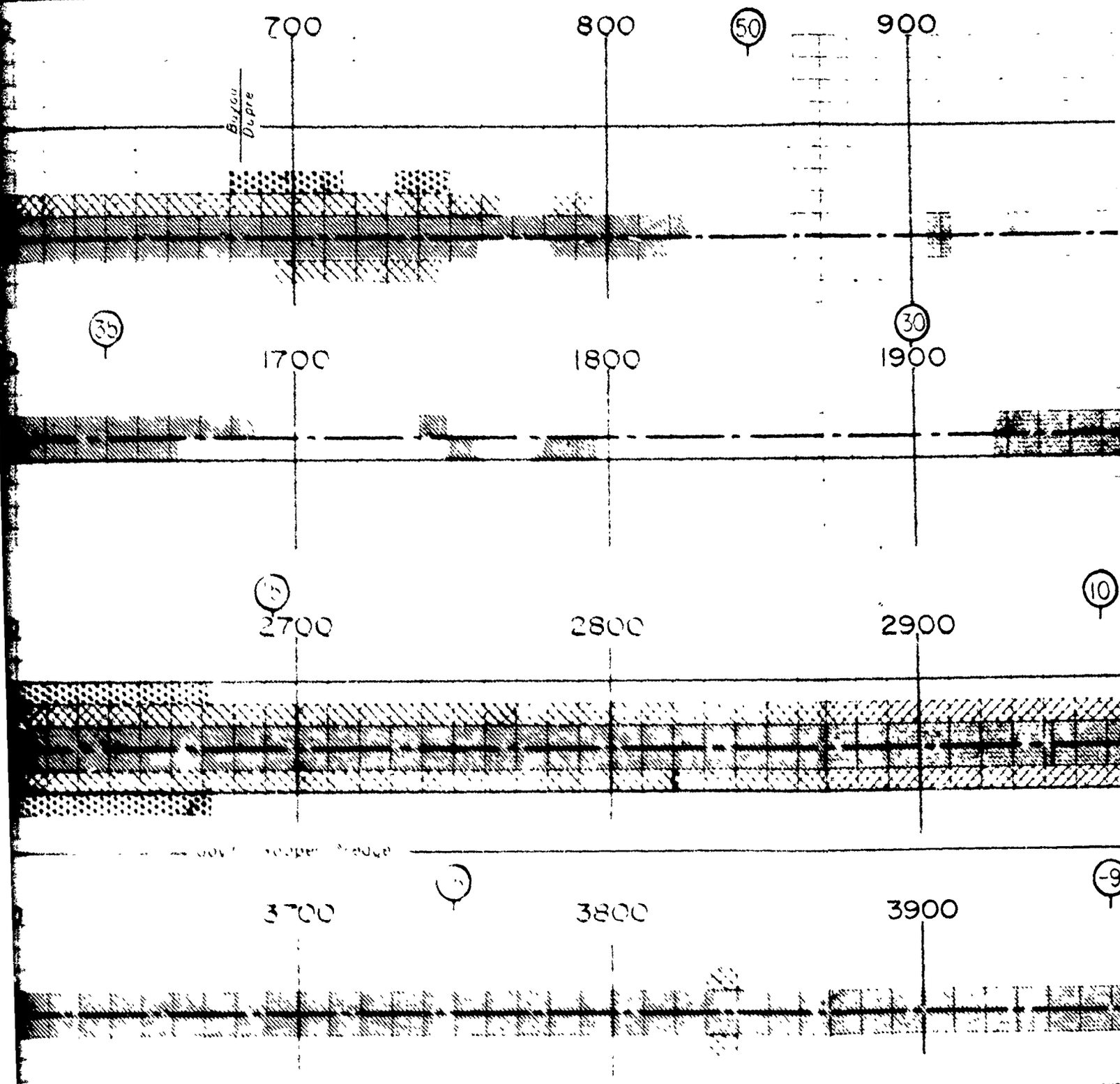
U S ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

FEBRUARY 1966

PLATE 4


0
65
100
200
INNER HARBOR
NAVIGATION CANAL
Leas
NORTH
CENTERLINE
SOUTH
45
1000
1100
1200
NORTH
CENTERLINE
SOUTH
Leased Dredges
25
2000
Bayou Pointe
en Pointe
2100
2200
NORTH
CENTERLINE
SOUTH
Contract Dredges
C
5
3000
3100
3200
NORTH
CENTERLINE
SOUTH

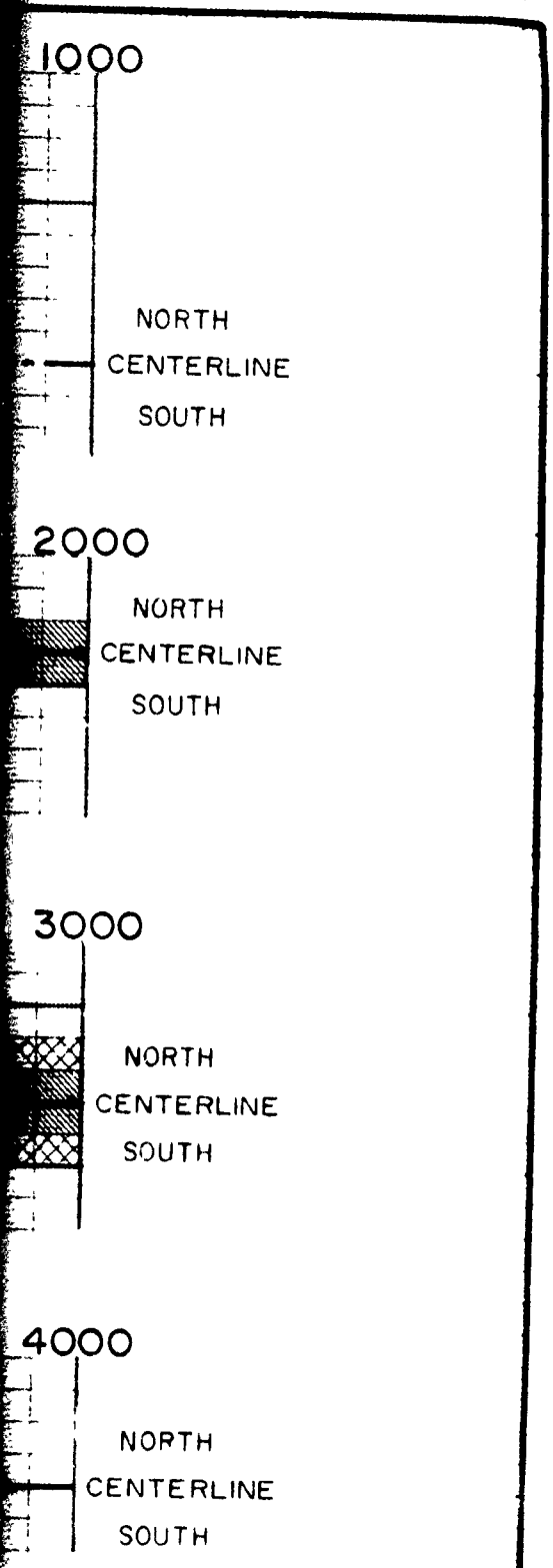

300
60
400
500
55
60
redges
Paris Road
Bayou Bienvenue
Bayou Ysclosky
40
1300
1400
1500
160
INNER END OF STONE DIKE
Contract Dredges
OUTER END OF STONE DIKE
20
2300
2400
2500
260
ct Dredges*
0
3300
3400
3500
360
LEGEND
1st Maintenance Dredging
2nd Maintenance Dredging
3rd Maintenance Dredging
100 Centerline Stationing
20 Channel Mileage
* Incluides 268,000 Cu Yds Dredged By Leased Dredge "SEA LANE"



MISSIS

SUMMARY OF M
4 SEPTEMBER

U S ARI

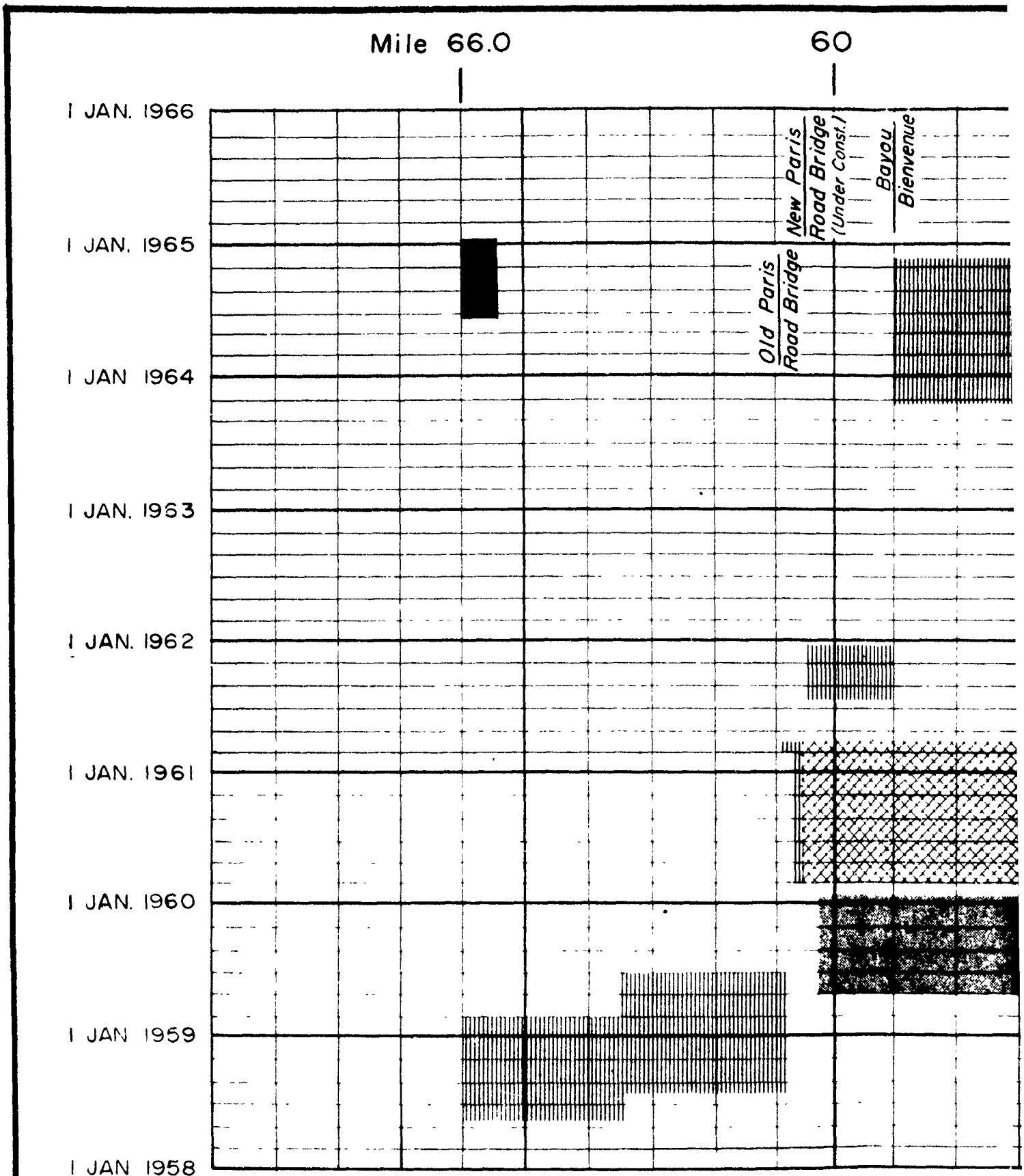


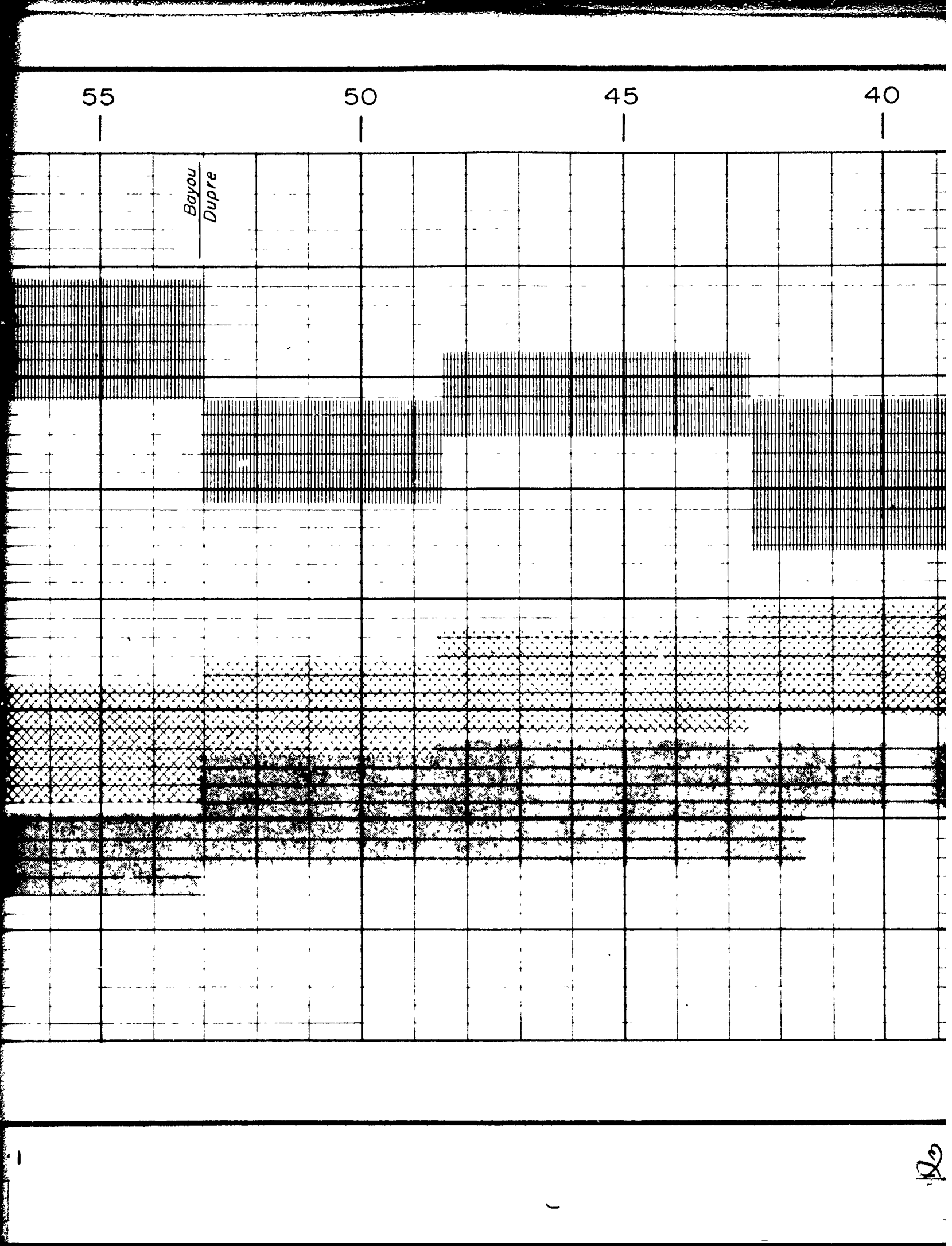
VER – GULF OUTLET, LA

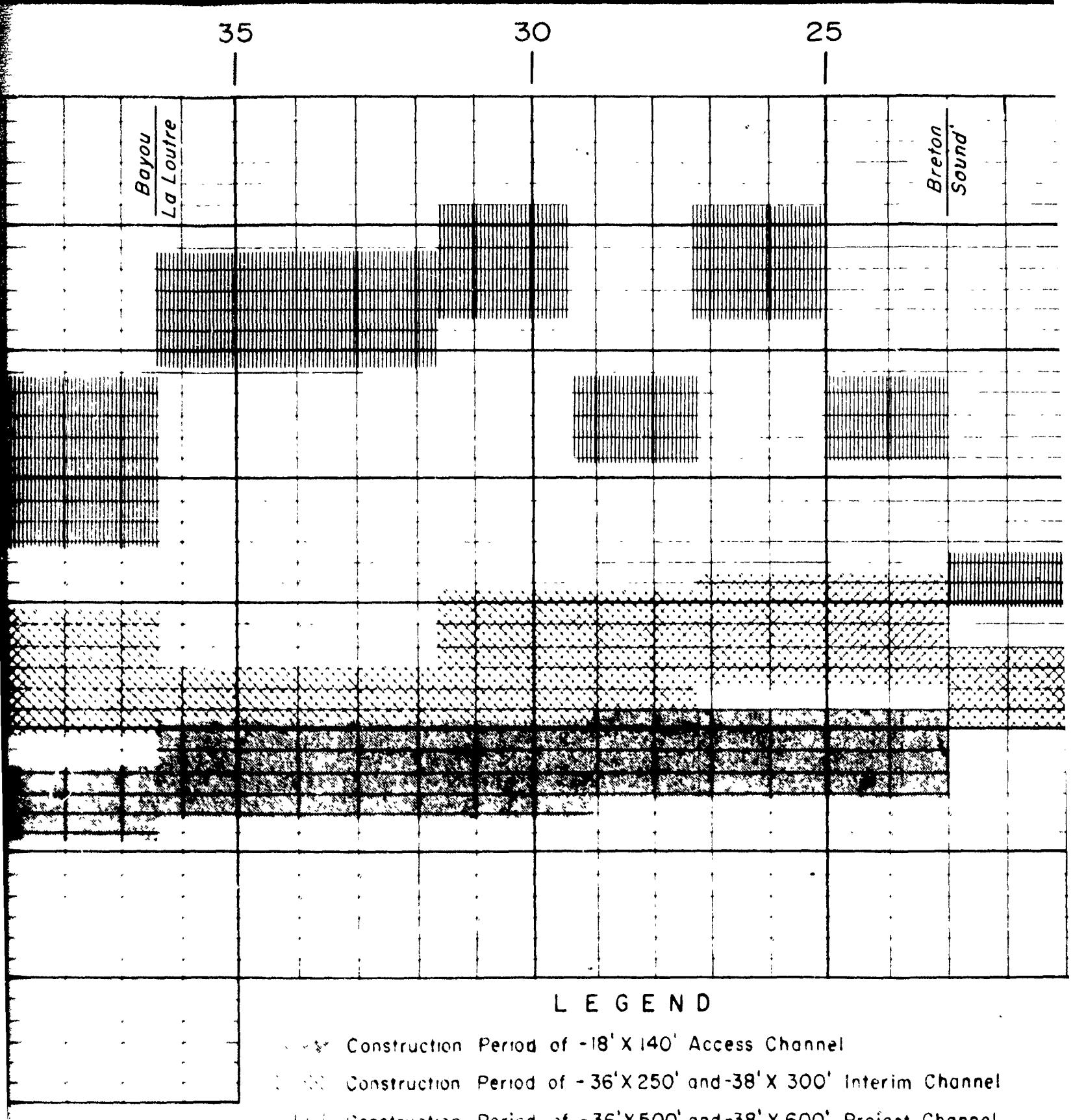
TENANCE DREDGING
3 – 31 JANUARY 1966

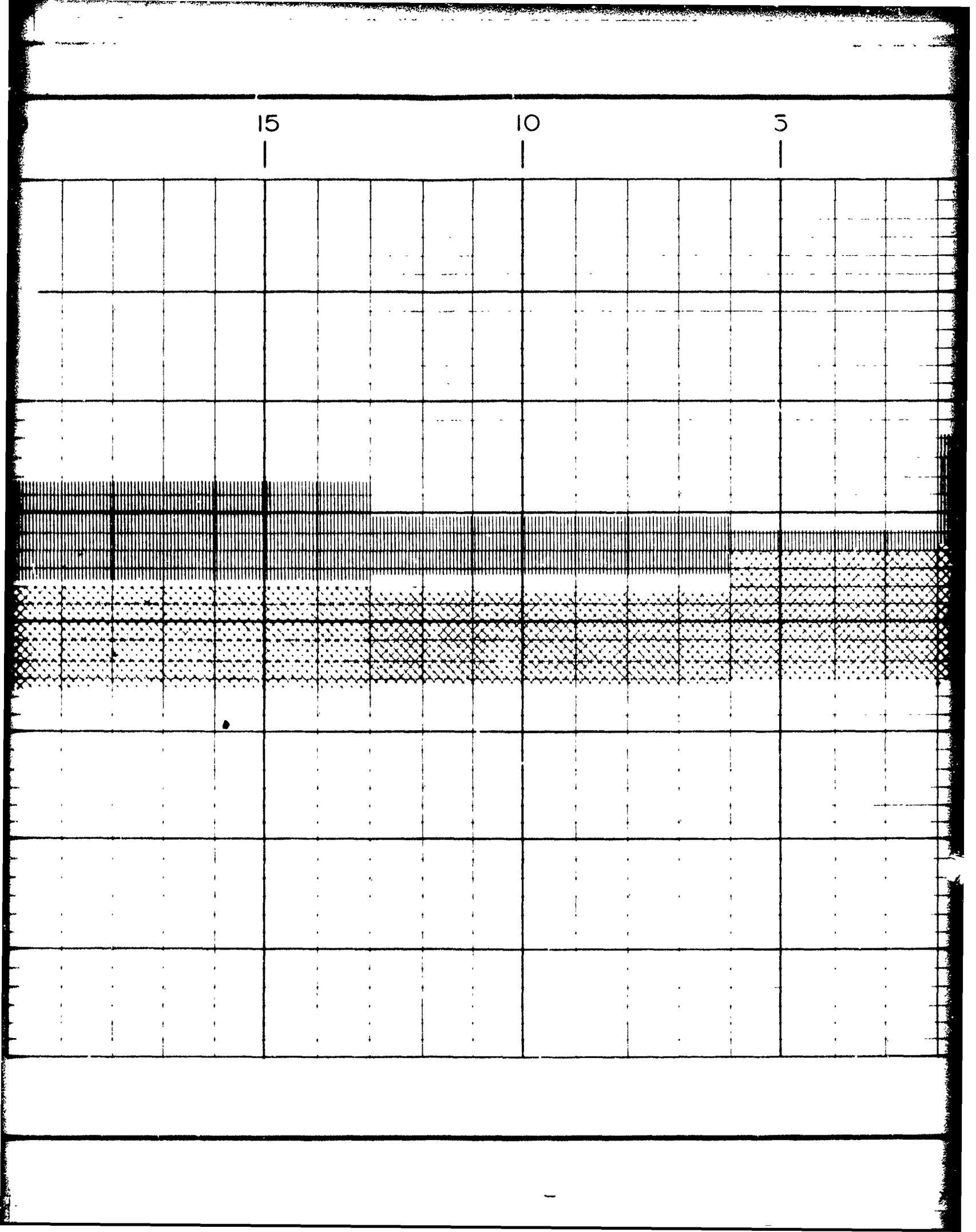
ER DISTRICT, NEW ORLEANS
OF ENGINEERS
RUARY 1966

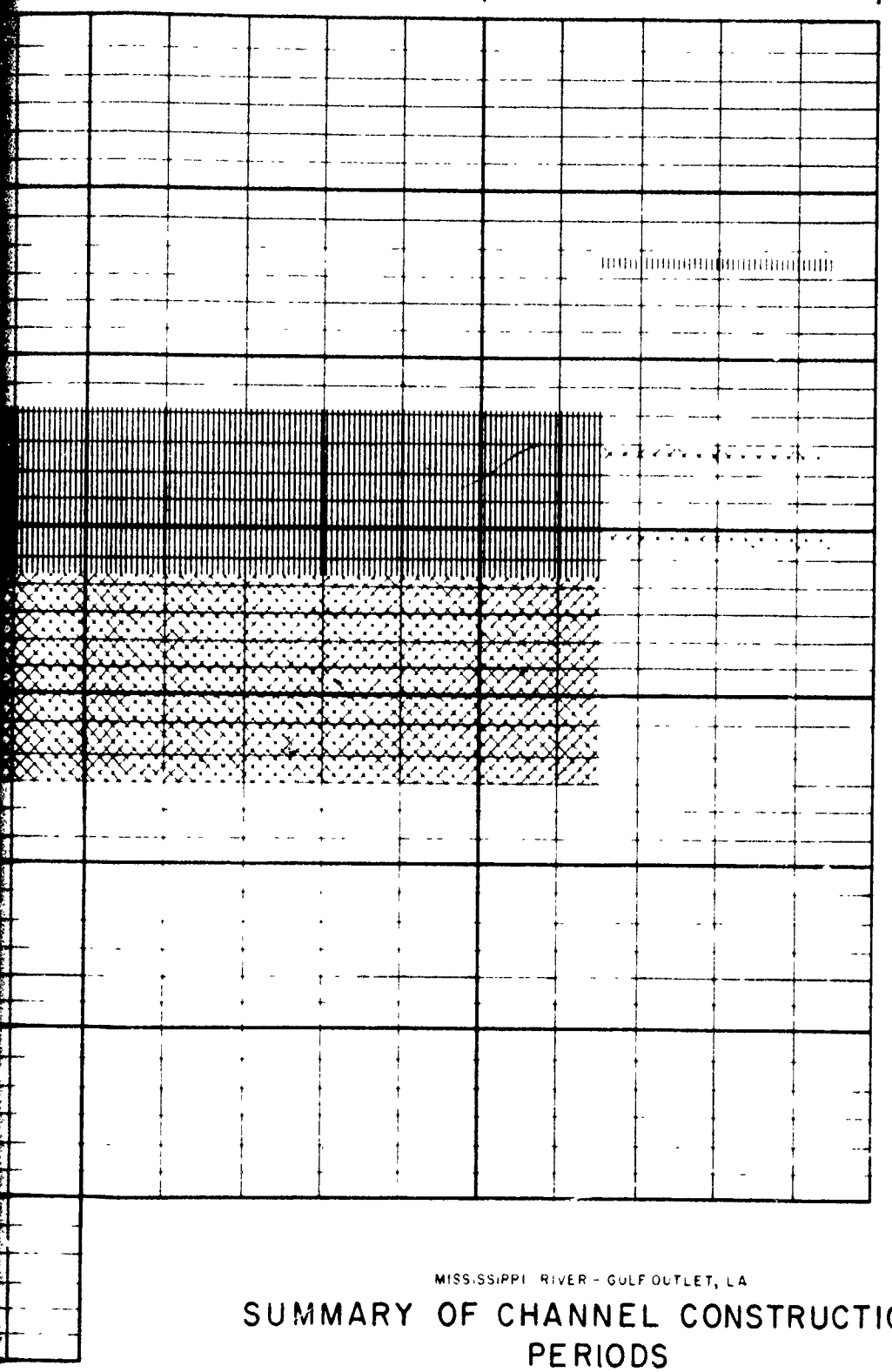
PLATE 54


Mile 66.0
60
1 JAN. 1966
1 JAN. 1965
1 JAN 1964
1 JAN. 1963
1 JAN. 1962
1 JAN. 1961
1 JAN. 1960
1 JAN 1959
1 JAN 1958
Old Paris Road Bridge
New Paris Road Bridge (Under Const.)
Bayou Bienvenue


55
50
45
40
Bayou
Dupre


35
30
25
Bayou La Loutre
Breton Sound
LEGEND
Construction Period of -18' X 140' Access Channel
Construction Period of -36'X250' and-38' X 300' Interim Channel
Construction Period of -36'X500' and-38' X 600' Project Channel
Construction Period of Turning Basin


15
10
5



MISSISSIPPI RIVER - GULF OUTLET, LA

SUMMARY OF CHANNEL CONSTRUCTION PERIODS 17 MARCH 1958 TO 22 JULY 1965

U S ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
FEBRUARY 1966

PLATE 6