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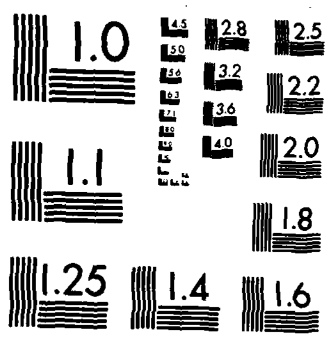

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

COE SAM/PD-N-84/012

PASCAGOULA HARBOR, MISSISSIPPI

FEASIBILITY REPORT

IMPROVEMENT OF THE FEDERAL DEEP-DRAFT NAVIGATION CHANNEL

VOLUME II

TECHNICAL APPENDICES

US ARMY CORPS
OF ENGINEERS
MOBILE DISTRICT

SEPTEMBER 1984
Revised
March 1985

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The report presents the results of a feasibility study to determine if widening and/or deepening the existing Federal deep-draft navigation project would be economically justified and environmentally feasible. The plan recommended provides for deepening the existing entrance channel to 44 feet at a width of 550 feet from the gulf to the southern end of Horn Island Pass, then continuing the 44-foot depth through Horn Island Pass at a width of 600 feet. Within Mississippi Sound and into the Pascagoula River, the channel would be deepened

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

Block 20 Continued.

to 42 feet at the present width of 350 feet. The existing Bayou Casotte channel would be deepened to 42 feet and widened to 350 feet and would include a new 1150-foot diameter turning basin just inside the mouth of Bayou Casotte.

Mitigation for the unavoidable loss of 4 acres of emergent wetlands from the construction of the Bayou Casotte turning basin would be provided by restoring 6 acres of disturbed wetland habitat to a natural emergent nature.

Construction is estimated to cost $57.3 million. Interest and amortization and future maintenance of the channel modifications amount to an annual charge of $5.4 million. Average annual equivalent benefits amount to $22.3 million, yielding a benefit-cost ratio of 4.1 to 1.

PASCAGOULA HARBOR, MISSISSIPPI
Feasibility Report
on
Improvement of the Federal
Deep-Draft Navigation Project

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PASCAGOULA HARBOR, MISSISSIPPI

APPENDIX A

GEOTECHNICAL CONDITIONS

GENERAL GEOLOGY

Mississippi Sound is located in the Gulf Coastal Plain physiographic province and is underlain by unconsolidated Holocene to consolidated Miocene soil deposits. The oldest (Miocene) deposits which outcrop in the coastal area are several hundred feet thick and consist of clay beds interspersed with sand layers. The sand beds contain water under artesian pressure and are the source of drinking water along the coast. The clay and silt beds are consolidated and dense. The semi-consolidated Pleistocene- Pliocene alluvial deposits (sand, clayey sand and silty sand) overlay the Miocene deposits. In the area of the ship channel the Miocene deposits are 66 to 90 feet below sea level and the top of the Pleistocene is 25 to 45 feet below sea level. The bottom of the sound consists of semi-consolidated to unconsolidated Holocene clay, sandy clay and clayey sand. The Holocene deposits blanket the Pleistocene deposits and range in thickness from 10 to 35 feet.

INVESTIGATIONS

General. Because a good deal of historical information was available for reference, drilling for this study was kept to a minimum. The new drilling work concentrated on deep water areas of Horn Island Pass and the Outer Bar Channel. Drilling was performed in August and September 1982 by the jack-up-barge "Sea Horse," which is capable of working in depths of up to 50 feet. This appendix contains a layout of boring locations and logs of borings. For speed and convenience borings were referred to the water surface at the time they were made. That level will be referred to as MTL (mean tide level).

Bar Channel. Fourteen (14) submarine split spoon borings were completed along the proposed SSW alignment of the Pascagoula Outer Bar Channel. The drilling began off of the west end of Petit Bois Island and continued on approximate 3,000-foot intervals for a distance of 7-1/2 statute miles where Gulf waters exceeded 50 feet in depth. All borings penetrated the marine sediments to -65 MTL. Continuous core samples were taken from each boring and forwarded to the laboratory for analysis. Pascagoula Channel. Thirty (30) splitspoon borings to -50 feet MTL were completed in 1963. These borings were spaced along that portion of the Harbor and Channel within the Mississippi Sound. Two (2) additional borings were completed in 1982. These were located in the approach to Horn Island Pass and extended to -70 MTL. The data gathered from all borings was used to provide a relative interpretation of the marine sediment characteristics pertinent to the study.

Bayou Casotte Channel. There was no drilling work performed in Bayou Casotte for purposes of this study; however, reference was made to sixteen (16) boring logs available from Vester J. Thompson, Jr., Inc. Their drilling was completed in 1976. Borings extended to -65 MTL, and were apparently drilled outside of the limits of the existing channel. Only sediments below -38 MTL were described in their boring logs. Also referenced were seven (7) logs from COE drilling performed in 1962 and 1963. These borings were drilled along the existing channel slopes and centerline to -50 MTL.

MATERIALS ENCOUNTERED

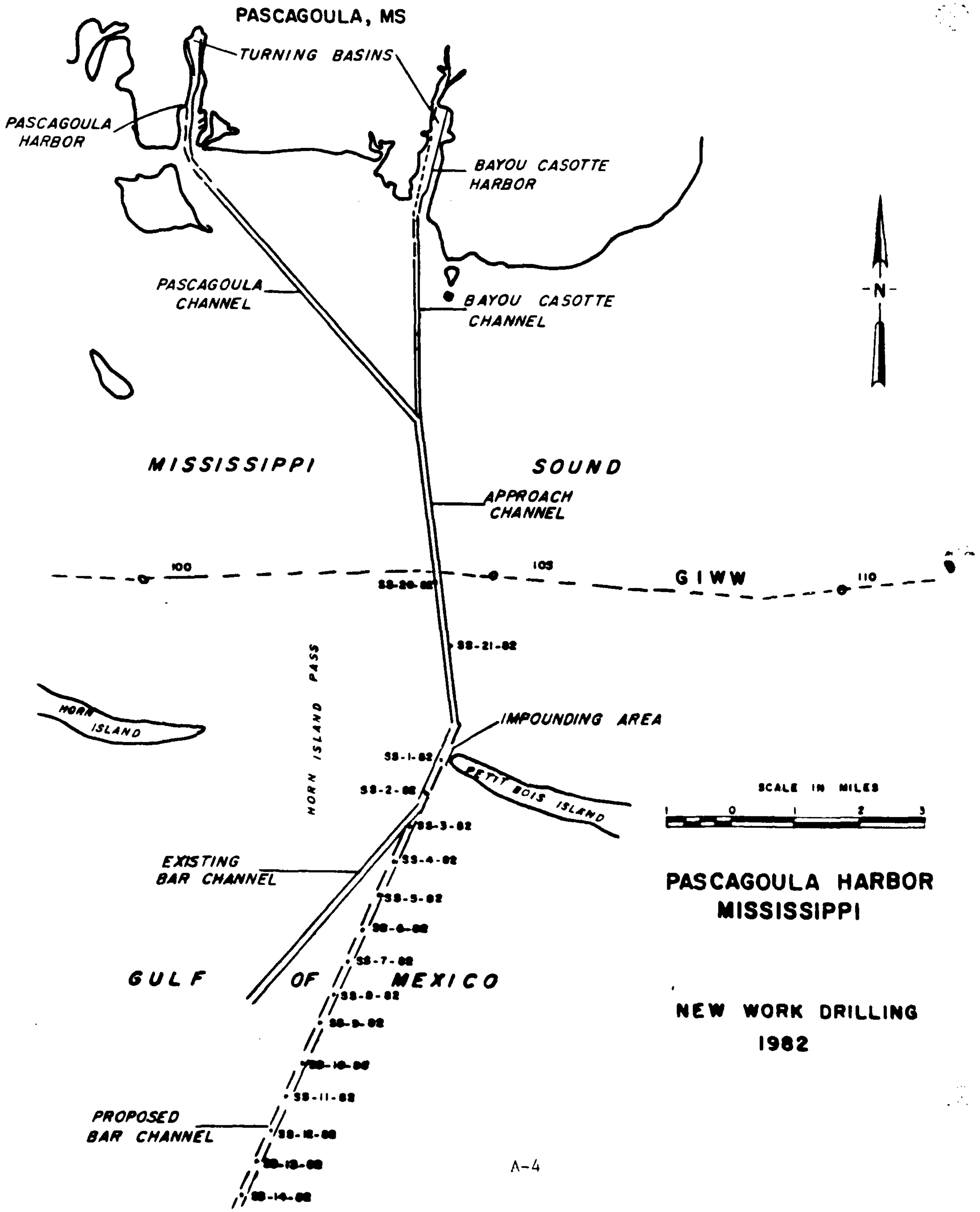
Bar Channel. Outer Bar sediments consist of two types; coarse-grained and fine-grained fractions containing traces of shell. The coarse- grained sediments include as a group clean sands (SP), silty sands (SM) and clayey sands (SC). This group of sediments is several feet thick, and covers the fine-grained group consisting of lean clays (CL), highly plastic clay sands (SC-H), fat clays (CH) and silts (ML). Generally, the fine-grained soils were not encountered above -50 MTL which indicates an inverted stratigraphy as compared to that of the Mississippi Sound sediments. Relatively speaking, the marine sediments from Petit Bois Island south into the Gulf of Mexico are of highest quality down to elevation -50 as indicated by the boring logs.

Pascagoula Channel. The data gathered from all borings provides enough information for a gross relative interpretation of the marine sediment characteristics common to the existing channel between -35 and -50 MTL only. Three general soil groups exist. There is an OL and OH group consisting of very soft, highly organic silts and clays. The second group consists of soft, fine-grained fat clays (CH), silty clays (CL) and clay-sands (SC-H). The third group of soils is composed of dense coarse-grained silty sands (SM), clayey sands (SC) and clean sands (SP). Soils of the first group are judged to be least in quantity and quality and almost always are found overlying the other groups in layers 2 to 12 feet thick. From the logs it seems that the greatest concentration of these sediments is in an area 4,000' either side of the Gulf Intracoastal Waterway. The largest quantity of material appears to represent soils of the second group. These soils are marginal in quality because they are predominantly silts and clays, although containing some sand and shell fragments. Soils of the third group are of the highest quality. Unfortunately, these high quality soil mixtures are most common at depths below -45 MTL except for 6,000 feet either side of the intersection of the Pascagoula, Bayou Casotte, and Approach Channels where significant quantities begin to appear at -38 MTL.

Bayou Casotte Channel. The boring logs infer that side slopes and bottom of the existing channel are covered by a few feet of very soft, fine-grained organic silts and clays of medium to high plasticity (OL and OH classifications). Immediately adjacent to the channel it is assumed that this same material, as well as very soft clays (CH and CL), exists in a layer 15' to 20' thick. From elevation -40 to -50 the sediments of Bayou Casotte Channel appear to be of a much higher quality. They include mostly dark-colored clayey sands (SC) with clean sands (SP) and silty sands (SM) intermixed. Within the turning basin and harbor there seems to be a wide distribution of these same soils with fine-grained clays (CH and CL) and clay sands (SC-H), but with less of the organic soils (OH, OL). Shell fragments are found intermixed throughout the sandy sediments of the turning basin, harbor and channel.

EXCAVATION

No materials have been located during drilling to date which might cause undue difficulty during excavation by hydraulic dredge. Generally, soils above -35 MTL would not be suitable for any type of construction. Some of the soils below -35 would be useful for dike construction and to some extent, beach nourishment. Side Slopes should be at equilibrium when cut to about 1 foot vertical to 5 feet horizontal.


PASCAGOULA, MS
TURNING BASINS
PASCAGOULA HARBOR
BAYOU CASOTTE HARBOR
PASCAGOULA CHANNEL
BAYOU CASOTTE CHANNEL
N
MISSISSIPPI SOUND
APPROACH CHANNEL
100
105
GIWW
110
SS-20-82
SS-21-82
HORN ISLAND PASS
HORN ISLAND
IMPOUNDING AREA
SS-1-82
SS-2-82
PETIT BOIS ISLAND
SCALE IN MILES
1 0 1 2 3
SS-3-82
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EXISTING BAR CHANNEL
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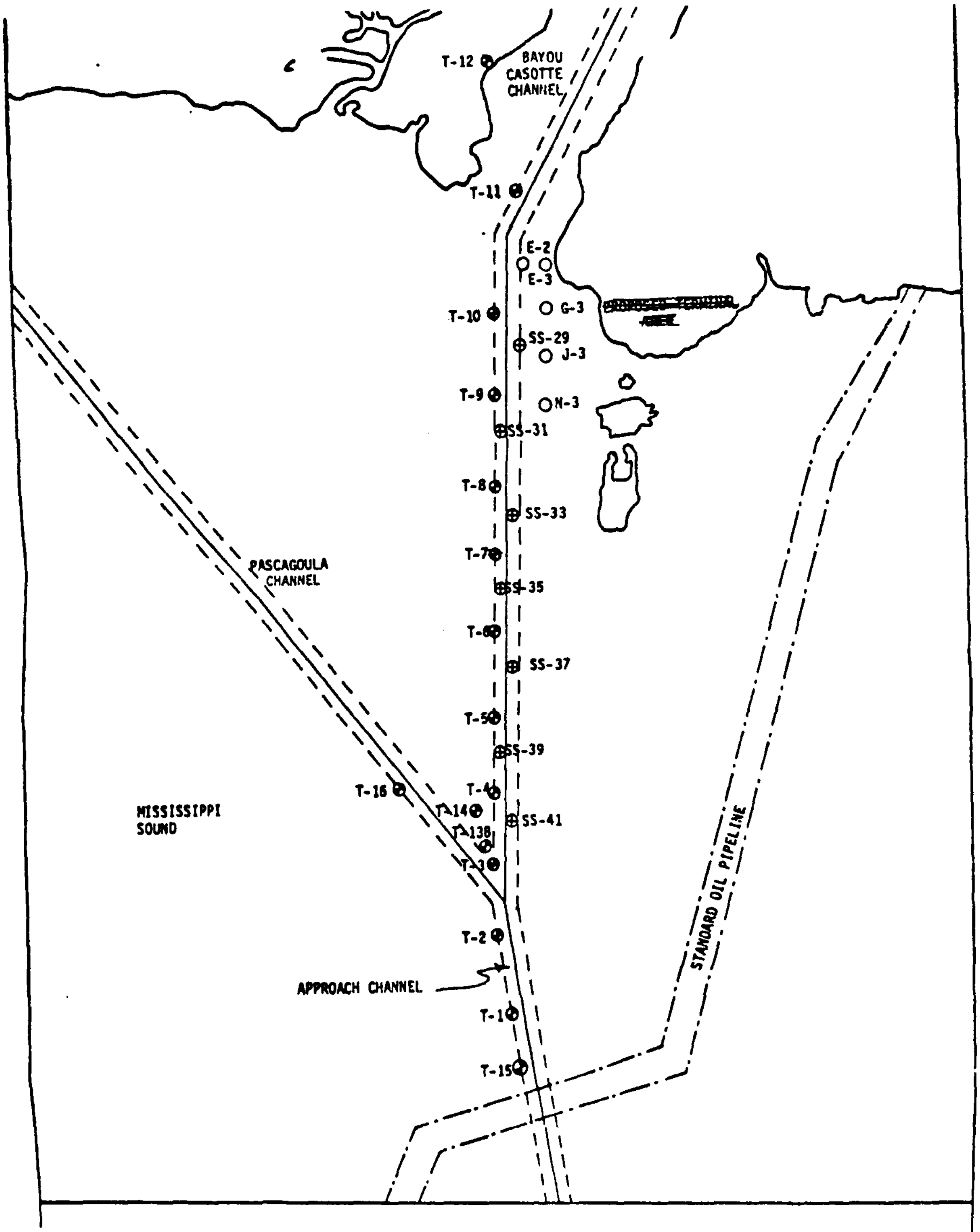
PROPOSED BAR CHANNEL
SS-12-82
SS-13-82
SS-14-82
PASCAGOULA HARBOR
MISSISSIPPI
NEW WORK DRILLING
1982



- THOMPSON'S BORING
- CORP OF ENGINEERS BORING
- HARRIS' BORING

VESTER J. THOMPSON, JR., INC.
3707 COTTAGE HILL ROAD
MOBILE, ALABAMA

DREDGE BORROW STUDY
BAYOU CASOTTE - PASCAGOULA CHANNEL
PASCAGOULA, MISSISSIPPI
OKC DREDGING
JANUARY 28, 1977

Summary of Data
Borings By Vester J. Thompson

Bayou Casotte Channel

1977

DEPTH OF SAMPLES	T-11	T-10	T-9	T-8	T-6	T-5	T-4	T-3	T-2	T-1	T-15	
	BORING DESIGNATION											
	48	40	34	48	39	25	31	9	5	32	72	% PASS #200
	26	13	--	25	29	16	18	3	2	15	--	% CLAY
-40	0	3	3	2	4	9	10	53	39	12	0	BLOW COUNT
	C	C	C	C	C	C	C	C	C	C	F	GROUP
	28	22	23	54	19	14	--	--	10	9	29	% PASS #200
	18	15	13	--	--	--	--	--	1	3	--	% CLAY
-45	5	4	10	0	6	18	11	56	23	36	10	BLOW COUNT
	C	C	C	F	C	C	C	C	C	C	C	GROUP
	17	33	31	27	19	16	13	8	--	11	8	% PASS #200
	--	--	--	--	9	10	11	3	--	1	--	% CLAY
-50	40	33	7	8	4	7	5	56	47	31	20	BLOW COUNT
	C	C	C	C	C	C	C	C	C	C	C	GROUP
	--	8	70	48	90	48	--	--	8	28	7	% PASS #200
	--	--	--	36	53	--	--	--	1	12	--	% CLAY
-55	100	85	12	5	6	13	7	75	81	5	61	BLOW COUNT
	C	C	F	C	F	C	F	C	C	C	C	GROUP
	15	--	9	30	39	23	43	7	18	10	6	% PASS #200
-60	--	--	--	--	12	--	22	--	5	3	--	% CLAY
	39	23	69	8	12	26	10	75	26	45	100	BLOW COUNT
	C	C	C	C	C	C	C	C	C	C	C	GROUP
	95	97	72	10	18	97	97	--	8	8	--	% PASS #200
-65	56	54	29	--	--	35	40	--	2	1	--	% CLAY
	7	10	19	100	27	5	6	52	22	64	--	BLOW COUNT
	F	F	F	C	C	F	F	C	C	C	--	GROUP

C = COARSE GRAINED SAMPLE

F = FINE GRAINED SAMPLE

BORING LOG CONTINUATION SHEET | MOBILE DISTRICT CORPS OF ENGINEERS | SHEET 2 OF 2 SHEETS

PROJECT: PASCAGOULA CHANNEL DEEPENING

ELEVATION TOP OF HOLE: -42.0' ±2'

DEPTH 18.0	W/C %	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	BLOWS PER FT. (N)
			GRAY & BROWN FAT CLAY (CH) W/TR. OF LIMONITE	2
				4
				5
22.5			GREENISH GRAY, W/TR. OF SAND	2
24.0			GREENISH GRAY SILTY FAT CLAY (CH) W/A LITTLE SAND	3
				2
27.0			W/A LITTLE SAND & TR. OF SHELL	WH
28.5			GREENISH GRAY CLAYEY SAND, HIGH LL (SC-H) W/TR. OF SHELL	2
30.0			BOTTOM OF HOLE	

NOTES: COORDINATES ARE ± 200'.
DEPTHS & ELEVATIONS ARE ±2'.
USED 300 LB. HAMMER.

FORM 927 | REMARKS | HOLE NO.

BORING LOG	SOUTH ATLANTIC DIVISION	MOBILE DISTRICT CORPS OF ENGINEERS	SHEET 1 OF 2 SHEETS

PROJECT AND LOCATION: PASCAGOULA CHANNEL DEEPENING

COORDINATES: N 185,570 E 596,943	SIZE & TYPE OF BIT: SPLITSPOON ; 340 LB HAMMER
DRILLING AGENCY: MOBILE DISTRICT	TYPE OF DRILL: F 314, SEAHORSE BARGE
	ELEVATION DATUM: ☐ NGVD ☒ MSL
HOLE NO.: SS-6-82	ELEVATION TOP OF HOLE: -42.0' ±2'
NAME OF DRILLER, INSPECTOR: J. DETLOFF; B. BRYANT	TOTAL NO. OF OVERBURDEN SAMPLES: DISTURBED 20; UNDISTURBED NONE
DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT	DATE DRILLED: STARTED 9-18-82; COMPLETED 9-18-82
THICKNESS OF OVERBURDEN	TOTAL NO. OF CORE BOXES / TOTAL CORE RECOVERY
DEPTH DRILLED INTO ROCK	GROUND WATER FIRST ENCOUNTERED AT
TOTAL DEPTH OF HOLE: 30.0'	STATIC GROUND WATER AT ___ ON ___

DEPTH IN FT.	W/C %	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	BLOWS PER FT. (N)
0.0			GREENISH GRAY CLAYEY SAND (SC)	WH
1.5			–	WH
3.0			W/A TR. OF SHELL	WH
4.5			– GREENISH GRAY CLAYEY SAND (SC)	3
6.0			–	3
				2
9.0			W/A TR. OF SHELL	WH
				WH
12.0				WH
13.5			GREENISH GRAY CLAYEY SAND, HIGH LL (SC-H) W/TR. OF SHELL	WH
15.0			GREENISH GRAY & BROWN SILTY FAT CLAY (CH) W/SOME SAND	2
16.5			GREENISH GRAY & BROWN FAT CLAY (CH) W/LITTLE SAND	4
18.0				

CONT. ON SHEET 2

FORM 927 DEC 82 | REMARKS | HOLE NO. SS-6-82

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE

BORING LOG CONTINUATION SHEET	MOBILE DISTRICT CORPS OF ENGINEERS	SHEET 2 OF 2 SHEETS

PROJECT: PASCAGOULA CHANNEL DEEPENING

ELEVATION TOP OF HOLE: -39.5 ±2'

DEPTH	W/C %	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	BLOWS PER FT. (N)	
18.0			GREENISH GRAY & BROWN SILTY LEAN CLAY (CL) W/A LITTLE SAND	13	300 LB. HAMMER
19.5			GREENISH GRAY & BROWN SILTY FAT CLAY (CH) W/A LITTLE SAND	5	
21.0			W/A LITTLE SAND & A TR. OF SHELL	8	
22.5				12	
				WH	
			GREENISH GRAY W/A LITTLE SAND	WH	
				3	
28.5			W/A LITTLE SHELL	3	
30.0			GREENISH GRAY CLAYEY SAND, HIGH LL (SC-H) W/TR. OF SHELL	2	
31.5			BOTTOM OF HOLE		

NOTES: COORDINATES ARE ± 200'.
DEPTHS & ELEVATIONS ARE ±2'.

FORM 927-A
DEC 82

REMARKS

HOLE NO.

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE

BORING LOG	SOUTH ATLANTIC DIVISION	MOBILE DISTRICT CORPS OF ENGINEERS	SHEET 1 OF 2 SHEETS

PROJECT AND LOCATION: PASCAGOULA CHANNEL DEEPENING

COORDINATES: N 188,388 E 598,279	SIZE & TYPE OF BIT: SPLITSPOON
DRILLING AGENCY: MOBILE DISTRICT	TYPE OF DRILL: F 314, SEAHORSE BARGE
	ELEVATION DATUM: ☐ NGVD ☒ MSL
HOLE NO.: SS-5-82	ELEVATION TOP OF HOLE: -39.5' ± 2'
NAME OF DRILLER, INSPECTOR: J. DETLOFF ; B. BRYANT	TOTAL NO. OF OVER-BURDEN SAMPLES: DISTURBED 21; UNDISTURBED NONE
DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.	DATE DRILLED: STARTED 9-17-82; COMPLETED 9-17-82

THICKNESS OF OVERBURDEN	TOTAL NO. OF CORE BOXES / TOTAL CORE RECOVERY
DEPTH DRILLED INTO ROCK	GROUND WATER FIRST ENCOUNTERED AT
TOTAL DEPTH OF HOLE 31.5'	STATIC GROUND WATER AT ON

DEPTH IN FT.	W/C %	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	BLOWS PER FT. (N)	
0.0'–1.5			GREENISH GRAY CLAYEY SAND (SC)	WH	140 LB. HAMMER
1.5–4.5			GREENISH GRAY SILTY CLAYEY SAND (SM-SC) W/TR. OF SHELL	WH, WH	
4.5–13.5			GREENISH GRAY CLAYEY SAND (SC)	WH, WH, WH, WH, WH, WH	300 LB. HAMMER
13.5–15.0			GREENISH GRAY CLAYEY SAND, HIGH LL (SC-H) W/TR. OF SHELL	WH	
15.0–18.0			GREENISH GRAY & BROWN SANDY FAT CLAY (CH) W/TR. OF SHELL; W/SOME SAND & TR. OF MICA	WH, 6	

CONT. ON SHEET 2

FORM 927 DEC 82 | REMARKS | HOLE NO. SS-5-82

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE

BORING LOG CONTINUATION SHEET	MOBILE DISTRICT CORPS OF ENGINEERS	SHEET 2 OF 2 SHEETS

PROJECT: PASCAGOULA CHANNEL DEEPENING

ELEVATION TOP OF HOLE: -33.5 ±2'

DEPTH 18.0	W/C %	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	BLOWS PER FT. (N)
19.5			GREENISH GRAY & BROWN FAT CLAY (CH) W/SOME SAND & TR. OF SHELL	5
21.0	22		W/LITTLE SAND	14
	24		W/LITTLE SAND & TR. OF SHELL	16
24.0	33			19
25.5			W/LITTLE SAND	7
27.0			W/TR. SAND & TR. OF SHELL	8
28.5			GREENISH GRAY W/SOME SAND & TR. OF SHELL	9
30.0			GREENISH GRAY CLAYEY SAND, HIGH LL (SC-H) W/LITTLE SHELL	2
31.5			GREENISH GRAY FAT CLAY (CH) W/SOME SAND & TR. OF SHELL	3
33.0			W/TR. OF SAND & SHELL	3
34.5			GREENISH GRAY CLAYEY SAND, HIGH LL (SC-H) W/TR. OF SHELL	3
36.0			GREENISH GRAY SANDY FAT CLAY (CH) W/TR. OF SHELL	2

BOTTOM OF HOLE

NOTES: COORDINATES ARE ± 200'.
DEPTHS & ELEVATIONS ARE ±2'.
USED 300 LB. HAMMER.

FORM 927-A DEC 82	REMARKS	HOLE NO. SS-4-82
	PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE	

BORING LOG	SOUTH ATLANTIC DIVISION	MOBILE DISTRICT CORPS OF ENGINEERS	SHEET 1 OF 2 SHEETS

PROJECT AND LOCATION: PASCAGOULA CHANNEL DEEPENING

COORDINATES: N 191,170 E 599,348	SIZE & TYPE OF BIT: SPLITSPOON; 300 LB. HAMMER
DRILLING AGENCY: MOBILE DISTRICT	TYPE OF DRILL: F-314, SEAHORSE BARGE
	ELEVATION DATUM: ☐ NGVD ☒ MSL
HOLE NO.: SS-4-82	ELEVATION TOP OF HOLE: -33.5' ± 2'
NAME OF DRILLER, INSPECTOR: J. DETLOFF, B. BRYANT	TOTAL NO. OF OVER-BURDEN SAMPLES: DISTURBED 24; UNDISTURBED NONE
DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.	DATE DRILLED: STARTED 9-24-82; COMPLETED 9-24-82
THICKNESS OF OVERBURDEN	TOTAL NO. OF CORE BOXES / TOTAL CORE RECOVERY
DEPTH DRILLED INTO ROCK	GROUND WATER FIRST ENCOUNTERED AT
TOTAL DEPTH OF HOLE: 36.0'	STATIC GROUND WATER AT ___ ON ___

DEPTH IN FT.	W/C %	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	BLOWS PER FT. (N)
0.0 – 1.5			GREENISH GRAY PR. GRD. SILTY SAND (SP-SM)	7
1.5 – 3.0			GREENISH GRAY PR. GRD. SAND (SP)	1
3.0 – 4.5			— WITR. OF SHELL	3
4.5 – 6.0			GREENISH GRAY CLAYEY SAND (SC)	WH
6.0 – 7.5			— WITR. OF SHELL	WH
7.5 – 9.0			GREENISH GRAY SILTY CLAYEY SAND (SM-SC) WITR. OF SHELL	WH
9.0 – 10.5			GREENISH GRAY CLAYEY SAND (SC) WITR. OF SHELL	WH
10.5 – 12.0				WH
12.0 – 13.5				WH
13.5 – 15.0				WH
15.0 – 16.5				WH
16.5 – 18.0			GREENISH GRAY CLAYEY SAND, HIGH LL (SC-H) WITR. OF SHELL	WH

CONT. ON SHEET 2

FORM 927 DEC 82	REMARKS — PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE	HOLE NO. SS-4-82

BORING LOG CONTINUATION SHEET	MOBILE DISTRICT CORPS OF ENGINEERS	SHEET 3 OF 3 SHEETS
PROJECT PASCAGOULA CHANNEL DEEPENING	ELEVATION TOP OF HOLE -24.0' ± 2'	

DEPTH 42.0'	W/C %	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	BLOWS PER FT. (N)
			GREENISH GRAY CLAYEY SAND, HIGH LL (SC-H) W/TR. OF SHELL	5 4 6
46.5			BOTTOM OF HOLE	
			NOTES: COORDINATES ARE ± 200'. DEPTHS & ELEVATIONS ARE ± 2'. USED 300 LB. HAMMER.	

FORM 927-A DEC 82	REMARKS PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE	HOLE NO. SS-3-82

BORING LOG CONTINUATION SHEET	MOBILE DISTRICT CORPS OF ENGINEERS	SHEET 2 OF 3 SHEETS
PROJECT PASCAGOULA CHANNEL DEEPENING	ELEVATION TOP OF HOLE -24.0' ±2'	

DEPTH 18.0'	W/C %	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	BLOWS PER FT. (N)
			GREENISH GRAY SILTY SAND (SM) W/TR. OF SHELL	17
19.5				WH
			GREENISH GRAY CLAYEY SAND, HIGH LL (SC-H) W/TR. OF SHELL	WH
				WH
	35			WH
25.5	68		GREENISH GRAY FAT CLAY (CH) W/ LITTLE SAND	WH
27.0	49		W/TR. OF SAND	WH
28.5	38		W/TR. OF SAND & SHELL	WH
30.0	25		GREENISH GRAY & BROWN FAT CLAY (CH) W/SOME SAND	5
				9
33.0	42			6
			W/A LITTLE SAND	10
				10
37.5			GREENISH GRAY & BROWN SILTY LEAN CLAY W/TR. SHELLS & SAND (CL)	5
39.0			GREENISH GRAY CLAYEY SAND (SC) W/TR. OF SHELL	3
42.0				5

CONT. ON SHEET 3

FORM 927-A DEC 82	REMARKS	HOLE NO. SS-3-82
	PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE	

BORING LOG	SOUTH ATLANTIC DIVISION	MOBILE DISTRICT CORPS OF ENGINEERS	SHEET 1 OF 3 SHEETS

PROJECT AND LOCATION: PASCAGOULA CHANNEL DEEPENING	
COORDINATES: N 193,904 E 600,325	SIZE & TYPE OF BIT: SPLITSPOON; 300 LB. HAMMER
DRILLING AGENCY: MOBILE DISTRICT	TYPE OF DRILL: F 314, SEAHORSE BARGE
	ELEVATION DATUM: ☐ NGVD ☒ MSL
HOLE NO.: SS-3-82	ELEVATION TOP OF HOLE: -24.0' ±2'
NAME OF DRILLER, INSPECTOR: J. DETLOFF; B. BRYANT	TOTAL NO. OF OVER-BURDEN SAMPLES: DISTURBED 31; UNDISTURBED NONE
DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	DATE DRILLED: STARTED 9-21-82; COMPLETED 9-21-82
THICKNESS OF OVERBURDEN	TOTAL NO. OF CORE BOXES — TOTAL CORE RECOVERY
DEPTH DRILLED INTO ROCK	GROUND WATER FIRST ENCOUNTERED AT
TOTAL DEPTH OF HOLE 46.5'	STATIC GROUND WATER AT — ON

DEPTH IN FT.	W/C %	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	BLOWS PER FT. (N)
0.0'			TAN PR. GRD. SAND (SP)	WH
				15
3.0			W/A TR. OF SHELL	40
4.5			TAN PR. GRD. SAND (SP)	35
6.0			TAN PR. GRD. SILTY SAND (SP-SM) W/TR. OF SHELL	58
7.5			TAN PR. GRD. SAND (SP)	44
9.0			W/A TR. OF SHELL	68
10.5			GREENISH GRAY SILTY SAND (SM) W/TR. OF SHELL & ROOTS	17
12.0			GREENISH GRAY CLAYEY SAND, HIGH LL (SC-H) W/TR. OF SHELL	16
				26
15.0			GREENISH GRAY SILTY SAND, FN. GRN., (SM) W/TR. OF SHELLS	2
16.5			GREENISH GRAY CLAYEY SAND (SC) W/TR. OF SHELLS	23
18.0				

CONT. ON SHEET 2

FORM 927 DEC 82	REMARKS — PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE	HOLE NO. SS-3-82

BORING LOG CONTINUATION SHEET	MOBILE DISTRICT CORPS OF ENGINEERS	SHEET 2 OF 2 SHEETS
PROJECT PASCAGOULA CHANNEL DEEPENING	ELEVATION TOP OF HOLE -38.0' ± 2'	

DEPTH 18.0'	W/C %	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	BLOWS PER FT. (N)
	30		GREENISH GRAY SILTY CLAYEY SAND (SM-SC) W/A TR. OF SHELL	3, 5, 4, 3
24.0			GREENISH GRAY CLAYEY SAND (SC) W/A TR. OF SHELL	8, 10
27.0			GREENISH GRAY CLAYEY SAND, HIGH LL (SC-H) W/TR. OF SHELL	3
28.5			GREENISH GRAY SANDY FAT CLAY (CH) W/A TR. OF SHELL	5
30.0			GREENISH GRAY SILTY LEAN CLAY (CL) W/TR. OF SHELLS & TR. OF SAND	6
31.5			BOTTOM OF HOLE	

NOTES: COORDINATES ARE ± 200'.
DEPTHS & ELEVATIONS ARE ± 2'.
USED 300 LB. HAMMER.

FORM 927-A DEC 82	REMARKS PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE	HOLE NO. SS-2-82

BORING LOG	SOUTH ATLANTIC DIVISION	MOBILE DISTRICT CORPS OF ENGINEERS	SHEET 1 OF 2 SHEETS

PROJECT AND LOCATION: PASCAGOULA CHANNEL DEEPENING	
COORDINATES: N 199,524 E 601,768	SIZE & TYPE OF BIT: SPLITSPOON; 300 LB. HAMMER
DRILLING AGENCY: MOBILE DISTRICT	TYPE OF DRILL: F 314, SEAHORSE BARGE
	ELEVATION DATUM: ☐ NGVD ☒ MSL
HOLE NO.: SS-2-82	ELEVATION TOP OF HOLE: -38.0' ± 2'
NAME OF DRILLER, INSPECTOR: J. DETLOFF; B. BRYANT	TOTAL NO. OF OVERBURDEN SAMPLES: DISTURBED 21; UNDISTURBED NONE
DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	DATE DRILLED: STARTED 9-22-82; COMPLETED 9-22-82
THICKNESS OF OVERBURDEN	TOTAL NO. OF CORE BOXES; TOTAL CORE RECOVERY
DEPTH DRILLED INTO ROCK	GROUND WATER FIRST ENCOUNTERED AT
TOTAL DEPTH OF HOLE 31.5'	STATIC GROUND WATER AT ON

DEPTH IN FT. 0.0'	W/C %	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	BLOWS PER FT. (N)
1.5			BROWN & GREENISH GRAY SILTY CLAYEY SAND (SM-SC)	6
3.0			BROWN & GREENISH GRAY SILTY SAND (SM)	24
4.5			TAN PR. GRD. SILTY SAND (SP-SM)	29
6.0			GREENISH GRAY	26
7.5			W/TR. OF SHELL	62
9.0			TAN PR. GRD. SAND (SP) W/A TR. OF SHELL	39
10.5			GREENISH GRAY SILTY SAND (SM) W/A TR. OF SHELL	8
12.0			GREENISH GRAY PR. GRD. SILTY SAND (SP-SM) W/TR. OF SHELL	22
13.5			GREENISH GRAY PR. GRD. SILTY SAND (SP-SM)	22
15.0			GREENISH GRAY CLAYEY SAND, HIGH LL (SC-H) W/TR. OF SHELL	2
16.5	29			2
18.0	35		GREENISH GRAY SILTY FAT CLAY (CH) W/SOME SAND & TR. OF SHELL	4

CONT. ON SHEET 2

FORM 927 DEC 82	REMARKS PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE	HOLE NO. SS-2-82

BORING LOG	SOUTH ATLANTIC DIVISION	MOBILE DISTRICT CORPS OF ENGINEERS	SHEET 1 OF 1 SHEETS

PROJECT AND LOCATION: PASCAGOULA CHANNEL DEEPENING

COORDINATES: N 199,524 E 602,535	SIZE & TYPE OF BIT: SPLITSPOON
DRILLING AGENCY: MOBILE DISTRICT	TYPE OF DRILL: F 314: SEAHORSE BARGE
	ELEVATION DATUM: ☐ NGVD ☒ MSL
HOLE NO.: SS-1-82	ELEVATION TOP OF HOLE: -48.0' ±2'
NAME OF DRILLER, INSPECTOR: J. DETLOFF; 3. BRYANT	TOTAL NO. OF OVER-BURDEN SAMPLES: DISTURBED 12; UNDISTURBED NONE
DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	DATE DRILLED: STARTED 9-14-82; COMPLETED 9-14-82
THICKNESS OF OVERBURDEN	TOTAL NO. OF CORE BOXES / TOTAL CORE RECOVERY
DEPTH DRILLED INTO ROCK	GROUND WATER FIRST ENCOUNTERED AT
TOTAL DEPTH OF HOLE: 18.0'	STATIC GROUND WATER AT ____ ON

DEPTH IN FT 0.0'	W/C %	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	BLOWS PER FT (N)	
0.0–1.5			NO SAMPLE	1	140 LB. HAMMER (0.0–4.5)
1.5–4.5			TAN PR. GRD. SAND (SP) W/A TR. OF SHELL	26, 51	
4.5–6.0			TAN PR. GRD. SAND (SP)	16	300 LB. HAMMER (4.5–18.0)
6.0–7.5			GREENISH GRAY, W/A TR. OF SHELL	20	
7.5–9.0			GREENISH GRAY SILTY CLAYEY SAND (SM-SC) W/A TR. OF SHELL	15	
9.0–18.0	34 (10.5–12.0); 37 (13.5–15.0); 32 (16.5–18.0)		GREENISH GRAY SILTY FAT CLAY (CH) W/SOME SAND & A TR. OF SHELL	2, 4, 5, 3, 4, 6	
18.0			BOTTOM OF HOLE		

FORM 927 DEC 82	REMARKS: COORDINATES ARE ±200'. DEPTHS & ELEVATIONS ARE ±2'. PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE	HOLE NO. SS-1-82

GW	Well graded gravels or gravel-sand mixtures, little or no fines.
GP	Poorly graded gravels or gravel-sand mixtures, little or no fines.
GM	Silty gravels, gravel-sand-silt mixtures.
GC	Clayey gravels, gravel-sand-clay mixtures.
SW	Well graded sands or gravelly sands, little or no fines.
SP	Poorly graded sands or gravelly sands, little or no fines.
SM	Silty sands, sand-silt mixtures.
SM-H	Same as above with high liquid limit.
SC	Clayey sands, sand-clay mixtures.
SC-H	Same as above with high liquid limit.
ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
OH	Organic clays of medium to high plasticity, organic silts.
OL	Organic silts and organic silt-clays of low plasticity.
MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
CH	Inorganic clays of high plasticity, fat clays.
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
PT	Peat and other highly organic soils.
	Sandstone
	No sample or recovery.

GENERAL NOTES:

~~Boring logs shown on the following sheets shall not be copied or altered.~~

While the borings are representative of subsurface conditions at their respective locations and for their respective vertical reaches, local minor variations in characteristics of the materials are anticipated and, if encountered, such variations will not be considered as differing materially from the description shown with the logs or profiles.

Soils are classified in accordance with the Unified Soil Classification System, Technical Memorandum No. 3-357 dated April 1960 for civil projects and Military Standard 619B dated 12 June 1968 for military projects.

Driving resistances are shown numerically. Blows per foot are determined with a standard split spoon sampler (1-3/8" I.D., 2" O.D.) and a 140-lb. driving hammer with a 30" drop unless otherwise noted on the boring logs.

FOR LOCATION OF BORINGS SEE SITE PLAN.

BORING LOG	SOUTH ATLANTIC DIVISION	MOBILE DISTRICT, CORPS OF ENGINEERS	SHEET 1 OF 2 SHEETS

PROJECT AND LOCATION: PASCAGOULA CHANNEL DEEPENING

COORDINATES: N 182,807 E 595,951	SIZE & TYPE OF BIT: SPLITSPOON; 300 LB. HAMMER
DRILLING AGENCY: MOBILE DISTRICT	TYPE OF DRILL: F 314, SEAHORSE BARGE
	ELEVATION DATUM: ☐ NGVD ☒ MSL
HOLE NO.: SS-7-82	ELEVATION TOP OF HOLE: -43.5' ±2'
NAME OF DRILLER, INSPECTOR: J. DETLOFF ; B. BRYANT	TOTAL NO. OF OVER-BURDEN SAMPLES: DISTURBED 18; UNDISTURBED NONE
DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	DATE DRILLED: STARTED 9-18-82; COMPLETED 9-18-82
THICKNESS OF OVERBURDEN	TOTAL NO. OF CORE BOXES / TOTAL CORE RECOVERY
DEPTH DRILLED INTO ROCK	GROUND WATER FIRST ENCOUNTERED AT
TOTAL DEPTH OF HOLE 27.0'	STATIC GROUND WATER AT ON

DEPTH IN FT. 0.0'	W/C %	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	BLOWS PER FT. (N)
0.0–4.5			GREENISH GRAY PR. GRD. SILTY SAND (SP-SM) W/A TR. OF SHELL	WH, 6, 8
4.5–6.0			GREENISH GRAY PR. GRD. SAND (SP)	8
6.0–7.5			GREENISH GRAY PR. GRD. SILTY SAND (SP-SM) W/TR. SHELL & ROOTS	11
7.5–9.0			GREENISH GRAY SILTY SAND (SM), SL. PLASTIC, W/TR. OF SHELL	6
9.0–13.5			GREENISH GRAY SILTY CLAYEY SAND (SM-SC) W/A TR. OF SHELL	WH, WH, WH
13.5–18.0			GREENISH GRAY CLAYEY SAND, HIGH LL (SC-H)	WH
			GREENISH GRAY CLAYEY SAND, HIGH LL (SC-H) W/A TR. OF SHELL	WH, WH

Depth marks: 3.0, 4.5, 6.0, 7.5, 9.0, 12.0, 13.5, 15.0, 18.0

CONT. ON SHEET 2

FORM 927 DEC 82	REMARKS — PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE	HOLE NO. SS-7-82

BORING LOG CONTINUATION SHEET	MOBILE DISTRICT CORPS OF ENGINEERS	SHEET 2 OF 2 SHEETS
PROJECT PASCAGOULA CHANNEL DEEPENING	ELEVATION TOP OF HOLE -43.5' ±2'	

DEPTH 18.0'	W/C %	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	BLOWS PER FT. (N)
			GREENISH GRAY CLAYEY SAND, HIGH LL (SC-H) W/A TR. OF SHELL	WH
				WH
21.0			GREENISH GRAY FAT CLAY (CH) W/A LITTLE SAND & A TR. OF SHELL	2
22.5			GRAY SILTY SAND (SM), SL. PLASTIC	8
				13
25.5			— GRAY SILTY SAND (SM)	11
27.0			BOTTOM OF HOLE	

NOTES: COORDINATES ARE ±200'.
DEPTHS & ELEVATIONS ARE ±2'.
USED 300 LB. HAMMER.

FORM 927-A DEC 82	REMARKS PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE	HOLE NO. SS-7-82

BORING LOG	SOUTH ATLANTIC DIVISION	MOBILE DISTRICT CORPS OF ENGINEERS	SHEET 1 OF 2 SHEETS

PROJECT AND LOCATION: PASCAGOULA CHANNEL DEEPENING

COORDINATES: N 179,974 E 594,404	SIZE & TYPE OF BIT: SPLITSPOON; 300 LB. HAMMER
DRILLING AGENCY: MOBILE DISTRICT	TYPE OF DRILL: F-314, SEAHORSE BARGE
	ELEVATION DATUM: ☐ NGVD ☒ MSL
HOLE NO.: SS-8-82	ELEVATION TOP OF HOLE: -43.0' ±2'
NAME OF DRILLER, INSPECTOR: J. DETLOFF; B. BRYANT	TOTAL NO. OF OVER-BURDEN SAMPLES: DISTURBED 18; UNDISTURBED NONE
DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	DATE DRILLED: STARTED 9-20-82; COMPLETED 9-20-82
THICKNESS OF OVERBURDEN	TOTAL NO. OF CORE BOXES; TOTAL CORE RECOVERY
DEPTH DRILLED INTO ROCK	GROUND WATER FIRST ENCOUNTERED AT
TOTAL DEPTH OF HOLE 27.0'	STATIC GROUND WATER AT ON

DEPTH IN FT.	W/C %	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	BLOWS PER FT. (N)
0.0' – 7.5			GREENISH GRAY SILTY SAND (SM) W/A TR. OF SHELL	WH, 2, 1, WH, 7
7.5 – 9.0			GREENISH GRAY PR. GRD. SILTY SAND (SP-SM) W/TR. SHELL	9
9.0 – 12.0			GREENISH GRAY SILTY SAND, (SM) FN. GRN., W/TR. OF OYSTER SHELLS	WH, 2
12.0 – 13.5			GREENISH GRAY CLAYEY SAND (SC) W/A TR. OF SHELL	3
13.5 – 18.0			GREENISH GRAY SILTY SAND (SM), FN. GRN., W/TR. OF SHELLS	WH, 2, 2

Depth scale marks: 3.0, 6.0, 7.5, 9.0, 12.0, 13.5, 15.0, 18.0

CONT. ON SHEET 2

FORM 927 DEC 82	REMARKS PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE	HOLE NO. SS-8-82

BORING LOG CONTINUATION SHEET	MOBILE DISTRICT CORPS OF ENGINEERS	SHEET 2 OF 2 SHEETS
PROJECT PASCAGOULA CHANNEL DEEPENING	ELEVATION TOP OF HOLE -43.0' ±2'	

DEPTH 18.0'	W/C %	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	BLOWS PER FT. (N)
19.5			GREENISH GRAY CLAYEY SAND, HIGH LL (SC-H) W/A TR. OF SHELL	WH
21.0			GREENISH GRAY SILTY FAT CLAY (CH) W/A LITTLE SAND & TR. SHELL	WH
24.0			GREENISH GRAY SILTY SANDY FAT CLAY (CH) W/A TR. OF SHELL	WH 4
27.0			DK. GRAY CLAYEY SAND (SC) W/A TR. OF SHELL	WH WH
			BOTTOM OF HOLE	

NOTES: COORDINATES ARE ± 200'.
DEPTHS & ELEVATIONS ARE ± 2'.
USED 300 LB. HAMMER.

FORM 927-A DEC 82	REMARKS PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE	HOLE NO. SS-8-82

BORING LOG	SOUTH ATLANTIC DIVISION	MOBILE DISTRICT CORPS OF ENGINEERS	SHEET OF 2 SHEETS

PROJECT AND LOCATION: PASCAGOULA CHANNEL DEEPENING

COORDINATES: N 177,230 E 593,371	SIZE & TYPE OF BIT: SPLITSPOON; 300 LB. HAMME
DRILLING AGENCY: MOBILE DISTRICT	TYPE OF DRILL: F-314; SEAHORSE BARGE
	ELEVATION DATUM: ☐ NGVD ☒ MSL
HOLE NO: SS-9-82	ELEVATION TOP OF HOLE: -44.5' ± 2'
NAME OF DRILLER, INSPECTOR: J. DETLOFF; B. BRYANT	TOTAL NO. OF OVER-BURDEN SAMPLES: DISTURBED 15; UNDISTURBED NONE
DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.	DATE DRILLED: STARTED 9-19-82; COMPLETED 9-19-82
THICKNESS OF OVERBURDEN	TOTAL NO. OF CORE BOXES / TOTAL CORE RECOVERY
DEPTH DRILLED INTO ROCK	GROUND WATER FIRST ENCOUNTERED AT
TOTAL DEPTH OF HOLE 22.5'	STATIC GROUND WATER AT ON

DEPTH IN FT.	W/C %	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	BLOWS PER FT. (N)
0.0 – 3.0			GREENISH GRAY PR. GRD. SILTY SAND (SP-SM) W/TR. OF SHELL	WH, 2
3.0 – 6.0			GREENISH GRAY SILTY SAND (SM) W/TR. OF SHELL	4, 1
6.0 – 9.0			GREENISH GRAY PR. GRD. SILTY SAND (SP-SM) W/TR. OF SHELL	10, 11
9.0 – 10.5			GREENISH GRAY SILTY CLAYEY SAND (SM-SC) W/TR. OF SHELL	2
10.5 – 15.0 (12.0)			GREENISH GRAY SILTY SAND (SM) W/A TR. OF SHELL	4, 3, WH
15.0 – 18.0			GREENISH GRAY CLAYEY SAND (SC) W/A TR. OF SHELL	WH, WH

CONT. ON SHEET 2

FORM 927 DEC 82	REMARKS: PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE	HOLE NO. SS-9-82

BORING LOG CONTINUATION SHEET | MOBILE DISTRICT CORPS OF ENGINEERS | SHEET 2 OF 2 SHEETS

PROJECT: PASCAGOULA CHANNEL DEEPENING

ELEVATION TOP OF HOLE: -44.5' ±2'

DEPTH 18.0'	W/C %	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	BLOWS PER FT. (N)
19.5			GREENISH GRAY FAT CLAY (CH) W/SOME SAND & TR. OF SHELL	WH
21.0			DARK GRAY SILTY LEAN CLAY (CL) W/TR. OF SHELL	WH
22.5			DARK GRAY FAT CLAY (CH) W/A TR. OF SAND & SHELL	WH

BOTTOM OF HOLE

NOTES: COORDINATES ARE ± 200'.
DEPTHS & ELEVATIONS ARE ± 2'.
USED 300 LB. HAMMER.

FORM 927-A DEC 82 | REMARKS | HOLE NO. [illegible] 52

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE

BORING LOG	SOUTH ATLANTIC DIVISION	MOBILE DISTRICT CORPS OF ENGINEERS	SHEET 1 OF 2 SHEETS

PROJECT AND LOCATION: PASCAGOULA CHANNEL DEEPENING

COORDINATES: N 174,465 E 591,886	SIZE & TYPE OF BIT: SPLITSPOON; 300 LB. HAMMER
DRILLING AGENCY: MOBILE DISTRICT	TYPE OF DRILL: F-314; SEAHORSE BARGE
	ELEVATION DATUM: ☐ NGVD ☒ MSL
HOLE NO. SS-10-82	ELEVATION TOP OF HOLE: -46.5' ±2'
NAME OF DRILLER, INSPECTOR: J. DETLOFF; B. BRYANT	TOTAL NO. OF OVER-BURDEN SAMPLES: DISTURBED 15; UNDISTURBED NONE
DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	DATE DRILLED: STARTED 9-19-82; COMPLETED 9-19-82
THICKNESS OF OVERBURDEN	TOTAL NO. OF CORE BOXES / TOTAL CORE RECOVERY
DEPTH DRILLED INTO ROCK	GROUND WATER FIRST ENCOUNTERED AT
TOTAL DEPTH OF HOLE 22.5'	STATIC GROUND WATER AT ____ ON ____

DEPTH IN FT. 0.0'	W/C %	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	BLOWS PER FT. (N)
0.0–1.5			GREENISH GRAY CLAYEY SAND (SC) W/A TR. OF SHELL	WH
1.5–4.5			GREENISH GRAY PR. GRD. SILTY CLAYEY SAND (SP-SM-SC) W/TR. SHELL	WH, WH
4.5–9.0			GREENISH GRAY PR. GRD. SILTY SAND (SP-SM), SL. PLASTIC — W/TR. SHELL	4, 7, 10
9.0–10.5			GREENISH GRAY SILTY CLAYEY SAND (SM-SC) W/A TR. OF SHELL	1
10.5–12.0			GREENISH GRAY SILTY CLAYEY SAND (SM-SC)	WH
12.0–15.0			GREENISH GRAY SILTY SAND (SM) W/A TR. OF SHELL, SL. PLASTIC	2, WH
15.0–18.0			GREENISH GRAY CLAYEY SAND (SC) W/A TR. OF SHELL	WH, WH

CONT. ON SHEET 2

FORM 927 DEC 82	REMARKS — PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE	HOLE NO. SS-10-82

BORING LOG CONTINUATION SHEET	MOBILE DISTRICT CORPS OF ENGINEERS	SHEET OF SHEETS

PROJECT: PASCAGOULA CHANNEL DEEPENING

ELEVATION TOP OF HOLE: -46.5' ± 2'

DEPTH 18.0'	W/C %	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	BLOWS PER FT. (N)	
			DARK GRAY FAT CLAY (CH) W/SOME SAND	WH	
				WH	
21.0			DARK GRAY FAT CLAY (CH) W/A TR. OF SAND	WH	
22.5			BOTTOM OF HOLE		

NOTES: COORDINATES ARE ± 200'.
DEPTHS & ELEVATIONS ARE ± 2'.

USED 300 LB. HAMMER.

FORM 927-A
DEC 82

REMARKS

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE

HOLE NO [illegible]

BORING LOG	SOUTH ATLANTIC DIVISION	MOBILE DISTRICT CORPS OF ENGINEERS	SHEET 1 OF 2 SHEETS

PROJECT AND LOCATION: PASCAGOULA CHANNEL DEEPENING

COORDINATES: N 171,656 E 591,081	SIZE & TYPE OF BIT: SPLITSPOON; 300 LB. HAMMER
DRILLING AGENCY: MOBILE DISTRICT	TYPE OF DRILL: F-34; SEAHORSE BARGE
	ELEVATION DATUM: ☐ NGVD ☒ MSL
HOLE NO.: SS-11-82	ELEVATION TOP OF HOLE: -47.5' ± 2'
NAME OF DRILLER, INSPECTOR: J. DETLOFF; B. BRYANT	TOTAL NO. OF OVERBURDEN SAMPLES: DISTURBED 22; UNDISTURBED NONE
DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.	DATE DRILLED: STARTED 9-25-82; COMPLETED 9-26-82
THICKNESS OF OVERBURDEN	TOTAL NO. OF CORE BOXES / TOTAL CORE RECOVERY
DEPTH DRILLED INTO ROCK	GROUND WATER FIRST ENCOUNTERED AT
TOTAL DEPTH OF HOLE: 52.5'	STATIC GROUND WATER AT ___ ON ___

DEPTH IN FT.	W/C %	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	BLOWS PER FT. (N)
0.0'				WH
			GREENISH GRAY SILTY CLAYEY SAND (SM-SC) W/A TR. OF SHELL	WH
3.0				4
				3
6.0				7
			GREENISH GRAY SILTY SAND (SM) W/A TR. OF SHELL	9
9.0				WH
10.5			GREENISH GRAY SILTY SAND (SM)	WH
12.0				WH
			GREENISH GRAY SILTY SAND (SM) W/A TR. OF SHELL	WH
15.0				4
				4
18.0				

CONT. ON SHEET 2

FORM 927 DEC 82 | REMARKS | HOLE NO. SS-11-82

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE

BORING LOG CONTINUATION SHEET	MOBILE DISTRICT CORPS OF ENGINEERS	SHEET 2 OF 2 SHEETS

PROJECT: PASCAGOULA CHANNEL DEEPENING

ELEVATION TOP OF HOLE: -47.5' ±2'

DEPTH 18.0'	W/C %	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	BLOWS PER FT. (N)
21.0			GREENISH GRAY SILTY LEAN CLAY (CL) W/TR. SHELL	WH WH
22.5			GREENISH GRAY FAT CLAY (CH) W/A TR. OF SAND	WH
24.0			CL	
27.0			SM	
30.0			CL	
37.5			CH	
39.0			SM	
[illegible]			SP (FN. TO MED. GRN.)	
52.5			SP (MED. TO CSE. GRN.)	

BOTTOM OF HOLE

FORM 927-A DEC 82	REMARKS COORDINATES ARE [illegible] DEPTHS & ELEVATIONS ARE [illegible]	HOLE NO. [illegible]

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE

NOTE: HOLE TAKEN FROM [illegible]
USED 300 LB. HAMMER

BORING LOG | **SOUTH ATLANTIC DIVISION** | **MOBILE DISTRICT CORPS OF ENGINEERS** | SHEET 1 OF 2 SHEETS

PROJECT AND LOCATION: PASCAGOULA CHANNEL DEEPENING

COORDINATES: N 168,892 E 590,350

SIZE & TYPE OF BIT: SPLITSPOON; 140 LB. HAMMER

DRILLING AGENCY: MOBILE DISTRICT

TYPE OF DRILL: F-214, [illegible] BARGE

ELEVATION DATUM: ☐ NGVD ☒ MSL

HOLE NO.: SS-12-82

ELEVATION TOP OF HOLE: [illegible] ±2'

NAME OF DRILLER, INSPECTOR: J. DETLOFF; B. BRYANT

TOTAL NO. OF OVER-BURDEN SAMPLES: DISTURBED 14 | UNDISTURBED NONE

DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.

DATE DRILLED: STARTED 9-18-82 | COMPLETED 9-19-82

THICKNESS OF OVERBURDEN: | TOTAL NO. OF CORE BOXES: | TOTAL CORE RECOVERY:

DEPTH DRILLED INTO ROCK: | GROUND WATER FIRST ENCOUNTERED AT:

TOTAL DEPTH OF HOLE: 21.0' | STATIC GROUND WATER AT: ON:

DEPTH IN FT. [illegible]	W/C %	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	BLOWS PER FT (N)
	27		GREENISH GRAY SILTY CLAYEY SAND (SM-SC) W/A TR. OF SHELL	WH
				WH
3.0	25		GREENISH GRAY SILTY SAND (SM) W/A TR. OF SHELL	8
4.5			GREENISH GRAY SILTY SAND (SM) W/A TR. OF MICA	3
6.0	26		GREENISH GRAY SILTY SAND (SM)	6
7.5			GREENISH GRAY PR. GRD. SILTY SAND (SP-SM) W/TR. OF SHELL	8
9.0	29		GREENISH GRAY SILTY SAND (SM) SL. PLASTIC	5
10.5				9
12.0	24		W/TR. SHELLS	8
				WH
15.0	32		GREENISH GRAY CLAYEY SAND (SC) W/A TR. OF SHELL	NH
16.5			DK. GRAY CLAYEY SILT (ML) W/TR. OF SHELL & SAND	WH
18.0				

CONT. ON SHEET 2

FORM 927 DEC 82 | REMARKS | HOLE NO. SS-12-82

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE

BORING LOG CONTINUATION SHEET	MOBILE DISTRICT CORPS OF ENGINEERS	SHEET 2 OF 2 SHEETS

PROJECT: PASCAGOULA CHANNEL DEEPENING

ELEVATION TOP OF HOLE: -49.0' ± 2'

DEPTH 18.0'	W/C %	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	BLOWS PER FT. (N)
19.5			DK. GRAY CLAYEY SILT (ML) W/TR. OF SHELLS	WH
21.0	79		DK. GRAY FAT CLAY (CH) W/TR. OF SHELL & SAND	WH
			BOTTOM OF HOLE	

NOTES: COORDINATES ARE ± 200'.
DEPTHS & ELEVATIONS ARE ± 2'.
USED 300 LB. HAMMER.

FORM 927-A DEC 82 | REMARKS | HOLE NO [illegible]

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE

BORING LOG	SOUTH ATLANTIC DIVISION	MOBILE DISTRICT CORPS OF ENGINEERS	SHEET 1 OF 1 SHEETS

PROJECT AND LOCATION: PASCAGOULA [illegible] DEEPENING

COORDINATES: N [illegible] E 588 930	SIZE & TYPE OF BIT: SPLITSPOON; [illegible] HAMMER
DRILLING AGENCY: MOBILE DISTRICT	TYPE OF DRILL: F-314, SEAHORSE BARGE
	ELEVATION DATUM: ☐ NGVD ☒ MSL
HOLE NO: SS-13-82	ELEVATION TOP OF HOLE: -50.0' ± 2'
NAME OF DRILLER, INSPECTOR: J. DETLOFF; B. BRYANT	TOTAL NO. OF OVERBURDEN SAMPLES: DISTURBED 9; UNDISTURBED NONE
DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT	DATE DRILLED: STARTED 9-20-82; COMPLETED 9-20-82
THICKNESS OF OVERBURDEN	TOTAL NO. OF CORE BOXES / TOTAL CORE RECOVERY
DEPTH DRILLED INTO ROCK	GROUND WATER FIRST ENCOUNTERED AT
TOTAL DEPTH OF HOLE: 13.5'	STATIC GROUND WATER AT ___ ON ___

DEPTH IN FT. (0.0')	W/C %	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	BLOWS PER FT. (N)
0.0–1.5			GREENISH GRAY PR. GRD. SILTY SAND (SP-SM)	WH
1.5–3.0			GREENISH GRAY SILTY CLAYEY SAND (SM-SC) W/TR. OF SHELL	5
3.0–4.5			GREENISH GRAY PR. GRD. SILTY SAND (SP-SM) W/A TR. OF SHELL	7
4.5–7.5			TAN PR. GRD. SAND (SP)	WH 10
7.5–9.0			GREENISH GRAY PR. GRD. SILTY SAND (SP-SM)	76
9.0–12.0			TAN PR. GRD. SAND, (SP) FN. GRN., W/TR. SHELLS	40 12
12.0–13.5			GREENISH GRAY SANDY FAT CLAY (CH) W/A TR. OF SHELL	2
13.5			BOTTOM OF HOLE	
15.0–18.0			NOTES: COORDINATES ARE ± 200'. DEPTHS & ELEVATIONS ARE ± 2'. USED 300 LB. HAMMER.	

FORM 927
DEC 82

REMARKS

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE

HOLE NO: SS-13-82

[illegible]ING LOG	SOUTH ATLANTIC DIVISION	MOBILE DISTRICT CORPS OF ENGINEERS	[illegible]

PROJECT AND LOCATION: PASCAGOULA CHANNEL DEEPENING	
COORDINATES: N 63,[illegible]7 E 487,910	SIZE & TYPE OF BIT: [illegible]
	TYPE OF DRILL: F[illegible]
DRILLING AGENCY: MOBILE DISTRICT	ELEVATION DATUM: ☐ NGVD ☒ MSL
HOLE NO.: [illegible]S-14-82	ELEVATION TOP OF HOLE: -49.5' [illegible]
NAME OF DRILLER, INSPECTOR: [illegible]. DETLOFF; S. BRYANT	TOTAL NO. OF OVERBURDEN SAMPLES: DISTURBED 13; UNDISTURBED NONE
DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT	DATE DRILLED: STARTED [illegible]-24-82; COMPLETED 9-24-82
THICKNESS OF OVERBURDEN	TOTAL NO. OF CORE BOXES; TOTAL CORE RECOVERY
DEPTH DRILLED INTO ROCK	GROUND WATER FIRST ENCOUNTERED AT
TOTAL DEPTH OF HOLE: 1[illegible].0'	STATIC GROUND WATER AT ON

DEPTH IN FT. 0.0'	W/C %	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	BLOWS PER FT (N)
			GREENISH GRAY PR. GRD. SILTY SAND (SP-SM)	WH
1.5			W/A TR. OF SHELL	6
3.0			GREENISH GRAY SILTY SAND (SM) W/A TR. OF SHELL	11
4.5			GREENISH GRAY PR. GRD. SILTY SAND (SP-SM) W/A LIT. SHELL	6
6.0			W/TR. OF SHELL	16
				31
9.0			TAN PR. GRD. SAND (SP)	7
10.5	46		GREENISH GRAY CLAYEY SAND, HIGH LL (SC-H)	6
[illegible]				16
	[illegible]		[illegible]EENISH [illegible] FAT CLAY [illegible] W/A TR. OF SAND	WH
				WH

FORM [illegible] REMARKS [illegible]

000 dwt and one of 79,000 dwt. They have indicated that they will change two 80,000 dwt tankers for lightering when the project is improved. These ld be vessels of the Kenneth E. Hill class, with a length of about 763 t, a beam of about 144 feet, and a loaded draft of about 40 feet. These ps are larger than any anticipated grain ship and bulk carrier. The LNG kers which would be used by Tenneco would have a length of 948 feet, a th of 135 feet and would be lightloaded for an entering draft of 34 feet at cagoula. The crude oil tankers would average about 3 trips per week, while LNG tankers would average about 1-1/2 trips per week; therefore, the oil kers dominate the future traffic pattern and the Kenneth E. Hill was ected as the design vessel for channel design. Recent information from neco revealed that they plan to provide their own turning basin. With that elopment, the LNG tanker was no longer a significant factor in the channel ign.

nnel Alignment. The route of the improved channel would be generally along same alignment as presently exists. (See Plate IX). Any deviation from present alignment with the exception of Horn Island Pass, results in a ked increase in dredging amount and hence cost, with no increase in safety benefits. Examination of navigation charts (see NOS chart no. 11375) ealed that the naturally deep thread of the pass has migrated westward ghtly. Realigning the pass channel segment between the obvious limits of upper and lower P.I. for about 500 feet to the west would have no effect the overall amount of dredging. That change, along with reconfiguring the toral catch basin, should ease some of the shoaling problem caused by erial being transported around the end of Petit Bois Island. The precise lignment would be determined by a survey made shortly before the work is e. The authorization for this proposed improvement should allow for ther realignment in the future, should surveys indicate that the westward ration trend is continuing and realignment is warranted.

nnel Limits. The proposed improvement would begin at deep water in the f of Mexico, or at about the 44-foot depth contour, and terminate in the agoula River at about station 49+60 (about Mile 0.9) and in Bayou Casotte about station 181+00N.

nnel Depth. The primary concern in design of navigation channels is establing the proper channel depth. Channel depths greater than the loaded tic draft amidship of vessels using the waterway are required in order to e safety and facilitate maneuverability. Factors which influence the ign depth of a navigation channel in addition to the static draft amidship vessel squat, trim, water salinity, tide variations, and characteristics bottom material. Some of these factors are determined by the hull struc- e and operating characteristics of the vessel while others are determined the local geological and environmental conditions in the project area.

hip in motion effects an apparent sinkage which is referred to as "squat". ship does not sink relative to the water, but instead there is a lowering the water surface due to the passage of the ship. This results in the ship ng closer to the bottom while in motion over a given location that it would

c. Bottom clearance squat computations [illegible] that [illegible] required for guaranteed clearance at extreme low water if voyage schedules require entry at all stages of tide.

That report also recommended on-line simulation studies with Pascagoula bar pilots to develop additional data and familiarize pilots with ship operation.

The Mobile District has recently completed the General Design Memorandum for Mobile Harbor Deepening, Alabama, dated August 1984. That project was originally designed using the general guides presented in the Committee on Tidal Hydraulics Report No. 3, as referenced by EM 1110-1-1607, which was in effect when that report was submitted in October 1980. That guidance has now been superseded by EM 1110-2-1613, dated 8 April 1983, which recommends bank clearance factors for all conditions which were previously the minimum allowances for ideal conditions. In addition, simulation studies have been performed by CAORF and Waterways Experiment Station (WES). The change in criteria, along with the results of those studies, showed that a reduction of channel design width from 550 feet to 400 feet would be satisfactory if proper bend widening was provided at each turn. Studies to determine if further width reduction is possible are still in progress. Experience gained from the Mobile Harbor studies was applied to the design of the Pascagoula Harbor channel. In recent discussions with CAORF staff regarding the Tenneco simulation, a pertinent comment was made; "In many ways, the conclusions of the Mobile Study may be as relevant to your investigations of Pascagoula as the earlier investigation for Tenneco. The long, straight narrow channels connected by minor turns in areas of soft bottoms would likely result in similar findings."

Local Conditions and Other Considerations. Mississippi Sound and vicinity, in common with other local gulf coast areas, has a diurnal tide with a mean range of 1.5 feet and an extreme range of 3.0 feet. Normal weather is relatively mild. Bottoms are entirely sedimentary deposits formed over relatively recent geological periods. The existing sediments can sometimes be firm, but are rarely hard, and rock is never encountered. Channel side slopes are very flat, typically 1 on 5. Shoaling material in estuarine channels originates from upland runoff and is typically a very soft organic clay mud. Bar channel shoaling is usually sand from littoral transport.

Discussions were held with the members of the Pascagoula Bar Pilots Association, Chevron Shipping representatives, Tenneco officials, and other owners and users. It was stated that Pascagoula Harbor is well known as an "easy" port with an excellent safety record. For large ships, the channel is operated on a one-way basis. Users consider the present channel width of 350 feet in the main channel as adequate for all present and projected future traffic. The 225-foot width of the Bayou Casotte channel is restrictive, but is in use by large tankers. Chevron Shipping officials have stated that a channel width of 300 feet might be adequate for their 80,000 dwt tanker.

Design Vessel. The Chevron Company is presently lightering crude oil from a VLCC in the gulf to their refinery at Bayou Casotte using two tankers, one of ıscagoula, Mississippi," 7 November 1979, CAORF 24-7914-01. The study used a ıthematical simulation model of Pascagoula Harbor conditions and LNG and oil ınker vessels. Selected combinations of wind and current conditions were camined to investigate their resultant effect on vessel performance. The ıORF model was verified using a model of an 80,000 dwt tanker which had been sed and validated in previous studies. That tanker was considered to closely ompare with the CHEVRON FRANKFURT, which is actually in use lightering oil at ascagoula. The 125,000 cubic meter LNG carrier EL PASO ARZEW was used to odel the LNG vessel. Table B-1 compares the major characteristics of these ıips.

TABLE B-1

Comparison of Tanker Ship Characteristics

Name	DWT	Length (feet)	Beam (feet)	Draft (feet)	SHP
CHEVRON FRANKFURT	78,872	759	121	36 1/	19,000
80,000 dwt CAORF model (75 percent loaded)	80,000	763	125	34	20,000
EL PASO ARZEW	N/A	948	135	34 2/	40,000

/ Most frequent arrival draft.
/ Planned arrival draft.

imulation runs using the 80,000 dwt model were compared to data available on he CHEVRON FRANKFURT. These runs were then repeated using the LNG vessel. opies of that report are on file in the District office and can be made vailable upon request. The final recommendations of that report are quoted erbatim below:

- Although there is no quantitative evidence indicating that channel improvements are essential, qualitative assessment suggests three areas to be considered for future port development.

    a. The first area would be the widening of the Bayou Casotte Channel. Providing a 300- to 350-foot channel would increase the available channel for slow speed and tug assisted operation associated with final port approach.

    b. Widening or connecting the turns in Horn Island Pass would be a potential port improvement after the widening of Bayou Casotte Channel.

APPENDIX B

DESIGN AND COST ESTIMATES

CHANNEL DESIGN

General. Full consideration was given to the Corps of Engineers design criteria contained in EM 1110-2-1613, HYDRAULIC DESIGN OF DEEP-DRAFT NAVIGATION PROJECTS, dated 8 April 1983. However, it was determined that significant deviation from Corps criteria was justified in the present case. Considerations of channel width involved estimation of vessel traffic density to determine whether a two-way or a one-way channel would be needed. Other factors influencing the formulation of channel width include environmental conditions in the area such as winds, waves, currents, and tides as well as the nature or character of the bottom sediments. A final consideration was a report conducted by the computer aided operations research facility (CAORF) for the Tennessee Gas Transmission Company (TENNECO) which investigated the ability of a LNG carrier to safely transit the existing channels at Pascagoula Harbor. Recommended dimensions and design rationale will be discussed in greater detail below.

A nominal depth of 42 feet for all channels was selected by economic optimization and an additional 2 feet for wave action were added to the entrance channel, making that channel 44 feet deep. Allowances of 2 feet for advanced maintenance and 2 feet for dredging tolerance were made in computing dredging quantities. The existing width of 350 feet in the Pascagoula River channel is considered adequate for all present and projected traffic but the Bayou Casotte channel should be widened from 225 feet to 350 feet.

The improved channel dimensions should be constructed along the existing alignment, with the minor exceptions discussed below. The Bayou Casotte channel would be widened on both sides of the existing centerline to the bayou mouth. The Entrance Channel would begin at deep water, or about at the 44-foot depth contour, in the Gulf of Mexico and end at P.I. 1 (Mile 11), the bend north of Petit Bois Island, which marks the transition to the Mississippi Sound channel. The improved portion of the Pascagoula River channel would end just downstream of the grain elevator. The improved Bayou Casotte channel would include a new turning basin just inside the mouth of the bayou and would end at the northern limit of that basin.

Applicable Prior Studies. During the present study it was learned that the CAORF Research Staff at the National Maritime Research Center, Kings Point, New York, had performed a simulation study for Tenneco for a LNG ship at Pascagoula Harbor in which the existing channel dimensions were used. That report was used by Tenneco in their consideration of Pascagoula (actually Bayou Casotte) as the site for a LNG terminal. The report title is "Investigation of Limiting Channel Conditions for LNG Vessel Transit Into the Port of

Appendix B, Design and Cost Estimates, has been extensively rewritten as the result of high-level review. While much of the original material has been retained, the changes in pagination made it impractical to identify pages containing revisions individually.

PASCAGOULA HARBOR, MISSISSIPPI
APPENDIX B
DESIGN AND COST ESTIMATES

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PASCAGOULA HARBOR, MISSISSIPPI
APPENDIX B
DESIGN AND COST ESTIMATES

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APPENDIX B

DESIGN AND COST ESTIMATES

BORING LOG CONTINUATION SHEET	MOBILE DISTRICT CORPS OF ENGINEERS	SHEET 2 OF 2 SHEETS
PROJECT PASCAGOULA CHANNEL DEEPENING	ELEVATION TOP OF HOLE −39.5 ± 2'	

DEPTH 18.0'	W/C %	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	BLOWS PER FT. (N)
			TAN SILTY SAND (SM)	12
				44
				20
22.5				
			TAN PR. GRD. SAND (SP)	98
				3
				100+
				40
28.5				
			BOTTOM OF HOLE	

NOTES: COORDINATES ARE ±200'.
DEPTHS & ELEVATIONS ARE ±2'.
USED 300 LB. HAMMER.

FORM 927-A DEC 82	REMARKS PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE	HOLE NO. SS-21-82

BORING LOG	SOUT[illegible]TLANTIC DIVISION	MOBILE DISTR[illegible] CORPS OF ENGINEERS	SHEET 1 OF 2 SHEETS

PROJECT AND LOCATION: PASCAGOULA CHANNEL DEEPENING

COORDINATES: N 206,134 E 603,450	SIZE & TYPE OF BIT: SPLITSPOON; 300 LB. HAMMER
DRILLING AGENCY: MOBILE DISTRICT	TYPE OF DRILL: F-314; SEAHORSE BARGE
	ELEVATION DATUM: ☐ NGVD ☒ MSL
HOLE NO.: SS-21-82	ELEVATION TOP OF HOLE: -39.5' ±2'
NAME OF DRILLER, INSPECTOR: J. DETLOFF; B. BRYANT	TOTAL NO. OF OVER-BURDEN SAMPLES: DISTURBED 19; UNDISTURBED NONE
DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	DATE DRILLED: STARTED 9-29-82; COMPLETED 9-29-82
THICKNESS OF OVERBURDEN	TOTAL NO. OF CORE BOXES / TOTAL CORE RECOVERY
DEPTH DRILLED INTO ROCK	GROUND WATER FIRST ENCOUNTERED AT
TOTAL DEPTH OF HOLE 28.5'	STATIC GROUND WATER AT ON

DEPTH IN FT. 0.0'	W/C %	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	BLOWS PER FT. (N)
0.0–1.5			GREENISH GRAY CLAYEY SAND, HIGH LL (SC-H)	WH
1.5–3.0			GREENISH GRAY FAT CLAY (CH) W/SOME SAND	WH
3.0–9.0			GREENISH GRAY CLAYEY SAND, HIGH LL (SC-H) — TAN	WH WH WH 9
9.0–10.5			TAN SANDY FAT CLAY (CH)	15
10.5–12.0			TAN SILTY SAND (SM) W/TR. OF SHELL, SL. PLASTIC	9
12.0–13.5			TAN PR. GRD. SILTY SAND (SP-SM)	4
13.5–15.0			BROWN CLAYEY SAND (SC)	5
15.0–18.0			BROWN SILTY SAND (SM) SL. PLASTIC	8 2

CONT. ON SHEET 2

FORM 927 DEC 82	REMARKS PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE	HOLE NO. SS-21-82

BORING LOG CONTINU[illegible]ON SHEET	MOBILE DISTRI[illegible] CORPS OF ENGINEERS	SHEET 3 OF 3 SHEETS

PROJECT	ELEVATION TOP OF HOLE
PASCAGOULA CHANNEL DEEPENING	-25.0' ± 2'

DEPTH 42.0'	W/C %	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	BLOWS PER FT. (N)	
			TAN PR. GRD. SAND (SP)	35	
				20	
45.0			BOTTOM OF HOLE		

NOTES: COORDINATES ARE ± 200'.
DEPTHS & ELEVATIONS ARE ± 2'.
USED 300 LB. HAMMER.

FORM 927-A DEC 82	REMARKS PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE	HOLE NO. SS-20-82

BORING LOG CONTINUATION SHEET | MOBILE DISTRICT CORPS OF ENGINEERS | SHEET 2 OF 3 SHEETS

PROJECT: PASCAGOULA CHANNEL DEEPENING

ELEVATION TOP OF HOLE: -25.0 ±2'

DEPTH 18.0'	W/C %	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	BLOWS PER FT. (N)
19.5	86		GREENISH GRAY FAT CLAY (CH) W/A LIT. SAND	WH
24.0			GREENISH GRAY CLAYEY SAND, HIGH LL (SC-H)	WH WH WH
25.5			GREENISH GRAY FAT CLAY (CH), SANDY	4
27.0			DK. BROWN SILTY FAT CLAY (CH) W/SOME SAND & TR. ORG. MATTER	6
28.5			GREENISH GRAY CLAYEY SAND, HIGH LL (SC-H)	3
30.0			GREENISH GRAY CLAYEY SAND (SC)	24
31.5			TAN SILTY SAND (SM)	55
37.5			TAN PR. GRD. SAND (SP)	26 34 24 7
39.0			90% LARGE DECOM. ROOTS W/TR. OF SAND	22
42.0			TAN PR. GRD. SAND (SP)	55 19

CONT. ON SHEET 3

FORM 927-A DEC 82 | REMARKS | HOLE NO. SS-20-82

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE

BORING LOG	SOUTH ATLANTIC DIVISION	MOBILE DISTRICT CORPS OF ENGINEERS	SHEET 1 OF 3 SHEETS

PROJECT AND LOCATION: PASCAGOULA CHANNEL DEEPENING

COORDINATES: N 210,293 E 602,549	SIZE & TYPE OF BIT: SPLITSPOON; 300 LB. HAMMER
DRILLING AGENCY: MOBILE DISTRICT	TYPE OF DRILL: F-314; SEAHORSE BARGE
	ELEVATION DATUM: ☐ NGVD ☒ MSL
HOLE NO.: SS-20-82	ELEVATION TOP OF HOLE: -35.0' ±2'
NAME OF DRILLER, INSPECTOR: J. DETLOFF; B. BRYANT	TOTAL NO. OF OVER-BURDEN SAMPLES: DISTURBED 30; UNDISTURBED NONE
DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	DATE DRILLED: STARTED 9-28-82; COMPLETED 9-28-82
THICKNESS OF OVERBURDEN	TOTAL NO. OF CORE BOXES / TOTAL CORE RECOVERY
DEPTH DRILLED INTO ROCK	GROUND WATER FIRST ENCOUNTERED AT
TOTAL DEPTH OF HOLE: 45.0'	STATIC GROUND WATER AT / ON

DEPTH IN FT.	W/C %	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	BLOWS PER FT. (N)
0.0	97		GREENISH GRAY SILTY FAT CLAY (CH) W/A TR. OF SAND	WH
	96			WH
3.0	85			WH
	85			WH
6.0	78			WH
	85		GREENISH GRAY FAT CLAY (CH) W/A TR. OF SAND	WH
9.0	111			WH
				WH
12.0	105			WH
	89			WH
15.0	3			WH
16.5			W/A LIT. SAND	WH
18.0				

CONT. ON SHEET 2

FORM 927 DEC 82 | REMARKS | HOLE NO. SS-20-82

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE

BORING LOG CONTINUATION SHEET		MOBILE DISTRICT CORPS OF ENGINEERS		SHEET OF 2 SHEETS
PROJECT PASCAGOULA CHANNEL DEEPENING			ELEVATION TOP OF HOLE -49.5' ±2'	

DEPTH 18.0'	W/C %	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	BLOWS PER FT (N)
19.0'	64		GREENISH GRAY FAT CLAY (CH) W/A TR. OF SAND	WH
			BOTTOM OF HOLE	

NOTES: COORDINATES ARE ±200'.
DEPTHS & ELEVATIONS ARE ±2'.
USED 300 LB. HAMMER.

FORM 927-A DEC 82	REMARKS	HOLE NO. SS-14-82
	PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE	

be statically at the same location. The amount of sinkage which occurs depends on the speed of the vessel through the water, the cross sectional area of the channel, whether it is through a wide or narrow waterway, whether the vessel is passing or overtaking another vessel, the location of the vessel relative to the center line of the channel, and the hull characteristics of the ship itself. Although the sinkage effect is most pronounced in restricted canals and channels in shallow estuaries, it occurs under all conditions of steaming.

Since the existing project being considered for improvement consists of an open water channel in a naturally shallow bay (Mississippi Sound), the equivalent of a land cut canal (inside Bayou Casotte), and a river section (above the mouth of Pascagoula River), each having different characteristics, vessel squat could vary between the three sections. The sound channel, although subject to cross current and wind effect, is wider, not completely confined and not expected to induce vessel squat to the extent of the Bayou Casotte and Pascagoula River sections. Those sections would afford some protection from wind effects and would not be subject to cross currents.

No definite allowance for squat can be fixed that would be applicable to all vessels on a particular waterway. However, based on available information, it is considered that an allowance of 1 foot would be generally adequate for the vessels expected to use the channel.

Another factor which must be considered in computing vessel clearance is the additional sinkage which occurs when the vessel passes from sea water into fresh or brackish water having a lower specific gravity. However, since the improved channel would be only 8 feet deeper that that presently existing and since salt water tends to follow deep water paths, it is estimated that after construction of the improvements the additional sinkage due to the slight change in density of the water would be insignificant. Therefore no allowance was made for this factor.

According to navigation interests, vessels are often trimmed so that the stern is from 1 to 3 feet deeper than the bow (4 feet for LNG carriers). This is done to give the vessel better handling characteristics. An average allowance of 1 foot added to the mean draft amidships is considered warranted for this factor.

Other factors which influence vessel sinkage below static draft such as pitch, roll, and heave, occur under the influence of strong wind and wave forces in open sea conditions. Provision of a depth in the outer bar channel 2 feet greater than in the more protected sound channel has proven to be satisfactory for vessels using the existing project.

In addition to the draft allowances discussed thus far, a clearance is also needed between the ship keel and the bottom of the channel as a safety measure and to facilitate maneuverability. Due to the soft "fluff" nature of the bottom material throughout the present project, a bottom clearance of 2 feet in addition to the other allowances is considered adequate.

In view of the draft allowances and clearances discussed in the preceding paragraphs for vessel squat, trim, wave action in exposed channels, and safety clearance, a total depth of 6 feet over the outer bar and 4 feet in the inner channels in addition to the mean static draft of expected vessels is considered appropriate.

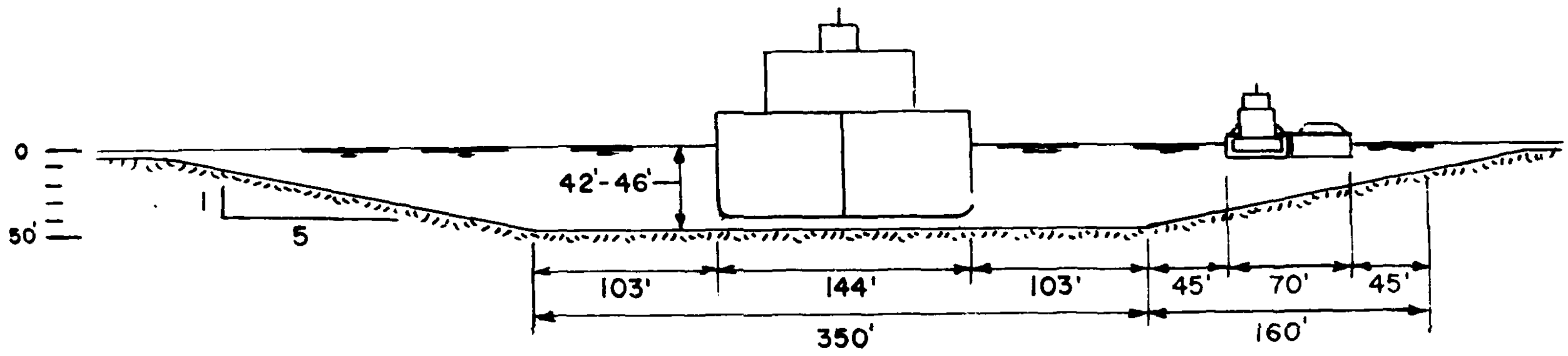
Navigation benefits were derived in Appendix C for several channel depths in the range considered. A comparison of annual benefits and charges are shown in both that appendix and the main report. Under all alternatives considered, maximization of benefits was realized at the 42-foot depth. Since vessels do not necessarily operate according to Corps criteria, due allowance for actual operating practices was made in computing benefits.

<u>One-way Traffic</u>. For many years the Pascagoula Harbor project has been operated as a one-way channel for all large vessels. It is the consensus of both the Bar Pilots Association and the Port Authority that there is no foreseeable need to change this operating mode. However, an analysis of vessel delays using the SLAM II computer program was performed and discussion of the results can be found in Appendix C. It was found that the reduction in delay costs was not sufficient to support widening the channel for 2-way traffic.

Table B-2 presents a summary of estimated vessel traffic expected to be calling at the port of Pascagoula and at Bayou Casotte for selected years throughout the life of the proposed plan. As indicated, the total number of deep draft vessels calling at the port at the end of the project life is 1,563. These figures are based on projected commerce and weighted average capacities of vessels anticipted to move over the waterway. Based on these assumptions, one deep-draft vessel would enter the Pascagoula Ship Channel approximately every 5.6 hours. In view of the distribution of expected commerce bewtween the two ports and various terminals, the indicated traffic densities are considered to be well within the capacity of the proposed waterway.

It is not anticipated that barge traffic will be sufficiently dense to constitute a major hazard to deep-draft traffic. In addition, the 1 on 5 sideslope common to this area provides a safe barge channel width of 150 feet over the sideslope and completely outside the ship channel (see Figure B-1). For comparison, the authorized width of the GIWW is 150 feet through this region. With a large ship centered in the channel and the tow centered over the sideslope clearance (a conservative assumption) there would be 148 feet of clearance between them, which seems adequate for safety. South of the intersection between the Pascagoula River channel and the Bayou Casotte channel, the natural depths in Mississippi Sound are sufficient for a barge to completely leave the ship channel with safety. In addition, there is good coordination between the ship pilots and the tug captains via two-way radio and ship/barge passing is not considered to be a problem by the pilots.

<u>Channel Width</u>. Determination of an adequate channel width is dependent upon the vessel beam and other characteristics, traffic density, one- or two-way traffic, the alignment of the channel, and the environmental forces to which vessels navigating the channel would be subjected. With the exception of the



CHANNEL SECTION

SHIP/BARGE CHANNEL PASSING CLEARANCE

FIGURE B-1

Table B-2

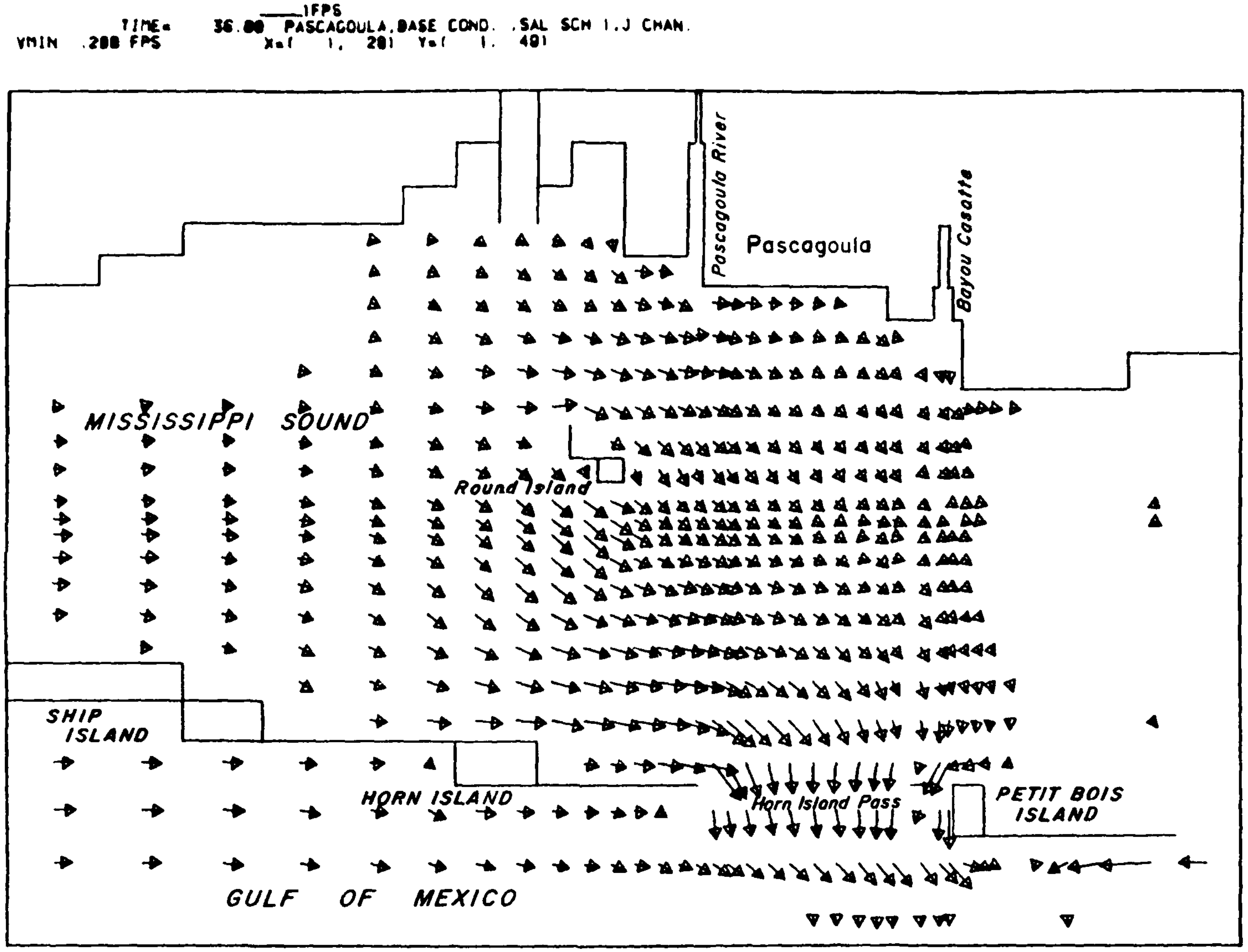
Summary of Deep-Draft Vessels Calling at Pascagoula Harbor for Selected Years During the Project Life

Channel Depth	Number of vessels 1995	2000	2010	2020	2030	2040	2044
38-Foot Channel							
Pascagoula River Channel	206	228	273	319	366	414	434
Bayou Casotte Channel	1157	1172	1208	1245	1291	1337	1356
TOTAL	1363	1400	1481	1564	1657	1751	1790
42-foot channel							
Pascagoula River Channel	144	156	188	222	254	290	306
Bayou Casotte Channel	1064	1079	1113	1150	1194	1238	1257
TOTAL	1208	1235	1301	1372	1448	1528	1563

turns discussed in "Bend Widening", the considered channel alignments would be straight. Cross currents and wind forces are expected to affect navigation in the Mississippi Sound channels to a greater degree than in the those portions in the inner harbors.

Bottom width of the channel was determined on the basis of a loaded design vessel (crude oil tanker) transiting the channel under one way conditions. According to EM 1110-2-1613, dated 8 April 1983, a channel with a bottom width of 430 feet should be recommended. In consideration of the other factors discussed above, however, it is recommended that a channel width of 350 feet be considered ample for the present study and that the final width be determined by the simulation modeling required by ETL 1110-2-289, ENGINEERING AND DESIGN, SHIP AND TOW SIMULATORS, dated 5 December 1983, during the next phase of study. In view of the indications that a 300-foot width might be adequate, this position is considered conservative.

Entrance Channel. The present entrance channel alignment is the result of historical modifications which have produced a channel crossing the opening between Petit Bois and Horn Islands at an angle to the observed tidal discharge. Data from the Mississippi Sound numerical model (Figure B-2) indicates direct cross currents of 0.7 feet/second south of Horn Island Pass and



MISSISSIPPI SOUND NUMERICAL MODEL-GRAPHIC PRINTOUT OF RESULTS FOR MAXIMUM EBB TIDE WITH 9 M.P.H. NNW WIND.

FIGURE B-2

other cross currents of 0.4 feet/second north of the pass. These currents are generated in the model by an ebb tide and a northwest wind of 9 miles/hour. These currents are located in the transition between the Gulf of Mexico and Mississippi Sound and when combined with increased wave action can cause serious navigation problems.

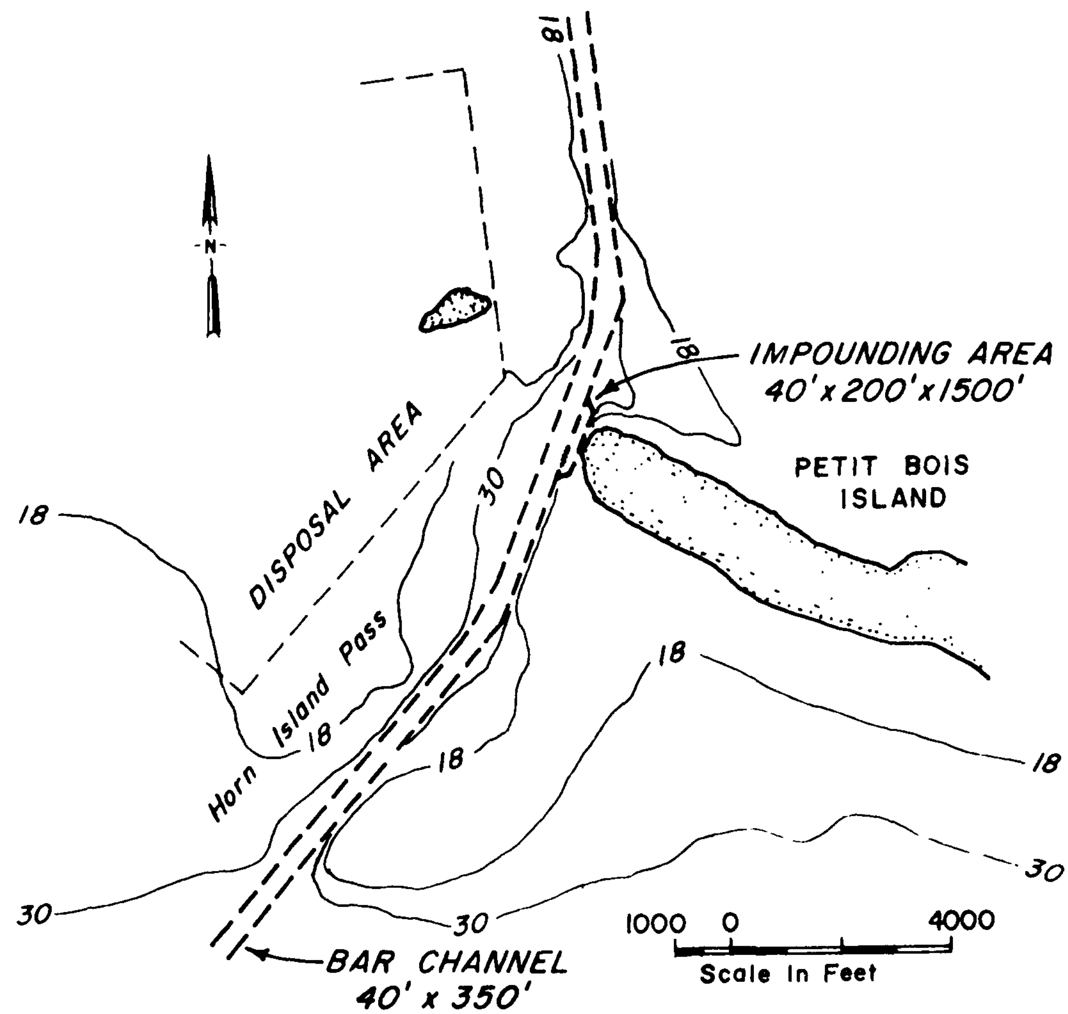
In discussions with the bar pilots they have stated that it is not uncommon to encounter cross currents in the entrance channel which they estimate to be in excess of 1 knot. A ship transiting that channel under those conditions must travel at an angle to the channel centerline to compensate.

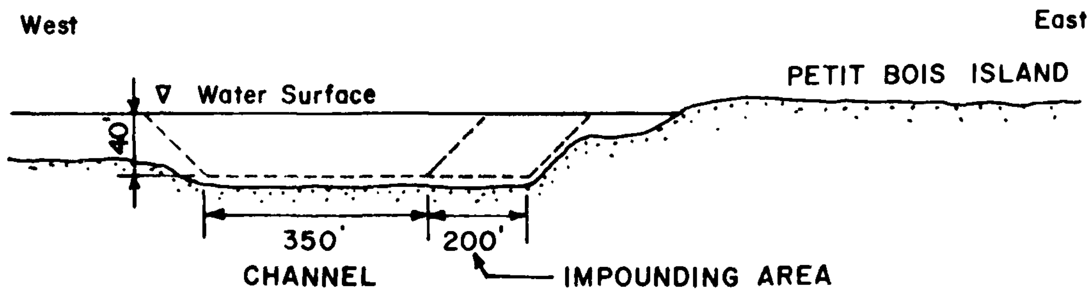
Results from the CAORF simulation experiment performed for Tenneco indicated that the LNG tanker could safely navigate the existing channels at Pascagoula Harbor. However, those test results also indicated that under certain adverse conditions the width of the swept path of the entering tanker was approaching the width of the entrance channel.

Based on this information and experience from the design of the Mobile Ship Channel, it is recommended that the gulf entrance channel be 200 feet wider than the more protected sound channel for a total channel width of 550 feet. In addition, the bends at each end of Horn Island Pass should be widened an additional 50 feet. Since the resulting distance between bend widening tangents is short, and Horn Island Pass presents the most serious navigation problems, it is recommended that all of Horn Island Pass be widened between the bends to provide a total width of 600 feet. Widening of the entrance channel should begin with a transition section starting about 1 mile north of the north end of Horn Island Pass and extending to the end of the channel in the Gulf of Mexico.

Entrance Channel Impoundment Basin. During prior improvements, an impoundment basin about 1,500 feet long and 200 feet wide and at channel depth was constructed between Petit Bois Island and the entrance channel (see Figure B-3). The basin was intended to catch littoral drift moving westwardly around that island and facilitate its removal by pipeline dredge. However, the volume of drift moving along the gulf face is sufficient to push a shoal across the basin in a relatively short time after dredging so that it begins to intrude into the channel and hinder navigation. In addition, the material removed by pipeline dredge has not been effectively returned to the littoral system. To provide beneficial use of the sand removed from the entrance channel, it should be deposited in a nearshore area where it could return to the system. To facilitate the use of a hopper dredge, it is proposed to reconfigure the basin so that it lies beneath, rather than beside, the channel (see Figure B-4). For the purpose of the present study, a replacement on a purely volumetric basis was used. That change should have no significant effect on the existing flow conditions. During detailed design, further attention will be given to optimizing the effectiveness of the basin.

Bend Widening. Due to the displacement resulting from the tendency of the stern of a vessel to follow a path to the outside of the bow track, widening of channels at bends is essential for safe navigation. All bend widening would be in accordance with the cutoff, or apex, method presented in



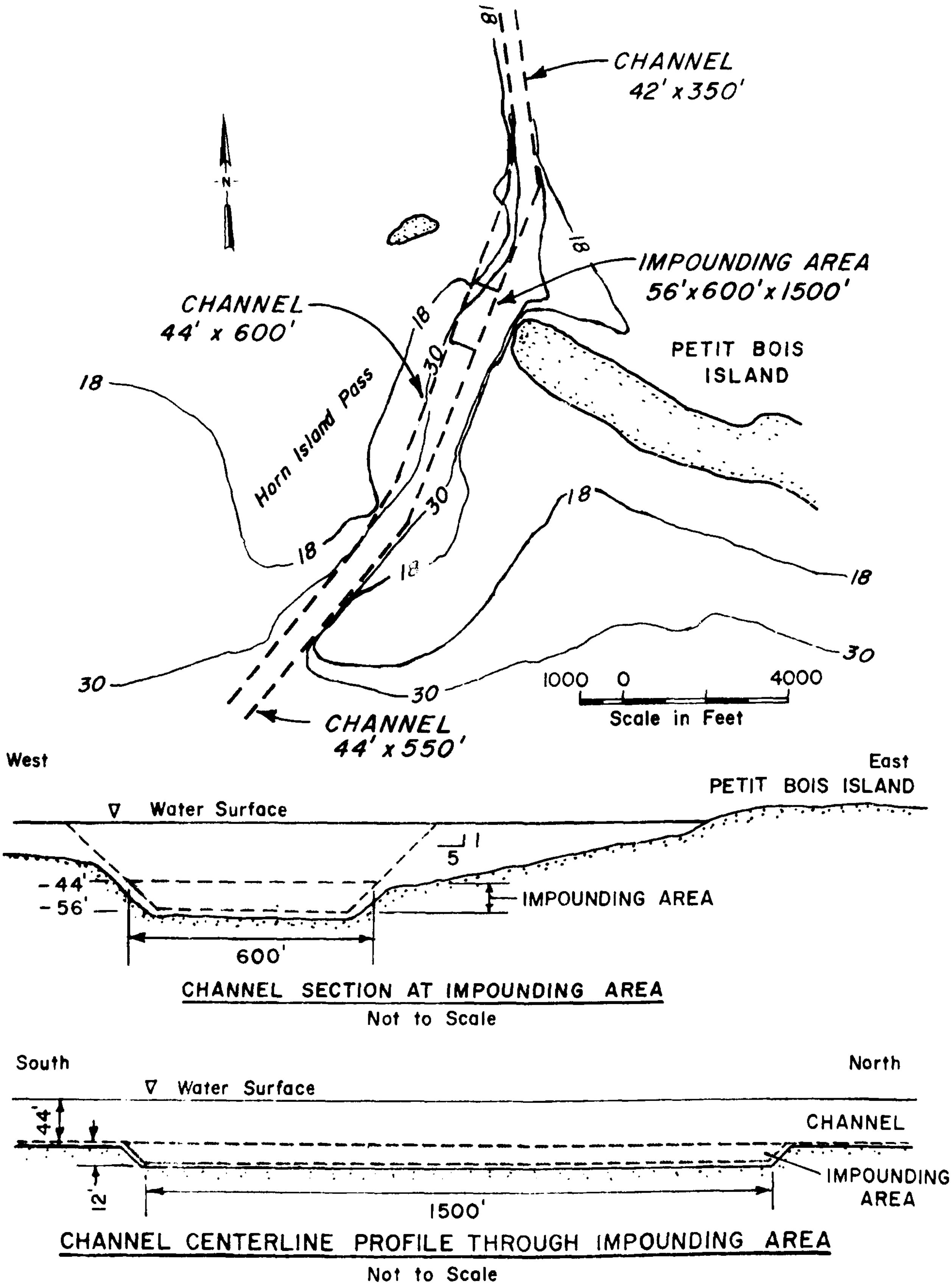


CHANNEL AND IMPOUNDING AREA SECTION

Not to Scale

EXISTING PROJECT
CONFIGURATION

FIGURE B-3



RECOMMENDED PLAN CONFIGURATION

FIGURE B-4

EM 1110-2-1613. The two turns in Horn Island Pass, with a total deflection of 47 degrees, were discussed above. Other areas considered for widening were:

(1) The intersection of the Pascagoula River and Bayou Casotte channels, where the bend into the Pascagoula River channel would be widened to 250 feet from the present 150 feet and the point between the two channels would be relieved an additional 500 feet to 1,000 feet,

(2) The 44 degree double turn at the upper end of the Pascagoula River leg, which would be widened by 280 feet, and

(3) The 15 degree turn at the entrance to Bayou Casotte, which would be widened to 100 feet from the existing 50 feet.

Detailed hydrographic surveys will be required prior to final design. In addition, particular emphasis will be made on bend widening in the proposed simulation study and further modifications will be made as indicated.

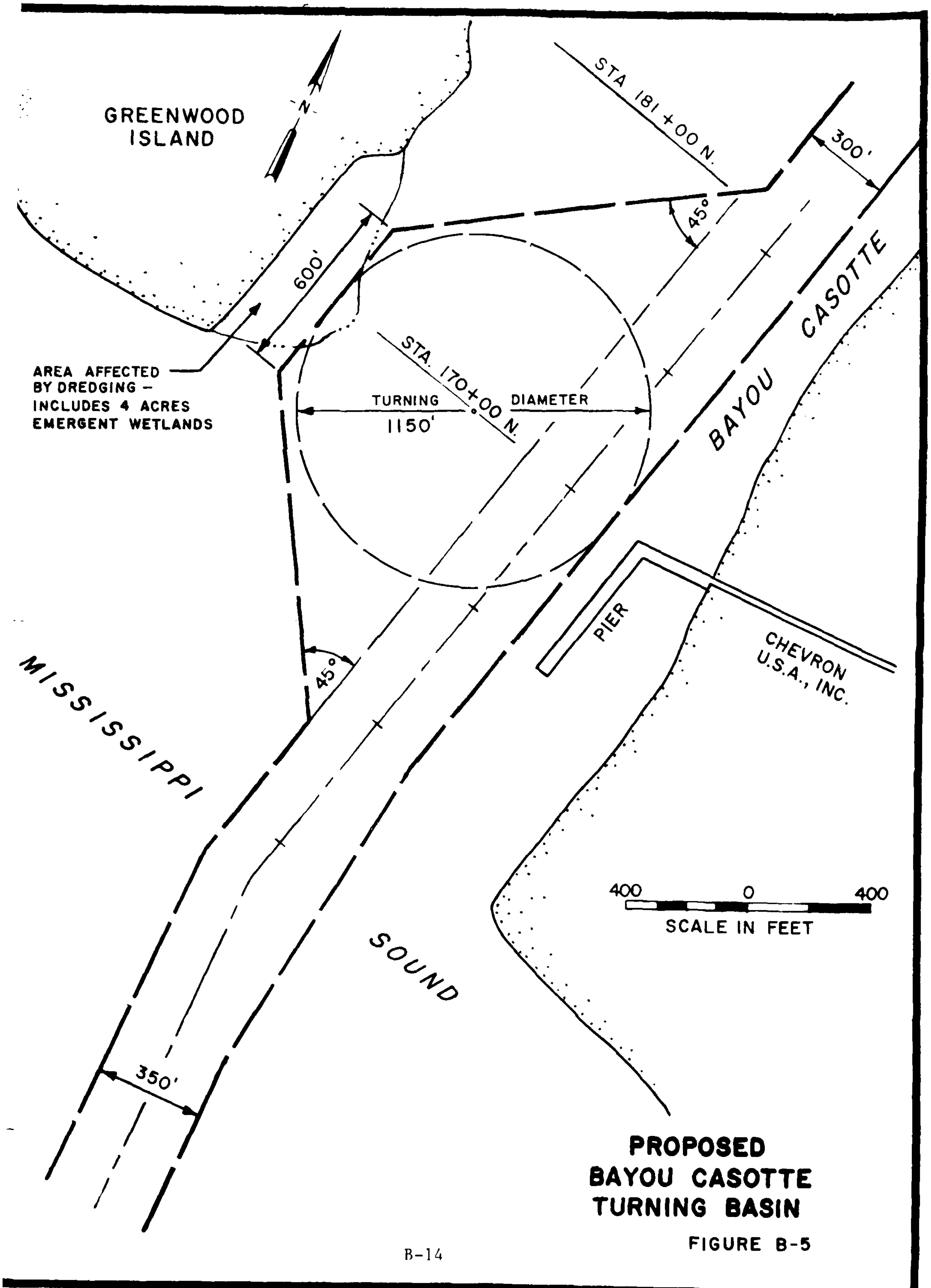
Turning Basin. Users of the Bayou Casotte channel must now traverse about a mile of relatively congested waterway to utilize the turning basin at the north end of the bayou channel, with commensurate costs and hazards. Provision of a basin at the mouth would decrease congestion in the upper channel and thereby improve navigation safety. Chevron Shipping officials have stated that they would prefer to turn their lightering tankers loaded and moor them for unloading facing south as an additional safety factor. This is considered impractical and unsafe under present conditions since it would require moving a heavily loaded tanker with a floating fender system tied alongside through a congested waterway. The newer 80,000 dwt tankers have a fender system which can be deployed by deck machinery as they approach the dock.

In accordance with EM 1110-2-1613, the proposed turning basin was designed to provide a minimum circular turning area with a diameter of 1,150 feet (1.5 x 763 rounded). The 1,150-foot turning diameter includes the proposed 350-foot channel. However, based on an evaluation of the factors in that area, it is recommended that the short side of the basin be reduced to 600 feet from the 1,150 feet indicated by Corps critera. The Chevron Frankfurt, with a length of about 760 feet, is presently turning in the present basin with a width of 950 feet. Fresh water inflow into the bayou is very low under normal conditions, so that the only currents are tidal and wind and wave action have a minimal effect on turning vessels. Side slopes within the basin will be flat (1 on 5) and the bottom will be soft mud.

The basin would be centered on Station 170 + 00 N inside the mouth of the bayou. The turning basin would terminate at about Station 181 + 00 N which would also be the end of the improved channel for Bayou Casotte. Figure B-5 shows the general layout and dimensions of the proposed turning basin.

DREDGED MATERIAL DISPOSAL

Bayou Casotte Channel. The new work material from widening the Bayou Casotte channel from 225 feet to 350 feet and constructing the new turning basin,



PROPOSED BAYOU CASOTTE TURNING BASIN

FIGURE B-5

estimated to be 6,260,000 cubic yards, would be removed by pipeline dredge discharging into bottom-dump hopper barges to be transported some 14 miles southwest into the Gulf of Mexico and dumped between the 50- and 60-foot depth contours. The turning basin is within the polluted portion of the bayou; however, the pollutants are mostly concentrated in the top 4 feet. Since most of the turning basin is in previously undisturbed material, pollutants will therefore be diluted to well below acceptable limits during construction dredging.

Inner Harbors-Pascagoula and Bayou Casotte. Deepening the Pascagoula River portion would require the removal of an estimated 623,000 cubic yards of polluted material which would be placed in the Double Barrel disposal area. That amount would not significantly affect the long-term disposal capacity of that area. Future maintenance material from Pascagoula River would be placed in either the Double Barrel area or in the Singing River Island area, as indicated by good management practice at the time. Future maintenance material from the inner harbor at Bayou Casotte, including the turning basin, would be placed in the Greenwood Island disposal area.

Main Channel. New work material from deepening the present 350-foot wide channel from the mouth of the Pascagoula River to the junction with the Bayou Casotte Channel and then south to the Beginning of the Entrance Channel at Horn Island Pass would require dredging 4,866,000 cubic yards of material. The material would be removed by pipeline dredge discharging into bottom-dump hopper barges which would then transport that material some 14 miles southwest into the Gulf of Mexico to be dumped between the 50- and 60-foot depth contours. All future maintenance material from the channels within Mississippi Sound, which would also include the Bayou Casotte leg between the bayou mouth and the junction with the Pascagoula Channel, would be placed in the open water disposal areas in Mississippi Sound which are presently in use.

Entrance Channel. Hopper dredging the entrance channel would require the removal of 3,348,000 cubic yards of sandy material from Horn Island Pass and the outer bar. Depending upon the size of the dredge performing the work, the material would be placed between the 15-foot and 30-foot depth contours in an area to the southeast of the east end of Horn Island. That area is presently designated as Area D on Plate IX. Sandy material placed in that area should generally move to the northwest, nourishing the eroding end of Horn Island.

RELOCATIONS

Usually relocations are the responsibility of the local sponsor. However, at Pascagoula Harbor relocation of the cable and pipelines is the responsibility of the owners, since this was a condition in the permit for construction under Section 10 of the River and Harbor Act of 1899.

Cable. A telephone cable belonging to the South Central Bell Telephone Company crosses the project above the mouth of Pascagoula River near the Ingalls Shipyard. The Department of the Army permit, dated 15 October 1968, licates that the top of the cable is 48 feet below mean low water. :pening of the Pascagoula River Channel will require the relocation of the ›le to a minimum depth of 52 feet.

›elines. Three submarine pipelines cross the project channels. One 20-inch ıde oil pipeline owned by the Chevron Pipeline Company crosses the Bayou ıotte Channel about 1-1/2 miles south of the bayou mouth. It also crosses : Pascagoula Channel about 3-1/2 miles south of the river mouth. The)-of-line (TOL) elevation at each crossing is 50 feet below mean low water .W). The two remaining pipelines, 12-inch and 16-inch natural gas lines, : owned by the Chandeleur Pipeline Company. They cross the main channel)ut 3/4 mile south of the intersection of the two channels. The TOL eleva-)n for the 12-inch line is -50 feet MLW and for the 16-inch line is -60 feet V. In addition, two "blanks" for future use, a 12-inch and a 20-inch, have :n installed at the same location. Both blanks have a TOL elevation of -60 :t MLW. All pipeline crossings were authorized by Department of Army :mits.

:sent standards require 10 feet of clearance from the bottom of the channel the TOL elevation for safety purposes. All pipelines with a TOL above :vation -56 feet would therefore have to be relocated. The Chevron pipeline ıld have to be relocated where it crosses both channels. The 12-inch pipe- ıe owned by Chandeleur P]ipeline Company would have to be lowered to at ast 56 feet below MLW. The other pipelines are not affected.

LTURAL RESOURCES

the tip of Greenwood Island, within the area which would be dredged for the nstruction of the proposed turning basin, there are two archeological sites th both prehistoric and historic value. These are sites 22Ja516 and Ja618. Prior to construction, those sites would be excavated and recovered tifacts would be preserved and curated. These sites are presently being oted by collectors; therefore, this action is favorable to State officials.

TIGATION

e recommended plan would result in the unavoidable loss of approximately ur acres of emergent wetlands, located at the southeast tip of Greenwood land, during the construction of the Bayou Casotte turning basin. In order mitigate for the loss of this habitat, it is proposed that six acres of sturbed wetland habitat located south of the Greenwood Island disposal site restored to its previous natural emergent nature. The impacts to this ea, associated with the use of the Greenwood Island disposal area, have sulted in increased elevations in portions of the wetland and impoundment of her areas. By shaving down and removing high areas, daily tidal inundation uld be restored and the area would begin to function as a productive wet- nd. The necessity and justification for this action are discussed in much eater detail elsewhere in this report.

COST ESTIMATES

Costs consist principally of dredging. These costs are based on current prices for maintenance dredging at Pascagoula Harbor and information received from the Water Resources Support Center. The first costs given in this appendix were estimated for the selected plan (Modified Plan A) as described in DETAILED DESCRIPTION OF THE SELECTED PLAN in the main report. Dredging costs were based on the quantities of new work for the selected plan listed in Table B-3. Estimated first costs, shown in Table B-4, are based on October 1984 values. That table also includes the estimated costs for advanced engineering and design.

INTEREST DURING CONSTRUCTION (IDC)

IDC was computed using the uniform series compound amount factor (USCAF) method for the estimated construction period of the pipeline dredging. Since the hopper dredging would take about half the time as the pipeline work, it would be logical for that work to begin about the middle of the period so all construction would finish concurrently. The total construction cost was assumed to be expended uniformly each month over the construction time and IDC was computed using the USCAF with an 8-3/8% interest rate. It is recognized that this is only a crude approximation to actual conditions and slightly overstates the actual IDC. The method is simple to use, however, and the result is conservative.

ANNUAL CHARGES

Total annual charges are summarized in Table B-5. These include interest, amortization, and future maintenance for the considered plan of improvement. Charges are given for both Federal and non-Federal interests. Estimates were based upon October 1984 dollars, an interest rate of 8-3/8%, and an economic period of analysis of 50 years (1995-2044).

PLANNING, DESIGN, AND CONSTRUCTION

In accordance with SADvR 1110-2-4, dated 22 August 1983, an estimate of Continued Planning and Engineering costs is shown in Table B-6 and a summary time-scaled network showing preconstruction planning and construction is shown on Figure B-6.

Table B-3

Dredging Quantities for Construction of the Selected Plan
(cubic yards)

	Quantity
goula River Channel (Main Channel)	
Inner Harbor	623,000
Mississippi Sound	4,866,000
a Casotte Channel and Turning Basin	6,260,000
Total Pipeline Dredging	11,749,000
Entrance Channel	
Total Hopper Dredging	3,348,000
l Dredging Quantity for Construction	15,097,000

: The above volumes include local dredging for berthing and ss.

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APPENDIX C
BENEFIT EVALUATION

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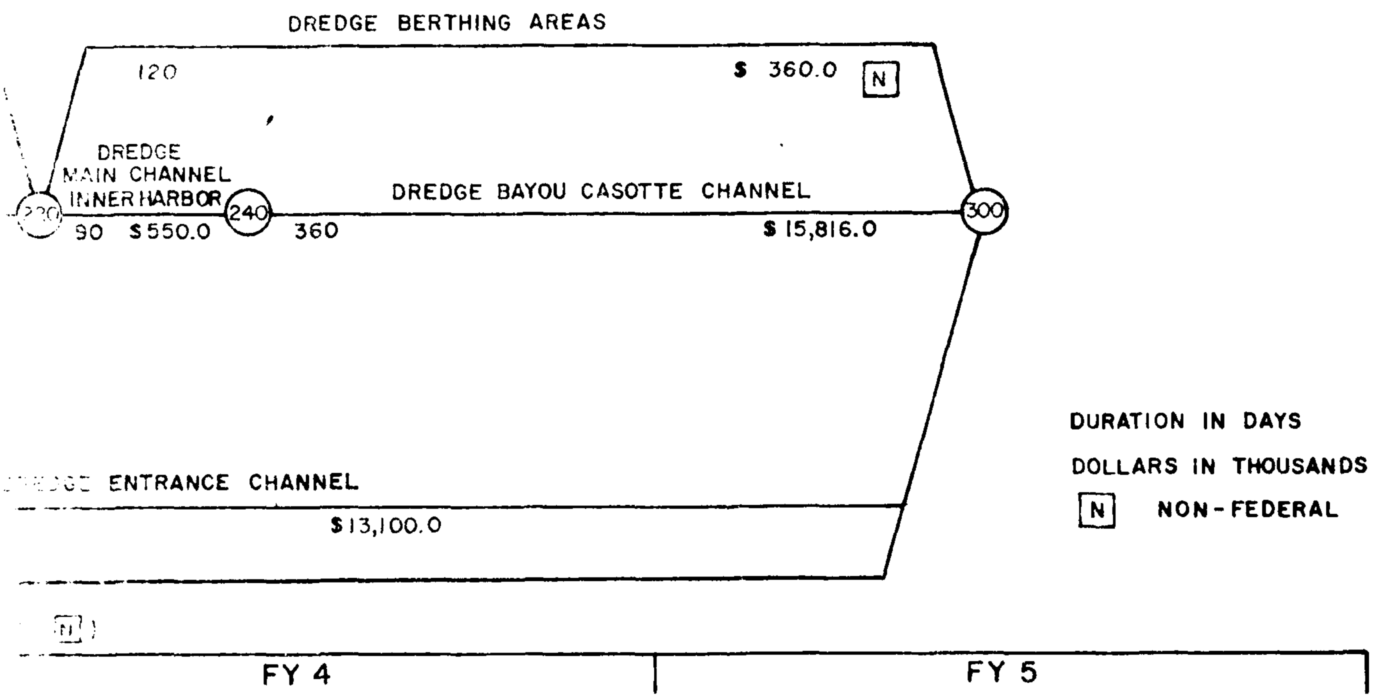
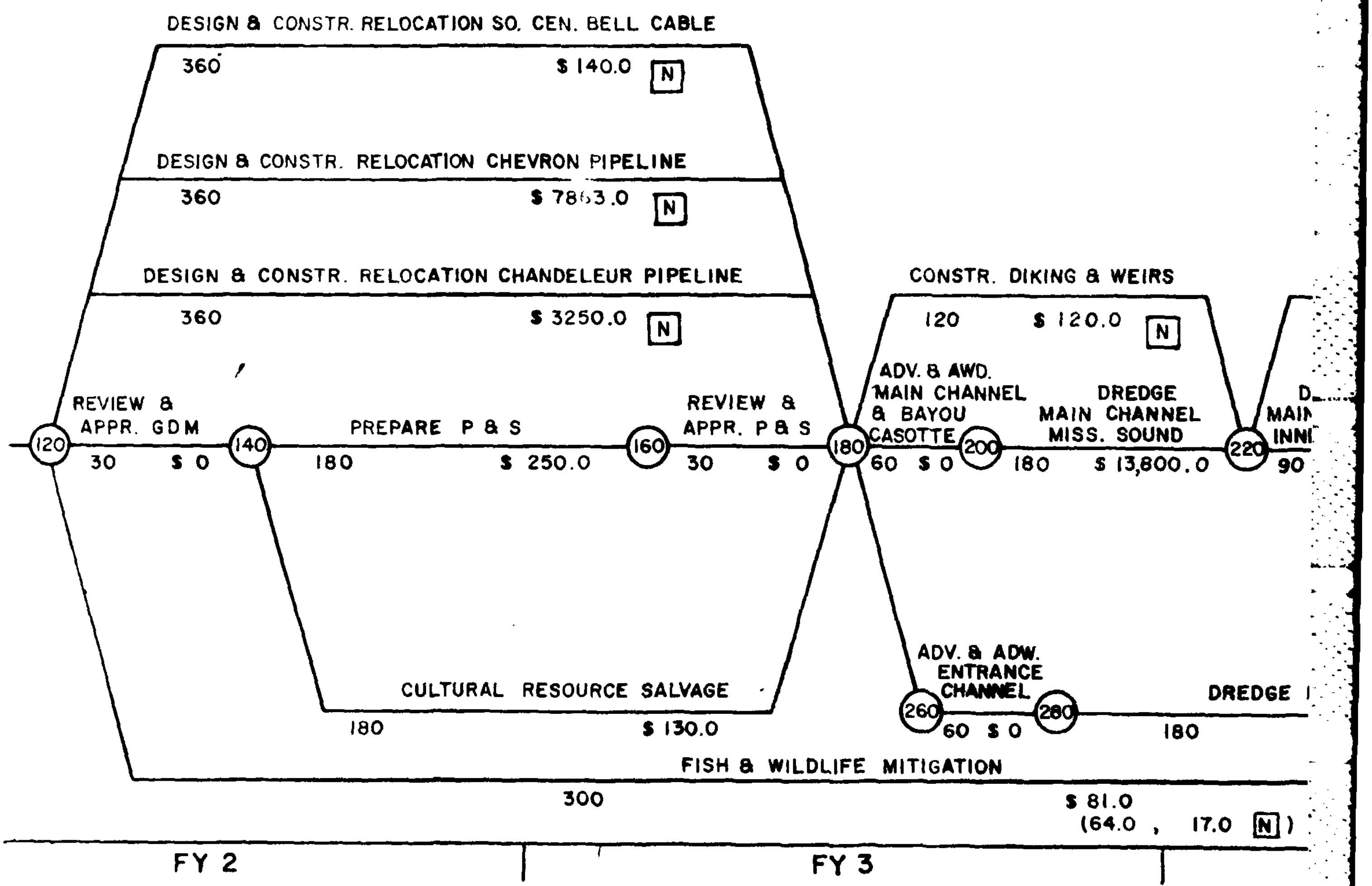


SCHEDULING DIAGRAM

Preconstruction Planning and Construction Activities
PASCAGOULA HARBOR, MISSISSIPPI

FIGURE B-6

3



-rements By Fiscal Year		
4 th	5 th	Total
15,000,000	3,030,000	$ 45,530,000
360,000	—	$ 11,750,000

NOTE:
FOR THE PURPOSES OF THIS NETWORK, IT WAS ASSUMED THAT THE PROJECT WOULD BE AUTHORIZED DURING THE GDM PHASE.

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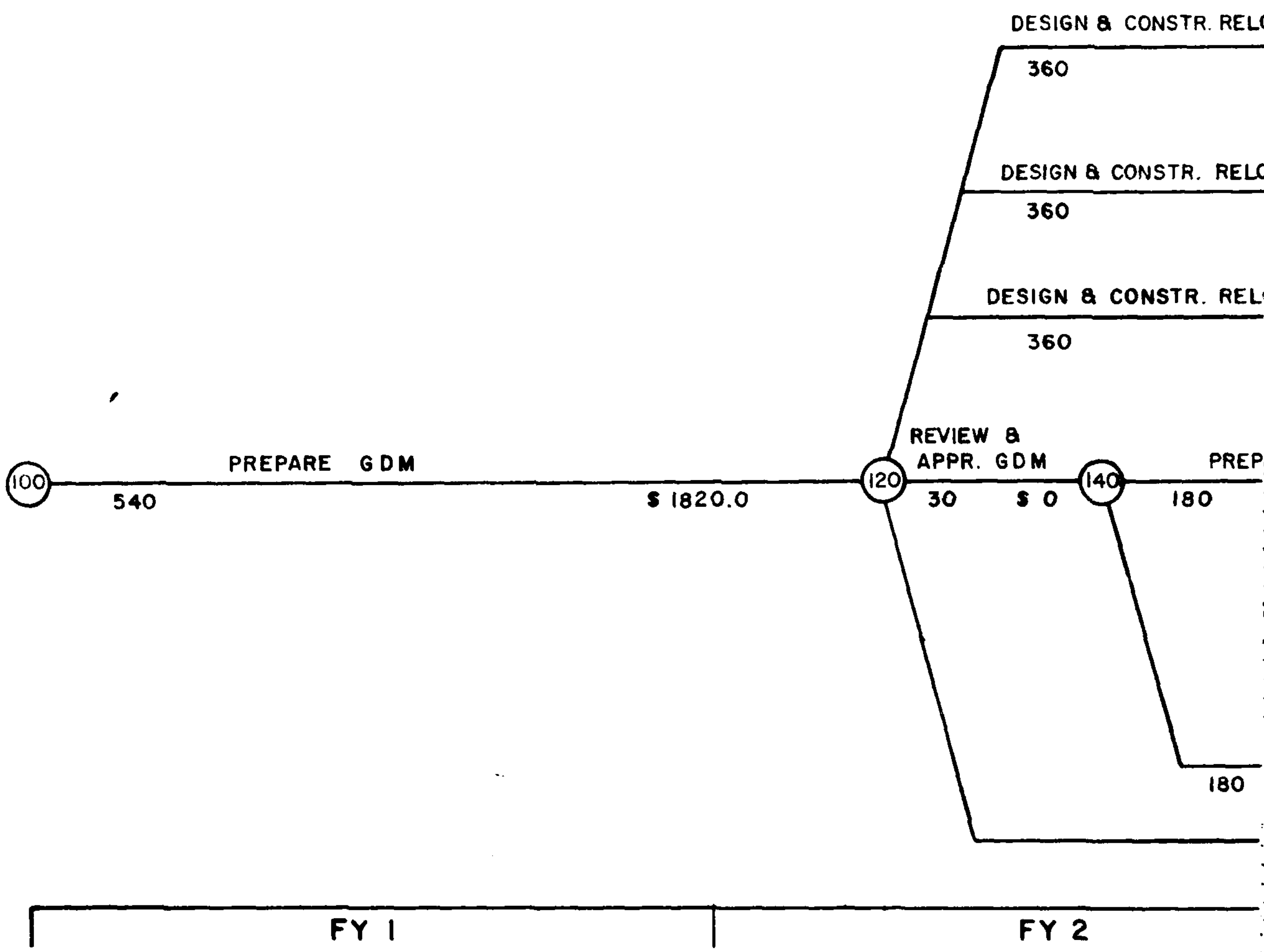

Pascagoula Harbor, Mississippi Appropriation Requirements By Fiscal Year						
	1 st	2 nd	3 rd	4 th	5 th	
Federal	$ 1,500,000	1,000,000	25,000,000	15,000,000	3,030,000	$
Non-Federal	—	8,000,000	3,390,000	360,000	—	$

Table B-6

Estimated Cost
Continuing Planning and Engineering

Item	Estimated Cost	Contingencies
Public Involvement	$ 26,000	$ 5,000
Cultural Resource Investigations	312,000	52,000
Environmental Studies (except FWS)	324,000	55,000
Fish and Wildlife Studies	26,000	5,000
Economic Studies	38,000	6,000
Surveying and Mapping	125,000	21,000
Hydrology and Hydraulic Investigations (including modeling)	151,000	26,000
Foundations and Materials Investigations	250,000	42,000
Design and Cost Estimates	62,000	10,000
Real Estate Studies	12,000	2,000
Study Management	125,000	21,000
Report Preparation	62,000	10,000
Supervision and Administration	307,000	52,000
TOTAL	$1,820,000	$307,000

Table B-5

Annual Charges for the Selected Plan

Item	Amount
INITIAL FEDERAL COST	$45,529,000
INTEREST DURING CONSTRUCTION	2,006,000
TOTAL INVESTMENT	47,536,000
FEDERAL ANNUAL CHARGES	
Interest ($47,536,000 @ 8.375%)	3,981,000
Amortization ($47,536,000 @ 0.1529%)	73,000
Maintenance Dredging	
Increase due to larger channels	
(Pipeline-120,000 cy @ $1.31/cy)	157,000
(Hopper-33,000 cy @ $4.05/cy)	134,000
TOTAL FEDERAL ANNUAL CHARGES	4,345,000
INITIAL LOCAL COST	11,750,000
INTEREST DURING CONSTRUCTION	518,000
TOTAL INVESTMENT	12,268,000
NON-FEDERAL ANNUAL CHARGES	
Interest ($12,268,000 @ 8.375%)	1,027,000
Amortization ($12,268,000 @ 0.1529%)	19,000
Maintenance Dredging	
Increase due to larger channels	
(10,000 cy @ $1.31/cy)	13,000
TOTAL NON-FEDERAL CHARGES	1,059,000
TOTAL ESTIMATED ANNUAL CHARGES	5,404,000

Table B-4 (Cont)

Estimated Initial cost for the Selected Plan

Item	Unit	Unit Cost($)	Quantity	Total Cost
NON-FEDERAL COST				
Diking and Weirs	LS			$ 90,000
Relocations	LS			8,334,000
Dredge Berthing Areas				
Pascagoula River Inner--Harbor--upland disposal	CY	0.97	172	167,000
Bayou Casotte--open gulf disposal	CY	2.00	50	100,000
Subtotal				8,691,000
Contingencies (25%)				2,173,000
Engineering and Design				326,000
Supervision and Administration				543,000
TOTAL NON-FEDERAL CONSTRUCTION COST				11,733,000
TOTAL PROJECT CONSTRUCTION COST				57,199,000
Fish and Wildlife Mitigation	LS			60,000
Contingencies (25%)				15,000
Engineering and Design				2,000
Supervision and Administration				4,000
TOTAL FISH AND WILDLIFE MITIGATION				81,000
FEDERAL SHARE				64,000
NON-FEDERAL SHARE				17,000
TOTAL INITIAL PROJECT COST				$57,280,000

Table B-4

Estimated Initial cost for the Selected Plan

	Item	Unit	Unit Cost($)	Quantity	Total Cost
09	CHANNELS				
	Entrance Channel Hopper dredging	CY	$3.00	3,348,000	$10,044,000
	Mississippi Sound Portions--All Channels Pipeline Dredging (with dump barges to gulf)	CY	2.00	11,075,000	22,152,000
	Main Channel--Inner Harbor Pipeline Dredging (with upland disposal)	CY	0.97	451,000	437,000
	Mobilization & Demobilization	LS			944,000
	Subtotal				33,577,000
	Contingencies (25%)				8,395,000
	TOTAL CHANNELS				41,972,000
18	CULTURAL RESOURCES				
	Salvage	LS			78,000
	Contingencies (25%)				20,000
	TOTAL CULTURAL RESOURCES				98,000
30	ENGINEERING AND DESIGN				1,262,000
31	SUPERVISION AND ADMINISTRATION				2,103,000
	TOTAL INITIAL FEDERAL COST (Corps of Engineers)				45,435,000
	OTHER FEDERAL AGENCIES				
	US Coast Guard--Aids to Navigation				31,000
	TOTAL INITIAL FEDERAL COST				45,466,000

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SYNOPSIS OF ECONOMIC REANALYSIS

The Economic Appendix to the Survey Report for Pascagoula Harbor, dated September 1984, was based on field information obtained during 1980, 1981, and 1982. During the Board of Engineers for Rivers and Harbors (BERH) staff review of the report in January 1985, a new field survey of the area was undertaken to provide current information concerning the different commodity movements utilizing the two channels in Pascagoula Harbor. The survey revealed that significant changes had occurred which required that benefits be reanalyzed for the project.

Results of the new survey showed that grain and crude petroleum tonnages had reduced from those shown in the report. It was also found that petroleum coke had recently began to be exported from Pascagoula. This movement did not exist when the original field information was obtained. It was also found that the LNG facility had plans for a separate turning basin. This was also not known when the Economic Appendix to the report was written. In addition, it was found that tug service for the LNG vessels had not been considered for these vessels operating on a 42-foot channel.

Corrections to the Economic Appendix in the form of revised pages would require that almost all of the pages and text be revised. To minimize corrections to the original text, pertinent information has been taken from the appendix and used to revise the economics associated with the project.

The following text and tables describe all of the changes and the resulting effects on the benefits to each channel involved at a 42-foot depth. When appropriate, footnotes are included in the tables which directly relate to the tables in the Economic Appendix that are being revised. Only benefits for the 42-foot channels were revised. Procedures used to maximize benefits for the crude petroleum and the LNG vessels have not changed. The benefits have been revised downward, but relationships remain the same. Benefits to petroleum coke represent only 7 percent of the total benefits to Bayou Casotte. Therefore, these additional benefits would not support either lesser or deeper channel depths. Because of these considerations changes to benefits at depths other than 42 feet are not considered necessary at this time.

REANALYSES OF THE ECONOMICS FOR PASCAGOULA HARBOR, MISSISSIPPI

INTRODUCTION

The Economic Appendix to the Survey Report for Pascagoula Harbor was based primarily on field information obtained during 1980 to 1983. During the BERH staff review of the report in January 1985, another field survey was conducted to verify the findings in the Economic Appendix. This field

Added: March 1985

survey revealed that significant changes had occurred which required that the economics of the alternative plans be reanalyzed. The following paragraphs describe the changes and the resulting effects on benefits to the area involved.

GRAIN

Basis for Change. Discussions with the Louis Dreyfus Company (LDC) revealed that 1984 exports to grain were about 868,000 tons as compared to about 3,800,000 tons exported in 1979. According to officials at LDC, 1979 was a peak year for grain exports and this volume is not expected to be handled again. However, they believe that exports were at a minimum in 1983 and began a continuing increase in 1984. They fully expect exports to reach 2,000,000 tons by the late 1980's. They would not project higher volumes after that time. For this reason, grain exports are shown to grow from about 868,000 tons in 1984 to 2,000,000 tons in 1995 and remain constant at that volume throughout project life.

Effects from Channel Deepening. The company officials at LDC stated that it was their belief that the company controlled movements would take full advantage of a deeper channel and that most of the grain exports would be loaded to the maximum draft possible at Pascagoula.

Distribution of 1984 Exports and Savings. Detailed information was obtained from LDC concerning individual vessel movements of grain in 1984. Total tonnage involved in these movements was 825,500 or about 95% of the total exports in that year. Of this total tonnage, LDC controlled the vessel movements for 28 percent of the tonnage loaded for export.

Consideration was given to these depths in allocating tonnages to the different areas with foreign port depths of at least 39 or 42 feet depending on the destination of the grain. The results showed that 410,455 tons or about 49.7 percent of the grain loaded at Pascagoula met the above requirements. This tonnage was distributed to four regions in the world based on actual destinations obtained from LDC. Table 1 below shows this distribution. It should be noted that of the 410,455 tons, LDC controlled only about 3.5 percent of the total.

Table 1

DISTRIBUTION OF GRAIN EXPORTS-1984
(Tonnage with Savings)

DESTINATION	TONNAGE	SAVINGS PER TON	% OF TOTAL
Far East	224,474	$0.84	54.7
Black Sea	51,382	1.82	12.5
S. Africa	53,420	1.95	13.0
W. Mediterranean	81,179	1.37	19.8

410,455 ÷ 825,544 = 49.7%

Added: March 1985

The tonnages shown in Table 1 were then adjusted to make the totals agree with the total grain exported in 1984. The percentages shown in Table 1 were used to make these adjustments. Savings per ton were taken from Table 36 on pages C-64 and C-65 of the Economic Appendix to the September 1984 Feasibility Report for Pascagoula Harbor. South Africa is a new foreign port that was not considered in the original economic analyses. The savings per ton have been calculated to be $1.95 considering an 80 percent empty backhaul. These data are shown in Table 2.

Table 2

DISTRIBUTION OF ADJUSTED GRAIN EXPORTS-1984
(Tonnage with Savings)

868,387 x 49.7 = 431,588

DESTINATION	TONNAGE	SAVINGS PER TON	% OF TOTAL	SAVINGS
Far East	236,079	$0.84	54.7	$198,306
Black Sea	53,949	1.82	12.5	98,187
S. Africa	56,106	1.95	13.0	109,407
W. Mediterranean	84,454	1.37	19.8	115,702
	431,588		100.0	$521,602

Distribution of Exports and Savings in 1995. As discussed before, LDC officials fully expect exports to continue to grow to about 2,000,000 tons by the late 1980's. This is supported by exports increasing from about 400,000 tons in 1983 (an all time low) to about 868,000 tons in 1984.

The 2,000,000 tons of grain exports were accepted as 1995 exports. These tonnages were adjusted downward to reflect the overall distribution shown in Table 1. This tonnage was then assigned to the different regions in the world as shown on the same Table. Savings per ton were obtained as explained above. The results of these distributions of tonnages and savings are shown below in Table 3. The tonnages and savings shown in this table represent a 3.5 percent of exports controlled by the LDC.

Table 3

DISTRIBUTION OF ADJUSTED GRAIN EXPORTS -1995
(Tonnage with Savings)

2,000,000 x .497 = 994,000

DESTINATION	TONNAGE	SAVINGS PER TON	% OF TOTAL	SAVINGS
Far East	543,700	$0.8[illegible]	54.7	457,000
Black Sea	124,300	1.8[illegible]	12.5	226,000
S. Africa	129,200	1.95	13.0	252,000
W. Mediterranean	196,800	1.37	19.8	270,000
Totals	994,000		100.0	$1,205,000

Added: March 1985

Officials with LDC have stated that the company will take full advantage of a deeper channel for those movements in which they control the shipping. Specific data on individual vessel exports showed that 28 percent of the total exports were controlled by the company. Only 3.5 percent of this total is involved in tonnages associated with savings. It does not seem appropriate to determine savings based on this distribution expecially since the company has stated that they will take full advantage of a deeper channel.

To compensate for this, it was estimated the controlled movements would increase from 3.5 percent to 14 percent. This means that 1/2 of the controlled traffic would realize savings in 1995. The increase of 10.5 percent was multiplied by 2,000,000 tons to obtain the adjusted tonnage receiving savings. The 1995 tonnages increased from 994,000 tons to 1,204,000 tons. This changed the percent of total tonnage receiving savings from 49.7 to 60.2 percent. The additional tonnages were distributed proportionately based on the percentages shown in Table 1 through 3. All of these computations are shown below in Table 4. These savings are believed to be the most representative of those that will occur by 1995; therefore, they are the recommended average annual equivalent benefits to be used for feasibility purposes.

Table 4

DISTRIBUTION OF ADJUSTED TONNAGES AND SAVINGS FOR GRAIN - 1995 THROUGH 2044[1/]
(Includes adjustments to Controlled Exports)[2/]

.105 x 2,000,000 Tons = 210,000 Tons + 994,000 Tons = 1,204,000 Tons

DESTINATION	TONNAGE	SAVINGS PER TON	% OF TOTAL	SAVINGS
Far East	658,600	$0.84	54.7	553,000
Black Sea	150,500	1.82	12.5	274,000
S. Africa	156,500	1.95	13.0	305,000
W. Mediterranean	238,400	1.37	19.8	327,000
Totals	1,204,000		100.0	$1,459,000

[1/] Replaces all data shown on Tables 45 and 46 in the report for a 42-foot channel in 1995. Tonnages and savings are constant throughout project life.

[2/] Increased LDC Controlled Shipments From 3.5 to 14%.

Added: March 1985

CRUDE OIL

Basis for Change. Operations at the Chevron Refinery are now somewhat different than they were at the time of the original field survey. According to interviews with Chevron officials in January 1985, the refinery now lighters only about 75 percent of the total tonnage of 16,718,000 refined each year. This restriction is brought about by available dock space which limits the existing operation to handle about 225,000 barrels of crude per day. The crude weighs about 7.5 pounds per gallon, and there are 42 gallons per barrel. This restricts the 365-day operation to about 12,935,000 tons or about 77 percent of the refinery's capacity to dockside unloading. The company's estimate of 75 percent is used in the revised benefit analyses. The remaining 25 percent is obtained through the company's pipeline from Empire, Louisiana. A substantial part of this 25 percent is lightered to Empire from the VLCC's and ULCC's in the Gulf of Mexico which handle the lightered petroleum movements into Pascagoula. The company officials have stated that a 42-foot channel will allow an additional 10 percent or about 1,672,000 tons to be handled at the dock because of more cargo handled by the larger vessels.

Determination of Benefits. Savings per ton of $0.94 as shown in the report is still valid. However, the original 16,718,000 tons have been reduced by 25 percent or to 12,538,500 tons. This represents revised benefits to the lightering operation of $11,786,000. The 10 percent increase in efficiency or about 1,672,000 tons are associated with reduced pipeline costs since a substantial part of the tonnage is lightered into Empire, Louisiana rather than Pascagoula. The costs of moving by pipeline is $0.25 per barrel according to officials at the refinery. There are 6.35 barrels per ton; therefore, the 10 percent increase in efficiency represents savings for 10,615,930 barrels of crude that would have moved by pipeline. This represents additional benefits of about $2,654,000. Total revised annual benefits to crude petroleum are $14,440,000. This replaces savings shown in Table 47 on page C-81 for 42 feet. Tonnage should be revised to 14,210,500 as explained above.

LIQUIFIED NATURAL GAS

Basis for Change. Page C-60 of the Economic Appendix to the Pascagoula Harbor Report shows the computation of vessel costs per ton for the LNG vessels operating on a 42-foot channel. The computation shows no tug service required. However, based on recent conversations with the tugboat operators in Pascagoula, tugboats are stationed on both Bayou Casotte and the Pascagoula rivers. To handle the LNG vessels, the tugs will leave either location and meet the vessel and escort it to the berthing area. A total charge of 1 hour per tug is charged for this service and 3 tugs are involved in each operation. Cost per hour for each tug is $652. Therefore, total costs for tugs for each vessel movement are $1,956. This changes the costs per ton for moving on a 42-foot channel to $41.74. The without project costs per ton are $42.66. The revised savings per ton is $0.92. These computations are shown on Tables 5 and 6 that follow. Revised total annual benefits to LNG are $4,451,000. This replaces savings shown in Table 48 on page C-82. Tonnage remains the same.

Added: March 1985

Table 5

?ERATING COST PER TON FOR LNG TANKERS WITH A 38-FOOT CHANNEL AVAILABLE
(Present Condition)

ssel size: 64,240 dwt
signed dimensions: 948.5' x 135' x 36' (fully loaded draft/with full load of fuel)
erating draft at Pascagoula (loaded): 34 feet (without trim/and light-load of fuel)
yload 60,480 short tons
fety clearance: 4 feet (level trim)
ssel travel time at sea: 202.9 hrs. (4,008 miles ÷ 19.75 knots)1/
ssel time in Pascagoula Harbor: 6.7 hrs. (20 miles ÷ 3 knots)1/
tal vessel travel time: 209.6 hours
ssel port time: 77.8 hrs. (1.62 days x 24 x 2)
g service: 4 tugs (inbound) and 2 tugs (outbound)
urs of tug service: 25.2 hrs. (inbound) and 14.6 hrs. (outbound)1/
st of tug service: $25,950 (39.8 hrs. x $652)
ssel cost per hour: $9,238 at sea and $7,941 in port
tal vessel costs per round trip: $2,554,095 [(209.6 x $9,238) + (77.8 x $7,941)]
tal vessel costs (incl. tug service): $2,580,045
st per ton: $42.66 ($2,580,045 ÷ 60,480 tons)

Round trip.
Includes two hours each for inbound and outbound tug service to meet vessel and to return to port (10 miles ÷ 5 knots). Also includes one hour standby time for tugs on inbound vessel and two hours standby time for tugs on outbound vessels.

Table 6

OPERATING COSTS PER TON FOR LNG TANKERS WITH A
42-FOOT CHANNEL AVAILABLE1/ 2/

ıfety clearance: 4 feet (vessel operating with a 4-foot stern trim)
ıyload: 60,480 short tons
ːssel time at sea: 202.9 hours
ːssel time in harbor: 3.3 hours (20 miles ÷ 6.0 knots)
ɪtal vessel travel time: 206.2 hours
ıg service required: 3 tugs, 1 hour each
ɪsts of tug service: $1,956 (3 x 652)
ːssel port time: 77.8 hours
ɪtal vessel costs: $1,904,876 at sea and $617,810 in port
ɪtal vessel cost: $2,522,686 + $1,956 (tug service) = $2,524,642
ːssel cost per ton: $41.74 ($2,524,642 ÷ 60,480 tons)

,Where data is not shown it is the same as shown in Table 5 above.
Replaces Table 33 on page C-60 of report.

Added: March 1985

PETROLEUM COKE

Basis for Change in Report. During the 1985 field survey, it was found that about 720,000 tons of petroleum coke is being exported to Europe annually. This commodity has only been exported for the last 15 months; so, information and data on these movements were not included in the Survey Report. The commodity is a by-product of the refinery and is produced at a rate of about 2,000 tons per day. The product is sold to an American exporter at the dock. The exporter then sells the commodity to several countries in Europe. The product is exported by selected vessels from the world fleet based on contract negotiations.

Confidentiality of Information. An attempt was made to obtain information concerning these movements from the company agent in Mobile. The agent said that detailed information could not be furnished without permission from the company which has not been obtained at this time. However, enough information has been obtained to allow an economic analyses to be performed.

The shipping manifest at the Port of Pascagoula showed that some of the coke was exported to Belgium. Since Antwerp is one of the major importing ports in Belgium, it was assumed that Antwerp is the central importing port in Europe for the coke. This was tested by computing the average distance from Pascagoula to 5 ports in the Eastern Mediterranean, the Western Mediterranean, Northern Europe, and Southern Europe, excluding all Russian ports. The average distance to these ports was 5,071 miles. The distance from Pascagoula to Antwerp is 4,815 miles; therefore, its use as the destination would be reasonable and conservative. The exporting agent provided the following information:

(1) The vessels always operate with 2-foot underkeel clearance.

(2) The vessels load to 36 feet at Pascagoula and always top off at either Lake Charles, Louisiana, Houston or Corpus Christi, Texas then proceed to foreign destinations.

(3) Port time is 2 days at other U. S. ports.

(4) One port is not preferred over another for topping off purposes.

(5) The company will utilize greater depths at Pascagoula and cease the topping off operation.

(6) Foreign port depths are adequate to handle the vessels if Pascagoula is deepened to 42 feet.

Procedures for Analyzing Vessel Costs. Since the company will utilize bulk carriers from the world fleet, an 80 percent empty backhaul was used in computing all vessel trip costs. This is the same as used for bulk carriers hauling grain. Total trip costs were calculated for the without project condition using both 38- and 40-foot draft vessels. The results showed the 40-foot vessels can operate light loaded cheaper than a 38-foot

Added: March 1985

l light loaded at Pascagoula and fully loaded at the topping-off port. the 40-foot vessel is utilized for the with project condition and it can operate cheaper, this is the only vessel used to determine gs for petroleum coke. Pertinent data involved in these savings are below.

PERTINENT DATA
PETROLEUM COKE MOVEMENTS

l Type	Bulk Carrier
l Draft	40 feet
l DWT	47,752
ad Capacity	51,343 tons
at Sea	15 knots
Time at Primary ts	110 hours each to load and unload
sion per foot	1,857 tons
Time at Topping Port	48 hours
per hour at sea	$798
per hour in Port	$418
aul	80 percent empty
nce to Topping off ts	Lake Charles, 318 miles, Houston 446 miles, Corpus 579 miles
ge Distance to ping off Ports	448 miles
nce to Antwerp gium	Lake Charles 5,013 miles, Houston 5,077 miles Corpus 5,139 miles
ge Distance to werp	5,076
nce to Antwerp	Pascagoula 4,807 miles
keel clearance all ports	2 feet

ut Project Condition. The without project condition assumes 40-foot vessels light loaded to 36 feet at Pascagoula. The vessels are d with 43,915 tons of coke. The vessels then travel 448 miles at sea e topping-off port where an additional 3,714 tons of coke is loaded n additional 2 foot of draft. This involves 48 hours of port time. essel then travels 5,076 miles to Antwerp light loaded by 2 feet. l unloading and port time at Antwerp is 110 hours. The vessel then ns empty to Pascagoula 80 percent of the time. Total cost of this ent is $610,694 for a load of 47,629 tons. Costs per ton for this ent are $12.82.

Project Condition. With the project, the vessel would fully load with 3 tons of coke. The vessel then travels 4,807 miles to Antwerp where argo is unloaded. This involves another 110 hours of port time. loading time is a small part of port time, no significant increase in time is considered because of the additional load. The vessel then ns empty to Pascagoula 80 percent of the time. Total costs for this hauling 51,343 tons of coke are $552,326 or $10.76 per ton

Added March 1985

Savings Per Ton. Field information on vessel operations has shown that larger vessels operate fully loaded 60 percent of the time on an average. To meet this average, the fully loaded vessel must return empty 80 percent of the time; therefore, savings of $2.06 per ton have been accepted as benefits to this project.

Total Savings. The refinery has stated that petroleum coke is produced as a by-product at a rate of 2,000 tons per day or about 60,000 tons per month. Since the refinery is operating at capacity and since coke is a by-product of this operation, 720,000 tons have been accepted for benefit purposes. This tonnage is expected to remain constant throughout project life. Annual benefits assigned to petroleum coke are $1,483,000.

NEW TURNING BASIN

Basis for Change. Benefits have been revised to the new turning basin based on two significant and one insignificant change. The 25 percent reduction in crude petroleum reduced the number of vessels using the turning basin both for the with and without project condition. Also, it was found that the LNG facility has a planned turning basin and would not use a new Federal turning basin. The petroleum coke vessels, however, would benefit from a new turning basin. Accordingly, the benefits for the turning basin have been recomputed to reflect these changes and amount to $509,000 per year The support for these benefits is shown below:

PERTINENT INFORMATION ON TURNING BASINS[1/]

Crude Petroleum Vessels

Distance from dock to existing turning basin	1 nautical mile
Turning time at existing turning basin	30 minutes
Number of tugs required at existing turning basin[2/]	3
Distance to new turning basin	0 nautical miles
Speed of tugs	5 knots
Hourly costs for tug service	$652
Number of trips - existing condition	213
Number of trips - modified 42-foot channel	143
Round trip time to existing turning basin	24 minutes
Turning time at new turning basin	15 minutes
Number of tugs required at new turning basin[2/]	2
Weighted hourly cost for 79,000 & 66,000 dwt vessels at sea	$958
Hourly costs for 80,000 dwt vessel at sea	$999
Hourly costs for 100,000 dwt vessels at sea	$1,121
Travel time to new turning basin	0

Petroleum Coke Vessels[3/]

Number of trips - existing condition	16
Number of trips - modified. 42-foot channel	14
Hourly vessel costs for 47,752 dwt bulkcarrier	$798

1/ Replaces Pertinent Information sheet on page C-90.
2/ Based on information furnished by company officials.
3/ Where data is not shown, it is the same as that for crude petroleum vessels.

Added: March 1985

Table 7

BENEFITS TO NEW TURNING BASIN[1/]

Project Condition

troleum Vessels	
trip travel and turning time: .9 hours	
ls = .9 x $958 x 213 trips	$183,649
= .9 x $652 x 213 trips x 3 tugs	374,965
Sub Total	$558,614
m Coke Vessels	
trip travel and turning time = .9 hour	
ls = .9 x $798 x 16 trips	$ 11,491
= .9 x $652x 16 trips x 3 tugs	28,166
Sub Total	$ 39,657
Total Costs	$598,271

oject Condition

Petroleum Vessels	
trip travel time and turning time - .25 hours	
ls (80,000 dwt) .25 x $999 x 143 trips	$ 35,714
.25 x $652 x 143 trips x 2 tugs	46,618
Sub Total	$ 82,332
um Coke Vessels	
trip travel and turning time = .25 hours	
ls (47,752 dwt) .25 x $798 x 14 trips	$ 2,793
.25 x $652 x 14 trips x 2 tugs	4,564
Sub Total	$ 7,357
Total Costs	$ 89,689
Total Savings	$ 508,582

ce: Table 54 on page C-91 of report.

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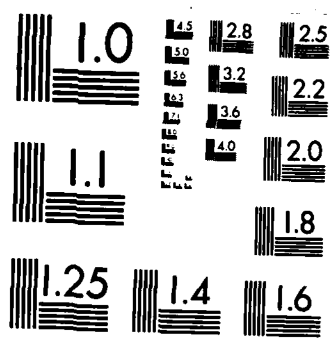

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REVISED BENEFITS

Summary of Changes. A summary of the revised benefits by type are shown below in Table 8. For comparative purposes benefits as shown in the report are also included.

Table 8

SUMMARY OF AVERAGE ANNUAL EQUIVALENT BENEFITS[1]

BAYOU CASOTTE	NEW	OLD
LNG Vessels	$4,451,000	$4,596,000
Petroleum Coke	1,483,000	0
Crude Oil	14,440,000	15,715,000
Sub Totals	$20,374,000	$20,311,000
Turning Basin	$509,000	$1,217,500
Total Benefits	$20,883,000	$21,528,500
PASCAGOULA RIVER		
Grain	$1,459,000	$2,922,000
Grand Total	$22,342,000	$24,450,500

[1] Excludes delay benefits in Table 59.

Allocation of Costs of the Combination Leg of the Channel. This project considers three different segments of channels and a turning basin on Bayou Casotte. The channels consist of the Pascagoula River Channel, the Bayou Casotte Channel, and the outer leg which is used to access each of the above channels. This channel is referred to as the combination leg. Costs of the combination channel leg were allocated to the Bayou Casotte Channel and the Pascagoula River Channel based on the percentage distribution of remaining benefits to each of the channels. The allocations for a 42-foot depth are shown in Table 9. This table replaces Table 56 on page C-96 of the Economic Appendix to the report.

Cost Recovery. EC 1105-2-124 requires that the time be shown when 100 percent of project costs can be recovered. Table 10 below meets the requirements of this EC and shows the costs per ton on each of the channels needed to recover all costs in 1995. This table replaces the similar type table shown on page C-100 of the Economic Appendix to the report. Table 11 shows the costs and savings per ton for each of the channels in 1995. Each of the channels show residual savings remaining after costs per ton are subtracted from savings per ton. Therefore, each channel can recover 100 percent of costs in 1995. Table 11 replaces the similar type table shown on page C-101 of the Economic Appendix to the report.

Added: March 1985

Table 9

ALLOCATION OF COMBINATION USE CHANNEL 1/
(1,000 @ 8-3/8%)
42 Feet

Channel	Average Annual Costs	Average Annual 3/ Benefits	Remaining Benefits	% Remaining Benefits	Additional Allocated Costs	Total Adjusted Costs	Average Annual 3/ Benefits	B/C Ratio	Remaining Benefits
Bayou Casotte 2/	$1,999	$20,883	$18,884	99.4	$2,052	$4,051	$20,883	5.2	$16,832
Pascagoula River	1,341	1,459	118	0.6	12	1,353	1,459	1.1	106
Totals	$3,340	$22,342	$19,002	100.0	$2,064	$5,404	$22,342	4.0	$16,938
Combination Channel	$2,064								

1/ Replaces Table 56 on page C-96 of report.
2/ Includes costs and benefits for the turning basin.
3/ Excludes $178,000 and $22,000 in reduction daily benefits to the Bayou Casotte and the Pascagoula River Channels, respectively. (See Table 59 in the Economic Appendix.)

Table 10

Recovery of 100% of Costs Recommended Plan Based on EC 1105-2-124
(1,000)

	Bayou Casotte	Pascagoula River	Miss. Sound	Total
First Costs (Oct 1984)	$21,586	$14,231	$21,462	$ 57,279
Construction Time (Months)	5.8	6.0	7.9	19.7
Allocation % 1/	99.4	0.6	0	100.0
Allocation Miss. Sound Costs	21,333	129	0	21,462
Allocation of Miss. Sound Time	7.8	0.1	0	7.9
Total Adjusted Construction Time	13.6	6.1	0	19.7
Total Adjusted First Costs	42,919	14,360	0	57,279
Value Compounded @ 8% Thru 1994 (10 yrs. - 2.159)	92,662	31,003		123,665
Construction Time	13.6 mos.	6.1 mos.		19.7 mos.
Interest During Construction @ 6.5%	3,416	512		3,928
Total First Costs	96,078	31,515		127,593
Average Annual Costs @ 6.5%	6,525	2,140		8,665

1995 Tonnages
(1,000 Tons)

Bayou Casotte			Pascagoula River
LNG	CRUDE	TOTAL	GRAIN
4,838	14,210.5	19,048.5	1,204

Costs Per Ton Required in 1995

	Bayou Casotte	Pascagoula River
Average Annual Costs	$ 6,525	$2,140
1995 Tonnage	19,048.5	1,204
Costs per Ton required 2/	0.34	1.78

1/ See Table 7.
2/ Costs per ton required to cover 100% of project costs.

Added: March 1985

Table 11

Recovery of 100% of Costs Recommended Plan Based on EC 1105-2-124

First Year of Project
Savings per Ton By Individual Movement

	Pascagoula River (Grain)				Bayou Casotte	
	Far East	Black Sea	South Africa	West Med.	LNG	Crude Oil
FY 1985 Savings per Ton	$0.84	$1.82	$1.95	$1.37	$0.92	1.02 1/
FY 1995 Savings per Ton 2/	1.36	2.95	3.16	2.22	1.49	1.66
Computed User Charge 5/	1.78	1.78	1.78	1.78	0.34	0.34
Residual Savings	-0.42 3/	1.17	1.38	0.44	1.15	1.32

Economic Life of Project
Savings per Ton By Individual Movement

	Pascagoula River (Grain)				Bayou Casotte	
	Far East	Black Sea	South Africa	West Med.	LNG	Crude Oil
FY 1985 Savings per Ton	$0.84	$1.82	$1.95	$1.37	$0.92	1.02 1/
Av. Ann. Eq. Savings per Ton 4/	4.29	9.31	9.97	7.00	4.70	5.24
Computed User Charge 5/	1.78	1.78	1.78	1.78	0.34	0.34
Residual Savings	2.51	7.53	8.19	5.22	4.36	4.90

1/ Average Savings per Ton for Lightering and Pipeline Costs.
2/ FY 1985 Savings Compounded @ 4.5% Growth Rate (11 Year Factor is 1.623).
3/ Savings per ton for all grain is $1.21 in 1985. This value multiplied by 1.623 is $1.96 per ton. This results in residual savings of $0.18 per ton for all grain. The break-even year for grain moving to the Far East is 2004.
4/ Based on compound growth for 50 years at 4.5% interest and amortization at 6.5%.
5/ See "Costs per Ton Required" in Table 10.

Added: March 1985

APPENDIX C
PASCAGOULA HARBOR, MISSISSIPPI
BENEFIT EVALUATION

Introduction

This section of the report contains estimates of benefits and other supporting data pertaining to the economics of the various plans of deep-draft channel improvements within the Pascagoula Harbor. The plans of improvement being considered are to increase the depth and/or width of the present deep draft channels leading into the ports of Pascagoula and Bayou Casotte. Benefits are related to reduced transportation charges for grain being exported from the Port of Pascagoula and reduced transportation costs associated with the import of LNG into the Port of Bayou Casotte. The Bayou Casotte channel will also realize additional benefits from the reduction in shuttle vessel costs of transporting heavy crude oil from super tankers in the Gulf of Mexico to the refinery located at the Port of Bayou Casotte.

Purpose of Study

The purpose of this analysis is to identify and measure the direct economic impacts the considered channel improvements would have on the transportation of products shipped through the ports of Pascagoula and Bayou Casotte by deep-draft vessels. This study involves the examination of the present and future commerce and vessel traffic that would move in the Pascagoula Harbor. Also, a review of the industrial development within the port was made to support the volume of traffic projected over the 50-year period of the economic analysis (1995-2044). Navigation benefits herein were developed for each of the improved channel depths for deep-draft vessel traffic investigated, ranging from 39 to 51 feet at 1 foot increments. No additional benefits can be realized with channel depths greater than 51 feet in the Bayou Casotte Channel and 46 feet in the Pascagoula Channel, because of the maximum size vessels needed and restriction resulting from channel depths at foreign ports.

A field canvass was made to interview officials of industries and other shipping interests presently shipping through the port. The survey included interviews with shippers, steamship lines or their agents, port officials, shipyards, and organizations that might be interested in the channel improvements. The survey was conducted to determine the need for channel improvements within the harbor and what effect these improvements would have on transportation needs and costs. The information collected consists of: (1) name and volume of present and future commerce for the port, (2) industrial expansion expected in the future, (3) type of transportation service required to meet the present and expanded demand for shipping by deep-draft vessels, (4) origin/destination matrix and shipping patterns required for delivery of each commodity, (5) type and size of terminals available at the port and future expansion of present terminals and new terminals planned, (6) what effect the channel improvements would have on commerce flowing through the port, (7) and to determine the general overall condition of the port as it pertains to coastwise, export, and import shipping. During the interview period, February 1980, contacts were made with nine (9) present or potential shippers, one (1) shipbuilding and repair facility, several port officials, two (2) steamship agencies, and numerous persons that have direct or indirect interests in the channel improvement being considered.

Current commerce and vessel traffic is defined as that occurring in 1979 rather than that occurring in later years. This is necessary since the Port Authority at Pascagoula put forth considerable effort and time in 1980 to provide detailed information concerning port operations in 1979. A similar request for later data was not considered to be warranted because of the time and effort involved. For benefit analyses, the importance of the use of 1979 data is primarily associated with grain exports. Changes in crude oil imports and LNG imports are not expected to begin until 1984 and 1989, respectively. Export grain tonnages from the Port of Pascagoula for 1980, 1981, and 1982 amounted to 3,525,860; 2,067,403; and 1,800,542, respectively. The high value of the U.S. dollar overseas, as well as the worldwide recession, are blamed for these reductions in exports. These reductions are assumed to be short term fluctuations and should not affect the long term growth of these exports. Sensitivity analyses for grain exports shows future growth to have no effect on the feasibility of the Pascagoula River Channel. This is discussed on page C-95.

This appendix documents current (1979) commerce and vessel traffic activity and the historical trends in commerce moving through the port. It identifies and evaluates the commerce and vessel traffic that would benefit by the considered channel improvements. The present commerce which would benefit by the planned improvements was projected over the economic project life (1995-2044), if appropriate. Transportation costs for deep-draft vessels operating under present channel conditions and with improvements were analyzed to determine the navigation benefits that will be realized by the channel improvement.

Benefits for each channel will be expressed in terms of average annual equivalent benefits for each channel depth being considered on each type of commerce at each of the ports within Pascagoula Harbor. Future benefits were computed for various periods of time over the 50-year project life and then converted to an average annual equivalent basis for comparison with the average annual cost of the improvements, using an interest rate of 8 1/8 percent. The cost analysis reflects transportation costs as of 1 January 1983. These benefits were further updated to reflect 1 October 1983 prices.

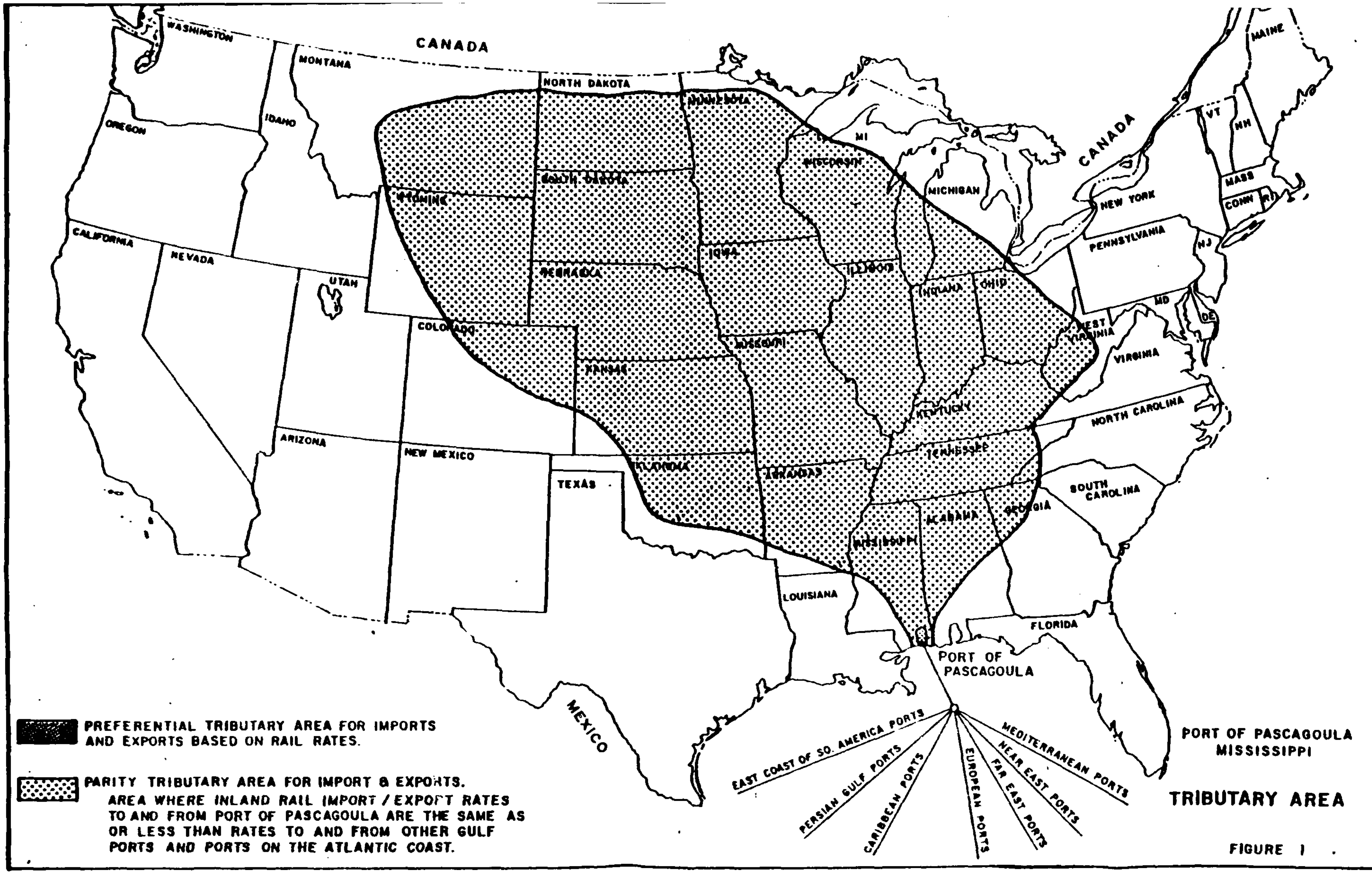
Benefits are based on transportation savings which would result from the use of larger and more economical vessels, reduced tug service requirements, increased vessel speed within the harbor, and increased loadings of the larger vessels presently using the port. Elimination or reduction in delays of vessels transiting the channels were examined and are presented later in this appendix. Delays are caused by vessels waiting on other ships to clear the channel, inadequate channel widths for vessels to pass, restricted sailing departures and arrivals at the port, and restricted transits during inclement weather conditions.

Tributary Area. The geographical area served by the Port of Pascagoula is very broad in scope both domestic and foreign. The area considered as directly tributary (commercially) to this port would be an area contiguous to the origin/destination of the domestic patterns of present and future commerce that would move through the port. The preferential area where the port has a freight rate advantage over other Gulf Coast ports encompasses a small area of southern Mississippi.

A secondary area, designated as a parity area where freight rates to Pascagoula would be equalized with other Gulf Coast ports includes all the midwest states and certain eastern and western states. Another, more generalized, tributary area would be on a world-wide basis determined by traffic patterns on exports and imports through the port. A delineation of the boundaries of the tributary area is shown in Figure 1.

EXISTING AND PLANNED PORT FACILITIES

Existing Facilities. The Pascagoula Harbor Complex consists of two port areas. One is located at the mouth of the Pascagoula River and designated hereafter as the "Port of Pascagoula." The other area is the industrial complex located to the east of Pascagoula on the Bayou Casotte Channel designated hereafter as "Port of Bayou Casotte." Port and dock facilities located at the port of Pascagoula consists of two public terminals and warehouses designated as terminals "A" & "B," owned and operated by Jackson County Port Authority. Litton Industries operate a large ship construction facility on the west bank of the Pascagoula Channel and Ingalls Shipbuilding, a division of Litton Industries, operates a large ship/submarine repair yard on the east bank of the Pascagoula Channel. The Jackson County Grain Terminal is leased and operated by Louis Dreyfus Grain Corporation. Under the terms of the lease, this facility is operated as a public grain terminal available to all grain shippers on equal terms. They publish a tariff, approved by the Federal Maritime Commission. The Jackson County Port Authority is authorized and empowered to establish rates and charges for all services at the terminal pursuant to Chapter 99, Laws of Mississippi of 1956, as amended. Shippers other than Dreyfus utilize the grain terminal for exporting grain. The terminal presently has a capacity of 6 million tons per year and additional capacity can readily be added when demand justifies it. Other private docks, terminals, repair yards, fish houses/docks, are owned and/or operated by Quaker Oats, F. B, Walker Shipyard, Hudship, Halter Marine, Mississippi Menhaden, Fish Meal Company, Standard Fish Meal Company, International Paper Company, and numerous other fishing and small boat repair facilities.



PREFERENTIAL TRIBUTARY AREA FOR IMPORTS AND EXPORTS BASED ON RAIL RATES.

PARITY TRIBUTARY AREA FOR IMPORT & EXPORTS. AREA WHERE INLAND RAIL IMPORT / EXPORT RATES TO AND FROM PORT OF PASCAGOULA ARE THE SAME AS OR LESS THAN RATES TO AND FROM OTHER GULF PORTS AND PORTS ON THE ATLANTIC COAST.

PORT OF PASCAGOULA
MISSISSIPPI

TRIBUTARY AREA

FIGURE 1

On the Bayou Casotte Channel, the Jackson County Port Authority owns and operates terminals "E", "F", "G", and "H." Chevron, U.S.A. operates a large petroleum and chemical refinery and ship/barge docking facilities. Corning Glass Works, Chicago Bridge and Iron, and Mississippi Chemical Companies have plants and dock facilities on the Bayou Casotte Channel. First Chemical Corporation has a plant adjacent to the turning basin, but uses Jackson County Port Authority terminal "F" for docking, loading/unloading vessels. There are other small docks and fish houses located at this port.

Jackson County Port Authority terminals are used for importing and exporting mostly break-bulk cargo. Louis Dreyfus docks are used for loading bulk grain onto ocean going vessels for export, and unloading grain barges that originate in the Midwest. Chevron, U.S.A., Inc. docks are used for importing crude oil and shipping petroleum and chemical products out by barge and ship. Chevron has constructed new facilities and modified their present refinery at Bayou Casotte to be capable of receiving and processing 45,803 tons of heavy high-sulphur foreign crude per day. The modified facility went on-line in the 4th quarter of 1983 and is now fully operational and heavy crude oil is being processed. The crude oil arrives at a position offshore in Very Large Crude Carriers (VLCC) and Ultra Large Crude Carriers (ULCC) tankers and is lightered to the refinery docks in smaller tankers. The refinery will process 16.7 million short tons of heavy crude per year. Litton Industries and Ingalls facilities are used for constructing and repairing vessels and launching new ships or drydocked vessels under repair. Mississippi Chemical Company uses their docks for bringing in phosphate rock from Tampa, FL, in ocean-going barges and shipping fertilizers by inland barges. Other dock facilities at the two ports are used for loading or unloading small, shallow draft vessels.

Planned facilities. Tennessee Gas Transmission Company (Tenneco) plans to import LNG by deep-draft vessels through a dock and terminal facility to be located at the Port of Bayou Casotte. The LNG product will be further shipped by pipeline to inland customers.

PORT COMMERCE

Existing Waterborne Commerce. In 1979, the Port of Bayou Casotte handled 9.4 million tons of imports, .6 million tons of exports, .5 million tons of coastwise receipts and 5.2 million tons of coastwise shipments. The remainder of Bayou Casotte tonnage consisted of 4.6 million tons of barge and shallow draft vessel cargo. The Port of Pascagoula handled 3.8 million tons of exports and about .3 million tons of imports and coastwise commerce. Tonnage of commerce moving in shallow draft vessels through the Port of Pascagoula was 1.0 million tons. Total commerce handled through both ports in 1979 was 25.3 million tons. Table 1 is an excerpt from Waterborne Commerce of the U.S., Part 2, 1979, for Pascagoula Harbor.

TABLE 1

COMMERCE THAT MOVED THROUGH

PASCAGOULA HARBOR IN 1979

FREIGHT TRAFFIC, 1979

(SHORT TONS)

COMMODITY	TOTAL	FOREIGN		DOMESTIC				
				COASTWISE		INTERNAL		LOCAL
		IMPORTS	EXPORTS	RECEIPTS	SHIPMENTS	RECEIPTS	SHIPMENTS	
TAL	25,209,493	9,492,825	4,417,289	574,277	5,295,767	1,889,988	3,501,169	198,242
RN	2,881,889		2,689,229		3,322	191,614	1,524	
CE	6,134	60	6,074					
EAT	138,807		122,380			16,427		
YBEANS	1,197,294		994,898			198,192	4,204	
LSEEDS, NEC	3,847		3,847					
IMALS AND PRODUCTS, NEC	7,898					7,898		
UDE RUBBER AND ALLIED GUMS	7,173	7,173						
ESH FISH, EXCEPT SHELLFISH	109,699					109,699		
ELLFISH, EXCEPT PREPARED	1,697					1,697		
NHADEN	58,547					58,547		
RINE SHELLS, UNMANUFACTURED	39,038					39,338		
PPER ORE AND CONCENTRATES	4,312		4,312					
NFERROUS ORES, CONCENT, NEC	52,801	5,107	30,561			13,003	4,130	
AL AND LIGNITE	1,853					1,853		
UDE PETROLEUM	8,688,140	8,684,400				16,247	1,429	
ND, GRAVEL, CRUSHED ROCK	4,215					4,215		
AY	11,732	6,283				2,711	2,738	
OSPHATE ROCK	54,179			54,179				
LPHUR, LIQUID	47,974					47,974		
NMETALLIC MINERALS, NEC	6,898	6,898						
EP FRUIT AND VEG JUICE, NEC	6,831		6,831					
EAT FLOUR AND SEMOLINA	14,598		14,598					
EPARED ANIMAL FEEDS	13,487	12,187					1,300	
AIN MILL PRODUCTS, NEC	9,210		5,059				4,151	
IMAL OILS AND FATS, NEC	11,839					6,239	4,800	
S	14,015						14,015	
SIC TEXTILE PRODUCTS	6	6						
MBER, POSTS, POLES, PILING	118					118		
LPWOOD, LOG	159,627					159,627		
DIUM HYDROXIDE	63,287		21,884			41,403		
ES, PIGMENT, TANNING MATS	3,328		3,328					
NZENE AND TOLUENE	132,761	66,809				64,550	1,402	
LPHURIC ACID	5,368		5,368					
SIC CHEMICALS AND PROD, NEC	598,679	248,487	246,501	3,082	11,831	24,467	64,527	
NTHETIC RUBBER	43,883					41,225	2,658	
TROGENOUS CHEM FERTILIZERS	26,962		4,318			1,408	21,236	
TASSIC CHEM FERTILIZERS	278,884					277,486	1,398	
RTILIZER AND MATERIALS, NEC	779,378		206,072			7,487	473,601	92,218
SOLINE	4,221,198			5,188	2,657,836	165,946	1,392,228	
T FUEL	595,097			4,371	467,493		123,233	
ROSENE	46,728				46,728			
STILLATE FUEL OIL	1,472,191	316,316		287,152	557,987	113,771	142,949	54,028
SIDUAL FUEL OIL	3,015,509			228,389	1,398,271	273,170	1,071,779	52,084
BRICATING OILS AND GREASES	134,814	98,877			35,937			
PHALT, TAR, AND PITCHES	152,294				74,836	5,467	71,991	
QUEFIED GASES	83,728				1,428		82,298	
BBER AND MISC PLASTIC PROD	5,633	5,394				239		
RUCTURAL CLAY PRODUCTS	5,332		1,056			4,276		
ON AND STEEL PLATES, SHEETS	578					578		
AD AND ZINC, UNWORKED	44,473		38,353			6,120		
BRICATED METAL PRODUCTS	753		672			81		
CHINERY, EXCEPT ELECTRICAL	6,978		246			1,495	5,237	
ECTRICAL MACH AND EQUIP	1,088						1,088	
SC TRANSPORTATION EQUIPMENT	12,819	12,819						
SC MANUFACTURED PRODUCTS	15	15						
ON AND STEEL SCRAP	3,838						3,838	
NFERROUS METAL SCRAP	15,438		15,438					
STE AND SCRAP, NEC	3,467						3,467	
MMODITIES, NEC	2,814	2,814						

TAL TON-MILES. 198,397,294.

ce: Waterborne Commerce of the U.S., Part 2, 1979

The major waterborne commodities handled at Pascagoula, including Ports of Pascagoula and Bayou Casotte, during CY 1979 by deep-draft vessels were: grain, crude petroleum, fertilizer and fertilizer material, petroleum products, chemicals, and general break-bulk cargo. A general break-down of this commerce is shown below:

PRODUCT	VOLUME (Thousand Short Tons)	PERCENT (%)
Crude Petroleum	8.7	44
Petroleum Products	6.2	31
Grain	3.8	19
Chemicals	.6	3
Fertilizer	.3	2
Other	.1	1
TOTAL (1979) TONNAGE	19.7	100%

Historical Trends in Port Commerce. The annual volume of waterborne deep-draft commerce shipped through the two ports within Pascagoula Harbor increased from 3.7 million tons in 1970 to 19.7 million tons in 1979.

Shallow-draft vessel commerce had no appreciable increase during this 10-year period and remained constant at about 6.0 million tons annually. A sharp increase in total port commerce occurred in 1975, and has steadily increased since that time. These increases were brought about primarily because of the completion of the Chevron Refinery in 1973 and the increased demand for foreign grain exports. Crude petroleum and petroleum products moving in deep-draft vessels, increased from 2.0 million tons in 1970 to 14.9 million tons in 1979, a 645 percent increase. Grain exports increased from 1.0 million tons in 1970 to 3.8 million tons in 1979, a 280 percent increase. For more statistical data on past trends in port commerce, refer to Table 2.

Published statistics on total commerce for years 1970-1979, allocated by foreign imports and exports, coastwise receipts and shipments, internal receipts, shipments, and local traffic are shown in Table 3. Foreign imports and exports and coastwise receipts and shipments designates waterborne commerce moving in deep-draft vessel. All other commerce is traffic moving in shallow-draft vessels.

Commerce Screened

Deep-draft vessels used in hauling bulk commodities, such as, fertilizer, phosphate rock, petroleum products, chemicals, and packages goods (identified as break-bulk commerce) were tankers, dry-bulk carriers, ocean barges, and general cargo ships loaded to drafts that could be accommodated by the present 38' channel depth. Commodities, moving in these deep-draft

TABULATION OF TONNAGES BY COMMODITY AND TYPE OF MOVEMENT FOR

PERIOD 1970 - 1979

COMMODITY GROUP	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
GRAIN & GRAIN PRODUCTS										
Deep Draft	855,774	622,204	1,417,343	2,490,613	1,531,334	1,983,286	2,158,696	1,812,638	3,400,349	3,816,006
Barge	478,548	488,885	792,824	544,680	292,617	891,695	742,799	563,228	542,493	411,961
TOTAL	1,334,322	1,111,089	2,210,167	3,035,293	1,823,951	2,874,981	2,901,495	2,375,866	3,942,842	4,227,967
FRESH FISH & MARINE SHELLFISH										
Deep Draft	0	0	0	0	0	1,977	0	0	0	0
Barge	122,895	177,590	192,959	137,628	86,927	37,189	37,733	41,866	75,515	161,899
TOTAL	122,895	177,590	192,959	137,628	86,927	39,166	37,733	41,866	75,515	161,899
METALLIC ORES										
Deep Draft	0	12,286	42,533	101,136	124,020	73,213	106,232	202,105	29,132	39,980
Barge	18,967	3,844	0	6,577	33,608	45,596	62,126	88,318	29,768	17,133
TOTAL	18,967	16,130	42,533	107,713	157,628	118,809	168,358	290,423	58,900	57,113
CRUDE PETROLEUM										
Deep Draft	27,422	0	0	18,503	1,393,089	5,626,420	8,746,[illegible]62	8,663,216	8,300,543	8,664,468
Barge	0	0	0	8,557	32,028	25,110	164,[illegible]94	74,418	119,315	15,672
TOTAL	27,422	0	0	27,060	1,425,126	5,651,530	8,910,[illegible]56	8,737,634	8,419,858	8,680,140
NONMETALLIC MINERALS (ex. fuels)										
Deep Draft	299,080	412,115	504,382	555,565	597,222	626,689	589,[illegible]36	331,913	473,735	105,953
Barge	331,817	359,167	440,750	476,740	363,096	537,161	400,[illegible]53	289,834	253,827	108,887
TOTAL	630,897	771,282	945,132	1,032,305	960,318	1,163,850	989,989	621,747	727,562	214,84[illegible]

Page 1 of 4 Pages

TABLE 8

ANNUAL VOLUME OF GRAIN, ACCEPTED FOR BENEFIT ANALYSIS, EXPORTS FROM PASCAGOULA, MS

ANNUAL VOLUME (Short Tons)

FOREIGN PORT DEPTH		FOREIGN DESTINATION	YEARS 1979	1995[1/]	2000	2010	2015	2020	2030	2040	2044
42'	A	Black Sea Area	116,000	178,000	197,000	236,000	255,000	274,000	313,000	351,000	367,000
43'	B	Eastern Mediterranean Area	50,000	77,000	85,000	102,000	110,000	118,000	135,000	151,000	158,000
42'	C	Western Mediterranean Area	46,000	70,000	78,000	93,000	101,000	109,000	124,000	139,000	145,000
44'	D	Eastern Coast of South America	45,000	69,000	76,000	91,000	99,000	106,000	121,000	136,000	142,000
39'	E	Eastern Coast of South America	70,000	107,000	119,000	142,000	154,000	165,000	189,000	212,000	221,000
46'	F	Northern Europe Area	164,000	251,000	278,000	333,000	360,000	388,000	442,000	497,000	518,000
41'	G	Northern Europe Area	66,000	101,000	112,000	134,000	145,000	156,000	178,000	200,000	209,000
49'	H	Southern Europe Area	35,000	54,000	59,000	71,000	77,000	83,000	94,000	106,000	111,000
45'	I	Southern Europe Area	81,000	124,000	138,000	165,000	178,000	191,000	218,000	245,000	256,000
39'[2/]	J	Far East Area	722,000	1,106,000	1,226,000	1,466,000	1,586,000	1,706,000	1,947,000	2,186,000	2,282,000
		TOTAL	1,395,000	2,137,000	2,365,000	2,833,000	3,065,000	3,296,000	3,761,000	4,223,000	4,409,000

1/ First year of project life.

2/ Restricted by Panama Canal.

Comparison of Projections of Grain Exports. The projections of growth shown in Table 7 were compared to national projections of the grain products as shown in "1972 OBERS Projections, Series E Population Supplement, Agricultural Projections" dated May 1975. The comparisons showed the factors of growth for exports of grain from Pascagoula to be slightly higher than that of the nation. The difference was not of enough significance to consider it as important, especially since the present worth of this difference will result in practically no change in average annual equivalent benefits.

Growth in Grain Exports. By applying the growth factors as shown in Table 7, to the volume of grain exported from Pascagoula to each foreign market region, in 1979, the growth in total accepted exports of grain will increase from 1,395,000 tons of accepted grain in 1979 to 2,137,000 by 1995, the first year of project life. Exports will further increase throughout the 50-year project to 4,409,000 tons by the end of year 2044. More detailed information on future volume of grain exports is shown in Table 8.

eral. The import and export commodities involved with modification of : Pascagoula Harbor Channels are associated with three companies: (1) grain elevator which exports corn, wheat, and soybeans, (2) the LNG minal on Bayou Casotte importing LNG, and (3) the petroleum refinery on 'ou Casotte importing heavy crude oil. Since the Federal Navigation oject is expected to be completed by 1995, import or export tonnages for :h commodity were projected when appropriate, through year 2044 which is : end of 50-year project life (1995-2044).

ojected Grain Exports. Attempts were made to project exports from Pasca-ıla based on historic relationships of national grain exports to those ıt occurred in Pascagoula. Regression techniques were used in these :empts, but the results revealed there were no relationships, between storical exports of grain from the U.S. and the smaller area involved. lividuals in Little Rock, Arkansas, and Washington, D.C., with Economic search Service (ERS) were contacted in an attempt to obtain regional or S. projections for grain exports. According to information received from S, there is nothing available on projected grain exports at this time. e Washington office stated they were working on the problem but did not pect any results for several months. Therefore, the method of least ıares was utilized for projection purposes, based on historical growth of ain exports at Pascagoula.

ch of the three grain crops was projected based on exports from Pasca-ıla that occurred each year from 1962 through 1979. For comparative rposes, the totals for exports of the three crops were also projected. e results of the computations were very similar; so, the sum of the three dividual projections was selected as the most representative for use in e benefit analysis. The results of the projections for exports of each the crops, the total projections of exports and increase factors for ojecting the 1979 grain exports at Pascagoula are shown in Table 7. The 79 tonnages shown in the table represents the computed trend values for at year rather than the actual tonnage exported. The actual tonnage of rn, soybeans, and wheat exported from Pascagoula in 1979 amounted to out 3.8 million tons as compared to the computed trend tonnage of approx-ately 2.6 million tons.

TABLE 7
PROJECTIONS OF EXPORTS OF GRAIN FROM PASCAGOULA HARBOR
(Thousands of Tons)

AR	CORN	WHEAT	SOYBEANS	TOTAL	FACTOR
79	1,078	508	1,015	2,601	1.000
95	1,770	620	1,594	3,984	1.532
00	1,986	655	1,775	4,416	1.698
10	2,419	725	2,137	5,281	2.030
15	2,635	760	2,318	5,713	2.196
20	2,851	795	2,499	6,145	2.363
30	3,284	866	2,861	7,011	2.696
40	3,716	936	3,223	7,875	3.028
44	3,889	964	3,368	8,221	3.161

Allocation of Heavy Crude Oil by Foreign Origin. In 1979, the Chevron refinery at Bayou Casotte received 58,835,000 barrels or 7,845,000 short tons of light crude oil by tankers. The source of supply was distributed as shown below.

Persian Gulf	79%
Angola and Nigeria	17%
Misc. foreign ports	3%
Domestic	1%
TOTAL	100%

Due to high costs of purchase and the limited availability of light crude, Chevron decided to convert their refinery at Pascagoula to process heavy high-sulphur crude, primarily from the Persian Gulf Area. They have spent about two billion dollars to modify their refinery at Pascagoula to process this heavy crude. Therefore, the benefit analysis is based on heavy crude oil imports beginning in 1984.

Allocation of Liquified Natural Gas (LNG) by Foreign Origin. Tennessee Gas Transmission Company plans to start importing LNG from Trinidad into their proposed terminal at Bayou Casotte by 1989. They expect to initially import 4,838,000 short tons annually, based on 80 shiploads at 60,480 short tons per trip.

A summary of commerce and tonnages accepted as base-year traffic that will be subjected to a rate analysis is shown in Table 6.

TABLE 6
SUMMARY OF BASE-YEAR TONNAGE ACCEPTED FOR BENEFIT ANALYSIS

	PORTS IN PASCAGOULA HARBOR	
COMMODITY	BAYOU CASOTTE	PASCAGOULA
Heavy Crude Oil	16,718,000 1/	-
Liquified Natural Gas (LNG)	4,838,000 2/	-
Grain	-	1,395,000 3/
TOTAL	21,556,000	1,395,000

1/ Base Year is 1984.
2/ Base Year is 1989.
3/ Base Year is 1979.

TABLE 5

ALLOCATION OF GRAIN EXPORTS FROM PASCAGOULA
BY FOREIGN PORT OF DESTINATION

PORT		ANNUAL (1979) VOLUME OF GRAIN
Black Sea Area (A)		
Novorossiysk, USSR		116,000
	SUB-TOTAL	116,000
Eastern Mediterranean Sea Area (B)		
Bar, Yugoslavia		50,000
	SUB-TOTAL	50,000
Western Mediterranean Sea Area (C)		
Tarragona, Spain		46,000
	SUB-TOTAL	46,000
East Coast of South America Area (D-E)		
Paranagua, Brazil		70,000
Santos, Brazil		45,000
	SUB-TOTAL	115,000
Northern Europe Area (F-G)		
Antwerp, Belguim		164,000
Riga, USSR		66,000
	SUB-TOTAL	230,000
Southern Europe Area (H-I)		
Lisbon, Portugal		35,000
Bilboa, Spain		81,000
	SUB-TOTAL	116,000
Far East Area (J)		
Kaohsiung, Taiwan		68,000
Tsingtao, China		76,000
Tokyo, Japan		251,000
Kashima, Japan		33,000
Taichung, Taiwan		38,000
Busan, Korea		17,000
Vladivostok (Nakhodka), USSR		44,000
Yokohama, Japan		35,000
Inchion, Korea		49,000
Kagoshima, Japan		111,000
	SUB-TOTAL	722,000
	GRAND TOTAL	1,395,000

trim and squat associated with the vessels since they are moving at speeds of 6 to 10 knots in the channel. Therefore, a 36-foot load with a 2-foot underkeel clearance is appropriate for use in the economic analyses.

Liquified Natural Gas (LNG). Tennessee Gas Transmission Company has plans to build an LNG terminal at Bayou Casotte. They expect to process about 4.8 million short tons of LNG annually. The terminal is expected to be operational by the end of 1988. This product will be shipped from Trinidad in three LNG carriers, 64,000 dwt in size, loaded to about 61,000 short tons at a draft of 34 feet. To fulfill their demand at Pascagoula, they expect to ship about 80 shiploads per year. The company has made a sizable investment in the purchase of land for the facility and preliminary plans have been completed for the terminals. The recession accompanied by the overall economic decline in the United States has been the major restriction on the construction of this facility. The annual volume of LNG is not expected to be constrained because of channel restrictions at foreign ports.

DETERMINATION OF BASE YEAR TONNAGE

General. The only commerce moving in 1979 that was analyzed for benefits is grain. Light crude oil imported for the Chevron refinery has been phased out and replaced with heavy crude oil. The LNG will not begin to be imported into the port until 1989. Consequently, three time periods will be considered as a base-year. The 1,395,000 tons of grain, accepted for benefit analysis, are based on base-year (1979) vessel traffic hauling grain from Pascagoula in dry bulk carriers loaded to 36 feet or greater going to foreign ports with depths of 39 feet or more. Also, it is based on present loaded draft allowances.

Alternative Routings via the Panama Canal. Two routes were available for grain vessels traveling between Pascagoula and Far East Countries, namely, through the Panama Canal or around the Cape of Good Hope (Africa). Presently, all grain vessels (dry-bulk carriers) exporting grain from Pascagoula to the Far East are using the Panama Canal, which restricts the use of vessels with loaded drafts over 39 feet. The present fleet of dry bulk carriers of 16,600 - 65,400 dwt class will continue to move via the Panama Canal. If a channel depth of 48 feet or greater were provided at Pascagoula, vessel sizes greater than 87,000 dwt could be more fully loaded and obtain greater efficiency by traveling the longer distance around the Cape of Good Hope. However, since 48 feet is required before benefits can be obtained and foreign port depths restrict drafts to 46 feet for grain, the routing via Cape of Good Hope is not being considered in the benefit analysis and all grain shipments to the Far East will be routed via the Panama Canal.

Allocation of Grain Exports (1979) to Each Foreign Market Area. As previously stated, grain exports from Pascagoula destined to foreign ports with depths less than 39 feet were eliminated. The base-year (1979) grain exports accepted for benefit analysis is 1,395,000 tons. This tonnage was allocated to each foreign region based on actual shipments to the ports in 1979. It is assumed the allocation will be the same in the future with or without the channel improvements. Table 5 gives the tonnage allocated to the foreign market areas with port depths of 39 feet or greater.

for reconciliation of these with engineering underkeel design clearance standards. The Principal and Guidelines require that the most likely condition expected to exist over the project form the basis of the without project and with project conditions and hence of the benefit evaluation. This means that without project and with project conditions must be based on actual and anticipated operational behavior of the carriers/ship operators even if such practice apparently deviates from Corps of Engineers design standards." From data extracted from port records relative to vessel activity at Pascagoula in 1979, there were 104 dry bulk carriers that hauled grain for export. There were 55 or 53 percent that were loaded to a draft of 36 feet or greater. It was assumed that where these vessels only loaded to 36 and 37 feet, they did so because of the amount of grain available for a particular ship, the limited demand of the foreign customers, vessel was fully loaded at this draft or a combination of the above. The vessels that loaded to 38 feet moved out through the present channel by utilizing a favorable tide and the most current knowledge of channel condition. Therefore, no allowance was made for underkeel clearance for without and with project conditions at any channel depth being considered on the Pascagoula River segment.

The third objective in selecting the annual volume of grain exports that would benefit by the project improvements is to determine harbor depths at each foreign port that received grain from Pascagoula. Interviews with shippers and port officials revealed that the ports now receiving the grain in 1979 would be the same ports served on future grain shipments. The shipping pattern might change slightly, but overall foreign customers will continue to import grain through most of these same ports being served from Pascagoula in 1979. Therefore, no change in foreign ports importing grain from Pascagoula will occur in the future without or with the project. In order for shipments to benefit by providing a deeper channel at Pascagoula, harbor depths at foreign ports must be 39 feet deep or greater. The annual volume of grain going to foregin ports with depths of 39 feet or greater is the volume of grain accepted as base-year (1979) tonnage.

Allocation of Grain to Different Size Vessels. A six-vessel fleet was assigned to the existing 38-foot channel depth. The first vessel being fully loaded with the next five sizes to be light-loaded by 1-foot increments up to five feet. With a 39-foot channel available a seven-vessel fleet is used, with the first two being fully loaded. For each additional foot of channel depth considered, another vessel is added. In each case, the last five vessels in the fleet will be light-loaded.

Heavy Crude Oil. The heavy crude arrives at a position offshore in VLCC's and ULCC's, and is then lightered to the refinery docks in smaller tankers. Crude oil carrying capacity of the shuttle tankers would be more fully utilized and/or larger vessels could be used, with corresponding reduction in lightering costs if an improved channel is provided into Bayou Casotte. No constraints are placed on the annual volume of heavy crude oil imports into Bayou Casotte due to depths at foreign ports because this crude is brought to an offshore transfer point in the Gulf of Mexico by VLCC or ULCC tankers. The shipping patterns to this point will not change without or with project considerations. Therefore, the depths at the origin port will not put a constraint on the volume received. At present, the shuttle tankers are moving into the port with a 36-foot load or a 2-foot underkeel clearance. According to officials at the refinery, there is negligible of Bayou Casotte annually is expected to be 16.7 million tons. The 16.7 million tons is accepted for benefit analysis. Liquified Natural Gas (LNG) is expected to start being imported into a new terminal at Bayou Casotte in 1989. The expected annual volume will be 4.8 million tons, according to company officials. The 4.8 million tons of LNG is accepted for benefit analysis, beginning in 1989.

Grain. Bulk grain, including corn, wheat, and soybeans, is shipped through the Jackson County Grain Terminal, which is leased and operated by Louis Dreyfus Grain Corporation.

In 1979, there were about 3.8 million short tons of grain exported through that elevator. This included 2,685,000 tons of corn, 995,000 tons of soybeans, and 123,000 tons of wheat. The primary market for this grain was countries located in the Black Sea area, Europe, the Far East, the Mediterrannean Sea, and the East Coast of South America. This grain was actually shipped to about 27 countries throughout the world. The elevator has a storage capacity of 2.8 million bushels of grain. It can load a ship at the rate of 60,000 bushels per hour. Grain is shipped into the elevator by rail, truck, and barge. During 1979, 9,219 trucks delivered 7,018,000 bushels of grain, 31,564 rail cars delivered 106,451,000 bushels, and 362 barges delivered 18,286,000 bushels for a total of 131,756,000 bushels. Most of this grain originated in the midwestern section (Grain Belt) of the United States, except for a small portion that originated within the Gulf Coast region.

The following rationale is the basis for accepting the base-year (1979) tonnage of grain:

The first objective, in selecting the annual volume of grain exports that would benefit by the project improvement, is to select a vessel-fleet that would benefit by having a deeper channel. Based on port data giving the vessel activity at the port in 1979, dry bulk carriers hauling grain were loaded to a draft ranging from 31 to 38 feet. Of the 104 vessel-types of dry bulk carriers hauling grain exports from Pascagoula, 49 vessels or 47 percent were loaded to drafts of 35 feet or less. The remaining 55 vessels or 53 percent were loaded to drafts of 36 feet or greater. The rationale for dividing vessels into these two categories is that grain moving in vessels loaded to 35 feet or less would continue to do so, thereby, would not benefit by channel deepening. These vessels were relatively small and were loaded to capacity and could not take advantage of a deeper channel, or the depth at the foreign port dictates the draft, or because the volume was controlled by the shipper or consignee. Under any of these circumstances, annual volume of grain moving in these size vessels would not benefit by a deeper channel.

The next objective is to determine the actual operating draft of vessels used in exporting grain from Pascagoula. The basis for the appropriate allowance for actual practice in this report is set out in EC 1105-2-118 dated 22 July 1983. It states in part . . ."This circular transmits planning guidance for analysis of without project and with project conditions and computation of benefit for deep draft navigation projects, and

TABLE 4
COMMODITIES THAT WERE MOVING IN DEEP-DRAFT VESSELS
WHICH WERE EXCLUDED FROM BENEFIT ANALYSIS

COMMODITY	ANNUAL VOLUME (1979) (Thousand Short Tons) TOTAL TONNAGE	TONNAGE EXCLUDED
Grain and Grain Products	3,816.0	2,421.0
Nonmetallic Minerals	106.0	106.0
Metallic Ores	40.0	40.0
Light Crude Oil	8,664.5	8,664.5 1/
Chemicals	607.3	607.3
Fertilizers	210.4	210.4
Petroleum Products	6,172.7	6,172.7
Other	83.2	83.2
TOTAL	19,700.1	18,305.1

1/ In 1984 the light crude will be replaced with 16,718,000 tons of heavy crude.

SOURCE: Waterborne Commerce, Part 2, 1979.

vessels were excluded from the benefit-analysis as shown in Table 4. It is expected these commodities will continue to move in relatively small ships in the future.

Waterborne Commerce Statistics for 1979 showed that a total of 3,803,000 tons of bulk grain was exported from the Port of Pascagoula in 1979. Port records show that 3,767,000 tons of bulk grain was exported in 1979. The 3,803,000 tons of bulk grain as reported by Waterborne was accepted as the official tonnage. Also there were 13,000 tons of bagged grain exported through the port in 1979, but not through the elevator. There were 160,000 tons that moved in general cargo ships, according to port records, which were eliminated because these type vessels can adequately operate on the present 38-foot channel depth. It was determined that dry bulk carriers, exporting grain from Pascagoula in 1979 with drafts of 35 feet or less were either light-loaded because of depths at the foreign destination or the relatively small ships were loaded to capacity for unexplained reasons. Port records indicate that about 59 percent, or 2,261,000 tons of the grain exports, was hauled in dry bulk carriers loaded to 35 feet or less. Therefore, the 160,000 tons being hauled in general cargo ships and the 2,261,000 tons moving in dry bulk carriers that were loaded to 35 feet or less was eliminated from further analysis, giving a total grain tonnage eliminated of 2,421,000 tons.

Light crude oil imported into Bayou Casotte in 1979 amounted to 8,664,500 tons. However, Chevron has recently completed their refinery renovation for refining heavy crude, exclusively. They now expect to import 16,718,000 tons of heavy foreign crude on an annual basis. Therefore, the 8,664,500 tons of light crude imported in 1979 was eliminated as tonnage that would benefit by channel improvement.

Total tonnage eliminated was 18,305,100 tons, leaving a balance of the 1979 tonnage accepted for benefit analysis of 1,395,000 tons, which is bulk grain moving in dry bulk carriers. For more detail of traffic that is excluded from benefit analysis refer to Table 4.

COMMERCE ACCEPTED FOR BENEFIT ANALYSIS

General. An examination of commerce currently moving through the ports of Bayou Casotte and Pascagoula was made to determine which commodity movements would be affected by greater channel dimensions. This would include current as well as future commerce which could be identified. After examining the port commerce to determine the quantities and traffic patterns, the commerce that obviously could not benefit from the channel improvements was excluded. This screening process entailed interviews with shippers, steamship lines/agents, terminal operators, and analysis of current and future shipping requirements. After examining the total commerce and screening out that commerce which obviously could not benefit by deep-draft channel improvements, the current commerce that would benefit by a greater channel dimension would be the grain exports. A total of 1,395,000 tons of grain was accepted as traffic that would benefit by channel improvement at Pascagoula. The heavy crude imported into the Port

TABLE 3

ANNUAL COMMERCE FOR PASCAGOULA HARBOR FOR YEARS 1970 - 1979, INCLUSIVE

(Thousand Short Tons)

				DOMESTIC				
		FOREIGN		COASTWISE		INTERNAL		
YEAR	TOTAL	IMPORTS	EXPORTS	RECEIPTS	SHIPMENTS	RECEIPTS	SHIPMENTS	LOCAL
1970	8,984.0	42.1	1,291.9	331.5	2,068.9	2,102.4	3,146.0	1.1
1971	10,098.5	57.0	897.6	445.4	2,208.3	2,203.7	4,263.0	23.5
1972	12,435.0	79.9	1,924.9	534.4	2,623.8	2,671.0	4,558.5	42.4
1973	12,876.9	57.8	2,832.9	648.2	2,669.8	2,082.1	4,485.6	100.6
1974	13,073.2	1,742.7	1,833.6	942.9	2,493.7	1,487.2	4,447.7	125.4
1975	19,951.0	5,800.0	2,250.6	682.0	4,265.4	2,331.3	4,510.4	111.2
1976	23,927.0	9,019.9	2,466.3	683.5	4,873.5	2,132.6	4,599.4	151.9
1977	23,832.9	8,964.6	2,227.6	636.8	5,294.0	1,805.2	4,740.4	164.3
1978	25,244.3	8,236.6	3,899.4	777.4	5,344.8	1,864.7	4,877.5	243.9
1979	25,289.5	9,452.8	4,417.2	574.3	5,255.8	1,890.0	3,501.2	198.2

TABLE 2

TABULATION OF TONNAGES BY COMMODITY AND TYPE OF MOVEMENT FOR PERIOD 1970 - 1979 (Cont'd)

COMMODITY GROUP	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
DEEP DRAFT VESSEL TRAFFIC	3,734,469	3,608,306	5,162,991	6,208,602	7,012,868	12,998,061	17,043,138	17,123,034	18,258,217	19,700,074
BARGE TRAFFIC	5,249,547	6,490,197	7,271,976	6,668,262	6,060,285	6,952,931	6,883,911	6,709,857	6,986,126	5,589,419
GRAND TOTAL	8,984,016	10,098,503	12,434,967	12,876,864	13,073,153	19,950,992	23,927,049	23,832,891	25,244,343	25,289,493

Source: Waterborne Commerce of the United States, Part 2.

TABLE 2

TABULATION OF TONNAGES BY COMMODITY AND TYPE OF MOVEMENT FOR

PERIOD 1970 - 1979 (Cont'd)

COMMODITY GROUP	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
FERTILIZER & FERT. MAT'LS										
Deep Draft	100,683	83,399	174,410	26,135	78,330	8,918	115,158	102,556	187,561	210,390
Barge	271,076	416,183	521,571	516,955	471,384	450,772	497,333	725,986	943,086	874,754
TOTAL	371,759	499,582	695,981	543,090	549,714	459,690	612,491	828,542	1,150,647	1,085,144
PETROLEUM (ex. crude)										
Deep Draft	2,026,096	2,195,656	2,481,712	2,600,763	2,893,885	4,283,631	4,968,460	5,603,878	5,428,721	6,172,703
Barge	3,383,753	4,429,617	4,688,763	4,356,601	4,264,571	4,510,898	4,387,198	3,170,068	4,454,218	3,548,844
TOTAL	5,409,849	6,625,273	7,170,475	6,957,364	7,158,456	8,794,529	9,355,658	8,773,946	9,882,939	9,721,547
IRON & STEEL PRODUCTS										
Deep Draft	1,639	0	125	953	500	0	4	4	1,079	0
Barge	41,520	31,427	15,799	21,870	9,400	14,271	600	3,591	11,414	570
TOTAL	43,159	31,427	15,924	22,823	9,900	14,271	604	3,595	12,493	570
WASTE & SCRAP MAT'LS										
Deep Draft	0	0	0	19,851	29,583	36,494	5,314	15,583	7,269	15,438
Barge	77,001	37,274	37,933	5,325	10,452	4,458	4,955	5,759	14,227	7,297
TOTAL	77,001	37,274	37,933	25,176	40,035	40,952	10,269	21,342	21,496	22,735
MISCELLANEOUS										
Deep Draft	79,634	37,345	140,689	112,780	164,860	34,480	90 458	169,897	109,471	16,580
Barge	9,201	21,593	16,835	25,593	104,931	15,005	11 662	1,283,254	13,846	21,858
TOTAL	88,835	58,938	157,524	138,373	269,791	49,485	102 120	1,453,151	123,317	38,438

TABLE 2

TABULATION OF TONNAGES BY COMMODITY AND TYPE OF MOVEMENT FOR PERIOD 1970 - 1979 (Cont'd)

COMMODITY GROUP	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
FOOD & KINDRED PRODUCTS										
Deep Draft	22,940	28,577	76,944	13,343	49,751	44,031	58,383	6,214	57,216	38,667
Barge	17,897	15,654	4,730	23,118	24,917	25,259	24,995	100,005	40,498	24,388
TOTAL	40,837	44,231	81,674	36,461	74,668	69,290	83,378	106,219	97,714	63,055
LUMBER & WOOD PRODUCTS										
Deep Draft	17,233	14,808	7,896	1,229	0	535	7,426	6,318	6,707	0
Barge	123,396	63,670	70,537	95,241	120,019	90,201	96,339	100,005	176,407	155,745
TOTAL	140,629	78,478	78,433	96,470	120,019	90,736	103,765	106,323	183,114	155,745
PULP, PAPER & ALLIED PRODUCTS										
Deep Draft	75	797	0	0	9,580	7,456	0	1,835	965	0
Barge	0	0	0	0	0	1,386	700	1,057	0	0
TOTAL	75	797	0	0	9,580	8,842	700	2,892	965	0
CHEMICALS & ALLIED PRODUCTS										
Deep Draft	301,565	184,789	304,432	248,096	73,316	225,702	172,641	183,132	229,047	607,322
Barge	373,476	445,293	489,275	449,377	246,315	303,930	452,624	262,468	310,876	240,172
TOTAL	675,041	630,082	793,707	697,473	319,631	529,632	625,265	445,600	539,923	847,494
RUBBER & RELATED PRODUCTS										
Deep Draft	2,328	16,330	12,525	19,635	67,389	45,229	24,268	23,745	26,422	12,567
Barge	0	0	0	0	20	0	0	0	636	239
TOTAL	2,328	16,330	12,525	19,635	67,409	45,229	24 268	23,745	27,058	12,806

Projected Heavy Crude Imports. Heavy crude oil is a relatively new raw material for producing refined petroleum products in the U.S. The renovated refinery at Bayou Casotte has begun processing heavy foreign crude. The company has no present plans for expansion of its facilities at Bayou Casotte; therefore, no attempt was made to project this commodity because of the uncertainty associated with future growth.

Projected Liquid Natural Gas (LNG) Imports. The LNG facility at Bayou Casotte is expected to import approximately 4.8 million tons of liquified natural gas during the initial year of operation in 1989. Continued operations will be dependent on the availability of foreign LNG and domestic demand in the future. Other contracts can and probably will be negotiated which will keep the Bayou Casotte facility operating for the entire life of the Federal Project (1995-2044).

According to officials of Tenneco, the annual volume of LNG will not escalate with time. No attempt is made to project this product, because of the uncertainty of its growth in volume over the next few years, and especially over a 50-year span. Therefore, the 4.8 million tons per year was held constant during the 50-year Federal project life.

Summary of Prospective Commerce. The annual volume of commodities that was accepted as prospective commerce, where a savings in transportation costs can be realized by providing the Federal project, is presented in Table 9.

TABLE 9
PROSPECTIVE COMMERCE FOR SELECTED YEARS DURING
PROJECT LIFE (1995-2044)

ANNUAL TONNAGE (Thousands of Short Tons)

YEARS	GRAIN	HEAVY CRUDE OIL	LNG	TOTAL
1979	1,395	0	0	1,395
1995 1/	2,137	16,718 2/	4,838 3/	23,693
2000	2,365	16,718	4,838	23,921
2010	2,833	16,718	4,838	24,389
2015	3,065	16,718	4,838	24,621
2020	3,296	16,718	4,838	24,852
2030	3,761	16,718	4,838	25,317
2040	4,223	16,718	4,838	25,779
2044	4,409	16,718	4,838	25,965

1/ First year of project life.
2/ Begins in 1984.
3/ Will begin in 1989.

VESSEL TRAFFIC

Current Vessel Trips. The number of trips for vessels which handled all port commerce, including cargo ships, fishing vessels, tows, and other crafts hauling cargo, that called at Pascagoula, MS, in 1979 were 10,980 inbound and 11,018 outbound. Vessels that comprise the deep-draft (19' draft or above) fleet calling at Pascagoula made 423 trips inbound and 520 trips outbound. The cause for the inbalance in the number of inbound and outbound deep-draft vessel traffic is due to some vessels moving empty with drafts under 19 feet, although, while moving in the opposite direction loaded their draft was over 19 feet. More detailed vessel traffic for the port in 1979 is presented in Table 10.

Trend in Vessel Traffic. The most dramatic change in number of vessel-trips are those calling at the port with drafts of 36 feet. There were nine vessel-trips drawing 36 feet in 1970. These increased to 156 trips in 1979. Most of these are tankers serving the Bayou Casotte refinery. There were 392 deep-draft vessels that moved inbound and outbound at Pascagoula in 1970, ten years later, in 1979, there were 943 vessel-trips. This is a 141 percent increase in the number of vessel-trips at Pascagoula. The annual volume of commerce for the port, moving in deep-draft vessels, was 3,734,000 tons in 1970, which increased to 19,700,000 tons in 1979, a 428 percent increase. The average tons haul per vessel in 1970 was about 19,000 short tons, assuming the 392 vessels were only loaded inbound or outbound (196 loaded vessel-trips). By 1979, the average load per vessel was 41,700 short tons. This indicates that the trend in vessels calling at Pascagoula, represents the use of larger vessels, which helps support the need for a greater channel dimension at the port. For more detail on vessel traffic at varying drafts refer to Table 11.

Vessel Sizes and Characteristics. In 1979, there were two types of vessels hauling grain for export from Pascagoula. They were general cargo vessels and dry bulk carriers. The general cargo ships ranged in size from 6,000 to 28,000 dwt. The dry bulk carriers ranged in size from 18,000 to 64,000 dwt. General cargo vessels are gradually being phased out as a grain hauler. With greater channel dimensions available at Pascagoula, there will be very few, if any, general cargo vessels hauling grain. Consequently, only the dry bulk carriers were considered in the benefit analysis of this report for grain commerce. Cargo handled through terminals A & B on the Pascagoula Channel and terminals E, F, G, & H on the Bayou Casotte Channel, owned and operated by the Jackson County Port Authority, was hauled mostly in relatively small general cargo ships. There were a few dry bulk carriers and tankers hauling commerce to or from terminals E, F, G, & H; however, these vessels were not large enough to require a deeper channel. Deep-draft ocean going barges served Mississippi Chemical's terminal for inbound phosphate rock. The 38-foot channel is adequate for all the type vessels mentioned above. Military vessels and oil rigs moved

TABLE 10

TOTAL INBOUND AND OUTBOUND TRIPS AND DRAFTS OF VESSELS CALLING AT

PASCAGOULA DURING C.Y. 1979

HARBOR OR WATERWAY DRAFT (feet)	DIRECTION SELF-PROPELLED VESSELS			NON SELF-PROPELLED VESSELS			DIRECTION SELF-PROPELLED VESSELS			NON SELF-PROPELLED VESSELS		
	DRY CARGO	TANKER	TOWBOAT	DRY CARGO	TANKER	TOTAL	DRY CARGO	TANKER	TOWBOAT	DRY CARGO	TANKER	TOTAL
PASCAGOULA HARBOR, MS		INBOUND						OUTBOUND				
38	-	-	-	-	-	-	24	4	-	-	-	28
37	5	-	-	-	-	5	13	9	-	-	-	22
36	117	-	-	-	-	117	25	6	-	-	8	39
35	-	4	-	-	-	4	24	8	-	-	6	38
34	-	9	-	-	-	9	12	19	-	-	12	43
33	2	5	-	-	1	8	4	7	-	-	26	37
32	3	42	-	-	2	47	9	10	-	-	29	48
31	-	2	-	-	-	2	5	6	-	-	6	17
30	4	3	-	-	-	7	9	8	-	-	7	19
29	1	6	-	-	-	7	2	4	-	-	1	7
28	2	4	-	-	-	6	8	7	-	-	3	18
27	2	3	-	-	-	5	2	4	-	-	-	6
26	4	3	-	-	-	7	6	42	-	-	1	49
25	6	2	1	-	1	10	4	6	1	-	3	14
24	9	6	-	-	-	15	4	10	-	-	-	14
23	15	7	-	-	-	22	3	7	2	-	13	25
22	15	15	-	-	-	30	2	5	-	-	7	14
21	25	9	-	-	2	36	2	1	-	2	36	41
20	24	12	4	-	-	40	8	3	3	-	3	17
19	24	5	17	-	-	46	3	4	14	-	3	24
18 and less	5,967	20	1,650	1,200	1,720	10,557	5,751	8	1,729	1,143	1,867	10,498
TOTAL	6,103	279	1,672	1,200	1,726	10,980	5,920	178	1,749	1,145	2,026	11,018

Source: Waterborne Commerce of the United States for Calendar Year 1979 - Part 2.

TABLE 11

INBOUND AND OUTBOUND TRIPS AND DRAFTS OF VESSELS THAT CALLED AT PASCAGOULA, WITH ACTUAL DRAFTS WHILE OPERATING IN PASCAGOULA AT 19 FEET AND OVER, FOR YEARS 1970 - 1979

DRAFT	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
				NUMBER OF VESSEL TRIPS						
38 Feet and Over	10	5	8	8	3	5	10	7	30	28
37 "	3	7	7	11	6	6	41	11	34	27
36 "	9	6	12	13	39	37	165	184	183	156
35 "	16	15	16	30	24	26	19	34	35	42
34 "	30	33	25	30	57	127	55	44	40	52
33 "	8	12	25	26	32	56	51	42	37	45
32 "	21	14	26	43	27	65	38	62	42	95
31 "	10	10	5	25	21	32	17	23	28	19
30 "	12	16	23	24	29	18	24	20	22	26
29 "	15	9	12	13	18	19	12	4	8	14
28 "	20	9	11	23	12	10	17	21	10	24
27 "	16	11	15	18	25	12	11	12	10	11
26 "	13	10	18	26	39	92	152	68	58	56
25 "	11	14	20	18	32	36	27	27	23	24
24 "	29	18	27	45	67	61	36	34	33	29
23 "	33	32	42	41	54	37	30	32	42	47
22 "	50	32	30	36	56	41	46	30	33	44
21 "	36	27	18	34	31	30	45	59	29	77
20 "	32	35	35	37	33	32	34	37	47	57
19 "	18	18	19	38	26	82	101	87	89	70
TOTAL	392	333	394	539	631	824	931	838	833	943

Source: Waterborne Commerce of the United States - Part 2, 1970 - 1979 issues.

over the Pascagoula Channel for sea trial and delivery. The present (38') channel depth is used by these vessels; however, officials of Litton Industries Shipyard stated that a wider channel is needed. Monetary benefits from infrequent events are small, therefore, these vessels were not considered in the benefit analysis. Tankers serving the Chevron U.S.A. refinery at Bayou Casotte range in size from 10,000 to 76,000 dwt. For outbound shipments of petroleum products from this refinery, relatively small tankers will continue to be used with or without channel improvements. On inbound crude oil, various types and sizes of vessels are currently being used. Crude oil is delivered off-shore in large VLCC and ULCC vessels. Shuttle tankers of 66,000 and 79,000 dwt are being used to deliver the crude oil to the docks at Bayou Casotte. Other crude oil is being delivered in various size tankers and barges. More detailed data on vessels currently using the port are shown in Table 12.

Channel Depths Considered. A 38-foot by 350-foot channel now exists on the Pascagoula River Channel. The Bayou Casotte Channel has widths of 225 and 300 feet with a depth of 38 feet. On the Pascagoula River Channel, only grain is accepted as prospective traffic that will benefit by a channel improvement. Based on interviews with the shippers of grain and port officials, a maximum depth needed would be about 42 feet. A 40-foot channel would be acceptable but a 42-foot channel would be more helpful. In order to consider available depths at all foreign ports, channel depths for each foot from 39 through 46 feet are being studied. The width of each channel will be determined in other sections of the report.

For the Bayou Casotte Channel, the study includes an analyses of 80,000, 100,000 dwt and the existing fleet of crude oil shuttle tankers, and 64,000 dwt LNG tankers. The 80,000 ton tankers need a channel depth of 42 feet to carry a full load of cargo, assuming a 2-foot underkeel clearance. These vessels have a fully loaded draft of 40 feet. The 100,000 dwt tanker have a 49-foot fully loaded draft. With a 2-foot clearance, they need a 51-foot channel depth. The 64,000 dwt LNG tankers have a fully loaded (design) draft of 36 feet; however, LNG company officials stated they would only load to a 34-foot arrival draft. These LNG tankers will need a 42-foot channel depth, which would include an allowance of 4 feet for trim and 4 feet for underkeel safety clearance. Therefore, channel depths considered for the Bayou Casotte segment will range from 39 to 51 feet. The characteristics of tankers that would use the Bayou Casotte Channel is shown in Table 13.

Vessel Fleet for Hauling Grain. To determine transportation costs for grain exports from Pascagoula under different channel depths a range in vessel sizes was used to compose a fleet of dry bulk carriers for each channel depth being considered. A fleet of dry bulk carriers was assigned to each channel depth ranging from 38 to 46 feet. The size (dwt) of vessels assigned to the 38-foot channel ranges from the size vessel that can be fully loaded to a vessel size that has to be lightloaded by 5 feet.

TABLE 12

TYPICAL CHARACTERISTICS OF DEEP-DRAFT VESSELS AND VESSEL-TRIPS FOR PASCAGOULA HARBOR

IN 1979

PASCAGOULA CHANNEL (With a 38' Channel Available)

TYPE OF VESSEL	VESSEL SIZE (DWT)	LENGTH (FT.)	BREADTH (FT.)	REGISTERED DRAFT (FT.)	NO. OF TRIPS (ONE-WAY)
Grain Terminal (Elevator)					
General Cargo Ships	6,000	350	50	20	3
" " "	16,000	500	70	30	6
" " "	28,000	560	90	33	1
Dry Bulk Carriers	18,000	530	70	30	6
" " "	30,000	606	80	35	51
" " "	40,000	650	89	38	31
" " "	53,000	685	95	42	6
" " "	64,000	740	106	43	9
				SUB-TOTAL	113
Terminals A & B (General Cargo)					
General Cargo Ships	5,000	346	56	22	5
" " "	24,000	507	68	30	8
Dry Bulk Carriers	17,000	472	70	31	1
" " "	24,000	648	106	33	2
				SUB-TOTAL	16
Litton Shipyard					
Military Vessels	N/A	563	55	30	18
" "	N/A	840	150	28	3
Oil Rigs	N/A	N/A	N/A	N/A	2
				SUB-TOTAL	23
				TOTAL TRIPS FOR PASCAGOULA CHANNEL	152

N/A = Not available

TABLE 12 (Cont'd)

TYPICAL CHARACTERISTICS OF DEEP-DRAFT VESSELS AND VESSEL-TRIPS FOR PASCAGOULA HARBOR

IN 1979

BAYOU CASOTTE CHANNEL (With a 38' Channel Available)

TYPE OF VESSEL	VESSEL SIZE (DWT)	LENGTH (FT.)	BREADTH (FT.)	REGISTERED DRAFT (FT.)	NO. OF TRIPS (ONE-WAY)
Terminals E, F, G, & H (General Cargo)					
General Cargo Ships	7,000	394	55	24	4
" " "	15,000	502	68	30	16
Dry Bulk Carriers	16,000	513	67	29	6
" " "	27,000	553	81	34	12
				SUB-TOTAL	38
Mississippi Chemical Deck (Phosphate Rock)					
Ocean Going Barges	25,000	420	80	32	39
Chevron Refinery Docks (Light Crude & Products)					
Tankers	10,000	430	61	27	3
"	29,000	575	84	34	20
"	50,000	751	103	40	32
"	58,000	711	106	42	4
"	76,000	767	116	44	119
				SUB-TOTAL	178
		TOTAL TRIPS FOR BAYOU CASOTTE CHANNEL			255

SOURCE: Jackson County Port Authority records.

TABLE 13

CHARACTERISTICS OF TANKERS THAT WILL BE USED AT DIFFERENT CHANNEL DEPTHS

BAYOU CASOTTE CHANNEL

PROJECT DEPTH	SIZE (Deadweight)	LENGTH	BREADTH	FULLY LOADED REGISTERED DRAFT	ALLOWABLE DRAFT[1]
38' Channel					
Crude Oil Tankers[2]	66,000	784	104	44	36
Crude Oil Tankers[1]	79,000	760	122	44	36
Crude Oil Tankers	80,000	760	122	40	36
LNG Tankers	64,000	948	135	36	34 (Use of tug service and level trim)
42' Channel					
Crude Oil Tankers	80,000	760	122	40	40
LNG Tankers	64,000	948	135	36	34
45' Channel					
Crude Oil Tankers	100,000	850	126	49	43
LNG Tankers	64,000	948	135	36	34
50' Channel					
Crude Oil Tankers	100,000	850	126	49	48
LNG Tankers	64,000	948	135	36	34
51' Channel					
Crude Oil Tankers	100,000	850	126	49	49
LNG Tankers	64,000	948	135	36	34

1/ An allowance of two feet for crude tankers and four feet for LNG tankers is made for safety clearance underkeel.

2/ Existing fleet.

For each foot of channel depth increase, another vessel size (dwt) is added to the fleet. In each case, the last five vessels are lightloaded by one-foot increments up to five feet. A display of vessels used for each channel depth is shown in Table 14. IT should be noted herein that vessels going to the Far East via the Panama Canal will be limited to those that have a loaded draft of 39 feet or less. The vessel-fleet for the Panama Canal will be the same as that for a 39-foot channel at Pascagoula. Large grain vessels destined to the Far East, routed around the Cape of Good Hope, cannot economically compete with vessels routed through the Panama Canal unless a channel depth of 48 feet or greater is provided at Pascagoula. Since foreign port depths restrict drafts to 46 feet for grain, the routing via Cape of Good Hope is not being considered in the benefit analysis.

Vessel Traffic for Heavy Crude Oil. Improvement of the Bayou Casotte Channel will allow the port to handle larger vessels calling at the refinery. Before 1984, vessel traffic serving the refinery hauled inbound light crude oil from numerous sources of supply and ranged in average size from 29,000 to 76,000 dwt. Light crude oil from the Persian Gulf was being shipped to an offshore point in the Gulf of Mexico south of Pascagoula by VLCC tankers and transferred into smaller shuttle tankers for lightering into Bayou Casotte terminal. However, the refinery expansion is now completed to process heavy crude oil. The crude oil is delivered to an offshore site about 55 miles south of Pascagoula in the Gulf of Mexico in Very Large Crude Carriers (VLCC) and Ultra Large Crude Carriers (ULCC) tankers and transferred by lighterage service into the refinery docks at Bayou Casotte.

With channel depths ranging from 38 through 42 feet, the most economical lightering shuttle service would be by use of two 80,000 dwt tankers. For depths from 43 through 51 feet, two 100,000 tankers were analyzed, but the results showed the 80,000 dwt vessels could operate at less cost than the 100,000 dwt vessels at the greater depths.

Vessel Traffic for Liquified Natural Gas (LNG). The three 64,000 dwt LNG tankers will have a loaded draft of 34 feet. With a 38-foot channel depth available, these ships will require standby tug assistance within the harbor of Pascagoula from the "farewell" buoy to the docks. The vessels will be at a level trim, loaded to a 34-foot draft. A safety clearance of 4 feet between ships' keel and channel bottom is allowed for these LNG vessel while operating in Pascagoula Harbor. With a channel depth of 42 feet, these vessels will be loaded with a 4-foot stern trim, and would not require tug service while traveling within the harbor channels. With a 4-foot stern trim the ships would have better maneuverability and speed in the harbor channels. The size and characteristics of the maximum size vessels for each selected channel depth are shown in Table 13.

Vessels' Travel Patterns. The foreign market area for grain exports from Pascagoula are: Black Sea Area (USSR); Northern Europe Area (Belgium, Poland, USSR, and Denmark); Southern Europe Area (Portugal, Spain, and

TABLE 1[illegible]

VESSEL FLEET OF DRY BULK CARRIERS FOR HAULING EXPORT GRAIN FROM PASCAGOULA

DWT	LENGTH (Ft.)	BEAM (Ft.)	REGISTERED DRAFT (Ft.)	(EXISTING) 38	39	40	41	42	43	44	45	46
40,128	648.1	92.7	38	X	X	X	X	X	X	X	X	X
43,931	663.8	95.3	39	X	X	X	X	X	X	X	X	X
47,752	679.4	97.3	40	X	X	X	X	X	X	X	X	X
51,798	694.9	100.5	41	X	X	X	X	X	X	X	X	X
56,077	710.5	103.1	42	X	X	X	X	X	X	X	X	X
60,597	726.0	105.7	43	X	X	X	X	X	X	X	X	X
65,364	741.5	108.3	44		X	X	X	X	X	X	X	X
70,386	756.9	110.9	45			X	X	X	X	X	X	X
75,622	772.3	113.5	46				X	X	X	X	X	X
81,227	787.7	116.2	47					X	X	X	X	X
87,060	803.1	118.8	48						X	X	X	X
93,179	818.4	121.4	49							X	X	X
99,591	833.8	124.1	50								X	X
106,306	849.1	126.7	51									X

Morrocco); countries bordering on the Easter Mediterranean Sea (Israel, Yugoslavia, and Egypt); Western Mediterranean Sea Area (Spain); and, Far East countries (Japan, Korea, China, Taiwan, USSR ports); East Coast of South America (Brazil); and, Caribbean Sea (Mexico, Venezuela, Dominican Republic). Vessels hauling grain to the Caribbean area would not need additional channel depths at Pascagoula because of the depths at these Caribbean ports. More details on foreign ports will be discussed later in this appendix. Grain ships traveling to the Far East have a choice of two routes; one is through the Panama Canal for vessels up to 65,364 dwt, loaded to a draft of 39 feet, and the other is around the Cape of Good Hope, with unlimited size vessels. Routing of grain vessels to other foreign ports used a direct route from Pascagoula.

By the end of 1984 all feed stock for the refinery will be heavy crude originating in the Persian Gulf area. The traffic pattern will be by use of VLCC and ULCC tankers routed around the Cape of Good Hope to a point about 55 miles offshore south of Pascagoula. The heavy crude will be off-loaded into smaller shuttle tankers for final delivery.

The LNG will be shipped directly from Trinidad to Bayou Casotte in LNG tankers.

Distance of Ocean Travel. Accepted grain exported from Pascagoula is shipped to various world-wide foreign ports. These ports have been grouped into seven regions, namely, Northern Europe, Southern Europe, Far East, Eastern Mediterranean, Western Mediterranean, East Coast of South American, and the Black Sea Area. Distance between Pascagoula and ports in countries assigned to each of these regions have been determined and the average distance is calculated for each region. These distances have been used for determining the line-haul costs of the vessels' travel. On grain to the Far Eastern Countries, there are two routes available, as previously discussed. All other grain shipments move directly over established routes. Heavy crude oil imported from the Persian Gulf area will be routed via the Cape of Good Hope to an offshore point in the Gulf of Mexico south of Pascagoula. The nautical miles is 12,342, plus another 55 miles from the off-loading point to Bayou Casotte refinery. LNG will be hauled 2,004 miles by direct routing to Pascagoula from one point of origin which is Trinidad. All of these nautical mile distances are shown on Table 15.

Channel Depths at Foreign Ports. The depths at foreign ports, which restrict the size vessel that can enter, are not always well defined or published in readily available publications. Foreign port depths as shown in Table 16 are the depths at locations within the port that would restrict the passage of vessels. It may be the depth of water along side of dock, the harbor entrance channel, an inside channel, or harbor area where vessels normally off-load cargo rather than unload at dockside. The depths at foreign ports were generally obtained from a publication entitled "Port Dues, Charges and Accommodations - 1977-78 Issue".

DISTANCE OF OCEAN MILES (NAUTICAL) BETWEEN PASCAGOULA, MS AND FOREIGN PORTS

COMMODITY	ORIGIN/DESTINATION	NAUTICAL MILES (One-Way) VIA: PANAMA CANAL	CAPE OF GOOD HOPE	DIRECT
Grain (Exports)				
To Black Sea Area:				
	Novorossiysk, USSR	N/A	N/A	6,780
	Distance			6,780
To Eastern Mediterranean Sea Area:				
	Bar, Yugoslavia	N/A	N/A	6,451
	Distance			6,451
To Western Mediterranean Sea Area:				
	Tarragona, Spain	N/A	N/A	5,004
	Distance			5,004
To East Coast of South America Area:				
	Paranagua, Brazil	N/A	N/A	5,693
	Santos, Brazil	N/A	N/A	5,343
	Average Distance			5,518
To Northern Europe Area:				
	Antwerp, Belguim	N/A	N/A	4,815
	Riga, USSR	N/A	N/A	5,804
	Average Distance			5,310

TABLE 15 (Cont'd)

DISTANCE OF OCEAN MILES (NAUTICAL) BETWEEN PASCAGOULA, MS AND FOREIGN PORTS

		NAUTICAL MILES (One-Way) VIA:		
COMMODITY	ORIGIN/DESTINATION	PANAMA CANAL	CAPE OF GOOD HOPE	DIRECT
To Southern Europe Area:				
	Lisbon, Portugal	N/A	N/A	4,325
	Bilboa, Spain	N/A	N/A	4,758
	Average Distance			4,542
To Far Eastern Area:				
	Kaohsiung, Taiwan	10,217	14,657	N/A
	Tsingtao, China	9,964	15,364	N/A
	Tokyo, Japan	9,081	15,756	N/A
	Kashima, Japan	9,625	15,257	N/A
	Taichung, Taiwan	10,217	14,657	N/A
	Busan, Korea	9,752	15,359	N/A
	Vladivostok (Nakhodka), USSR	9,146	15,861	N/A
	Yokohama, Japan	9,071	15,716	N/A
	Inchion, Korea	9,863	15,417	N/A
	Kagoshima, Japan	9,525	15,122	N/A
	Average Distance	9,646	15,317	N/A
Heavy Crude Oil (Import)				
Persian Gulf to Offshore:				
	Unloading (VLCC & ULCC tankers)	N/A	12,342	N/A
	Offshore unloading to dock (shuttle tanker)	N/A	N/A	55
LNG (Import)				
	Port of Spain, Trinidad	N/A	N/A	2,004

N/A = Not applicable.

TABLE 16
DEPTHS AT FOREIGN PORTS

PORT	DEPTH (ft.)
ack Sea Area	
vorossiysk, USSR	42
stern Mediterranean Sea Area	
r, Yugoslavia	43
stern Mediterranean Sea Area	
rragona, Spain	42
st Coast of South America Area	
ranagua, Brazil	39
ntos, Brazil	44
rthern Europe Area	
twerp, Belguim	46
iga, USSR	41
uthern Europe Area	
isbon, Portugal	49
ilboa, Spain	46
ar East Area[1/]	
aohsiung, Taiwan	46
singtao, China	39
oyko, Japan	39
ashima, Japan	62
aichung, Taiwan	43
usan, Korea	42
ladivostok (Nakhodka), USSR	39
okohama, Japan	39
nchion, Korea	49
agoshima, Japan	39

of these Far East ports have depths 39 feet or over. Vessels' ft is limited to 39 feet on all traffic to the Far East because of the foot allowable draft on vessels transiting the Panama Canal.

TABLE 23

UNLOADING TIME REQUIREMENTS FOR ULCC'S AND VLCC'S WITH (USING 80,000 DWT VESSEL) SHUTTLE VESSEL

OPERATING AT DIFFERENT CHANNEL DEPTHS

CHANNEL DEPTH	TONNAGE HAULED BY EACH SHUTTLE VESSEL	SHUTTLE TRIPS TO ULCC USING 2-80,000 VESSELS	SHUTTLE TRIPS TO VLCC USING 2-80,000 VESSELS	SHUTTLE TRANSIT TIME PER TRIP 1/	UNLOADING TIME (hrs.) TOTAL ANNUAL HOURS FOR ULCC	UNLOADING TIME (hrs.) TOTAL ANNUAL HOURS FOR VLCC
38 ft.	[illegible] 2/	8[illegible].71	134.27	50.0 hrs.	4,285.50	6,713.50
[illegible] ft.	79,[illegible]31 3/	8[illegible].42	129.11	51.4 hrs.	4,236.39	6,636.25
[illegible] ft.	82,[illegible] 4/	79.[illegible]	124.33	52.8 hrs.	4,190.74	6,564.62
41 ft.	8[illegible],10[illegible] 5/	76.5[illegible]	119.90	54.2 hrs.	4,148.47	6,498.58
42 ft.	8[illegible],14[illegible] 6/	73.90	115.76	55.6 hrs.	4,108.84	6,436.26

1/ See Table 2[illegible].

2/ Light-loaded by 4 feet.

3/ " " " 3 " .

4/ " " " 2 " .

5/ " " " 1 " .

6/ Fully loaded.

NOTE: Immersion factor for an 80,000 dwt tanker is 3,037 short tons per foot of draft.

NOTE: Annual volume (short tons) hauled by Mother Ships.

- ULCC 6,513,660
- VLCC 10,203,897

Total unloading times for the ULCC's and VLCC's are determined based on the total time per trip shown above in Table 22 and the total number of trips of each of the larger vessels determined from the tonnage hauled at each depth divided into the total annual tonnage hauled by the type of larger vessel involved. The results of these computations are shown in Table 23.

These values are used in conjunction with the costs per hour at sea for each of the larger vessels to determine total costs of unloading each of the larger tankers. These results are shown in Table 24.

Total costs associated with the two 80,000 dwt shuttle vessels are determined based on the number of trips shown in Table 23, the travel and port time, and the hourly costs of operating the vessels at sea and in port. The results of these computations are shown in Tables 25 and 26.

Operating Costs on Heavy Crude Shuttle Vessels for a Channel Depth Ranging from 43 to 51 Feet. Benefits to these depths are determined by the use of two 100,000 dwt shuttle vessels. As these vessels are more fully loaded, they also require more time to load at sea and unload in port. Round trip travel time is the same regardless of load. Transit times for the 100,000 dwt vessels are shown below in Table 27.

TABLE 27
TOTAL TRANSIT TIME TO SHUTTLE CRUDE OIL IN 2-100,000 DWT VESSELS
AT VARIOUS CHANNEL DEPTHS

CHANNEL DEPTH	TIME IN PORT	TRAVEL TIME AT SEA	LOADING TIME AT SEA	TOTAL TIME AT SEA	TOTAL TRIP TIME
38 ft.[1/]	20.0 hrs.	12.0 hrs.	18.0 hrs.	30.0 hrs.	50.0 hrs.
43 ft.	23.5 hrs.	12.0 hrs.	21.5 hrs.	33.5 hrs.	57.0 hrs.
44 ft.	24.2 hrs.	12.0 hrs.	22.2 hrs.	34.2 hrs.	58.4 hrs.
45 ft.	24.9 hrs.	12.0 hrs.	22.9 hrs.	34.9 hrs.	59.8 hrs.
46 ft.	25.6 hrs.	12.0 hrs.	23.6 hrs.	35.6 hrs.	61.2 hrs.
47 ft.	26.3 hrs.	12.0 hrs.	24.3 hrs.	36.3 hrs.	62.6 hrs.
48 ft.	27.0 hrs.	12.0 hrs.	25.0 hrs.	37.0 hrs.	64.0 hrs.
49 ft.	27.7 hrs.	12.0 hrs.	25.7 hrs.	37.7 hrs.	65.4 hrs.
50 ft.	28.4 hrs.	12.0 hrs.	26.4 hrs.	38.4 hrs.	66.8 hrs.
51 ft.	29.1 hrs.	12.0 hrs.	27.1 hrs.	39.1 hrs.	68.2 hrs.

[1/] With a 350-foot channel width.

Time at sea required for each of the ULCC and VLCC vessels is based on the time allocated to one 100,000 dwt vessel for purposes of unloading the larger tankers at sea. The two 100,000 dwt vessels should be able to shuttle during this time frame since two docks are utilized in unloading

ANNUAL TRANSIT COSTS BY USING 2-80,000 DWT SHUTTLE VESSELS

(38' Channel Depth)

Shuttle Vessel Data:

TONS HAULED AT 38 Ft.	SHUTTLE VESSELS	ANNUAL ULCC TONNAGE	ANNUAL VLCC TONNAGE	SHUTTLE TRIPS TO ULCC	[illegible]
75,994	2-80,000 dwt	6,513,660	10,203,897	85.71	[illegible]

Mother Ship Costs:

SHUTTLE TRIPS TO ULCC	SHUTTLE TRIPS TO VLCC	SHUTTLE VESSELS	HOURS PER TRIP	TOTAL HOURS ULCC	TOTAL HOURS VLCC	[illegible]	[illegible]
85.71	134.27	2-80,000 dwt	50.0	4,285.50	6,713.50	[illegible]	[illegible]

Cost of 2-80,000 Shuttle Vessels Serving the ULCC and VLCC Tankers:

SHUTTLE TRIPS TO ULCC	SHUTTLE TRIPS TO VLCC	SHUTTLE TRAVEL TIME	PORT TIME	HOURLY OPERATING COSTS		TOTAL COSTS		TOTAL COSTS
				AT SEA	IN PORT	TO ULCC	TO VLCC	
85.71	134.27	30.0 3/	20.0 3/	$999	$504	$3,432,685	$5,377,514	[illegible]

VESSEL		ANNUAL COSTS AT 38 Ft.		ANNUAL TONNAGE	COSTS PER TON
ULCC		$10,885,170			
VLCC		12,621,880			
2-80,000 dwt		8,810,149			
	TOTAL	$32,317,199	÷	16,718,000	$1.93

1/ Based on an hourly cost of $2,540.

2/ Based on an hourly cost of $1,880.

3/ See Table 23.

used on a wider channel. The costs of the two mother ships and two 80,000 dwt vessels used to shuttle the cargo on a 38-foot by 350-foot channel amounted to about $32,317,199 per year or about $1.93 per ton. The computational procedures and the resulting costs per ton of shuttling the heavy crude in the 80,000 dwt vessel fleets are shown in Table 21.

As shown in the above tables, the costs of shuttling heavy crude from the ULCC's and VLCC's with drafts of shuttle vessels restricted by a 38-foot channel depth varies from about $46.7 million to about $32.3 million based on the fleet of shuttle vessels used. Use of the two-vessel existing shuttle fleet and the 80,000 dwt shuttle fleet will cost about $2.97 and about $1.93 per ton, respectively, to shuttle the crude oil from the larger vessels to port. This difference is assigned as benefits to a wider channel only.

With Project Improvements for a Channel Depth from 39 Through 42 Feet. Costs of the use of the ULCC's, the VLCC's, and the two 80,000 dwt vessels are calculated in an identical manner as those for the "without project" condition. The fully loaded draft of an 80,000 dwt vessel is 40 feet, which for benefit purposes, will require a 42-foot channel. Benefits are determined for each incremental foot of channel depth from 39 through 42 feet. Benefits for incremental depths between 43 and 51 feet are determined by the use of two 100,000 dwt vessels which can be fully loaded on a 51-foot channel with 2-foot underkeel clearance.

Operating Costs on Heavy: Crude Shuttle Vessels for a Channel Depth Ranging from 38 to 42 Feet. The 80,000 dwt vessel must be light-loaded to move commerce over a 38-foot channel with a 350-foot width. As the vessels are more fully loaded, more time is required to load at sea and to unload in port. Round-trip travel time for the vessels is the same regardless of load. Table 22 shows the transit time for shuttle vessels with different depths of channel available. These are used in calculating the costs of transferring the crude oil from mother ship to dock, by use of the 80,000 dwt shuttle vessels.

TABLE 22
VESSEL TRANSIT TIME REQUIRED TO MOVE HEAVY CRUDE AT DIFFERENT CHANNEL DEPTHS FOR EACH OF THE 80,000 DWT VESSELS

CHANNEL DEPTH	TIME IN PORT	TRAVEL TIME AT SEA	LOADING TIME AT SEA	TOTAL TIME AT SEA	TOTAL TIME PER TRIP
38 ft.	20.0 hrs.	12.0 hrs.	18.0 hrs.	30.0 hrs.	50.0 hrs
39 ft.	20.7 hrs.	12.0 hrs.	18.7 hrs.	30.7 hrs.	51.4 hrs
40 ft.	21.4 hrs.	12.0 hrs.	19.4 hrs.	31.4 hrs.	52.8 hrs
41 ft.	22.1 hrs.	12.0 hrs.	20.1 hrs.	32.1 hrs.	54.2 hrs
42 ft.	22.8 hrs.	12.0 hrs.	20.8 hrs.	32.8 hrs.	55.6 hrs

ANNUAL TRANSFER COSTS BY USING A 79,000 AND 66,000 DWT SHUTTLE FLEET

(38' Channel Depth)

Number of Shuttle Trips Annual to Unload the VLCC Vessels:

TONS HAULED BY VLCC	PERCENT ALLOCATION	ALLOCATED TONNAGE	TONNAGE HAULED AT 38 FT.	TRIPS	SHUTTLE VESSEL
10,203,897	56.5	5,765,202	66,689	86.45	Frankfurt
10,203,897	43.5	4,438,695	51,288	86.54	Johnson

Shuttle Vessel Data:

VESSEL	LOADING TIME AT SEA	TRAVEL TIME AT SEA[1/]	TOTAL TIME AT SEA	TIME IN PORT	TOTAL HRS. PER TRIP	COST PER HR. AT SEA	COST PER HR. IN PORT
Frankfurt	20.0 hrs.	12.0 hrs.	32.0 hrs.	24.0 hrs.	56.0	$991	$502
Johnson	20.0 hrs.	12.0 hrs.	32.0 hrs.	26.0 hrs.	58.0[2/]	$919	$479

Mothership Data:

VESSEL	SHUTTLE TRIPS TO UNLOAD	SHUTTLE TRANSIT TIME PER TRIP (Hrs.)[3/]	TOTAL ANNUAL TRANSIT TIME (Hrs.)	COSTS PER HR. AT SEA	TOTAL ANNUAL COSTS
ULCC	110.43	57.0	6,294.51	$2,540	$15,988,055
VLCC	172.99	57.0	9,860.43	$1,880	$18,537,608

1/ Round-trip.

2/ Assigned time for the motherships to load each shuttle vessel. (Cont'd).

3/ Weighted.

TABLE 20 (Cont'd)

ANNUAL TRANSFER COSTS BY USING A 79,000 AND 66,000 DWT SHUTTLE FLEET

(38' Channel Depth)

Costs of Shuttle Vessels Serving the ULCC Tanker:

VESSEL	ANNUAL TRIPS	TRAVEL TIME (Hrs.)	COST AT SEA (Per Hour)	PORT TIME (Hrs.)	COST IN PORT (Per Hour)	TOTAL COSTS
Frankfurt	55.18	32.0	$991	24.0	$502	$2,414,677
Johnson	55.25	32.0	$919	26.0	$479	$2,312,876

Costs of Shuttle Vessels Serving the VLCC Tanker:

VESSEL	ANNUAL TRIPS	TRAVEL TIME (Hrs.)	COST AT SEA (Per Hour)	PORT TIME (Hrs.)	COST IN PORT (Per Hour)	TOTAL COSTS
Frankfurt	86.45	32.0	$991	24.0	$502	$3,783,052
Johnson	86.45	32.0	$919	26.0	$479	$3,622,737

Summary of Costs:

VESSEL	ANNUAL COSTS @ 39 Ft.		ANNUAL TONNAGE		COSTS PER TON
ULCC	$ 15,988,055				
VLCC	18,537,608				
Frankfurt	6,197,729				
Johnson	5,935,613				
TOTAL	$ 46,659,005	÷	16,718,000	=	$2.79

NOTE: Example for computing shuttle vessel costs, based on calculating costs for the Frankfurt: (86.45 x 32.0 x $991) + (86.45 x 24.0 x $502) + (55.18 x 32.0 x $991) + (55.18 x 24.0 x $502) = $6,197,729.

TABLE 20

ANNUAL TRANSFER COSTS BY USING A 79,000 AND 66,000 DWT SHUTTLE FLEET

(38' Channel Depth)

Shuttle Fleet Tonnage Data:

TONS HAULED AT 38 FT.	VESSEL NAME	% OF TOTAL	ANNUAL TONNAGE	ALLOCATED TONNAGE
66,689	Frankfurt	56.5	16,718,000	9,445,670
51,288	Johnson	43.5	16,718,000	7,272,330
117,977		100.0		16,718,000

Mothership Data:

VESSEL TYPE	IMPORT TRIPS	BARRELS HAULED PER TRIP	CONVERSION BBLS. TO LONG TONS	CONVERSION LONG TONS TO SHORT TONS	TONS HAULED BY VESSEL TYPE	COSTS PER HOUR AT SEA
ULCC	14.6	2,880,000	7.23	1.12	6,513,660	$2,540
VLCC	35.3	1,866,000	7.23	1.12	10,203,897	$1,880

Number of Shuttle Trips Annually to Unload the ULCC Vessels:

TONS HAULED BY ULCC	PERCENT ALLOCATION	ALLOCATED TONNAGE	TONNAGE HAULED AT 38 FT.	TRIPS	SHUTTLE VESSEL
6,513,660	56.5	3,680,218	66,689	55.18	Frankfurt
6,513,660	43.5	2,833,442	51,288	55.25	Johnson

TABLE 18

PERTINENT DATA ON VESSEL DELIVERING HEAVY CRUDE, BEGINNING IN 1984

	CHEVRON NORTH AMERICA (ULCC)	OTTO N. MILLER (VLCC)	FRANKFURT (With a 38' Channel)	JOHNSON (With a 38' Channel)	80,000 With a 38' Through 42' Channel	100,000 With a 43' Through 51' Channel
Vessel size (DWT)	406,000	264,000	79,000	66,000	80,000	100,000
Hourly operating costs at sea	$2,540 1/	$1,880 1/	$991 2/	$919 2/	$999 2/	$1,121 2/
Hourly oeprating costs in port	-	-	$502 2/	$479 2/	$504 2/	$533 2/
Average load (short tons)	446,141 3/	289,062 3/	66,689	51,288	75,994 - 88,144	87,123 - 110,451
Immersion factor (short tons per ft.)	-	-	2,527	2,244	3,037 3/	2,916 3/
Loading time at sea (hrs.)	-	-	20.0 3/	20.0 3/	18.0 3/ - 20.8 3/4/	21.5 - 27.1 3/4/
Travel time at sea (hrs.)	-	-	12.0 3/	12.0 3/	12.0 3/	12.0 3/
Port time to unload (hrs.)	-	-	24.0 3/	26.0 3/	20.0 - 22.8 3/4/	23.5 - 29.1 3/4/
Change in loading time at sea per 1 ft. additional load (hrs.)	-	-	-	-	+0.7 3/	+0.7 3/
Change in travel time at sea per 1 ft. additional load (hrs.)	-	-	-	-	0.0	0.0
Change in port time per 1 ft. additional load (hrs.)	-	-	-	-	+0.7 3/	+0.7 3/
Carrying capacity (short tons)	446,141	289,062	86,905	69,245	88,144	110,451
Fully loaded draft (ft.)			44	44	40	49

1/ Computed by Mobile District. See Text.

2/ Determined from MMS Data.

3/ Information and data received from company. For large carriers, represents short tons of crude imported per trip.

4/ Loading time at sea increases .7 hr. per 1 foot of additional load. 100,000 dwt increases the same and continues on from the end of the 80,000 dwt computations.

NOTE: The Frankfurt and Johnson represent the existing fleet of shuttle vessels.

trip. The VLCC vessels will make an average of 35.3 trips per year hauling about 1,866,000 barrels per trip. Barrels are converted to short tons by assuming 7.23 barrels per long ton and 1.12 short tons per long ton. The results of the use of this formula allocates 6,513,660 tons to the ULCC's and 10,203,897 tons to the VLCC's. The total annual tonnage of 16,717,557 is rounded to 16,718,000 tons for computational purposes.

Pertinent data and operating costs of vessels used for delivering heavy crude to Pascagoula are shown in Tables 18 and 19, which contains a substantial portion of the data utilized in the benefit analysis. Additional data will be shown and explained in subsequent paragraphs and tables.

For the without project condition, the crude oil vessel operating costs per year are determined for the existing 38 foot channel, based on the existing fleet of shuttle vessels. This analysis involves the costs associated with a 66 and a 79 thousand dwt vessel fleet for the shuttle service. Total costs associated with the larger vessels unloading at sea and the two existing shuttle vessels hauling 16,718,000 tons of crude to port over a 38-foot channel amounts to approximately $46,659,000 or about $2.79 per ton. The computational procedures involved in this cost determination are shown on Table 20.

TABLE 19
AND HOURLY COSTS OF TANKERS
DELIVERING HEAVY CRUDE TO PASCAGOULA

VESSEL SIZE (d.w.t.)	HOURLY OPERATING COSTS[1/] AT SEA	HOURLY OPERATING COSTS[1/] IN PORT
406,000 (ULCC)	$2,540[2/]	N/A
264,000 (VLCC)	1,880[2/]	N/A
100,000	1,121	$533
80,000	999	504
79,000	991	502
66,000	919	479

1/ Costs for 1 January 1983 determined from MMS data.
2/ Costs computed by Mobile District. See text.

The next analysis of vessel operating costs for a 38-foot channel considered the use of two 80,000 dwt shuttle vessels since this fleet will be tankers of 66,000 and 79,000 dwt for the existing channel. The company would not continue to use the existing fleet with a modified channel. The 80,000 dwt vessels they prefer to use will not be used unless the Bayou Casotte Channel is widened. These vessels could then be utilized even on the existing 38-foot depth. If the channel is widened, vessels larger than 80,000 dwt may also be used.

Although company officials state they would continue to use the 66,000 and 79,000 dwt tankers in their shuttle service under the existing channel condition (38 feet), it is shown further in this appendix that two 80,000 dwt tankers are more economical to operate than the current fleet (66,000 - 79,000 dwt vessels). Also, the 80,000 dwt tankers can be fully loaded on a 42-foot channel with two feet underkeel. For channel depths greater than 42 feet it is more economical to use the 80,000 dwt tankers, rather than light-loading the 100,000 dwt tankers.

Benefits assigned to heavy crude are based on providing a deeper and wider navigation channel. Benefits for widening the existing 38-foot channel is determined from difference in vessel operating costs for the existing fleet and the 80,000 dwt shuttle vessels light-loaded on a 38-foot existing channel. Benefits for deepening the existing channel from 38 feet to 39-42 feet is determined from the difference in costs for a 80,000 dwt fleet light-loaded and a 80,000 dwt vessel more fully loaded. For channel depths 43 to 51 feet, benefits are based on the costs of operating the existing fleet at 38 feet vs. the costs for operating the 100,000 dwt tankers at the different depths involved. For purposes of optimization and maximization, benefits are determined at 1-foot increments of channel depths from 39 through 51 feet, inclusive.

Data relating to volume of traffic, vessel sizes, vessel operating procedures, travel time, and time in port were furnished by officials of the petroleum refinery. These data are utilized to a great extent in the determination of transportation costs for both the with and without projection conditions.

Vessel times at sea for the ULCC's and the VLCC's are based on the time involved in loading the fleet of shuttle vessels at sea, shuttle vessel travel time and unloading time at the dock. Vessel time at sea for the mother vessels to unload is varied, based on the different shuttle vessel fleets used.

All shuttle vessels are loaded to the extent necessary to allow 2 feet underkeel clearances for purposes of safety because of type cargo being carried. The clearances are for purposes of such things as trim, squat, roll, and pitch of the vessel.

According to information received from the company, the ULCC vessels will make an average of 14.6 trips per year hauling about 2,880,000 barrels per

$79,225 Total Panama Canal toll ($10,079 + $42,207 + $26,939)
$46,816 Total in-port operating cost ($418/hr. x 112 hrs.)

$126,041 Total adjusted in-port operating cost ($79,225 + $46,816)

136 Adjusted in-port hours (112 hrs. + 24 hrs.)
$927 Adjusted in-port operating cost ($126,041/hr. + 136 hrs.)

As previously stated, all grain to the Far East is routed through the Panama Canal because a channel depth of 48 feet at Pascagoula is needed before the alternative route around the Cape of Good Hope becomes more economical. Based on the size of vessels required by each route, the Cape of Good Hope route does not become more economical until a fleet of vessels reaches the size that makes it less costly per ton of cargo hauled.

These hourly costs for each size vessel were used to arrive at a cost per ton. A voyage constitutes a one-way movement from Pascagoula to the destination foreign port plus some part of the return to Pascagoula. Port time is calculated as the time a vessel spends in port to load or unload and perform other activities necessary to ready the vessel for sailing. The hourly port costs are multiplied by the hours a vessel spends in port at the origin and destination to obtain total port costs. In calculating at-sea costs, an allowance is made to reflect a partial empty return (back-haul). Dry bulk carriers do not operate fully loaded at all times. A sampling of vessel logs from dry bulk carriers docked at the Port of Mobile showed they operate about sixty percent of the time with cargo aboard. The other forty percent of the time they are empty. To compensate for an average fully loaded condition of 60 percent at all times, an 80 percent empty backhaul was assigned to all bulk carriers hauling grain. Therefore, eighty percent of the cost for returning the vessel to Pascagoula is added to the costs of the initial one-way movement. To simplify the calculation of total costs, a factor of 1.80 is applied to the one-way miles of haul. The adjusted miles of haul, divided by the vessels' speed gives the total time the vessel is at sea. This time is multiplied by at sea hourly costs to obtain total costs. The sum of total port costs and total at sea costs divided by the tons hauled equals the cost per ton for each vessel. The tons a vessel will haul depends on the channel depth available at Pascagoula and at the foreign port of destination. These costs-per-ton for each ship in a fleet of vessels assigned to a particular channel depth, is weighted to arrive at an average per-ton cost for the fleet of vessels. The per-ton costs for each vessel is weighted according to its carrying capability. The vessel carrying capability is based on the number of vessels in the world fleet for this size category multiplied by the volume (short tons) of cargo each of these vessels can haul. A percentage factor is derived by dividing the carrying capability of each vessel by the total carrying capability of the fleet of vessels assigned to a particular channel depth.

Operating Costs for Oil Tankers. Chevron plans to continue using lightering service to deliver crude to their refinery with two shuttle

TABLE 17

HOURLY OPERATING COSTS OF FOREIGN FLAG DRY BULK CARRIERS THAT WILL BE USED IN THE BENEFIT ANALYSIS ON GRAIN EXPORTS

VESSEL SIZE (DWT)	NUMBER OF VESSELS IN WORLD FLEET	REGISTERED DRAFT (Ft.)	LENGTH (Ft.)	WIDTH (Ft.)	HOURLY COSTS		HOURLY COSTS ADJUSTED TO REFLECT PANAMA CANAL CHARGES	
					AT SEA	IN PORT	AT SEA	IN PORT
40,328	167	38	648	93	$ 738	$401	$738	$814
43,931	107	39	664	95	758	395	758	833
47,752	161	40	679	98	798	418	798	886
51,798	207	41	695	100	850	453	850	951
56,077	82	42	710	103	881	472	881	1,003
60,597	71	43	726	106	895	474	895	1,034
65,364	66	44	742	108	897	464	897	1,077
70,386	66	45	757	111	900	449	-	-
75,672	39	46	772	114	902	436	-	-
81,227	31	47	788	116	905	437	-	-
87,060	9	48	803	119	939	460	-	-
93,179	13	49	818	121	985	496	-	-
99,591	8	50	834	124	1,031	527	-	-
106,304	1	51	849	127	1,064	541	-	-

The vessel operating cost of LNG tankers was furnished by the Tennessee Gas Transmission Company. These costs were used to develop an hourly operating cost. They are effective as of 1 January 1981. The costs are updated to reflect a 1 January 1983 price level. Total annual benefits for all commodities will be further updated to reflect a 1 October 1983 price level at the end of this appendix.

Operating Costs for Dry Bulk Carriers. A fleet of dry bulk carriers were assigned to each channel depth on the Pascagoula River Channel being analyzed. The volume of grain that would benefit by channel improvements was allocated to that amount which would move in maximum size vessels fully loaded or light-loaded up to five feet that would operate on a particular channel depth. Therefore, these are the only size dry bulk carriers where costs are needed. For grain traffic to the Far East, the Panama Canal toll charges were included in the computation of costs per ton hauled by adjusting the in-port hours and the hourly in-port operating cost. Some of the Panama Canal toll charges are flat rate costs while other charges are based on vessel characteristics. The cost items considered included a toll charge for a Panama Canal net vessel-ton for laden vessels and vessels in ballast, tug service, charges for line handlers, agents fees, and launch service. The total Panama Canal toll charge was calculated for each size vessel and added to the total in-port cost for each size vessel. A 24-hour period to transit the Panama Canal was added to the in-port hours before an adjusted in-port hourly operating cost was calculated. These adjusted hourly operating costs were those used to compute the cost per ton which were, in turn used to compute the savings per ton. The hourly operating costs and adjusted in-port hourly operating cost are shown on Table 17. The data used to compute the Panama Canal toll charges were obtained from a Boyd Steamship Corporation pamphlet. The values shown in this pamphlet are 1 January 1983 price levels.

The computation of the Panama Canal toll charges and the adjustment of in-port operating costs for 40-foot draft vessel are as follows:

40-ft. Draft
47,752 DWT
23,064 Panama Canal Net Ton (48.3% DWT)
$1.83 Per Panama Canal Net Ton, Laden

$1.46 Per Panama Canal Net Ton, Ballast
80% Empty Back haul
$10,079 Line handlers, tug service, agents fee, launch service
112 Hours in-port time, load and unload

$418 Per hour in-port operating cost
24 Hours in-port time, Panama Canal transit
$42,207 Panama Canal toll, laden (23,064 ton x $1.83/ton)
$26,939 Panama Canal toll, ballast (23,064 ton x $1.46/ton x 80%)

Foreign Port Depths on Grain Traffic. The volume of grain being shipped to foreign ports with depths 38 feet or less was eliminated from the benefit analysis. Some of these ports are: Odessa, USSR; Alexandria, Egypt; Lenningrad, USSR; Rijeka, Yugoslavia; Tsingtao, China; Assab, Ethiopia; Bandar Abbas, Iran; Haifa, Israel; Veracruz, Mexico; Chinhae, Korea; and Casablanca, Morraco. The grain going to foreign ports with depths of 39 feet or greater was used. Those are ports such as, Novorossiysk, USSR; Antwerp, Belgium; Lisbon, Portugal; Bilboa, Spain; and Santos, Brazil. Where foreign ports have depths less than the depth being considered at Pascagoula, then those benefits are restricted to the depth of the foreign port. Traffic to each foreign port was analyzed separately. All traffic to the Far East countries was restricted to a depth of 39 feet because of the 39-foot allowable draft of vessels transiting the Panama Canal. As discussed on page C-16, grain vessels leaving Pascagoula typically load to drafts greater than the nominal channel depth.

Foreign Port Depths on Crude Oil Traffic. Benefits on crude oil shipments are based on the use of different size shuttle tankers that can be used for moving this product from a VLCC or ULCC tanker at a point in the Gulf of Mexico near Pascagoula to the docks at Bayou Casotte. Therefore, the depths at foreign ports of origin are not being considered.

Foreign Port Depths on LNG Traffic. The proposed terminal in Trinidad will have a dedicated channel and berth located 20 miles south of Port of Spain on the Gulf of Paria. The channel and turning basin will have a depth of 45 feet. The channel will be about one-half mile long and the tugs will meet the vessel in deep water which extends to within one mile of shore. LNG tanker sizes will not be restricted by channel depths at this foreign port.

VESSEL COSTS AND UNIT SAVINGS

Basis for Vessel Operating Costs. These costs are expressed in terms of cost-per-hour for the operation of the vessel while at sea and while in port or in a stand-by status. Hourly operating costs for dry bulk carriers and the shuttle tankers are based on costs as developed by Marine Management Systems, Inc. (MMS), under contract by the Corps of Engineers. Vessel characteristics, operating procedures, and costs are on file in the MMS computer data bank. The Corps has access to this file on computer time share contract. Hourly operating costs are developed, by the Corps, from this data. These cost data obtained from MMS and reported in this appendix are effective as of 1 January 1983. Hourly vessel operating costs for the VLCC and ULCC tankers are not available through MMS; therefore, operating cost data for these vessels have been determined based on the relationships of growth for the shuttle vessel costs from the 1975 OCE cost data to the 1983 MMS cost data. Based on these factors of growth, the 1975 at sea operating costs for the large tankers were increased by approximately 22 percent.

TABLE 24

UNLOADING COSTS FOR ULCC AND VLCC TANKERS WITH 2-80,000 DWT SHUTTLE VESSEL OPERATING AT DIFFERENT CHANNEL DEPTHS (350 Feet Wide)

CHANNEL DEPTH	TOTAL ANNUAL HOURS FOR ULCC	TOTAL ANNUAL HOURS FOR VLCC	COSTS PER HOUR FOR ULCC	COSTS PER HOUR FOR VLCC	TOTAL COSTS FOR ULCC'S	TOTAL COSTS FOR VLCC'S
38 ft.	4,285.50	6,713.50	$2,540	$1,880	$10,885,170	$12,621,880
39 ft.	4,236.39	6,636.23	2,540	1,880	10,760,431	12,476,150
40 ft.	4,190.74	6,564.62	2,540	1,880	10,644,480	12,341,486
41 ft.	4,148.47	6,498.58	2,540	1,880	10,537,114	12,217,330
42 ft.	4,108.84	6,436.26	2,540	1,880	10,436,454	12,100,169

TABLE 25

COSTS FOR SHUTTLE SERVICE USING 2-80,000 DWT TANKERS

CHANNEL DEPTH (Ft.)[1]	TRIPS	TRAVEL TIME	PORT TIME	AT SEA COSTS PER HOUR	AT SEA COSTS TOTAL	IN PORT COSTS PER HOUR	IN PORT COSTS TOTAL	TOTAL COSTS
38	219.98	30.0	20.0	$999	$6,592,801	$504	$2,217,398	$8,810,199
39	211.53	30.7	20.7	999	6,487,477	504	2,206,850	8,694,327
40	203.70	31.4	21.4	999	6,389,784	504	2,197,027	8,586,811
41	196.44	32.1	22.1	999	6,299,418	504	2,188,027	8,487,445
42	189.66	32.8	22.8	999	6,214,627	504	2,179,421	8,394,048

[1] All channel depths required to be at least 350 feet wide.

TABLE 26

TOTAL ANNUAL VESSEL OPERATING COSTS FOR DELIVERYING HEAVY CRUDE OIL FROM MOTHER SHIPS
TO DOCKS BY USING 2-80,000 DWT SHUTTLE TANKERS

CHANNEL DEPTH (Ft.)	SHUTTLE COSTS	ULCC AND VLCC COSTS	TOTAL COSTS
38	$8,810,199	$23,507,050	$32,317,199
39	8,694,327	23,236,581	31,930,908
40	8,586,811	22,985,966	31,572,777
41	8,487,445	22,754,444	31,241,889
42	8,394,048	22,536,623	30,930,671

and since port time exceeds time at sea in all instances. Vessel times required to unload the large tankers are based on the number of trips required to unload each shuttle vessel at each incremental foot of channel depth. Trips are determined by dividing the tonnage hauled each trip at each channel depth into the annual tonnage imported by each of the larger tankers. The results of these computations are shown in Table 28.

Annual costs of operating the 100,000 dwt shuttle vessels are determined by multiplying the total number of trips to each large tanker as shown in Table 28 by the number of hours in port. The results of this computation are then multiplied by the costs per hour in port for the 100,000 dwt vessels to obtain total port costs. This is then added to the results of multiplying the total number of trips by the time at sea; the results of which is then multiplied by the costs per hour at sea for the shuttle vessels. These computations are shown in Table 29.

Annual costs associated with the large tankers operating at sea while unloading are determined by multiplying the total time assigned to two 100,000 dwt vessels at each increment of depth by the cost per hour for operating the vessel at sea. These computations are shown in Table 30.

TABLE 30
TOTAL ANNUAL SHUTTLE COSTS ASSIGNED TO ULCC'S AND VLCC'S
(USING 2-100,000 DWT SHUTTLE TANKERS)

CHANNEL DEPTH	UNLOADING TIME (Hrs.) ULCC	VLCC	TOTAL COSTS ULCC[1]	TOTAL COSTS VLCC[1]
38 ft.[2]	4,489.50	7,033.00	$11,403,330	$13,222,040
43 ft.	4,261.32	6,675.84	10,823,753	12,550,579
44 ft.	4,224.66	6,618.47	10,730,136	12,442,724
45 ft.	4,190.19	6,564.25	10,643,083	12,340,790
46 ft.	4,157.93	6,513.52	10,561,142	12,245,418
47 ft.	4,127.84	6,465.95	10,484,714	12,155,986
48 ft.	4,099.20	6,421.12	10,411,968	12,071,706
49 ft.	4,071.80	6,378.46	10,342,372	11,991,505
50 ft.	4,046.08	6,338.65	10,277,043	11,916,662
51 ft.	4,021.75	6,300.32	10,215,245	11,844,602

[1] Costs per hour at sea for ULCC = $2,540. Costs per hour at sea for VLC = $1,880.
[2] With a channel width of 350 feet.

TABLE 28

STAND-BY TIME TO UNLOAD THE ULCC AND VLCC TANKERS

(USING 2-100,000 DWT TANKERS)

CHANNEL DEPTH	TONNAGE HAULED BY EACH SHUTTLE VESSEL[1]	SHUTTLE TRIPS TO ULCC[2]	SHUTTLE TRIPS TO VLCC[2]	SHUTTLE TRANSIT TIME PER TRIP (Hrs.)[3]	UNLOADING TIME (Hrs.) TOTAL ANNUAL HOURS FOR ULCC'S	UNLOADING TIME (Hrs.) TOTAL ANNUAL HOURS FOR VLCC'S
38 ft.[4]	72,543	89.79	140.66	50.0	4,489.50	7,033.00
43 ft.	87,123	74.76	117.12	57.0	4,261.32	6,675.84
44 ft.	90,039	72.34	113.33	58.4	4,224.66	6,618.47
45 ft.	92,955	70.07	109.77	59.8	4,190.19	6,564.25
46 ft.	95,871	67.94	106.43	61.2	4,157.93	6,513.52
47 ft.	98,787	65.94	103.29	62.6	4,127.84	6,465.95
48 ft.	101,703	64.05	100.33	64.0	4,099.20	6,421.12
49 ft.	104,619	62.26	97.53	65.4	4,071.80	6,378.46
50 ft.	107,535	60.57	94.89	66.8	4,046.08	6,338.65
51 ft.	110,451	58.97	92.38	68.2	4,021.75	6,300.32

1/ Maximum load - 110,451. Immersion factor = 2,916 short tons per foot.

2/ ULCC's import 6,513,660 tons per year. VLCC's import 10,203,897 tons per year.

3/ See Table 27.

4/ With a channel width of 350 feet.

TABLE 29

TOTAL ANNUAL SHUTTLE COSTS ASSIGNED TO THE 2-100,000 DWT TANKERS

CHANNEL DEPTH (Ft.)	TRIPS	TRAVEL TIME (Hrs.)	PORT TIME	AT SEA COSTS PER HOUR	AT SEA COSTS TOTAL	IN PORT COSTS PER HOUR	IN PORT COSTS TOTAL	TOTAL COSTS
38[1/]	230.45	30.0	20.0	$1,121	$7,750,034	$533	$2,456,597	$10,206,631
43	191.88	33.5	23.5	1,121	7,205,766	533	2,403,393	9,609,159
44	185.67	34.2	24.2	1,121	7,118,254	533	2,394,883	9,513,137
45	179.84	34.9	24.9	1,121	7,035,862	533	2,386,783	9,422,645
46	174.37	35.6	25.6	1,121	6,958,683	533	2,379,244	9,337,932
47	169.23	36.3	26.3	1,121	6,886,350	533	2,372,249	9,258,607
48	164.38	37.0	27.0	1,121	6,817,989	533	2,365,593	9,183,582
49	159.79	37.7	27.7	1,121	6,752,997	533	2,359,156	9,112,153
50	155.46	38.4	28.4	1,121	6,691,993	533	2,353,229	9,045,222
51	151.35	39.1	29.1	1,121	6,633,837	533	2,347,484	8,981,321

Total annual vessel operating costs for deliverying heavy crude oil from the mother ships to docks by using 2-100,000 dwt shuttle tankers is shown in Table 31.

Vessel Operating Costs for LNG Tankers. As previously stated, the LNG will originate in Trinidad and will be transported to Pascagoula by LNG tankers. The annual volume (short tons) will be 4,838,000 tons beginning in 1989 based on information from the company. There will be three identical vessels in operation for transporting the LNG to Pascagoula. The hourly operating costs of each of these vessels is: $9,238 at sea and $7,941 in port (effective 1 January 1983). Each of the vessels will be loaded to a draft of 34 feet. A 4-foot stern trim is needed for a more efficient operation within the Pascagoula Harbor. In addition to this 38-foot draft, an additional 2.5 feet is needed for safety and an additional 1.5 feet is needed for low water condition which is another 4 more feet of depth required. Company officials stated that to obtain desired efficiency on LNG tankers operating in the Pascagoula Harbor Channel a 350-foot channel width would be required.

TABLE 31
ANNUAL COSTS FOR SHUTTLING CRUDE OIL IN 2-100,000 DWT TANKERS

CHANNEL DEPTH (Ft.)	ANNUAL COSTS 1/ SHUTTLE TANKERS	ULCC & VLCC TANKERS	TOTAL
38 2/	$10,206,631	$24,625,370	$34,832,001
43	9,609,159	23,374,332	32,983,491
44	9,513,137	23,173,360	32,686,497
45	9,422,645	22,983,873	32,406,518
46	9,337,932	22,806,560	32,144,492
47	9,258,607	22,640,700	31,899,307
48	9,183,582	22,483,674	31,667,256
49	9,112,153	22,333,877	31,446,030
50	9,045,222	22,193,705	31,238,927
51	8,981,321	22,059,847	31,041,168

1/ Reflects 1 January 1983 prices.
2/ With a channel width of 350 feet.

Savings in transportation costs are based on the vessels' increased speed and the reduction of tug service while operating in the two channels. With channel depths of 38 through 41 feet available, the LNG tankers will be fully loaded with a level trim and will require the use of tug service while transiting the port channels. Benefits can only be realized by providing a 42-foot channel depth. No benefits can be realized by increased channel depths from 39 through 41 feet because both the 4 feet of trim and 4-foot clearance are required for safe operation of the vessel without tugs. According to information from the company, vessel port time will not change, therefore, costs per tons based on the different channel conditions are determined using a constant port time for all depths.

Pertinent data and actual computation for costs per ton for the different channel depths are shown in Tables 32 and 33.

Unit Costs and Savings on Dry Bulk Grain Vessel Traffic. The vessel operating costs per hour, as shown in Table 17, is used to calculate the cost per-ton for a fleet of ships assigned to a particular channel depth on Pascagoula River Segment. Per-ton costs for each vessel is weighted to represent an average cost for a fleet of vessels assigned to a channel depth. The size of a vessel fleet of dry bulk carriers assigned to the various channel depths considered in the benefit analysis is shown in Table 14. The per-ton costs are based on a vessel's payload (limited by channel depths available at Pascagoula and the foreign port), distance of travel, port time, speed and hourly operating costs, plus the Panama Canal toll fee on vessels destined to the Far East and routed through the Panama Canal. Costs on grain vessels are further adjusted to reflect the empty backhaul of the vessel.

The cost per ton for each vessel size in the designated fleet for each channel depth considered was adjusted to reflect the weighted average per-ton costs for the fleet of vessels. This adjustment represents each vessels' proportionate share of the costs, based on the number of vessels in the world fleet and the amount of tonnage loaded for that particular type and size (dwt) vessel. An example of how a weighted average per-ton cost was calculated from the hourly costs for a designated fleet of vessels for a 38 and 39 channel depth at Pascagoula, based on a voyage to Japan through the Panama Canal, is shown in Tables 34 and 35.

Market areas for grain exports from Pascagoula have been grouped into seven regions where the ports in each region have depths which could accommodate vessels that would benefit by greater channel dimensions at Pascagoula, Each port within a region is analyzed on an individual basis. If depths vary for ports within a region, then the region is divided accordingly. Therefore, a total of 10 regions or sub-regions have been used as foreign destinations. Vessels will be loaded to the same drafts for navigating channels at Pascagoula and the foreign port under the varying channel depths being considered at Pascagoula. Present grain exports to ports in the Black Sea and Western Mediterranean Sea Regions have maximum depths of 42 feet; consequently, savings are limited to vessels that have drafts of 42 feet. On the grain exports to the Far East Region, the routing will continue to be via the Panama Canal. Vessel sizes are limited to those with drafts of 39 feet or less due to the depths of the canal. Depths at some ports in the Northern Europe Region, that receive Pascagoula grains, are 46 feet, others have depths of 41 feet. Some southern Europe port where grain is shipped have depths of 49 feet and others have depths of 46 feet. Because of small tonnages moving into the 49-foot ports, depths were restricted to 42 feet. Ports on the East Coast of South America have

TABLE 32
OPERATING COST PER TON FOR LNG TANKERS WITH A 38-FOOT CHANNEL AVAILABLE
(Present Condition)

Vessel size: 64,240 dwt
Designed dimensions: 948.5' x 135' x 36' (fully loaded draft/with full load of fuel)
Operating draft at Pascagoula (loaded): 34 feet (without trim/and light-load of fuel)
Payload (fully loaded): 60,480 short tons
Safety clearance: 4 feet
Vessel travel time at sea: 202.9 hrs. (4,008 miles ÷ 19.75 knots)1/
Vessel time in Pascagoula Harbor: 6.7 hrs. (20 miles ÷ 3 knots)1/
Total vessel travel time: 209.6 hours
Vessel port time: 77.8 hrs. (1.62 days x 24 x 2)
Tug service: 4 tugs (inbound) and 2 tugs (outbound)
Hours of tug service: 25.2 hrs. (inbound) and 14.6 hrs. (outbound)2/
Cost of tug service: $25,950 (39.8 hrs. x $652)
Vessel cost per hour: $9,238 at sea and $7,941 in port
Total vessel costs per round trip: $2,554,095 [(209.6 x $9,238) + (77.8 x $7,941)]
Total vessel costs (incl. tug service): $2,580,045
Cost per ton: $42.66 ($2,580,045 ÷ 60,480 tons)

1/ Round trip.
2/ Includes two hours each for inbound and outbound tug service to meet vessel and to return to port (10 miles ÷ 5 knots). Also includes one hour standby time for tugs on inbound vessel and two hours standby time for tugs on outbound vessels.

TABLE 33
OPERATING COSTS PER TON FOR LNG TANKERS WITH A
42-FOOT CHANNEL AVAILABLE[1]

ssel operating with a 4-foot stern trim

ssel fully loaded to: 60,480 short tons

ssel time at sea: 202.9 hours

ssel time in harbor: 3.3 hours (20 miles ÷ 6.0 knots)

tal vessel travel time: 206.2 hours

tug service required

ssel port time: 77.8 hours

tal vessel costs: $1,904,876 at sea and $617,810 in port

tal vessel cost: $2,522,686

ssel cost per ton: $41.71 ($2,522,686 ÷ 60,480 tons)

Where data is not shown it is the same as shown in Table 34.

TABLE 34

COMPUTATION FOR ARRIVING AT A WEIGHTED PER TON COST FOR A FLEET OF GRAIN SHIPS ASSIGNED TO A 38-FOOT CHANNEL

VESSEL SIZE (dwt)	VESSEL REGISTERED DRAFT (Ft.)	VESSEL TRAVEL TIME (Hrs.)	HOURLY SEA COSTS	PORT TIME (Hrs.)	HOURLY PORT COSTS a/	TOTAL VESSEL COSTS	IMMERSION FACTOR Tons/Ft.	COST PER TON	DISTRIBUTION FACTOR (Percent)*	ADJUSTMENT FACTOR
						39-FOOT CHANNEL				
40,300	38	1,158	$738	133	$ 814	$ 962,522	1,739	$22.22	17.37	3.8596
43,900	39	1,158	758	134	838	989,702	1,842	21.82 1/	12.12	2.6446
47,800	40	1,158	798	136	886	1,044,208	1,945	21.99 2/	19.86	4.3672
51,800	41	1,158	850	137	951	1,114,190	2,048	22.49 3/	27.67	6.2230
56,100	42	1,158	881	138	1,003	1,158,201	2,151	22.40 4/	11.87	2.6589
60,600	43	1,158	895	140	1,039	1,181,452	2,254	21.93 5/	11.11	2.4364

WEIGHTED AVERAGE COST FOR FLEET $22.19

*DISTRIBUTION FACTOR

VESSEL SIZE (dwt)	NUMBER OF VESSELS IN FLEET	PAYLOAD (Short Tons)	CAPABILITY FACTOR a/	PERCENTAGE DISTRIBUTION
40,300	167	43,331	7,236,204	17.37
43,900	107	47,201	5,050,537	12.12
47,800	161	51,395	8,274,524	19.86
51,800	207	55,695	11,528,940	27.67
56,100	82	60,319	4,946,135	11.87
60,600	71	65,157	4,626,156	11.11
		TOTAL	41,662,496	100.00%

a/ Calculated by multiplying the number of vessels by their payload (tons).
a Includes Panama Canal charges.

1/ Based on the vessel being light-loaded by 1 foot.
2/ " " " " " " " 2 feet.
3/ Based on the vessel being light-loaded by 3 feet.
4/ " " " " " " " " 4 " .
5/ " " " " " " " " 5 " .

COMPUTATION FOR ARRIVING AT A WEIGHTED PER TON COST FOR A FLEET OF GRAIN SHIPS ASSIGNED TO A 39-FOOT CHANNEL

[illegible]	[illegible]	VESSEL TRAVEL TIME (Hrs.)	HOURLY SEA COSTS	PORT TIME (Hrs.)	HOURLY PORT COSTS[a]	TOTAL VESSEL COSTS	IMMERSION FACTOR Tons/Ft.	COST PER TON	DISTRIBUTION FACTOR (Percent)*	ADJUSTMENT FACTOR
						39-FOOT CHANNEL				
[illegible]	[illegible]	1,158	$738	133	$ 814	$ 962,522	1,739	$22.22	15.62	3.4708
[illegible]	[illegible]	1,158	758	134	838	989,702	1,842	20.97	10.90	2.2857
[illegible]	[illegible]	1,158	798	136	886	1,044,208	1,945	21.12[1/]	17.87	3.7741
[illegible]	[illegible]	1,158	850	137	951	1,114,190	2,048	21.60[2/]	24.90	5.3784
[illegible]	42	1,158	881	138	1,003	1,158,201	2,151	21.51[3/]	10.69	2.2994
[illegible]	43	1,158	895	140	1,039	1,181,452	2,254	21.05[4/]	10.00	2.1050
[illegible]	[illegible]	1,158	897	141	1,072	1,189,459	2,357	20.33[5/]	10.02	2.0371
								WEIGHTED AVERAGE COST FOR FLEET		$21.35

*DISTRIBUTION FACTOR

[illegible]	NUMBER OF VESSELS IN FLEET	PAYLOAD (Short Tons)	CAPABILITY FACTOR[a/]	PERCENTAGE DISTRIBUTION
[illegible]	167	43,331	7,236,204	15.62
[illegible]	107	47,201	5,050,537	10.90
[illegible]	161	51,395	8,274,524	17.87
[illegible]	207	55,695	11,528,940	24.90
[illegible]	82	60,319	4,946,135	10.69
[illegible]	71	65,157	4,626,156	10.00
65,500	66	70,318	4,640,993	10.02
		TOTAL	46,303,489	100.00%

[a/] Calculated by multiplying the number of vessels by their payload (tons).
[a] Includes Panama Canal charges.
[1/] Based on the vessel being light-loaded by 1 foot.
[2/] Based on the vessel being light-loaded by 2 feet.
[3/] " " " " " " " " 3 " .
[4/] " " " " " " " " 4 " .
[5/] " " " " " " " " 5 " .

America have depths of 39 and 44 feet. Ports in Eastern Mediterranean Sea Region have depths of 43 feet. The unit costs and savings per short ton for each of the ten regions or sub-regions for grain shipments are shown in Table 36.

Per-Ton Costs and Savings on Crude Oil Tankers for Channel Depths 39 Through 42 Feet. Total costs of operating the two 80,000 dwt shuttle vessels at each channel depth must be added to the total costs of operating the ULCC's and the VLCC's at that depth to determine full costs of transfer operation. The results of these computations as well as total costs and unit savings for each incremental foot of depth are shown in Table 37.

The maximum fully loaded draft of an 80,000 dwt vessel is 40 feet which requires a 42-foot channel for safe navigation. In order to determine benefits for channel depths in excess of 42 feet, two 100,000 dwt vessels are used to replace the 80,000 dwt vessels for purposes of shuttling the crude oil, The procedure used to calculate the costs for all of the vessels involved are identical to those used to determine benefits relating to the use of the 80,000 dwt vessels. The maximum fully loaded draft of the 100,000 dwt vessels is 49 feet; therefore, costs of moving the crude in these vessels are determined for incremental channel depths ranging from 43 through 51 feet.

Per Ton Costs and Savings on Crude Oil Tankers for Channel Depths 43 Through 51 Feet. Total annual costs of shuttling the crude oil from the ULCC's and VLCC's are obtained by adding the total unloading costs of the ULCC's, and the VLCC's plus the total lightering costs for the two 100,000 dwt shuttle tankers. Costs per ton are obtained by dividing total annual costs by 16,718,000 tons which are the total annual imports of heavy crude oil into Pascagoula. These computations are shown in Table 38. Table 38 also shows savings for the widening of the Bayou Casotte Channel with depth remaining at 38 feet. When comparing the results from Tables 37 and 38, it is obvious that maximum savings are obtained through use of the 80,000 dwt vessels for both increased width and depth.

Unit Costs and Savings on LNG Tankers. Information received from the company shows the LNG vessels will operate 332 days per year. Three LNG tankers will operate at a draft of 34 feet, within the Pascagoula Harbor, under all channel conditions. They will have a load of 60,480 short tons per trip. With channel depths of 38 through 41 feet, the vessels will operate with tug assistance, reduced speed, and a level trim. With a 42-foot channel available they can operate with no tug assistance, and with a 4-foot stern trim at a normal speed. They will operate at a speed of 6 knots with a 350' x 42' channel available. The vessels require a 4-foot underkeel clearance for safety. The total annual tonnage demand for LNG at Bayou Casotte that would be delivered by Tenneco is 4,838,000 tons. The difference in total operating costs under conditions with a 38-foot channel available vs costs with a 42-foot channel available divided by the tons hauled per trip gives the unit costs and savings per ton.

FOREIGN DESTINATIONS	CHANNEL DEPTHS (Ft.) 38	39	40	41	42	43	44	45	46
(A) Black Sea Region									
Costs Per Ton	$14.79	$14.22	$13.68	$13.27	$12.97	$12.97	$12.97	$12.97	$12.97
Savings Per Ton	-	0.57	1.11	1.52	1.82	1.82	1.82	1.82	1.82
(B) Eastern Mediterranean Region									
Costs Per Ton	14.12	13.58	13.06	12.67	12.39	12.22	12.22	12.22	12.22
Savings Per Ton	-	0.56	1.06	1.45	1.73	1.90	1.90	1.90	1.90
(C) Western Mediterranean Region									
Costs Per Ton	11.18	10.75	10.34	10.03	9.81	9.81	9.81	9.81	9.81
Savings Per Ton	-	0.43	0.84	1.15	1.37	1.37	1.37	1.37	1.37
(D) East Coast of South America Region									
Costs Per Ton	12.23	11.75	11.31	10.97	10.72	10.58	10.44	10.44	10.44
Savings Per Ton	-	0.48	0.92	1.26	1.50	1.65	1.79	1.79	1.79
(E) East Coast of South America Region									
Costs Per Ton	12.23	11.75	11.75	11.75	11.75	11.75	11.75	11.75	11.75
Savings Per Ton	-	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48
(F) Northern Europe Region									
Costs Per Ton	11.80	11.35	10.92	10.59	10.35	10.21	10.08	9.99	9.95
Savings Per Ton	-	0.45	0.88	1.21	1.45	1.59	1.72	1.81	1.85
(G) Northern Europe Region									
Costs Per Ton	11.80	11.35	10.92	10.59	10.59	10.59	10.59	10.59	10.59
Savings Per Ton	-	0.45	0.88	1.21	1.21	1.21	1.21	1.21	1.21

[illegible]

ANNUAL VOLUME OF [illegible] AND [illegible] FROM PASCAGOULA, TABULATED BY DESTINATION [illegible]

[illegible] (19[illegible]-2044)

CHANNEL DEPTH (Ft.)

To (G) [illegible] Europe Area (maximum depth 41 Ft.)

YEAR	TONNAGE	39 SAVINGS PER TON	39 TOTAL SAVINGS	40 SAVINGS PER TON	40 TOTAL SAVINGS	41 SAVINGS PER TON	41 TOTAL SAVINGS	42 SAVINGS PER TON	42 TOTAL SAVINGS	43 SAVINGS PER TON	43 TOTAL SAVINGS	44 SAVINGS PER TON	44 TOTAL SAVINGS	45 SAVINGS PER TON	45 TOTAL SAVINGS	[illegible]	[illegible]
[illegible]	[illegible]	$0.4[illegible]	$ 30,000	$0.88	$ 58,[illegible]	[illegible]	$ [illegible]	[illegible]	$ [illegible]	$1.21	$ [illegible]	[illegible]	$ [illegible]	[illegible]	$ [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	0.4[illegible]	56,[illegible]	0.88	[illegible]	[illegible]	[illegible]	[illegible]	127,000	1.21	[illegible]	[illegible]	123,[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	0.45	[illegible]	0.8[illegible]	99,000	1.[illegible]	[illegible]	1.21	1[illegible],000	1.21	1[illegible],000	[illegible]	13[illegible],000	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	62,[illegible]	0.88	119,[illegible]	1.2[illegible]	[illegible]	1.21	[illegible]	1.21	1[illegible],000	1.21	163,000	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	67,000	0.88	129,[illegible]	1.21	[illegible]	1.21	176,000	1.21	176,000	1.21	176,000	1.21	176,[illegible]	[illegible]	[illegible]
[illegible]	[illegible]6,[illegible]	0.45	72,000	0.88	139,[illegible]	1.21	1[illegible]9,000	[illegible]	189,000	1.21	189,[illegible]	1.21	189,0[illegible]	1.21	189,[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	0.45	82,000	0.88	159,000	1.21	21[illegible]	[illegible]	216,000	1.21	216,[illegible]	1.21	216,000	[illegible]	216,000	[illegible]	[illegible]
[illegible]	[illegible]	0.45	92,[illegible]	0.88	177,000	1.21	242,000	1.21	242,000	1.21	242,[illegible]	1.21	242,000	1.21	242,[illegible]	[illegible]	242,[illegible]
[illegible]	[illegible]	0.45	96,000	0.88	185,000	1.21	253,000	1.21	253,000	1.21	253,[illegible]	1.21	253,000	1.21	253,[illegible]	[illegible]	253,[illegible]

To (H) Southern Europe Area (maximum depth 49 Ft.)

YEAR	TONNAGE	39 SAVINGS PER TON	39 TOTAL SAVINGS	40 SAVINGS PER TON	40 TOTAL SAVINGS	41 SAVINGS PER TON	41 TOTAL SAVINGS	42 SAVINGS PER TON	42 TOTAL SAVINGS	43 SAVINGS PER TON	43 TOTAL SAVINGS	44 SAVINGS PER TON	44 TOTAL SAVINGS	45 SAVINGS PER TON	45 TOTAL SAVINGS	[illegible]	[illegible]
1979	35,[illegible]	[illegible]	$ 14,000	$0.77	$ [illegible]	$1.[illegible]	$ [illegible]7,[illegible]	$1.26	$ 45,[illegible]	$1.38	$ 48,000	$1.49	$ 52,000	[illegible]	$ 55,[illegible]	$ [illegible]	$ [illegible]
[illegible]	54,000	[illegible]	21,000	0.77	41,[illegible]	1.[illegible]	56,[illegible]	[illegible]	6[illegible],000	1.38	74,000	1.49	8[illegible],000	1.57	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	24,000	0.77	[illegible]	1.2[illegible]	63,[illegible]	1.26	[illegible]5,[illegible]	1.38	[illegible]2,000	1.49	89,000	1.57	9[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	26,000	0.77	55,0[illegible]	1.[illegible]	75,000	1.26	89,000	1.38	95,000	1.49	106,000	1.57	112,000	[illegible]	[illegible]
[illegible]	77,[illegible]	[illegible]	31,000	0.77	57,[illegible]	[illegible]	8[illegible],000	1.26	97,000	1.38	106,000	1.49	115,000	1.57	12[illegible]	[illegible]	[illegible]
[illegible]	83,000	[illegible]	33,[illegible]	0.77	64,[illegible]	1.[illegible]	87,000	1.2[illegible]	10[illegible]	1.3[illegible]	114,000	1.49	124,0[illegible]	1.57	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	37,000	0.77	72,[illegible]	[illegible]	99,[illegible]	[illegible]	119,000	1.38	130,000	[illegible]	141,0[illegible]	1.57	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	0.40	42,000	0.77	81,[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	146,000	[illegible]	[illegible]58,[illegible]	1.57	[illegible]	[illegible]	[illegible]
20[illegible]	[illegible],000	0.40	44,000	0.77	8[illegible],0[illegible]	[illegible]	116,000	[illegible]26	[illegible]9,000	1.[illegible]8	153,000	[illegible]	165,000	1.57	174,[illegible]	[illegible]	[illegible]

TABLE 45 (Cont'd)

ANNUAL VOLUME OF TRAFFIC AND SAVINGS ON GRAIN EXPORTS FROM PASCAGOULA, TABULATED BY DESTINATION AND CHANNEL DEPTHS BEING CONSIDERED, DURING PROJECT LIFE (1995-2044)

CHANNEL DEPTH (Ft.)

YEAR	ANNUAL TONNAGE	39 SAVINGS PER TON	39 TOTAL SAVINGS	40 SAVINGS PER TON	40 TOTAL SAVINGS	41 SAVINGS PER TON	41 TOTAL SAVINGS	42 SAVINGS PER TON	42 TOTAL SAVINGS
To: (E) East Coast of South America Area (maximum depth 39 Ft.)									
[illegible]	[illegible]	$0.48	$ 33,000	$0.48	$ 33,000	$0.48	$ 33,000	$0.48	$ 33,000
[illegible]	[illegible]	0.48	51,000	0.48	51,000	0.48	51,000	0.48	51,000
[illegible]	119,000	0.48	56,000	0.48	56,000	0.48	56,000	0.48	56,000
[illegible]	[illegible]	0.48	68,000	0.48	68,000	0.48	68,000	0.48	68,000
[illegible]	[illegible]	0.48	73,000	0.48	73,000	0.48	73,000	0.48	73,000
[illegible]	[illegible]	0.48	79,000	0.48	79,000	0.48	79,000	0.48	79,000
[illegible]	[illegible]	0.48	90,000	0.48	90,000	0.48	90,000	0.48	90,000
[illegible]	212,000	0.48	101,000	0.48	101,000	0.48	101,000	0.48	101,000
[illegible]	[illegible]	0.48	105,000	0.48	105,000	0.48	105,000	0.48	105,000
To: (F) Northern Europe Area (maximum depth 46 Ft.)									
[illegible]	[illegible]	$1.46	$ 75,000	$0.89	$145,000	$1.21	$199,000	$1.45	$238,000
[illegible]	[illegible]	0.46	115,000	0.89	223,000	1.21	305,000	1.45	364,000
[illegible]	[illegible]	0.46	128,000	0.89	247,000	1.21	338,000	1.45	404,000
[illegible]	[illegible]	0.46	153,000	0.89	295,000	1.21	404,000	1.45	483,000
[illegible]	[illegible]	0.46	165,000	0.89	319,000	1.21	437,000	1.45	522,000
[illegible]	[illegible]	0.46	178,000	0.89	343,000	1.21	470,000	1.45	562,000
[illegible]	[illegible]	0.46	203,000	0.89	392,000	1.21	536,000	1.45	641,000
[illegible]	[illegible]	0.46	228,000	0.89	440,000	1.21	602,000	1.45	720,000
[illegible]	[illegible]	0.46	238,000	0.89	459,000	1.21	629,000	1.45	752,000

YEAR	43 SAVINGS PER TON	43 TOTAL SAVINGS	44 SAVINGS PER TON	44 TOTAL SAVINGS	45 SAVINGS PER TON	45 TOTAL SAVINGS	46 SAVINGS PER TON	46 TOTAL SAVINGS
To: (E) East Coast of South America Area (maximum depth 39 Ft.)								
[illegible]	$0.48	$ 33,000	$0.48	$ 33,000	$0.48	$ 33,000	$0.48	$ 33,000
[illegible]	0.48	51,000	0.48	51,000	0.48	51,000	0.48	51,000
[illegible]	0.48	56,000	0.48	56,000	0.48	56,000	0.48	56,000
[illegible]	0.48	68,000	0.48	68,000	0.48	68,000	0.48	68,000
[illegible]	0.48	73,000	0.48	73,000	0.48	73,000	0.48	73,000
[illegible]	0.48	79,000	0.48	79,000	0.48	79,000	0.48	79,000
[illegible]	0.48	90,000	0.48	90,000	0.48	90,000	0.48	90,000
[illegible]	0.48	101,000	0.48	101,000	0.48	101,000	0.48	101,000
[illegible]	0.48	105,000	0.48	105,000	0.48	105,000	0.48	105,000
To: (F) Northern Europe Area (maximum depth 46 Ft.)								
[illegible]	$1.59	$261,000	$1.72	$282,000	$1.81	$297,000	$1.85	$304,000
[illegible]	1.59	400,000	1.72	433,000	1.81	455,000	1.85	466,000
[illegible]	1.59	444,000	1.72	480,000	1.81	505,000	1.85	526,000
[illegible]	1.59	531,000	1.72	574,000	1.81	604,000	1.85	617,000
[illegible]	1.59	574,000	1.72	620,000	1.81	653,000	1.85	668,000
[illegible]	1.59	617,000	1.72	667,000	1.81	702,000	1.85	718,000
[illegible]	1.59	704,000	1.72	761,000	1.81	801,000	1.85	819,000
[illegible]	1.59	791,000	1.72	855,000	1.81	900,000	1.85	920,000
[illegible]	1.59	826,000	1.72	893,000	1.18	939,000	1.85	961,000

TABLE 15 [illegible]

ANNUAL VOLUME OF TRAFFIC AND SAVINGS [illegible] TABULATED [illegible] ESTIMATED [illegible]

[illegible] DEPTHS BEING CONSIDERED, DURING [illegible]

		CHANNEL DEPTH (Ft)															
		33		4[illegible]		41		42		43		44		45		4[illegible]	
YEAR	ANNUAL TONNAGE	SAVINGS PER TON	TOTAL SAVINGS	SAVINGS PER TON	TOTAL SAVINGS	SAVINGS PER TON	TOTAL SAVINGS	SAVINGS PER TON	TOTAL SAVINGS	SAVINGS PER TON	TOTAL SAVINGS	SAVINGS PER TON	TOTAL SAVINGS	SAVINGS PER TON	TOTAL SAVINGS	SAVINGS PER TON	TOTAL SAVINGS
[illegible] Western Mediterranean Sea Area (maximum depth 4[illegible] Ft)																	
[illegible]	48,000	$0.43	$ 20,000	$0.84	$ [illegible]	$1.[illegible]	$ [illegible]	$1.37	$ 63,000	[illegible]	$ 63,000	$[illegible]	$ 6[illegible]	[illegible]	[illegible]	$1.37	$ [illegible]
[illegible]	[illegible]	0.43	31,000	0.84	[illegible]	1.15	[illegible]	1.37	97,[illegible]	[illegible]	[illegible]	[illegible]	97,000	[illegible]	[illegible]	[illegible]	97,[illegible]
[illegible]	78,[illegible]	0.43	34,000	0.84	[illegible]	1.15	[illegible]	1.37	107,000	[illegible]	[illegible]	1.3[illegible]	107,[illegible]	[illegible]	[illegible]	1.37	[illegible]
[illegible]	[illegible],000	0.43	40,000	0.84	78,000	1.15	[illegible]	[illegible]	128,000	[illegible]	[illegible],000	1.3[illegible]	128,[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	10[illegible],000	0.43	44,000	0.84	85,000	1.15	1[illegible],000	1.[illegible]	139,000	[illegible]	139,000	1.37	139,000	1.37	[illegible]	[illegible]	139,000
[illegible]	1[illegible],000	0.43	47,000	0.84	91,000	1.15	125,000	1.37	149,000	1.37	149,000	1.37	149,000	1.37	[illegible]	1.37	[illegible]
[illegible]	1[illegible],000	[illegible]	54,000	0.84	1[illegible],000	1.15	142,000	1.37	170,000	1.37	170,[illegible]	1.37	[illegible]	1.3[illegible]	[illegible]	1.37	170,[illegible]
[illegible]	13[illegible]	0.43	60,000	0.84	[illegible]	1.15	150,[illegible]	1.37	1[illegible],000	[illegible]	1[illegible],000	1.37	[illegible]	[illegible]	[illegible]	1.37	[illegible]
[illegible]	145,000	0.43	61,000	0.84	1[illegible],000	1.15	1[illegible],000	1.37	200,000	[illegible]	200,000	1.37	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] (D) East Coast South America Area (maximum depth 46 Ft.)																	
1979	45,000	$0.48	$ 21,000	$0.92	$ 41,000	$1.26	$ 5[illegible],000	$1.50	$ 68,000	$1.65	$ 7[illegible],000	[illegible]	$ 80,[illegible]	$[illegible]	$ [illegible]	[illegible]	$ [illegible],000
[illegible]	[illegible],000	0.48	[illegible]	0.92	61,000	1.26	[illegible],000	1.50	104,[illegible]	1.65	114,[illegible]	[illegible]	1[illegible]	[illegible]	12[illegible]	[illegible]	[illegible]
2000	[illegible],000	0.48	36,000	0.92	7[illegible],000	1.26	95,000	1.50	115,000	1.65	1[illegible]	[illegible]	13[illegible]	[illegible]	1[illegible]	1.78	[illegible]
2010	[illegible],000	0.48	43,000	0.92	[illegible]	1.26	115,000	1.50	137,000	1.65	151,000	[illegible]	1[illegible],000	[illegible]	[illegible]	1.78	16[illegible],000
[illegible]	93,000	0.48	4[illegible],000	0.92	85,000	1.26	12[illegible],000	1.50	149,000	1.65	163,[illegible]	[illegible]	1[illegible],000	1.78	[illegible]	1.78	[illegible]
[illegible]	106,000	0.48	51,000	0.92	98,000	1.26	[illegible]	1.50	16[illegible],000	1.65	17[illegible]	1.7[illegible]	1[illegible],000	1.78	[illegible]	1.78	190,000
[illegible]	12[illegible],000	0.48	58,000	0.92	1[illegible],000	[illegible]	152,000	1.50	182,000	1.65	2[illegible]	1.78	216,000	1.78	215,000	1.78	[illegible],000
20[illegible]	136,000	0.48	65,000	0.92	125,000	1.26	[illegible]	1.50	205,000	1.65	225,[illegible]	1.75	243,000	1.78	243,000	1.75	2[illegible]
2044	142,000	[illegible]48	68,000	0.92	131,000	1.26	179,000	1.50	214,000	1.65	235,[illegible]	1.78	254,000	[illegible]	254,000	[illegible]	2[illegible],000

[illegible] Page

TABLE 45

ANNUAL VOLUME OF TRAFFIC AND SAVINGS ON GRAIN EXPORTS FROM PASCAGOULA, TABULATED BY DESTINATION AND CHANNEL DEPTHS BEING CONSIDERED, DURING PROJECT LIFE (1995-2044)

		CHANNEL DEPTH (Ft.)															
		39		40		41		42		43		44		45		46	
YEAR	ANNUAL TONNAGE	SAVINGS PER TON	TOTAL SAVINGS	SAVINGS PER TON	TOTAL SAVINGS	SAVINGS PER TON	TOTAL SAVINGS	SAVINGS PER TON	TOTAL SAVINGS	SAVINGS PER TON	TOTAL SAVINGS	SAVINGS PER TON	TOTAL SAVINGS	SAVINGS PER TON	TOTAL SAVINGS	SAVINGS PER TON	TOTAL SAVINGS
To: (A) Black Sea Area (maximum depth 42 ft.)																	
1979	116,000	$0.58	$ 67,000	$1.11	$129,000	$1.52	$176,000	$1.82	$211,000	$1.82	$211,000	$1.82	$211,000	$1.82	$211,000	$1.82	$211,000
1995	178,000	0.58	102,000	1.11	197,000	1.52	270,000	1.82	323,000	1.82	323,000	1.82	323,000	1.82	323,000	1.82	323,000
2000	197,000	0.58	113,000	1.11	219,000	1.52	299,000	1.82	358,000	1.82	358,000	1.82	358,000	1.82	358,000	1.82	358,000
2010	236,000	0.58	136,000	1.11	262,000	1.52	358,000	1.82	428,000	1.82	428,000	1.82	428,000	1.82	428,000	1.82	428,000
2015	255,000	0.58	147,000	1.11	283,000	1.52	387,000	1.82	463,000	1.82	463,000	1.82	463,000	1.82	463,000	1.82	463,000
2020	274,000	0.58	158,000	1.11	304,000	1.52	416,000	1.82	498,000	1.82	498,000	1.82	498,000	1.82	498,000	1.82	498,000
2030	313,000	0.58	180,000	1.11	347,000	1.52	475,000	1.82	568,000	1.82	568,000	1.82	568,000	1.82	568,000	1.82	568,000
2040	351,000	0.58	202,000	1.11	390,000	1.52	534,000	1.82	638,000	1.82	638,000	1.82	638,000	1.82	638,000	1.82	638,000
2044	367,000	0.58	211,000	1.11	407,000	1.52	557,000	1.82	666,000	1.82	666,000	1.82	666,000	1.82	666,000	1.82	666,000
To: (B) Eastern Mediterranean Area (maximum depth 43 ft.)																	
1979	50,000	$0.55	$ 27,000	$1.06	$ 53,000	$1.45	$ 72,000	$1.73	$ 87,000	$1.91	$ 95,000	$1.91	$ 95,000	$1.91	$ 95,000	$1.91	$ 95,000
1995	77,000	0.55	42,000	1.06	81,000	1.45	111,000	1.73	133,000	1.91	146,000	1.91	146,000	1.91	146,000	1.91	146,000
2000	[illegible]	0.55	47,000	1.06	90,000	1.45	123,000	1.73	147,000	1.91	162,000	1.91	162,000	1.91	162,000	1.91	162,000
2010	102,000	0.55	56,000	1.06	108,000	1.45	147,000	1.73	176,000	1.91	193,000	1.91	193,000	1.91	193,000	1.91	193,000
2015	110,000	0.55	60,000	1.06	116,000	1.45	159,000	1.73	190,000	1.91	209,000	1.91	209,000	1.91	209,000	1.91	209,000
2020	118,000	0.55	65,000	1.06	125,000	1.45	171,000	1.73	205,000	1.91	225,000	1.91	229,000	1.91	229,000	1.91	229,000
2030	135,000	0.55	74,000	1.06	143,000	1.45	195,000	1.73	234,000	1.91	257,000	1.91	257,000	1.91	257,000	1.91	259,000
2040	151,000	0.55	83,000	1.06	160,000	1.45	220,000	1.73	263,000	1.91	288,000	1.91	288,000	1.91	288,000	1.91	288,000
2044	158,000	0.55	87,000	1.06	168,000	1.45	229,000	1.73	274,000	1.91	301,000	1.91	301,000	1.91	301,000	1.91	301,000

ained constant throughout the project life. The unit savings applicable channel depths 39 to 51 feet at one foot increments was applied to the ual tonnage for commodity for years 1995, 2000, 2015, 2020, 2030, 2040, 2044 to arrive at annual benefits for the project.

jected Benefits on Grain. Annual benefits on grain exports to the ten eign regions or sub-regions are shown in Table 45. Grain to each region certain shipping restrictions that limit the benefits to certain chan- depths at Pascagoula. These restrictions have been previously cussed in this appendix. The maximum depths at the foreign destination indicated in Table 45 for each of the areas or regions. A summary of efits on grain exports is shown on Table 46.

jected Benefits on Heavy Crude Oil. Since the annual tonnage on crude was not projected, the unit savings for each channel depth considered lied to the annual tonnage was the only change throughout the project e. The change in benefits was for the different channel depths being sidered. The tonnage and benefits on heavy crude oil is shown in Table

jected Benefits on LNG. The unit savings on LNG for the one channel th examined for improvement was applied to the projected annual volume this traffic. The annual savings was $4,596,000 for a 42-foot channel ch was held constant throughout the project life (1995-2044). Although efits for LNG are shown for a 43- to 51-foot channel depth, they remain stant for these depths since they maximize with a 42-foot channel depth. tonnages and benefits for LNG are shown in Table 48.

RAGE ANNUAL EQUIVALENT BENEFITS

eral. Even though maximum benefits are obtained at different channel ths for each of the commodities, AAEB's are shown at 8-1/8 percent erest for one foot increments of channel depths from 39 through 51 feet the Pascagoula River Channel and from 38 through 51 feet for the Bayou otte Channel. Benefits are shown for the one foot increment below where maximum is obtained and then held constant for each greater channel th. For example, if maximum benefits are obtained for a commodity at a nnel depth of 42 feet, AAEB's are shown for 39-, 40-, and 41-foot depths held constant for depths of 43 through 51 feet. The annual benefits on in, which is expected to increase over the project life, is converted to average annual equivalent benefit (AAEB) basis for each channel depth ng considered in this analysis. Since grain benefits maximize with a -foot channel, they are held constant for depths greater than 46 feet. vy crude oil tonnages are not expected to grow over time; however, the efits will increase if greater channel depths are provided. LNG will eive benefits at a 42-foot channel depth only, and will not increase h time.

in. The average annual equivalent benefits applicable to grain exports m the Port of Pascagoula to the Black Sea Area (A) are assigned to nnel depth through 42 feet. These benefits are shown for depths of 39 ough 42 feet and held constant for greater depths. Exports to the

TABLE 44
SUMMARY OF BASE-YEAR SAVINGS FOR GRAIN, HEAVY CRUDE OIL, AND LNG

DEPTH (Ft.)	PASCAGOULA CHANNEL GRAIN EXPORTS 1/	BAYOU CASOTTE CHANNEL CRUDE OIL IMPORTS 2/	BAYOU CASOTTE CHANNEL LNG IMPORTS 3/	BAYOU CASOTTE CHANNEL TOTAL SAVINGS 4/
38	-	$14,377,000	-	$14,377,000
39	$ 925,000	14,712,000	-	14,712,000
40	1,193.000	15,046,000	-	15,046,000
41	1,398,000	15,381,000	-	15,381,000
42	1,532,000	15,715,000	4,596,000	20,311,000
43	1,583,000	13,709,000	4,596,000	18,305,000
44	1,623,000	13,876,000	4,596,000	18,472,000
45	1,647,000	14,210,000	4,596,000	18,806,000
46	1,658,000	14,545,000	4,596,000	19,141,000
47	1,658,000	14,712,000	4,596,000	19,308,000
48	1,658,000	15,046,000	4,596,000	19,642,000
49	1,658,000	15,213,000	4,596,000	19,809,000
50	1,658,000	15,381,000	4,596,000	19,977,000
51	1,658,000	15,548,000	4,596,000	20,144,000

1/ Base year is 1979. These savings represent total base year benefits to the Pascagoula Channel.
2/ Base year is 1984.
3/ Base year is 1989.
4/ Represents base year and total benefits to the Bayou Casotte Channel since neither commodity is projected to grow in the future.

TABLE 42
BASE-YEAR (1984) SAVINGS ON HEAVY CRUDE OIL IMPORTS TO BAYOU CASOTTE

CHANNEL DEPTH (Ft.)	ANNUAL TONNAGE	UNIT SAVINGS	TOTAL SAVINGS
38[1/]	16,718,000	$0.86	$14,377,000
39	16,718,000	0.88	14,712,000
40	16,718,000	0.90	15,046,000
41	16,718,000	0.92	15,381,000
42	16,718,000	0.94	15,715,000
43	16,718,000	0.82	13,709,000
44	16,718,000	0.83	13,876,000
45	16,718,000	0.85	14,210,000
46	16,718,000	0.87	14,545,000
47	16,718,000	0.88	14,712,000
48	16,718,000	0.90	15,046,000
49	16,718,000	0.91	15,213,000
50	16,718,000	0.92	15,381,000
51	16,718,000	0.93	15,548,000

[1/] Two 80,000 dwt tankers operating on channel width of 350 feet and existing depth of 38 feet.

TABLE 43
BASE-YEAR (1989) SAVINGS ON LNG IMPORTS TO BAYOU CASOTTE

CHANNEL DEPTH (Ft.)	ANNUAL TONNAGE	UNIT SAVINGS	TOTAL SAVINGS
42	4,838,000	$0.95	$4,596,000

TABLE 41 (Cont'd)

BASE-YEAR (1979) SAVINGS ON GRAIN EXPORTS FROM PASCAGOULA, MS

ITEM	CHANNEL DEPTH (Ft.) 39	40	41	42	43	44	45	46
To: (G) Northern Europe Area (maximum depth 41 ft.)								
Tons	66,000	66,000	66,000	66,000	66,000	66,000	66,000	66,000
Unit Savings	$0.45	$0.88	$1.21	$1.21	$1.21	$1.21	$1.21	$1.21
Total Savings	30,000	58,000	80,000	80,000	80,000	80,000	80,000	80,000
To: (H) Southern Europe Area (maximum depth 49 ft.)								
Tons	35,000	35,000	35,000	35,000	35,000	35,000	35,000	35,000
Unit Savings	$0.40	$0.77	$1.05	$1.26	$1.38	$1.49	$1.57	$1.61
Total Savings	$ 14,000	$ 27,000	$ 37,000	$ 44,000	$ 48,000	$ 52,000	$ 55,000	$ 56,000
To: (I) Southern Europe Area (maximum depth 46 ft.)								
Tons	81,000	81,000	81,000	81,000	81,000	81,000	81,000	81,000
Unit Savings	$0.40	$0.77	$1.05	$1.26	$1.38	$1.49	$1.57	$1.61
Total Savings	$ 32,000	$ 62,000	$ 85,000	$102,000	$112,000	$121,000	$127,000	$130,000
To: (J) Far East Area (via Panama Canal)								
Tons	722,000	722,000	722,000	722,000	722,000	722,000	722,000	722,000
Unit Savings	$0.84	$0.84	$0.84	$0.84	$0.84	$0.84	$0.84	$0.84
Total Savings	$606,000	$606,000	$606,000	$606,000	$606,000	$606,000	$606,000	$606,000
TOTAL SAVINGS	$925,000	$1,193,000	$1,398,000	$1,532,000	$1,583,000	$1,623,000	$1,647,000	$1,658,000

TABLE 41

BASE-YEAR (1979) SAVINGS ON GRAIN EXPORTS FROM PASCAGOULA, MS

ITEM			CHANNEL DEPTH (Ft.)					
	39	40	41	42	43	44	45	46
To: (A) Black Sea Area								
Tons	116,000	116,000	116,000	116,000	116,000	116,000	116,000	116,000
Units Savings	$0.58	$1.11	$1.52	$1.82	$1.82	$1.82	$1.82	$1.82
Total Savings	$ 67,000	$129,000	$176,000	$211,000	$211,000	$211,000	$211,000	$211,000
To: (B) Eastern Mediterranean Sea Area								
Tons	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
Unit Savings	$0.55	$1.06	$1.45	$1.73	$1.91	$1.91	$1.91	$1.91
Total Savings	$ 27,000	$ 53,000	$ 72,000	$ 87,000	$ 95,000	$ 95,000	$ 95,000	$ 95,000
To: (C) Western Mediterreanean Sea Area								
Tons	46,000	46,000	46,000	46,000	46,000	46,000	46,000	46,000
Unit Savings	$0.43	$0.84	$1.15	$1.37	$1.37	$1.37	$1.37	$1.37
Total Savings	$ 20,000	$ 39,000	$ 53,000	$ 63,000	$ 63,000	$ 63,000	$ 63,000	$ 63,000
To: (D) East Coast of Southern America Area (maximum depth 44 ft.)								
Tons	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000
Unit Savings	$0.48	$0.92	$1.26	$1.50	$1.65	$1.78	$1.78	$1.78
Total Savings	$ 21,000	$ 41,000	$ 57,000	$ 68,000	$ 74,000	$ 80,000	$ 80,000	$ 80,000
To: (E) East Coast of Southern America Area (maximum depth 39 ft.)								
Tons	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000
Unit Savings	$0.48	$0.48	$0.48	$0.48	$0.48	$0.48	$0.48	$0.48
Total Savings	$ 33,000	$ 33,000	$ 33,000	$ 33,000	$ 33,000	$ 33,000	$ 33,000	$ 33,000
To: (F) Northern Europe Area (maximum depth 46 ft.)								
Tons	164,000	164,000	164,000	164,000	164,000	164,000	164,000	164,000
Unit Savings	$0.46	$0.89	$1.21	$1.45	$1.59	$1.72	$1.81	$1.85
Total Savings	$ 75,000	$145,000	$199,000	$238,000	$261,000	$282,000	$297,000	$304,000

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TABLE 40

SUMMARY OF UNIT SAVINGS BY CHANNEL DEPTHS FOR PASCAGOULA AND BAYOU CASOTTE CHANNELS

CHANNEL DEPTHS (Ft.)	PASCAGOULA CHANNEL									BAYOU CASOTTE CHANNEL	
					GRAIN[1/]						
	A	B	C	D	E	F	G	H & I	J	CRUDE OIL	LNG
38	-	-	-	-	-	-	-	-	-	$0.86	-
39	$0.58	$0.55	$0.43	$0.48	$0.48	$0.46	$0.45	$0.40	$0.84	0.88	-
40	1.11	1.06	0.84	0.92	0.48	0.89	0.88	0.77	0.84	0.90	-
41	1.52	1.45	1.15	1.26	0.48	1.21	1.21	1.05	0.84	0.92	-
42	1.82	1.73	1.37	1.50	0.48	1.45	1.21	1.26	0.84	0.94	$0.95
43	1.82	1.91	1.37	1.65	0.48	1.59	1.21	1.38	0.84	0.82	0.95
44	1.82	1.91	1.37	1.78	0.48	1.72	1.21	1.49	0.84	0.83	0.95
45	1.82	1.91	1.37	1.78	0.48	1.81	1.21	1.57	0.84	0.85	0.95
46	1.82	1.91	1.37	1.78	0.48	1.85	1.21	1.61	0.84	0.87	0.95
47	1.82	1.91	1.37	1.78	0.48	1.85	1.21	1.61	0.84	0.88	0.95
48	1.82	1.91	1.37	1.78	0.48	1.85	1.21	1.61	0.84	0.90	0.95
49	1.82	1.91	1.37	1.78	0.48	1.85	1.21	1.61	0.84	0.91	0.95
50	1.82	1.91	1.37	1.78	0.48	1.85	1.21	1.61	0.84	0.92	0.95
51	1.82	1.91	1.37	1.78	0.48	1.85	1.21	1.61	0.84	0.93	0.95

A - To: Black Sea Area - Depths restricted at 42 feet.
B - To: Eastern Mediterranean Area - Depths restricted at 43 feet.
C - To: Western Mediterranean Area - Depths restricted at 42 feet.
D - To: East Coast of South America Area - Depths restricted 44 feet.
E - To: East Coast of South America Area - Depths restricted at 39 feet.
F - To: Northern Europe Area - Depths restricted at 46 feet.
G - To: Northern Europe Area - Depths restricted at 41 feet.
H & I - To: Southern Europe Area - Depths restricted at 49 and 46 feet, respectively.
J - To: Far East Area - Depths restricted, by Panama Canal, to 39 feet.

1/ [illegible] grain is restricted to a maximum depth of 46 feet.

[illegible] vessels operating on channel width of 350 feet and a channel depth of 38 feet.

A summary of unit costs and savings per ton is shown for all effective depths in Table 39. It should be noted that maximum benefits are obtained at a channel depth of 42 feet. No benefits can be realized with channel depths 39 through 41 feet nor depths over 42 feet.

TABLE 39
SUMMARY OF LNG TANKER OPERATING COSTS AND SAVINGS PER TON

CHANNEL DEPTH (Ft.)	TOTAL OPERATING COSTS PER TRIP	TONS HAULED PER TRIP	COSTS PER TON	SAVINGS PER TON
38	$2,580,045	60,480	$42.66	-
42	2,522,686	60,480	41.71	$0.95

Summary of Unit Savings. A summary of unit savings for the entire harbor is shown in Table 40. These unit savings are shown for channel depths ranging from 39 through 51 feet. There are numerous restrictions that limit savings to a certain channel depth, such as, depths at foreign ports, depths in the Panama Canal, limited vessel size needed by shipper and type of service involved.

BENEFITS

Base-Year Benefits. Base-year benefits are not necessarily obtained for the same year on all commodities. For grain the base year is 1979, for heavy crude oil the base year is 1984 and for LNG the base year is 1989. The reason for showing the base-year is to give some indication of what the benefits would be if the channel improvements were available at these various times.

If deeper channels into the Port of Pascagoula had been available in 1979, annual grain benefits would have ranged from $925,000 for a 39-foot channel to $1,658,000 for a 46-foot channel. No additional benefits on grain could be realized from a channel depth improvement greater than 46 feet. Heavy crude oil imports into the Port of Bayou Casotte, expected to begin in 1984, would realize $15,715,000 in benefits for a 42-foot channel improvement and $15,548,000 for a 51-foot channel; however, about $14,377,000 of these amounts can be assigned to widening only. The LNG imports into the Port of Bayou Casotte, expected to begin in 1989, would realize annual benefits of $4,596,000 for a 42-foot channel depth improvement. No benefits would be realized from channel depths other than the 42-foot depth. More detail of these benefits is given in Tables 41, 42, 43, and 44.

Projected Annual Benefits. The base-year volume of traffic on grain was projected from 1979 to 1995 and further projected over the 50-year project life (1995-2044). Heavy crude and LNG tonnage was not projected, therefore

TABLE 38

TOTAL ANNUAL COSTS AND COST PER TON AND SAVINGS FOR SHUTTLING CRUDE OIL IN 100,000 DWT TANKERS

CHANNEL DEPTHS (Ft.)	ULCC & VLCC COSTS	SHUTTLE COSTS	TOTAL COSTS	TONS PER YEAR	COSTS PER TON	SAVINGS PER TON
38[1/]	34,525,663	$12,133,342	$46,659,005	16,718,000	$2.79	-
38[2/]	24,625,370	10,206,631	34,832,001	16,718,000	2.08	$0.71
43	23,374,332	9,609,159	32,983,491	16,718,000	1.97	0.82
44	23,173,360	9,513,137	32,686,497	16,718,000	1.96	0.83
45	22,983,873	9,422,645	32,406,518	16,718,000	1.94	0.85
46	22,806,560	9,337,932	32,144,492	16,718,000	1.92	0.87
47	22,640,700	9,258,607	31,899,307	16,718,000	1.91	0.88
48	22,483,674	9,183,582	31,667,256	16,718,000	1.89	0.90
49	22,333,877	9,112,153	31,446,030	16,718,000	1.88	0.91
50	22,193,705	9,045,222	31,238,927	16,718,000	1.87	0.92
51	22,059,847	8,981,321	31,041,168	16,718,000	1.86	0.93

1/ Existing fleet of one 66,000 and one 79,000 dwt vessel.

2/ Costs based on the use of two 100,000 dwt shuttle vessels. Unit savings are associated with only widening the 35-foot channel.

TABLE 37

COSTS PER TON AND UNIT SAVINGS ON CRUDE OIL AT VARIOUS CHANNEL DEPTHS

USING 66,000-79,000 AND 80,000 DWT SHUTTLE VESSELS

CHANNEL DEPTHS (Ft.)	TOTAL COSTS FOR ULCC & VLCC SHIPS	SHUTTLE VESSEL COSTS	TOTAL COSTS	TONS PER YEAR	COSTS PER TON	SAVINGS PER TON
38 1/	$34,525,663	$12,133,342	$46,659,005	16,718,000	$2.79	-
38 2/	23,507,050	8,810,199	32,317,199	16,718,000	1.93	0.86
39 2/	23,236,581	8,694,327	31,930,908	16,718,000	1.91	0.88
40 2/	22,985,966	8,586,811	31,572,777	16,718,000	1.89	0.90
41 2/	22,754,444	8,487,445	31,241,889	16,718,000	1.87	0.92
42 2/	22,536,623	8,394,048	30,930,671	16,718,000	1.85	0.94

1/ Existing fleet of one 66,000 and one 79,000 dwt vessel operating on the existing channel width.

2/ Two 80,000 dwt vessels operating on full 350 foot channel width.

TABLE 36 (Cont'd)

PER-TON COSTS AND SAVINGS ON GRAIN EXPORTS FROM PASCAGOULA, MS

[illegible] DESTINATIONS	CHANNEL DEPTHS (Ft.) 38	39	40	41	42	43	44	45	46
(d) Southern Europe Region									
Costs Per Ton	$10.24	$ 9.85	$ 9.48	$ 9.19	$ 8.99	$ 8.86	$ 8.75	$ 8.67	$ 8.64
Savings Per Ton	-	0.40	0.77	1.05	1.26	1.38	1.49	1.57	1.60
(e) Southern Europe Region									
Costs Per Ton	10.24	9.85	9.48	9.19	8.99	8.86	8.75	8.67	8.64
Savings Per Ton	-	0.40	0.77	1.05	1.26	1.38	1.49	1.57	1.60
(f) Far East Region (via Panama Canal)									
Costs Per Ton	22.19	21.35	21.35	21.35	21.35	21.35	21.35	21.35	21.35
Savings Per Ton	-	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84

TABLE 45 (Cont'd)

ANNUAL VOLUME OF TRAFFIC AND SAVINGS ON GRAIN EXPORTS FROM PASCAGOULA, TABULATED BY DESTINATION AND CHANNEL DEPTHS BEING CONSIDERED, DURING PROJECT LIFE (1985-2044)

CHANNEL DEPTH (Ft.)

YEAR	TONNAGE	39 SAVINGS PER TON	39 TOTAL SAVINGS	40 SAVINGS PER TON	40 TOTAL SAVINGS	41 SAVINGS PER TON	41 TOTAL SAVINGS	42 SAVINGS PER TON	42 TOTAL SAVINGS	43 SAVINGS PER TON	43 TOTAL SAVINGS	44 SAVINGS PER TON	44 TOTAL SAVINGS	45 SAVINGS PER TON	45 TOTAL SAVINGS	46 SAVINGS PER TON	46 TOTAL SAVINGS
To: (1) Southern Europe Area (maximum depth 46 Ft.)																	
1979	81,000	$0.40	$ 32,000	$0.77	$ 62,000	$1.05	$ 85,000	$1.26	$102,000	$1.38	$117,000	$1.49	$121,000	$1.51	$127,[illegible]	$1.51	[illegible]
1985	124,000	0.40	49,000	0.77	95,000	1.05	13[illegible],000	1.26	156,000	1.32	171,000	1.49	185,000	1.51	[illegible]	[illegible]	[illegible]
2000	138,000	0.40	55,000	0.77	106,000	1.05	145,000	1.26	173,000	1.32	190,000	1.49	205,000	1.51	[illegible]	[illegible]	[illegible]
2010	165,000	0.40	65,000	0.77	126,000	1.05	173,000	1.26	207,000	1.32	227,000	1.49	245,000	1.51	255,[illegible]	[illegible]	[illegible]
2015	178,000	0.40	71,000	0.77	137,000	1.05	187,000	1.26	224,000	1.32	245,000	1.49	265,000	1.51	[illegible]	[illegible]	[illegible]
2020	191,000	0.40	76,000	0.77	150,000	1.05	201,000	1.26	241,000	1.32	265,000	1.49	286,000	1.51	[illegible]	[illegible]	[illegible]
2030	218,000	0.40	87,000	0.77	168,000	1.05	230,000	1.26	275,000	1.32	302,000	1.49	326,000	1.51	[illegible]	[illegible]	[illegible]
2040	245,000	0.40	97,000	0.77	188,000	1.05	259,000	1.26	309,000	1.32	339,000	1.49	366,000	1.51	[illegible]	[illegible]	[illegible]
2044	256,000	0.40	102,000	0.77	197,000	1.05	269,000	1.26	322,000	1.32	355,000	1.49	383,000	1.51	[illegible]	[illegible]	[illegible]
To: (3) Far East Area (via Panama Canal - maximum depth 37 Ft.)																	
1979	722,000	$0.84	$ 606,000	$0.84	$ 606,000	$0.84	$ 606,000	$0.84	$ 606,000	$0.84	$ 606,000	$0.84	$ 606,000	$0.84	$ [illegible]	$0.84	$ [illegible]
1985	1,106,000	0.84	929,000	0.84	929,000	0.84	929,000	0.84	929,000	0.84	929,000	0.84	929,000	0.84	[illegible]	[illegible]	[illegible]
2000	1,226,000	0.84	1,030,000	0.84	1,030,000	0.84	1,030,000	0.84	1,030,000	0.84	1,030,000	0.84	1,030,000	0.84	[illegible]	[illegible]	[illegible]
2010	1,466,000	0.84	1,232,000	0.84	1,232,000	0.84	1,232,000	0.84	1,232,000	0.84	1,232,000	0.84	1,232,000	0.84	[illegible]	[illegible]	[illegible]
2015	1,586,000	0.84	1,332,000	0.84	1,332,000	0.84	1,332,000	0.84	1,332,000	0.84	1,332,000	0.84	1,332,000	0.84	[illegible]	[illegible]	[illegible]
2020	1,706,000	0.84	1,433,000	0.84	1,433,000	0.84	1,433,000	0.84	1,433,000	0.84	1,433,000	0.84	1,433,000	0.84	[illegible]	[illegible]	[illegible]
2030	1,947,000	0.84	1,635,000	0.84	1,635,000	0.84	1,635,000	0.84	1,635,000	0.84	1,635,000	0.84	1,635,000	0.84	1,635,[illegible]	[illegible]	[illegible]
2040	2,186,000	0.84	1,836,000	0.84	1,836,000	0.84	1,836,000	0.84	1,836,000	0.84	1,836,000	0.84	1,836,000	0.84	[illegible]	[illegible]	[illegible]
2044	2,282,000	0.84	1,917,000	0.84	1,917,000	0.84	1,917,000	0.84	1,917,000	0.84	1,917,000	0.84	1,917,000	0.84	[illegible]	[illegible]	[illegible]

TABLE 46

SUMMARY OF ANNUAL VOLUME OF TRAFFIC AND SAVINGS FOR SELECTED YEARS

ON GRAIN EXPORTS FROM PASCAGOULA

YEAR	ANNUAL TONNAGE	39	40	41	42	43	44	45	46
					CHANNEL DEPTHS				
					ANNUAL SAVINGS				
1995	2,137,000	$1,419,000	$1,829,000	$2,143,000	$2,346,000	$2,428,000	$2,489,000	$2,526,000	$2,542,000
2000	2,368,000	1,574,000	2,028,000	2,375,000	2,601,000	2,759,000	2,759,000	2,800,000	2,818,000
2010	2,833,000	1,882,000	2,426,000	2,841,000	3,111,000	3,300,000	3,300,000	3,349,000	3,371,000
2015	3,065,000	2,036,000	2,623,000	3,073,000	3,365,000	3,570,000	3,570,000	3,622,000	3,646,000
2020	3,296,000	2,190,000	2,822,000	3,305,000	3,619,000	3,840,000	3,840,000	3,896,000	3,921,000
2030	3,761,000	2,498,000	3,220,000	3,771,000	4,129,000	4,381,000	4,381,000	4,445,000	4,474,000
2040	4,223,000	2,806,000	3,616,000	4,235,000	4,638,000	4,920,000	4,920,000	4,992,000	5,025,000
2044	4,409,000	2,929,000	3,775,000	4,421,000	4,842,000	5,136,000	5,136,000	5,211,000	5,246,000
AVERAGE ANNUAL EQUIVALENT BENEFITS 8 1/8%		$1,768,000	$2,278,000	$2,668,000	$2,922,000	$3,023,000	$3,099,000	$3,144,000	$3,165,000
AVERAGE ANNUAL EQUIVALENT BENEFITS 8 1/8%[1/]		$1,713,000	$2,207,000	$2,585,000	$2,831,000	$2,991,000	$3,003,000	$3,048,000	$3,068,000

[1/] Assumes savings are constant after 2015 to meet requirements of only 20 year growth.

TABLE [illegible]

ANNUAL TONNAGE AND SAVINGS [illegible]

INTO BAYOU CASOTTE [illegible]

CHANNEL DEPTHS (Ft.)	ANNUAL [illegible] SAVINGS [illegible] TONS	SAVINGS	INCREMENTAL SAVINGS
38	16,718,000	NONE	-
38 1/	16,718,000	$14,[illegible],000	$14,377,000
39	16,718,000	14,712,000	335,000
40	16,718,000	15,046,000	669,000
41	16,718,000	15,381,000	1,004,000
42	16,718,000	15,715,000	1,338,000
43	16,718,000	13,709,000	-668,000
44	16,718,000	13,876,000	-501,000
45	16,718,000	14,210,000	-167,000
46	16,718,000	14,545,000	168,000
47	16,718,000	14,712,000	335,000
48	16,718,000	15,046,000	669,000
49	16,718,000	15,213,000	836,000
50	16,718,000	15,381,000	1,004,000
51	16,718,000	15,548,000	1,171,000

1/ Savings to 30,000 dwt vessels operating on a full channel width of 350 feet.

2/ The incremental benefits for 38 feet are assigned to widening only. All others are incremental from this value and are assigned to channel deepening.

TABLE 48
ANNUAL SAVINGS ON LNG IMPORTS TO BAYOU CASOTTE, MS

YEAR	ANNUAL[1/] TONS	SAVINGS
1989	4,838,000	$4,596,000
1995	4,838,000	4,596,000
2000	4,838,000	4,596,000
2010	4,838,000	4,596,000
2015	4,838,000	4,596,000
2020	4,838,000	4,596,000
2030	4,838,000	4,596,000
2040	4,838,000	4,596,000
2044	4,838,000	4,596,000

[1/] Savings can only be realized by providing a 42-foot channel.

Eastern Mediterranean Sea Area (B) are assigned to channel depths up to a maximum depth of 43 feet. These AAEB's are shown for depths of 39 through 43 feet and are held constant for greater depths. Exports to the Western Mediterranean Sea Area (C) receive maximum benefits at 42 feet because of restricted depths at the foreign ports in this area. Benefits to this area are shown for channel depths of 39 through 42 feet and held constant for the greater depths. Grain exports to certain ports in the East Coast of South America Area (D) receive maximum benefits at a channel depth of 44 feet. Benefits to these ports in this area for depths 39 through 44 feet are increased, but benefits are held constant for depths greater than 44 feet. Benefits on grain exported to other ports in the East Coast of South America Area (E) maximize with a channel depth of 39 feet. Benefits on grain shipped to certain ports in the Northern Europe Area (F) maximize with a 46-foot channel at Pascagoula, due to these foreign port depths. Since we are only considering a channel depth through 46 feet, no restrictions are placed on these benefits. Benefits on grain to other ports in the Northern Europe Area (G) maximize with a 41-foot channel depth. On grain to certain ports in the Southern Europe Area (H), benefits maximizes with a 46-foot channel depth. No restrictions are placed on these benefits. Other ports in the Southern Europe Area (I) also maximize with a 46-foot channel depth; however, no restrictions are placed on these benefits. Benefits on grain to the Far East Area (J) are not restricted by channel depths at foreign ports because the 39-foot restriction at the Panama Canal limits benefits to this depth.

All traffic to the Far East is routed via the Panama Canal because it is not economical to ship around the Cape of Good Hope, unless there is a channel depth at Pascagoula of 48 feet or greater.

A summary of Average Annual Equivalent Benefits on grain exports from Pascagoula, which are the benefits assigned to the Pascagoula River Channel segment, is shown in Table 49.

TABLE 49
SUMMARY OF AAEB FOR GRAIN EXPORTS
AT 8-1/8 PERCENT INTEREST RATE

CHANNEL DEPTH (Ft.)	AVERAGE ANNUAL EQUIVALENT BENEFITS 1/
39	$1,768,000
40	2,278,000
41	2,668,000
42	2,922,000
43	3,023,000
44	3,099,000
45	3,144,000
46	3,165,000 2/

1/ Benefits reflect 1 January 1983 prices.
2/ Benefits are held constant for any channel depth greater than 46 feet.

Heavy Crude Oil. AAEB's associated with this commodity are based on widening the 38-foot channel and greater channel depths which allow either the use of more fully loaded or larger shuttle vessels. Benefits are derived by the use of a 66,000 and 79,000 dwt tanker fleet operating on a channel with the existing depth of 38 feet and with wider and deeper channel depths from 38 through 42 feet. For channel depths from 43 through 51 feet, a shuttle fleet of 100,000 dwt tankers has been used to calculate benefits. Benefits are shown in Table 50 for a widened channel and a deeper channel at one foot increment of depth from 39 through 51 feet. Tonnage of heavy crude was not projected; therefore, base-year (1984) benefits are representative of AAEB's at any interest rate.

LNG. A committed fleet of three 64,000 dwt LNG tankers are used in the determination of AAEB's for this commodity. Benefits would accrue by eliminating the need for certain tug service, and allowing increased speed for these vessels within the harbor. There are no benefits on LNG for channel depths from 39 through 41 feet. Benefits are assigned to a 42-foot channel only. There are no additional benefits assigned to depths of 43 through 51 feet. Maximum benefits are obtained for these vessels at a channel depth of 42 feet since the vessels can operate in the channel fully loaded, at maximum allowable speeds and without the need of tugs. AAEB's for channel depth of 42 feet are shown in Table 51. Since maximum benefits are obtained at 42 feet, benefits for a 43- through 51-foot channel depth are the same as those for a 42-foot channel. Tonnage on LNG was not projected; therefore, baseyear (1989) benefits represent the AAEB at any interest rate.

Summary of Average Annual Equivalent Benefits. A summary of the Average Annual Equivalent Benefits for each channel improvement associated with the widening of the 38-foot Bayou Casotte Channel and for increased depths of 39 through 51 feet are shown in Table 52. Benefits are those in effect as of 1 January 1983, with a 50-year project life from 1995-2044, inclusive. Grain benefits are associated with the Port of Pascagoula and the heavy crude oil and LNG are associated with the Port of Bayou Casotte. Benefits as shown in Table 53 also reflect a price level as of 1 January 1983. An update analysis from 1 January 1983 to 1 October 1983 shows a slight decrease of change. However, the change is so insignificant that no change in benefits is necessary.

Average annual equivalent benefits shown in Table 52 represent a 50-year growth period on grain over the project life (1995-2044). However, regulations require that project benefits for a 20-year growth be shown, to assure that a project be feasible at this shortened growth period. Since crude oil and LNG did not have a growth over the base-year these commodities would be the same for either a 20- or 50-year growth period. Table 53 shows the AAEB with a growth rate restricted to a 20-year period or to the year 2015 and held constant thereafter.

Proposed Turning Basin. The local sponsor has requested that a new turning basin be considered as a part of the Bayou Casotte analyses. The new

TABLE 50
AVERAGE ANNUAL EQUIVALENT BENEFITS ON CRUDE OIL
IMPORTS TO BAYOU CASOTTE, MS

CHANNEL DEPTH (Ft.)	AVERAGE ANNUAL EQUIVALENT BENEFITS[1/]
38	$14,377,000[2/]
39	14,712,000
40	15,046,000
41	15,381,000
42	15,715,000
43	13,709,000
44	13,876,000
45	14,210,000
46	14,545,000
47	14,712,000
48	15,046,000
49	15,213,000
50	15,381,000
51	15,548,000

1/ Based on 1 January 1983 prices.
2/ Widening of Bayou Casotte Channel at 38 feet only.

NOTE: The benefits for increased channel depths of 39 through 51 include benefits for widening only of the 38-foot channel.

TABLE 51
AVERAGE ANNUAL EQUIVALENT BENEFITS FOR LNG IMPORTS TO
BAYOU CASOTTE FOR SELECTED CHANNEL DEPTHS

CHANNEL DEPTH (Ft.)	AVERAGE ANNUAL EQUIVALENT BENEFITS[1/]
39	-
40	-
41	-
42	$4,596,000
43	4,596,000
44	4,596,000
45	4,596,000
46	4,596,000
47	4,596,000
48	4,596,000
49	4,596,000
50	4,596,000
51	4,596,000

[1/] Benefits reflect 1 January 1983 prices.

TABLE 52
SUMMARY OF AVERAGE ANNUAL EQUIVALENT BENEFITS
AT 8-1/8 PERCENT FOR INDIVIDUAL CHANNELS
(Unrestricted growth period)

CHANNEL DEPTH (Ft.)	PASCAGOULA RIVER CHANNEL	BAYOU CASOTTE CHANNEL 1/	TOTAL BENEFITS
38	-	$14,377,000 2/	$14,377,000
39	$1,768,000	14,712,000	16,480,000
40	2,278,000	15,046,000	17,324,000
41	2,668,000	15,381,000	18,049,000
42	2,922,000	20,311,000	23,233,000
43	3,023,000	18,305,000	21,328,000
44	3,099,000	18,472,000	21,571,000
45	3,144,000	18,806,000	21,950,000
46	3,165,000	19,141,000	22,306,000
47	3,165,000	19,308,000	22,473,000
48	3,165,000	19,642,000	22,807,000
49	3,165,000	19,809,000	22,974,000
50	3,165,000	19,977,000	23,142,000
51	3,165,000	20,144,000	23,309,000

1/ Benefits maximize with a 42-foot channel.
2/ Benefits associated with widening existing channel with a 38-foot depth.

TABLE 53
SUMMARY OF AVERAGE ANNUAL EQUIVALENT BENEFITS
AT 8-1/8 PERCENT FOR INDIVIDUAL CHANNELS
(20-year growth period - 1995-2015)

CHANNEL DEPTH (FT.)	PASCAGOULA RIVER CHANNEL	BAYOU CASOTTE[1/] CHANNEL
38	-	$14,377,000[2/]
39	$1,713,000	14,712,000
40	2,207,000	15,046,000
41	2,585,000	15,381,000
42	2,831,000	20,311,000
43	2,991,000	18,305,000
44	3,003,000	18,472,000
45	3,048,000	18,806,000
46	3,068,000	19,141,000
47	3,068,000	19,308,000
48	3,068,000	19,642,000
49	3,068,000	19,809,000
50	3,068,000	19,977,000
51	3,068,000	20,144,000

[1/] *Benefits maximizes with a 42-foot* channel.
[2/] Benefits associated with widening the existing Bayou Casotte Channel.

turning basin will be located across from the refinery and about 1/4 mile upstream of the LNG facility. The basin will be sized to enclose a 1,400-foot circle and includes includes the width of the modified channel on one side.

The turning basin is needed because of the inadequate size of the existing turning basin which is located about 6,000 feet upstream from the refinery. The existing turning basin is also congested because it is used periodically as an anchorage area by vessels awaiting a berthing area.

Benefits to the proposed turning basin have been determined based on reduced vessel operating time and reduced tug service time as associated with shorter travel distance between the two facilities and the turning basins and the reduced turning time at the new turning basin.

A pertinent data sheet is enclosed which shows the data used in the computation of benefits to the proposed turning basin. As shown on Table 54, benefits of more than $1,200,000 are realized by converting to the use of 80,000 dwt tankers from 79,000 dwt and 661,000 dwt vessels. This occurs primarily because of the substantial reduction in trips required to shuttle the crude to Pascagoula. Benefits slightly increase from the 80,000 dwt analysis when the use of 100,000 dwt vessels is analyzed for a 46-foot turning basin. The higher vessel operating costs are slightly offset by the 15 fewer trips required by the 100,000 dwt vessels. Tables 54 and 55-B show average annual equivalent benefits of about $1,218,000 for a 42-foot turning basin. Average annual costs are $638,000 which produces a B/C ratio of 1.9.

Different Plans Considered. Five different plans were considered in the determination of costs and benefits for the turning basin on Bayou Casotte and the appropriate channels associated with Bayou Casotte and the Pascagoula River. Each of these plans only considered different disposal areas; therefore, benefits are the same for each plan at each channel depth. The different disposal plans are discussed in more detail in the main body of this report. Tables 55-A through 55-C show the incremental plans for 38, 42, and 46 feet. As shown on the tables, Plan E produces the maximum net benefits at 42 feet.

Determination of Net Benefits and Costs. Based on data and information shown in Tables 55-A, -B, and -C, maximum net benefits are obtained from a 42-foot channel under Plan E. Table 55-A only related to widening the existing Bayou Casotte Channel; therefore, it was not utilized directly in this computation of deeper depths.

Allocation of Cost to the Combination Leg of the Channel. This project considers three different channels and a turning basin on Bayou Casotte. The channels consist of the Pascagoula River Channel, the Bayou Casotte Channel, and the outer leg which is used to access each of the above channels. This channel is referred to as the Combination Leg.

PASCAGOULA HARBOR
PERTINENT INFORMATION ON TURNING BASINS

'etroleum Vessels

ance from dock to existing turning basin	1 nautical mile
ing time at existing turning basin	30 minutes
er of tugs required at existing turning basin	3
d of tugs	5 knots
ly costs for tug service	$652
er of trips - existing condition	284
er of trips - modified 42-foot channel	190
d trip time to existing turning basin	24 minutes
ing time at new turning basin	15 minutes
er of tugs required at new turning basin	2
hted hourly cost for 79,000 & 66,000 dwt ssels at sea	$958
ly costs for 80,000 dwt vessel at sea	$999
ly costs for 100,000 dwt vessels at sea	$1,121
el time to new turning basin	0

ssels

ance from dock to existing turning basin	1.25 nautical mile
ing time at existing turning basin	30 minutes
er of tugs required at existing turning basin	3
d of tugs	5 knots
ly costs for tug service	$652
er of trips	80
d trip time to existing turning basin	30 minutes
ing time at new turning basin	15 minutes
el time to new turning basin (round trip)	6 minutes
er of tugs required at new turning basin	3
ly costs for LNG vessels at sea	$9,238
ance to new turning basin	.25 nautical mile

TABLE 54
PASCAGOULA HARBOR
BENEFITS TO NEW TURNING BASIN - 42 AND 46 FEET[1]

CRUDE PETROLEUM VESSELS

Without Project Condition

R/T travel & turning time = .9 hour	
[illegible] = .9 x [illegible] x 284 trips	[illegible]
[illegible] .9 x $652 x 284 trips x 3 tugs	[illegible]
TOTAL	$744,819

With Project Condition	42 FOOT 80,000 DWT	46 FOOT 100,000 DWT
R/T travel time & turning time - .25 hours		
Vessels = .25 x $999 x 190 trips (80,000 DWT)		
Vessels = .25 x $1,121 x 175 trips (100,000 DWT)	$ 47,453	$ 49,044
Tugs = .25 x $652 x 190 trips x 2 tugs (80,000 DWT)	61,940	57,050
Tugs = .25 x 652 x 175 trips x 2 tugs (100,000 DWT)		
TOTAL	$ 109,393	$ 106,094
SAVINGS	$ 635,426	$ 638,725

LNG VESSELS

Without Project Condition	42 FOOT 64,000 DWT	46 FOOT 64,000 DWT
R/T travel & turning time = 1 hour		
Vessels = 1 hr. x $9,238 x 80 trips	$ 739,040	SAME
Tugs = 1 hr. x $652 x 80 trips x 3 tugs	156,480	SAME
TOTAL	$ 895,520	SAME
With Project Condition		
R/T travel & turning time = .35 hours		
Vessels = .35 x $9,238 x 80 trips	$ 258,664	SAME
Tugs = .35 x $652 x 80 trips x 3 tugs	54,768	SAME
TOTAL	$ 313,432	SAME
SAVINGS	582,088	582,088
TOTAL SAVINGS	$1,217,514	$1,220,813

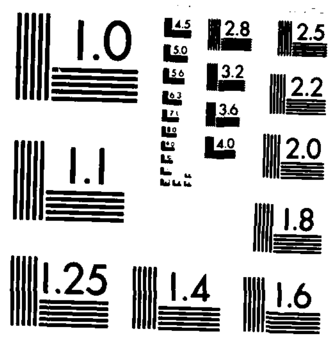
[1] [illegible] turning basin are $1,200,242. The only [illegible] the computational procedure for crude petroleum is [illegible] vessels require 220 trips. Benefits to LNG Vessels [illegible] depths.

[illegible] DWT VESSELS

$1,000 FIRST COSTS	CONSTRUCTION TIME MONTHS	INT. DURING CONSTRUCTION 8-1/8%	TOTAL FIRST COSTS	8-1/8% ANN. COSTS ($1,000)	O&M ($1,000)	TOTAL AVER. ANN. COSTS 8-1/8%	8-1/8% BENEFITS ($1,000)	8-1/8% REMAINING BENEFITS ($1,000)	B/C RATIO 8-1/8%
[illegible]	2.6	$5[illegible]	$4,94[illegible]	$ 41[illegible]	21	$ 431	$ 1,2[illegible]	$ [illegible]	2.8
[illegible]	[illegible]	2[illegible]	4,24[illegible]	39[illegible]	25	381	14,377	1[illegible]	37.7
$ [illegible]	4.8	$7[illegible]	$[illegible],24[illegible]	$ 7[illegible]	$46	$ 812	$1[illegible]	$14,[illegible]	
$ 4,84[illegible]	2.6	[illegible]	$4,[illegible]	$ 410	$30	$ 44[illegible]	$ 1,2[illegible]	$ [illegible]	2.7
4,[illegible]	2.2	28	4,[illegible]	356	36	392	14,377	12,989	36.7
$ [illegible]	4.[illegible]	$[illegible]	$9,24[illegible]	$ [illegible]	$66	$ 832	$15,577	$14,[illegible]	
$ [illegible],034	4.[illegible]	$66	[illegible]	$ 423	$21	$ 444	$ 1,200	$ 756	2.7
[illegible],113	3.6	57	[illegible],167	345	25	370	14,377	14,007	38.9
$ [illegible],147	7.7	$123	$[illegible]	$ 7[illegible]	$46	$ 814	$15,577	14,753	
[illegible]	[illegible]	$531	$1[illegible]	$ [illegible]	$21	$1,444	$ 1,200	-244	0.83
[illegible]	[illegible]	290	[illegible]	1,2[illegible]	25	1,231	14,377	15,146	11.7
[illegible]	[illegible]	$ [illegible]	$[illegible]	[illegible]	$46	$2,675	$1[illegible]	$1[illegible],902	
[illegible]	4.[illegible]	$ 7[illegible]	[illegible]	$ 423	$22	$ 445	$ 1,200	$ 755	2.7
4,113	3.6	50	[illegible]	345	25	370	[illegible],377	14,0[illegible]	38.9
$ [illegible],147	[illegible]	$1[illegible]	$ [illegible]	$ [illegible]	$47	$ 815	$15,577	$14,[illegible]	

AD-A154 885 PASCAGOULA HARBOR MISSISSIPPI FEASIBILITY REPORT ON IMPROVEMENT OF THE FE..(U) CORPS OF ENGINEERS MOBILE AL MOBILE DISTRICT MAR 85 COE-SAM/PD-N-84/012 3/6

UNCLASSIFIED F/G 13/2 NL



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

TABLE 55-B

PASCAGOULA HARBOR - 42 FEET

DIFFERENT PLANS CONSIDERED FOR INCREMENTAL CONSTRUCTION OF TURNING BASIN AND APPROPRIATE CHANNELS

42'	FIRST COSTS $1,000	CONST. TIME MONTHS	INT. DURING CONSTRUCTION 8-1/8% ($1,000)	TOTAL FIRST COSTS 8-1/8% ($1,000)	ANNUAL COSTS 8-1/8% ($1,000)	O&M ($1,000)	TOTAL AVER. ANN. COSTS 8-1/8% ($1,000)	AVER. ANNUAL EQUIV. BENEFITS 8-1/8% ($1,000)	REMAINING BENEFITS 8-1/8% ($1,000)	B/C RATIO 8-1/8%
PLAN A										
Turning Basin	$ 7,362	3.1	$ 75	$ 7,437	$ 617	$21	$ 638	$ 1,218	$ 580	1.9
Bayou Casotte	11,986	3.5	142	12,128	1,006	25	1,031	20,311	19,280	19.7
Pascagoula River	9,527	2.1	68	9,595	796	74	870	2,922	2,052	3.4
Mississippi Sound & Bar	13,305	7.0	315	13,620	1,129	86	1,215			
TOTALS	$42,180	15.7	$600	$42,780	$3,548	$206	$3,754	$24,451	$20,697	6.5
PLAN B										
Turning Basin	$ 7,362	3.1	$ 75	$ 7,437	$ 617	$30	$ 647	$ 1,218	$ 571	1.1
Bayou Casotte	11,986	3.5	142	12,128	1,006	36	1,042	20,311	19,264	19.4
Pascagoula River	9,527	2.1	68	9,595	796	94	890	2,922	2,032	3.3
Mississippi Sound & Bar	13,305	7.0	315	13,620	1,129	93	1,222			
TOTALS	$42,180	15.7	$600	$42,780	$3,548	$253	$3,801	$24,451	$20,645	6.4
PLAN C										
Turning Basin	$ 5,812	4.7	$ 93	$ 5,904	$ 490	$21	$ 511	$ 1,218	$ 707	2.4
Bayou Casotte	10,179	5.4	186	10,365	859	25	884	20,311	19,427	23.0
Pascagoula River	9,703	8.0	263	9,966	826	74	900	2,922	2,022	3.2
Mississippi Sound & Bar	15,694	12.6	670	16,364	1,357	86	1,443			
TOTALS	$41,388	30.7	$1,211	$42,599	$3,532	$206	$3,738	$24,451	$20,713	6.5
PLAN D										
Turning Basin	$18,573	6.3	$396	$18,969	$1,573	$21	$1,594	$ 1,218	$ -376	0.76
Bayou Casotte	25,134	7.4	630	25,764	2,136	25	2,161	20,311	18,150	9.4
Pascagoula River	9,703	8.0	263	9,966	826	74	900	2,922	2,022	3.2
Mississippi Sound & Bar	15,694	12.6	670	16,364	1,357	86	1,443			
TOTALS	$69,104	34.3	$1,959	$71,063	$5,892	$206	$6,098	$24,451	$18,353	4.0
PLAN E										
Turning Basin	$ 5,812	4.7	$ 93	$ 5,905	$ 490	$ 21	$ 511	$ 1,218	$ 707	2.4
Bayou Casotte	10,179	5.4	186	10,365	859	25	884	20,311	19,427	23.0
Pascagoula River	9,527	5.1	164	9,691	804	94	898	2,922	2,024	3.3
Mississippi Sound & Bar	13,305	7.0	315	13,620	1,129	93	1,222			
TOTALS	$38,823	22.2	$ 758	$39,581	$3,282	$233	$3,515	$24,451	$20,936	7.0

TABLE 55-C

PASCAGOULA HARBOR - 46 FEET

DIFFERENT PLANS CONSIDERED FOR INCREMENTAL CONSTRUCTION OF TURNING BASIN AND APPROPRIATE CHANNELS

46'	FIRST COSTS $1,000	CONST. TIME MONTHS	INT. DURING CONSTRUCTION 8-1/8% ($1,000)	TOTAL FIRST COSTS 8-1/8% ($1,000)	ANNUAL COSTS 8-1/8% ($1,000)	O&M ($1,000)	TOTAL AVER. ANN. COSTS 8-1/8% ($1,000)	AVER. ANNUAL EQUIV. BENEFITS 8-1/8% ($1,000)	REMAINING BENEFITS 8-1/8% ($1,000)	B/C RATIO 8-1/8%
PLAN A										
Turning Basin	$10,226	4.1	$ 142	$10,370	$ 860	$21	$ 881	$ 1,221	$ 340	1.4
Bayou Casotte	18,532	6.1	382	18,914	1,568	25	1,593	19,141	17,548	12.0
Pascagoula River	14,657	7.1	353	15,010	1,245	74	1,319	3,165	1,846	2.4
Mississippi Sound & Bar	27,783	17.0	1,723	29,506	2,447	86	2,533			
TOTALS	$71,200	34.3	$2,600	$73,800	$6,120	$206	$6,326	$23,527	$17,201	3.7
PLAN B										
Turning Basin	$10,228	4.1	$ 142	$10,370	$ 860	30	$ 890	$ 1,221	$ 331	1.4
Bayou Casotte	18,532	6.1	382	18,914	1,568	36	1,604	19,141	17,537	11.9
Pascagoula River	14,657	7.1	353	15,010	1,245	94	1,339	3,165	1,826	2.4
Mississippi Sound & Bar	27,783	17.3	1,723	29,506	2,447	93	2,540			
TOTALS	$71,200	34.6	$2,600	$73,800	$6,120	$253	$6,373	$23,527	$17,154	3.7
PLAN C										
Turning Basin	$11,711	5.0	$ 198	$11,909	$ 987	$21	$1,008	$ 1,221	$ 213	1.2
Bayou Casotte	20,686	7.5	525	21,211	1,759	25	1,784	19,141	17,357	10.7
Pascagoula River	14,070	8.5	405	14,475	1,200	74	1,274	3,165	1,891	2.5
Mississippi Sound & Bar	30,950	23.0	2,459	33,409	2,770	$ 86	2,856			
TOTALS	$77,417	44.0	$3,587	$81,004	$6,716	$206	$6,922	$23,527	$16,605	3.4
PLAN D										
Turning Basin	$20,615	6.8	$ 475	$21,090	$1,749	21	$1,770	$ 1,221	$ -549	0.69
Bayou Casotte	33,692	9.8	1,118	34,810	2,886	25	2,911	19,141	16,230	6.6
Pascagoula River	14,070	8.5	401	14,475	1,200	74	1,274	3,165	1,891	2.5
Mississippi Sound & Bar	30,950	23.0	2,459	33,409	2,770	86	2,856			
TOTALS	$99,327	48.1	$4,457	$103,784	$8,605	$206	$8,811	$23,527	$14,716	2.7
PLAN E										
Turning Basin	$11,711	5.0	$ 198	$11,909	$ 987	$ 21	$1,008	$ 1,221	$ 213	1.2
Bayou Casotte	20,686	7.5	525	21,211	1,759	25	1,784	19,141	17,357	10.7
Pascagoula River	14,656	7.1	352	15,008	1,244	94	1,338	3,165	1,827	2.4
Mississippi Sound & Bar	27,783	17.0	1,626	29,409	2,439	93	2,532			
TOTALS	$74,836	36.6	$2,701	$77,537	$6,429	$233	$6,662	$23,527	$16,865	3.5

Costs of the combination channel leg were allocated to the Bayou Casotte Channel and the Pascagoula River Channel based on the percentage distribution of remaining benefits to each channel for Plan E. Table 56 shows the allocations for a 42 depth.

Sensitivity. The only sensitivity analyses considered for this project involve the projection of grain. Based on the allocated costs in Table 56 for the Pascagoula River Channel for 42 feet of depth ($1,006) and the benefits assigned to a 42-foot channel in Table 41 ($1,532) based on 1979 traffic, the B/C ratio for 1979 conditions for grain is 1.5; therefore, projected grain traffic is not needed to justify this portion of the project.

Table 57 deleted.

Vessel Delays. A simulation model of Mobile Harbor was revised to conform to the parameters of Pascagoula Harbor using SLAM II simulation language. This model incorporated the logic and code necessary to simulate one-way traffic within the channel limits (length and width). In addition to sequencing vessel traffic in both directions (up and down channel) and from both Pascagoula River and Bayou Casotte, the model also accounts for vessel delays because of channel use. The traffic simulated included all types of vessels which will use the harbor during project life. These were; general cargo ships, dry bulk carriers, crude oil tankers, product tankers, chemical tankers, liquid gas tankers, liquid natural gas (LNG) tankers, and ocean-going barge carriers.

The model was used to determine the effects of arrival distributions of vessel traffic on the system cost associated with delaying vessels which arrive at the "at sea" entrance or harbor entrances to the channel. The model was applied to three conditions for the years 1995, 2000, 2010, 2020,

Revised: March 1985

TABLE 56

ALLOCATION OF COSTS TO COMBINATION USE CHANNEL @ 8-1/8%
(1,000)

42 FEET (PLAN E)

	REMAINING BENEFITS	PERCENT OF TOTAL	AVERAGE ANNUAL COSTS	ADDITIONAL ALLOCATED COSTS	TOTAL ADJUSTED COSTS	AVERAGE ANNUAL EQUIV. BENEFITS 1/	B/C RATIO 1/	REMAINING BENEFITS 1/
Bayou Casotte 2/	$20,134	90.9	$1,395	$1,111	$2,506	$21,529	8.6	$19,023
Pascagoula River	2,024	9.1	898	111	1,009	2,922	2.9	1,913
TOTALS	$22,158	100.0	$2,293	$1,222	$3,515	$24,451	6.5	$20,936
COMBINATION CHANNEL			$1,222					

1/ Excludes $178,000 and $22,000 in delay reduction benefits to the Bayou Casotte and the Pascagoula River Channels, respectively (see Table 59).

2/ Includes costs and benefits for the turning basin.

2030, 2040, and 2044: the present configuration, with Bayou Casotte widened to 350 feet, and with the proposed dimensions of 42 by 350 feet for the entire channel. Delay costs for Pascagoula Harbor could be further reduced by introducing the channel to two-way traffic. The results for the three conditions listed above showed thet reductions in delay costs were not significant enough to support further channel widening for two-way traffic.

Delay Costs. Delay costs were calculated for the three different conditions listed above. This allowed determination of average annual equivalent benefits for each of the channels involved. Values for each period from 1995 through 2044, as discussed above and shown in Table 58, were used in these computations.

Table 58

PASCAGOULA HARBOR
ONE-WAY TRAFFIC DELAY COSTS

	38' BY 350' EXCEPT BAYOU CASOTTE	38' BY 350' INCLUDING BAYOU CASOTTE	42' BY 350' INCLUDING BAYOU CASOTTE
Number of Ships			
1995	1322	1254	1233
2044	1720	1705	1552
Hours of Delay			
1995	275.91	123.16	137.35
2044	576.13	237.54	210.85
Delay Costs			
1995	$328,803.76	$195,680.93	$211,116.60
2044	$747,638.67	$297,213.87	$338,084.62
Average Annual Equivalent Benefits	$393,000.00	$215,000.00	$193,000.00

Average Annual Equivalent Benefits. Since the number of vessels operating overtime does not change because of deepening a 350-foot-wide Bayou Casotte from 39 through 42 feet, average annual benefits are determined for this channel by subtracting average annual delay costs for a 38- by 350-foot channel at Bayou Casotte ($215,000) from the average annual delay costs for the existing project ($393,000). Average annual equivalent benefits of $178,000 are assigned to a 38- by 350-foot Bayou Casotte Channel. These benefits are constant for each channel depth from 38 through 42 feet.

Average annual equivalent benefits for a 42- by 350-foot channel on the Pascagoula River are determined by subtracting average annual delay costs for both channels being modified to 42 by 350 feet ($193,000) from average annual delay costs of $215,000 associated with both channels having dimensions of 38 by 350 feet. This calculation is appropriate since delay costs are the same for either a 38- by 350-foot or a 42- by 350-foot channel at Bayou Casotte. Average annual benefits of $22,000 are assigned to the 4-foot incremental depth for the Pascagoula River Channel. Benefits for each incremental foot of depth are estimated by dividing $22,000 by 4.

Average annual equivalent benefits for the channel depths ranging from 38 through 42 feet and 350-foot channel widths for each of the channels are shown in Table 59.

TABLE 59

AVERAGE ANNUAL EQUIVALENT BENEFITS ASSOCIATED WITH TRAFFIC DELAYS (8-1/8%)

DEPTH[1/]	BAYOU CASOTTE CHANNEL	PASCAGOULA RIVER CHANNEL
38	$178,000	0
39	178,000	$ 5,500
40	178,000	11,000
41	178,000	16,500
42	178,000	22,000

1/ Each channel width is 350 feet.

Land Enhancement. There are no land enhancement benefits or costs associated with Plan "E", even though disposal will occur on the LNG facility lands. Disposing on these lands is the cheapest alternative cost for disposal. Also, Real Estate Division in Mobile has appraised the lands with and without disposal and has found no difference in value.

Multiport Analyses. For purposes of multiport analyses for Pascagoula Harbor, competing ports were assumed to be all of those ports on the Gulf Coast exporting a million tons or more of grain each year. There are seven competing ports on the Gulf Coast meeting these requirements. The controlling channel depths at six of these ports is 40 feet with Corpus Christi, Texas, having a controlling depth of 45 feet.

Benefits maximize at 42 feet on the Pascagoula Channel; therefore, comparisons were made for savings on the Pascagoula Channel from 40 to 42 feet.

There are seven foreign regions, excluding the Far East, that will realize savings at these increments of depth. The Far East will receive no savings because of the 39-foot restriction across the Panama Canal. Savings per ton from 40 to 42 feet range from $0.33 to $0.71 with an average of $0.55 per ton for these locations.

It is believed that deepening the Pascagoula Channel will have little or no effect on grain movements from the other Gulf ports. This is based on historical changes that have occurred to export grain shipments from Corpus Christi. This port has channel depths 5 feet deeper than any port on the Gulf Coast. This deeper channel has not caused significant decreases in exports of grain from the other port. From 1978 through 1981, export grain from the Ports of Houston and Galveston increased from about 12.8 million tons and 2.8 million tons to approximately 13.5 million tons and 5.9 million tons, respectively. During the same period grain exports from Corpus Christi decreased from 4.6 million tons to 1.9 million tons.

Compliance with EC 1105-2-124. Table 60 shows the requirements of EC 1105-2-124. The table only analyzes 100 percent recovery since the benefits to the project can easily meet this recovery requirement. Based on this, it is not necessary to show the effects of 50 percent cost recovery.

The first part of Table 60 shows the 1983 first costs adjusted to represent expenditures on the two channels. These values are grown at 8 percent to the first year of project life (October 1994). Interest during construction is added to these values to obtain a total first cost for each of the channels. Total first costs are converted to average annual costs through use of the interest and amortization factor for 6.5 percent and 50 years.

The second and third parts of the table show the 1995 tonnage for each channel and the amount per ton required for 100 percent cost recovery for each channel. The fourth part of the table shows the October 1983 savings per ton for each movement and increases these values at a compound interest rate of 4.5 percent through 1995 which is the first full year of project life. Each of these values is then compared to the required savings per ton for each of the channels. As shown on the table, movement E on the Pascagoula River is the only one that does not exceed the 100 percent requirements. However, it does equal the required $0.81 per ton for grain. Savings for each remaining movement far exceed this requirement; therefore, the projects are shown to be viable in 1995 based on 100 percent cost recovery.

TABLE

RECOVERY OF 100% OF COSTS OF RECOMMENDED PLAN BASED ON EC 1105-2-124

($1,000)

	BAYOU CASOTTE	PASCAGOULA RIVER	MISSISSIPPI SOUND	TOTAL
First Costs (October 1983)	$15,991	$9,527	$13,305	$38,823
Construction Time (Months)	10.1	5.1	7.0	22.2
Allocation % 1/	90.9	9.1	0	100.0
Allocated Mississippi Sound Costs	$12,094	$1,211	0	$13,305
Allocation of Miss. Sound Time	6.3	0.7	0	7.0
Total Adjusted Construction Time	16.4	5.8	0	22.2
Total Adjusted First Costs	$28,085	$10,738	0	$38,823
Value Compounded @ 8% through 1994 (11 yrs.-2.332)	$65,494	$25,041		$90,535
Construction Time	16.4 mos.	5.8mos.		22.2 mos.
Interest During Construction (6.5%)	$ 2,374	$393		$ 2,767
Total First Costs	$67,868	$25,434		$93,302
Average Annual Costs @ 6.5%	$ 4,609	$1,727		$ 6,336

1/ See Table

1995 TONNAGES
(1,000 Tons)

BAYOU CASOTTE LNG	BAYOU CASOTTE CRUDE	TOTAL	PASCAGOULA RIVER GRAIN
4,838	16,718	21,556	2,137

COSTS PER TON REQUIRED IN 1995 ($1,000)

	BAYOU CASOTTE	PASCAGOULA RIVER
Average Annual Costs	$ 4,609	$1,727
1995 Tonnage	21,556	2,137
Costs Per Ton Required 1/	$0.21	$0.81

1/ Costs per ton required to recover 100% of project costs.

TABLE

RECOVERY OF 100% OF COSTS OF RECOMMENDED PLAN BASED ON EC 1105-2-124

($1,000)

SAVINGS PER TON BY INDIVIDUAL MOVEMENT

	GRAIN A THRU J (Pascagoula River)										BAYOU CASOTTE	
	A	B	C	D	E	F	G	H	I	J	LNG	CRUDE OIL
1983 Savings Per Ton	$1.82	$1.73	$1.37	$1.50	$0.48	$1.45	$1.21	$1.26	$1.26	$0.84	$0.95	$0.94
1995 Savings Per Ton 1/	$3.09	$2.93	$2.32	$2.54	$0.81	$2.46	$2.05	$2.14	$2.14	$1.42	$1.61	$1.59
1995 Savings Required	$0.81	$0.81	$0.81	$0.81	$0.81	$0.81	$0.81	$0.81	$0.81	$0.81	$0.21	$0.21
Residual Savings	$2.28	$2.12	$1.51	$1.73	$0.00	$1.65	$1.24	$1.33	$1.33	$0.61	$1.40	$1.38

1/ 1983 savings compounded at 4.5% growth rate (12 year factor is 1.696).

PASCAGOULA HARBOR
PROJECTED VESSEL FLEET

Projected Vessel Fleet. The Principles and Guidelines require that the composition of the vessel fleet be determined throughout project life for both the with and without project condition. Since the vessel fleet is not defined, it is assumed that the projected fleet only involves those vessels associated with benefits for the harbor under study. The Pascagoula Harbor fleet only considers bulk carriers exporting grain from Pascagoula. Tankers hauling crude and LNG are committed vessels and are not expected to change during the project life since the commodities involved are not projected to grow in the future.

The projected fleet is determined based on an allocation procedure involving the utilization of a computed percentage of the world fleet dwt capability as related to each foot of depth for either the with or without project condition. For example, it is assumed that the without project condition will involve vessels with drafts ranging from 30 through 38 feet. The average dwt for vessels with 30-foot drafts is 18,511, and there are 276 vessels of this type in the world fleet. Multiplication of these two values produces a world fleet capability of 5,109,036 dwt for the 30-foot draft vessels. This computation is continued for the remaining eight drafts associated with the without project condition and the sum of all drafts is determined. Each of the nine world fleet capabilities is then calculated as a percent of the total. Each of these percentages is then multiplied by each years' grain projection to determine the amount of grain hauled by each draft vessel. Each of these tonnages is then divided by the dwt for that vessel class to determine the number of vessels involved. Vessels have not been rounded in these calculations. The vessels for the with project condition were determined using the same procedure except that the range of vessels was expanded to considerr the deeper channel depths. Tables 61 and 62 show the computations of tonnages and vessels for the with and without project conditions. Table 63 shows a summary of the vessels for both conditions. For purposes of this table, vessel numbers have been rounded up or down based on standard rounding procedures.

TABLE 60

PASCAGOULA HARBOR

DETERMINATION OF EXISTING AND PROJECTED FLEET OF BULK CARRIERS - EXISTING CHANNEL CONDITIONS (38' x 350')

DRAFT	WORLD FLEET OF DRY BULK CARRIERS: DWT (World Fleet)	NUMBER OF VESSELS	TOTAL DWT	PERCENT OF TOTAL	1979 TONS	RECONSTRUCTED TRIPS	1979 ACTUAL TRAFFIC PATTERN: NUMBER OF VESSELS	AVERAGE ACTUAL DWT[1/]
30	18,511	276	5,109,036	6.1	223,000	12.0	3	30,933
31	20,622	313	6,454,686	7.8	285,000	13.8	7	22,424
32	22,896	410	9,387,360	11.3	413,000	18.0	4	25,144
33	25,338	359	9,096,342	10.9	399,000	15.7	6	27,958
34	27,957	357	9,980,649	12.0	439,000	15.7	11	33,451
35	30,758	462	14,210,196	17.1	625,000	20.3	18	32,645
36	33,749	339	11,440,911	13.7	501,000	14.8	23	35,163
37	36,936	292	10,785,312	13.0	475,000	12.9	10	40,389
38	40,329	167	6,734,776	8.1	296,000	7.3	22	50,071
		TOTAL	83,199,268	100.0%	3,656,000	130.5	104	

PROJECTED GRAIN TRAFFIC TO ALL DESTINATIONS - 38' CHANNEL

DRAFT	DWT (World Fleet)	PERCENT ALLOCATION	1995 ANNUAL TONS (000's)	1995 NUMBER VESSELS	2000 ANNUAL TONS (000's)	2000 NUMBER VESSELS	2010 ANNUAL TONS (000's)	2010 NUMBER VESSELS	2020 ANNUAL TONS (000's)	2020 NUMBER VESSELS	2030 ANNUAL TONS (000's)	2030 NUMBER VESSELS	2040 ANNUAL TONS (000's)	2040 NUMBER VESSELS	2044 ANNUAL TONS (000's)	2044 NUMBER VESSELS
30	18,511	6.1	341	18.4	378	20.4	453	24.5	527	28.5	601	32.5	675	36.5	705	38.1
31	20,622	7.8	437	21.2	484	23.5	579	28.1	674	32.7	769	37.3	863	41.8	901	43.7
32	22,896	11.3	633	27.6	701	30.6	839	36.6	976	42.6	1,114	48.7	1,251	54.6	1,306	57.0
33	25,338	10.9	611	24.1	676	26.7	809	31.9	942	37.2	1,074	42.4	1,207	47.6	1,260	49.7
34	27,957	12.0	672	24.0	744	26.6	891	31.9	1,037	37.1	1,183	42.3	1,328	47.5	1,387	49.6
35	30,758	17.1	958	31.1	1,061	34.5	1,268	41.2	1,477	48.0	1,686	54.8	1,893	61.5	1,976	64.2
36	33,749	13.7	767	22.7	850	25.2	1,017	30.1	1,184	35.1	1,350	40.0	1,517	44.9	1,583	46.9
37	36,936	13.0	728	19.7	807	21.8	965	26.1	1,122	30.4	1,282	34.7	1,439	39.0	1,503	40.7
38	40,328	8.1	454	11.3	503	12.5	601	14.9	700	17.4	798	19.8	897	22.2	936	23.2
	TOTAL	100.0	5,601	200.1	6,204	221.8	7,422	265.3	8,639	309.0	9,857	352.5	11,070	395.6	11,557	413.1

[1/] Cannot be associated with fully loaded draft since information only relates to actual loaded draft. Vessels could be and probably were light loaded.

TABLE 61

PASCAGOULA HARBOR

PROJECTED FLEET OF DRY BULK CARRIERS - MODIFIED CHANNEL CONDITION (42' x 350')

VESSEL REG. DRAFT	DRY BULK WORLD FLEET (DWT)	PERCENT ALLOCATION	1979 TONS	1979 TRIPS	1995 TONS	1995 TRIPS	2000 TONS	2000 TRIPS	2010 TONS	2010 TRIPS	2020 TONS	2020 TRIPS	2030 TONS	2030 TRIPS	2040 TONS	2040 TRIPS	2044 TONS	2044 TRIPS
			TRAFFIC THAT WAS SCREENED FROM BENEFIT ANALYSIS															
30	18,511	6.1	138,000	7.5	211,000	11.4	234,000	12.6	280,000	15.1	326,000	17.6	372,000	20.1	418,000	22.6	436,000	23.6
31	20,622	7.8	176,000	8.5	270,000	13.1	299,000	14.5	358,000	17.4	417,000	20.2	475,000	23.0	534,000	25.9	557,000	27.0
32	22,896	11.3	255,000	11.1	391,000	17.1	434,000	19.0	519,000	22.7	604,000	26.4	689,000	30.1	774,000	33.8	808,000	35.3
33	25,338	10.9	247,000	9.7	378,000	14.9	418,000	16.5	500,000	19.7	582,000	23.0	664,000	26.2	746,000	29.4	779,000	30.7
34	27,957	12.0	272,000	9.7	416,000	14.9	462,000	16.5	550,000	19.7	641,000	22.9	732,000	26.2	821,000	29.4	858,000	30.7
35	30,758	17.1	387,000	12.6	592,000	19.2	656,000	21.3	785,000	25.5	914,000	29.7	1,042,000	33.9	1,170,000	38.0	1,222,000	39.7
36	33,749	13.7	310,000	9.2	475,000	14.1	526,000	15.6	629,000	18.6	731,000	21.7	835,000	24.7	938,000	27.8	979,000	29.0
37	36,936	13.0	293,000	7.9	450,000	12.2	499,000	13.5	597,000	16.2	695,000	18.8	792,000	21.4	890,000	24.1	929,000	25.2
38	40,328	8.1	183,000	4.5	281,000	7.0	311,000	7.7	372,000	9.2	433,000	10.7	495,000	12.3	555,000	13.8	579,000	14.4
	TOTAL	100.0	2,261,000	80.7	3,464,000	123.9	3,839,000	137.2	4,590,000	164.1	5,343,000	191.0	6,096,000	217.9	6,846,000	244.8	7,147,000	255.6
			TRAFFIC DESTINED TO THE FAR EAST - VIA THE PANAMA CANAL															
39	43,931	12.9	93,100	2.1	142,700	3.2	158,200	3.6	189,100	4.3	220,100	5.0	251,200	5.7	282,000	6.4	294,400	6.7
40	47,752	21.2	153,100	3.2	234,500	5.3	259,900	5.4	310,800	6.5	361,700	7.6	412,800	8.6	463,400	9.7	483,800	10.1
41	51,798	29.5	213,000	4.1	326,300	6.3	361,700	7.0	432,500	8.3	503,300	9.7	574,400	11.1	644,900	12.5	673,200	13.0
42	56,077	12.7	91,700	1.6	140,500	2.5	155,700	2.8	186,200	3.3	216,700	3.9	247,300	4.4	277,600	5.0	289,800	5.2
43	60,597	11.8	85,200	1.4	130,500	2.2	144,700	2.4	173,000	2.9	201,300	3.3	229,700	3.8	257,900	4.3	269,300	4.4
44	65,364	11.9	85,900	1.3	131,600	2.0	145,900	2.2	174,500	2.7	203,000	3.1	231,700	3.5	260,100	4.0	271,600	4.2
	TOTAL	100.0	722,000	13.7	1,106,000	21.5	1,226,000	23.4	1,466,000	28.0	1,706,000	32.6	1,947,000	37.1	2,186,000	41.9	2,282,000	43.6
			TRAFFIC DESTINED TO COUNTRIES OTHER THAN THE FAR EAST															
39	43,931	10.1	68,000	1.5	104,100	2.4	115,000	2.6	138,100	3.1	160,600	3.7	183,200	4.2	205,700	4.7	214,800	4.9
40	47,752	16.5	111,000	2.3	170,100	3.6	187,900	3.9	225,600	4.7	262,400	5.5	299,300	6.3	336,100	7.0	351,000	7.4
41	51,798	23.1	155,500	3.0	238,200	4.6	263,100	5.1	313,800	6.1	367,300	7.1	419,000	8.1	470,500	9.1	491,300	9.5
42	56,077	9.9	66,600	1.2	102,100	1.8	112,800	2.0	135,300	2.4	157,400	2.8	179,600	3.2	201,700	3.6	210,600	3.8
43	60,597	9.3	63,600	1.0	95,900	1.6	105,900	1.7	127,100	2.1	147,900	2.4	168,700	2.8	189,400	3.1	197,800	3.3

1/ Fully loaded draft is restricted to 39 feet. Remainder of vessels are light loaded to the extent necessary.

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SECTION D-1

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PASCAGOULA HARBOR, MISSISSIPPI
APPENDIX D
ENVIRONMENTAL DOCUMENTATION

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APPENDIX D

ENVIRONMENTAL DOCUMENTATION

COSTS FOR TUG ASSISTANCE FOR OIL TANKERS

As indicated in the design and cost appendix (Appendix B), determination of the appropriate channel width required by the 80,000 dwt crude oil tankers in accordance with the guidance of EM1110-2-1613 yields a width of 430 feet. Review of modeling performed by the Computer Aided Operations Research Facility (CAORF) for dry bulk carriers on a 55- by 400-foot channel considered for Mobile Harbor and for use of the existing Pascagoula Harbor channel by LNG tankers seems to indicate that a channel width less than 430 feet can be safely navigated. Further, user representatives indicate that a 350-foot channel width can be safely and efficiently navigated. There is, however, some uncertainty concerning the performance of the 80,000 DWT tankers in the 350-foot channel. Should these vessels be unable to safely maneuver the 350-foot channel, tug assistance may be required for inbound crude oil tankers. Accordingly, an estimate of the cost of tug assistance has been developed. If tug assistance is required, the benefits of the recommended plan would be reduced by the amount of this cost.

If tug assistance is required, it is expected that two tugs would meet the 80,000 DWT tanker near the north end of Horn Island Pass (see Plate VIII), travel with vessel to the dock in Bayou Casotte, and return to their base in Pascagoula River. It is estimated that each inbound trip require about 5 hours tug service for two tugs valued at $652 per hour, amounting to $6,500 per trip. Based on the estimated 190 trips per year required for the 80,000 DWT vessels, the total value of tug service is $1,200,000. Therefore, if it develops that tug service is required, the benefits for the recommended plan would be reduced by $1,200,000.

TABLE 62

PASCAGOULA HARBOR

SUMMARY OF PROJECTED VESSEL FLEET OF DRY BULK CARRIERS HAULING GRAIN EXPORTS FROM PASCAGOULA RIVER CHANNEL (1995-2044)

VESSEL TRIPS - WITHOUT PROJECT CONDITION

VESSEL REG. DRAFT (Ft.)	DWT	1995	2000	2010	2020	2030	2040	2044
	38' CHANNEL AVAILABLE							
30	18,311	18	20	25	29	33	37	38
31	20,622	21	24	28	33	37	42	44
32	22,896	28	31	37	43	49	55	57
33	25,338	24	27	32	37	42	48	50
34	27,957	24	27	32	37	42	48	50
35	30,758	31	35	41	48	55	62	64
36	33,749	23	25	30	35	40	45	47
37	36,936	20	22	26	30	35	39	41
38	40,328	11	13	15	17	20	22	23
		200	224	266	309	353	398	414

VESSEL TRIPS - WITH PROJECT CONDITION

VESSEL REG. DRAFT (Ft.)	DWT	1995	2000	2010	2020	2030	2040	2044
	42' CHANNEL AVAILABLE							
30	18,311	11	13	15	18	20	23	24
31	20,622	13	15	17	20	23	26	27
32	22,896	17	19	23	26	30	34	35
33	25,338	15	17	20	23	26	29	31
34	27,957	15	17	20	23	26	29	31
35	30,758	19	21	26	30	34	38	40
36	33,749	14	16	19	22	25	28	29
37	36,936	12	14	16	19	21	24	25
38	40,328	7	8	9	11	12	14	14
39	43,931	6	7	7	9	10	11	12
40	47,752	9	9	12	14	15	17	17
41	51,798	11	12	14	17	20	22	23
42	56,077	5	5	5	7	7	9	9
43	60,597	4	4	5	5	7	7	7
44	65,364	4	4	5	5	7	7	7
45	70,386	2	2	2	2	3	3	3
46	75,672	1	1	1	1	2	2	2
47	81,227	1	1	1	1	1	1	1
	TOTAL	166	185	217	253	289	324	337

TABLE 6Y (Cont'd)

PASCAGOULA HARBOR

PROJECTED FLEET OF DRY BULK CARRIERS - MODIFIED CHANNEL CONDITION (42' x 350')

44	65,364	9.3	62,600	1.0	95,900	1.5	105,900	1.6	127,100	1.9	147,900	2.3	168,700	2.6	189,400	2.9	197,000	3.0
45	70,386	10.0	67,300	1.0	103,100	1.5	113,900	1.6	136,700	1.9	159,000	2.3	181,400	2.6	203,700	2.9	212,700	3.0
46	75,672	6.4	43,100	0.6	66,000	0.9	72,900	1.0	87,500	1.2	101,800	1.3	116,100	1.5	130,400	1.7	136,100	1.8
47	81,227	5.4	36,300	0.4	55,700	0.7	61,500	0.8	73,800	0.9	85,900	1.1	98,000	1.2	110,000	1.4	114,900	1.4
	TOTAL	100.0	673,000	12.0	1,031,000	18.6	1,139,000	20.3	1,367,000	24.3	1,590,000	28.5	1,814,000	32.5	2,037,000	36.4	2,127,000	38.1
	TOTALS		3,654,000	106.4	5,601,000	164.00	6,204,000	180.9	7,423,000	216.4	8,639,000	252.1	9,857,000	287.5	11,069,000	323.1	11,556,000	337.3

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SECTION D-2

SECTION 404(b)(1) EVALUATION FOR PASCAGOULA HARBOR, MISSISSIPPI NAVIGATION IMPROVEMENTS

Section 404(b)(1) Evaluation
For
Pascagoula Harbor, Mississippi
Navigation Improvements

Introduction. The proposed plan to provide navigation improvements to the Pascagoula Harbor Project requires the widening and deepening of the existing channel alignments from the Gulf of Mexico [illegible] Pascagoula Harbor and the disposal of materials dredged from these [illegible]. For ease of presentation of the Section 404(b)(1) Evaluation, the discussion of the materials to be disposed is divided into two categories: A) materials dredged from the Pascagoula Entrance Channel and B) materials dredged from the channel alignments within Mississippi Sound.

A(1). Project description. Materials to be removed from the Pascagoula Entrance Channel would be disposed in shallow water adjacent to the eastern end of Horn Island. Approximately 3,348,000 cubic yards of new work material and a total of 34,550,000 cubic yards of maintenance material would be disposed in this area over the life of the project. See pages 63-68 of the Main Report and pages EIS-15 - EIS-17 of the FEIS for a more detailed description of the proposed plan.

a. Authority and Purpose. This study was originally authorized by United States Senate Public Works Committee Resolutions adopted on September 23, 1965, and February 10, 1971 and House Public Works Committee Resolution adopted on June 23, 1971. These resolutions requested feasibility studies to determine if modifications to the existing navigation project at Pascagoula Harbor are warranted. In 1977, the study was postponed at the request of the Jackson County Port Authority. The study was resumed in 1984, also at the Port Authority's request.

b. Description of the Proposed Dredged and Fill Materials from the Pascagoula Entrance Channel.

(1) General characteristics. The fill material that would be placed in the shallow subtidal site consists of naturally occurring sand.

(2) Quantity of material proposed for discharge. Approximately 3,348,000 cubic yards of new work and a total of 34,550,000 cubic yards of maintenance material dredged from the Pascagoula Entrance Channel would be placed on the shallow subtidal site.

(3) Source of materials. The dredged material would be obtained by dredging the pass and gulf legs of the Pascagoula Entrance Channel which is approximately 24,000 feet east of the proposed disposal site.

c. Description of the Proposed Discharge Site.

(1) Location and areal extent. The site is located in the Gulf of Mexico east of Horn Island, Mississippi, and occupies approximately 830 acres of shallow subtidal habitat.

(2) Type of discharge site. The discharge site is typical of the nearshore Gulf of Mexico with predominately marine sand substrate.

(3) Method of discharge. The material would be placed on the site utilizing either an hydraulic pipeline/cutterhead dredge or hopper dredge or split hull hopper barges.

(4) When would disposal occur? Disposal is scheduled to begin in 1995.

(5) Projected life of discharge site. The proposed life of the disposal site is 50 years.

A(II). Factual Determinations.

a. Physical Substrate Determinations.

(1) Substrate elevation and slope. The disposal of dredged material may result in some mounding, however the wave climate on the Gulf shore of Horn Island is such that this should not pose a significant impact to the resources of the island or circulation in the nearshore Gulf of Mexico.

(2) Sediment type. Mineral composition and particle size of the substrate would not be altered.

(3) Dredged or fill material movement. The dredged material is expected to be transported in the littoral drift system of the nearshore Gulf of Mexico. This movement however, would not have any adverse impact on the area and would result in nourishment of Horn Island.

(4) Physical effects on benthos. The disposal of the dredged material would disrupt the benthic community of the disposal site during placement, however the community should reestablish within 6 to 12 months after the disposal occurs.

(5) Actions taken to minimize impacts. Since the material to be disposed is naturally occurring sand and the substrate of the disposal site is sand, no further actions are deemed necessary.

b. Water Circulation, Fluctuation and Salinity Determinations.

(1) Water. There would be no significant impacts on water chemistry, color, odor, taste, dissolved gas levels, nutrients or eutrophication characteristics due to dredging or disposal. Water clarity may be temporarily reduced during the dredging and disposal activities but should return to normal shortly after construction is completed.

(2) Current patterns and circulation. The disposal would not result in any change in current patterns or circulation.

(3) Normal water level fluctuations. There would be no change in normal water level fluctuations.

(4) Salinity gradients. There would be no change in salinity patterns or gradients.

c. Suspended Particulate/Turbidity Determinations.

(1) Expected changes in suspended particulates and turbidity levels in vicinity of disposal site. Short-term increases in suspended particulate levels may occur at the time of dredging and disposal. However, due to the nature of the material to be disposed these increases would be within the normal range of fluctuation of these parameters for this area of the nearshore Gulf of Mexico and would not violate state water quality standards.

(2) Effects on chemical and physical properties of the water column. Slight decreases in the degree of light penetration and dissolved oxygen concentration may occur during disposal and dredging activities.

(3) Effects on biota. Effects would be insignificant since the biota of this area is adapted to the naturally turbulent nature of the nearshore zone.

(4) Actions taken to minimize impacts. Due to the nature of the material to be disposed and the energy regime of the disposal site the impacts would be minimal. Efforts would be made to schedule disposal at times when utilization of the area by sea turtles is evident.

d. Contaminant Determinations.

Analytical testing of the sediments to be disposed and of elutriate samples prepared with these sediments did not reveal the presence of contaminants. Results of the sediment and elutriate tests are presented on Tables 404-2 through 404-19 for the stations shown on Figures 404-1 and 404-2. In addition the material has been determined to meet the criteria set forth in 40 CFR 230.60(b) in that the material is characterized as sand which is sufficiently removed from sources of pollution to provide reasonable assurance that the material would not be contaminated by such pollution and the fact that the material itself is inert. Also the material originates in the near vicinity of the disposal activity, is similar to the substrate of the disposal site, and receives the same overlying waters as the disposal site. Hence, no further physical, biological, or chemical testing is required pursuant to the 404(b)(1) Guidelines.

e. Aquatic Ecosystem and Organism Determinations.

(1) Effects on plankton. Disposal of dredged material into open water would destroy some phytoplankton and zooplankton, and could reduce light penetration which may tend to affect primary production by the phytoplankton. Due to the nature of the materials to be disposed, these impacts would not be significant.

(2) Effects on benthos. Open water disposal of the sandy material could smother some of the benthos of the proposed site, however these organisms are adapted to a very rigorous environment in which they experience wave and storm induced sedimentation and the impacts due to the disposal would not be significant.

(3) Effects on nekton. Some nekters in and around the open water disposal areas would probably vacate the area, at least until conditions become more favorable. All such organisms would not be expected to vacate; however, it is logical to assume that many would avoid an area of disturbance such as that associated with discharge of dredged material. Some nektonic filter feeders may be killed as a result of being in the affected area and other organisms less capable of movement, such as larval forms, may be physically covered with dredged material. Generally, however, most organisms would avoid and later return to the project area.

(4) Effects on aquatic food web. No significant effects.

(5) Effects on special aquatic sites.

(a) Sanctuaries and refuges. The proposed disposal of dredged material would not significantly affect any of the fish and wildlife resources which are designated for preservation or general use in the 1980 Mississippi Coastal Program.

(b) Wetlands. No wetlands would be filled during the proposed activity.

(c) Mud flats. No significant effects.

(d) Vegetated shallows. No significant effects.

(e) Coral reefs. Not applicable to this area.

(f) Riffle and pool complexes. Not applicable to this area.

(6) Threatened and endangered species. The green sea turtle, *Chelonia mydas*, may have nested on Horn Island in the past. The loggerhead sea turtle, *Caretta caretta caretta*, probably nested on Horn Island in the past and could nest there now, although there are no recent records. Kemp's ridley sea turtle, *Lepidochelys kempi*, is a rare visitor in the open gulf. The recommended plan, however, should not significantly impact these threatened species.

(7) Other wildlife. No significant effects.

(8) Actions to minimize impact. Construction boat operators would be instructed to keep a lookout for sea turtles and should any be sighted appropriate coordination efforts with the National Marine Fisheries Service would be initiated immediately and a coordinated effort be made to avoid impacts to these species.

f. Proposed Disposal Site Determinations.

(1) Mixing zone determination. The State of Mississippi determines mixing zones on a case-by-case basis. For similar disposal activities, the State has established a mixing zone of 750 feet. Turbidity increases of 50 JTU's above background levels beyond a 750-foot mixing zone would not occur due to the nature of the material to be disposed.

(2) Determination of compliance with applicable water quality standards. This area of the nearshore Gulf of Mexico is classified for recreational use and shellfish harvest. The disposal operation would not alter constituent concentrations established for this use, and would not violate other State Water Quality Standards.

(3) Potential effects on human use characteristic. The disposal operation would not adversely affect any of the human use characteristics of the area. Horn Island is a part of the Gulf Islands National Seashore system and is currently undergoing erosion/deposition in a westerly direction. The disposal activity would help to reduce the rate of erosion of the eastern end of the island thereby helping to maintain the island as a national park.

g. Determination of Cumulative Effects on the Aquatic Ecosystem.

Cumulative effects of the disposal action would be positive in that the rate of erosion of the eastern end of Horn Island should be reduced over the life of the project. Beneficial impacts of helping maintain the position of the island include protection of mainland shores, protection of seagrass beds along the northern shore of the island, and protection of wildlife and shorebird habitat.

h. Determination of Secondary Effects on the Aquatic Ecosystem.

Secondary effects of the discharge operation would be in terms of maintenance of Horn Island and its effects on the overall nearshore community. This should result in increased stability of the ecosystem which in turn would result in increased productivity.

B(I). Project Description. Materials to be removed from the Pascagoula and Bayou Casotte channel alignments within Mississippi Sound will be disposed in three currently used upland disposal sites and six currently used open water disposal sites within Mississippi Sound. Approximately 623,000 cubic yards of new work and 33,163,000 cubic yards of maintenance material would be disposed in the upland areas over the life of the project. Approximately 92,738,000 cubic yards of maintenance material would be disposed in the open water sites over the life of the project. These sites are currently used for disposal of maintenance material from the existing Federal project. See Pages 63-68 of the Main Report and pages EIS-15 - EIS-17 of the FEIS for a more detailed description of the proposed plan. Refer to Table 404-1 for a detailed breakdown of quantities to be dredged and disposal sites to be utilized.

a. Authority and Purpose. This study was originally authorized by United States Senate Public Works Committee Resolutions adopted on September 23, 1965, and February 10, 1971 and House Public Works Committee Resolution adopted on June 23, 1971. These resolutions requested feasibility studies to determine if modifications to the existing navigation project at Pascagoula Harbor are warranted. In 1977, the study was postponed at the request of the Jackson County Port Authority. The study was resumed in 1984, also at the Port Authority's request.

b. Description of the Proposed Dredged and Fill Materials.

(1) General characteristics. The fill material that would be placed in the upland and Mississippi Sound open water disposal sites consists predominately of silt and clay with small amounts of sand.

(2) Quantity of material proposed for discharge. Refer to Table 404-1.

(3) Source of materials. The dredged material would be obtained by dredging the channel alignments within Mississippi Sound which are within approximately 1,000 - 2,000 feet of adjacent proposed disposal sites.

c. Description of the Proposed Discharge Sites.

(1) Location and areal extent. The Double Barrel (Lowery Island) Disposal Site is a 115 acre site located on the west bank of the Pascagoula River, south of the L&N Railroad. The Singing River Island Disposal Site is a 333 acre diked disposal site located on Singing River Island which was built over a number of years by the deposition of dredged material. The Greenwood Island Disposal Site is a 101 acre site located on the west side of the mouth of Bayou Casotte. Open water disposal sites 3 and 4 are located on the east side of the Bayou Casotte channel, sites 6S (6B), 7, 8, and 9 are located on the west side of the Upper and Lower Pascagoula channels. The set back is approximately 1,000 feet from the channel with the exception of site 6S (6B) which is set back approximately 2,000 feet from the channel. The area of Mississippi Sound bottoms designated as open water disposal sites for the project occupy about 4,200 acres of which approximately 1,860 acres would be utilized for each maintenance cycle depending upon dredging needs. For a more detailed discussion of these sites refer to pages 11-28 of the Main Report and pages EIS-17 - EIS-23.

(2) Type of discharge site. Lowery Island, Singing River Island, and Greenwood Island are diked currently used upland disposal sites. Sites 3, 4, 6S (6B), 7, 8, and 9 are currently used open water disposal sites and are typical of eastern Mississippi Sound with substrates composed predominately of silt and clay with varying percentage of sand. These sites were the subject of an EA/FONSI prepared 6 December 1984 and 404(b)(1) Evaluation prepared 18 October 1984 for recertification of the existing Federal project. Water Quality Certification was received from the State of Mississippi on 6 September 1984 and is in effect until 1989.

(3) Method of discharge. The material would be placed on the sites using a hydraulic cutterhead/pipeline dredge.

(4) When would disposal occur? Disposal is scheduled to begin in 1995.

(5) Projected life of discharge site. The proposed life of the disposal sites is 50 years.

B(II). Factual Determinations.

a. Physical Substrate Determinations.

(1) Substrate elevation and slope. Bathymetry recorded in 1979 and 1982 indicated that adequate depths exist to support the disposal of dredged material for the proposed 50-year project life. Based on this bathymetry, depths at each open water site to be utilized are as follows: Site 3--5.5 feet to 11.0 feet (1979 data); Site 4--5.5 feet to 13.0 feet (1979 data): Site 6B--6.0 feet to 11.0 feet (1982 data); Sites 7, 8, and 9--5.5 feet to 16.5 feet (1982 data). Due to the silty nature of the material to be disposed and the natural oceanographic conditions of eastern Mississippi Sound, no significant buildup should be experienced. Should significant buildup of dredged material occur in these open water disposal areas, a re-evaluation of the disposal practice utilized would be conducted. It should be noted that the State of Mississippi Bureau of Marine Resources prohibits disposal in open water less than 4 feet in depth. The Corps of Engineers intends to meet this requirement throughout the life of the proposed project. The upland disposal area dikes would reach elevations of 40 feet for the 50-year project life. Present dike elevations at Lowery Island are about 16 feet, Singing River Island about 24 feet, and Greenwood Island about 18 to 19 feet.

(2) Sediment type. The predominant types of material to be disposed are silts and clays with some sand therefore the mineral composition and particle size of the disposal site substrate would not be altered.

(3) Dredged or fill material movement. The dredged material, when placed into the open water disposal areas, will be subject to mud flows. The disposal sites are of such size that these mud flows should not impact adjacent areas not previously impacted by deposition of comparable material. Since these areas are currently utilized for disposal of similar materials from the existing Federal project and projected quantities for the proposed plan are only on the order of 5% greater than those currently disposed, this movement of materials should not pose a significant problem. Upland disposal would be confined to the limits of the diked areas. The residence time of the return water within the disposal sites would be such that no impacts would result from movement of materials.

(4) Physical effects on benthos. The disposal of the dredged material would disrupt the benthic community of the open water disposal sites during placement, however the community should reestablish within 6

to 12 months after the disposal occurs. The return from the upland disposal sites would have no impacts on the benthos.

(5) Actions taken to minimize impacts. The materials to be disposed are similar in granulometry to those that exist at the proposed disposal sites, therefore no futher actions are de[illegible]sary.

b. Water Circulation, Fluctuation and Salinity Determinations.

(1) Water. Increases in dissolved and total organic carbon, dissolved ammonia, nitrate and total Kjeldahl nitrogen levels would be associated with disposal however, these increases are expected to be short-term in nature and therefore no significant impacts are expected to result from the proposed open water disposal activities. Ambient conditions in the Pascagoula Harbor/Bayou Casotte/Mississippi Sound area are turbid; however, it is recognized that during open water disposal of dredged material that turbidity plumes and mud flows occur, both of which tend to reduce water clarity. This condition will prevail during the disposal operations but would not affect a large portion of the Sound. Color would be affected during disposal with the water appearing darker due to the presence of a "plume" from the discharge of silty material. This would be a temporary condition which would cease shortly after disposal ceases. There would be no significant impacts on odor, taste, or eutrophication characteristics due to the open water disposal activities.

The return water from the upland disposal areas would have no significant impact on water chemistry, color, odor, taste, dissolved gas levels, nutrients or eutrophication characteristics of the adjacent areas. There may be some increase in nutrient concentrations or decreases in dissolved oxygen but these would be rapidly dispersed due to the nature of oceanographic conditions within Mississippi Sound.

(2) Current patterns and circulation. Based on results obtained from the WIFMS model during the Mississippi Sound and Adjacent Areas Study (USACE, 1984), the following conditions are typical of Mississippi Sound in the region of Pascagoula: 1) under low freshwater inflow and winds from the south/southeast currents are less than 1 foot per second (fps), except in the Horn Island Pass area. During ebb cycle, highest velocities are located in the pass with measurable velocities present in the eastern half of the study area. During flood cycle, flows enter Horn Island Pass and are deflected westward with velocities reduced from those observed during ebb periods. Flows within the channel are oriented southward out of the Sound even during flood tides; 2) under high freshwater inflow and south/southeast winds and during ebb cycles, strong flows are noted out of Pascagoula River, in the channels and in Horn Island Pass. Velocities are 1 fps or greater. During flood cycles, flows enter through Horn Island Pass and are deflected westward. Southward flows are noted out of the Pascagoula River and down the channels; and 3) under low freshwater inflow and winds from the north/northwest, ebb velocities are typically less than 1 fps and are primarily westward in nature with a southerly deflection in the region of Horn Island Pass. Flood currents are reduced in magnitude with flows entering through Horn Island Pass and being deflected eastward.

This study also projected what conditions would have been prior to the provision of a navigation channel system. Under low freshwater inflow and winds from the south/southeast, ebb current velocities were low, about 0.2 fps, in most of the Sound, with somewhat higher velocities in Horn Island Pass and south of Petit Bois Island. During flood cycles, current velocities appear to be very low, on the order of 0.2 to 0.4 fps with highest velocities in the pass. Flows appear to be deflected westward on incoming tides. Under high freshwater inflow and winds from south/southeast, "preproject" currents during ebb cycles were primarily to the south, approaching 1 fps in the area of the river and island pass. During flood cycles, flows probably entered the south through the island pass and were deflected westward with velocities less than 1 fps. Under conditions of low freshwater inflow and north/northeast winds ebb flows were oriented to the east, turning southeast and south through the tidal pass at less than 1 fps. Flood cycles produced flows in an eastward direction at velocities of 0.2 fps or less. Thus, "preproject" and existing conditions appear to be much the same. Therefore, the use of open water disposal in Mississippi Sound should not result in any change in current patterns or circulation.

Disposal into the upland disposal sites and subsequent return flows would have no effect on current patterns and circulation.

(3) Normal water level fluctuations. There would be no change in normal water level fluctuations with either open water or upland disposal.

(4) Salinity gradients. Salinities in Mississippi Sound are highly variable in response to freshwater inflow and influence of the Gulf of Mexico. Based on the results of the WIFMS model, use of the proposed disposal areas in Mississippi Sound would not significantly alter salinities in the area. Salinity changes would be localized and less than $\pm$ 2 ppt. The return water from the upland disposal areas would have no impact on salinity.

(5) Actions taken to minimize impacts. Based on the results of the model studies on Pascagoula Harbor and analysis of historic bathymetric data, it appears that the use of the proposed disposal sites for the maintenance materials from the proposed navigation improvements would not cause significant circulation problems in the project area. The minus 4-foot MLW restrictions by the State of Mississippi would be observed during disposal operations.

c. Suspended Particulate/Turbidity Determinations.

(1) Expected changes in suspended particulates and turbidity levels in vicinity of disposal sites. Localized short-term increases in suspended particulate levels may occur at the time of disposal, however these increases would be within the range of ambient turbidities for this area and would not violate state water quality standards.

(2) Effects on chemical and physical properties of the water column. Decreases in the degree of light penetration and dissolved oxygen

oncentration would occur during disposal activities, however these changes ould be localized and short-term in nature.

(3) Effects on biota. Effects would be insignificant since the iota of this area are adapted to periodic increases of suspended material ue to storm related events and annual high freshwater inflows.

d. Contaminant Determinations. Extensive studies on pollution ransport into Mississippi Sound indicate that although the load of ollutants into the *Escatawpa and East Pascagoula Rivers and Bayou Casotte* s high, the contaminants become trapped in the sediments and are contained n the immediate vicinity of the sources (Lytle and Lytle, 1979).

district-wide sediment sampling program containing elutriate analyses was onducted in 1974 (Gulf South Research Institute, 1977) which indicated that ost consituents contained in the sediments are not released to the water olumn on disturbance. Analysis of the material in the vicinity of the roposed dredging indicated that constituents such as total organic carbon, mmonia nitrogen, total Kjeldahl nitrogen, phosphorus and lead are released nto the water column. However, enough mixing occurs to dilute these onstituents to acceptable concentrations.

ecent data (GeoScience, Inc., 1983) indicated that nitrogen compounds and otal phosphorus were detected in significant quantities in sediments but nly total Kjeldahl nitrogen (TKN) and ammonia were released into the water olumn in appreciable quantities following elutriation of sediments. Tables 04-2 and 404-3 present data for TKN and ammonia, respectively. Ambient evels are very close to the EPA (1976) criterion values and reflect a ontinuous release from the sediments as modified by tidal surges, reshwater input, winds, etc. For ammonia, the process of elutriation, hich is assumed to be comparable to the action of a dredge cutterhead, ould in all cases create water column levels in excess of EPA criteria alues, the worst occuring at Stations 5 and 6 (Figure 404-1). The increase ould be rapidly diluted downward due to mixing and the tidal effects, but ince ambient values are so close to criteria values, these resulting values ould still exceed criteria. During the sampling of these two stations hrimp boats were continuously working the waters and the continual isturbance of the bottom was probably the cause for the increased levels of hese nutrients over the other stations that were surveyed. Phosphorus (Table 404-4) showed a potentially lowered release level. Comparison of itrogen and phosphorus reveal that nitrogen species were released much more eadily during elutriation than was phosphorus and appear to show a weak elationship to the particle size and organic carbon content. Neither of hese compounds are toxic at the observed levels. Ammonia may reach localized levels in excess of criteria values.

Arsenic, chromium, iron, lead, nickel, and zinc (Tables 404-5 through 404-10) occur in concentrations greater than those recorded in natural estuarine sediments. Analyses indicate that these forms are tightly bound to the sediments, predominantly montmorillinite clays (GeoScience, 1983). These relatively high levels of certain metals in the sediments do not appear to pose any particular hazard with respect to dredge disruption of these sediments. Preliminary data from Isphording (personal communication) indicates that as a general rule heavy metals are partitioned in the sediment predominately as organic and sulfide complexes, in residual phase, or in a moderately reducible phase. Only small percentages of the total metal concentration is found in the easily reducible phase or in the pore water/exchangeable phase. For selected metals within Mississippi Sound amounts partitioned in the easily reducible or pore water/exchangeable phase vary with metal and location within the Sound: Zinc - 7.6 to 17.8% of total; Lead - 17.8 to 24.9 %; Copper - 7.8 to 13.7%; Iron - 6.2 to 14.2%: and Nickel - 1.7 to 3.6%. No identified release from sediments following elutriation or resulting concentrations well below published toxic threshold values leads to a conclusion that the activities of physically disturbing these sediments through dredge activities would have no demonstrated effect on life in the water column. Tables 404-17 through 404-19 present available data on cadmium, copper, and mercury concentrations from the project area. These heavy metals present no problem within the area.

A number of high molecular weight hydrocarbons were identified from the channel sediments (Table 404-11 and 404-12) in concentrations felt to be representative of shipping channels. These compounds were not released into the overlying water during elutriation and therefore should not have significant detrimental effects on aquatic life. Aromatic hydrocarbons have also been demonstrated to occur in the project area (Lytle and Lytle, 1983b and GeoScience, Inc., 1983). Data obtained from Lytle and Lytle are presented in Table 404-13 and Figure 404-2. Analysis of these samples indicate that the hydrocarbons are generally not released into the surrounding waters after sediments are resuspended, rather they remin bound to the clays, thereby reducing the effects of disposal. Lytle and Lytle (1983a) indicate that the abundance of petroleum hydrocarbons in the upper Bayou Casotte sediments compared with their relative paucity in lower bayou regions near the oil refinery source suggest that dredging of these areas has removed the contaiminated sediments and thus has improved the lower bayou region.

With the exception of DDD, DDE, and PCB's, no chlorinated hydrocarbon pesticides were detected in the sediments (Table 404-14). The levels of DDD, DDE, and PCB's are insignificantly low and reflect the ubiquitous nature and world-wide contamination observed with these compounds. None of these compounds were observed in ambient water nor were they elutriated from sediments.

With the exception of certain pthalates (Tables 404-15 and 404-16), no base, neutral, or acid extractable organic compounds were detected in either sediments, elutriate, or water column samples. These compounds, like PCB's and certain chloronated hydrocarbon pesticide residues, show a world wide increase coincident with increase and manufacture and subsequent disposal of wastes.

e. Aquatic Ecosystem and Organism Determinations.

(1) Effects on plankton. Disposal of dredged material into open water would destroy some phytoplankton and zooplankton, and would reduce light penetration which may tend to affect primary production [illegible]

TABLE 404-7

Iron Analysis

Station	Rep	Sediment(S) mg/kg	Elutriate(E) g/l	Ambient(A) g/l	E-A	(E-A)/S	(E-A)/A
1	A	28600	159	7	152	Ins.	21.7
	B	23500	26	4	22	Ins.	5.5
2	A	37600	8	7	1	Ins.	0.1
	B	33400	10	4	6	Ins.	1.5
3	A	40000	31	6	25	Ins.	4.2
	B	39900	18	5	13	Ins.	2.6
4	A	34100	164	5	159	Ins.	31.8
	B	34300	132	5	127	Ins.	25.4
5	A	27300	9	44	---	----	----
	B	30400	22	21	1	Ins.	0.1
6	A	13600	7	6	1	Ins.	0.2
	B	15100	6	5	1	Ins.	0.2
7	A	25500	8	8	---	Ins.	----
	B	22500	19	7	12	Ins.	1.7

Source: GeoSciences, Inc., 1983.

TABLE 404-6

Chromium Analysis

tion	Rep	Sediment (S) mg/kg	Elutriate (E) g/l	Ambient (A) g/l
	A	44.0	1.1	<1.0
	B	34.0	<1.0	<1.0
	A	53.9	<1.0	<1.0
	B	49.7	<1.0	<1.0
	A	64.6	<1.0	<1.0
	B	65.3	<1.0	<1.0
	A	49.3	<1.0	<1.0
	B	63.2	<1.0	<1.0
	A	49.4	<1.0	<1.0
	B	65.7	<1.0	<1.0
	A	16.8	<1.0	<1.0
	B	21.6	<1.0	<1.0
	A	38.8	<1.0	<1.0
	B	30.4	<1.0	<1.0

om: GeoScience, Inc., 1983.

TABLE 404-5

Arsenic Analysis

Station	Rep	Sediment(S) mg/kg	Elutriate(E) g/l	Ambient(A) g/l	E-A	E-A / S	E-A / A
1	A	10	21	4	17	0.0017	4.25
	B	9.4	25	7	18	0.0019	2.57
2	A	15	20	11	9	0.0006	0.82
	B	16	22	11	11	0.0007	1.0
3	A	21	25	18	7	0.0003	0.39
	B	21	25	23	2	0.0001	0.1
4	A	16	28	16	12	0.0008	0.75
	B	15	30	20	10	0.0007	0.5
5	A	14	49	20	29	0.002	1.45
	B	15	37	20	17	0.001	0.85
6	A	6.9	21	36	--	-----	----
	B	6.5	26	29	--	-----	----
7	A	16	25	17	8	0.0005	0.47
	B	13	25	16	9	0.0007	0.56

[illegible], 1983.

TABLE 404-4

Phosphorus Analysis

Station	Rep	Sediment(S) mg/kg	Elutriate(E) mg/l	Ambient(A) mg/l	E-A	E-A / S	E-A / A
1	A	427	0.271	0.025	.246	.0006	9.8
	B	453	0.999	0.028	.971	.002	34.6
2	A	491	0.026	0.021	.005	.00001	0.2
	B	515	0.033	0.023	.01	.00002	0.4
3	A	533	0.030	0.020	.01	.00002	0.5
	B	519	0.035	0.023	.012	.00002	0.5
4	A	577	0.076	0.018	.058	.0001	3.2
	B	638	0.085	0.024	.061	.0001	2.5
5	A	685	1.24	0.021	1.219	.002	58.0
	B	690	1.16	0.023	1.137	.002	49.0
6	A	148	0.148	0.018	.13	.0009	7.2
	B	157	0.117	0.015	.102	.0006	6.8
7	A	381	0.042	0.019	.023	.00006	1.2
	B	317	0.037	0.02	.017	.00005	.9

From: GeoScience, Inc., 1983.

TABLE 404-3

Ammonia Analysis

Station	Rep	Sediment(S) mg/kg	Elutriate(E) mg/l	Ambient(A) mg/l	E-A	E-A / S	E-A / A
1	A	154	8.3	0.01	8.29	0.05	825
	B	170	9.8	0.02	9.78	0.06	485
2	A	199	6.6	0.03	6.57	0.03	215
	B	206	5.5	0.04	5.46	0.03	137
3	A	198	5.2	0.02	5.18	0.03	255
	B	188	4.9	0.04	4.86	0.03	122
4	A	577	11.0	0.01	10.00	0.02	1095
	B	638	11.0	0.03	10.97	0.02	366
5	A	685	12.0	0.01	11.99	0.02	1195
	B	690	10.0	0.01	9.99	0.01	995
6	A	24	1.5	0.01	1.49	0.06	149
	B	25	1.4	0.01	1.39	0.06	135
7	A	128	4.2	0.02	4.18	0.03	205
	B	126	5.2	0.03	5.17	0.04	172

From: GeoScience, Inc., 1983.

TABLE 404-2

Total Kjeldahl Nitrogen (TKN) Analysis

Station	Rep	Sediment(S) mg/kg	Elutriate(E) mg/l	Ambient(A) mg/l	E-A	E-A / S	E-A / A
1	A	1680	5.7	0.18	5.52	.003	30.6
	B	1910	10.0	0.19	9.81	.005	51.6
2	A	2480	8.0	0.21	7.75	.003	36.9
	B	2430	6.1	0.22	5.88	.002	26.7
3	A	2480	5.5	0.17	5.33	.002	31.4
	B	2500	5.1	0.19	4.91	.002	25.8
4	A	2380	11.0	0.31	10.65	.004	34.4
	B	2120	11.0	0.23	10.77	.005	46.8
5	A	1660	12.0	0.01	11.95	.007	1195
	B	1670	11.0	0.03	10.97	.007	366
6	A	647	1.3	0.08	1.22	.002	15.3
	B	653	1.4	0.11	1.25	.002	11.4
7	A	1720	4.7	0.01	4.65	.003	465
	B	1700	5.4	0.01	5.35	.003	535

From: GeoScience, Inc., 1983.

TABLE 404-1

CHANNEL REACH, DREDGING QUANTITY, DISPOSAL SITE MATRIX

CHANNEL REACH	DREDGING QUANTITIES		DISPOSAL SITES
Bayou Casotte	NW:	NONE	NONE
Inner Harbor	O&M:	99,000	Greenwood Island
Bayou Casotte	NW:	2,322,000	Gulf site
Turning Basin	O&M:	incl. in Inner Harbor O&M	
Pascagoula	NW:	623,000	Double Barrel I. &
Inner Harbor			Singing River I.
mile 0.0 - 1.2	O&M:	225,435	Double Barrel I.
mile 1.2 - 1.8	O&M:	113,565	Singing River I.
Bayou Casotte	NW:	3,938,000	Gulf site
Channel	O&M:	800,000	Open Water 3, 4
Upper Pascagoula	NW:	3,302,000	Gulf site
Channel			
mile 1.8 - 3.0	O&M:	225,250	Singing River I.
mile 3.0 - "Y"	O&M:	675,750	Open Water 6B, 7
Lower Pascagoula	NW:	1,564,000	Gulf site
Channel	O&M:	379,000	Open Water 7, 8, 9
Entrance Channel	NW:	3,348,000	Horn Island site
	O&M:	691,000	Horn Island site

Notes: NW = New Work in cubic yards
O&M = Maintenance in cubic yards per year

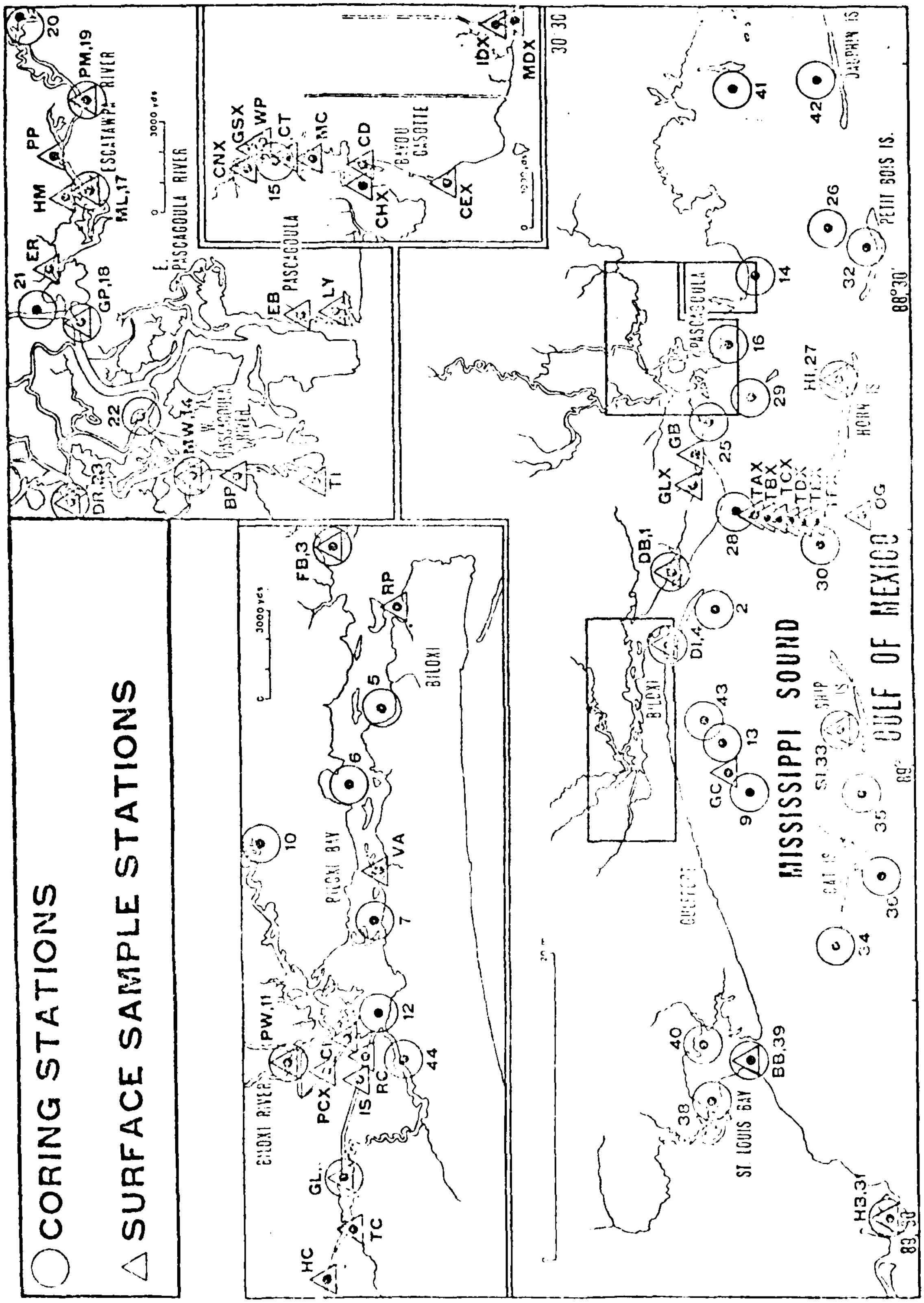

Figure 404-2 From Lytle and Lytle, 1983b

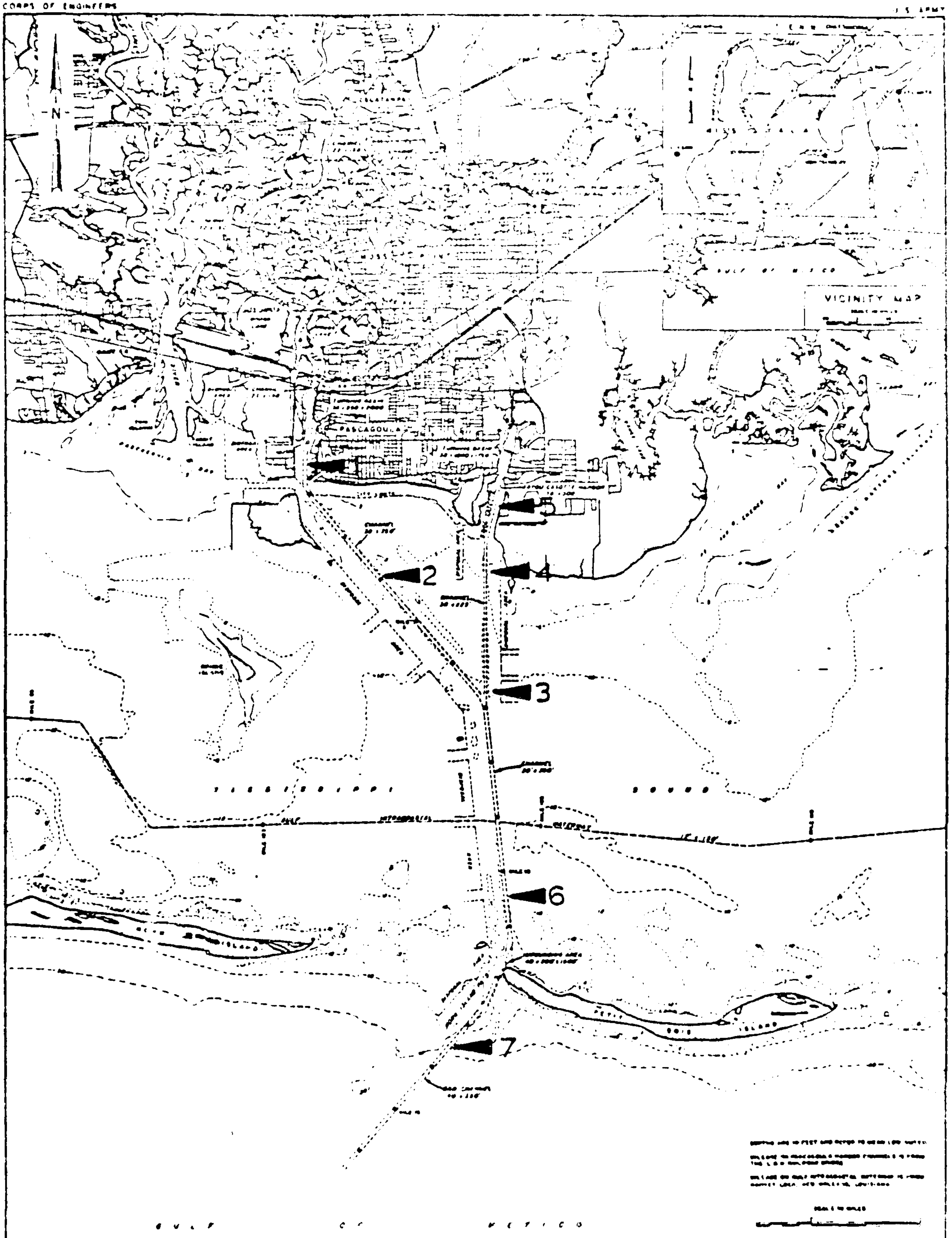

Figure 404-1 Sediment Quality Sampling Stations (from GeoScience, 1993).

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U.S. Environmental Protection Agency, 1976. Quality Criteria for Water. EPA-440/9-76-023.

Water and Air Research, 1975. A study on the effects of maintenance dredging on selected ecological parameters in the Gulfport Ship Channel, Gulfport, Mississippi. Prepared for the Mobile District under Contract No. DACW01-74-C-0156.

g. The disposal operation would not violate the Specified Protection Measures for Marine Sanctuaries Designated by the Marine Protection, Research, and Sanctuaries Act of 1972.

h. The proposed disposal of fill materials would not result in significant adverse effects on human health and welfare, including municipal and private water supplies, recreation and commercial fishing, plankton, fish, shellfish, wildlife, and special aquatic sites. The life states of aquatic life and other wildlife would not be adversely affected. Significant adverse effects on aquatic ecosystem diversity, productivity and stability, and recreational, aesthetic and economic values would not occur.

i. Appropriate steps to minimize potential adverse impacts of the discharge on aquatic systems have been included in this evaluation.

j. On the basis of the guidelines, the proposed sites for the discharge of fill materials are specified as complying with the requirements of these guidelines with the inclusion of appropriate and practical conditions to minimize pollution or adverse effects to the aquatic ecosystem.

DATE: 3 April 85

Patrick J. Kelly
PATRICK J. KELLY
Colonel, CE
District Engineer

equipment would be evident and would temporarily degrade aesthetic qualities of the area. It should be recognized, however, that the Pascagoula Harbor area is primarily an industrial area which tends to offset the aesthetic degradation caused by the action in the northern portions of the project area.

(e) Parks, national and historic monuments, national seashores, wilderness areas, research sites, and similar preserves. No significant effects.

g. Determination of Cumulative Effects on the Aquatic Ecosystem. The data and information presented suggest that the utilization of the proposed disposal sites would have no significant cumulative adverse effects on the aquatic ecosystem. Should excessive or rapid shoaling of the open water sites occur during the 50-year project life, modifications in disposal practices or disposal site use would be addressed.

h. Determination of Secondary Effects on the Aquatic Ecosystem. The impacts associated with the disposal of sandy materials in the shallow subtidal region of Horn Island which are addressed in this Sec. 404(b)(1) evaluation would act to maintain the structure of Hown Island and thereby positively impact the aquatic ecosystem of the nearshore Gulf of Mexico and this area of Mississippi Sound.

III. Findings of Compliance or Non-Compliance with the Restrictions on Discharge.

a. No significant adaptations of the guidelines were made relative to this evaluation.

b. A number of alternatives were considered during the planning process including: (1) No action and;

(2) Use ocean dumping for all maintenance material with the exception of the material from the inner harbor areas.

c. The planned disposal of dredged materials would not violate any applicable State water quality standards.

d. The disposal operation would not violate the Toxic Effluent Standards of Section 307 of the Clean Water Act.

e. As required by the Coastal Zone Management Act, the proposed action is consistent with the Mississippi Coastal Program (MCP) to the maximum extent practicable.

f. Use of the selected disposal site would not harm any endangered species or their critical habitat. The US Fish and Wildlife Service and the National Marine Fisheries Service concurred with this finding on December 21, 1983 and August 15, 1984, and June 25, 1984, respectively.

(c) Mud flats. No significant effects.

(d) Vegetated shallows. No significant effects.

(e) Coral reefs. Not applicable to this area.

(f) Riffle and pool complexes. Not applicable to this area.

(6) Threatened and endangered species. No threatened or endangered species would be impacted by the proposed action.

(7) Other wildlife. No significant effects. See pages EIS-29 through EIS-30 of the Environmental Impact Statement for additional information.

(8) Actions to minimize impact. No actions which would further reduce impacts to the aquatic ecosystem and the organisms living in that system are deemed necessary.

f. Proposed Disposal Site Determinations.

(1) Mixing zone determination. The State of Mississippi determines mixing zones on a case-by-case basis. For similar disposal activities, the State has established a mixing zone of 750 feet. In all cases, mixing zones would be restricted to as small an area as feasible. Based on previous dredging/disposal actions at Pascagoula Harbor, it is felt that any reasonable mixing zone requirements established by the State would be met.

(2) Determination of compliance with applicable water quality standards. State water quality classification for this area of Mississippi Sound is for recreational use, closed to shellfish harvest. The disposal operation would not alter constituent concentrations established for this use and would be in compliance, to the maximum extent practicable, with all applicable water quality standards.

(3) Potential effects on human use characteristics.

(a) Municipal and private water supply. No significant effects.

(b) Recreational and commercial fisheries. Some impacts to fish and wildlife resources could occur depending upon timing of dredged material placement in open water, however these are not considered to be significant.

(c) Water-related recreation. No significant effects.

(d) Aesthetics. Dredging in late fall to early winter would miss the peak recreational season however it may not be possible to schedule the disposal activities during this time due to weather and the time required to complete the activities would be longer than this period. The presence of the dredge, dredge pipe, and associated water and land based phytoplankton. Studies conducted on the effect of maintenance dredging in a similar and nearby area, Gulfport Ship Channel, indicated that plankton are affected only in a localized area over a short period of time, and further concluded that the dredging effects on the regional and local plankton systems are negligible (Water and Air Research, 1975).

Return water from the upland disposal areas would have no impact on plankton.

(2) Effects on benthos. Open water disposal would cover and destroy most of the benthic organisms in the affected portion of the disposal area. In addition, the possibility exists that mud flows would disrupt additional organisms outside the limits of the disposal area. The extent to which this may be expected to occur is not considered significant. Benthic communities would re-establish within 6 to 12 months after disposal through immigration from outlying areas and through the settling of the planktonic larvae which characterize most benthic species. The benthic communities which characterize the Mississippi Sound area are adapted to highly variable oceanographic conditions and are able to respond to natural perturbations such as sedimentation and storm induced sediment disturbance (Vittor, 1983). In addition the Gulfport study indicated that benthic community changes appear to be dominated by natural variations and seasonal changes rather than by dredging and disposal activities.

Return water from the upland disposal sites would have no impact on the benthos.

(3) Effects on nekton. Some nekters in and around the open water disposal areas would probably vacate the area, at least until conditions become more favorable. All such organisms would not be expected to vacate; however, it is logical to assume that many would avoid an area of disturbance such as that associated with discharge of dredged material. Some nektonic filter feeders may be killed as a result of being in the affected area and other organisms less capable of movement such as larval forms may physically covered with dredged material. Generally, however, most organisms would avoid and later return to the project area.

Return water from the upland disposal sites would have no impact on the nekton.

(4) Effects on aquatic food web. No significant effects.

(5) Effects on special aquatic sites.

(a) Sanctuaries and refuges. The proposed disposal of dredged material would not significantly affect any of the fish and wildlife resources which are designated for preservation or general use in the 1980 Mississippi Coastal Program.

(b) Wetlands. No wetlands would be filled during the proposed activity.

TABLE 404-8

Lead Analysis

Station	Rep	Sediment(S) mg/kg	Elutriate(E) g/l	Ambient(A) g/l
1	A	69.1	<5.0	<5.0
	B	53.7	<5.0	<5.0
2	A	67.3	<5.0	<5.0
	B	58.4	<5.0	<5.0
3	A	76.0	<5.0	<5.0
	B	71.0	<5.0	<5.0
4	A	81.4	<5.0	<5.0
	B	86.2	<5.0	<5.0
5	A	131	<5.0	<5.0
	B	162	<5.0	<5.0
6	A	22.9	<5.0	<5.0
	B	30.0	<5.0	<5.0
7	A	49.9	<5.0	<5.0
	B	43.1	<5.0	<5.0

From: GeoScience, Inc., 1983.

TABLE 404-9

Nickel Analysis

Station	Rep	Sediment(S) mg/kg	Elutriate(E) g/l	Ambient(A) g/l
1	A	17	<3.0	<3.0
	B	16	<3.0	<3.0
2	A	24	<3.0	<3.0
	B	22	<3.0	<3.0
3	A	29	<3.0	<3.0
	B	28	<3.0	<3.0
4	A	21	<3.0	<3.0
	B	21	<3.0	<3.0
5	A	14	<3.0	<3.0
	B	21	<3.0	<3.0
6	A	6	<3.0	<3.0
	B	9	<3.0	<3.0
7	A	17	<3.0	<3.0
	B	13	<3.0	<3.0

From: GeoScience, Inc., 1983.

TABLE 404-10

Zinc Analysis

Station	Rep	Sediment(S) mg/kg	Elutriate(E) g/l	Ambient(A) g/l	E-A	(E-A)/S	(E-A)/A
1	A	101	59.3	62.2	---	------	----
	B	78	44.9	50.7	---	------	----
2	A	121	47.8	56.4	---	------	----
	B	101	44.9	44.9	---	------	----
3	A	122	53.5	47.8	5.7	0.00005	0.1
	B	119	44.9	50.7	---	------	----
4	A	106	91.1	56.4	34.7	0.0003	0.6
	B	120	36.3	44.9	---	------	----
5	A	132	53.6	44.9	8.7	0.00007	0.2
	B	141	82.4	39.2	43.2	0.0003	1.1
6	A	30	59.3	56.4	2.9	0.0001	0.1
	B	35	47.8	47.8	---	------	----
7	A	69	59.3	59.3	---	------	----
	B	59	59.3	56.4	2.9	0.00005	0.1

From: GeoScience, Inc., 1983.

TABLE 404-11

High Molecular Weight Hydrocarbon Analysis

Station	Rep	Sediment g/kg	Elutriate g/l	Ambient g/l	
1	A	45200	149	86	
	B	109000	57	38	
2	A	105000	43	29	*
	B	63000	<20	33	*
3	A	11400	<20	<20	*
	B	44000	<20	<20	*
4	A	10900	29	<20	*
	B	18600	20	<20	*
5	A	49200	<20	<20	*
	B	4100	29	<20	*
6	A	10600	76	77	*
	B	1300	116	130	*
7	A	2100	141	190	*
	B	2500	170	120	*

* means that the quantity released from elutriation was insignificant compared to the ambient water concentration and considering the quantities observed as sediment concentrations.

From: GeoScience, Inc., 1983.

TABLE 404-12

Partition of Aliphatic and Aromatic High Molecular Weight Hydrocarbon in Sediment, Elutriate and Water Samples

Station	Rep	Sediment g/kg		Elutriate g/l		Ambient g/l		
		AL	AR	AL	AR	AL	AR	
1	A	0	45200	112	37	40	46	
	B	95000	14000	31	26	23	15	
2	A	101000	1000	17	26	8	21	
	B	54000	9000	10	8	8	25	
3	A	2800	8600	0	0	0	0	*
	B	29000	15000	5	0	0	0	
4	A	0	10900	11	18	14	0	
	B	14000	4600	17	3	0	0	
5	A	41100	8100	7	4	0	0	
	B	0	4100	27	2	0	0	
6	A	600	10000	76	0	77	0	
	B	0	1300	115	1	130	0	
7	A	0	2100	136	5	190	0	
	B	0	2500	169	4	117	3	

* Zero (0) is only justifiable value when partition of two whose total is less than detection limits of <20 g/kg.

From: GeoScience, Inc., 1983.

Table 404-13 **From Lytle and Lytle, 1983b**

General Location	Location Name[1]	Location Code[2]	TKN[3], mg/g	TOC[4], %	Total HCs[5], µg/g	Aromatic HCs[6], µg/g	Phenols[7], µg/g
Pascagoula River System	McInnis Lake	17/ML	4.24/--[8]	14.0/--	1510/--	246/--	1.56/--
	Griffin Point	18/GP	2.79/--	3.30/--	338/--	57.1/--	1.30/--
	Paper Mill	19/PM	3.81/--	12.2/--	306/--	0.00 /--	2.43/--
	Dead River	23/DR	0.86/2.09	0.145/--	137/--	0.052/--	[illegible]
	Mary Walker Bayou	24/MW	-- /3.26	-- /3.64	855/--	139 /--	[illegible]/--
	Pt. aux Chenes	14	.000	0.277	0.2	0.00	[illegible]
	Bayou Casotte	15	1.19	2.66	4660	325	[illegible]
	Mouth E. Pascagoula Rvr.	16	.000	0.863	14.8	3.93	0.462
	Escatawpa River Control	20	3.18	7.14	794	113	0.687
	E. Pascagoula **I-10**	21	0.73	1.94	51.2	14.5	0.806
	Bayou Chemise	22	0.45	0.828	6.96	1.20	0.000
	Mouth W. **Pascagoula Rvr.**	25	0.73	0.850	12.9	3.30	0.246
	Round Island	29	0.51	1.82	90.6	10.0	0.534
	Lake Yazoo	LY	0.573	2.49	9850	1930	0.907
	Elevator Bayou	EB	1.84	3.86	56.8	11.1	1.36
	Twin Islands	TI	0.571	0.206	3.59	0.717	0.480
	Halter Marine	HM	2.20	6.51	-	-	1.84
	Pogey Plant	PP	1.15	4.85	31.1	1.79	0.865
	Miss. Chem. E. **Bank**	MC	--	4.17	149	22.2	--
	Bayou Pierre	BP	2.15	3.96	577	374	0.415
	Mississippi **Hwy. Dept.**[9]		0.54	11.4	1730	197	1.10
	Escatawpa **River Bridge**[9]	ER	-	10.9	1870	110	1.84
	West Prong	WP	1.06	2.82	13,300	1000	2.75
	Graveline Bayou	GB	0.395	0.454	98.0	28.2	2.07
	Chevron N. Dock	CD	0.71	1.37	95.1	15.6	0.437
	Cooling Tower **Canal**	CT	0.809	2.61	8460	684	
Biloxi Bay System	Davis Bayou	1/DB	0.76/--	1.58/--	18.4/--	8.13/--	1.17/--
	Old Fort Bayou	3/FB	0.71/--	1.35/--	3.69/--	0.963/--	0.299/--
	Deer Island	4/DI	0.55/--	0.692/--	170/--	77.1/--	0.763/--
	Gulfport Lake	8/GL	1.08 /--	3.67/--	24.3/--	10.6/--	0.354/--
	Power Plant	**11/PW**	0.23/--	0.315/--	1.15/--	0.410/--	0.505/--
	South Deer Island	**2**	**0.220**	**0.866**	**5.44**	**1.62**	**0.254**

[illegible]	Location Code[2]	TKN[3], mg/g	TOC[4], %	Total HCs[5], μg/g	Aromatic HCs[6], μg/g	Phenols[7], μg/g
[illegible]	[illegible]	--	--	[illegible]	[illegible]	--
[illegible] Canal	[illegible]	--	--	134	48.0	--
[illegible]	CEX	--	2.96	27.5	3.88	--
[illegible]	CHX	--	0.891	181	4.87	--
[illegible]	GSX	--	3.24	67.0	5.56	--
[illegible]	[illegible]	0.31	[illegible]	1580	163	0.468
[illegible]	[illegible]	[illegible]	[illegible]	238	[illegible]	--
[illegible]	[illegible]	0.12	[illegible]	7.74	[illegible]	[illegible]
[illegible]	[illegible]	0.41	[illegible]	[illegible]	2.13	[illegible]
[illegible]	TCX	0.30	[illegible]	11.1	--	[illegible]
[illegible]	TDX	1.36	1.65	18.3	11.6	2.55
[illegible]	TEX	0.75	1.31	63.5	14.1	3.37
[illegible] 6	TFX	1.77	0.997	25.6	4.67	2.41
[illegible]	PCX	8.40	34.7	98.5	41.5	1.15

[illegible] and surface sample locations may be found in Tables 2 and 3.
[illegible] surface grabs (2 letter code) where complete bio-geo-chemical analyses were performed or [illegible] both. In columns of tabulated data where both core and samples were collected at [illegible] top segment of these core precedes data from surface grab samples. Secondary stations [illegible] only select chemical data collection. Refer to Fig. 2 for geographic locations.
[illegible] sediment wt. basis.
[illegible] sediment wt. basis.
[illegible] aliphatic and aromatic hydrocarbons, dry sediment wt. basis.
[illegible] dry sediment basis.
[illegible] metrically, reported dry sediment basis.
[illegible] available.
[illegible] from essentially same location.

General Location	Location Name[1]	Location Code[2]	TKN[3], mg/g	TOC[4], %	Total HCs[5], µg/g	Aromatic HCs[6], µg/g	Phenols[7], µg/g
Biloxi Bay System (Cont.)	Goat Island	5	0.99	1.62	101	8.45	2.39
	Keesler AFB	6	1.59	2.04	99.4	10.1	0.335
	Popps Ferry	7	0.69	1.58	25.2	7.91	0.490
	Cedar Lake	10	0.76	1.44	7.56	3.15	0.260
	Big Lake	12	1.41	2.30	243	50.9	1.15
	Bernard Bayou	44	0.07	0.368	38.0	6.34	0.285
	Rhodes Point	RP	0.719	2.00	217	41.9	0.324
	V.A. Hospital	VA	1.60	2.65	109	21.2	0.297
	Industrial Seaway	IS	0.307	2.93	8600	2610	0.548
	Turkey Creek	TC	1.28	1.99	704	156	0.632
	Reichhold Indus. Canal	RC	2.59	2.62	1900	419	0.580
	Hewchem Indus. Canal	HC	0.88	1.53	550	89.5	0.347
	Coley Island	CI	0.31	1.31	227	2.91	0.492
St. Louis Bay System	Heron Bay	31/HB	1.32/--	0.328/--	37.0/--	9.15/--	0.378/--
	St. Louis Bay Bridges	39/BB	1.07/--	2.08/--	63.9/--	9.77/--	0.773/--
	Mouth Jourdan River	38	1.39	1.83	32.5	7.04	0.537
	Mouth Wolf River	40	0.97	1.56	12.8	3.52	0.485
Mississippi Sound System	Horn Island	27/HI	0.112/--	0.0959/--	0.985/--	0.070/--	0.224/--
	West Ship Island	33/SI	0.97/1.07	1.19/1.29	29.9/--	3.52/--	0.470/--
	Gulfport Channel	9	0.26	1.17	11.7	1.91	0.602
	Edgewater	13	0.44	1.10	20.7	3.63	0.302
	East Mississippi Sound	26	0.07	0.370	2.13	0.071	0.319
	Bellefontaine Point	28	0.44	0.526	16.1	2.90	0.390
	West Horn Island	30	0.26	0.597	6.37	0.826	0.282
	Petit Bois Island	32	1.08	0.303	69.9	3.99	1.77
	Pass Marianne	34	0.69	1.11	27.5	2.42	0.655
	Ship Island Pass	35	0.39	0.883	8.77	1.05	0.341
	Cat Island Channel	36	0.26	0.678	4.80	0.547	0.456
	Bayou La Batre	41	0.0045	0.563	12.3	1.54	0.842
	Dauphin Island	42	0.048	1.31	27.4	11.0	1.62
	D'Iberville	43	1.45	1.36	38.8	6.60	1.15
	Open Gulf	OG	0.73	1.09	18.9	3.77	0.285
	East Gulfport Channel	GC	1.55	1.36	34.5	5.91	0.529

TABLE 404-14

Chloronated Hydrocarbon Compounds from Bulk Sediments (µg/kg)

Station	Rep	DDD	DDE	PCB
1	A	1.3	1.7	7.3
	B	3.7	2.4	13.0
2	A	2.1	1.8	7.8
	B	1.5	1.4	5.9
3	A	<0.5	2.4	<3.2
	B	<0.5	3.1	<3.2
4	A	1.6	1.6	7.3
	B	1.0	0.6	4.4
5	A	1.6	1.4	10.1
	B	<0.5	1.1	9.1
6	A	<0.3	0.3	<1.8
	B	<0.3	0.2	<1.9
7	A	<0.4	0.8	3.1
	B	<0.4	4.7	<2.7

< means that the compound was not detected

From: GeoSciences, Inc., 1983.

TABLE 404-15

Selected Phthalate Recovery from [illegible] Sediments [illegible]

Station	Rep	39112 Sediment	[illegible]39 [illegible]	[illegible]
1	A	830	110	<38
	B	<120	<190	3000
2	A	<55	<87	1400
	B	<60	<87	1600
3	A	<60	<87	2300
	B	<60	<90	4200
4	A	970	<245	3000
	B	<30	<50	410
5	A	<60	<90	2800
	B	130	<50	220
6	A	<29	<46	910
	B	<15	<24	84
7	A	<23	106	160
	B	<22	235	200

39112 = Di-N-butyl phthalate
34295 = Butyl-benzyl phthalate
39339 = Diethyl phthalate
< - means that the compound was not detected

From: GeoScience, Inc., 1983.

TABLE 404-16

Base/Neutral/Acid Compounds Showing Release through Elutriation

		Bis (2-ethylhexyl) phthalate			Di-n-octyl phthalate		
ation	Rep	Sediment mg/kg	Elutriate g/l	Ambient g/l	Sediment mg/kg	Elutriate g/l	Ambient g/l
	A	180	1	62	418	73	1
	B	87000	1	14	99000	8	1
	A	63000	1	1	76000	1	1
	B	59000	21	1	114000	14	1
	A	68000	0	0	240000	1	1
	B	55000	34	1	130000	17	1
	A	92000	1	1	200000	7	1
	B	16000	1	1	40000	6	1
	A	860	1	1	160000	17	1
	B	570	27	1	1500	25	1
	A	25000	48	6	62000	35	68
	B	3900	33	27	28500	23	91
	A	12000	48	1	30000	31	1
	B	2800	60	1	14000	40	2

rom: GeoScience, Inc., 1983.

TABLE 404-17

Cadmium Analysis

Station	Rep	Sediment(S) mg/kg	Elutriate(E) g/l	Ambient(A) g/l	E-A	(E-A)/S	(E-A)/A
1	A	0.2	1.7	1.4	0.3	0.0015	Ins.
	B	0.2	1.8	1.8	---	------	----
2	A	0.2	2.0	1.7	0.3	0.0015	Ins.
	B	0.1	2.1	2.1	---	------	----
3	A	0.06	2.0	2.0	---	------	----
	B	0.2	1.8	2.0	---	------	----
4	A	0.3	2.0	2.0	---	------	----
	B	0.3	2.0	1.8	0.2	0.0007	Ins.
5	A	0.8	1.6	1.4	0.2	0.0003	Ins.
	B	0.7	1.2	1.2	---	------	----
6	A	0.06	1.4	1.4	---	------	----
	B	0.06	1.4	1.4	---	------	----
7	A	0.2	2.8	2.1	0.7	0.0035	Ins.
	B	0.1	2.8	2.7	0.1	0.001	Ins.

From: GeoScience, Inc., 1983.

TABLE [illegible]-18

Copper Analysis

[illegible]	Rep	Sediment (S) mg/kg	Elutriate (E) µg/l	Ambient (A) µg/l
	A	14	<4.0	<4.0
	B	11	<4.0	<4.0
	A	15	<4.0	<4.0
	B	11	<4.0	<4.0
	A	11	<4.0	<4.0
	B	10	<4.0	<4.0
	A	11	<4.0	<4.0
	B	11	<4.0	<4.0
	A	24	<4.0	<4.0
	B	22	<4.0	<4.0
	A	3	<4.0	<4.0
	B	3	<4.0	<4.0
	A	6	<4.0	<4.0
	B	6	<4.0	<4.0

[illegible]: GeoScience, Inc., 1983.

TABLE 4.4-19

Mercury Analysis

[illegible]	[illegible]	Sediment(3) mg/kg	Elutriate(?) µg/l	Ambient(?) [illegible]
1	[illegible]	0.0[illegible]	<2.0	[illegible]
	[illegible]	0.[illegible]	2.0	[illegible]
2	A	0.10	<2.0	2.0
	B	0.06	<2.0	<2.0
3	A	0.06	<2.0	2.0
	B	0.06	<2.0	2.0
4	A	0.05	<2.0	<2.0
	B	0.06	<2.0	<2.0
5	A	0.03	0.4	<2.0
	B	0.04	0.5	<2.0
6	A	0.02	<2.0	<2.0
	B	0.01	<2.0	<2.0
7	A	0.03	<2.0	<2.0
	B	0.02	<2.0	<2.0

From: GeoScience, Inc., 1983.

United States Department of the Interior
NATIONAL PARK SERVICE
Gulf Islands National Seashore
P. O. Box 100
Gulf Breeze, Florida 32561

IN REPLY REFER TO:

L54 (GUIS-R)

January 16, 1984

Mr. Willis E. Ruland
Chief, Environment and
Resources Branch
Mobile District, Corps of Engineers
P.O. Box 2288
Mobile, Alabama 36628

Dear Mr. Ruland:

As manager of Petit Bois and Horn Islands, I am keenly interested in your proposal for channel improvements at Pascagoula Harbor, Mississippi. Of primary concern to the Seashore is the quality of material, method of disposal, and location of disposal sites.

As part of the scoping process, you should consider the detrimental effects on submerged lands within the boundary of the Seashore of thin layer disposal. Further, you should consider the positive effects of adding compatible material to the island sand budget by either nourishment or island creation.

I appreciate the opportunity to comment and make the Seashore Staff available to assist in any way. If you have any questions, please contact Buck Thackeray at FTS 946-5254.

Sincerely,

F. D. Pridemore
Superintendent

SECTION D-5

GULF ISLANDS NATIONAL SEASHORE

STATE OF MISSISSIPPI
DEPARTMENT OF ARCHIVES AND HISTORY
P. O. BOX 571
JACKSON, MISSISSIPPI 39205-0571

March 6, 1985

Mr. James B. Hildreath
Environment & Resources Branch
Mobile District, Corps of Engineers
P. O. Box 2288
Mobile, Alabama 36628-001

RE: Pascagoula Harbour, Mississippi; Feasibility Report and Environmental Impact Statement (Sept. 1984).

Dear Mr. Hildreath:

We have reviewed the above report and it is our determination that both sites JA516 and JA618 are eligible for the National Register of Historic Places. Should development of the harbour impact these sites appropriate mitigation should be undertaken in consultation with this office.

We appreciate your continued cooperation.

Sincerely,

Elbert R. Hilliard
State Historic Preservation Officer

Roger G. Walker

By: Roger G. Walker
Interagency Coordinater

RGW/11

United States Department of the Interior
NATIONAL PARK SERVICE
SOUTHEAST REGIONAL OFFICE
75 Spring Street, S.W.
Atlanta, Georgia 30303

Y REFER TO:
H2217

AUG 1 8 1983

Mr. Willis E. Ruland
Chief, Environment and Resources Branch
Mobile District, Corps of Engineers
Post Office Box 2288
Mobile, Alabama 36628

Dear Mr. Ruland:

We have reviewed Cultural Resources Reconnaissance of Pascagoula Harbor, Mississippi by Tim S. Mistovich, Vernon J. Knight, Jr., and Carlos Solis and offer the following comments:

Except for occasional typographical errors, our only criticism of the report concerns some of the illustrations. Figure 3 is practically illegible, and it is extremely difficult if not impossible to correlate the survey areas with the map. Figures 1 and 3 do not correlate. Features are present in each that do not show on the other. This may be a function of reproduction of Figure 3, however.

A map is needed showing archeological site locations. Site descriptions cannot be correlated with locations on the ground. Also, a map is needed showing islands, bayous, etc. mentioned in the text. For instance, where is Greenwood Island? Certain bayous are shown on one map but not another. The reader has to flip around from map to map to locate a particular feature. The best maps are in Chapter 10 at the end of the report.

Plates 7 and 8 are not very clear.

The time required to further investigate magnetic anomalies seems excessive at five days per unit. If contouring of the anomalies can more or less pin point a source(s), and hand held metal detectors are used, it does not seem that it should take two days to locate the source(s) if there is anything there at all of significance. Unless a source is buried a considerable distance in the bottom, two days for identification and evaluation seems awfully long.

The draft should be subjected to a careful editing, and it should be insured that all photographs and other illustrations will be clear and sharp.

Except for the above, we find the report, its conclusions, and recommendations logical and reasonable.

Sincerely,

Wilfred M. Husted

Wilfred M. Husted
Acting Chief, Archeological Services Branch

STATE OF MISSISSIPPI
DEPARTMENT OF ARCHIVES AND HISTORY
P. O. BOX 571
JACKSON, MISSISSIPPI 39205-0571

August 18, 1983

Mr. Willie E. Ruland
Department of the Army
Mobile District Corps of Engineers
P. O. Box 2288
Mobile, ALabama 36628

Dear Mr. Ruland:

We have received and reviewed the draft report entitled "Cultural Resources Reconaissance of Pascagoula Harbor, Mississippi." We would like to make the following comments:

1. Page 5, 3rd paragraph; considering the source of the information on the Big Sandy I and Stanley points, these identifications should be used with caution.

2. Page 25, 1st paragraph; I think the site is Ja-516, not Ja-519.

3. Page 40, 4th paragraph; Mark Williams was employed by the Mississippi Department of Archives and History when the Earthwork site was excavated.

4. Page 41; the map on this page is illegible in part. This office needs a clear record of all land which has received cultrual resource survey.

5. Page 87; the sherd identified as residual incised with Chevrons on the lip is probably Twin Lake punctated.

6. Page 97; we would like to have the disposal sites plotted on a quadrangle map for the same purpose as stated in comment #4 above.

7. Page 123; we would also like to see the data presented on this map transferred to a quadrangle map.

Sincerely,

Sam McGahey
Chief Archaeologist

SM:ks

D-[illegible]

SECTION D-4

CULTURAL RESOURCES LETTERS

Southeast Region
9450 Koger Boulevard
St. Petersburg, FL 33702

June 25, 1984 F/SER23:AM:

Mr. Willis E. Ruland
Chief
Environment & Resources Branch
Mobile District
Corps of Engineers
P.O. Box 2288
Mobile, Alabama 36628

Dear Mr. Ruland:

This responds to your June 20, 1984, letter regarding channel improvements for Pascagoula Harbor, Mississippi. A biological assessment (BA) was transmitted pursuant to Section 7 of the Endangered Species Act of 1973 (ESA).

We have reviewed the BA and concur with your determination that populations of endangered/threatened species under our purview would not be adversely affected by the proposed action.

This concludes consultation responsibilities under Section 7 of the ESA. However, consultation should be reinitiated if new information reveals impacts of the identified activity that may affect listed species or their critical habitat, a new species is listed, the identified activity is subsequently modified or critical habitat determined that may be affected by the proposed activity.

Sincerely yours,

Andreas Mager, Jr. / for

Charles A. Oravetz, Chief
Protected Species Management Branch

We conclude, therefore, that none of the proposed alternative improvements of the Pascagoula Harbor channel would significantly affect the continued existence of any endangered or threatened species.

We appreciate your assistance in helping us protect the nation's resources.

Sincerely,

Willis E. Ruland
Chief, Environment and
Resources Branch

June 20, 1984

Environmental Studies
and Evaluation Section

Mr. Andreas Mager, Jr.
Fishery Biologist
Protected Species Management Branch
National Marine Fisheries Service
Southeast Region
9450 Koger Boulevard
St. Petersburg, Florida 33702

Dear Mr. Mager:

Reference is made to your letter of May 29, 1984, regarding channel improvements for Pascagoula Harbor, Mississippi. This letter constitutes our biological assessment under Section 7 of the Endangered Species Act of 1973, as amended.

Alternatives under consideration include disposal of sand in about 10 feet of water immediately offshore of Horn Island, disposal in the existing disposal area two miles southeast of Horn Island in five to six fathoms of water, and the offshore disposal of silty material in ten fathoms of water.

The green sea turtle, Chelonia mydas, may have nested on Horn Island in the past. The loggerhead sea turtle, Caretta caretta, probably nested on Horn Island in the past and could nest there now, although there are no recent records. Kemp's ridley sea turtle, Lepidochelys kempi, is a rare visitor in the open gulf. None of the alternatives under consideration should significantly impact sea turtles. However, disposal close to the beach near Horn Island could be scheduled during the winter months to avoid disturbing sea turtles should they attempt to nest on Horn Island. In addition, construction boat operators are instructed to keep a lookout for sea turtles to avoid turtles being hit. The boat operators are further requested to report any sightings.

Guidelines for Conducting a Biological Assessment

(1) Conduct a scientifically sound on-site inspection of the area affected by the action. Unless otherwise directed by the Service, include a detailed survey of the area to determine if listed or proposed species are present or occur seasonally and whether suitable habitat exists within the area for either expanding the existing population or reintroducing a new population.

(2) Interview recognized experts on the species listed, including those within the Fish and Wildlife Service, the National Marine Fisheries Service, state conservation agencies, universities and others who may have data not yet found in scientific literature.

(3) Review literature and other scientific data to determine the species distribution, habitat needs, and other biological requirements.

(4) Review and analyze the effects of the action on the species, in terms of individuals and population, including consideration of the cumulative effects of the action on the species and habitat.

(5) Analyze alternative actions that may provide conservation measures.

(6) Conduct any studies necessary to fulfill the requirements of (1) through (5) above.

(7) Review any other information.

Endangered and Threatened Species and Critical Habitats Under NMFS Jurisdiction

Pascagoula Harbor, Mississippi

Listed Species	Scientific Name	Status	Date Listed
green sea turtle	*Chelonia mydas*	Th	7/28/78
Kemp's (Atlantic) ridley sea turtle	*Lepidochelys kempi*	E	12/2/70
loggerhead sea turtle	*Caretta caretta*	Th	7/28/78

SPECIES PROPOSED FOR LISTING
None

CRITICAL HABITAT
None

CRITICAL HABITAT PROPOSED LISTING
None

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Region
9450 Koger Boulevard
St. Petersburg, FL 33702

May 29, 1984 F/SER23:AM:cf

Mr. Willis E. Ruland
Chief, Environment and Resources Branch
Mobile District, Corps of Engineers
P.O. Box 2288
Mobile, Alabama 36628

Dear Mr. Ruland:

This responds to your May 24, 1984, letter regarding your proposal to prepare a draft environmental impact statement for channel improvements at Pascagoula Harbor, Mississippi. A list of endangered and threatened species was requested pursuant to Section 7 of the Endangered Species Act of 1973.

The enclosed list provides the threatened and endangered species under National Marine Fisheries Service jurisdiction that may be present in the project area. Upon receipt of the list, the Corps of Engineers must ensure that its actions are not likely to jeopardize the continued existence of the listed species.

For a major federal action, the agency must conduct a biological assessment to identify any endangered or threatened species which are likely to be affected by such action. The biological assessment must be complete within 180 days after receipt of the species list, unless it is mutually agreed to extend this period. The components of a biological assessment are also enclosed.

At the conclusion of the biological assessment, the federal agency should prepare a report documenting the results.

If the biological assessment reveals that the proposed project is likely to adversely affect listed species, the formal consultation process shall be initiated by writing to the Regional Director at the address on the letterhead. If no adverse effect is evident, there is no need for formal consultation. We would, however, appreciate the opportunity to review your biological assessment.

If you have any questions, please contact Andreas Mager, Jr., Fishery Biologist, FTS 826-3366.

Sincerely yours,

Andreas Mager, Jr.
Fishery Biologist
Protected Species Management Branch

Enclosures

[illegible] Jackson, [illegible]

United States Department of the Interior
FISH AND WILDLIFE SERVICE
JACKSON MALL OFFICE CENTER
300 WOODROW WILSON AVENUE, SUITE 3185
JACKSON, MISSISSIPPI 39213

December 21, 1983

IN REPLY REFER TO:
Log No. 4-3-84-074

Mr. Willis E. Ruland
Chief, Environment & Resources Branch
Mobile District, Corps of Engineers
P.O. Box 2288
Mobile, Alabama 36628

Dear Mr. Ruland:

This responds to your letter of December 9, 1983, concerning channel improvements at Pascagoula Harbor, Jackson County, Mississippi.

We have reviewed the information you enclosed relative to the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.).

Our records indicate no endangered, threatened or proposed species, or their Critical Habitat occurring in the project area. Therefore, no further endangered species consultation will be required for this project, as currently described.

If you anticipate any changes in the scope or location of this project, please contact our office for further coordination.

We appreciate your participation in the efforts to enhance the existence of endangered species.

Sincerely yours,

Dennis B. Jordan

Dennis B. Jordan
Field Supervisor
Endangered Species Field Office

cc: RD, FWS, Atlanta, GA (AFA/SE)
ES, FWS, Daphne, AL
Department of Wildlife Conservation, Jackson, MS

SECTION D-3

ENDANGERED SPECIES LETTERS

SECTION D-6

COE LETTER TO EPA ON TENNECO JURISDICTION

DEPARTMENT OF THE ARMY
MOBILE DISTRICT, CORPS OF ENGINEERS
P. O. BOX 2288
MOBILE, ALABAMA 36628

REPLY TO
ATTENTION OF:

September 18, 1984

Regulatory Branch

SUBJECT: Jurisdictional Determination, Tenneco Site

Mr. Charles R. Jeter
Regional Administrator
Environmental Protection Agency
Region IV
345 Courtland Street, N.E.
Atlanta, Georgia 30365

Dear Mr. Jeter:

Reference is made to your letter of July 19, 1984, regarding my jurisdictional determination for the Tenneco Site adjacent to Bayou Casotte and Mississippi Sound, Pascagoula, Jackson County, Mississippi. This site is a 200-acre, dike-enclosed tract which has been used for disposal of dredged material and industrial wastes since 1957. Your letter requested an explanation of my determination to not exert jurisdiction over the Site under Section 404 of the Clean Water Act. This jurisdictional determination is important to our respective agencies because of its impact on the Special Management Area Plan and the Harbor Deepening Study currently underway for the Port of Pascagoula.

My technical report is attached for your review and includes exhibits which must be returned to me for transmittal to the original owners of the information. Among the more significant considerations for my decision are:

a. The Mississippi Department of Wildlife Conservation, Bureau of Marine Resources, has not exerted their jurisdiction over the site because it is above the limits of their authority defined by the mean high tide.

b. A complete traverse of the dike system indicates it is approximately seven to eight feet high and intact along its entire periphery.

c. The alleged breach in the dike was identified as a two- to three-foot notch in the dike at the location of the original, wooden weir structure.

d. The diked area is well above the mean high tide elevation of 0.78 foot National Geodetic Vertical Datum (NGVD) and is essentially dry except for abnormal rainfall events and storm surges.

e. The last detrital export from the Tenneco Site probably occurred during Hurricane Frederick in September, 1979.

f. Although wetland vegetation may be found within the diked area, it is characterized by a predominance of transition zone species and is completely different from vegetation (obligate hydrophytes) found in adjacent jurisdictional wetlands.

g. According to the Soil Conservation Service, Jackson County Soil Survey, the soils of the Tenneco site are not of a hydric series.

h. Historically, the Mobile District and commenting agencies have not considered this diked disposal area, nor more extensively vegetated diked disposal areas, as jurisdictional wetlands.

These considerations and others are more completely described in the attached exhibits and documents. Given these facts and the regulations administered by the Corps of Engineers, I believe you will agree with me that the Tenneco Site is not a water of the United States under 33 CFR 323.2(a)(7), is not a jurisdictional wetland under 33 CFR 323.2(c), and is not a wetland performing significant public interest functions under 33 CFR 320.4(b)(2).

Finally, I ask that you concur with me that the Tenneco Site is not a "Special Case" under the April 23, 1980 Memorandum of Agreement between our respective agencies. This agreement contemplates that consultation between our agencies will occur in advance of any jurisdictional calls by the District Engineer. In the absence of this prior consultation, the determination of the District Engineer is binding subject only to discretionary review by the Chief of Engineers. The public, Port of Pascagoula, and others have relied upon my jurisdictional determination of this site since at least January 31, 1984 when members of my staff explained the determination to the Special Management Area Task Force for the Port of Pascagoula. Further, the site is not a bottomland hardwood or other "Special Case" wetland identified by your agency and published in the Consolidated List of Special Cases, 45 Federal Register 70564-70566, October 24, 1980.

In conclusion, I ask for your thorough consideration of my position in this matter and your subsequent agreement regarding my jurisdictional call. If you desire further clarification or a formal presentation in regard to this matter, please contact me at your convenience.

Sincerely,

Patrick J. Kelly
Colonel, CE
District Engineer

Enclosure

List of Exhibits and Documents Concerning the
Tenneco Site Jurisdictional Determination
with Explanatory Descriptions

1. Xerox of an aerial photograph of Bayou Casotte, Jackson County, Mississippi, January 1958.

This photograph documents that the South Hydraulic Fill Area (Tenneco Site) had been recently filled up to the dike on the shoreline of Bayou Casotte and Mississippi Sound immediately south of the H. K. Porter Co., Inc. plant.

2. Four black and white aerial photographs of the H. K. Porter property, (now known as the Corning and Tenneco Site), Jackson County, Mississippi flown on August 17, 1961.

These photographs indicate the following:

a. The extent of the south dike constructed on the beach berm.

b. The eastern dike had recently been up-graded during maintenance of the outfall and drainage canal.

c. The South Hydraulic Fill Area was beginning to vegetate naturally.

3. Three black and white aerial photographs of the H. K. Porter property, Jackson County, Mississippi flown February 4, 1968, which indicate the following:

a. Four inch diameter pipeline discharging a slurry of sea water, magnesite and unreacted dolomite into the diked disposal area and the mechanical discharge or dumping of solid magnesite waste into the diked disposal area.

b. Recent increase of made land created by unconfined open water disposal south of the Tenneco site.

c. Gradual increase of vegetation coverage inside the disposal area and rapid creation of a tidal marsh between the created land in Mississippi Sound and the south dike of the Tenneco site.

d. Outfall ditch from weir structure located in the southeast corner of the Tenneco diked disposal site.

4. Two black and white aerial photographs of the H. K. Porter Co., Inc. property, Jackson County, Mississippi flown January 24, 1970 indicating the following:

a. An increase since 1968 of the area covered by both liquid and solid disposal of magnesite into the diked disposal area.

b. Increased vegetative coverage on the Tenneco site and a stabilized tidal marsh created by open water disposal south of the Tenneco site.

5. Black and white aerial photograph of Bayou Casotte, Jackson County, Mississippi, flown February 20, 1972.

This photograph indicates an increase in the area covered by the discharge and dumping of magnesite into the diked disposal area since 1970.

6. Black and white 9"x9" positive print of a color infrared negative of Bayou Casotte, Jackson County, Mississippi flown January 21, 1984.

This positive print documents a larger area of industrial deposition of magnesite in the disposal area known in this time frame as the "Tenneco Site".

7. Topographic map, Bayou Casotte Industrial area, Jackson County, Mississippi prepared by Michael Baker, Jr. Inc. dated April 17, 1956, which indicates the following:

a. Original shoreline and land elevations prior to the construction of Bayou Casotte Harbor.

b. Priest Bayou and an extensive area cut by mosquito ditches below 2' mean low water, existed at the site of what is presently the "Tenneco Site".

8. Hydraulic Dredging Plan, Bayou Casotte Industrial Area, Jackson County, Mississippi prepared by Michael Baker, Jr. Inc. dated April 8, 1956 with 10 revisions, which indicates the dike alignment for the South Hydraulic Fill Area, now the "Tenneco Site".

9. Photographs of Bayou Casotte Industrial Area taken in 1957. Seven xeroxed photographs and 17 black and white 8"x10" document the extensive dike construction around the marshes of the South and North Hydraulic Fill Areas and the filling of these disposal areas in the Bayou Casotte Industrial Area.

10. "Engineering and Economic Data on Pascagoula Harbor" October 2, 1957, prepared by Michael Baker, Jr., Inc. pages 1-4 with transmittal letter dated September 27, 1957. This document states that: "Several hundred acres of adjoining marsh lands are being prepared for industrial sites with the spoils from harbor dredging....Approximately 6,800,000 cubic yards of material dredged will be deposited in land fill areas..."

11. Map of Corps of Engineers jurisdiction for the Jackson County Special Management Area with a copy of March 5, 1984 cover letter from Bureau of Marine Resources and resource table.

The map clearly indicates that the diked portion of the "Tenneco Site" is not a jurisdictional wetland. The resource table indicates that the Chevron/Tenneco Management Unit designated for private development contains 820 acres of emerg[illegible] wetlands and 17 acres of shrub wetlands that are jurisdictional wetlands. This does not include the 200 acre plus shrub dominated Tenneco disposal site.

12. Summaries of the November 17 and 18, 1983, January 31, 1984 and March 14 and 15, 1984 Task Force Meetings for the Pascagoula SMA prepared by Ralph M. Fields Associates, Inc., document the following:

a. Mapping of Wetlands in the SMA by Michael Baker, Jr. Inc., was modified by Corps of Engineers to delineate the boundaries of wetlands subject to Section 404 regulatory program.

b. The jurisdictional determination which included maps and acreages involved was described and explained to all Task Force Members on January 31, 1984. At this time the Corps of Engineers representative giving the presentation explained that the Corps does not exert jurisdiction within diked disposal areas. The "Tenneco Site" was given as a specific example.

c. The regulatory agency position statement identifies the upland portion of the "Tenneco Site" as an acceptable development area with reasonable waterfront access provided.

13. Memorandum of Understanding, Geographical Jurisdiction of the Section 404 Program. Department of the Army, Office of the Chief of Engineers, Washington D. C. 20214, United States Environmental Protection Agency (EPA), Washington D. C. 20460, April 23, 1980 and published in Federal Register, Volume 45 Number 129, July 2, 1980.

Under this MOU, except in special cases previously agreed to, the District Engineer is authorized to make a final determination on the extent of jurisdiction, without prior consultation with EPA and such determination shall be binding, subject only to discretionary review by the Chief of Engineers.

14. Jurisdiction of Dredged and Fill Program: Consolidated List of Special Cases, as Published in the Federal Register Volume 45 Number 208, October 24, 1980.

This notice lists special cases which have been developed pursuant to a April 23, 1980 MOU between Chief, U. S. Army Corps of Engineers and the Administrator of the Environmental Protection Agency where by jurisdictional determinations involving a special case will be referred to EPA for a decision. The first special case covers bottomland hardwoods in certain counties of Arkansas, Kentucky, Louisiana, Mississippi, Tennessee and Texas. The second special case involves wetlands near City of Huntington Beach in Orange County, California.

The Tenneco site in Jackson County is not located in one of the counties specified as a special case nor is the site a bottomland hardwood. Therefore, the April 23, 1980 MOU does not apply to the Tenneco Site.

15. Topographic Survey of the Tenneco Site conducted in March of 1978.

This survey indicates that the Tenneco Site is a diked area well above the mean high tide.

16. Topographic survey of the weir on the Tenneco Site, August 2, 1984.

This survey documents that the disposal site is not below the mean high tide and that the alleged breach is the site of the original weir.

17. Disposition Form: Mean High Tide Elevation at Tenneco Site, Bayou Casotte, Jackson County, Mississippi, August 20, 1984.

The mean high tide at the Tenneco Site is +0.78' NGVD.

18. Disposition Form: Jurisdictional Determination for Tenneco Property, Jackson County, Mississippi.

This DF documents that the deposition of dredged material within this old diked disposal area does not need to be specified using 404(b)(1) guidelines.

19. Memorandum for the Record: Trip Report-Tenneco Property Alternative Disposal Site Pascagoula Harbor Deepening Study, Jackson County, Mississippi on July 18, 1984.

The inspection revealed the following to EPA representative:

a. The dike was intact and disposal site extremely dry.

b. Alleged breach was notch in dike at site of original wooden weir.

c. Tidal marsh created by the Corps existed south of the dike outside of the disposal site.

Photographs of the site were taken and locations are indicated on attached aerial mosaic dated April 24, 1981.

20. Memorandum for the Record: Disposal of industrial waste on South Hydraulic Fill Area (Tenneco Site) Jackson County, Mississippi by H. K. Porter Co., Inc. August 27, 1984.

Magnesite and other silicate minerals were deposited by way of a 4" discharge pipe and by mechanical means into the diked disposal area of the Tenneco Site from 1958 until 1980. Additionally, Corning Glass Works disposed of 20,000 cubic yards of settled suspended magnesite into the Tenneco site under DOA permit MS00076-00600-F.

21. Department of the Army Permit MS00076-00600-F Corning Glass Works, issued December 20, 1976.

This permit authorized the hydraulic transfer of 20,000 cubic yards of settled suspended magnesite in an existing lagoon to the diked disposal area now known as the "Tenneco Site". The permit was for the discharge of water into Mississippi Sound. The disposal area was not considered a wetland in 1976. EPA had no comment on the application while on public notice, all other local, State and Federal commenting agencies had no objection to the issuance. The permit was required in order for Corning to comply with the conditions of an existing NPDES permit.

Portion of Soil Survey Jackson County, Mississippi, U. S. Department of ·iculture, Soil Conservation Service, June 1964.

The Tenneco Site is mapped as made land in this Soil Survey. Made land defined as ..."This land type is made up of areas that are along the ıches and marshes and that have been diked and then filled, by pumping :h silt, mud and sand. After these areas are dry they are leveled and ɜn they are used for industrial sites..."

. Memorandum for the Record: Vegetative sample of natural marsh adjacent Mississippi Sound, Jackson County, Mississippi, August 27, 1984.

The natural marsh south of Chevron is dominated by Distichlis spicata, ırtina alterniflora and Juncus roemerianus. It is a water of the United ıtes under the jurisdiction of the Mobile District, Corps of Engineers.

. Memorandum for the Record: Vegetative sample of "Tenneco" marsh jacent to Bayou Casotte and Mississippi Sound, Jackson County, Mississippi gust 27, 1984.

The man-made marsh south of the "Tenneco Site" diked disposal area is minated by Distichlis spicata and Spartina alterniflora. Though made by en water disposal of dredged material it is considered a "water of the ited States" under jurisdiction of the Mobile District Corps of Engineers.

. Memorandum for the Record: Vegetative sample of the Tenneco Site, a sposal area adjacent to Bayou Casotte and Mississippi Sound, Jackson unty, Mississippi August 17, 1984.

The "Tenneco Site" is dominated by Iva frutesceus and Baccharis limifolia with dominent groundcover of Solidago sp. on the flat eastern rtion and by Myrica cerifera and Baccharis halimifolia with stands of perata cylindrica and Panicum repens. The vegetation on the eastern rtion is composed of species typically found in the transition zone tween uplands and tidal marsh. This diked and previously filled disposal ea is not a water of the United States. The Mobile District Corps of gineers does not consider previously used diked disposal areas well above e mean high tide a regulated wetland.

. Two Department of the Army files on dredging and disposal activities sociated with the maintenance dredging of the federally authorized channel Bayou La Batre, and Bayou Coden, Alabama, FP82-BB02-5 and FP82-BC01-5.

These files describe diked disposal areas containing lush marsh getation as upland disposal sites. EPA, Fish and Wildlife and National rine Fisheries Service had no objection to these projects for disposal in ese previously used disposal areas. Photographs of the lush marsh getation are included.

. Letter dated July 19, 1984 from Regional Administration, Region IV, vironmental Protection Agency to District Engineer, U. S. Army Corps of gineers, Mobile.

This letter concerns the Corps determination that the Tenneco Site is not a "water of the United States". EPA indicates they have determined this area to be a "water of the United States" and have invoked the current Memorandum of Understanding on Geographical Jurisdiction (April 23, 1980) which outlines the procedures to resolve conflicts between these agencies concerning the extent of waters of the United States. EPA would like the opportunity to examine the rational for the Corps decision and review a summary of the Corps findings prior to further consideration of their options given under this Memorandum of Understanding.

28. U. S. Department of the Interior letter to Regional Administrator, Environmental Protection Agency, Region IV dated July 30, 1984.

This letter concerns the Corps of Engineers jurisdictional determination on the "Tenneco Site". FWS opinion is that the area is a functional wetland supporting wildlife and providing detrital material to the adjacent estuarine fishery based on a supplemental Fish and Wildlife Coordination Act Report prepared for the Feasibility Study on Deepening the Pascagoula Harbor Project. The letter admits that the area is an old spoil disposal site, and alleges that several areas are present where, Scirpus sp., Juncus roemerianus, Spartina patens, Spartina alterniflora, Distichlis spicata and Baccharis halimifolia are the predominate vegetation. They fully support a decision by EPA that federal jurisdiction should be asserted over the Tenneco disposal area so that adequate mitigation will be assured.

29. Supplemental Fish and Wildlife Coordination Act Report to the Pascagoula Harbor Navigation Project, Alternative Changes, provided by U. S. Department of the Interior, U. S. Fish and Wildlife Service, July 16, 1984.

The FWS states in their cover letter that the Tenneco alternative is of such an adverse nature to them that they will oppose its selection and implementation. The report indicates their on-site inspections revealed that the vegetation of the Tenneco Site consists basically of Seirpus robustus and Spartina patens with major shrub species of Baccharis halimifolia and Iva frutescens. No vegetation sampling was conducted to confirm their assumptions. Please check exhibit #25. They also indicate tidal flushing within the filled diked disposal area without benefit of tide data or elevations inside the disposal site. They report a vast amount of detrital material is contributed to the estuarine system, again without supporting data. See exhibit #25 photograph of clean rainwater, after a 6" rain, coming out the old weir structure on page 4 of the photographs.

30. 33 CFR, Regulatory Programs, of the Corps of Engineers as published in the Federal Register, Volume 47, Number 141, July 22, 1982.

Section 323.2 defines "waters of the United States". Note Section 323.2(a)(7), waste treatment systems including treatment ponds or lagoons designed to meet requirements of the Clean Water Act are not waters of the United States. Diked disposal areas previously filled fit this category.

Section 323.2(c) defines wetlands as..."areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

.nds generally include swamps, marshes, bogs and similar areas. The
, District uses a 3 parameter approach to delineate wetlands: (a) ıtion or saturation, (b) prevalence at wetland vegetation (obligate)hytes) and (c) hydric soil.

'he "Tenneco Site" is saturated and inundated on the lower portion of ıstern half by rainwater for some portions of the year depending on ıll events. However, the vegetation is not dominated by obligate)hytes but by three transition zone species. The soil is not a hydric series but made land from hydraulic disposal and industrial disposal.

Section 320.4(b)(2) describes wetland functions important to the public est review. The "Tenneco Site" does not perform functions as listed.

(i) A significant natural biological function including food chain ction, general habitat, nesting, spawning, rearing and resting sites ny aquatic life or wading birds. Rather it has limited use by rabbits few assorted small rodents and song birds.

(ii) A area to be set aside for study of the aquatic environment or nctuaries or refuges.

(iii) Additional filling of the "Tenneco Disposal Site" would not t natural drainage characteristics, sedimentation patterns, salinity ibution, flushing characteristics, current patterns or other onmental characteristics. Some were affected by the initial filling in prior to Section 404 regulations.

(iv) The "Tenneco Site" is not significant in shielding other areas wave action, erosion or storms.

(v) The "Tenneco Site" does not serve as a valuable storage area for or floodwaters.

(vi) It is not a prime natural recharge area.

(vii) It does not serve significant and necessary water purification ions. The rainwater that may flow out is very similar to the rainwater falls into the area.

Section 330.4(a)(1) and (2) indicate that even if the Tenneco Site were dered a regulated wetland, the filling has already been authorized by ationwide Permits.

SECTION D-7

TENNECO SITE INSPECTION REPORT

SAMCP-S [illegible] August 1984

MEMORANDUM FOR RECORD

SUBJECT: Vegetative Sample of the "Tenneco Site". A Disposal Area Adjacent to Bayou Casotte and Mississippi Sound, Jackson County, Mississippi

PLACE AND DATE: Diked disposal area "Tenneco Site," south of Corning Plant in Sections 20, 21, 28, and 29, T. 8 S., R. 5 W., Jackson County, Mississippi, 1200 hours, 2 August 1984 and 0900 hours, 3 August 1984.

The inside of the diked disposal area of the "Tenneco Site" was sampled on 2 August 1984 by Mr. Art Mosev, a biologist, and Mr. Frank Hubiak, a physical scientist, representatives of the Mobile District Corps of Engineers. The area was photographed on 3 August 1984 because of heavy rain on the 2nd of August. This disposal area was constructed during the initial construction of the Bayou Casotte Harbor and Channel in March of 1957. The south dike was constructed on the natural beach berm along the shoreline. The majority of the site was, prior to filling in 1957, a tidal marsh below 2 feet in elevation.

METHOD: The eastern lower portion of the disposal area was sampled using the following techniques:

a. Ground cover: Ocular estimation of percent coverage by annual and perennial plant species in a circular milacre plot (1/1000-acre).

b. Midstory: Stem count by species of woody plants over 3 feet in height in a circular 1/100-acre plot. Shrubs with numerous stems from one root system were tallied as one stem.

c. Twenty-one plots of ground cover and midstory were sampled along three north-south lines that paralleled the eastern dike at 100-yard intervals. Sample lines started 100 yards from the eastern dike with plot lines 500 yards apart. See attached field notes, photographs, and map which denotes plot numbers, locations, and alignment. The dikes were not sampled but notes of the vegetation were recorded. The western portion, higher in elevation, was not sampled due to the inability to traverse the heavy woody midstory vegetation dominated by Myrica cerifera, and Baccharis halimifolia.

RESULTS: The data from the vegetation samples are summarized in the following tables.

Percent Coverage of Created Marsh by Species

Species	No. of Plots Where Presences Was Found	Average Percent Coverage in Plots Where Found	Percent Coverage of the Disposal Area
Solidago sp.	14	37	25
Fimbristylis sp.	4	45	9

27 August 1984

Vegetative Sample of the "Tenneco Site". A Disposal Area Adjacent to Bayou Casotte and Mississippi Sound, Jackson County, Mississippi

	No. of Plots Where Presences Was Found	Average Percent Coverage in Plots Where Found	Percent Coverage of the Disposal Area
s spicata	6	20	6
obustus	6	16	5
ali	1	80	3
sp.	7	5	2
ustifolia	2	1	>1
halimifolia	2	2	>1
alterniflora	1	2	>0.1
cent coverage by ground cover species			51

Woody Plants present in "Tenneco Site"

	No. of Plots Where Presence Was Found	Stems	No. of Plants/Acre
scens	10	227	1,080
halimifolia	11	124	590
rifera	1	4	3

[illegible] number of plants per acre projected from sample data 1,673
astern portion of Tenneco Site.

[illegible] The Tenneco Site is dominated by Iva frutescens and Baccharis [illegible] shrubs with an understory of Solidago sp. on the flat eastern portion of the site. The higher western portion is dominated by Myrica cerifera [illegible] aris halimifolia with stands of Imperata cylindrica and Panicum [illegible] It is a diked disposal area that traps rainwater which inundates [illegible] tions of the area with runoff water from within the diked area after heavy rains. The vegetation of the western portion is composed of [illegible] typically found in the transition zone between uplands and tidal [illegible]

AD-A154 885 PASCAGOULA HARBOR MISSISSIPPI FEASIBILITY REPORT ON 4/6
IMPROVEMENT OF THE FE..(U) CORPS OF ENGINEERS MOBILE AL
MOBILE DISTRICT MAR 85 COE-SAM/PD-N-84/012

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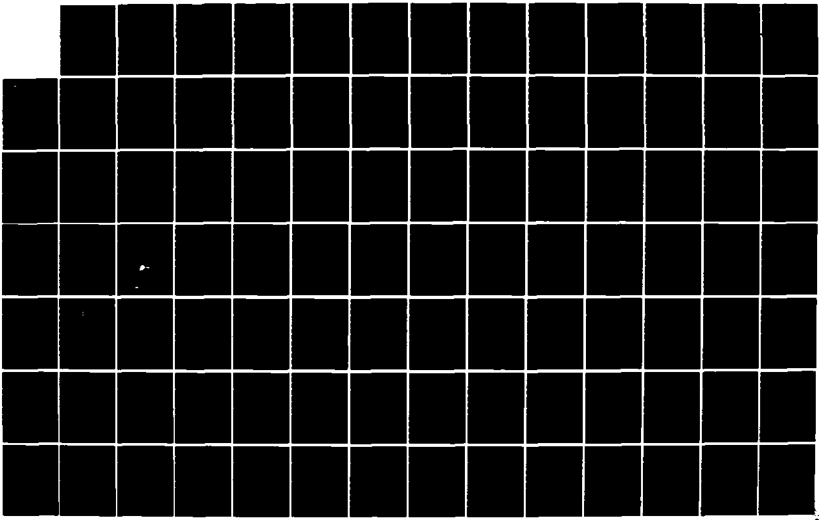

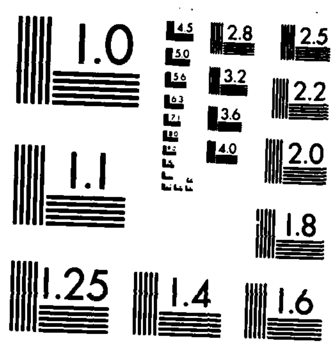

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

Clean Water Act and Section 323.2(7) does not apply. However, Section 330.4 (a)(2) states that the discharge of dredged or fill material into other non-tidal waters of the United States that are not part of a surface tributary system to interstate waters or navigable waters of the United States have been permitted by the Nationwide Permit. Therefore the Mobile District has determined that the deposition of dredged or fill material in the diked portion of the Tenneco Site does not require an individual Department of the Army Permit on specification using 404(b) guidelines.

ART HOSEY
Chief, Assessment and
Monitoring Branch

SAMOP-S 27 August 1984

SUBJECT: Vegetative Sample of the "Tenneco Site". A Disposal Area Adjacent to Bayou Casotte and Mississippi Sound, Jackson County, Mississippi

FIELD NOTES: Vegetation Sampling "Tenneco Site" inside diked disposal area, Jackson County, Mississippi.

2 August 1984, 1200 hours, heavy rain, plots 1-19.
3 August 1984, 0900 hours, sunny, hot, humid, plots 20-21.

Six inches of rain was recorded at the Chevron Refinery during the night of 1 August and early morning of 2 August 1984. Sample plots start 50 yards north of dike, 100 yards west of southeast corner. Plots were taken every 100 yards on a 0° heading.

PLOT	WATER DEPTH (in inches)	GROUND COVER SPECIES	PERCENT COVERAGE	MIDSTORY SPECIES	NUMBER OF STEMS
A-1	12	Scirpus robustus	5	Iva frutescens	5
		Pologonum sp.	3		
A-2	8	Scirpus robustus	30	None present	
		Distichlus spicata	20		
A-3	8	Distichlus spicata	75	Iva frutescens	5
		Pologonum sp.	5		
		Solidago sp.	1		
A-4	6	Fimbristylis sp.	40	Iva frutescens	56
		Distichlus spicata	1		
A-5	5	Solidago sp.	45	Baccharis halimifolia	12 Lg.
		Pologonum sp.	10		
		Distichlus spicata	5		
A-6	5	Solidago	20	Baccharis halimifolia	21 Sm.
		Scirpus	10		
		Pologonum	2		
		Distichlus	2		
		Typha	2		
A-7	6	Solidago	40	Baccharis halimifolia	12
		Spartina alterniflora	2		
		Pologonum	2		
A-8	8	Solidago	20	Baccharis halimifolia	16
		Sciripus robustus	20		
A-9	8	Solidago	60	Baccharis halimifolia	19
		Pologonum	2		
A-10	12	Scirpus robustus	3	Baccharis halimifolia	5
		Pologonum sp.	10		

SAMOP-S 27 August 1984

SUBJECT: Vegetative Sample of the "Tenneco Site". A Disposal Area Adjacent to Bayou Casotte and Mississippi Sound, Jackson County, Mississippi

PLOT	WATER DEPTH (in inches)	GROUND COVER SPECIES	PERCENT COVERAGE	MIDSTORY SPECIES	NUMBER OF STEMS
A-11	8	Baccharis halimifolia	3	Baccharis halimifolia	7
		Fimbristylis sp.	30		

End of plot line approximately 50 yards south of property line East/West at north end.

2 August 1984 second plot line, starting 600 yards west of dike along east border on north property line, heading 180°. Sampled every 100 yards.

PLOT	WATER DEPTH (in inches)	GROUND COVER SPECIES	PERCENT COVERAGE	MIDSTORY SPECIES	NUMBER OF STEMS
A-12	.5	Salsola kali	80	None present	
		Distichlus spicata	15		
A-13	1	Solidago sp.	20	Iva frutescens	13
		Fimbristylis sp.	50	Baccharis halimifolia	5
A-14	1	Solidago sp.	40	Iva frutescens	27
A-15	2	Solidago sp.	80	Iva frutescens	8
				Baccharis halimifolia	16
A-16	3	Solidago sp.	60	Iva frutescens	11
A-17	5	Solidago	50	Iva frutescens	22
				Baccharis halimifolia	5
A-18	6	Solidago	5	Iva frutescens	56
A-19	8	Fimbristylis sp.	60	Myrica cerifera	4
				Iva frutescens	18
				Baccharis halimifolia	6

Plot A-19 50 yards from south dike near short pine tree.

3 August 1984 approximately 860 yards west of eastern dike along the north property line is a large wooded area with a closed canopy. The following tree species were found in groups planted in mid 1960 by H. K. Porter employees to beautify the higher disposal mounds.

Cypress, Taxodium distichum	2"-4" dbh
Sweet Gum, Liquidambar styraciflua	3"-8" dbh
Pine, Pinus sp.	6"-8" dbh
one Willow, Silax nigra	12" dbh

This area is bordered on the east south and west by a heavy stand of Baccharis halimifolia and Myrica cerifera.

PLOT	WATER DEPTH (in inches)	GROUND COVER SPECIES	PERCENT COVERAGE	MIDSTORY SPECIES	NUMBER OF STEMS
A-20	None present	Solidago	60	Baccharis halimifolia	33

SAMOP-S 27 August 1984

SUBJECT: Vegetative Sample of the "Tenneco Site". A Disposal Area Adjacent to Bayou Casotte and Mississippi Sound, Jackson County, Mississippi

PLOT	WATER DEPTH (in inches)	GROUND COVER SPECIES	PERCENT COVERAGE	MIDSTORY SPECIES	NUMBER OF STEMS
A-21	None present	Scirpus robustus	30	Silax nigra	1
		Solidago	20	12" dbh	
		Typha angustifolia	1		
		Baccharis halimifolia	1		
A-22	None present	no ground cover		Myrica cerifera	Too thick to count

No further plots were taken due to thickness of Wax myrtle and Baccharis bushes with small pockets of cordgrass, Imperata cylindrica, and tupelo grass, Panicum repens.

SECTION D-8

FISH AND WILDLIFE COORDINATION ACT REPORT

FISH AND WILDLIFE COORDINATION ACT REPORT

The U.S. Fish and Wildlife Service, in accordance with the Fish and Wildlife Coordination Act (FWCA), as amended, submitted a report on the final array of alternatives. Their Executive Summary and entire coordination act report is included on the pages immediately following this discussion. Under normal conditions, that report would be presented without comment. Since extensive revisions became necessary as a result of the review process, many of their comments are no longer germane and it was considered that some discussion was warranted to avoid any misconceptions. The USFWS recommendations presented in that report are summarized below and our response to those recommendations follows thereafter.

1. Permanent filling of wetlands and waterbottoms for dredged material disposal should be eliminated from project plans. This would not only avoid project impacts, but would also reduce project expenditures that would otherwise be required for compensation of fish and wildlife losses. Channel dimensions should be held to an absolute minimum to reduce dredging requirements. This would prolong the life of upland disposal sites and reduce the quantity of material proposed for discharge into open waters.

2. All dredged material should be placed in upland or selected gulf sites unless the intended use was for benefiting fish and wildlife resources as agreed to by the various reviewing agencies. The current maintenance dredging practice of open water disposal in the sound should be discontinued and all material which cannot be placed in upland sites should be transported to deeper waters in the gulf.

3. The FWS recommends that Plan B, with appropriate mitigation, be the selected plan. This plan would eliminate shallow open water disposal, and the quantified impacts are minor. Only 7 acres of wetlands, to be created by shaving down low productive uplands, would be required to replace fish and wildlife losses under this plan.

4. If the Grande Batture nourishment feature is pursued, they recommend that their plan, which would modify Plan D by adding gulf disposal, as in Plan B, and reduce nourishment of the Grande Batture Islands to a limited scale, be an alternative carried forward for additional study. This plan would result in only minor impacts to fish species which would otherwise be greatly impacted by Plan D. Shrimp and seatrout as well as wildlife species would benefit from such a plan. The marsh to be preserved by reduction of erosion could be considered as a project benefit.

The FWS also recommends that the creation of oyster reefs be an integral part of their suggested plan if the Grande Batture Island renourishment feature is implemented. They believe that the benefits of such a measure would far outweigh its cost. The size and location of the reefs should be coordinated with the various State and Federal agencies.

5. Plan A also results in minor quantifiable impacts, but is not as desirable as Plan B or the FWS plan because it proposes use of the existing maintenance practice of disposal within the sound. Like Plan B, only 7 acres of wetland creation would be required to mitigate the losses of wetland in Bayou Casotte. This plan is more preferable than either Plan C or Plan D as proposed and deserves further study.

6. Plan C would result in extensive fish and wildlife losses. Approximately 309 acres of wetland creation would be required to replace in-kind fish and wildlife losses. The FWS strongly recommends that Plan C as proposed be eliminated.

7. Plan E requires the filling of 257 acres of wetland at the Tenneco site and dredging of 10 acres at Bayou Casotte. The FWS opposes this alternative, but should the action be pursued, recommends that 251 acres of wetland be created as mitigation for project losses at Tenneco and 7 acres be created for losses at Bayou Casotte.

8. If wetland creation from shaving down low productive uplands is implemented as mitigation, it should be developed prior to or concurrently with project initiation. The overall detailed mitigation plan, including wetland acreage, area, wetland type, plants, survival rate assurances, monitoring, etc., should be submitted by the COE for agencies' approval prior to implementation. Compensation lands should be acquired in fee title or comprehensive easements as part of project cost. These areas would be managed either by the state or Federal government. Cost of managing these areas would also be attributed to project expense.

Other general measures which could further help mitigate any of the project plans are:

A. Dredging should be conducted during the late fall months (October - November), at which time aquatic resource spawning and migration activities are lowest.

B. Monitoring of the bay and deep gulf disposal sites should be conducted throughout the project to determine if the proposed work is creating any environmental problems.

Many of these recommendations have been incorporated throughout the planning of navigation improvements at Pascagoula Harbor. With the exception of the 4 acres of marsh to be dredged during the construction of the Bayou Casotte turning basin, no wetlands would impacted by the recommended plan. That loss would be mitigated for by restoring 6 acres of previously impacted wetlands to a more productive state. In the design of the channels and turning basin widths have been kept to a minimum, thus reducing impacts and keeping dredging requirements to a minimum. Although not economical as currently designed, additional investigations will be made concerning the nourishment of Grande Batture as well as Round Island, in the Continuing Planning and Engineering phase of the study. Additional information from the Tennessee Gas Transmission Company indicates that the Tenneco site would not be available for use as a disposal site at the proposed construction date. Plans C and E are therefore non-implementable. Restoration of 6 acres of previously impacted wetlands is proposed as mitigation for the recommended plan. The COE will coordinate the mitigation plan with concerned State and Federal agencies for their comments and recommendations. All costs for mitigation have been included in project costs following Corps of Engineers regulations. Monitoring of open water disposal sites is an integral part of maintaining Federal navigation projects and would be conducted in both Mississippi Sound and at the gulf disposal site. The level of detail of this monitoring has, as yet, not been determined. When detailed plans are available they will be coordinated with the State of Mississippi, the Environmental Protection Agency, and other concerned agencies.

The recommended plan would continue the present practice of open water disposal of maintenance materials at selected sites within Mississippi Sound. Results of the Mississippi Sound and Adjacent Areas study were used in modifying the maintenance disposal practice for the existing Federal project to include removing sites 1, 2, 5, and 6N (6) from further use because of the impacts these sites have had on water circulation and possible future impacts to water quality. Use of sites 3, 4, 65 (6B), 7, 8, and 9 does not appear to have caused any impacts to the Mississippi Sound system and projection of their future use did not show any adverse impacts. Monitoring of these areas would provide data to check our projections and make further refinements as necessary. For a detailed discussion, please refer to the Section 404(b)(1) Evaluation in Appendix D to the Main Report.

Restricting dredging to a two month period during late fall is impractical for a number of reasons. Due to the magnitude of the present maintenance operation it is not economically feasible to conduct it in two-month increments. Similarly, the size of the proposed project is such that it is not economically feasible to construct it in two-month increments. In addition results of the Mississippi Sound and Adjacent Areas Study have shown that the environmental sensitivity within the area varies spatially as well as temporally. The migratory and life cycle patterns of marine, estuarine, and terrestrial forms attest to the fact that there are particularly sensitive periods and places critical to their sustenance. It is also shown that due to the number of species utilizing the Sound and their differing physiological requirements, there is not a 'temporal window' in which usage of the Mississippi Sound is low. On the other hand, it is possible to determine specific spatial/temporal windows for restrictive locations, e.g., nesting times and sites of species utilizing proposed upland disposal sites, or small channels during spawning or migratory times, or wetland/shallow water shoreline areas during nursery activities.

To try to place a dredging window, therefore, on the Pascagoula Harbor improvements would be environmentally infeasible, and would not be responsive to navigation requirements. The dredging and disposal operation impacts a very small area in relation to the area available for the species

PASCAGOULA HARBOR, MISSISSIPPI

FISH AND WILDLIFE COORDINATION ACT REPORT

Submitted to Mobile District

U.S. Army Corps of Engineers

Mobile, Alabama

Prepared by:

Fish and Wildlife Service

Division of Ecological Services

Daphne, Alabama

September 1984

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A discussion of sediment chemistry is provided in the Problems and Impacts Sections.

Mississippi Sound

Mississippi Sound is approximately 81 miles long, 7 to 15 miles wide and averages 9.9 feet in depth (Eleuterius, C., 1976a). The portion of the sound within the limits of the Pascagoula Harbor Study extends from the Grand Bay marshes on the east to the mouth of the West Pascagoula River and south to Horn and Petit Bois Islands.

The average tidal range within the project area is approximately 1.5 feet. Tides are diurnal with a period of 24.8 hours. The major tidal wave enters the project area between Horn and Petit Bois Islands and splits in both an east and west movement.

Circulation within the study area is greatly influenced by tide, winds, and freshwater discharges. Wind can have a significant influence on the circulation patterns. Winds, especially from the east/west vectors, can tremendously affect circulation patterns within the Sound. This is demonstrated in the Mississippi Sound and Adjacent Areas Study (U.S. Army COE, Mobile District, 1983). Freshwater inflows, while having some influence on circulation, have a less significant effect. The circulation patterns do not show appreciable changes during high and low flow periods.

Salinities within the project area (from the Pascagoula River to Bangs Lake and south to the islands) are greatly influenced by freshwater inflows from the Pascagoula River. During winter and spring flood periods the salinities range from 1 to 29 ppt. (U.S. Army COE, Mobile District, 1983). During low flow periods of summer and early fall they may range from 5 to 29 ppt.

Data collected during March 1981 (high freshwater discharge) at 6 locations scattered in the Gulf of Mexico within an area 12 miles south of Petit Bois and Horn Islands and 20 miles in width (Raytheon, 1981) reflected a fairly uniform system. Data collected during July 1981 (low freshwater discharge) at 4 locations within the same area reflected a slightly stratified system.

Submerged and emergent vegetative wetlands within the sound are a major factor for the high productivity of this estuarine and marine system. Two major tracts of estuarine wetlands are the Bangs Lake marshes and the Pascagoula River marshes. Marshes are also located in smaller streams such as Bayou Casotte, the Escatawpa River, and on the islands within the Sound. Seagrasses are restricted to the north side of Horn and Petit Bois Islands. A specific discussion of these wetlands will be provided in following sections of this report.

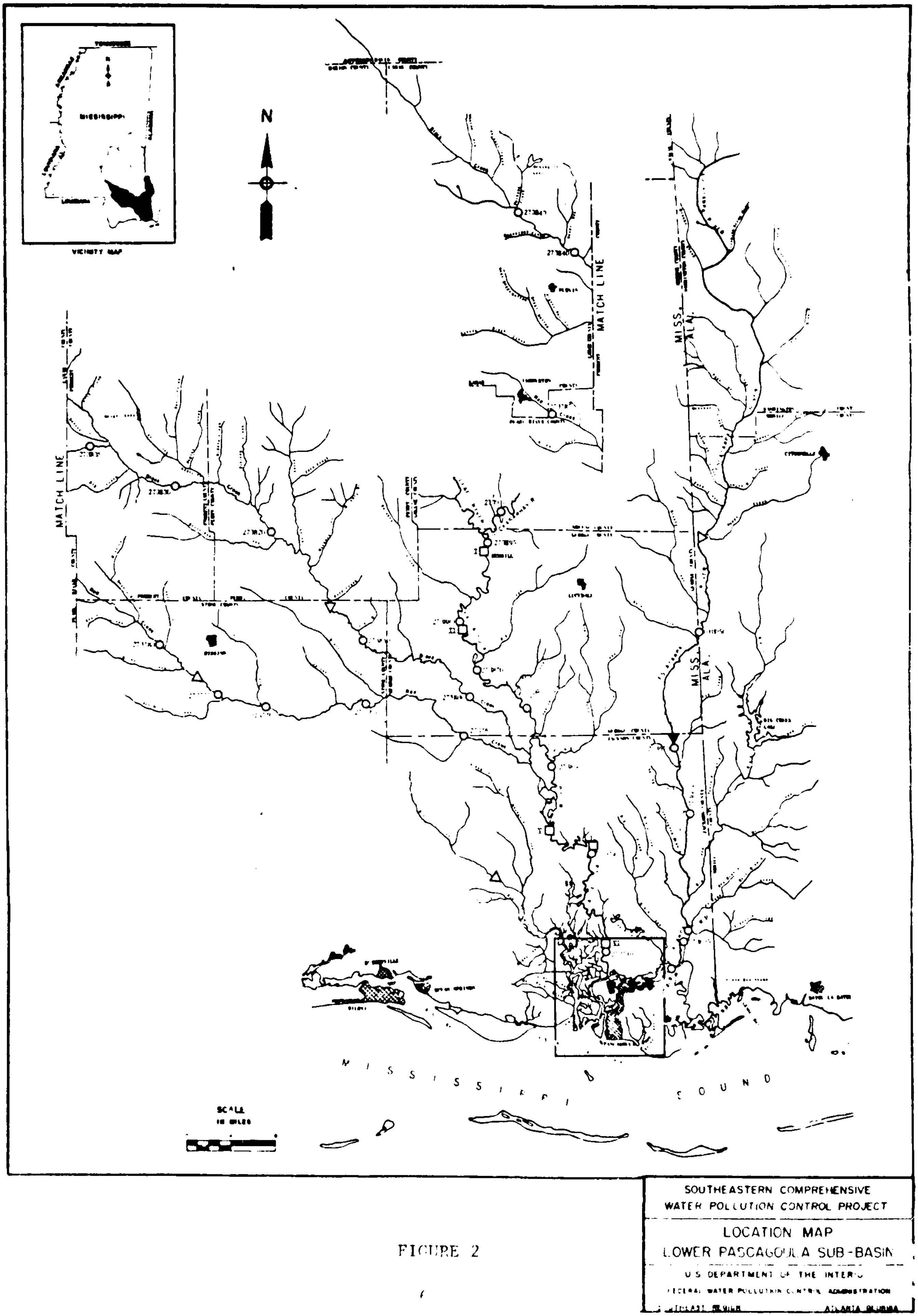
enters the lower coastal plain and is generally deep and sluggish from there on downstream. About 18 miles above its mouth the Pascagoula divides into the Pascagoula River and the West Pascagoula River. These two rivers are interconnected by a maze of bayous as they flow to the Sound. A more specific discussion of habitat types will be provided in following sections. Tidal effects are felt upstream from the mouth during low water to at least river mile 42 but not beyond river mile 53. Salt water has penetrated as far as mile 17 during hurricane tides but penetration beyond mile 17.5 would be a rare event that would be the result of a high tide occurring simultaneously with low river flow. This took place in October 1963 when the salt wedge reached mile 20. About 30 percent of the time the salt wedge is below mile 8; about 40 percent of the time, below mile 9; about 55 percent of the time, below mile 11.5; and about 89 percent of the time, below mile 15.

The Escatawpa River, which joins the Pascagoula River in an estuary common to both, has its headwaters in Washington County, Alabama. It has a length of about 111 miles of which 56 are in Alabama. The Escatawpa drains an area of about 1060 square miles. Big Creek, Jackson Creek, and Franklin Creek are important tributaries. The maximum penetration of salt water from Mississippi Sound has been observed at mile 15.5 at a time of low flows and a high tide. About 40 percent of the time the salt water front will be below mile 7; about 55 percent of the time, below mile 11; about 85 percent of the time, below mile 12.5; and more than 99 percent of the time, below mile 16.

The surface waters of the Pascagoula Basin are used for municipal and industrial supplies, stock watering, fish and wildlife, recreation, and disposal of municipal and industrial waste. Poor water quality in the lower Pascagoula and Escatawpa Rivers has been well documented. Oyster fishing in Pascagoula Bay (mouth of West Pascagoula River) has been closed since the early 1960s because of pollution. Pollution sources include municipalities, industries, oil field operations and sand and gravel operations. Water quality control measures applied to upstream sources are needed if improvements are to be realized.

The average discharge of the Pascagoula-Escatawpa River system as it enters the sound is approximately 15,200 cfs. The total sediment loads entering the Mississippi Sound from the system between 1961 and 1981 ranged between .35 million and 3.9 million tons (Simons, Li and Assoc., 1983).

Major factors that contribute to sediment distribution in the study area are inflow from the Pascagoula River system, and circulation patterns. A map showing the distribution of sediment types is shown on page 90 in the Mississippi Sound and Adjacent Areas Study Report.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M I S S I S S I P P I   S O U N D
SCALE
10 MILES
VICINITY MAP
MISSISSIPPI
SOUTHEASTERN COMPREHENSIVE
WATER POLLUTION CONTROL PROJECT
LOCATION MAP
LOWER PASCAGOULA SUB-BASIN
U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
ATLANTA, GEORGIA

FIGURE 2

AREA SETTING

The project area is located in the coastal lowlands which range from about sea level to 30 feet in elevation. Many creeks, rivers, and wetlands interact with the estuarine and marine environment of the Mississippi Sound and support a rich diversity of fish and wildlife species. The association of the marine, estuarine and palustrine systems within the project area is especially vital to the seafood industry, which provides a substantial economical contribution to the Pascagoula area. Major components of this association are broken down for specific discussion and include: 1) Pascagoula River Basin, 2) Mississippi Sound and 3) Islands within the Sound.

Pascagoula River Basin

The Pascagoula River Basin encompasses 9,700 square miles, including all or part of 22 counties in southeastern Mississippi and 3 counties in southwestern Alabama (U.S. Dept. of the Interior, 1967). Main headwater streams are the Leaf and Chickasawhay Rivers. The basin streams rise inland, flow southward, and drain into Mississippi Sound through the Pascagoula River (Fig. 2). The basin is bounded on the north and west by the Pearl River Basin, on the east by the Mobile River Basin, on the southwest by the basins of the Biloxi and Wolf Rivers, and on the south by Mississippi Sound.

Roughly oval in shape, the basin has a maximum length of 164 miles and a maximum width of 84 miles (U.S. Dept. of Interior, Feb. 1967). It lies in the Gulf Coastal Plain physiographic province. Elevations in the basin range from sea level in the Coastal Pine Meadows region to about 700 feet above mean level in the North Central Hills region.

Rainfall in the basin is heavy and, in general, well distributed throughout the year. There is some seasonal variation, with the highest monthly totals occurring in the winter and spring and the least during the fall. The average annual precipitation over the basin is about 58 inches, of which 26 percent occurs in the winter, 29 percent in the spring, 27 percent in the summer, and 18 percent in the fall. Usually March and July are the wettest months and October is the driest. During the winter and spring, runoff is about 50 percent of the precipitation. During the summer and fall it is less than 10 percent of precipitation. The area is subject to hurricanes which cause intense rainfall and high tides on the coast. Prolonged droughts seldom occur in the basin, with excessive rather than insufficient rainfall being more common.

The Pascagoula River is formed by the confluence of the Leaf and Chickasawhay Rivers in George County, Mississippi. It flows south about 81 miles from this point to Mississippi Sound. For the first 70 miles or so the river flows through a wooded floodplain and for the remaining distance through marsh. About 37 miles above its mouth, it would go to Greenwood Island, Singing River Island, or present practice.

Element VII: New work material from Bayou Casotte would go to the Tenneco area. The main channel new work and all O&M would go to the gulf.

The alternative plans which are being evaluated by the COE in detail for the draft feasibility report are:

Plan A = Elements I + II + III
Plan B = Elements I + II + IV
Plan C = Elements I + II + V
Plan D = Elements I + II + VI
Plan E = Elements I + II + VII

The current benefit/cost ratios of each plan, excluding fish and wildlife resource mitigation costs, are: Plan A (6.5), Plan B (6.4), Plan C (6.5), Plan D (4.0), and Plan E (6.7). Mitigation cost on a per acre basis will be provided with this report. The average time of construction has been calculated to be 3 years. This will be included with the 50 year beneficial project life (53 years) for purposes of calculating average annual habitat units (AAHU) for the various plans and mitigation measures.

development. Various commercial and industrial interests now occupy much of this landfill.

Maintenance material from within Bayou Casotte Harbor has in the past and is now being placed on a diked 101-acre portion of Greenwood Island. Most of the maintenance material from the Mississippi Sound portion of the Bayou Casotte Channel is discharged into the sound 2000 ft. east of and parallel to the channel. One open water disposal site is located on the west side of the channel near the mouth of Bayou Casotte.

With the proposed expanded project, the existing 38 ft. channel which crosses about 22 miles of the sound would be deepened to 42 ft. The channel in the area of Horn Island Pass would be deepened to 44 ft. and the Bayou Casotte Channel would be widened to 350 ft.

The disposal plans are combinations of various elements including:

Element I: Disposal of all materials, both new work and maintenance, from the Horn Island Entrance Channel in a shallow subtidal region south of Horn Island;

Element II: Disposal of all materials (new work and operation and maintenance (O&M)) from the Pascagoula inner harbor channels in the existing Singing River Island or Double Barrel disposal sites. Bayou Casotte inner harbor new work and O&M to Greenwood Island. About 10 acres of wetlands would be dredged in Bayou Casotte for a turning basin.

Element III: Disposal of the new work material from the three sound channels in the Gulf of Mexico; maintenance materials to be disposed of utilizing current practices; turning basin dredged in Bayou Casotte.

Element IV: Sound channels - new work to gulf, O&M to gulf. Turning basin to be dredged in Bayou Casotte.

Element V: New work material from the lower and upper Pascagoula channels would be used to enlarge the Singing River Island disposal site. This enlargement would be conducted using new work material and would require the filling of 50 acres of existing wetlands. New work materials from the Bayou Casotte Channel to be placed on 257 acres of wetlands on the Tenneco property. Maintenance materials to be placed in Singing River Island, Greenwood Island, or via present practices.

Element VI: Material from Bayou Casotte Channel would go to renourish the Grande Batture Island chain. This would result in a rip-rap dike 16,000 ft. long, 240 acres of fill behind the dike, and 570 acres of open water marsh creation behind the fill. The upper and lower sound channel material would go to Singing River Island. O&M

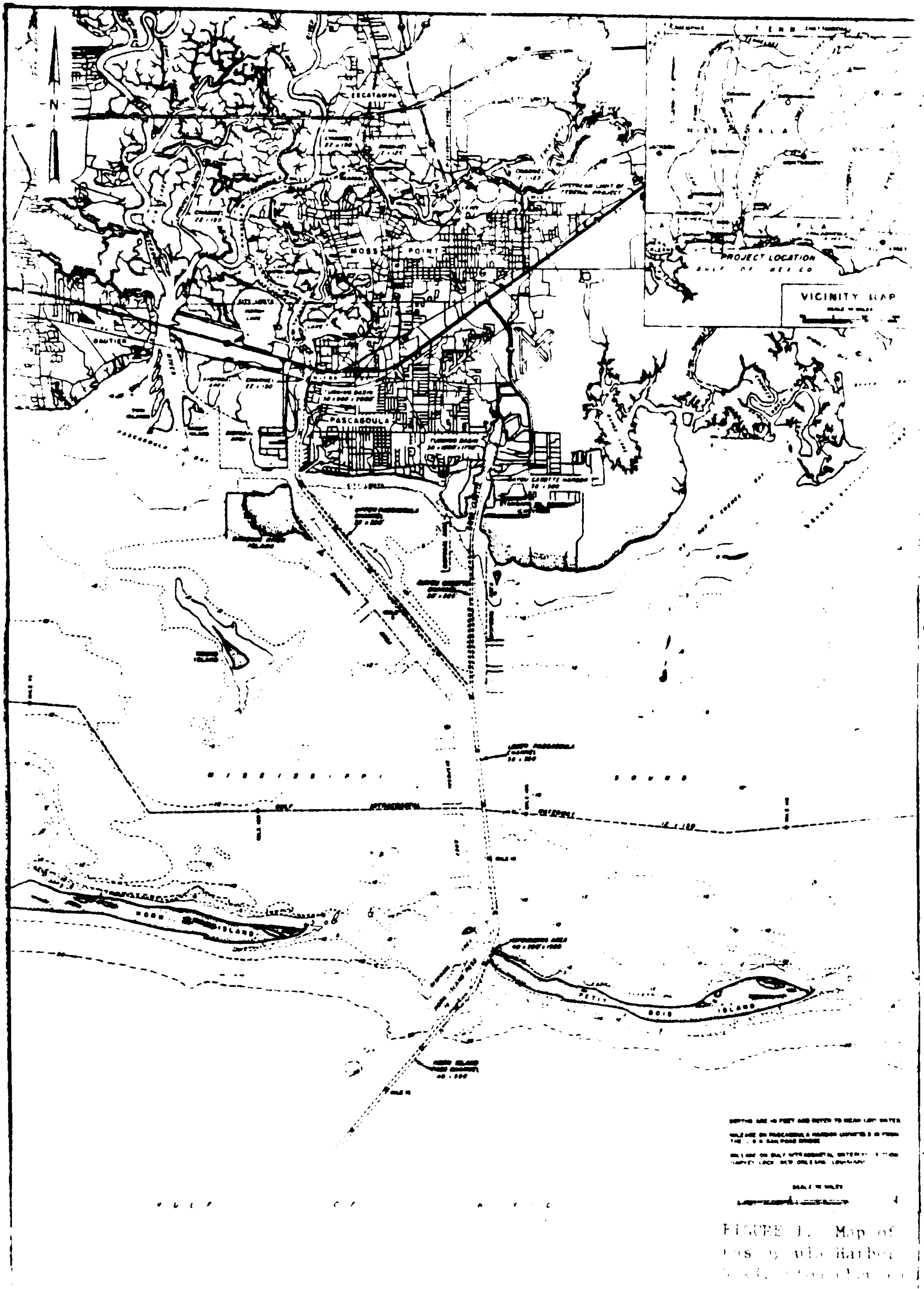


FIGURE 1. Map of
Pascagoula Harbor
[illegible]

PROJECT DESCRIPTION

A survey study of the Pascagoula Harbor, Mississippi, is now being conducted by the COE. This project concerns both the Pascagoula Harbor and Bayou Casotte navigation channels and is located at Pascagoula, Mississippi (Fig. 1). Pascagoula Harbor is located on the west side of the city of Pascagoula, at the mouth of the East Pascagoula River, a main distributary of the Pascagoula River. Bayou Casotte Channel is located about 3 miles east of Pascagoula Harbor. The overall Pascagoula/Bayou Casotte navigation complex is divided into four major channel segments which are: Horn Island Entrance Channel, Lower Pascagoula Channel, Upper Pascagoula Channel, and Bayou Casotte Channel (Fig. 1).

The existing project was authorized by the River and Harbor Acts of March 4, 1913, March 4, 1915, May 17, 1950, September 3, 1954, July 3, 1958, July 14, 1960, and October 23, 1962. Work was completed in August 1965 and consists of a channel 40 ft. deep, 350 ft. wide, and approximately 4 miles long from the Gulf of Mexico through Horn Island Pass, a 40 by 200 by 1500 ft. impounding area for littoral drift adjacent to the channel at the west end of Petit Bois Island, a 38 by 350 ft. channel approximately 11 miles long through Mississippi Sound and up the East Pascagoula River to the railroad bridge at the city of Pascagoula, and a 950 by 2000 ft. turning basin adjoining the west side of the Pascagoula River channel; and a 38 ft. by 225 ft. channel approximately 3 miles long from the main channel in Mississippi Sound to the mouth of Bayou Casotte, thence 38 by 300 ft. for one mile up Bayou Casotte to a 38 by 1000 ft. turning basin.

Dredged material from construction and maintenance of the Gulf of Mexico portion of the channel has in the past been removed by hopper dredge and disposed of south of Horn Island in water 30 to 40 ft. deep. Spoil from the channel across Mississippi Sound and into the East Pascagoula River has been placed in the sound 2000 ft. west of and parallel to the channel. Irwin Lake, part of Lac La Buche, and marshes adjoining these waterbodies were filled during harbor development and are now partially occupied by the Ingalls shipbuilding complex. Maintenance spoil from the river has been placed in a diked, 115-acre portion of this filled area. Additional maintenance material from a nearby segment of the project has been placed in a diked portion of a 333 acre spoil island, located just south of the mouth of the East Pascagoula River.

Dredged material from construction of the Bayou Casotte Channel was previously placed approximately 2000 ft. east of and parallel to the channel in Mississippi Sound, in Back Bayou (a former tributary of Bayou Casotte), on marsh and uplands adjoining Back Bayou, on the east shore of Bayou Casotte, and on marsh and uplands of Greenwood Island on the west side of Bayou Casotte. Back Bayou, part of Bayou Casotte, and marshes adjoining these waterbodies were filled during harbor

7. Plan E requires the filling of 257 acres of wetland at the Tenneco site and dredging of 10 acres at Bayou Casotte. As of now, the FWS opposes this alternative, but recommends that should the action be pursued 251 acres of wetland be created as mitigation for project losses at Tenneco and 7 acres be created for losses at Bayou Casotte.

8. If wetland creation from shaving down low productive uplands is implemented as mitigation, it should be developed prior to or concurrently with project initiation. The overall detailed mitigation plan, including wetland acreage, area, wetland type, plants, survival rate assurances, monitoring, etc., should be submitted by the COE for agencies' approval prior to implementation. Compensation lands should be acquired in fee title or, if acceptable, comprehensive easements as part of project cost. These areas will either be managed by the State or Federal government. Cost of managing these areas over the project life will also be attributed to project expense.

Other general measures which could further help mitigate any of the project plans are as follows:

A. Dredging should be conducted during the late fall months (October - November) at which time aquatic resource spawning and migration activities are lowest.

B. Monitoring of the bay and deep gulf disposal sites should be conducted throughout the project to determine if the proposed work is creating any environmental problems.

Sincerely yours,

Assistant Regional Director--
Habitat Resources

should be held to an absolute minimum to reduce dredging requirements. This would prolong the life of upland disposal sites and reduce the quantity of material proposed for discharge into open waters.

2. All dredged material should be placed in upland or select gulf sites unless the intended use of such is for benefiting fish and wildlife resources as agreed to by the various reviewing agencies. The current maintenance dredging practice of open water disposal in the sound should be discontinued and all material which cannot be placed in upland sites should be transported to deeper waters in the gulf.

3. The FWS recommends that Plan B, with appropriate mitigation, be the selected plan. This plan would eliminate shallow open water disposal, and the quantified impacts are minor. Only 7 acres of wetlands to be created by shaving down low productive uplands would be required to replace fish and wildlife losses under this plan.

4. If the Grande Batture nourishment feature is pursued, we recommend that our suggested plan, which basically modifies Plan D by incorporating the gulf disposal, as in Plan B, and the renourishment of the Grande Batture Islands on a limited scale, be an alternative carried forward for additional study. This plan would result in only minor impacts to fish species which would otherwise be greatly impacted by Plan D. Shrimp and seatrout as well as wildlife species would benefit from such a plan. The acres of marsh to be preserved by reduction of erosion could be considered as a project benefit.

The FWS also recommends that the creation of oyster reefs be an integral part of our suggested plan if the Grande Batture Island renourishment feature is implemented. The benefits of such a measure would far outweigh its cost. The size and location of the reefs should be coordinated with the various State and Federal agencies.

5. Plan A also results in minor quantifiable impacts, but is not as desirable as Plan B or the FWS plan because it proposes use of the existing maintenance practice of disposal within the sound. Like Plan B, only 7 acres of wetland creation would be required to mitigate the losses of wetland in Bayou Casotte. This plan is more preferable than either Plan C or Plan D as they are currently proposed. It deserves further study.

6. Plan C would result in extensive fish and wildlife losses. Approximately 309 acres of wetland creation would be required to replace in-kind fish and wildlife losses. The FWS, therefore, strongly recommends that Plan C as proposed be eliminated.

the open waters. We are cognizant that marshes are a valuable resource and one that is diminishing along the gulf coast. However, we are also aware of the problems of creating marshes in open waters and, therefore, believe that the magnitude of marsh as proposed under Plan D is excessive. Our proposal is that this acreage be reduced to about 80 acres of open water fill for marsh creation.

If Plan B is not selected, we have proposed a plan which could meet the intended project objective, reduce the amount of fill on wetlands and waterbottoms that is currently proposed with Plan D, and provide positive fish and wildlife impacts. This plan would incorporate parts of the COE Plans B and D. Some of the new work material could be used for marsh creation behind the stabilizing dike. However, reasonable assurances must be provided that the marsh creation would be successful behind the dike, and if not, total restoration would be provided. The FWS plan would eliminate the massive amounts of fill by taking the new work material not needed for an acceptable Grande Batture Islands feature to gulf sites. All maintenance material as proposed under Plan B would also be taken to the gulf. In addition to coordination with FWS, further study of the marsh creation plans and assurances of success should be coordinated with the Mississippi Department of Wildlife Conservation (Bureau of Marine Resources), the National Marine Fisheries Service, and EPA. All material not used for such purposes should then be taken to gulf sites as proposed under Plan B.

In addition, the FWS proposes that oyster reef construction also be investigated as part of the FWS plan if this alternative is pursued. The monetary return on reefs is high and could be positively reflected in the benefit/cost ratio.

In general, if Plan B is not selected, we believe that an acceptable plan could be worked out that would incorporate the Grande Batture Islands feature and reduce the impacts and amount of fill as proposed under Plan D. As stated above, the high benefit/cost ratio of this project should provide the flexibility for development of such a plan. Plan C is extremely adverse and would require over 300 acres of costly compensation. This plan should, therefore, be eliminated.

In view of the different degrees of impacts associated with the various alternatives and the potential to achieve project objectives with limited amounts of adverse impacts, we make the following specific recommendations:

1. Permanent filling of wetlands and waterbottoms for dredged material disposal should be eliminated from project plans. This would not only avoid project impacts, but would also reduce project expenditures that would otherwise be required for compensation of fish and wildlife losses. Channel dimensions

material not needed for the Grande Batture Island feature to be taken to the gulf sites. About 80 acres of wetland would be established behind the dike. This would grade from higher marsh vegetation to more tidal vegetation as it extended from the dike. Only 10 acres of wetlands would be lost due to the dredging of the turning basin within Bayou Casotte. All maintenance material would go to open gulf sites.

The various alternatives pose potential damages and benefits to fish and wildlife resources. Under Plan B the current practice of discharging maintenance material in Mississippi Sound would be eliminated. Instead, all new work and maintenance material would be taken to gulf sites. The FWS views gulf disposal as a positive feature when compared to the current method of disposal in the shallow sound. Furthermore, this plan avoids the permanent filling of wetlands at Singing River Island. Because it is the least damaging alternative, the FWS recognizes this plan, as currently proposed, as being preferred.

However, a major resource problem within the project area that is not considered by this plan is natural erosion of marsh as in the Bangs Lake area. A high wave climate has completely eroded the Grande Batture Islands and is now eroding the Bangs Lake marshes. The FWS and COE have agreed that this erosion could possibly be reduced by renourishing the Grande Batture Islands as a project feature.

Aerial photos from 1956 and 1979 reveal that about 200 acres of marsh have been lost in the Bangs Lake area as a result of erosion over that time frame. We estimate that this erosion could be reduced by 80 percent over the project life by stabilizing the Grande Batture Islands. This would result in the saving of about 400 acres of wetlands from erosion by the end of the project life, which amounts to about 196 acres when annualized.

The COE has incorporated this renourishment feature into Plan D. However, this plan also includes the filling of 50 acres of wetland at Singing River Island. In addition, Plan D would also require 240 acres of fill behind a riprap dike at the Grande Batture Islands as well as 570 acres of open water marsh creation adjacent to that fill using 7 million cubic yards of new work material.

Even though the concept of saving the eroding marsh by reconstructing the islands is supported by the FWS, we believe that the magnitude of the fill material associated with Plan D is such that it should be modified or eliminated. Attempts at open water marsh creation have, in some cases, not been successful. Furthermore, this form of marsh creation often replaces productive shallow waters. Therefore, the actual habitat gain is not as high as with shaving down low productive uplands to create marsh. The actual trade-off depends on the value of

The major environmental concern for each alternative plan is centered around the deposition of material dredged from within Mississippi Sound. Material dredged from the upper channels and entrance channel will go into either upland or approved open water sites.

Plan A would take all of the new work dredged material from the Mississippi Sound channels to gulf sites. This plan, as well as all other plans, would require the new work and maintenance material from the entrance channel to be disposed in open waters at the south site off the east end of Horn Island. Maintenance would occur using the existing open water disposal method. About 10 acres of vegetated wetland would be lost due to dredging in Bayou Casotte.

Plan B is similar to Plan A except that all new work and maintenance material would be taken to gulf sites.

Plan C would involve the use of new work material for filling 50 acres of wetland at Singing River Island and 257 acres of wetland within the Tenneco area. An additional 10 acres of marsh would be dredged in Bayou Casotte and maintenance material would be placed in Mississippi Sound.

Plan D would require filling 50 acres of wetland at Singing River Island with new work material. New work material (7 million cubic yards) from Bayou Casotte would go to the Grande Batture Island area for renourishment. About 240 acres of fill would be placed behind a dike constructed at that site. An additional 570 acres in this area would be used for open water marsh creation. Maintenance material would be placed within the sound.

Plan E (the NED plan) would require that the new work from the Pascagoula Channel as well as maintenance material be taken to gulf sites. The material within the inner harbor areas would be placed in existing upland disposal areas. New work from the Bayou Casotte channel would go into 257 acres of wetland at the Tenneco site. All maintenance material would then go to gulf sites. About 10 acres of wetlands would be dredged for the Bayou Casotte turning basin. The jurisdictional status of the Tenneco wetlands in terms of the applicability of Section 404 of the Clean Water Act (33 U.S.C. 1344) is still questionable and is currently being reviewed by the Environmental Protection Agency (EPA). EPA's decision could play a major role in the mitigation requirements for this wetland. This report is written in the context that the area is jurisdictional as reflected by our suggested mitigation requirements. The FWS' recommendations, therefore, could be subject to change pending a final jurisdictional determination. If so, a supplemental report addressing this feature of the project should be provided.

The FWS plan is basically a modified version of Plan D which recommends the use of less open water fill behind the Grand Batture Island dike. This plan is suggested in case the Grande Batture Island feature is pursued. The FWS plan would require all of the new work

United States Department of the Interior
FISH AND WILDLIFE SERVICE
75 SPRING STREET, S.W.
ATLANTA, GEORGIA 30303

October 9, 1984

Colonel Patrick J. Kelly
District Engineer, U.S. Army
Corps of Engineers
Post Office Box 2288
Mobile, Alabama 36628

Dear Colonel Kelly:

The Fish and Wildlife Service (FWS) has prepared the accompanying report relative to fish and wildlife impacts associated with the proposed expansion of the Pascagoula Harbor Navigation Project, Mississippi. This report is submitted in accordance with the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.).

The FWS has reviewed five alternative plans (A,B,C,D and E) proposed by the Corps of Engineers (COE) for deepening the existing Pascagoula Harbor channels. We have also recommended further study of a modified version of Plan D, which incorporates the Grande Batture Island nourishment feature, and is referred to as the FWS plan. While some alternatives would have extremely adverse environmental impacts, others could provide the intended navigation objectives while at the same time possibly benefiting fish and wildlife resources. In some cases, modifications of certain project features may have to be made to develop a totally agreeable plan. In view of the high benefit/cost ratios for several alternative project plans, we believe that the flexibility exists that would allow our agencies to work out a mutually agreeable solution. Major concerns of the FWS involve filling wetlands and waterbottoms, disposal of dredged material in the gulf and Mississippi Sound, marsh erosion within the Bangs Lake area, and water quality. When quantifiable, beneficial and adverse project impacts of each plan were assessed by use of the FWS' Habitat Evaluation Procedures (HEP). Acreages and methods of compensation as well as positive project impacts are specifically identified in the recommendation section of this summary and in the project report.

The Pascagoula project area supports a rich diversity of fish and wildlife resources. Vegetated wetlands and open waters found here provide optimum habitat for many species that support varied consumptive and non-consumptive human uses. The multimillion dollar seafood industry of this area, as well as overall area environmental quality, are dependent upon the health of this estuarine complex.

Islands

Several islands are found within the project area. Singing River Island is near the harbor and is a major disposal site for upper harbor channel maintenance. Portions of this island (about 115 acres) consist of emergent wetlands. Another smaller island southwest of Singing River Island is Round Island which is part of the Coastal Barrier Resources system. This island is experiencing a significant erosion problem. A section pertaining to the Coastal Barriers Resources Act is contained in this report. This island is well vegetated with forest and emergent vegetation. It is an important nesting and resting area for ospreys and great blue herons.

Two other major islands located within the Sound and study area are Horn and Petit Bois. Both are part of the Gulf Islands National Seashore. They are about 16 km south of the Mississippi mainland (Fig. 1).

Prior to Hurricane Frederic in September 1979, Petit Bois Island was about 6.7 km and Horn Island 21.7 km long. At their widest points, Petit Bois and Horn Islands were 1.06 km and 1.11 km respectively. (U.S. Dept. of the Interior, NPS, 1979). Both islands experienced noticeable erosion along their northern shores as a result of Hurricane Frederic. The area of Petit Bois is about 1500 acres while Horn is approximately 3600 acres.

Southerly winds striking the barrier islands generate wave action which contribute to the westerly drifting currents along the seaward side of the islands (U.S. Army 1979: A-32). This flow results in a westward drift of sediments along the beaches (Eleuterius, C.K., 1975:31). The navigation channel which enters the sound through Horn Island Pass near the western tip of Petit Bois Island prevents the natural westerly drift of the island which is predicted to be about 1 ft. per year.

Petit Bois and Horn Islands contain well developed beaches on the gulf side which are backed by well defined dune lines. Marshes and small tidal and non-tidal pools are located in the middle and northern portions of the islands. Several species of sea grasses occur along the northern shores of the islands. A description of the fish and wildlife resources associated with these islands is provided in following sections of this report.

FISH AND WILDLIFE RESOURCES

HABITAT TYPES

Within the immediate project area several habitat types are found which support many species of fish and wildlife. These include but are not limited to evergreen forest, hardwood forest, palustrine forested wetlands, palustrine emergent wetlands, estuarine emergent wetlands, submerged aquatic beds, intertidal flats, open water bottoms, beaches, and dunes. Approximately 160,000 acres of these habitats are located within the project area. The acreages of each habitat type as derived from national wetland inventory maps (USFWS, 1979) are shown in Table 1.

Within the project area, habitat types that could most be subject to alteration from direct and secondary project actions are palustrine emergent wetlands, estuarine emergent wetlands, estuarine scrub/shrub, intertidal flats, beaches and dunes, submerged aquatic beds, and open waters of the Sound.

These waterbottoms, grassbeds, intertidal flats and tidal marshes provide vital spawning, nursery, and feeding habitat for a major portion of the marine and freshwater finfishes and shellfishes. In addition, these habitats also support many species of wildlife.

The high values of wetlands is of such importance that the following section is devoted to the different types of wetland resources in the study area and their general location. Species of fish and wildlife which use these systems are further discussed in detail under the Fish and Wildlife Resource Sections.

Table 1

Habitat Distribution Within the Pascagoula Harbor Study Area[1]

Habitat Type	Area (acres)
Marine Open Water	20,575
Estuarine Open Water	94,053
Riverine	162
Palustrine Open Water	52
Estuarine Open Water - Excavated/Diked	364
Palustrine Open Water - Excavated/Diked	280
Marine Intertidal Beach/Bar	245
Estuarine Intertidal Beach/Bar	202
Estuarine Intertidal Flats	963
Palustrine Flats	79
Estuarine Subtidal Aquatic Beds	1,838
Estuarine Intertidal Aquatic Beds	62
Palustrine Aquatic Beds	8
Estuarine Emergent Wetlands	28,985
Palustrine Emergent Wetlands	1,415
Palustrine Emergent Wetlands - Diked	253
Estuarine Scrub/Shrub	320
Palustrine Scrub/Shrub	418
Palustrine Scrub/Shrub - Diked	127
Estuarine Forested - Evergreen	114
Palustrine Forested - Evergreen Broad-Leaf	223
Palustrine Forested - Evergreen Needle-Leaf	6,379
Palustrine Forested - Deciduous Broad-Leaf	1,149
Palustrine Forested - Deciduous Needle-Leaf	72
Palustrine Forested - Dead	45
Upland Forested - Evergreen	1,733
Dunes	165
Agricultural	554
Spoil	323
Urban/Industrial	11,436

[1]Calculated from National Wetlands Inventory Maps (USFWS, 1979)

WETLANDS

Fish and Wildlife Service Definition

Typically, wetlands are lands where hydric saturation is the overriding factor in determining the nature of soil development and the types of floral and faunal communities inhabiting the terrain. The FWS defines wetlands in its Classification of Wetlands and Deepwater Habitats of the United States as "...lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water." (U.S.D.I. 1979). Additionally, at least one of the following characteristics must be applicable to an area in order to be classified as a wetland: 1) at least periodically, the land supports predominantly hydrophytes; 2) the substrate is predominantly undrained hydric soils; and 3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year.

Wetlands within the project area provide excellent fish and wildlife habitat. The following sections will specifically discuss wetland values with major emphasis on palustrine and estuarine types. Use of these habitats by various fish and wildlife species will be specifically addressed in the appropriate fish and wildlife sections.

Within the project area a variety of habitat types are prevalent. For purposes of discussion and in consideration of those habitats most likely to be impacted by direct and secondary project impacts, we have broken them down to include (1) palustrine forested wetlands, (2) palustrine scrub/shrub, (3) palustrine emergent wetlands, (4) riverine, (5) estuarine scrub/shrub, (6) estuarine emergent wetlands, (7) estuarine intertidal flats, (8) seagrasses, and (9) estuarine subtidal open water and marine subtidal open water.

Palustrine Wetlands

Palustrine wetlands are all nontidal wetlands consisting of emergent mosses or lichens, persistent emergents, shrubs, trees, and all such wetlands that occur in tidal areas where the salinity is below 0.5 ppt. The palustrine system includes the vegetated wetlands that have been traditionally called fresh marshes, bottomland hardwoods, and swamps. These wetlands are commonly located along river channels, shoreward of lakes, river floodplains, inland lakes, and on slopes.

The broad category of palustrine wetlands has been further subdivided into groups which describe the various habitats in terms of either dominant life form of the vegetation or the physiography and composition of the substrate. The classes of palustrine wetlands include: forested wetlands, scrub/shrub wetlands, emergent wetlands, unconsolidated bottom, aquatic bed, and aquatic flats.

Palustrine forested wetlands are not prevalent within the immediate project area and are basically associated with the Pascagoula and Escatawpa River system. Some remnant tracts are present along Bayou Casotte. Vegetation associated with this habitat type include water oak (Quercus nigra), sweetgum (Liquidambar styraciflua), swamp bay (Persea palustris), pond cypress (Taxodium distichum), sweet bay (Magnolia virginian), and red maple (Acer rubrum).

Palustrine emergent wetlands are found primarily in the reaches of the Pascagoula River above I-10. The palustrine emergent wetlands are characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. The vegetation is generally present for most of the growing season and is usually dominated by perennial plants. Emergent wetlands have been subdivided into two subclasses consisting of persistent and nonpersistent wetlands. Persistent emergent wetlands are dominated by plants which are typically standing throughout the year until the beginning of the next growing season. Characteristic vegetation associated with persistent emergent wetlands in the project area includes cattails, bulrushes, and smartweed. In contrast, nonpersistent wetlands are dominated by plants which fail to remain standing and fall below the surface of water at the end of the growing season. Common vegetation associated with this wetland subclass consists of bulltongue, pickerelweed, arrowhead, and wild rice. Both persistent and nonpersistent emergent wetlands occur throughout the project area.

As the tidal and salinity influences are felt downstream near Mississippi Sound, vegetative types change. This condition is most noticeable between Highway 90 and Interstate 10 and demonstrates the transition between the palustrine and estuarine systems.

The water bottoms, grassbeds, and tidal marshes within the Pascagoula River estuarine system provide vital spawning, nursery, and feeding habitat for many marine and freshwater finfishes and shellfishes. The detrital material produced in the estuary is a major component of the estuarine and marine food chain.

Estuarine Wetlands

The estuarine system can be broken down into two subsystems (subtidal and intertidal) with each of these being further divided into separate classes which are rock bottom, unconsolidated bottom, rocky shore, unconsolidated shore, aquatic bed reef, streambed, emergent wetland, scrub/shrub wetland, and forested wetland (Cowardin et al., 1979).

The assemblages of organisms within each of the estuarine subsystems range from fresh to marine in character inhabiting areas ranging from vigorously flushed to somewhat stagnate waters. The hydrodynamic conditions of an estuary influence the circulation, storage, and recycling of organic materials and nutrients which help assure a perpetual supply of ingredients to maintain high levels of biological productivity. Estuarine hydrology is greatly influenced by discharge of fresh water, tidal movements, currents, and wind.

Estuarine scrub/shrub wetlands in the study area are primarily located along the Pascagoula River in the area of Hwy 90 and in the Tenneco/Bayou Casotte areas. (Baccharis halimifolia) dominates the scrub/shrub system. Estuarine emergent wetlands are generally composed of such species as threesquare (Scirpus spp), black needlerush (Juncus roemerianus), saltmeadow cordgrass (Spartina patens), and giant cordgrass (Spartina cynosorides). In the more saline marshes, species such as black needlerush (Juncus roemerianus) and saltgrass (Distichlis spicata) are dominant. Smooth cordgrass (Spartina alterniflora) is also common along the intertidal zones of the saline marshes. Most of the saline marshes are located south of I-10. These marshes are also prevalent in the Bangs Lake, Tenneco, and Bayou Casotte areas. Saline marshes consisting primarily of (Juncus roemerianus) and (Distichlis spicata) are also located on Horn, Petit Bois, and Singing River Islands.

The works of Smalley (1959), de La Cruz (1965), Heald (1969), Odum (1970), and Kirby (1971) have demonstrated the various processes that contribute to the biological fertility of estuarine marshes. These are summarized as follows (de La Cruz 1973):

1. The net primary production of the vascular plants on the marsh is high and only a small percentage (less that 10%) of the organic material produced by the marsh plants is actually grazed by marsh herbivores.

2. The bulk of the plant material dies (annually for most of the species) and falls to the surface of the mud where it may decompose to particulate organic detritus, or be transported to the estuarine waters and neighboring marine environment, or both.

3. Much of the detritus is consumed by detritivores, mostly filter feeders and benthic scavengers which form the base of the food chain for secondary and higher consumers.

4. The detritus feeders obtain their nutrition primarily from bacteria, fungi, and protozoa attached to the detrital particles rather than from the relatively resistant cellulose and lignin substrate.

5. The attendant microbes increase the protein content and either maintain or increase the caloric value of the detritus to the point where it presents a food source of high nutritional value.

Marshes also provide habitats for many species of plants and animals and are vital spawning, feeding, and nursery grounds for most marine fishes. Furthermore, they buffer storm surges and act as catch basins for runoff and other forms of upland pollution.

Seagrasses (Humm 1973) are also an important integral part of the estuary as illustrated by the following description of their ecological roles:

1. They trap sediment and stabilize bottom sediments;

2. They carry on basic productivity that, in the eastern Gulf, may considerably exceed the basic productivity of all the benthic algae of the same area or of the plankton in the overlying water;

3. They serve as a direct food source for marine organisms while partially decomposed leaves in the form of detritus serve as food for a wide variety of detritus-feeders, especially invertebrates and some fishes;

4. They serve as a nursery for juveniles of many species of seafood organisms including shrimp, crabs, bay scallops, and fishes;

5. They provide a habitat for a certain assemblage of invertebrate species that burrow or grow attached to the leaves; and

6. They provide an important substrate for attachment of scores of species and a significant biomass of benthic algae.

Submerged grassbeds within the project area are primarily limited to the northern shores of Horn and Petit Bois Islands. About 700 acres of grassbeds were identified in these areas in 1979 (COE Resource Inventory, Pascagoula Harbor). Species common to these islands are manatee grass (Cymodocea manatorum), turtle grass (Thalasia testudinum), and shoal grass (Halodule wrightii).

Intertidal flats are defined as portions of the unvegetated bottom of sounds, lagoons, estuaries, and rivers which lie between the high and low tide lines. These habitats are unvegetated only in the sense that they lack macroscopic plants such as grasses and shrubs. Benthic microalgae are usually abundant. Intertidal flats serve not only as a primary site for conversion of plant matter by benthic invertebrates but also as a major location for baitfish feeding such as anchovies, sardines, menhaden, and shad which are planktivorous, herbivorous, or detritivorous. Bait fishes are vital links in the estuarine food chains. Many marine fishes are also dependent upon intertidal flats in critical postlarval stages because they need the shallows for protection from predators. Intertidal flats are important in their own right as producers of usable plant matter. Even more significant is their function as the primary estuarine habitat where plant production from other habitats of the estuary is converted into animal biomass. (U.S.D.I. 1979a). Flats are exposed during low tides and especially those associated with strong north winds along the shorelines and within the marshes of the Sound.

Open waters within the Mississippi Sound and project area, with the exception of the channels, range in depths of up to 18 feet near the islands. The majority of the inshore bottoms (between the mainland and islands) consist of muddy-sand. Mud bottoms are prevalent near the mainland and the passes are composed primarily of sand (U.S. Army COE, Mobile District, 1983).

FISHERIES

The forested and emergent wetlands, rivers, tidal streams, flats, subtidal regions (sound), and grassbeds provide extremely valuable habitat for many commercially and recreationally important fin and shellfishes. As stated in the previous habitat section, these wetlands play an extremely important role as food and shelter for most of the aquatic organisms within the project area. In addition, this vegetation also serves a valuable function by assimilating various pollutants from the water column. The ability of wetlands to absorb pollutants becomes even more important when located in a highly industrialized area such as Pascagoula Harbor.

A large number of organisms including phytoplankton, zooplankton, and benthos also contribute to the high fishery value of the Mississippi Sound Region. A detailed discussion on these organisms is found in the Mississippi Sound and Adjacent Areas Plan Formulation Document (U.S. Army COE, Mobile District, 1983). Much of the bottom productivity and fishery utilization of these areas depends on their physical makeup. Lunz and Kendall, 1983, showed that a silty-mud bottom was intensively used by many bottom feeding fishes within the Sound. Much of this substrate type is prevalent within the project area. The degree of use by various organisms is also influenced greatly by depth.

In addition to the food and cover provided by vegetation and substrate, other important physical features of this estuarine area that are vital to fishery production are the passes between the islands. These areas are primary migration routes for fishes passing between gulf waters and the estuarine marshes. Maps furnished the Corps by the FWS show fishery use of these areas by seasons. These maps are contained in the Mississippi Sound and Adjacent Areas Study.

Christmas and Waller, 1973, reported 138 fish species in 98 genera and 52 families taken from stations across Mississippi Sound. The bay anchovy (Anchoa mitchilli) were the most abundant species and made up over 70% of the catch. Menhaden (Brevoortia patronus), Atlantic croaker (Micropogonias undulatus), and spot (Leiostomous xanthurus) followed in order.

Richmond (1962) recorded 61 fish species from Horn Island or nearby waters. Modde and Ross (1978) studied the surf zone of Horn Island and recorded 76 species of which many were immature marine and estuarine species. It is believed that the high energy beaches of the islands perform as a nursery function in the early life stages of many marine fishes.

The life stages of most estuarine dependent fishes can be generally described. Most of these fish spawn in the open waters of the Gulf of Mexico. As the larval stages develop they are carried into the estuary by currents through the passes. As larvae reach the mouths of rivers and streams they are normally mature enough to swim into these systems for shelter and food. Once mature, they migrate out of the estuaries and back to the gulf to spawn. The value of the estuary to marine fishes is well documented.

To further emphasize the importance of the estuarine system we have selected two species of finfishes that are of high recreational (spotted seatrout) and commercial value (menhaden) to illustrate life stage requirements. For this illustration, commercial species are those which are harvested on a large scale by professional fishermen for human consumption or industrial use such as creating meals, oils, and animal foods. This fishery contributes greatly to the economic base of the study area as well as radiating influence to other parts of the country. Commercial landings (pounds, dollars) for the study area are provided in Table 2. Sport or recreational species are those primarily harvested by sports fishermen with rod and reel in lieu of commercial nets. This activity also generates much revenue for the local economy. Some species, such as spotted seatrout, contribute to both the commercial and recreational fishery.

The spotted seatrout, (Cynoscion nebulosus) is probably the most valued and sought after sport species in the project area. Peak spawning of the spotted seatrout in the Gulf of Mexico is usually cited as late as April to July (Pearson, 1929; Tabb, 1966). This activity has been closely linked to water temperatures. Spawning is reported to occur at temperatures of 21°C in Texas (Simmons 1951) and 24°C in Florida (Jannke, 1971). The only published account of actual observation of spotted seatrout spawning was that of Tabb (1966). He stated it took place at night in deep holes and grass flats. Spawning may also occur in the most seaward regions of the estuary near the passes (Tabb and Manning 1961; Etzold and Christmas 1979) or even outside the estuaries (Jannke 1971; King 1971). A fecundity estimate of approximately 1 million eggs was reported by Pearson (1929), Tabb (1961), and Sundararaj and Suttkus (1962) for trout of 534, 625, and 433 mm standard lengths, respectively. Larvae move into the shallow grassbeds and nursery areas where they begin to school in 6 to 8 weeks. Adults often concentrate in the deep passes of the sound. Spotted seatrout have been reported taken from Mississippi waters with temperatures from 5°C to 35°C (Etzold and Christmas 1979). Trout will usually seek warmer gulf waters if temperatures drop below 7°C. Spotted seatrout have been taken in waters with salinities that range from .2 to 77 ppt (Simmons 1957). However, Tabb (1966) has suggested that salinity levels below 5 ppt are intolerable and, if unable to reach higher saline waters, juveniles and larvae may suffer significant mortalities during post-storm freshets.

The gulf menhaden (Brevoortia patronus) supports the largest single fishery in the United States and serves as a food source for many other important sport and commercial species. Gulf menhaden may spawn up to four or five times during a single spawning season (Combs, 1969). Spawning as reported by Turner, 1969 and Fore, 1970 occurs from October to March. Larvae spend about 3 to 5 weeks in the offshore waters prior to moving through the passes into the estuaries (Reintjes, 1970; Etzold and Christmas, 1979). It is reported that the peak timing of these larvae migrations is from December through March (Suttkus, 1956; Etzold and Christmas, 1979). Postlarvae and juveniles prefer the less saline estuarine waters. Juveniles remain in the nearshore areas where they travel about in dense schools. Emigration of adults from the estuary back to the open gulf spawning grounds has been reported to occur over a wide time span from mid-summer through winter. Gulf menhaden have two feeding stages. Up to approximately 30 mm the larvae feed as select carnivores on individual zooplankton. After transformation into juveniles they feed as omnivorous filters of phytoplankton, zooplankton, and organic detritus (Reintjes and Pacheco, 1966).

Similar description of other important sport and commercial finfishes can be found in the Mississippi Sound and Adjacent Areas Report as well as the Corps of Engineers Resource Inventory for Pascagoula Harbor.

Shellfishes within the project area also provide an excellent sport and commercial fishery. These primarily include brown shrimp, white shrimp and blue crab. While oyster reefs are found within the project area (major reefs primarily between the east and west Pascagoula Rivers) it is unfortunate that due to pollution (fecal coliform) no harvesting of these shellfishes is allowed.

Like most finfishes, the life cycles of the brown shrimp (Penaeus Aztecus) and white shrimp (P. setiferus) are greatly dependent upon estuaries. Shrimp are the most important commercial shellfish species within the Mississippi Sound and project area. In 1982, over 2,885,000 lbs. valued at $5,193,000 were landed at Pascagoula (NMFS) (Table 2). Brown shrimp are harvested in the Mississippi Sound from May to August and offshore from June to November. Peak spawning in offshore waters occurs from around November to April. After fertilization, the demersal shrimp eggs become planktonic larvae and go through five naupliar, three protozoeal, and three mysis stages.

Recruitment of the postlarval brown shrimp mainly occurs from February through April (Baxter and Renfro, 1967); Gaidry and White, 1973; White and Boudreaux, 1977). Transformation into the juvenile stage occurs in about 4 to 6 weeks after entering the estuary (Perez-Farfante 1969). The period of May through August is mostly cited as peak emigration periods. After leaving the estuaries the brown shrimp make their way toward the deeper spawning grounds. Brown and white shrimp both prefer soft bottom substrates. In most cases the brown shrimp are found in higher salinity areas than the white. In general, it is thought they [illegible] salinities of 10 to 20 ppt (Gunter et al., 1964).

Brown and white shrimp prefer temperatures above 15°C in the estuary (Venkataramaiah, 1971). All feeding stages of brown shrimp are omnivorous. The larvae feed mainly on algae and zooplankton; postlarvae feed on detritus, algae, and microorganisms; and adults feed on detritus and benthic organisms.

White shrimp spawn in offshore waters from 7 to 31 meters from spring to fall (Lindner and Anderson, 1956; Renfro and Brusher, 1963; Bryan and Cody, 1975). The recruitment of postlarval white shrimp by estuaries occurs from late spring to fall while temperatures are above 25°C (Baxter and Renfro, 1967). Juvenile white shrimp tend to move further up the water courses than brown shrimp. As the white shrimp reach 120 to 140 mm they leave the estuaries and return to the Gulf of Mexico as waters began cooling from September to December (St. Amant, et. al., 1966b). Both juvenile and adult white shrimp are omnivorous.

While shrimp provide an excellent food item and contribute significantly to the economy of the region, another important function is that they are a major component in the food web that sustains many other commercial and sport species.

The landings for the Pascagoula Moss Point area are broken down by the National Marine Fisheries Service into three categories. These are industrial, food fish, and shrimp. The industrial fishes include those such as menhaden, spot, croaker, white trout, etc., which are basically used for producing meals, oil, and animal feed. Food fish include red snapper, black drum, flounder, spotted seatrout, white trout, and croaker. In 1982 the pounds of food fish, shrimp, and industrial landed at Pascagoula were 2,111,000, 2,885,000, and 324,185,000 respectively, for a total of 329,181,000 lbs. This represented a total landing value of over $17,000,000. Specific breakouts of the lbs. and values from 1981 to 1983 are provided in Table 2.

While these figures only show the base value of dockside landings, it is obvious that the real monetary contribution of these species to the economy is magnified many times when considering the many jobs and revenue stimulated by the fishing industry.

Table 2. Pounds and Value of Commercial fish and Shellfish Landed at the Port of Pascagoula from 1980 - 1982.*

Year	Category	lbs	Value
1980	Food Fish	8,360,000	$ 2,650,000
	Shrimp	2,020,000	$ 3,790,000
	Industrial	281,488,000	$12,480,000
	Total	291,868,000	$18,920,000
1981	Food Fish[1]	5,440,000	$ 2,176,000
	Shrimp	3,390,000	$ 4,746,000
	Industrial[2]	211,700,000	$ 9,831,000
	Total	220,530,000	$16,753,000
1982	Food Fish	2,111,000	$ 925,000
	Shrimp	2,885,000	$ 5,193,000
	Industrial	324,185,000	$10,834,000
	Total	329,181,000	$17,002,000

*Landing data provided by the U.S. Dept. of Commerce, National Marine Fisheries Service, Pascagoula, Mississippi, January 1983.

[1] Food Fish - That primarily used for human consumption such as red snapper, spotted seatrout, flounder, croaker, etc.

[2] Industrial - Those species primarily used for commercial purposes such as for the manufacturing of meals, oil, and animal foods. Major species in this group include menhaden, spot, croaker, etc.

WILDLIFE

alustrine forested wetlands, while limited within the immediate roject area, provide one of the most productive wildlife habitats in he United States. Studies conducted in Louisiana have shown that the arrying capacity for white-tailed deer, squirrel, rabbit, raccoon, nd gray fox to be two to five times greater than nearby mixed pine orest. Forested wetland also provides major wintering grounds for any species of waterfowl. Tree cavities provide excellent nest sites or wood duck and the undergrowth provides prime brood habitat.

ading birds such as green-backed herons, tricolored herons, great lue herons, snowy egrets, and common egrets greatly utilize these reas. Water pockets throughout the forests offer excellent feeding abitat for these birds.

he more permanently inundated forested wetlands provide excellent abitat for highly diversified reptile and amphibian populations. The merican alligator, presently listed as an endangered species in the tudy area, widely utilizes the aquatic terrestrial resources of orested wetlands.

urbearers such as muskrat, nutria, river otter, and beaver also nhabit these areas.

alustrine emergent wetlands provide important wildlife habitat in the roject area. Overwintering waterfowl, both diving and dabbling ducks uch as canvasback, redhead, ring-necked, mallard, pintail, and igeon, extensively utilize the emergent wetlands for feeding and oosting. Non-game avian fauna such as raptors, wading birds, rails, nd snipe heavily utilize these areas. Mammals such as muskrat, utria, beaver, raccoon, mink, and river otter are also common in hese fresh marsh systems as are various species of reptiles and mphibians.

diverse wildlife population is also supported by the intertidal and ubtidal estuarine subsystems. The coastal marshes within the project rea grade from salt to fresh as they extend from the Gulf area north o above Interstate 10. Animal life in this estuary can be grouped nto communities which generally parallel salinity gradients. This rouping has been illustrated in studies conducted in the marshes of ouisiana (Palmisano 1972). Aerial surveillance associated with this tudy showed muskrats to favor brackish marshes. Fur catch records lso showed nutria pelt production to decline in higher salinity arshes. Puddle ducks were shown to favor the fresh marsh habitats ore than the brackish or saline marshes. The value of the estuary to ildlife is largely related to the diversity of plant communities. ontinued productivity requires that this diversity be maintained and hat natural and unnatural processes, which tend to reduce this iversity, be modified to assure these optimum conditions.

ct and Compensation Assessment Procedures

›r resource projects often result in direct and secondary adverse ıcts upon the nation's fish and wildlife resources. In realizing › connection and the need to preserve natural resources, Congress sed the Fish and Wildlife Coordination Act (FWCA). This act vides for a basic procedural framework for the orderly sideration of fish and wildlife impacts resulting from water elopment projects. It specifically requires that project impacts fish and wildlife resources be fully identified, and conservation sures be formulated and given equal consideration as integra tures of project alternatives. The remainder of this report will ter on fish and wildlife impacts, means of assessing project ges, and methods of mitigating and/or compensating for such ct losses.

tat Evaluation Procedures

FWS' 1980 Habitat Evaluation Procedures (HEP) was the major method d for evaluating project impacts and potential compensation sures. HEP is a species-habitat approach which provides a ntitative methodology for impact assessment. A major part of the luation involves the Habitat Unit (HU) which is derived by tiplying the quality, or Habitat Suitability Index (HSI), of the itat type for a species by the available acreage. These tability indices are derived from an evaluation of the ability of damental habitat components to supply life requisites of select ies of fish and wildlife.

HSI for a particular species can range from 0 to 1.0 and is ermined by utilizing models developed for a specific animal in a ticular habitat. An HSI of 0.1 indicates that a habitat type vides little potential value for the evaluation species, while a of 1.0 indicates that the habitat provides optimum life requisites the form of food, cover, and reproduction. A value between 0 and can be correlated to various levels of carrying capacity in a ear manner, i.e., the difference between 0.1 and 0.2 is of the same nitude as the difference between 0.8 and 0.9. The HSI is an ression of habitat quality per acre per year and total HUs can be ained by multiplying the HSI by the total acreage of that habitat e. HUs are determined at various target years (times at which the ject or conditions could alter acreages or HSIs) and averaged over project life. This value is called the Average Annual Habitat t (AAHU). The impact of proposed land use changes resulting from ject development and mitigation measures can be determined by paring the AAHU values for the future without project conditions to AAHU values with expected changes to habitat conditions resulting n the project. Thus, the HEP provides a means to quantitatively

NATIONAL SPECIES OF SPECIAL EMPHASIS (NSSE)

The FWS has established a list of species and groups of species that are considered to be of highest priority (Federal Register, Vol. 47, No. 176, September 10, 1982). The list consists of those fish, wildlife, and plant species of special biological, legal, or public interest to which the FWS' efforts and attention are to be focused. Initially, 859 species of special emphasis (SSE) were identified throughout the country; however, the list was further refined to 49 species and 19 groups of species for designation as NSSEs on the basis of several biological, political, social, and economic criteria (47FR 39890, September 10, 1982).

There are 13 species and 9 species groups within the project area (Table 4). The FWS will focus on these species in addressing impacts and mitigation measures.

Table 4. National Species of Special Emphasis (NSSE) Present In or Near the Study Area

Species	Groups of Species
Birds	
Mallard	Seabird "group"
Black duck	Gull and tern "group"
Wood duck	Shorebird "group"
Redhead	Songbird "group"
Canvasback	Bay duck "group"
Osprey	Surface feeding duck "group"
bald eagle	Heron and allies "group"
Peregrine falcon	
American woodcock	
Least tern	
Mourning dove	
Reptiles	
American alligator	Sea turtle "group"
Fish	
Striped bass	Shad "group"

able 3. (Continued)

pecies	General Distribution
eptiles	
lligator, American (*Alligator mississippiensis*-E	Coastal plain
nake, eastern indigo (*Drymarchon corais couperi*)-T	South
urtle, Kemp's (Atlantic) ridley (*Lepidochelys kempii*)-E	Coastal waters
urtle, green (*Chelonia mydas*)-T	Coastal waters
urtle, hawksbill (*Eretmochelys imbricata*)-E	Coastal waters
urtle, leatherback (*Dermochelys coriacea*)-E	Coastal waters
urtle, loggerhead (*Caretta caretta*)-T	Coastal waters

ENDANGERED AND THREATENED SPECIES

Several species of wildlife listed by the FWS and State of Mississippi as being endangered or threatened are known to occur or visit the project area (Table 3).

The COE has coordinated this project with the FWS' Endangered Species Office as evidenced by their letter of December 21, 1983 (Appendix E). Even though no adverse effects on endangered species are expected, they should be given full consideration during project planning. Since some species are currently under status review and could become listed during the project construction period, we recommend that you stay informed on their status along with the presently listed species.

Species recognized by the state which could occur in the area include all of those listed under the federal group plus the eastern indigo snake (Farancia erythrogramma), yellow-blotched sawback turtle (Graptemys flavimaculata), and black pine snake (Pitophis melanoleucus lodingi).

Table 3. Federally Listed Species in the Project Area
(E=Endangered; T=Threatened; CH=Critical Habitat determined)

Species	General Distribution
Mammals	
Manatee, Florida (Trichechus manatus)-E	Coastal waters
Panther, Florida (Felis concolor)-E	Entire state
Whale, right (Eubalaena glacialis)-E	Coastal waters
Whale, finback (Balaenoptera physalus)-E	Coastal waters
Whale, humpback (Megaptera novaeangliae)-E	Coastal waters
Whale, sei (Balaenoptera borealis)-E	Coastal waters
Whale, sperm (Physeter catodon)-E	Coastal waters
Birds	
Eagle, bald (Haliaeetus leucocephalus)-E	Entire state
Falcon, Arctic peregrine (Falco peregrinus tundrius)-E	Entire state
Pelican, brown (Pelecanus occidentalis)-E	Coast
Warbler, Bachmann's (Vermivora bachmanii)-E	Entire state
Woodpecker, ivory-billed (Campephilus principalis)-E	South, W. Central
Woodpecker, red-cockaded (Picoides dentrocopos borealis)-E	Entire state

chromium, iron, lead, mercury, nickel, and zinc. Even though these chemicals are tied to the sediments, some may be consumed by certain species of aquatic organisms and passed through the food chain.

As demonstrated by recent COE numerical model testing, the configuration of Singing River Island has a definite effect on circulation and salinity patterns of the Middle River area. During low flow the ridge running southeast of the island tends to restrict the westward diffusion of freshwater from the East Pascagoula River and, therefore, increases salinities in the Middle River area. This restriction on circulation and deflection of freshwater toward the east is likely aggravating existing degraded water quality in the Harbor area and, furthermore, could be profoundly impacting oyster production in the Middle River area.

Another resource problem involves the natural erosion of the Grande Batture Islands. High wave energies coming between Petit Bois and Dauphin Island have significantly eroded the islands. A serious loss of the Bangs Lake marshes is likely since the Grande Batture Islands historically provided some wave buffering benefits. Photos showing the area in 1957 and 1979 revealed that about 200 acres of marsh have been lost in the Bangs Lake area. A more detailed discussion of this matter is provided in the Impact Section.

Open water disposal of dredged material is occurring within Mississippi Sound from the islands to the upper Pascagoula and Bayou Casotte channels. This method of disposal causes increased turbidity levels, resuspension of pollutants, and possible circulation alteration through the shallowing of the upper disposal areas. Impacts have not been quantified, but if the material was placed on low productive uplands or deeper gulf sites, it would, in our opinion, result in a less damaging impact on the fish and wildlife resources of the Sound. Areas for such gulf disposal are being studied in conjunction with this study.

FISH AND WILDLIFE RESOURCE PROBLEMS WITHIN THE PROJECT AREA

Several environmental problems have been identified within the Pascagoula Harbor area which in some cases are and in other cases could have a significant adverse impact on fish and wildlife resources. These activities should be discussed not only from the standpoint that they could be impacting fish and wildlife but also because they could possibly be totally or partially corrected through the implementation of certain project features.

Major environmental problems include previous and ongoing wetland losses, industrial discharges (i.e. sediment chemistry), circulation associated within the configuration of Singing River Island, existing dredging problems, and erosion of Bangs Lake marshes.

The creation of the port and additional developments along the Pascagoula River and Bayou Casotte have resulted in substantial losses (several hundred acres) of wetland habitat. In view of the important ecological functions wetlands perform, it becomes imperative that the remaining systems be protected and, in cases where losses are unavoidable, that they be totally compensated.

The Port of Pascagoula area (comprised of the Escatawpa River to mile 10, the east and west Pascagoula Rivers to mile 2 below the confluence of the Escatawpa, and Bayou Casotte) has one of the worst water quality problems within Mississippi. Activities in this heavily-developed industrial area contribute over 60 million gallons a day of municipal and industrial discharges to surface waters (U.S. Army, COE, Mobile District, June 1983). The water quality problem on the Escatawpa River is so severe the State has had to lower the dissolved oxygen standard (DO) from 5.0 mg/l to 3.0 mg/l. DO concentrations during 1981 sampling by the U.S. Geological Survey (USGS) showed DO levels in the Escatawpa ranged from 4.6 mg/l to zero on the bottom. Bayou Casotte has been recognized as having both DO and bacteria problems as a result of discharges from the Pascagoula/Bayou Casotte Sewage treatment plant and other sources. The USGS confirmed the problem in July 1978 when sampling showed fecal coliform bacteria concentrations as high as 28,000 mpn/100 ml. The allowable limit for fish and wildlife uses is 2000 mpn/100 ml.

Bacterial problems still exist within the project area. This is evidenced by the closure of the major oyster reefs near the mouth of the West Pascagoula River.

Sediment sampling within the harbor and sound area show various metals, PCBs, and pesticides are tied up in the sediments. Six stations sampled (1 in each of the inner harbors, 1 in the upper and lower Pascagoula Channel, 1 in Bayou Casotte, 1 at the junction of the Pascagoula and Bayou Casotte Channels, and 1 in the Pass Channel) during August 1983 showed high concentrations of arsenic, cadmium,

Common Goldeneye	Short-billed Dowitcher
Bufflehead	Long-billed Dowitcher
Oldsquaw	Stilt Sandpiper

Birds occurring on or near Horn and Petit Bois Island

(This list has been tabulated from the personal field notes of J.A. Jackson and C.D. Cooley and also includes some species that have been listed for the area by the Mississippi Ornithological Society but not personally observed. Common names are given because they have been standardized by the American Ornithologists' Union. Scientific names for these species can be found in the AOU Checklist of North American Birds (AOU 1957).)

Common Loon
Red-throated Loon
Horned Grebe
Eared Grebe
Pied-billed Grebe
White Pelican
Brown Pelican
Gannet
Blue-faced Booby
Double-crested Cormorant
Magnificent Frigatebird
Great Blue Heron
Green Heron
Little Blue Heron
Cattle Egret
Reddish Egret
Great Egret
Snowy Egret
Louisiana Heron
Black-crowned Night Heron
Yellow-crowned Night Heron
Least Bittern
American Bittern
Glossy Ibis
White-faced Ibis
White Ibis
Mallard
Black Duck
Mottled Duck
Gadwall
Pintail
Green-winged Teal
Blue-winged Teal
American Wigeon
Northern Shoveler
Redhead
Ring-necked Duck
Canvasback
Greater Scaup
Lesser Scaup
White-winged Scoter
Surf Scoter
Black Scoter
Ruddy Duck
Red-breasted Merganser
Bald Eagle
Osprey
Peregrine Falcon
Merlin
American Kestrel
King Rail
Clapper Rail
Yellow Rail
Black Rail
Purple Gallinule
Common Gallinule
American Coot
American Oystercatcher
Semipalmated Plover
Piping Plover
Snowy Plover
Wilson's Plover
Killdeer
American Golden Plover
Black-bellied Plover
Ruddy Turnstone
Common Snipe
Long-billed Curlew
Whimbrel
Spotted Sandpiper
Solitary Sandpiper
Willet
Greater Yellowlegs
Lesser Yellowlegs
Red Knot
Pectoral Sandpiper
White-rumped Sandpiper
Baird's Sandpiper
Least Sandpiper
Dunlin
Semipalmated Sandpiper
Western Sandpiper
Buff-breasted Sandpiper
Marbled Godwit
Sanderling
American Avocet
Black-necked Stilt
Wilson's Phalarope
Parasitic Jaeger
Herring Gull
Ring-billed Gull
Laughing Gull
Bonaparte's Gull
Gull-billed Tern
Forster's Tern
Common Tern
Sooty Tern
Least Tern
Royal Tern
Sandwich Tern
Caspian Tern
Black Tern
Black Skimmner
Belted Kingfisher
Boat-tailed Grackle

of these areas include raccoon, nutria, swamp rabbit, eastern cottontail, Norway rat, common rat and brown rat. Feral pigs also occur on Horn Island and are reported to be causing extensive damage to the dunes by destroying sea oats which retard erosion.

(osprey, hawks, eagles, owls) (U.S. Dept. of Interior 1979a). Many wading birds and sediment probing shorebirds can only gather food on the intertidal or very shallow subtidal flats. The deeper subtidal habitats are often only accessible to some deep-diving ducks.

The subtidal subsystem of the estuary is that area of which the substrate is continuously submerged. This zone would include the open waters of Mississippi Sound. Mammals which would be most closely associated with this zone would be the Atlantic bottle-nosed dolphin and, occasionally, the Florida manatee. Birds which utilize the subtidal areas include terns, gulls, pelicans, skimmers, loons, grebes, and cormorants. Several species of reptiles also inhabit the deeper waters of the subtidal zones. Sea turtles, like many other species, utilize both the subtidal and intertidal subsystems of the estuary and no ally nest in the sand on open beaches. However, since most of their life is spent in open subtidal waters, we feel it appropriate to mention them under this subsystem. Five species of sea turtles are likely to occur in the project area. These are the green sea turtle, hawksbill turtle, loggerhead sea turtle, Atlantic ridley, and leatherback turtle.

Island Wildlife

Wildlife species utilizing the islands within the study area consist mainly of birds, some small mammals, and reptiles (U.S. Dept. of Interior, NPS, 1979). About 112 bird species are known to use the islands for permanent or transient purposes. Page 29 contains a list of these birds. Many shorebirds and wading birds frequent the islands. Seabirds including least terns, royal terns, common terns, sandwich terns, and black skimmers are commonly observed. Some birds listed by the FWS as being endangered also are known from the area of Horn and Petit Bois Islands. These are the brown pelican, bald eagle, and peregrine falcon. Several colonies of shore and wading birds are also located on both of these islands. Round Island supports a good population of ospreys and great blue herons.

Sea turtles are also known to regularly use the Gulf waters near Horn and Petit Bois islands. These include the loggerhead, green, Atlantic ridley, hawksbill, and leatherback. Of these the Atlantic ridley, hawksbill, and leatherback are listed by the U.S. Fish and Wildlife Service as endangered while the loggerhead and green turtles are listed as threatened. The loggerhead turtles have been reported nesting on northern gulf beaches; however, no confirmed nests have been reported for Horn or Petit Bois islands (U.S. Dept. of Interior, NPS, 1979).

The American alligator, which is also on the FWS' list of endangered species, has also been regularly seen on the islands.

The mammal populations on the islands are limited. Mammal inhabitants the 15,000 acres, 12,359 are vegetated and 2,554 acres are open water. Brackish and intermediate marshes are the primary wetland types and consist of approximately 35 percent and 34 percent respectively of the total unit. Over a 10 year period from 1969 through 1978, midwinter inventories recorded an estimated average population of approximately 2,600 wintering waterfowl for the Pascagoula unit annually. Of those species found in the marshes two-thirds were diving ducks. This area is also reported by local birders to support abundant populations of lesser scaup.

The Point Aux Chenes-Grand Bay swamp unit consists of 31,649 acres. Of this, 26,269 are vegetative wetlands and 5,380 acres are open water. During the ten year survey it was estimated that this unit hosted over 1,000 winter waterfowl annually. Major species were redhead, lesser scaup, American wigeon, and mallard.

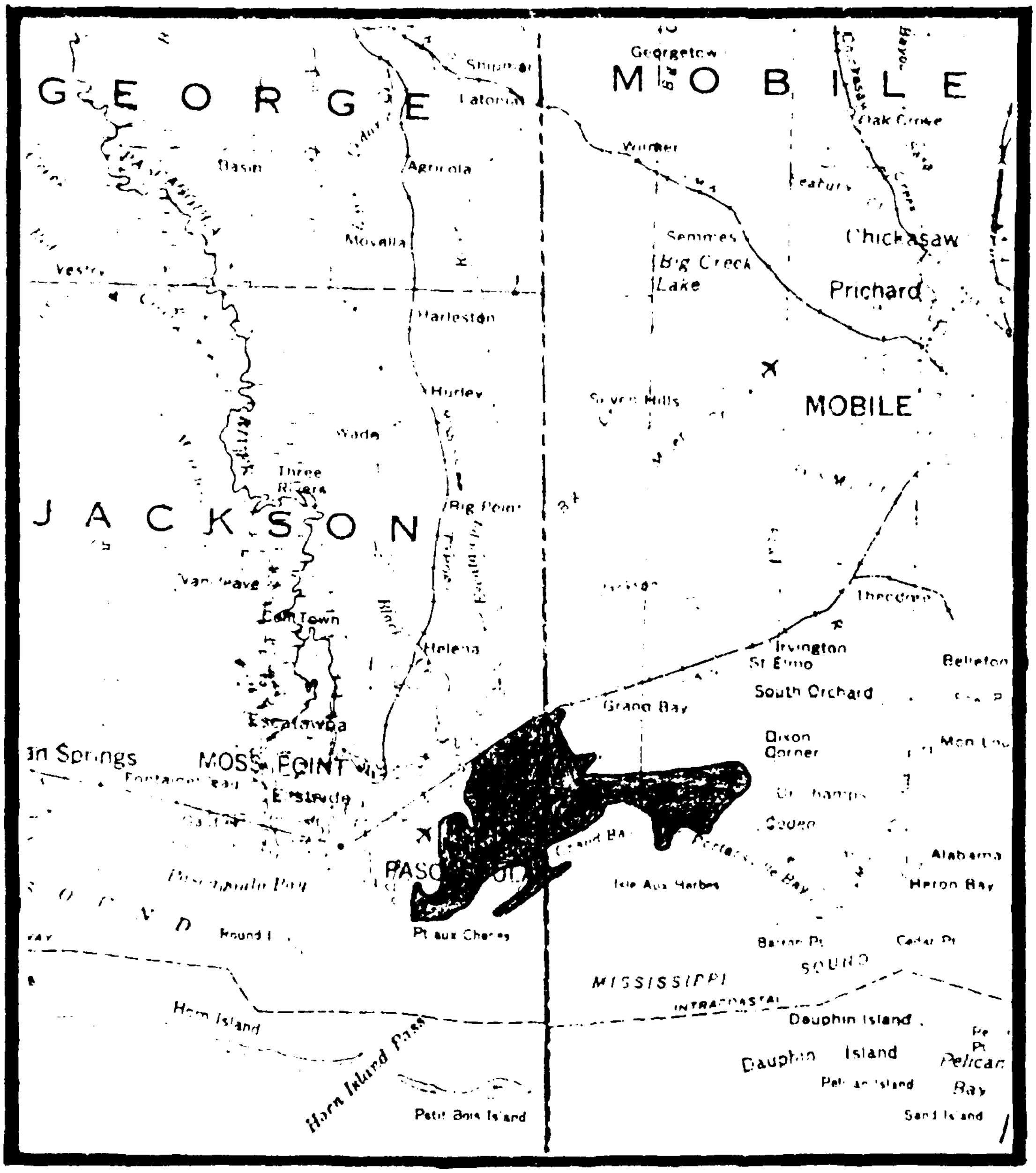
Seabirds are usually more common over the open subtidal waters of the project area; however, they do range into the marshes for feeding and nesting. Those present include brown pelican, white pelican, ring-billed gull, herring gull, laughing gull, Forester's tern, common tern, sooty tern, least tern, royal tern, and black skimmer.

Shorebirds are also common inhabitants of the marsh habitat and intertidal shorelines and include black-necked stilt, killdeer, American oystercatcher, black-bellied plover, greater yellowlegs, lesser yellowlegs, sanderlings, and sandpipers. Other birds which occur in the estuarine marshes include the northern harriers, long-billed marsh wren, and red-winged blackbird.

Amphibians and reptiles are generally restricted to the fresh marshes, open ponds, and lakes within the intertidal zones. Major amphibians along the coastal area include the bull frog, pig frog, and southern cricket frog. Reptiles which inhabit the various intertidal marshes include the American alligator, western cottonmouth, red-eared turtle, diamondback terrapin, and gulf salt marsh snake. Of these, only the gulf salt marsh snake and diamondback terrapin are common in the brackish to saline marshes.

Tidal flats are another estuarine habitat type which support many wildlife species. Tidal flats fall in the intertidal subsystem under the class unconsolidated bottoms. Mammals such as river otter, mink, and raccoon utilize these mudflats for feeding; however, the greatest use is from wading and shorebirds. Birds which utilize intertidal flats can be placed in the following ecological categories: (1) waders (herons, egrets, ibises, yellowlegs), (2) shallow-probing and surface searching shorebirds (sandpipers, plovers, knots, oystercatchers), (3) deep-probing shorebirds (godwits, willets, [illegible]rlews), (4) aerial-searching birds (terns, gulls, skimmers, [illegible]), (5) floating and diving water birds (ducks, [illegible] loons, cormorants, and swans), and (6) birds of prey

THE POINT AUX CHENES - GRAND BAY SWAMP UNIT

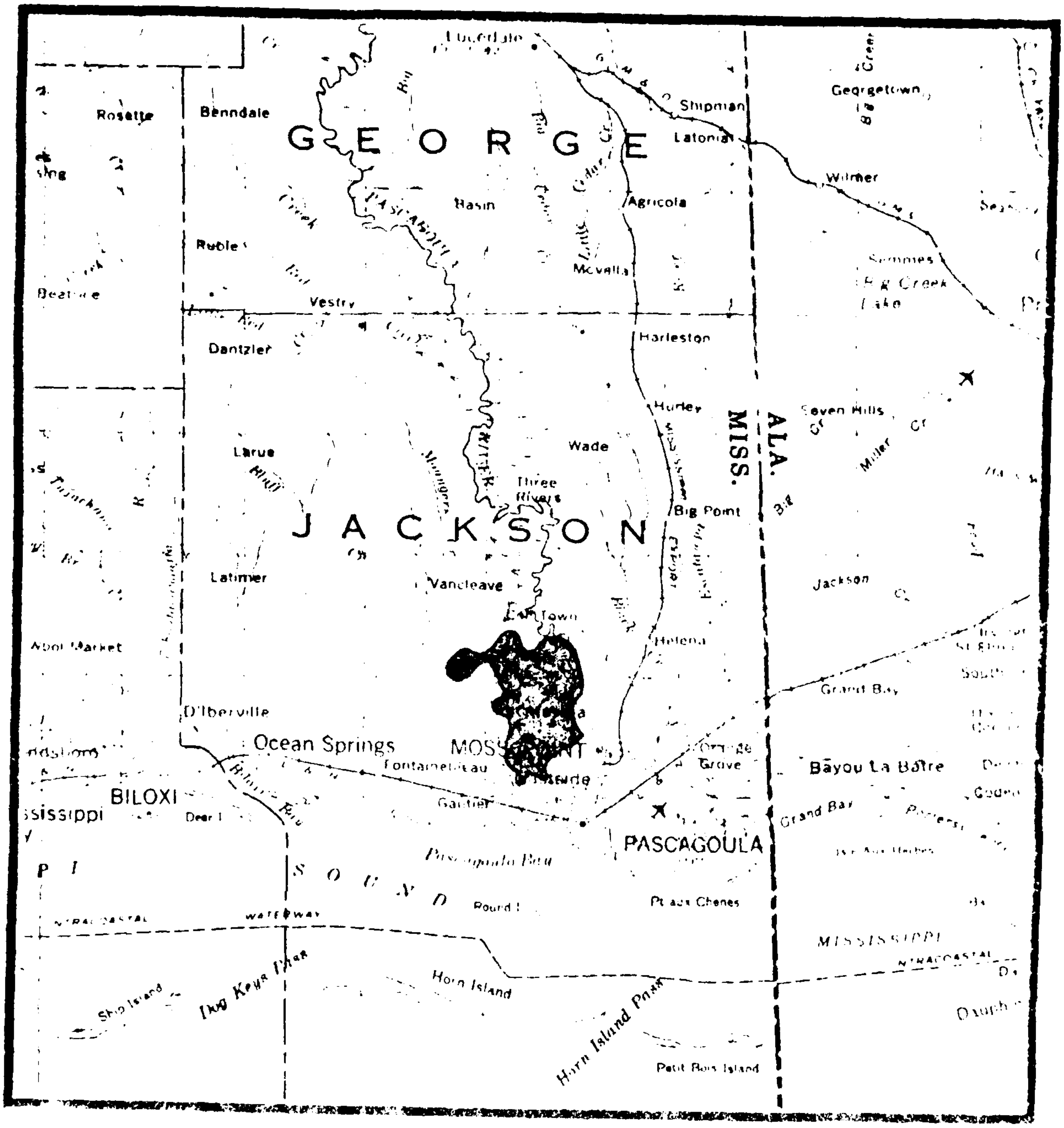


KEY WETLAND UNIT

Department of the Interior
U.S. Fish and Wildlife Service

FIGURE 4

THE PASCAGOULA MARSH UNIT



KEY WETLAND UNIT

Department of the Interior
U.S. Fish and Wildlife Service

FIGURE 5

The intertidal marshes along the Mississippi coastal zone support diverse wildlife populations. Many species of mammals, birds, reptiles, and amphibians are associated with these estuarine habitats. Mammals such as nutria, mink, muskrat, raccoon, and beaver are common here. Other mammals including the short-tailed shrew, eastern cottontail, swamp and marsh rabbits, and eastern mole also inhabit emergent wetlands. Both nutria and muskrat are abundant in coastal marshes; however, nutria are more abundant in fresh marsh whereas muskrats tend to favor brackish marsh (U.S.Dept. of Interior, 1980a). Mink are also common in the coastal marshes but their densities decrease with increasing salinity levels. Many non-game mammals also inhabit the coastal marshes.

The Mississippi coastal zone is a major corridor for migratory birds. Tidal marshes provide important feeding and cover habitat for many species of ducks. Dabbling ducks, including species such as mallard, gadwall, American wigeon, mottled duck, green-winged teal, blue-winged teal, northern pintail, and northern shoveler heavily utilize the intertidal marshes. The abundance of these species generally declines with progression from the fresher to more saline marshes. However, diving ducks such as redhead, canvasback, lesser scaup, bufflehead, ruddy duck, and common goldeneye are more common in the bays, larger marsh ponds, and lakes.

Rails, gallinule, and snipe also inhabit the coastal marshes. King rail and clapper rail nest and winter in the coastal marshes but the Virginia rail and sora rail are considered winter residents. The common snipe winters in the fresh to brackish marshes as well as other wet areas along the coast. Coots are also abundant here in winter.

Wading birds utilize the coastal marshes for feeding and nesting purposes. Species such as great blue heron, little blue heron, green backed heron, tricolored heron, American egret, and snowy egret are common. Nesting colonies of wading and shorebirds are located on the mainland as well as on the islands.

The importance of coastal wetlands is further emphasized by their inclusion as special preservation units by the FWS. The FWS has identified and categorized 33 wetland areas over the entire nation. The top 15 categories represent the most critical areas and ones that are receiving a major acquisition thrust. In view of their importance and vulnerability to development, the coastal wetlands have been placed in Category 9. (U.S. Dept. of the Interior, FWS, June 1982). Fourteen units comprise the coastal wetlands category in Louisiana, Mississippi, and Alabama. Of these two units (the Pascagoula marsh unit and the Point Aux Chenes-Grand Bay swamp unit) are located within the Pascagoula project area (Fig. 3 and 4).

The Pascagoula marsh unit encompasses nearly 15,000 acres and spans the area between the East Pascagoula and West Pascagoula Rivers. Of evaluate project effects and mitigation measures on fish and wildlife habitat and its productivity over time.

The HEP analysis is generally conducted by a team which, at a minimum, is composed of FWS, State, and COE biologists. The Pascagoula Harbor Evaluation Team consisted of a FWS biologist, a COE biologist, and a State biologist from the Mississippi Bureau of Marine Resources. At times personnel from the FWS' Regional Office (HEP Coordinator) and National Coastal Ecosystems Team (NCET) were called on to assist with the evaluation procedures and use of HSI models.

HEP Procedures (Fisheries)

With the exception of spot and oysters, species used in the evaluation of the Pascagoula Harbor Project contained SI variables which were associated with marsh to open water acreages (Appendix A). The specific project-related fishery losses that can be quantified using HEP are the 10 acres of marsh to be dredged in Bayou Casotte, 50 acres of marsh to be filled on Singing River Island, the annual erosion of the Bangs Lake marsh, the 240 acres of fill behind the Grande Batture dike, and the 570 acres of waterbottom loss and marsh gain behind the Grande Batture dike. Since the models are structured on an estuarine basis, an area larger than the above mentioned marshes had to be used for evaluation purposes. The area must include a marsh and open water complex for the analysis. This is called the project area (Fig. 5). Shrimp, seatrout, and menhaden (HSI models) all have marsh variables. Thus, to evaluate these species, multiple habitats (marsh and water) must be rated collectively and given a common HSI value. Thus, if the HSI value of shrimp is .5, the marsh is .5 and water is .5. An acre loss of either due to the project would result in a loss of .5 HU's. The area evaluated for fishery project impacts and mitigation extends from the West Pascagoula River to the Bangs Lake area on the east and south past Horn and Petit Bois islands to the vicinity of the proposed gulf disposal site. This included the major wetlands associated with the Pascagoula and Bangs Lake systems. This explains why the AAHUs for fish are much larger than for wildlife in the impact tables. The losses (project) and gains (mitigation) of habitat units (marsh creation, oyster reef construction, and preservation of marsh) were also computed within the project area over the 53 year project life.

Fishery evaluations were based on the entire project area (as above). The percent of marsh within the project area is an important variable for species such as menhaden, shrimp, and seatrout. For this evaluation all marsh and open water was used to show losses and gains for these species. The spot model contains no marsh variable and is therefore only sensitive to open water losses. No acreage losses are shown for seatrout or shrimp habitat from erosion or its reduction since the erosion results in a marsh to open water trade-off. This change in marsh acreages does, however, effect the HSI for shrimp and seatrout due to a change in the marsh to open water percentages.

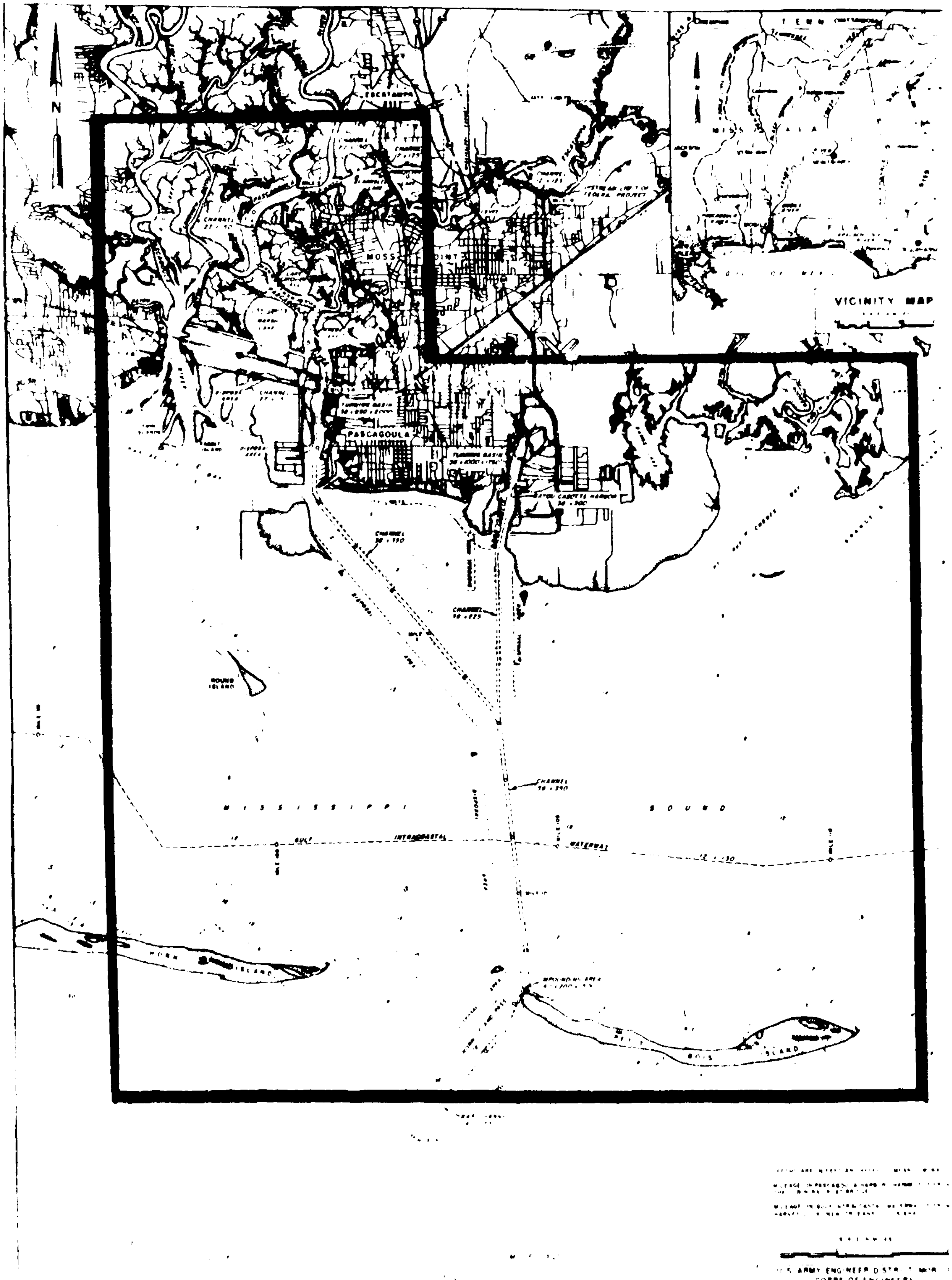

MOSS POINT
PASCAGOULA
VICINITY MAP
MISSISSIPPI SOUND
GULF INTRACOASTAL WATERWAY
HORN ISLAND
CORPS OF ENGINEERS

FIGURE 5

The major means of replacing unavoidable fishery losses would be creation of marshes from shaving down low productive uplands and possible establishment of oyster reefs. Some open water marsh creation will be considered on a limited scale and with full assurance of success.

HEP Procedures (Wildlife)

Wildlife species selected for evaluation were muskrat and clapper rail. Quantifiable losses of these species would occur with the erosion of Bangs Lake marsh and dredging or filling of 10 acres of marsh in Bayou Casotte, and 50 acres of marsh on Singing River Island. In addition, the FWS evaluated and quantified wildlife losses for the Tenneco tract. This wetland (a scrub-shrub/emergent wetland) represents a different habitat type than the more tidal marshes evaluated for muskrat and rail. Species evaluated for this area were raccoon, indigo bunting, and swamp rabbit. If necessary, the means of compensating wildlife habitat losses would be through creating marsh or reducing erosion of the Bangs Lake wetlands.

The HSI values of the various emergent wetlands within the project area (Bayou Casotte, Bangs Lake, and Singing River Island) were different and, therefore, the areas were separately evaluated. The AAHUs for each area were added to get total AAHU losses for the various plans. As previously stated, the Tenneco wetland was evaluated with different species than the other wetland tracts. For created marshes, a potential value of 1.0 was assumed to be attainable by the fifth year. Loss of AAHUs were then compared against gains derived from mitigative actions to obtain mitigation ratios and compensation acreages.

SPECIFIC EXPLANATION OF EVALUATION PROCEDURES

Habitat Types in the Project Area

The Pascagoula Harbor Project basically extends from the East Pascagoula River at U.S. Highway 90 and Bayou Casotte through the sound and terminates at the gulf disposal sites. Even though some physical and chemical changes could occur over the entire Sound from this construction, our major centers of interest are Singing River Island marshes and water bottoms, Bangs Lake marshes, Tenneco area, turning basin in Bayou Casotte, ship channel, and proposed disposal sites in the gulf, sound, and uplands. Habitat types to be considered for mitigation purposes are 1) emergent wetlands, and 2) oyster reefs. Quantitative impacts could be assessed for actions such as the destruction of wetlands at Singing River Island, Bayou Casotte, and Tenneco. Other quantified impacts include creating marsh and oyster reefs, and reducing marsh erosion with renourishment of the Grand Batture Islands. Other actions such as maintenance disposal in the gulf and sound could not be quantitatively assessed using the HEP procedures.

Evaluation Species

Finfishes, shellfishes, and wildlife species were selected for evaluation. This species selection was based on both economical and ecological factors. Factors such as 1) trophic levels, 2) utilization levels within the water column, and 3) economical importance were considered. Species chosen to be used for fishery evaluations and compensation were 1) shrimp, 2) spotted seatrout, 3) menhaden, and 4) spot. Oysters were also evaluated for possible fishery compensation purposes. Species selected for wildlife evaluations in the tidal wetlands of the Singing River Island, Bayou Casotte, and Bangs Lake area were 1) muskrat and 2) clapper rail. Raccoon, indigo bunting, and swamp rabbit were chosen for the less tidal Tenneco area. The reason for the limited number of evaluation species was primarily due to the availability of models that were applicable to the habitat type and have no reflection on the degree of diversity or productivity of the estuary.

Calculating HSIs and HUs

The HSI for each evaluation species was calculated by using specific models. The HSI is a function of the suitability of the habitat types used by the species. To obtain the HSI, variables (suitability indexes) such as salinity, water temperature, substrate type, and percent of marsh within the project area were rated for fishery resources. Variables such as percent of canopy closure and percent of area covered by emergent vegetation were rated for wildlife. Each species (fish and wildlife) must be rated on a scale between 0 and 1.0. These environmental indices are then combined to obtain the overall HSI value of the species for each particular habitat type (Appendix A). Once the HSI has been derived the habitat units can be calculated by multiplying the HSI value by the total acreage of habitat being evaluated.

Sampling

To obtain HSI values, sampling of the habitat quality for each selected species must be conducted. Basically, the HSI value for each species in the project area was obtained by the evaluation team through utilization of existing data. The physical and chemical data generated from the Mississippi Sound and Pascagoula Projects and the Gulf of Mexico Estuarine Inventory (GMEI) was the major source of information used for obtaining HSI values of the various fishery species. The National Coastal Ecosystem Team (NCET) also supplied information relative to the acres of various habitat types. Wildlife evaluations were conducted using existing data, aerial photos, and general knowledge of the area.

Compilation and Computation

Models and various computations are used in deriving baseline HSI values for the evaluation species (Appendix A). Baseline Habitat Units for each evaluation species are equal to the area of available habitat multiplied by the evaluation species' mean HSI in available habitat. HUs are calculated on Form Bs for each target year in the life of the Navigation Project (i.e., 0, 3, and 53). For example, with these target years, it is assumed the channels, turning basins, and wetland fill will be complete by year 3 of the 53 year project life. No major alteration in acres or HSIs is expected that would effect HUs between year 3 and 53.

After HUs for each target year have been predicted, the next step in impact assessment is to calculate the average annual habitat units (AAHU) throughout the period of analysis. AAHUs are calculated using Form C, and Form D is used to calculate the change in AAHUs between future-with the project conditions and future-without the project conditions for each evaluation species.

Assumptions must be made by the team for projecting with and without project conditions. When it is assumed that significant changes or actions could occur over the project life at specific time intervals (target years) which could alter the acreage figure or HSI value of a particular habitat type, then this time frame or target year is used in HEP computations.

The first step in the compensation process is selecting a candidate compensation study area. If no exact area is located then a theoretical one must be considered for compensation calculations. In the case of this project, 500 acres was used for mitigation involving shaving down low productive uplands. This acreage is used for analyses only since the amount of actual mitigation required may be more or less, depending on the management potential. The same calculations used to determine baseline HUs for the impact areas are performed for the compensation area, with and without management activities. In addition, the AAHU available in the mitigation area were estimated for each evaluation species with and without management actions over various target years, and the change in AAHUs was determined. Like the project target years, the mitigation target years are based on incremental changes such as the time frame for marsh creation and erosion rates of the Bangs lake marshes. The changes in AAHUs due to the with and without proposed project conditions are weighed against the AAHUs incurred due to with and without compensation conditions to derive a compensation ratio. This ratio multiplied by the size of the management area used for the analysis will give the actual acres required for mitigation. The end product is the acreage required to compensate all target species' AAHU losses that will occur as a result of the Pascagoula Harbor Navigation Project. This is calculated on Form H.

IMPACTS

General Project Impacts

Five alternative plans, A, B, C, D and E, are being considered by the COE for the Pascagoula Harbor Project. Some of these plans could be environmentally damaging while others could avoid major impacts to fish and wildlife and might improve water quality within the sound.

Plan A would avoid the filling of marsh, but also retains the current method of maintenance dredging by disposal in the shallow Mississippi Sound waters. This alternative, as with all alternatives, would require the dredging of 10 acres of marsh in Bayou Casotte for construction of a turning basin. As with all plans, the disposal of material from the entrance channel will be conducted in the shallow waters south of the east end of Horn Island. The intent is to reduce the erosion rate of the island by reintroducing the dredged material in the littoral drift.

Gulf Disposal, Plan B, would avoid filling waterbottoms and productive vegetative wetlands, and would eliminate maintenance dredge spoil disposal in the shallow waters of the sound. Though not quantifiable, the elimination of shallow sound disposal would probably positively affect water quality. This is the most preferred plan from a fish and wildlife standpoint.

With Plan C, 50 acres of wetlands on Singing River Island and 257 acres of wetlands on the Tenneco property would be filled. These losses are quantifiable with the use of the FWS' HEP procedures and, therefore, compensation measures have been identified. (See specific impact and discussion sections.) With Plan C, the disposal of maintenance dredge spoil in the sound would continue.

Plan D would incorporate a renourishment plan for the Grande Batture Islands. Island reconstruction could save marsh acreages adjacent to the Bangs Lake area that would otherwise erode over the 50 year project life. This feature, however, would require the filling of 810 acres of waterbottoms in Point Aux Chenes Bay and therefore produce fishery losses. Approximately 240 acres of fill would be placed behind a Grande Batture Island dike for stabilization and 570 acres of open water would be filled for marsh creation. Plan D would also require filling 50 acres of wetland on Singing River Island.

Plan E (the NED plan) requires that some new work and all of the maintenance material from the Mississippi Sound channels be taken to gulf sites. However, new work material from the Bayou Casotte Channel (7 million CYs) is to be placed on wetlands at the Tenneco site. The FWS has quantified wildlife losses resulting from this action. As stated in the executive summary, the 404 jurisdictional status of this area is currently being reviewed by EPA.

Should the Grande Batture feature be pursued, the FWS recommends the COE consider a modified version of Plan D. The FWS' plan will be discussed in the specific impact section and would incorporate Plan B (Gulf Disposal) with Grande Batture Islands renourishment. However, substantially less fill would be involved, thereby reducing fish and wildlife impacts.

The construction of the turning basin in Bayou Casotte would occur with each plan and result in the deepening of water areas that are presently shallow. Even though some productivity loss would occur, the area would still have some fishery use. However, the habitat unit value of shrimp and seatrout would be effected by this feature and quantifiable losses would occur that should be mitigated. Wildlife losses have also been quantified that would result from eliminating 10 acres of vegetated wetlands in the turning basin.

Numerical model data has been analyzed which shows minimal salinity changes resulting from any of the plans. A major concern is potential increases or decreases in salinity and the significant impact of such change on the oyster grounds at the mouth of the Pascagoula River. Higher salinities could trigger an increase in the oyster drill population. The area contains a viable oyster population which cannot be harvested (due to pollution) but can be used for seed production. It does not appear from the model data that channel expansion or filling Singing River Island as proposed under Plans C and D would alter the salinities in this area. The island now deflects fresh water from the East Pascagoula River to the east away from the oyster beds. Therefore, altering the configuration of the northern half of the island might impact the oysters at the mouth of the Pascagoula River.

In addition, some circulation problems have also been identified that have been caused by the bar which extends from the southeast side of Singing River Island parallel to the ship channel for about one mile. This bar appears to have impacted east-west circulation, but the degree of impact is unknown.

The resuspension of sediment by dredging, including pollutants such as heavy metals, pesticides, hydrocarbons, etc., must also be considered. Sediment concentrates and stores contaminants. Contaminants in sediment are, in many cases, not readily available to the biota within the water column (if left undisturbed). However, if disrupted such as by dredging, the material can become available to the biota through resuspension in the water column. An even greater problem may arise when contaminated sediment is exposed to air. Oxidation, as well as pH, and temperature changes may greatly increase the bioavailability of contaminants associated with dredged material.

Bottom sediments can be particularly effective in concentrating and storing contaminants that are introduced into the water column. This capability is generally dependent upon the contaminant type and sediment composition. Materials with low solubility (e.g., heavy metals and many chlorinated hydrocarbons) can be expected to accumulate in the bottom material. Fine grained sediments of high organic content have an excellent ability to bind with toxic materials, thereby concentrating and removing them from the water column. Course grained sandy type substrates, on the other hand, lack this ability. Contaminants pass rapidly through this material and into other mediums.

If undisturbed, contaminants in fine grained organic sediments usually remain tightly bound with minimal leaching into the surrounding waters. However, concern remains high because of potential bioconcentration by the infauna resulting in lethal and sublethal impacts as well as transport through the food chain to higher trophic levels.

During dredging operations sediments become temporarily resuspended, releasing some contaminants into the water column at the dredge site. This release also occurs as sediment is discharged at the disposal site. Long term impacts to the infauna and related species also are of concern, especially if the disposal site has significant resource values.

The largest industrial complex in Mississippi is located in the Pascagoula/Moss Point area. Of the 47 major industries listed in the Statewide 208 Water Quality Management Plan, 11 are in this area. Principal activities are petrochemical, pulp and paper, and shipbuilding. These heavy industries have a history of discharging a wide range of heavy metals and organic compounds in their effluents. The state ambient water monitoring network has reported total copper levels in the waters of the Pascagoula River basin as high as 170 ppb. The Gulf Coast Research Laboratory (GCRL) is presently investigating the transport of pollutants in the Mississippi Sound. Elevated levels of aromatic hydrocarbons, total hydrocarbons, and phenols were found in the sediments of Pascagoula Harbor and adjacent areas. (Lytle, Thomas F. and Julia S. Lytle, 1983). Bioassays determined the material to be toxic to endemic estuarine species. Unfortunately, there is a lack of adequate data to assess heavy metal contamination in this area.

Two specific impact features of primary importance are disposal of dredged material in the Gulf of Mexico and the erosion of the Bangs Lake marshes. Each of these features could play a significant role in attempts to mitigate project losses. They will be specifically discussed in the following sections.

Gulf Disposal

Gulf disposal of dredged material is proposed as part of the project. Approximately 300,000 cubic yards of dredged material from annual maintenance of the sound channels is now placed adjacent to these channels. The average depth of the area is about 12 feet. Even though the impacts of this activity are unquantified, an improvement would occur if the material was placed in deeper gulf waters. Plans B and E would eliminate this shallow water disposal and all new work and maintenance material would be taken to a gulf disposal site.

Even though impacts such as increased turbidities and covering of benthic forms will occur in the gulf disposal areas, it is believed that this method of disposal would be much less damaging than spoil disposal within the more shallow sound waters. Impacts of gulf disposal of dredged material cannot be quantified using our HEP procedures and, thus, no compensation for such action would be required.

However, we are concerned that the proposed disposal site could be located in or near the pass between Petit Bois and Horn Islands. This pass is a vital migration route for fishes going to and from the gulf and estuarine marshes. Impacts could be reduced if the disposal site was shifted from the pass and into an area south of Horn Island. Caution should be taken to assure such an adjustment would not impact sensitive areas such as grassbeds. Dredge and disposal impacts could be reduced if activities were conducted during late fall to early winter months when migrations and spawning activity are lowest. We support and encourage the implementation of a monitoring program to prevent short and long term adverse effects which may otherwise go unnoticed for a considerable length of time.

Grande Batture Islands/Bangs Lake Marshes

A comparison of aerial photographs has revealed that about 200 acres of marsh were lost in the Bangs Lake area between 1956 - 1979. It is assumed that most of this loss is a result of erosion and as much or more would occur over the project life. The loss rate is about 10 acres per year. We estimate about 80 percent of this erosion would be reduced by construction of a rip-rap dike on top of the old Grande Batture Island chain. This could save 8 acres of marsh a year or about 400 over the project life. Reducing this erosion is, therefore, being considered as a mitigation measure.

In addition, the possibility of establishing oyster reefs north of the Grande Batture Islands in association with the renourishment plan is also being considered. This could be attributed either as a project benefit or a mitigative measure as explained in following sections of this report.

As stated above, five alternatives (A,B,C,D, and E) are being considered for further study by the COE. Each of the plans will result in varying degrees of impacts. Some of these impacts are quantifiable, whereas others can only be expressed in qualitative terms. While all of the plans contain common features (elements I & II), the major differences with fish and wildlife impacts are related to the manner of disposal of material dredged from the sound. The FWS has also recommended a plan which we believe meets project objectives while minimizing impacts on fish and wildlife resources. This plan basically reduces the impacts of Plan D while maintaining the feature of reducing marsh erosion at Bangs Lake. Because the specific impacts of each plan vary in this regard, each one is discussed separately below.

Specific Impacts

Plan A

Plans A, B, C, D, and E all call for placement of the entrance channel material in the region south of Horn Island and placement of the Pascagoula and Bayou Casotte inner harbor material in the existing Singing River Island, Greenwood Island, and Double Barrel sites. We have no major objection to the proposed method of disposal of material from the entrance channel. If monitoring of this area shows that adverse impacts are occurring, then necessary measures should be taken to rectify the situation. No means to quantify or mitigate this disposal method is provided.

The upland sites on Singing River and Greenwood Islands and the Double Barrel area are currently being used as disposal sites and should therefore pose no adverse impacts on fish and wildlife under normal operating conditions. We have experienced some unfortunate incidents on both the Singing River and Double Barrel areas recently involving dike failure, and over pumping into disposal areas. Hopefully these were isolated cases and, with strict monitoring, such problems will be avoided.

With Plan A, 10 acres of marsh in the Bayou Casotte area would be lost due to construction of a turning basin. This would result in a loss of 6.0 AAHUs for rail and 4.0 AAHUs for muskrat. Fishery impacts would occur from the loss of 10 acres of marsh. This is reflected in the lower HSI value over the project life for seatrout and shrimp and is a result of the reduction of marsh to open water percentages. The AAHU losses for seatrout and shrimp are -6.0 and -8.0 respectively.

Plan B

Plan B does not involve the filling of vegetated wetlands or waterbottoms and it would eliminate the current method of discharging dged material into shallow sound waters. This is considered to be ubstantial environmental improvement over current dredged material position in waters of about 10 feet to 15 feet. However, the ee of improvement cannot be quantified.

e additional mitigative measures could be emp[illegible] yed that would ther reduce the limited impacts of this plan. These include sonal dredging and some adjustment in the location of the specific osal site.

or fishery migration routes are through the island passes. This uld be a major feature for consideration when designating gulf osal sites.

with Plan A, Plan B would result in the loss of 10 acres of marsh the turning basin in Bayou Casotte. The same impacts apply for B as with A in terms of AAHU losses for fish and wildlife.

n C

n C would be the most adverse alternative in terms of fish and dlife impacts because highly productive marshes at Bayou Casotte acres), Singing River Island (50 acres), and Tenneco (257 acres) ld be dredged or filled. These fish and wildlife habitat losses quantifiable using the FWS' HEP procedures as shown in Tables [illegible] ire acreages of marsh and water were used in evaluation of all hery species except spot, producing high AAHU values. Only direct ages of impacted habitat were assessed for wildlife and, thus, the l AAHU values.

shown in Table 5, the loss of these wetlands would result in a stantial fishery impact. It should also be realized that even ugh only three species of finfish and one species of shellfish were d for the evaluations, they represent a broad range of similar life uisites of many species of fin and shellfishes that utilize these e habitats. Oysters would not be impacted by any of the proposed ns. However, they were also evaluated for mitigation and/or incement.

dlife species were also evaluated using HEP. HSI models are ited and, thus, the reason for the low number of evaluation cies. This does not reflect the high diversity of such systems as been described in the fish and wildlife resource sections. erse impacts on muskrat and rail in terms of AAHUs lost are vided in Table 5. Table 6 is specifically directed at the HU ses of the Tenneco area. This wetland type differs in tidal imes from the others evaluated for muskrat and rail and therefore, uired a separate set of evaluation species. It can be reasonably imed that such losses of habitat would have a devastating impact on y other species of wildlife. Total compensation for Plan C, therefore, would require combining the acres required to replace the wildlife losses at Tenneco as well as the fish and wildlife losses resulting from the filling and dredging of wetlands at Singing River Island and the Bayou Casotte turning basin. From a wildlife standpoint, Plan C would by far be the most adverse plan of those considered.

Table 5. The Average Annual Habitat Unit (AAHU) changes based on with and without project conditions for fish and wildlife species with Plan C. (This table does not include the Tenneco area)

Species	AAHU With	AAHU Without	AAHU Change
Spot	35,071	35,068	+ 3
Menhaden	111,046	111,084	-38
SST	69,730	69,790	- 60
Shrimp	41,959	42,013	- 54
Muskrat	1,765	1,788	- 23
Rail	1,959	1,993	- 34

Table 6. The average annual habitat unit (AAHU) changes based on with and without project conditions for fish and wildlife species with the filling of 257 acres at Tenneco with Plan C.

Species	AAHU With	AAHU Without	AAHU Change
Muskrat	7.0	221	-214
Raccoon	7.0	231	-224
Rabbit	8.0	257	-249
Bunting	7.0	244	-244

The impacts on the fishery resources, while not quantifiable, should also be given serious concern. Filling this wetland would eliminate a large and very important detrital source.

Plan D

With Plan D, 10 acres of wetlands would be lost at Bayou Casotte plus

...es of [illegible] lands would be filled on Singing River Island. This ... adversely impact both fish and wildlife resources. Unlike Plan ... this alternative would not require the filling of the Tenneco ...nds. Instead, this material (7 million cubic yards) which would ... from the Bayou Casotte Channel, would be used for renourishing ...oximately 16,000 ft. of the Grande Batture Islands. This would ...ist of about 15 acres of rip-rap dike, 240 acres of fill behind ...dike, and 570 acres of open water marsh creation. The 240 acres ...ill would extend about 650 ft. behind the dike and the marsh would ...d beyond this for 1,700 more feet (Fig. 6).

...rip-rap used for dike construction would provide some fishery ...fits, and involve no quantifiable losses. The 240 acres of fill ...sed behind the dike would be a total fishery loss. The 570 acres ...rsh would essentially be trading one fishery habitat type (open ...) for another (marsh) and, therefore, no acreage increase is ...d. However, the HSI value of shrimp and seatrout would increase ...to the increase of marsh to open water ratio. This HSI would also ...ove for these species by the preservation of the Bangs Lake ...nes. Species such as spot would be further impacted from such ... [illegible] marsh variable is contained in the HSI ... [illegible] shows the fishery losses in terms of ...

... [illegible] result from filling the Singing River ... [illegible] wildlife loss, however, would be offset ... [illegible] Grande Batture Island renourishment. This ... [illegible] of marsh (annualized) over the project ... [illegible] total of over 400 acres of marsh would be prevented ... [illegible] The plan would benefit wildlife more than ... [illegible] creation and preservation of wetlands ... reflect an increase in wildlife AAHUs for each species ... [illegible] Table 7). As a result, no compensation would be required ...ildlife.

...7. The average annual habitat unit (AAHU) changes based on with and without project conditions for fish and wildlife species with plan D.

...es	AAHU With	AAHU Without	AAHU Change
	34,779	35,069	-290
...den	110,866	111,084	-218
...out	70,250	69,792	+459
...p	42,656	42,015	+641
	2,416	1,808	+608
...at	2,177	1,623	+554

dredged material to the north would be a qualitative plus over the method of disposing in the shallow waters of the sound.

his plan, fish and wildlife impacts occurring from wetland fill ging River Island (as in Plan D) would be avoided. The ation of fill (240 acres) behind the dike would also greatly e fishery impacts. We recommend that the fill immediately the dike be sloped to about 100 ft. in a manner that would be ive to the establishment of higher marsh plants. From this the slope should extend another 100 ft. to establish tidal This 200 ft. wide strip behind and along the 16,000 ft. dike 40 acres of high and 40 acres of tidal marsh.

rnative would have its greatest impact on spot. This impact is a loss of -80 AAHUs, is due to the elimination of open water creation behind the dike and reduction of erosion rates. No or gains would occur to menhaden as a result of marsh n, while seatrout and shrimp would show AAHU gains of +236 and AAHUs respectively from the creation of about 80 acres of marsh. servation of 196 acres annualized at Bangs Lake. These gains would obviously offset the AAHU losses for seatrout (-6) and shrimp (-8) as a result of the 10 acres of wetland dredged in asotte.

fe species would also show large gains from this plan. While nd muskrat losses of -6 and -4 AAHUs respectively would occur dredging of 10 acres of wetlands in Bayou Casotte, the gains lands from marsh creation and preservation would more than ly compensate these losses. Rail would experience a gain of AHUs for marsh preservation (196 annualized acres) and AAHUs sh creation (80 acres). Muskrat would show gains of +161 and for each of these respective measures.

the FWS also recommends that oyster reef construction be a the present plan. The location and size of reef should ... With ...

plan could be subject to change pending EPA's 404 jurisdictional decision on the Tenneco area.

The gulf disposal of dredged material, while not quantifiable, is viewed as a positive impact on fish and wildlife over other methods. Fish and wildlife losses due to wetland impact at Bayou Casotte could be mitigated by creating 7 acres of marsh by shaving down low productive uplands. This would create habitat while also increasing the HSI value of shrimp and seatrout over the project area due to the increase of marsh to water percentage. The HSI values of rail and muskrat for the marsh to be impacted was .58 and .40, respectively. Assuming a value of 1.0 could be reached over a 5 year period would require that 6.0 acres of wetlands be created by shaving down low productive upland habitats and planting them. This would replace both the rail and muskrat losses. Since fisheries impacts require 7 acres of the same habitat, both fish and wildlife resources would be mitigated by the creation of 7 acres of marsh.

If the filling of the Tenneco wetlands is unavoidable, then compensation measures for adverse impacts on wildlife resources should be provided. The manner in which the HUs lost are to be replaced would be through creation of similar habitat by shaving down low productive uplands. This would require 251 acres of such habitat as determined by an analysis using the FWS' HEP. The impacts on the fishery resources, while not quantifiable, should also be given serious concern. Filling this wetland would eliminate a large and very important detrital source.

We are cognizant that this alternative has a higher benefit/cost (B:C) ratio than other less damaging alternatives. However, Alternative B, which is preferred by the FWS and other federal and state agencies (Appendix 5), also reflects a high B:C ratio. The relatively high return on expended dollars as stated in the report should provide flexibility in COE evaluations to select a plan that could meet intended project objectives while avoiding and even improving the environmental quality of the area. The COE's NED plan does not do this. However, we still maintain that the gulf disposal alternative (B) does provide such positive impacts, avoids significant mitigation, has a very high B:C ratio, and should be the selected plan.

In summary, we believe the COE's NED plan would be extremely damaging to wetland habitats. Much of this damage could be avoided if the filling of the 257 acres of the Tenneco property is eliminated. We believe that the benefits of the gulf disposal plan (B) are such that it should be selected by the COE. Most state and federal agencies also support this position. We, therefore, recommend that the COE reconsider this alternative. Otherwise, serious environmental damages could result that would necessitate costly mitigation measures. (See the cost of wetland creation, Appendix B of our draft report).

it is a tradeoff of water to marsh habitat. Spot losses (-290 ...) cannot be replaced in-kind by any marsh creation program, so no ...gation can be provided. However, menhaden losses (-216 AAHUs) ...d be replaced in-kind through creation of 290 acres of wetlands by ...ng down low productive uplands.

...e spot and menhaden reflect substantial losses, species such as ...mp and seatrout show gains from the project. The losses of ...rbottoms and marshes are adequately replaced for these species ...ugh gains of marshes (open water creation and erosion prevention). ... gains in AAHUs for seatrout and shrimp are +439 and +641 ...ectively. The gains in seatrout and shrimp would be due to the ...s in HSI over the project life as a result of the increased ratio ...arsh to open water. This increase would occur from the open water ... creation and erosion prevention at Bangs Lake.

...e Plan B reflects substantial gains for some species, losses that ...d occur to others cannot be ignored. In addition, the benefits ...ibuted to this plan are contingent upon the success of marsh ...tion and accuracy of predictions involving the erosion rates being ...ed with the Grande Batture Islands feature.

...xperience has shown that open water marsh creation is not always ...essful. A case example involves the Coffee Island marsh creation ...ct which has for all practical purposes been a failure. The ... of success depends greatly on the selected area, time, and ...y. Complete assurance must be given that marsh creation will be ... successful.

...e the FWS believes that the Grande Batture Islands concept is good ... the standpoint of preserving eroding marshes, we are also ...erned about the magnitude of material proposed for use in this ... The 570 acres of open water marsh is very large. If for some ...on failures occur, the end result could be substantial fish and ...life damages. The 240 acres of fill behind the dike is also ...ssive. This would result in a total loss of fishery habitat and ...efore is not viewed as an acceptable feature. The FWS could ...ort a Grande Batture Islands plan, but the fill must be reduced. ...filling of Singing River Island marshes as well as the magnitude ...ill involved with the Grande Batture Islands renourishment are ... that we cannot support this alternative as planned. A plan ...iring less fill, such as proposed in Plan E, would be preferable.

...E

...would result in the dredging of 10 acres of wetland in Bayou ... and the filling of 257 acres of wetlands at the Tenneco site. ... the executive summary, the recommendations regarding this include the Grande Batture Islands concept or open water marsh creation as contained in Plans D and E. However, as explained in this report, the uncertainty of success as well as past experience with open water marsh creation are factors that make Plans D and E less desirable than B.

Plan C

This plan would result in substantial fish and wildlife losses. If these losses are unavoidable, acceptable mitigation in terms of marsh credits for these losses could be in one of two forms. 1) shaving down of low productive uplands (see Appendix B) or 2) renourishment of the Grande Batture Islands. To compensate for lost fish and wildlife resources would require creating 251 acres of shrub/scrub habitat to replace wildlife losses at the Tenneco site and 58 acres of emergent wetland habitat to replace fish and wildlife losses at Singing River Island and Bayou Casotte. The 58 acres of emergent wetlands would compensate for the fishery loss at the two sites and likewise also fulfill wildlife losses for rail and muskrat, which were evaluated for this habitat type.

As previously stated, this is the most adverse alternative considered and should be eliminated.

Plan D

Plan D would result in the filling of 50 acres of wetlands on Singing River Island. However, unlike Plan C, the material proposed for filling 257 acres of the Tenneco marshes would instead be used to renourish the Grande Batture Islands. This would amount to placing 7 million cubic yards of fill behind a riprap dike. Some material would be placed behind the dike, covering 240 acres for stabilization (upland) while the remainder would be used in an attempt to create 570 acres of marsh. About 200 annualized acres of marsh could be saved from erosion at the Bangs Lake area which is a total of about 400 acres over the project life.

The filling of 50 acres of wetlands on Singing River Island would adversely affect wildlife. Rail and muskrat impacts are reflected in AAHU losses of 28 and 19 respectively. However, if successful, the marsh creation at the Grande Batture Islands (570 acres) and erosion control (200 acres) could compensate for these damages. Rail and muskrat net gains in AAHU would be 608 and 554 respectively.

The filling of 50 acres of wetlands at Singing River Island plus the 240 acres of fill behind the Grande Batture dike would result in substantial fishery impacts for species such as spot and menhaden. The AAHU losses for these are -296 and -216 respectively. Open water marsh creation would negatively effect spot due to the additional losses of open water. Menhaden would not gain from marsh creation se lost at Bayou Casotte to obtain a total AAHU project loss. e AAHU losses were then applied to various mitigative measures.

mitigation for these impacts can be realized through marsh ation (shavedown), marsh creation (open water behind dike only), preservation (Grande Batture). Acres required for replacement of 's lost will be reported for the different measures.

following provides a specific discussion of each proposed ernative in terms of quantified impacts. With some, negative acts occur, whereas in others, positive impacts are evidenced by reases in the AAHU. Following the discussion of alternatives and uired compensation, a section is included devoted to the cost of igating measures. In cases where no compensation is required and efits (marsh preservation) are realized, the value of each ernative is expressed. A general discussion of unquantified acts follows the cost-benefit sections.

n A

only quantifiable adverse impacts associated with this plan are 10 es of marsh to be dredged in Bayou Casotte. Fishery impacts could mitigated by creating 7 acres of marsh by shaving down low ductive uplands. This would create habitat while also increasing HSI value of shrimp and seatrout over the project area due to the rease of marsh to water percentage. The HSI values of rail and krat for the marsh to be impacted was .58 and .40, respectively. uming a value of 1.0 could be reached over a 5 year period would uire that 6.0 acres of wetlands be created by shaving down low ductive upland habitats and planting them. This would replace both rail and muskrat losses. Since fisheries impacts require 7 acres the same habitat, both fish and wildlife resources would be igated by the creation of 7 acres of marsh.

work material would be taken to the gulf, but maintenance material ld continue to be placed in open water. The loss of about 10 acres marsh per year at Bangs Lake due to erosion would continue with or hout this plan.

n B

s plan, like Plan A, would impact 10 acres of wetland within the ou Casotte area. The mitigation for wildlife losses is likewise same. Unlike Plan A, this alternative would require that all new k and maintenance material be taken to deep gulf sites and is, refore, preferred over Plan A. As with Plan A, 10 acres of marsh Bangs Lake would continue to erode annually. This plan as rently proposed would be the preferred plan. The impact area for improvement in water quality and fisheries resources is likely to ur with elimination of shallow sound disposal. This plan does not

Table 11. The Average Annual Habitat Unit (AAHU) changes based on with and without project conditions for each species with the creation of 100 acres of oysters.

Species	AAHU With	AAHU Without	AAHU Change
Oyster	80.40	0	+80.40

In cases where unavoidable losses of marsh and waterbottom would occur, several possible means of providing compensation for lost fish and wildlife resources were considered including shaving down low productive uplands, open water marsh creation in association with dike construction, preservation of the Bangs Lake marshes, and oyster reef creation.

An explanation of the cost of mitigation and marsh values is provided in following sections of this report. The analyses deriving cost and values are provided in Appendices B and C. In addition to being a project feature, the Grande Batture Island reestablishment could also be considered as a compensation measure for unavoidable marsh damages.

Both positive and negative quantifiable fishery impacts were shown using multiple habitats within the project area. This included marsh, open water, and grassbeds. The percent of emergent vegetation within the project area was an important HSI variable for species such as seatrout, shrimp, and menhaden. Models for other species such as spot and oysters have no marsh variable. Oysters were only used for analyzing mitigative or enhancement actions since the project would not directly impact this species.

Actual fishery mitigation in terms of AAHUs gained was calculated for marsh creation, preservation of the Bangs Lake marshes, and oyster reef construction. Creation of oyster reefs and open water marsh might have to be limited to a size recommended by the agencies since a trade off of other productive habitats would occur. For example, open water marsh creation results in the loss of productive waterbottoms and, in some cases, fishery losses. This is reflected in the spot HSI model and must be considered, at least in a qualitative sense.

Wildlife habitat values for muskrat and rail varied among the major impact areas (Singing River Island and Bangs Lake). The HSI and AAHUs of each area were kept separate. In cases where more than 1 area was impacted, the AAHUs were added. For example, with Plan C, the AAHUs for vegetat[illegible] lands lost on Singing River Island were added to

b) limiting the degree or magnitude of the action and its implementation; c) rectifying the impact by repairing, rehabilitating, or restoring the affected environment; d) reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and e) compensating for the impact by replacing or providing substitute resources or environments. The FWS supports and adopts this definition of mitigation and considers the specific measures a desirable sequence to follow in the mitigation process.

In accordance with CEQ guidelines and FWS' mitigation policy, recommendations are made below that will first avoid or minimize project impacts. For impacts that are unavoidable, measures are provided to mitigate these impacts. Where possible, both positive and negative impacts that could be quantified using the FWS' HEP analysis are assessed and compensation is recommended. Such impacts in this case would include the filling of marshes and preservation of marshes in the Bangs Lake area. Impacts which could not be quantified included such features as increases or decreases in turbidity, suspended sediments, channel deepening and gulf disposal.

Fish and wildlife resources within the project area and the impact of various alternatives were evaluated using the HEP. Alternatives A and B involve minimum marsh acreage losses and represent two of the more desirable plans from a fish and wildlife perspective. Plan C would require several hundred acres of fill of vegetated wetlands. This plan is extremely detrimental and should be eliminated. Potentially positive fish and wildlife impacts could occur with the incorporation of the Grande Batture Island nourishment feature as contained in Plans D and the FWS Plan. Plan D, however, does result in significant fish and wildlife losses as a result of dredging and filling. Therefore, should the Grande Batture nourishment concept be pursued, the FWS Plan would be preferred. Over 400 acres of marsh would be saved by the end of the 50 year project life. Annualized, this represents nearly 200 acres of marsh. The FWS Plan also avoids the extra cost of mitigation by not filling marshes and limits the filling of waterbottoms. (See cost and benefits section, page 66).

Oyster reef construction was also considered for the Point Aux Chenes area immediately north of the Grande Batture Island renourishment site with the FWS Plan. Even though no impact on oysters is expected from any of the project alternatives, the opportunity to establish oyster beds in this area appear good. We have therefore decided to look at the concept in terms of an enhancement and/or compensation measure. The cost and benefits of reef construction has therefore been calculated for cost to benefit analysis (see cost benefit section). An equal tradeoff analysis would have to be used in cases of mitigation. The amount of reef to be created and area would have to be agreed on by state and federal agencies. For this analysis, one hundred acres of oyster reef were used. This resulted in a gain of about 80 AAHUs over the project life (Table 11).

Bangs Lake/Grande Batture area. Oyster reefs have been determined to be a resource category II within the project area and could be used to replace some wetland losses on a limited scale. This categorization is only for this project area. If the filling of waterbottoms is unavoidable, these habitat losses would probably be replaced with marsh or oyster units.

Several methods of regaining lost habitat units are available using HEP as computed by various equations. These are (1) in-kind, (2) RVI, and (3) equal replacement.

The purpose of in-kind replacement is to replace losses of average annualized habitat units (AAHUs) for a given evaluation species with equal gains in AAHUs for that same species. The logic of in-kind replacement is simple. However, the goal of achieving no net losses may be difficult to attain because of the need to develop like habitat values in similar quantities within a compensation area.

Relative replacement is compensation that offsets HU losses at a differential rate. A gain of HUs for any target species can be used to offset HU losses for any adversely affected species at a differential rate depending on the particular species involved. Trade-off rates must be determined for each species so that equivalence can be determined. For example, a relative value index would be calculated that would evaluate the number of spot HUs that equal one shrimp HU, or vice versa.

Equal replacement or out-of-kind compensation offsets HU losses through equal HU gains. A gain of one HU for any species can be used to offset the loss of one HU for any adversely affected species. After the initial tradeoff, gains obtained through management for selected target species are then used to offset habitat unit losses for negatively affected species. All HUs for evaluation species are considered to have equal value.

Mitigation/Compensation

The primary goal of the FWS relative to water resource activities was authorized by Congress through the Fish and Wildlife Coordination Act. This Act states that fish and wildlife resource conservation should receive equal consideration and be coordinated with other features of Federal water resource projects. If such projects might impact public fish and wildlife resources then it becomes incumbent upon the Federal and State agencies responsible for such resources to recommend measures to mitigate such losses.

The President's Council on Environmental Quality further defined the term "mitigation" in the National Environmental Policy Act (NEPA) regulations to include: a) avoiding the impact altogether by not taking a certain action or parts of an action; b) minimizing impacts

The FWS has categorized the emergent wetlands within the study area including those proposed for filling and preservation (prevented from further erosion) as resource category II. These coastal wetland represent fish and wildlife habitats of extreme importance and are being lost at an alarming rate.

The FWS also views oyster reefs within the project area to represent a resource category II habitat. Many reefs in the sound have been altered due to storms or closed to harvest due to pollution. Oyster reefs not only provide a lucrative commercial fishery but also create habitat utilized for feeding purposes by many important sport and commercial fish species.

According to our mitigation policy, resource category II losses should be compensated for by replacing the same kind of habitat value through 1) physical modification of replacement habitat to convert it to the same type lost; 2) restoration of previously altered habitat; 3) increased management of similar habitat so that the in-kind value of the lost habitat is replaced; or 4) a combination of these measures. However, an exception can be made to this planning goal when (1) different habitats and species available for replacement are determined to be of greater value than those lost, or (2) in-kind replacement is not physically or biologically attainable in the ecoregion section. In either case, replacement involving different habitat kinds might be recommended, provided that the total value of the habitat lost is recommended for replacement.

The waterbottoms adjacent to Singing River Island have been classified as resource category III wetlands. According to FWS policy, it is preferable, in most cases, to recommend ways to replace such habitat value losses in-kind. However, if the FWS determines that in-kind replacement is not desirable or possible, then other specific ways to achieve this planning goal include: (1) substituting different kinds of habitats, or (2) increasing management of different replacement habitats so that the value of the lost habitat is replaced. By replacing certain habitat losses with different habitats or increasing management of different habitats, populations of certain species would be different, depending on the ecological attributes of the replacement habitat. This would result in no net loss of total habitat value, but might result in significant differences in fish and wildlife populations. This is generally referred to as out-of-kind replacement.

Compensation Analysis Options

In the event unavoidable project losses occur, the impacts should be fully compensated. Since the marshes within the project area have been determined to be resource category II, the recommended mitigation would likely be in-kind habitat. An exception might be made if the establishment of oysters is deemed feasible and acceptable in the

DISCUSSION

HEP Analysis

The HEP is an analytical methodology that is based upon a determination of the overall value of affected habitats to selected evaluation species, both game and non-game. A variety of affected fish and wildlife species and habitats can be quantified and conservation measures identified to offset project-related losses. HEP is founded on the recognition that fish and wildlife resources are of value to the nation in more than economic terms. For this reason, we strongly contend that the result of the HEP analysis is a more appropriate justification of the need for compensation measures than a userday-based economic analysis.

Resource Categories

To assure consistent and effective recommendations on mitigating adverse effects of land and water development on fish, wildlife, and their habitats, the FWS established a Mitigation Policy (Federal Register Vol. 4, No. 15, January 23, 1981). Within the policy there are four resource categories (Table 10) that are used to indicate the necessary level of mitigation.

Table 10. Resource Categories for Determining Levels of Compensation Requirements

Resource Category	Designation Criteria	Mitigation Goal
I	Habitat to be affected is of high value for evaluation species and is unique and irreplaceable on a national basis or in the ecoregion section.	No loss of existing habitat value.
II	Habitat to be affected is of high value for evaluation species and is relatively scarce or becoming scarce on a national basis or in the ecoregion section.	No net loss of in-kind habitat value.
III	Habitat to be affected is of high to medium value for evaluation species and is relatively abundant on a national basis.	No net loss of habitat value while minimizing loss of in-kind habitat value.
IV	Habitat is of medium to low value to evaluation species.	Minimize loss of habitat value.

16,000 ft. dike in lieu of the 650 feet of fill (240 acres) and 1,700 ft. of open water marsh creation (570 acres) as proposed under Plan D.

The FWS plan further reduces dredging impacts proposed under other plans by taking all dredged material to deeper gulf waters rather than continuing disposal in the shallow waters of the sound. The only fish and wildlife losses that are quantifiable are due to the 10 acres of marsh to be dredged in Bayou Casotte and the loss of waterbottoms from open water marsh creation. The loss to spot (-80 AAHUs) is due to the prevention of further erosion of marsh and a subsequent loss of open water, and loss of waterbottoms due to open water marsh creation (Table 9). Spot losses cannot be compensated with marsh creation or preservation programs. Most fish and wildlife losses would be mitigated by marsh creation behind the dike and the reduction of marsh erosion resulting from placement of a dike on the Grande Batture Islands. Shrimp and seatrout show large gains from this plan due to the limited losses of wetlands and the addition of marsh creation and preservation features. Muskrat and rail also gain habitat units for the same reason.

Oyster reefs in the Point Aux Chene area would also be recommended. The gain of 80 AAHUs for oysters was based on creation of 100 acres of reef (Table 9). Suitable areas, acres, and methods should be coordinated with the Mississippi Bureau of Marine Resources.

Table 9. The Average Annual Habitat Unit (AAHU) changes based on with and without project conditions for fish and wildlife species with the FWS plan.

Species	AAHU With	AAHU Without	AAHU Change
Spot	35,069	34,989	- 80
Menhaden	111,084	111,084	0
SST	70,028	69,792	+236
Shrimp	42,303	42,015	+288
Oysters	80	0	+ 80
Muskrat	1,821	1,611	+214
Rail	2,022	1,785	+237

In view of the high value of the Tenneco wetlands, the filling of this 257 acre tract would make this alternative extremely detrimental to fish and wildlife resources. The impacts of such habitat losses to wildlife species are quantified as shown in Table 8.

Table 8. The average annual habitat unit (AAHU) changes based on with and without project conditions for wildlife species with the COE's NED plan for the 257 acres at Tenneco.

Species	AAHU With	AAHU Without	AAHU Change
Muskrat	7.0	221	-214
Raccoon	7.0	231	-224
Rabbit	8.0	257	-249
Bunting	7.0	251	-244

The impacts on the fishery resources, while not quantifiable, should also be given serious concern. Filling this wetland would eliminate a large and very important detrital source.

FWS' Recommended Plan

As discussed above, renourishing the Grande Batture Islands could be used as a mitigation measure as with Plan C or as a project feature with Plan D. If used as mitigation, it would replace losses of habitat units. However, it may also be used as a project feature which could serve to avoid impacts (such as filling the Tenneco marshes) and provide enhancement benefits to certain species by saving marshes which would likely otherwise be lost to erosion. Enhancement of such features would occur only after all quantifiable losses are adequately mitigated. These benefits, which will be further explained in the discussion and appendix, would be in the form of values such as mandays of hunting, fishing, trapping, and commercial fisheries production.

Therefore, the FWS recommends that the COE also consider a modified plan if the Grande Batture Island nourishment alternative is pursued. This plan is a combination of Plan B and a modified version of the Grande Batture Island nourishment, Plan D. Under this plan rip-rap would be used to restabilize the Grande Batture Islands. Our AAHU calculations were based on 40 acres of high marsh behind the dike with dredged material for stabilization. This would slope to elevations that would create an additional 40 acres of tidal marsh. This represents a total of about 200 ft. of marsh paralleling the

The COE's NED Plan E

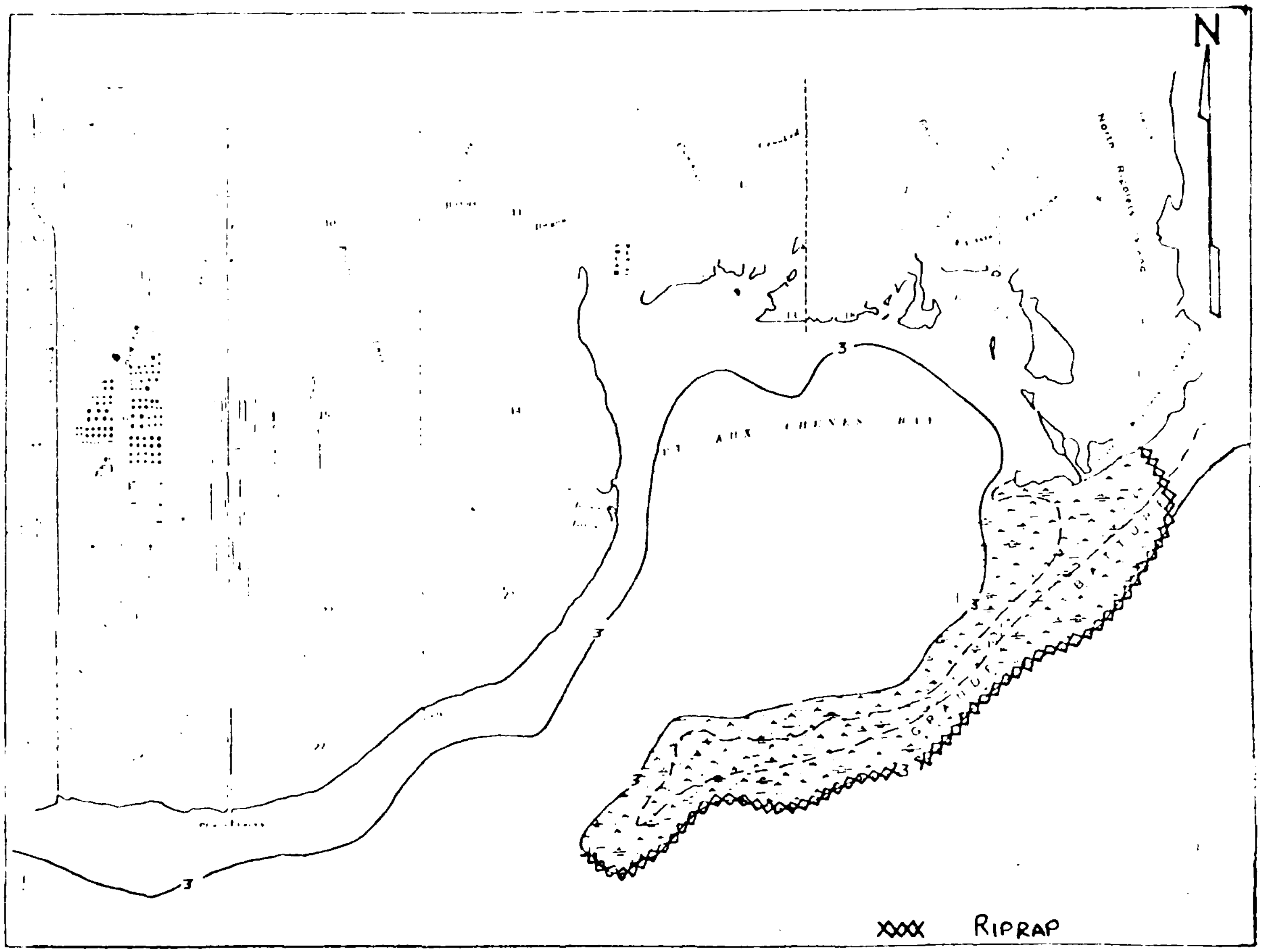
Under this alternative the new work from the Pascagoula Channel as well as maintenance material will be taken to gulf sites. The material within the inner harbor areas will be placed in existing upland disposal areas. New work from Bayou Casotte would go into 257 acres of wetlands at the Tenneco area. All maintenance material would then go to the gulf sites. About 10 acres of wetlands will be dredged from the Bayou Casotte turning basin.

While the FWS views the gulf disposal of some new work and all maintenance material as a positive feature of this alternative, we cannot support the filling of 257 acres of wetlands when other more acceptable alternatives are available.

On site inspections of the Tenneco area by the FWS and other agencies revealed that this wetland system supports valuable fish and wildlife resources. The area basically consists of a shrub wetland intermixed with various emergent vegetation such as *Scirpus robustus* and *Spartina patens*. The major shrub species are *Baccharis halimifolia* and *Iva frutescens*. Pockets of water are found throughout this area during various times of the year and the southern portion of this wetland receives tidal influence through a break in an old low dike.

While restricted tidal flushing does not enable large-scaled direct fishery use of the area as a major nursery site, it obviously contributes a vast amount of detrital material to the adjacent estuarine system. This detrital export is likely greatest during heavy rainfalls and high tide conditions. In view of the restricted tidal action within this area, the FWS has not quantified fishery losses using our Habitat Evaluation Procedures (HEP). However, as previously stated, the area does contribute to the marine system. Our quantified evaluations of this particular area have been based on wildlife species.

The gulf disposal of dredged material, while not quantifiable, is viewed as a positive impact on fish and wildlife over other methods of disposal. Our major concern, therefore, involves the dredging of 10 acres of wetlands in Bayou Casotte and the filling of 257 acres of wetlands at the Tenneco site. The 10 acres of marsh in the Bayou Casotte area would be lost due to construction of a turning basin. This would result in a loss of 6.0 AAHUs for rail and 4.0 AAHUs for muskrat. Fishery impacts would occur from the loss of 10 acres of marsh. This is reflected in the lower HSI value over the project life for seatrout and shrimp and is a result of the reduction of marsh to open water percentages. The AAHU losses for seatrout and shrimp are -6.0 and -8.0, respectively.



U.S. Army Corps of Engineers,
Mobile District

FIGURE 6

The FWS has also recognized the value of preserving the Bangs Lake marshes in terms of monetary benefits (see Appendix C). These fish and wildlife benefits are derived only for the preservation of the 196 acres annualized of the Bangs Lake marshes and not for other marsh creation programs. Furthermore, these benefits would only apply if all AAHU losses have been replaced.

These benefits are derived by taking the actual as well as potential values of marsh for such activities as hunting, fishing, and trapping. Values we have used for this purpose are based only on tangible revenue items. They do not reflect the total value of marshes which would have to include such things as filtration and flood control benefits. We wanted to demonstrate as accurately as possible the economical values of such habitats in a manner that could be reasonably accepted for incorporation in the project benefit to cost ratios for preservation of the Bangs Lake marshes.

From a overall project standpoint, the FWS Plan could serve a three-fold benefit.

1) The monetary saving of 196 annualized acres of marsh which would otherwise be lost without the project could be applied as a project benefit. Our calculations (Appendix C) show that the annualized acreage (196) of Bangs Lake marsh is valued at $66,68[illegible].90. Future projections show that without the Grande Batture Islands nourishment approximately 400 acres would be lost. The total 50 year benefits of the annualized acres (196) is $13,06[illegible],868 and could be applied to such a plan if it can be viewed as enhancement and not mitigation.

2) This plan would eliminate filling the Tenneco and Singing River Island marshes and likewise the cost of mitigating for these losses. For example, if the Tenneco marshes are filled, our calculations show that 251 acres of wetland creation would be required to compensate for the wildlife losses. In considering that to create 1 acre of tidal wetland would cost approximately $60,000, a plan to fill the Tenneco marshes could require over $15,000,000 for mitigation alone. See Appendix B.

3) Oyster reefs may also be established with the Grande Batture Islands alternative. If so, the value of such reefs may be used as project benefits. Our calculations show that the annual cost of any acre of reef with maintenance to be $300 and the benefits $9,000. (See Appendix B).

The FWS intends to pursue the Grande Batture Islands project feature or modification, if Plan B is not selected for implementation by the COE, and will work closely with the COE in further development of this feature.

[illegible] and Benefits [illegible] Plans

[illegible] impacts will occur with [illegible] in quantified [illegible] compensated. However, [illegible] which would result [illegible] the project cost should reflect [illegible] they [illegible] quantified.

[illegible] example of project cost in relation to fish and wildlife impacts would be the expenditures required to replace unavoidable wetland losses. Such compensation should be in the form of creating marsh by grading down, planting, and managing low productive uplands. We have computed cost for these actions (see Appendix B). Benefits to fish and wildlife resources could be applied to the project in cases where the alternative resulted in enhancement resources above any compensation requirements. An example of this would be renourishment of the Grande Batture Islands. This action, as part of the project, could save many acres of marsh in the Bangs Lake area which would otherwise be lost to erosion. If no mitigation was required then full benefits could be attributed for this action. Benefits as computed in Appendix C would be in the form of userdays for hunting and fishing, trapping values, and fishery production. In addition, other benefits could be derived by planting oyster shells north of the Grande Batture Islands.

Benefits will only result where resources are being enhanced and not compensated. However, once compensation is complete, any additional gains in habitat units would be recognized as benefits. For example, if the project required 100 acres of mitigation and the Grande Batture renourishment was projected to save 200 acres over the 50 year life, then 100 acres would be for mitigation and the remainder would be [illegible] and project benefits.

[illegible]

[illegible] losses do occur, mitigation in the form [illegible] be recommended. Generally, the replacement of wetlands [illegible] the following preferred order: 1) creation, 2) [illegible], and 4) preservation. A brief example of [illegible] follows.

[illegible] down uplands of low productivity to [illegible] establishment and planting the area. [illegible] include removing material from an old [illegible] located in a former wetland area. [illegible] the use of water control structures or [illegible] better water exchange or fluctuation of water [illegible] establishment. Preservation credit could occur in [illegible] trends indicated wetlands would be destroyed without protection measures. Marsh creation (as above) is usually preferred. However, in view of the expected losses of the Bangs Lake marshes without the project it appears that prevention of erosion could provide high mitigation potential and should be considered further.

Marsh creation using dredge disposal material has also been considered for the area behind the Grande Batture Islands dike. The FWS would consider such a measure but with some reservation. Previous marsh creation attempts using similar methods have been unsuccessful. Some success on Theodore Island was noted for dike stabilization purposes but only after much time and effort. In addition, when waterbottoms are filled to create marsh, a trade of one productive habitat type for another occurs. Therefore, the value of the waterbottoms being lost must be considered in computing total gains of HUs. The balance of marsh created and that saved from erosion would have to be weighed against the value of waterbottoms that would be lost. Some open water marsh creation might be considered in association with nourishment of the Grande Batture Islands. This would be behind the wave break structure which should increase its success.

It is therefore our belief that the most adequate and effective methods of replacing unavoidable HU losses would be through a marsh creation program which incorporates the shaving down of relatively low quality upland habitat or by preserving the Bangs Lake marsh through renourishment of the Grande Batture Islands. However, all methods would be considered. Regardless of the compensation measures ultimately recommended to Congress, they should be oriented toward the creation, restoration, enhancement or preservation of wetlands to offset the unavoidable fishery losses caused by the project. Also, the costs for initial development and continuing operation and maintenance of compensation measures should be provided as an integral part of the annual project cost. This should include necessary monitoring.

Estate Alternatives - Fee Title or Easement

The FWS has usually supported fee title acquisition of wildlife compensation lands. The advantages of fee title acquisition to accomplish compensation objectives include offsetting habitat value losses through management on the fewest acres, reducing administrative concerns, and assuring cost effectiveness. Situations do arise that indicate less-than-fee-title estates would accomplish the compensation goal better than fee title. In these cases, less-than-fee-title estates are given priority consideration. As described in the FWS' mitigation policy, fee title acquisition will be recommended only under one or more of the following three conditions:

[illegible] consideration of the [illegible] would [illegible] consistent with the mitigation goal for the specific project area; or

(2) When other means and measures for mitigation will not compensate habitat losses consistent with the mitigation goal for the specific project area; or

(3) When land acquisition in fee title is the most cost-effective means that may partially or completely achieve the mitigation goal for the specific project area.

FWS recommendations for fee title land acquisition will seek to identify mitigation lands with marginal economic potential.

The FWS believes that if acquisition for this project is required, it should be in fee title. However, should easements be significantly [illegible] to allow acceptable and complete [illegible] would be amenable to such acquisition. This [illegible] should only be requested should other measures [illegible], such as [illegible], fail to fully [illegible] project impacts.

Management Authority Delegation

The management of lands and waters designated for project fish and wildlife purposes would be accomplished in accordance with a General Plan developed jointly by the FWS, COE, and the Mississippi Department of Wildlife Conservation. Such action is required under Section 3 of the FWCA and is formalized in a Memorandum of Agreement between the FWS and COE which became effective in 1955. The General Plan will describe the management responsibility of the agencies involved. As a general rule, the FWS administers lands of particular value for the conduct of the National Migratory Bird Management Program. The State fish and game agencies normally are charged with managing resident game species but may also manage migratory birds on areas under their control. Regardless, the COE should bear the costs of initial developments and operation and maintenance for the lands authorized for resource compensation.

Unquantified Impacts

Dredging and disposal actions of each plan would result in some impacts which cannot be assessed in quantitative terms. These impacts are both positive and negative and include 1) turbidity, 2) salinity, 3) circulation, 4) covering of benthic organisms, and 5) increased development.

Turbidity would increase in the sound and gulf with various alternatives. However, such an impact in the shallow estuarine waters of the sound could be eliminated with gulf disposal. While this would increase gulf turbidity, we view the decrease of suspended sediments in the shallower estuarine waters as a positive trade-off. Spawning and migration of larval fishes and shellfishes could be effected depending on the time of year of the disposal. Therefore, further consideration should be given to seasonal dredging. The dynamic character of an estuarine system make it extremely difficult to specifically identify prime times for dredging. However, we should attempt to identify times when these critical spawning activities and migrations are lowest.

Salinity profiles were also computed using model data. As stated above, one major concern related to salinity was the possible impact on the oyster reefs near the mouth of the West Pascagoula River. Data shows that even channel depths of 55 feet would not create a significant salinity change in that area. Therefore, we do not anticipate any salinity problems with oysters. Monitoring of this area, however, should be conducted to assure no damages would occur.

Circulation improvement south of Singing River Island has also been considered. An underwater bar currently extends about a mile southeast of the island and parallel to the navigation channel. This bar, while restricting east-west circulation, also deflects fresh water from the East Pascagoula River toward the east. Reducing the size of the bar could have positive and negative impacts. The salinity profiles in the area of the oyster reefs could change. Further study would be needed to determine the detriments or benefits of reducing the bars dimensions.

Disposal in the gulf will result in the loss of some benthic forms. However, we believe that this disposal method would result in less damaging impacts than the current method of disposing in the sound. Impacts of this action could not be quantified using HEP. A monitoring program to determine salinity shifts and other possible project impacts should be implemented.

Other impacts that could not be quantified relate to secondary development stimulated by the deeper channel. Maximum use of existing harbor sites should be encouraged. The FWS is currently involved with long range harbor planning through the State of Mississippi's Special Management Area (SMA) program. Hopefully, the SMA plan will provide a means for future wetland losses to be avoided or adequately compensated.

Coastal Barrier Resources Act

The Coastal Barriers Resources Act (CBRA) (PL97-348), enacted on October 18, 1982, is broad legislation resulting from Congressional concern over burgeoning Federal expenditures in coastal areas. Most concern was voiced over expenditures in coastal barrier areas which are subject to frequent drastic change from natural forces. The purpose of the Act is to minimize the loss of human life, wasteful expenditures of Federal revenues, and damage to fish, wildlife, and other natural resources associated with coastal barriers. CBRA establishes the Coastal Barrier Resources System (CBRS) consisting of a series of units along the Atlantic and Gulf coasts.

Under CBRA, no new expenditures or new financial assistance may be made available under authority of any Federal law for any purpose within the CBRS, except as provided in Section 6 of the Act. Expenditures or financial assistance made available under authority of any Federal law shall be new if:

> "(1) in any case with respect to which specific appropriation is required, no money for construction or purchase purposes was appropriated before the date of the enactment of this Act; or
>
> (2) no legally binding commitment for the expenditure or financial assistance was made before such date of enactment."

Under Section 6, the appropriate Federal officer, after consultation with Department of the Interior, may make Federal expenditures or financial assistance available within units of the CBRS if the proposed action falls within the following exceptions:

(1) facilities necessary for energy exploration and development

(2) ship channel maintenance and dredge disposal

(3) maintenance of highways

(4) military activities essential to national defense

(5) Coast Guard facilities

(6) Activities permitted, if compatible with the purposes of the CBRA, including:

(a) management of fish, wildlife, and their habitat

(b) establishment of air and water navigation devices

(c) projects under the Land and Water Conservation Act and Coastal Zone Management Act

(d) scientific research

(e) emergency actions related to disaster relief

(f) maintenance of roads not a part of an essential system

(g) non-structural projects for shoreline stabilization.

These activities can only be conducted after consultation with the Secretary of the Interior. This responsibility has been delegated to the Regional Director, FWS.

As proposed, the Pascagoula Harbor Project does not appear to be in conflict with this Act as it relates to the Round Island unit, the only part of the CBRS found within the project area.

Endangered Species Consideration

A listing of fish and wildlife species that presently require consideration under the Endangered Species Act and are associated with the project area is contained in this report. The FWS has determined the project will not have significant impacts on endangered species in the area (See Appendix D). Since some species are currently under status review and could become listed during the project construction period, we recommend that you stay informed on the status of these species along with the presently listed species. It is recommended that the COE take every precaution in fulfilling your obligation to ensure that those species listed or being reviewed for possible proposed listing under the Act receive adequate consideration. Under the Endangered Species Act, it is the responsibility of the Federal action agency to determine the actual presence of listed species and the anticipated impact of the project on those species. They are required to initiate consultation with the FWS to determine if the expected impact will jeopardize the continued existence of that species.

CONCLUSIONS AND RECOMMENDATIONS

The FWS believes that the project objectives could be adequately achieved with minimum adverse impact to the environment. The potential to avoid impacts, while at the same time benefiting fish and wildlife resources, can be implemented as [illegible] project features. While some alternatives require no compensation and may even enhance overall environmental quality, others, such as the filling of wetlands, could be very damaging. In cases where damages are unavoidable, every attempt should be made to assure complete compensation of such impacts.

The recommendations listed below are provided to avoid, minimize, and, where unavoidable, compensate for project impacts:

Recommendations

1. Permanent filling of wetlands and waterbottoms for dredged material disposal should be eliminated from project plans. This would not only avoid project impacts but would also reduce project expenditures that would otherwise be required for compensation of fish and wildlife losses. Channel dimensions should be held to an absolute minimum to reduce dredging requirements. This would prolong the life of upland disposal sites and reduce the quantity of material proposed for discharge into open waters.

2. All dredged material should be placed in upland or select gulf sites unless the intended use of such is for benefiting fish and wildlife resources as agreed to by the various reviewing agencies. The current maintenance dredging practice of open water disposal in the sound should be discontinued and all material which cannot be placed in upland sites should be transported to deeper waters in the gulf.

3. The FWS recommends that Plan B, with appropriate mitigation, be the selected plan. This plan would eliminate shallow open water disposal, and the quantified impacts are minor. Only 7 acres of wetlands to be created by shaving down low production uplands would be required to replace fish and wildlife losses under this plan.

4. If the Grande Batture nourishment feature is pursued, we recommend that our suggested plan, which basically modifies Plan D by incorporating the gulf disposal, as in Plan B, and the renourishment of the Grande Batture Islands on a limited scale, be an alternative carried forward for additional study. This plan would result in only minor impacts to fish species which would otherwise be greatly impacted by Plan B. Shrimp and seatrout as well as wildlife species would benefit from such a plan. The acres of marsh to be preserved by reduction of erosion would be considered as a project benefit.

The FWS also recommends that the creation of oyster reefs be an integral part of our suggested plan if the Grande Batture Island renourishment feature is implemented. The benefits of such a measure would far outweigh its cost. The size and location of the reefs should be coordinated with the various state and federal agencies.

5. Plan A also results in minor quantifiable impacts but is not as desirable as Plan B or the FWS Plan because it proposes use of the existing maintenance practice of disposal within the sound. Like Plan B, only 7 acres of wetland creation would be required to mitigate the losses of wetland in Bayou Casotte. This plan is more preferable than either Plan C or Plan D as they are currently proposed. It deserves further study.

6. Plan C would result in extensive fish and wildlife losses. Approximately 309 acres of wetland creation would be required to replace in-kind fish and wildlife losses. The FWS, therefore, strongly recommends that Plan C as proposed be eliminated.

7. Plan E requires the filling of 257 acres of wetland at the Tenneco site and dredging of 10 acres in Bayou Casotte. As of now the FWS opposes this alternative but recommends that should the action be pursued 251 acres of wetland be created as mitigation for project losses at Tenneco and 7 acres be created for losses at Bayou Casotte.

8. If wetland creation from shaving down low productive uplands is implemented as mitigation, it should be developed prior to or concurrently with project initiation. The overall detailed mitigation plan, including wetland acreage, area, wetland type, plants, survival rate assurances, monitoring, etc., should be submitted by the COE for agencies' approval prior to implementation. Compensation lands should be acquired in fee title or, if acceptable, comprehensive easements as part of project cost. These areas will either be managed by the state or federal government. Cost of managing these areas over the project life will also be attributed to project expense.

Other general measures which could further help mitigate any of the project plans are as follows:

A. Dredging should be conducted during the late fall months (October - November) at which time aquatic resource spawning and migration activities are lowest.

B. Monitoring of the bay and deep gulf disposal sites should be conducted throughout the project to determine if the proposed work is creating any environmental problems.

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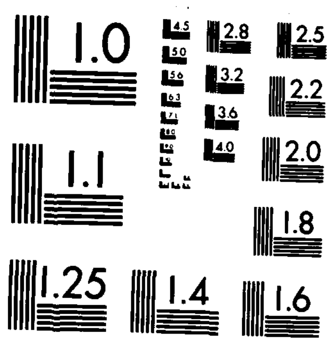

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

APPENDIX A

APPENDIX A

BASIS FOR HSI EVALUATIONS

On March 21, members of the Pascagoula Harbor evaluation team met to begin evaluation of the project area. Four species, spot, menhaden, seatrout, and shrimp were used for these analyses.

Data used to compute HSI values for these species were obtained from the COE. The acres of open water and marsh was 116,630 and 25,785 respectively for a total project area of 142,415 acres as computed by the National Coastal Ecosystem Team.

The following is a case by case explanation of the species HSI derivation. Each SI variable, means of evaluation, and HSI values are presented. HSI calculations for wildlife species are also included in this appendix.

SPOT

V1-B - Fine sands.

V2-29.4°C Avg. summer water temperature

V3-27.6 ppt. The avg. summer salinity

V4-7.33 ppm The avgerage minimum summer Dissolved Oxygen

V5-B - Waters in this area are between 3 to 6 meters.

SPOT -HSI CALCULATIONS

V(1): Dominant Sediment Type

A) Mud
B) Fine Sand
C) Coarse Sand.
D) Shell or Pebble

V(1) = B

V(1) = .8

V(2): Average Summer Temperature (C).

V(2) = 1

V(3): Average Summer Salinity (Parts per Thousand).

V(3) = .999

V(4): Average Minimum Summer Dissolved Oxygen Concentration (MG/L).

V(4) = 1

V(5): Average Water Depth at Mean High Water.

A) 0 to 3 N.
B) >3 to 6 M.
C) >6 M.

V(5) = .3

Component Index Scores.

Food= .8
Water Quality=.3

Equations. The SI values for the habitat variables are combined through the use of equations so that life requisite scores for spot can be obtained. The suggested equations for obtaining food and water quality values for spot are as follows:

Life requisite	Equation
Food (F)	V_1
Water Quality (WQ)	V_2, V_3, V_4, or V_5

HSI determination. The equation for determining HSI is based on the limiting factor concept which would indicate that HSI is equal to the lowest life requisite level. Sample data sets from which habitat suitability index values have been generated with the model equations are given in Table 2. The equation for spot is as follows:

HSI = F or WQ, whichever is lowest.
HSI = .3

SEATROUT

V1-10.2 ppt -	Lowest monthly average winter-spring salinity. Salinity ranges from the port to the islands range from 5 ppt to 25 ppt.
V2-32.2 ppt	Highest monthly average summer salinity.
	The highest monthly average summer salinity (June-August) range from the port area to the islands was 26 to 36 ppt respectively.
V3-9.20°C	Lowest monthly average winter water temperature (C)
V4-31.5°C	Highest monthly average summer water temperature (C)
V(5):	Percent Area with Submerged and Emergent Vegetation is 18%.
V(5) = 18%	25,785 acres of vegetation ÷ 142,415 of total area = 18%

SEATROUT - HSI CALCULATIONS

V(1): Lowest Monthly Average Winter-Spring Salinity. (Parts per thousand)
10.2 ppt
V(1) = .420

V(2): Highest Monthly Average Summer Salinity. (Parts per Thousand)
32.2 ppt.
V(2) = 1

V(3): Lowest Monthly Average Winter Water Temperature. (C_)
9.20
V(3) = .350

V(4): Highest Monthly Average Summer Water Temperature (C).
31.5°C
V(4) = 1

V(5) = Percent Area with Submerged and Emergent Vegetation.
18%
V(5) = .35

Life Requisite and Habitat Suitability Index (HSI) Equations

The HSI equation considers two life requisites as its components; water quality and food/cover. The water quality component is made up of the habitat variables salinity and temperature and is weighted since it is assumed that water quality is relatively more important than food/cover. In order to obtain a HSI for spotted seatrout the SI values for each habitat variable or life requisite must be combined as follows:

Life requisite	Equation
Water quality	$(SI_{v_1} \times SI_{v_2})^{1/2} (SI_{v_3} \times SI_{v_4})^{1/2} = .57335$
Food/cover	$SI_{v_5}^{2} = .36$

The following equation is used to determine an HSI for spotted seatrout in estuarine habitats:

$$HSI = [(\text{Water quality})^2 \times \text{Food/cover}]^{1/3}$$

HSI*= .49181

*HSI had to be expanded to reflect marsh percentage changes occurring over entire acreage of project area.

MENHADEN

V3-27.2 ppt   Average annual salinity.

V5-B   Substrate is sandy muds from port to islands.

V8-9.2°C   Lowest monthly average winter water temperature (Same as Seatrout V3)

V9-10.2 ppt   Lowest monthly average winter salinity. (Same as Seatrout V1)

V10-7.00 mg/L-Lowest weekly (changed to monthly) DO.

V11-A   Marsh in project area > 1000 acres

V12-B   Water color green on an average from port to islands

V13-31.5°C- Highest monthly average summer water temperature.

V14-27.2 ppt- Average annual salinity

MENHADEN - HSI CALCULATIONS

V(3): Average Annual Salinity. (Parts per Thousand) 27.2 ppt

V(3)= .680

V(5): Substrate Composition. (B)
A) Mud.
B) Sandy Mud.
C) Sand and Shell.
V(5) = 5

V(8): Estuarine - Lowest Monthly Average Winter Water Temperature.
(C)
9.2°C

V(8) = 1

V(9): Estuarine - Lowest Monthly Average Winter Salinity. (Parts per Thousand) 10.2
V(9) = 1.0

V(10): Lowest weekly average dissolved oxygen concentration. (ppm) 7.00
V(10) = 1

V(11): Marsh Acreage (A)
A) >1000
B) >500-1000
C) >50-500
D) >=50
V(11) = 1

V(12): Estuarine Water Color (B)
A) Brown
B) Green
C) ClearA
V(12) = .5

V(13): Highest Monthly Average Summer Water Temperature. (C) 31.5
V(13) = 1

V(14): Average Annual Salinity. *(Parts per Thousand) 27.2 ppt*
V(14) = 1

Water Quality = 1.0
Food = .5641
Cover = 1.0

HABITAT SUITABILITY INDEX FOR *GULF* MENHADEN IN ESTUARINE HABITATS = .901485 = .90

Life requisite	Equation
Water quality	$\dfrac{(V_8 \times V_{13}) + (V_9 \times V_{14}) + V_{10}}{3}$
Food	$[(V_3) \times (V_{12}) \times V_5]$
Cover	V_{11}

The following equation is used to determine an HSI for gulf menhaden in estuarine habitats:

$$HSI = [\text{Water quality} \times (\text{Food})^2 \times \text{Cover}]^{1/4}$$

$$HSI = .78$$

SHRIMP

V1 = 18% - (25,785 marsh ÷ 142,415 open water = 18.11%

V2 = 2 - Substrate (muddy sands)

V3 = 24.4 ppt - mean salinity during spring (ppt)

V4 = 20°C - Mean water temperature C°

BROWN SHRIMP - HSI CALCULATIONS

V(1): Percent of Estuary Covered by Vegetation (Marsh and Seagrass).
18
V(1) = .18

V(2): Substrate Characteristics (2).

1) Soft Bottom - Peaty silts, Organic Muds with Decaying Vegetation
2) Muddy Sands and Sand.
3) Coarse or Hard Bottom - Sands, Shell, Gravel with Little or no organic material

V(2) = .8

V(3): Average salinity during spring. (Parts per thousand)
24.4 ppt

V(3)= .912

V(4): Average Spring Water Temperature. (C) 20°C

V(4) For Brown Shrimp = 0.8

COMPONENT INDEX SCORES.

Food, Cover for White Shrimp = .29715
Water Quality for White Shrimp = .894427

Component Index (CI) Equations and HSI Determination

To obtain an HSI for white shrimp in estuarine habitats, the SI values for each habitat variable or life requisite must be combined. The suggested equation is as follows:

Component	Equation
Food, Cover (FC)	$(SI_{V_1}^2 \times SI_{V_{2b}})^{1/3}$ for brown shrimp
	$SI^2 \times SI)^{1/3}$ for white shrimp
Water quality (WQ)	$SI_{V_{3b}} \times SI_{V_4})^{1/2}$ for brown shrimp
	$SI_{V_{3w}} \times SI_{V_4}{}^{1/2}$ for white shrimp

HSI = FC or WQ, whichever value is lowest.

HSI* = .2959

*As with seatrout the HSI for shrimp to be expanded to reflect marsh percentage changes occurring over the entire acreage of project area.

WILDLIFE

Clapper Rail
(Bangs Lake Area)

V1 = 100% - Percent of shoreline of persistent emergent and scrub/shrub mangrove wetlands bordered by tidal flats or exposed tidal channels.

V2 = 75% - Percent of area covered by persistent emergent wetlands

V3 = 100% - Percent of emergent wetlands within 15 m of tidal influenced bodies of water.

HSI=(SIv_1 x SIv_2 x SIv_3) 1/3
HSI=(1.0 x .75 x 1.0) 1/4
HSI= .91

(Singing River)

V1 = 100%
V2 = 50%
V3 = 10%

HSI= (SIv_1 x SIv_2 x SIv_3) 1/3
HSI= (1 x .5 x .4) 1/3
HSI= .58

(Bayou Casotte)

V1 = 100%
V2 = 50%
V3 = 10%

HSI= (SIv_1 x SIv_2 x SIv_3) 1/3
HSI= (1 x .5 x .4) 1/3
HSI= .58

Table 3.
[illegible] Value of an acre of marsh for commercial fisheries

Species	Pounds/Acre[2]	Ex-vessel Price/lb.	Value/Acre
Shrimp (inshore)	64.24	$2.00	$128.48
Shrimp (offshore)	30.00	$2.00	$ 60.00
Menhaden	457.12	$ .05	$ 22.86
Croaker	17.88	$ .42	$ 7.51
Blue Crab	.45	$ .29	$ .13
Seatrout	2.88	$ .92	$ 2.65
Spot	3.45	$ .20	$ .69
Red Drum	.20	$ .38	$ .08
			$222.40/acre

[1] Ex-vessel price/lb. 1983 from NMFS, Pascagoula, MS

[2] Taken from studies in similar marshes of Louisiana

Table 4.
Shows the annual commercial fishery benefits
of saving 408 acres of marsh.

Year	Acres saved	$/acre	Total dollars
1984	0	$222.40	0
1987	+ 8	$222.40	$ 1,779.20
1990	+ 32	$222.40	$ 7,117.00
2000	+112	$222.40	$24,909.00
2010	+192	$222.40	$42,701.00
2020	+272	$222.40	$60,493.00
2030	+352	$222.40	$78,285.00
2037	+408	$222.40	$97,411.00

Annualized values = 196 acres X $222.4 = $43,590.00.

tudies conducted by the Fish and Wildlife Service in Louisiana have stimated that similar marshes can support a sport finfish harvest of 1.4 lbs/acre, a manday effort of 4.1 mandays/acre. Potential ombined commercial harvest of 576.22 lbs/acre of estuarine-dependent ommercial fishes, shrimp, and crabs were reported.

'able 2. Sports fishing values in terms of mandays per acre over project life.

'ear	Acres of marsh	Mandays (4.1/acre)	Manday value[1]
984	0	0	
.987	+ 8	32.8	$ 656.00
990	+ 32	131.2	$ 2,624.00
!000	+112	459.2	$ 9,184.00
!010	+192	787.2	$15,744.00
!020	+272	1,115.2	$22,304.00
!030	+352	1,443.2	$28,864.00
!037	+408	1,672.8	$33,456.00
\nnualized =	196	836.4	$16,728.00

[1] $20.00 per manday (Dept. of Interior, Nov. 1982)

)f the major commercial estuarine dependent commercial species (fishes, shrimp, and crabs), it was estimated that over 576 pounds vere produced per acre. This figure was derived by applying 1963-1973 landing data (lbs) to total acres in the Louisiana study unit. A breakdown of lbs/acre taken from this study is provided in Table 3 vith current ex-vessel prices[1]. This is used to obtain a dollar value per acre of marsh for commercial species.

WETLAND VALUES

The value of an acre of wetland habitat has often been debated and a wide range of economical benefits reported by various authors. Monetary values in terms of such features as fish and wildlife production, waste assimilation, and flood control benefits have ranged from $50,000 to $80,000. (Sea Grant, 1984).

Since some features of this project (Grande Batture nourishment) could result in saving many acres of valuable wetlands, benefits may be attributed to the project. This could apply in cases where the Grande Batture Island nourishment is enhancing and not mitigating the project. In cases where the marsh preservation is applied as mitigation, no benefits would be given. Any benefits resulting from this action could be applied to the B:C ratio.

The FWS has established marsh values which are based strictly on tangible items such as hunting, fishing, and trapping activities. It should be realized that these values do not represent the total value of wetlands for such features as filtration and flood control. In addition, many of the values are based on potential rather than actual occurrences. Much of our estimates were derived from similar marsh values obtained in Louisiana coastal wetlands. (Dept. of Interior, June 1981).

Table 1. Acres and Habitat Units of brackish marsh within the Bangs Lake unit with and without the Grande Batture Island Feature

Target Year	Acres of Marsh Without the Project	Acres of Marsh With the Project	Net Change
1984	2,220	2,220	0
1987[1]	2,190	2,198	+ 8
1990	2,160[2]	2,192[3]	+ 32
2000	2,060	2,172	+112
2010	1,960	2,152	+192
2020	1,860	2,132	+272
2030	1,760	2,112	+352
2037	1,690	2,098	+408

Annualized = 196 acres saved over 50 years of beneficial life

[1] Project is in place.
[2] Without the project a loss of 10 acres would occur each year.
[3] With the project a loss of only 2 acres (80% reduction) is estimated per year.

APPENDIX C

of Conservation and Natural Resources (Marine Resources Division), and Louisiana Department of Wildlife and Fisheries. The following is an itemized list of the cost of planting oysters over a cultch free area. Since some of the Grande Batture/Point Aux Chene area could have some cultch, this value is considered conservative and reduction in cost is likely.

Cost and Benefits of Creating 1 Acre of Oyster Reef

Cultch material = \$13.00 cy^3 x 300 cys/acre = \$4,000.00.[1]

Seed = \$1,000.00

Total Reef = \$5,000.00 initial cost for 1 acre.

Maintenance Cost

Every 5 years about 1/5 acre of reef will need restoring (this will vary with climatic conditions).

Over 50 years will need to replace 1/5 acre 10 times or 2 acres of reef.

2 acre cost not assuming inflation is therefore \$10,000.00.
Total cost of reef and O&M = \$15,000 over 50 years, or about \$300/year.

Benefits

1 acre of reef can be reasonably assumed to produce 900 barrels of oysters. Each barrel is worth \$10.00 at 1984 prices.[2]
1 acre can produce \$9,000.00 per year.

Not assuming inflationary cost and benefits the annual benefits could approach \$8,700.00.

\$9,000.00	= harvest value/yer
300.00	= annual O&M Cost
\$8,700.00	= net benefits of 1 acre of reef per year over 50 year project

1 Assumed cultch material purchase from Louisiana
2 Obtained from Gulf Coast Research Lab, Ocean Springs, MS

The manner in which each cost in Table 1 was derived is provided in itemized form as follows:

1. Purchase of land - This cost was provided by the Corps of Engineers for the Bangs Lake area. Upland values were estimated to be about $15,000.00 per acre. This is believed to be a conservative figure for purchase of such waterfront property required for adequate marsh creation.

2. Grading area down - This cost was computed on the average price of moving 1 cubic yard of material. On an average the height of upland elevations to be graded down was estimated to be about 6 ft. This amounts to 9,680 cubic yards per acre. This times $3.50/cubic yard is $33,880.00 per acre. (Personal contact with consultants).

3. Purchase of plants - Cost of plants would be on an average of about $.50 (personal contact with consultants). It would take 5,000 plants/acre if planted on 3 ft. centers. This cost would therefore be $2,500.00 per acre.

4. Planting (labor cost) - From interviews with consultants it was estimated that one man could plant an acre of marsh in 50 hours. An average salary of $10.00 per hour was used. Thus $500.00 per acre was computed for labor.

5. Reports - Reports on the mitigation would be required. This would describe the methods, plants, etc., to be employed. A base figure of $600.00 was estimated.

6. Botanist time - Estimated through personal contact to be $400.00 per acre. This takes into consideration that supervision would require about 2 days per acre.

7. Proposals, secretary time - Based on an estimate from personal contact. $2500.00.

8. Maintenance cost based on 10% of project cost - $5,538.00.

Oyster Reef Creation
(Cost and Benefits)

The possibility of creating oyster reefs in association with the renourishment of the Grande Batture Islands has also been discussed. Cost factors would include such items as 1) price of shell for cultch, 2) transportation cost 3) labor used for shell placement, 4) cost of seed oysters, and 5) maintenance of reefs. The cost estimates for these items were obtained from personnel of the Mississippi Bureau of Marine Resources, Gulf Coast Research Laboratory, Alabama Department

Table 1. Projected Cost of Marsh Creation Program Which Involves Shaving Down Low Productive Uplands.

Actions	Cost of Action[1]
Purchase of land[2]	$15,000.00
Grading area down	$33,880.00
Purchasing plants	$ 2,500.00
Planting (labor)	$ 500.00
Reports on mitigation	$ 600.00
Botanist time	$ 400.00
Proposals, Secretary	$ 2,500.00
Project cost (sub)	$55,380.00
Maintenance (10% of project cost)	$ 5,380.00
Total	$60,760.00

[1] The cost of land purchase, grading down area, plants, labor (botanist time), and maintenance, are figured on a per acre basis. Report writing, secretarial time, etc., are variable work items.

[2] Avg. price of land near areas (waterfront) required for adequate marsh creation programs.

Once the plants are in the ground the FWS usually requests that periodic reports be submitted to provide information relative to the status of the vegetated area in terms of survival rate, condition of the plants, and wildlife utilization of the area.

In general, the major cost involves purchase of the site, preparation of site, planting, and reporting on the status of the project. In order to provide the Corps with some indication of this cost we contacted various consultants which provide marsh creation services. Three consultants and other individuals were interviewed for purposes of deriving an average cost figure for marsh creation. The following table (Table 1) shows the average cost of several major items involved with marsh creation programs. Naturally the cost is subject to change in acordance with project location. However, we feel the figures provided here are approaching average values and can be used for projecting project cost for compensation.

APPENDIX B

Project Cost of Mitigation and Possible Enhancement Features

When unavoidable project impacts occur to fish and wildlife resources, compensation measures are recommended. With the Pascagoula Harbor Project, quantified impacts would occur with certain alternatives. In such cases, compensation in the form of marsh creation will be recommended. Funds needed for programs to regain lost wetland habitat units should be absorbed as a project cost. The following is a discussion of our recommended marsh creation method and cost. Also included is a discussion on the benefits and cost of creating oyster reefs.

Marsh Creation Method

The replacement of wetland losses can occur through several methods: 1) creation, 2) restoration, 3) enhancement, 4) preservation. We prefer shaving down low productive uplands for such purposes. With the Pascagoula Harbor project, another potential means to regain marsh values exist in the form of preservation. This is because the Bangs Lake marshes are naturally eroding and will further erode without the project unless something is done to reduce wave energies in the area. This could be done by renourishing the Grande Batture Island chain which has eroded from the same energies now working on the Bangs Lake wetlands.

In view of this, the FWS is looking at both (shaving down uplands and Grande Batture Island nourishment) as possible means of compensation. The following is a general description of what would be involved with marsh creation and general cost items.

Marsh Creation (Shave down)

This involves marsh creation from shaving down low productive areas. A large part of project cost involved with this is the purchase of acceptable sites. Such sites have to be in areas of suitable hydrologic regimes such as near tidal creeks, rivers, or bays.

The area must be shaved down to elevations suitable for the particular marshes to be established. The cost of this activity varies with the amount of material required for removal.

Once the area is prepared it is then planted with species conducive to the area. Often this is done by a professional since conditions are placed on these programs which require a certain degree of success. If the first attempt fails it must be tried again. Usually a survival rate of at least 75 percent plus is requested over a designated time frame. This cost involves the consultants fee, cost of plants, and preparation of area, etc.

APPENDIX B

<u>HSI Calculations</u>

V_1 - % herbaceous cnaopy - 50% = .6 <u>Food value</u>

V_2 - % shrub canopy cover - 50%

HSI = $V_1 + V_2$

HSI = .6 + 1.0

HSI = 1.0

V_3 - NA - Crops

V_4 - % shrub crown cover - 50% = 1.0 <u>cover</u>

HSI = $V_4 + V_5$

HSI = 1.0 + 1.0 = 2.0

HSI = 1.0

V_5 - 5+ = 1.0

Rabbit = 1.0 HSI

Wildlife Evaluation Species for Tenneco Area

Raccoon -

HSI Variable

V_1 Distance to water - photo = .5 miles

V_2 Water regime

A) Permanent

B) Semi-permanent

C) No water

V_3 NA

V_4 No. of refuge sites/acre = 5+

HSI Calculations

V_1 = Distance to water = .5 mi.+ = .8

V_2 = Water regime = A permanent water on all sides of area = 1.0

Water value = $(V_1 \times V_2)$

(.8 x 1) = .90

V^3 - NA - Forest

V_4 - 5+ = 1.0

Raccoon = .9 HSI

Bunting

HSI Variables

V_1 % shrub crown cover = 50

V_2 Average height of shrub canopy = 8 ft.

HSI Calculations

V_1 = % shrub crown cover = 50% = 1.0

V_2 = Average height of shrub = 6' = .8

$(V_1 \times V_2)$ = HSI =

1.0 x .8 = .90

Bunting = .9 HSI

Rabbit

HSI Variables

V_1 % herbaceous canopy = 70%

V_2 shrub canopy cover = 50+

V_3 Crops (NA)

V_4 % shrub crown cover = 50+

V_5 No. of refuge sites -over 5/acre

V_6 Fence rows (NA)

(Bayou Casotte)

V1 = 50%
V1 = .6

V2 = 100%
V2 = 1

V3 = 50%
V3 = .3

V4 = 50%
V4 = .70

V5 = None
V5 = .1

$$HSI = (V_1 \times V_2 \times V_3{}^2 \times V_4 \times V_5)^{1/6}$$

$$HSI = (.6 \times 1 \times .3^2 \times .7 \times .1)^{1/6}$$

$$HSI = (.00378)^{1/6}$$

$$HSI = .40$$

MUSKRAT
(Bangs Lake area)

V1 = 100% Percent canopy cover of emergent herbaceaous vegetation.
V1 = 1

V2 = 100% Percent of persistent emergent vegetation
V2 = 1

V3 = 75% Percent of persistent and nonpersistent vegetation
V3 = 1 consisting of olney bulrush, common three-square bulrush, or cattail.

V4 = 25% Percent of area in open water
V4 = 1

V5 = 25% Percent of open water supporting aquatic vegetation
V5 = .3

$$HSI = (V_1 \times V_2 \times V_3^{\,2} \times V_4 \times V_5)^{1/6}$$

$$HSI = (1 \times 1 \times 1^2 \times 1 \times .3)^{1/6}$$

$$HSI = (.3)^{1/6} = .82.$$

(Singing River Island)

V1 = 50%
V1 = .6

V2 = 100%
V2 = 1

V3 = 50%
V3 = .3

V4 = 50%
V4 = .70

V5 = None
V5 = .1

$$HSI = (V_1 \times V_2 \times V_3^{\,2} \times V_4 \times V_5)^{1/6}$$

$$HSI = (.6 \times 1 \times .3^2 \times .7 \times .1)^{1/6}$$

$$HSI = (.00378)^{1/6}$$

$$HSI = .40$$

Hunting and Trapping

Potential hunting values with the Bangs Lake marsh is also based on similar manday use values obtained from marshes in Louisiana. As with sport and commercial fishing values, population trends within the Pascagoula area dictate that the demand for sport hunting and trapping would not decline over the project life. Hunting manday values were based on waterfowl, rabbit, snipe, and rail.

Table 5 shows the habitat, species, potential manday effort per acre and value/manday in a brackish marsh.

Table 5
Shows potential mandays/acre and
$/mandays for brackish marsh

Habitat	Hunting activity	Potential mandays/acre	$/manday
Brackish Marsh	Waterfowl	.383	$15.00
	Rabbit	.120	$11.00
	Rails	.188	$11.00
	Snipe	.188	$11.00

Table 6
Shows annualized value of saving 196 acres
of marsh for various hunting activities

Hunting Activity	Potential MD/acre	$/MD	Annualized Acres	Potential Annual MDs[1]	Annualized Values[2]
Waterfowl	.383	$15.00	196	75	$1,125.00
Rabbit	.120	$11.00	196	24	$ 264.00
Rail	.188	$11.00	196	37	$ 407.00
Snipe	.188	$11.00	196	37	$ 407.00
Non-consumptive	.60	$11.00	196	118	$1,298.00
					$3,501.00

Total annualized manday values $3,501.00

[1] Annual mandays derived by multiplying the potential manday/acre figure by the annualized acres.

[2] Annualized values derived by multiplying the $/manday by the annual mandays.

Trapping

Values for potential fur trapping were obtained by taking an average of fur prices for furbearers common to brackish marshes. These were muskrat, otter, raccoon, nutria, and mink. The values of the pelts were averaged and this average was applied to the average fur animal harvest per acre as obtained from Louisiana marsh studies. Table 7 shows the value of an acre of marsh in terms of fur production.

Table 7
Dollar Value Per Acre of Marsh for Fur Trapping

Avg. fur animal/acre	Annualized acres	Total animal harvest per yr.	$ value/pelt[1] average price	Annual Value
$.50	196	98	$9.50	$931.00

[1] 1983 prices provided by Mississippi Dept. of Wildlife Conservation. Fur price per dry pelt: muskrat, $2.50; otter, $15.00; raccoon, $10.00; nutria, $1.00; mink, $19.00. Avg. price = $9.50/pelt.

The annual benefits for each outdoor related activity for the Bangs Lake marshes are provided in Table 8. All prices and manday efforts/acre were based on existing situations. In view of this, it will likely be necessary to extrapolate and annualize values over the project life.

Table 8
Annualized Dollar Value of Preserving 196 Acres of Marsh

Activity	
Sports fishing	$16,393.00
Commercial fishery	$43,590.00
Sports hunting and non-consumptive rec.	$ 3,501.20
Trapping	$ 931.00
Total annual value of 196 annualized acres =	$66,683.00

LITERATURE CITED

Sea Grant Advisory Service, March 20, 1984. Supporting Fisheries Interest in Mobile Bay.

U.S. Department of the Interior, U.S. Fish and Wildlife Service. June 1981. Deep-Draft Access to the Ports of New Orleans and Baton Rouge, Louisiana. pp. 24.

U.S. Department of the Interior, U.S. Fish and Wildlife Service. Nov. 1982. 1980 National Survey of Fishing, Hunting, and Wildlife Associated Recreation. pp. 156.

APPENDIX D

Unitcu States Department of the Interior
FISH AND WILDLIFE SERVICE
JACKSON MALL OFFICE CENTER
300 WOODROW WILSON AVENUE, SUITE 3185
JACKSON, MISSISSIPPI 39213

7

December 21, 1983

IN REPLY REFER TO:
Log No. 4-3-84-074

Mr. Willis E. Ruland
Chief, Environment & Resources Branch
Mobile District, Corps of Engineers
P.O. Box 2288
Mobile, Alabama 36628

Dear Mr. Ruland:

This responds to your letter of December 9, 1983, concerning channel improvements at Pascagoula Harbor, Jackson County, Mississippi.

We have reviewed the information you enclosed relative to the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.).

Our records indicate no endangered, threatened or proposed species, or their Critical Habitat occurring in the project area. Therefore, no further endangered species consultation will be required for this project, as currently described.

If you anticipate any changes in the scope or location of this project, please contact our office for further coordination.

We appreciate your participation in the efforts to enhance the existence of endangered species.

Sincerely yours,

Dennis B. Jordan

Dennis B. Jordan
Field Supervisor
Endangered Species Field Office

cc: RD, FWS, Atlanta, GA (AFA/SE)
ES, FWS, Daphne, AL
Department of Wildlife Conservation, Jackson, MS

APPENDIX E

WILLIAM A. ALLAIN
Governor

MISSISSIPPI DEPARTMENT OF WILDLIFE CONSERVATION

Bureau of Marine Resources
P. O. Drawer 959
Long Beach, MS 39560
(601) 864-4602
Enforcement Division 374-3205

Commissioners:

Edmund Keiser
Oxford, MS

Hunter M. Gaieb
Cleveland, MS

Lonnie Fadlock
Morton, MS

A. G. Williams
Osyka, MS

Joseph W. Gex
Bay St. Louis, MS

Richard L. Leard
Bureau Director

September 10, 1984

SEP 11 1984

Mr. Larry E. Goldman
Field Supervisor
U.S. Fish & Wildlife Service
P. O. Drawer 1197
Dalphne, AL 36526

Dear Mr. Goldman:

The Bureau of Marine Resources has reviewed a copy of the Draft Fish & Wildlife Coordination Act Report for Pascagoula Harbor, Mississippi prepared by your office and dated June 19, 1984. We have also reviewed the Supplement Report for the Pascagoula Harbor Project and offer the following comments.

The draft report which discusses fish and wildlife impacts associated with the proposed expansion of Pascagoula Harbor is quite comprehensive in its coverage of the fish and wildlife resources in the project area. The information regarding project impacts anticipated was also thorough and our staff utilized this information in preparing comments to the Corps of Engineers for the proposed improvements at Pascagoula Harbor.

The Bureau of Marine Resources supports the Fish and Wildlife Service in their efforts to further reduce the impacts associated with the alternative plans outlined by the Corps of Engineers in the Draft Report. We concur with your suggestion that the Corps consider a plan which would include gulf disposal of new work and maintenance material from the Sound channels, with the renourishment of Grande Batture on a limited scale (FWS Recommended Plan E). This differs from the Corps of Engineers Selected Plan E (COE/NED) and incorporates the most positive aspects of the alternative disposal elements into a more appropriate approach to the major disposal problems.

Finally, we agree that because of the disposal options available and because of the high benefit/cost ratios for this project the flexibility exist to allow for the development of a mutually agreeable plan for the navigation improvements at Pascagoula Harbor.

We appreciate the opportunity to review your report and look forward to working with you in developing a solution to the project at Pascagoula Harbor.

Sincerely,

(for) Richard L. Leard, Ph.D.
Bureau Director

RLL:RLL:bh

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Southeast Region
9450 Koger Boulevard
St. Petersburg, FL 33702

July 25, 1984 F/SER113/DEN

Mr. Larry E. Goldman
Field Supervisor
U.S. Fish and Wildlife Service
P.O. Drawer 1197
Daphne, AL 36526

Dear Mr. Goldman:

The National Marine Fisheries Service has reviewed the supplemental report to the Pascagoula Harbor Navigation project which accompanied your letter of July 16, 1984.

We offer the following comments for your consideration.

General Comment:

In accordance with our previous comments regarding the Fish and Wildlife Service Coordination Act Report for the Pascagoula Harbor Navigation Project, the supplemental information presented is complete and adequately addresses the environmental damage to fish and wildlife resources that would occur should the COE implement the NED Plan for this project.

Specific Comment:

Page 1, paragraph 6,
reveal should be revealed.

We appreciate the opportunity to provide these comments. If you have any further questions, please contact Mr. David Nixon of our Panama City Area Office at 904-234-5061.

Sincerely yours,

Edwin Keppner
for Richard J. Hoogland
Chief, Environmental Assessment Branch

30 1984

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Southeast Region
9450 Koger Boulevard
St. Petersburg, FL 33702

July 10, 1984 F/SER113/DEN

Mr. Larry E. Goldman
Field Supervisor
U.S. Fish and Wildlife Service
P.O. Drawer 1197
Daphne, Alabama 36526

Dear Mr. Goldman,

As requested, the National Marine Fisheries Service has reviewed the Draft Fish and Wildlife Coordination Act Report for the Pascagoula Harbor Project which accompanied your June 27, 1984 letter. The following comments are offered for your consideration.

General Comments:

The overall report is very well written and informative.

We concur with, and strongly support, Plan B which recommends deep Gulf disposal for all dredged material and mitigation for the 10 acre loss of tidal wetlands. We cannot, however, fully support the FWS alternate plan E at the present time. The uncertainty of success of open water marsh creations makes this plan questionable.

Specific Comments:

Page 15, 3rd Paragraph,

Manatee grass (Cymodocea manatorum) is mispelled in the text.

Page 66, Paragraph 5,

Marsh creation using of dredge disposal......."
of should be deleted from the sentence.

We appreciate the opportunity to provide these comments.

Sincerely yours,

Edwin J. Keppner
for Richard J. Hoogland
Chief, Environmental Assessment Branch

JUL 20 1984

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET
ATLANTA, GEORGIA 30365

JUL 18 1984

4PM-EA/WET

Mr. Larry E. Goldman
Field Supervisor
U.S. Department of the Interior
Fish and Wildlife Service
Post Office Drawer 1197
Daphne, Alabama 36526

SUBJECT: Draft Fish and Wildlife Coordination Act Report
Pascagoula Harbor Project

Dear Mr. Goldman:

We have reviewed the Fish and Wildlife Service Coordination Report on the Proposed Expansion of the Pascagoula Harbor Navigation Project, and we are in agreement with the "Conclusions and Recommendations" contained on pages 72 through 74 of the report and in your letter of June 20, 1984, to Colonel Patrick J. Kelly of the Mobile Office of the Corps of Engineers.

We agree that Plan C would have severe impacts on wetlands and should be eliminated from further consideration. We further agree that the Grande Batture Island erosion problem should be stabilized, but not at the expense of filling 75 acres of wetlands and 220 acres of waterbottoms at Singing River Island as proposed under Plan D. We agree with your contention that Plan B, which disposes of all maintenance and new work materials at the deeper Gulf sites, is the least damaging to fish and wildlife resources and is therefore the preferred plan. Plan E, which is suggested by your office as a revision to Plan B, would be acceptable to EPA.

The report is well prepared and we offer our support in implementing the recommendations as a part of the Pascagoula Harbor Expansion Plan.

Sincerely yours,

E. T. Heinen, Chief
Environmental Assessment Branch
Office of Policy and Management

GULF OF MEXICO FISHERY MANAGEMENT COUNCIL
Lincoln Center, Suite 881 • 5401 W. Kennedy Blvd.
Tampa, Florida 33609 • Phone: 813/228-2815

July 20, 1984

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R

26 1984

Mr. Larry E. Goldman
Field Supervisor
U.S. Fish and Wildlife Service
P.O. Drawer 1197
Daphne, AL 36526

Dear Mr. Goldman:

This responds to your June 27, 1984, letter transmitting for our review a copy of your draft Fish and Wildlife Coordination Act Report on the Pascagoula Harbor Project.

The Gulf of Mexico Fishery Management Council (GMFMC) has reviewed the subject document with respect to project impacts on fishery resources we manage pursuant to the Magnuson Fishery Conservation and Management Act. Depending on which plan the Corps of Engineers would follow, as much as 600 acres of wetlands could be destroyed. For example, under Plan C, 75 acres of wetlands on Singing River Island, 225 acres of waterbottom adjacent to the island, and 300 acres of wetlands on the Chevron property would be filled. These wetlands provide habitat, food, and water quality maintenance functions (cycle nutrients) that sustain such fishery resources as brown and white shrimp, menhaden, seatrout, blue crab, spot, croaker, and others. At least 138 fish species have been taken from the Mississippi Sand area 1/.

In view of the above, the GMFMC strongly endorses the recommendations in your report which greatly reduce the environmental impact of the Pascagoula Harbor Navigation Project.

We appreciate the opportunity to review your excellent report.

Sincerely yours,

Alex Jernigan by

Alex M. Jernigan
Chairman

cc:
GMFMC
Florida/Alabama Habitat Advisory Panel
Staff

1/ Christmas, J. Y. and R. S. Waller. 1973. Estuarine vertebrates, Mississippi. In J. Y. Christmas (ed.). Cooperative Gulf of Mexico Inventory and Study, Mississippi. Gulf Coast Research Laboratory, Ocean Springs, Mississippi. pp. 320-434.

A council authorized by the Magnuson Fishery Conservation & Management Act

SECTION D-9

CORRESPONDENCE CONCERNING COASTAL ZONE
MANAGEMENT ACT

-0001

July 30, 1984

Environmental Compliance
Section

Dr. Richard L. Leard, Executive Director
Mississippi Bureau of Marine Resources
Post Office Box 959
Long Beach, Mississippi 39560

Dear Dr. Leard:

Pursuant to the requirements of the Coastal Zone Management Act, please review the proposed improvement of the Federal deep-draft navigation channel at Pascagoula Harbor, Jackson County, Mississippi, for consistency with the Mississippi Coastal Program. Upon completion of your review, we request that a Certification of Consistency be granted for construction and five (5) year maintenance of the project.

Enclosed to facilitate your review are a completed application form and Feasibility Report, Volumes I and II, containing the Environmental Impact Statement for the proposed activity. A Statement of Consistency based on our review of the Mississippi Coastal Program is included on the application form. We have determined that the proposed action is consistent with the program to the maximum extent practicable.

If you have any questions concerning the proposed action, please contact Mr. Curtis M. Flakes at 205/694-4108.

Sincerely,

Lawrence R. Green
Chief, Planning Division

Enclosures

AM A. ALLAIN
Governor

MISSISSIPPI
:PARTMENT
ıF WILDLIFE
SERVATION

Bureau of
e Resources
P. O Drawer 959
each, MS 39560
(601) 864-4602
Enforcement
ıision - 374-3205

September 21, 1984

Mr. Lawrence R. Green, Chief
Planning Division
U. S. Army Corps of Engineers
P. O. Box 2288
Mobile, AL 36628

Dear Mr. Green:

With this letter we are responding to your July 30, 1984 letter requesting our concurrence on your consistency determination for the Pascagoula Harbor Project as described in the Draft Feasibility Report and the Draft Environmental Statement. Presently, we feel that the project is not ripe for consistency review for several reasons.

First, on July 18, 1984 we received a request from Mr. Willis E. Ruland, Chief, Environmental and Resources Branch, for comment on the Draft Feasibility Report and the Draft Environmental Impact Statement for the navigation improvements at Pascagoula Harbor. It was our understanding that our comments and those of others would be used in the preparation of the final reports.

We responded to this request on September 10, 1984. In our letter we recommended that the Corps of Engineers adopt Plan 3 with a small scale feature for replenishing the Grand Batture Island Basin.

We believe that this plan should be selected as the preferred plan because: (1) it minimizes the [illegible] disposal, [illegible] [illegible] Feasibility Report, [illegible]

[illegible] to one of the [illegible] should [illegible] that [illegible] quality. [illegible] problems, needs and opportunities [illegible] study area, the following study objectives were developed.

a. Recommend the plan that reasonably maximizes net economic development (NED) benefits, unless there are believed to be overriding reasons favoring the selection of another alternative which would justify an exception by the Assistant Secretary of the Army for Civil Works.

[illegible]ember [illegible], [illegible]

[illegible] Studies and
[illegible] Section

[illegible] Charlie [illegible] (USA, [illegible])
[illegible] Director
[illegible] of Natural Resources
[illegible] Box [illegible]
[illegible] Mississippi [illegible]

Dear [illegible]:

[illegible] part of the [illegible] process as outlined in the Council on Environmental Quality Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (40 CFR Part 1501.7), we are requesting your input in identifying significant resources and issues which should be addressed in the feasibility studies concerning channel improvements at Pascagoula Harbor, Mississippi. A map of the study area is enclosed. Even though we believe that many of the resources and issues have been identified through your efforts on the Mississippi Sound and Adjacent Areas Study and informal coordination on this study, we want to ensure that all significant issues are identified prior to coordination of the draft Environmental Impact Statement in March 1984.

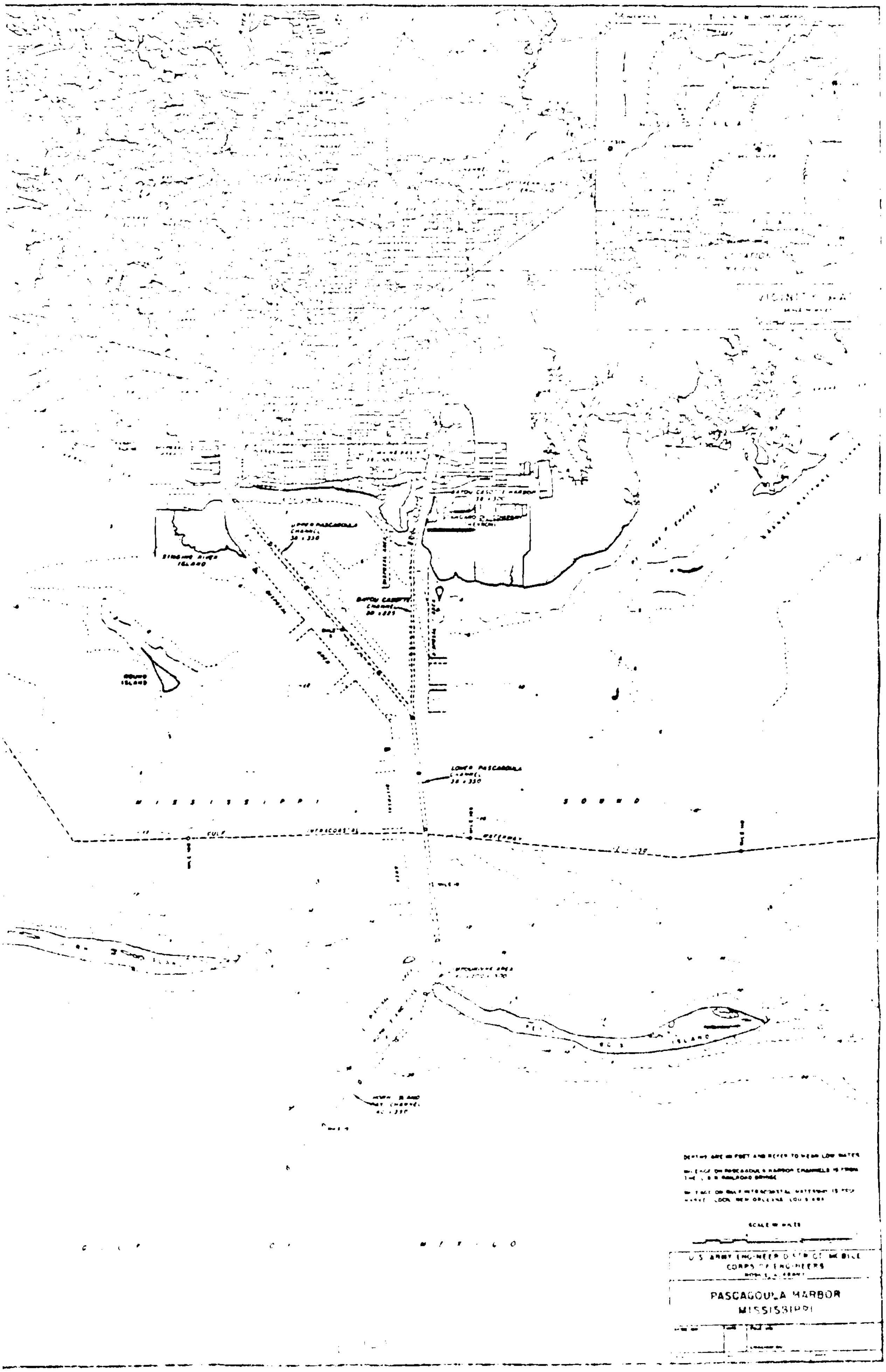
Preliminary determinations indicate that channel improvements would involve deepening existing channels to approximately 42 feet. This would result in new work quantities of 14 million cubic yards with maintenance activities involving approximately 5 percent greater amounts than current quantities. Disposal options currently being considered include use of Singing River Island, thin layer disposal in Mississippi Sound, open water disposal, Gulf disposal, island nourishment and island creation.

To assist us in meeting our current schedule, we would appreciate receiving your comments by January 13, 1984. Any questions should be addressed to Dr. Susan Ivester Rees of our Environmental Studies and Evaluation Section at (205) 690-2724 or FTS 537-2724. Thank you for your assistance in this important matter.

Sincerely,

Willis E. Ruland
Chief, Environment and
Resources Branch
Planning Division

Enclosure


M I S S I S S I P P I
S O U N D
PASCAGOULA HARBOR
MISSISSIPPI

SAMPD-ES 15 December 1983

SUBJECT: Pascagoula Harbor Deepening Study

Commander
8th Coast Guard District
ATTN: Ens. David Thompson
Hale Boggs Federal Building
500 Camp Street
New Orleans, LA 70130

1. As part of the scoping process as outlined in the Council on Environmental Quality Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (40 CFR Part 1501.7), we are requesting your input in identifying significant resources and issues which should be addressed in the feasibility studies concerning channel improvements at Pascagoula Harbor, Mississippi. A map of the study area is provided as Inclosure 1. Even though we believe that many of the resources and issues have been identified through your efforts on the Mississippi Sound and Adjacent Areas Study and informal coordination on this study, we want to ensure that all significant issues are identified prior to coordination of the draft Environmental Impact Statement in March 1984.

2. Preliminary determinations indicate that channel improvements would involve deepening existing channels to approximately 42 feet. This would result in new work quantities of 14 million cubic yards with maintenance activities involving approximately 5 percent greater amounts than current quantities. Disposal options currently being considered include use of Singing River Island, thin layer disposal in Mississippi Sound, open water disposal, Gulf disposal, island nourishment and island creation.

3. To assist us in meeting our current schedule, we would appreciate receiving your comments by 13 January 1984. Any questions should be addressed to Dr. Susan Ivester Rees of our Environmental Studies and Evaluation Section at (205) 690-2724 or FTS 537-2724. Thank you for your assistance in this important matter.

FOR THE COMMANDER:

1 Incl
as

Copy Furnished: [illegible]

WILLIS E. RUTLAND
Chief, Environment and
Resources Branch
Planning Division

SECTION E-2

CORRESPONDENCE DURING PLANNING

1. Use the material for the expansion of commercial and industrial development projects, as envisioned in the 1975 Port Authority Study.

2. Development of the east side of Bayou Casotte, south of the Chevron facility. (This is a refinement of the item 1.)

3. Development of Greenwood Island for harbor facilities. (Also refinement of item 1.)

4. Place material upland--no specific areas designated.

5. Continue building Singing River Island (Preferably for industrial development, but if not, for the creation of a tidal marsh area.)

6. Expand the beach front for recreational purposes.

7. Create more effective barrier island protection against storm tides.

8. Deep water disposal.

9. Develop the area west of the Pascagoula River and south of Highway 90. (See item 1 again.)

10. Restore and expand the east end of Petit Bois.

In summary, because of the heavy dependence of per capita income in Jackson county on industrial growth and development, significant interest continues to remain on expansion of Pascagoula Harbor. Expansion of onshore harbor facilities will require inclusion of now existing marshland into industrial development area. Logically, Jackson County residents would prefer that available dredge material be used to minimize development costs.

With regard to the proposed barge channels, both the east and west leg, interest still remains in the area. However that interest has been tempered with realism. First priority remains expansion of the incoming ship channel, with lesser priority being placed on both the east and west leg barge channels.

FINAL PUBLIC MEETING

A formal public meeting was held on 1[illegible] August 1984 at Pascagoula, Mississippi, to present the results of this study to the public. A brief summary of that meeting follows.

PASCAGOULA HARBOR, MISSISSIPPI

APPENDIX E

PUBLIC INVOLVEMENT AND COMMENTS

GENERAL

Formal public meetings were held on 15 March 1967, shortly after the study was initiated, and again on 9 May 1972, after the study had been reinitiated. The meetings were held to permit local interests to express their desires, views, and opinions in regard to the advisability and justification for modifying the existing Federal project. Since those meetings had indicated that those local interests were generally supportive of channel improvements, when the study was resumed for the third time the decision was made to omit a formal meeting. Informal contacts indicated that the general public would still favor widening and/or deepening the project. In addition, since the Mississippi Sound and Adjacent Areas study was already in progress, and task force meetings for the Pascagoula Special Management Area began shortly after this study was resumed, there was considerable coordination and input between all three studies. An informal public workshop was arranged after the study was well under way.

PUBLIC WORKSHOP

The Mississippi Cooperative Extension Service, Sea Grant Advisory Service, sponsored a public workshop on Pascagoula Harbor in Pascagoula on 17 August 1982, to discuss two items:

1. What should be done with the dredged material resulting from new work and/or maintenance of the project?

2. Was there still public interest in the barge channels proposed to connect the harbor areas to the GIWW west of the present intersection? If so, to what extent?

Those invited included city, county and state officials, as well as, industrial leaders and those recognized as having a major interest in environmental matters. Equal numbers of individuals with environmental interests and industrial development interests were invited. However, at the meeting, those with devlopment interests outnumbered those with environmental concerns. The results of the workshop, paraphrased slightly for brevity, follow.

The ten most important items suggested for dealing with dredged material, in order of importance, were:

SECTION E-1

SUMMARY OF PUBLIC INVOLVEMENT

PASCAGOULA HARBOR, MISSISSIPPI
APPENDIX E
PUBLIC INVOLVEMENT AND COMMENT

Table of Contents

APPENDIX E

PUBLIC INVOLVEMENT AND COMMENTS

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IV
345 COURTLAND STREET
ATLANTA, GEORGIA 30365

MAR 5 1985
4PM-EA/RGR

Mr. Lawrence R. Green, Chief
Planning Division
U.S. Army Corps of Engineers, Mobile
P.O. Box 2288
Mobile, Alabama 36628

Dear Mr. Green:

This response is in regard to your letter of February 8, 1985, concerning a Gulf of Mexico dredge disposal site off the coast of Mississippi. We are in agreement with the concept of finding a suitable disposal site within a 14 mile zone south of Horn and Petit Bois Islands in order to save additional costs of transporting dredged materials. However, we must caution you that suitable site-specific investigations are necessary to assure that an environmentally acceptable site(s) is available within this 14 mile zone. Based on your experience of finding sites within 16 miles offshore of Mobile Bay, you should be successful off the coast of Mississippi. Should suitable sites be unavailable within this zone we would have to look further offshore.

We look forward to working with you during the site specific designation studies during the port authorization phase of this project. Should you have any questions, please contact Reginald Rogers of this office.

Sincerely yours,

E.T. Heinen, Chief
Environmental Assessment Branch
Office of Policy and Management

SECTION D-10

EPA LETTER OCEAN DISPOSAL SITE DESIGNATION forwarding a copy of your letter to the Board of Engineers for Rivers and Harbors so that your recommendations may be considered in the Secretary of the Army's final decision on the project.

Should you need further information do not hesitate to contact me directly or contact Mr. Curtis Flakes or Dr. Susan Ivester Rees of Environmental Section at (205) 694-4108 or 690-2724.

Sincerely,

Lawrence R. Green, Chief
Planning Division

Enclosure

September 27, 1984

Environmental Studies
and Evaluation Section

Dr. Richard L. Leard, Director
Bureau of Marine Resources
Mississippi Department of Wildlife
Conservation
Post Office Drawer 959
Long Beach, Mississippi 39560

Dear Dr. Leard:

Reference is made to your letter of September 21, 1984, concerning coastal zone consistency for the Pascagoula Harbor deepening project. Our Final Environmental Impact Statement (FEIS), which has been transmitted to our higher authority, considered and responded to all comments received on the Draft EIS including your comments relative to provision of erosion control at Grande Batture. While we share your interest in protecting the wetlands [illegible] the Point [illegible] Chenes [illegible], we are constrained by Federal [illegible] to select the plan which maximizes net economic benefits [illegible] consistent with protecting the Nation's environment. [illegible] have [illegible] our [illegible] your comments that there [illegible] ample provisions [illegible] a [illegible] the increase in cost for [illegible] other than the least-cost [illegible]. Since your concerns in the September 21 letter are similar to those expressed in your comments on the Draft Environmental Impact Statement (DEIS), we have enclosed excerpts from the FEIS including responses to your comments and those of the Fish and Wildlife Service. An entire copy of the FEIS will be made available to you as soon as possible.

In conclusion, we reiterate our consistency determination for the selected plan which was provided to your agency on July 30, 1984; the selected plan is consistent with the Mississippi Coastal Program (MCP) to the maximum extent practicable. Thus, State agreement with our consistency determination was presumed since no response was received from your agency within 45 days in accordance with 15 CFR 930.41(a) and Chapter VIII Section 4, Part IV C1.c. of the MCP. Although consistency agreement with your coastal program has been presumed, consistent with Federal and State regulation, we are

Mr. Lawrence R. Green
September 21, 1984
Page two

b. Develop a plan of improvement that meets the needs of present and future navigation and minimizes the impacts of dredged material disposal. The plan should also contribute to environmental quality and enhance recreational values."

We would greatly appreciate your response to our September 10th letter and consideration of a revised plan encompassing these suggestions. Once we have received this response we will be in a position to determine coastal consistency for the Pascagoula Harbor Project.

We are looking forward to working with the Corps to develop a plan which will provide a solution for the existing navigation problems and enhance the economic and environmental quality of the area.

Sincerely,

Richard L. Leard, Ph.D.
Bureau Director

RLL:PLL:gb

Mailing List

Mr. Charles L. Blalock, Executive Director
Department of Natural Resources
Post Office Box 20205
Jackson, Mississippi 39205

Mrs. Deborah Franklin, Coordinator
A-95 State Clearinghouse
Department of Planning and Policy
1304 Sillers Building
Jackson, Mississippi 39201

Dr. Richard L. Leard
Department of Wildlife Conservation
Bureau of Marine Resources
Post Office Box 959
Long Beach, Mississippi 39560

Mr. Robert Seyforth
Mississippi Bureau of Pollution Control
Post Office Box 10385
Jackson, Mississippi 39209

Dr. Harold Howse, Director
Gulf Coast Research Laboratory
East Beach Drive
Ocean Springs, Mississippi 39565

Dr. James I. Jones, Director
Mississippi-Alabama Sea Grant Consortium
Caylor Building
Gulf Coast Research Laboratory
Ocean Springs, Mississippi 39565

Mississippi Chapter, Sierra Club
1101 Hickory Drive
Long Beach, Mississippi 39560

Mr. Paul Pella
Jackson County Port Authority
3033 Pascagoula Street
Pascagoula, Mississippi 39567

Pascagoula Bar Pilots Association
Post Office Box 2156
Pascagoula, Mississippi 39567

Mississippi Coast Audubon Society
4 Hartford Place
Gulfport, Mississippi 39501

Southern Mississippi Planning and
Development District
1020 32nd Avenue
Gulfport, Mississippi 39501

Gulf Regional Planning Commission
Post Office Box 4206
Gulfport, Mississippi 39501

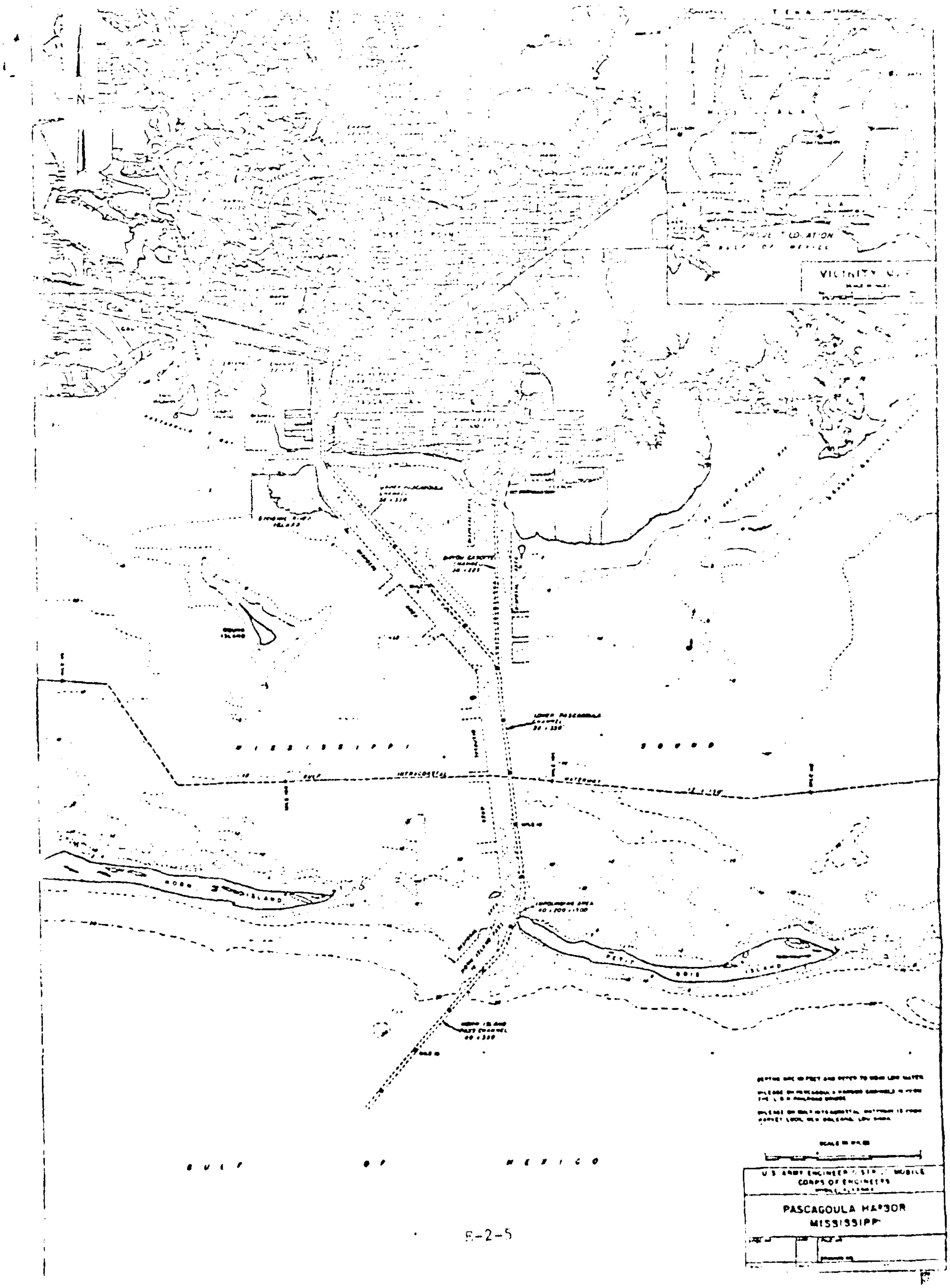
Regional Administrator
Environmental Protection Agency
Region IV, 345 Courtland Street, N. [illegible]
Atlanta, Georgia 30308

Mr. Larry Goldman, Field Supervisor
Division of Ecological Services
U. S. Fish and Wildlife Service
Post Office Drawer 1197
Daphne, Alabama 39526

Dr. Edwin Keppner
National Marine Fisheries Service
3500 Delwood Beach Road
Panama City, Florida 32407

Gulf Islands National Seashore
Coastal Field Research Laboratory
3500 Park Road
Ocean Springs, Mississippi 39[illegible]

Commander
8th Coast Guard District
ATTN: Ens. David Thompson
Hale Boggs Federal Building
500 Camp Street
New Orleans, Louisiana 70130


VICINITY MAP
GULF OF MEXICO
PASCAGOULA HARBOR
MISSISSIPPI

SOUTHERN MISSISSIPPI PLANNING & DEVELOPMENT DISTRICT

January 5, 1984

Willis E. Ruland, Chief
Environment and Resources Branch
Planning Division
Department of the Army
Mobile District, Corps of Engineers
Post Office Box 2288
Mobile, Alabama 36628

Attention: Environmental Studies and Evaluation Section

Dear Sir:

The Southern Mississippi Planning and Development District is in receipt of your letter dated December 15, 1983 requesting a reply by January 13, 1984 concerning input in the identification of resources and issues that should be addressed in the feasibility studies relating to channel improvements at Pascagoula Harbor, Mississippi. It is the District's pleasure to be of assistance in this matter.

Briefly stated, preliminary findings show that contemplated improvements to the channel would involve: (1) deepening channel depth to approximately 42 feet; (2) new work quantities of some 14 million cubic yards; (3) an increase in maintenance quantities of about 5 percent more than current amounts, and (4) proper disposal of the generated materials.

A 42 foot channel depth will provide an improved safety of movement for all waterborne traffic and ships of greater draft. The reduction of navigational hazard through channel improvement should engender greater use of port and harbor facilities by oceangoing vessels and a corresponding growth in the volume of world trade. It is the District's considered opinion that improvements to the harbor channel will be of direct benefit not only to the port facility and adjoining communities, but also will have a positive impact upon the economy of the coastal region.

1020 32ND AVENUE GULFPORT, MISSISSIPPI 39501 U.S.A. (601) 868-2311

Key to successful completion of the Pascagoula Harbor Channel Improvements appears to be proper use and disposal of spoil so that quality of the environment is protected while useful applications of dredged materials are maximized. The Bureau of Marine Resources, designated state agency for management of the Mississippi wetlands, has an active Special Management Area (SMA) Task Force that is involved in spoil management under the Coastal Program. Useful applications of spoil have been under study by the Corps of Engineers for a number of years.

It is the District's hope that spoil disposal problems will be resolved in such a manner that the substantial economic benefits of the project may be realized. Thank you for this opportunity to express our comments.

Sincerely,

Volney J. Cissna, Jr.

Volney J. Cissna, Jr., AICP
Special Projects Officer

VJC/rwm (0941P)

GULF COAST RESEARCH LABORATORY
EAST BEACH
OCEAN SPRINGS, MISSISSIPPI 39564

THE DIRECTOR'S ROOM

January 10, 1984

Mr. Willis E. Ruland, Chief
Environment and Resources Branch
Department of the Army
Mobile District Corps of Engineers
P. O. Box 2288
Mobile, AL 36828

Dear Mr. Ruland:

In reply to your request for input in identifying significant resources and issues concerning channel improvements at Pascagoula Harbor, Mississippi, we also believe much of the work has already been incorporated in the Mississippi Sound and Adjacent Areas Study. Like the Gulport Harbor Project, the deposition of dredged materials appears to be the most significant environmental problem.

Although no details were given in the list of disposal options you are considering, island nourishment in the vicinity of Horn Island Pass appears to be both environmentally acceptable and economically feasible. You might also consider nourishment of east side of Round Island if you are not presently doing so. It has been severely eroded by past storms, has little or no marsh areas which would be destroyed by this action and has historical interest (lighthouse).

In the Master Plan of the Greater Port of Pascagoula Area Port, Harbor, and Industrial Development, published by the Jackson County Port Authority (September, 1975), the Authority proposes using dredge spoil to build and extend the area south of the Chevron, U.S.A. plant. This action would further restrict the westward current drift within the Mississippi Sound, as well as destroy a large area of viable salt marsh. Serious consideration should be given to these problems in considering any disposal option in this area.

Sincerely,

Harold D. Howse
Director

mlf

Tennessee Gas Transmission
A Tenneco Company

Tenneco Building
P.O. Box 2511
Houston, Texas 77001
(713) 757 2131

January 25, 1984

Mr. Lawrence R. Green
Corps of Engineers
P. O. Box 2288
Mobile, AL 36628

Dear Mr. Green:

This letter is to confirm our verbal response to your written questions of January 3, 1984 concerning a proposed LNG receiving terminal at Pascagoula, Mississippi.

A major priority for using the Pascagoula site as an LNG receiving terminal would be an overall channel with both a minimum width of 350 feet and a minimum depth of 42 feet.

This would allow the use of fully loaded, 125,000 cubic meter LNG tankers, although still requiring a restriction on inbound channel speeds. With reduced speeds in a 350 foot wide channel, stand-by tags may still be required, however, the average number of tugs would be reduced.

Our existing studies and simulations do not estimate the minimum prudent tug requirements for various weather conditions and channel configurations. Therefore, a quantitative answer on tug requirement reductions for a given channel configuration is not possible.

If additional clarification is needed, please call me or Mr. Rex Tidwell.

Sincerely,

V. V. Staffa

VVS/ji

Attachment

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET
ATLANTA, GEORGIA 30308

4E-ER/WT

JAN 28 1980

Mr. Lawrence R. Green
Chief, Planning Division
Mobile District, Corps of Engineers
P.O. Box 2288
Mobile, Alabama 36628

SUBJECT: Studies for Improvement of Navigation Facilities,
Pascagoula Harbor, Mississippi

Dear Mr. Green:

This is in response to your letter of November 27, 1979, requesting information on specific problems and profile data in the area of the proposed studies on Pascagoula Harbor up to Dog River Mile 6.

Some water quality and environmental problems do exist in the area and any development of port facilities should be done with due consideration given to existing problems so that the present difficulties are not aggravated.

The study area contains five municipal waste treatment plants. The city of Pascagoula operates three of these plants and the city of Moss Point operates two plants. The Pascagoula plants consist of the Foster Street Plant which discharges 3.55 mgd into the Pascagoula River, the Eastside Plant which discharges 0.66 mgd into the Pascagoula River and the Bayou Casotte Plant which discharges an estimated 1.46 mgd into Bayou Casotte. The Moss Point Plants consist of the MacFarland Street Plant which discharges 1.35 mgd into Goods Lake which drains into the Escatawpa River, and the Dantzler Street Plant which discharges 0.70 mgd into the East Pascagoula River.

The last O&M reports show that the Pascagoula plants are having problems removing the required amount of suspended solids, while the BOD level is adequate. The Bayou Casotte arm of the harbor is confined and has a small drainage area and does not have good flushing. There is a proposal to abandon the Bayou Casotte Plant and treat the flow at the Foster Street Plant.

The Moss Point trickling filter plants were achieving secondary treatment plant levels as of the last O&M report one year ago.

Water quality problems are complicated by the configuration of the harbor channels and spoil piles. Virtually all pollutants from the treatment systems and surface runoff from the Pascagoula, Moss Point, and Bayou Casotte areas enter the triangular area of Mississippi Sound between the Pascagoula and the Bayou Casotte approach channels. Continued overboard disposal of dredged spoil in the present manner will gradually choke off the east-west littoral currents along the north shore of Mississippi Sound and adversely affect water quality in the recreational areas along the shore to the east and west of the harbor area.

Another related effect could be an increase in the erosion along the barrier islands resulting from the deflection of the natural littoral currents along the north shore. The flow of water through Mississippi Sound will take the path of least resistance, and with the flow progressively being blocked off along the north shore, the current will increase along the barrier islands. Another condition aggravating water quality problems along the north shore of Mississippi Sound is the hundreds of storm water drains which discharge into the shallow waters along the shore. Many of these drains contain septic tank seepage.

For these reasons, the Environmental Protection Agency has consistently recommended Gulf disposal of all materials in the Mississippi Sound channels which cannot be deposited upland.

Another problem related to harbor expansion is the location of suitable upland disposal sites. Some of these problems were discussed in detail in our review of previous reports such as the "Master Plan, Greater Port of Pascagoula Area Port, Harbor and Industrial Development by Michael Baker, Jr., including a Bulk Transfer Terminal at Bayou Casotte, Pascagoula, covered in the Environmental Protection Agency letter of March 15, 1976; "Navigation improvements at Krebs Lake, Mississippi," covered in our letter of June 21, 1979; and the Environmental Protection Agency letter of May 28, 1978, relating to the maintenance dredging of the Pascagoula River, Jackson County, Mississippi, (SAMOP-S-PN-FP 78-00909-E). Since the upper Pascagoula and Dog River Harbor areas are fringed with marsh and wetlands considerable care must be taken in selecting spoil sites which conform to present standards with regard to wetland protection.

The best water quality data on the river systems can be obtained from the state.

Sincerely yours,

Arthur G. Linton, P.E.
Federal Activities Coordinator
Enforcement Division

cc: See Attached

cc: Area Office
U.S. Fish and Wildlife Service
Jackson, Mississippi

Mr. J. Paul Smith
U.S. Fish and Wildlife Service
NSTL Station, Mississippi

Mr. James W. Warr
Alabama Water Improvement Commission

Mr. Hugh A. Swingle, Director
Alabama Division of Marine Resources

Regional Director
National Marine Fisheries Service

Mr. John Hall
National Marine Fisheries Service

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET
ATLANTA, GEORGIA 30365

JAN 20 1984

4PM-EA/RGR

Willis E. Ruland, Chief
Environment and Resources Branch
Planning Division
U.S. Army Corps of Engineers
P.O. Box 2288
Mobile, Alabama 36628

Dear Mr. Ruland:

This is in response to your December 15, 1983, request for identifying resources and issues which should be addressed in the feasibility studies concerning channel improvements at Pascagoula Harbor, Mississippi.

These studies should adequately discuss the ecological consequences of each of the alternative disposal site options, e.g., effects of constructing islands in the sound on water exchange. The loss of fishing habitat, such as grass beds and bay bottoms, should be minimized to the maximum extent possible.

We are providing the following priority list of disposal site alternatives that include the sites the COE is suggesting plus this agency's preferences. Our first priority is at the top of the list with lesser priorities following. The last three (10, 11, 12) on the list are unacceptable and should be eliminated.

1. Upland sites with reclamation of materials.
2. Upland sites.
3. Ocean disposal.
4. Non-upland site with reclamation of materials.
5. Expand Pitit Bais Island.
6. Expand Grande Batture Island.
7. Horn Island "B".
8. Expand Singing River Island slightly (only to North).
9. Sound Island.
10. Point Aux Chene.
11. Expand Horn Island.
12. Point Toussant.

appreciate the opportunity to review this subject and ovide comments. We will continue to provide assistance rectly and also through the SMA process for coastal ssissippi.

ncerely yours,

eppard N. Moore, Chief
vironmental Review Section
vironmental Assessment Branch

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET
ATLANTA, GEORGIA 30365

FEB 7 1984

4PM-EA/RCR

Mr. Willis E. Ruland, Chief
Environment and Resources Branch
Planning Division
U.S. Army Corps of Engineers
P.O. Box 2288
Mobile, Alabama 36628

Dear Mr. Ruland:

This is in reference to our letter to you dated January 20, 1984, regarding dredged material disposal sites for the Pascagoula Harbor area.

Difficulty in reading one of the figures by my staff lead us to suggest that Petit Bois Island be used for disposal of dredged material. This was an error and we prefer that no dredged material be disposed on the Sound side of the Island. However we would not object to clean sand being placed on the Gulf side of the Island.

If we can provide further reviews and comments please let me know.

Sincerely yours,

Sheppard N. Moore, Chief
Environmental Review Section
Environmental Assessment Branch

Mississippi Chapter, Sierra Club
1101 HICKORY DRIVE
LONG BEACH, MISSISSIPPI 39560

30 July 1982

ıwrence R. Green, Chief
ng Division
e District, Corps of Engineers
e, Alabama 36628

Mr. Green:

This letter will serve to express the Mississippi Chapter's interest e Pascagoula Harbor study relating to ship channel widening and ning. Our purpose for input at this time is to inform you of our rns and apparent needs for investigation by your able cadre of eers and scientists.

We are concerned with the water quality, both on and below the study and the effects dredging may have upon an already bad water quality tion. Will channel deepening aggravate salt water intrusion of local water aquifers? Will a deeper channel create dead, oxygen deficient and a sink for toxic industrial byproducts? What method of dredge minimize the redistribution of heavy metals, pesticides and toxic cals of the polluted waterbottom?

We would like the study to examine the feasibility of the following atives among others: relocation of the harbor channel approaches e east of Petit Bois island; the construction of a marsh-upland habitat island from dredged spoils. We would like the study to mine the increased incidence, if any, of accidental crude oil spills ntentional discharges of oily bilge water as a result of a deeper r. Other questions which we believe should be answered by the Study

1. What is the justification for deepening the Pascagoula Harbor, considering the changed circumstances since 1965 when the study was authorized and the proximity of the Port of Mobile?
2. Who are the beneficiaries of a deeper, wider channel? Who are the sponsors and their shared costs (federal, state and local governments and private user)? Does the fishing industry gain or lose overall?
3. Could the deeper, wider ship channel be maintained without federal aid? Are user fees being considered? Could the Port of Pascagoula respond to a major oil spill? Does the harbor area have adequate land acreage for handling larger bulk and containerized cargoes? What is the berthing capacity of the harbor for deep-draft vessels.

The burden of proof of whether or not the Pascagoula Harbor project is mically and environmentally sound lies with the Corps of Engineers and

Mississippi Chapter, Sierra Club

30 July 198[illegible]

the Port of Pascagoula. The Mississippi Chapter chooses to function as a sounding board for the purposes of the study results and recommendations. Our objective is to have the Pascagoula Harbor be viable and self-sufficient for the citizens of Mississippi while at the same time not being a liability for the coastal environment.

Thank you for the invitation to input information at a meaningful point in the planning process.

Sincerely,

Cy Rhode

Cy Rhode,
Coastal Affairs Chairperson

STUDY AUTHORITY

This study was authorized by several resolutions adopted by the Senate and House Public Works Committees. Those resolutions requested studies to determine if modifications to the existing navigation project for Pascagoula Harbor are warranted.

The present study is primarily responsive to the resolution adopted September 23, 1965 by the Committee on Public Works of the United States Senate which reads, in pertinent part,

> "That the Board of Engineers for Rivers and Harbors ... is hereby requested to review the report of the Chief of Engineers on Pascagoula Harbor, Mississippi ... with a view to determining the advisability of modifying the project at this time."

The other resolutions authorized study of inter-harbor barge channels. After the study was initiated the Jackson County Port Authority, as local sponsor, requested that study of those channels be deferred until the problems associated with the deep-draft channel be resolved.

PURPOSE OF THE STUDY

In response to current policies, plans were initially formulated to address a wide range of water-related problems in the study area. However, preliminary evaluations indicated that it was not practical for this study to address many of those problems. The study considered the need for modification of the existing Federal project at Pascagoula Harbor in Jackson County, Mississippi, to accommodate present and prospective commerce. The primary study area included the Federal project and all lands and waters directly impacted by the project. Plans were formulated to meet the identified needs and associated costs and benefits were estimated. The economic, environmental, and social impacts of the proposed improvements were assessed. The study was performed in sufficient detail to determine what resource management measures or systems would be in the overall public interest at Pascagoula Harbor and should be recommended for Congressional authorization.

STUDY FINDINGS

Plans with channel dimensions up to 55 feet deep by 600 feet wide were initially considered. However, early economic surveys showed that, while deepening and/or widening the existing project was probably feasible, dimensions that were very much greater than the existing channel could not be justified. In addition, rerouting the channel to any extent resulted in large quantities of new work dredging, with attendant high costs and extensive environmental problems. Therefore, alternatives such as rerouting the channel around Petit Bois Island and straightening the bar channel were

DEPARTMENT OF THE ARMY
MOBILE DISTRICT, CORPS OF ENGINEERS
P. O. BOX 2288
MOBILE, ALABAMA 36628

REPLY TO
ATTENTION OF:

August 1, 1984

Coastal Branch

NOTICE OF PUBLIC MEETING

AND

PUBLIC INFORMATION BROCHURE

he Mobile District of the US Army Corps of Engineers has recently completed detailed feasibility study of the deep-draft channel portion of the ascagoula Harbor navigation project. This public meeting is being held to resent the results of that study and receive comments from the general ublic.

ll interested persons and organizations are invited to attend and articipate in this meeting. It is requested that persons having important acts or statements submit them in writing where possible, for accuracy of he record. Written statements may be submitted at the meeting, or mailed n advance. Oral statements will be heard and recorded and, along with ritten statements, will become a part of the official record.

he public meeting will be held on:

Tuesday, August 14, 1984
7:00 PM
at
Gulf Coast Junior College Auditiorum
Gautier, Mississippi

e welcome your comments. Please review the contents of thi brochure and ttend the meeting and present your views. If you cannot attend, or you ish to present a written statement in advance, such correspondence should e directed to the District Engineer, US Army Corps of Engineers, Mobile istrict, ATTN: SAMPD-N, PO Box 2288, Mobile, Alabama 36628-0001.

S Army Corps
f Engineers
obile District

PUBLIC MEETING ANNOUNCEMENT

UBLIC MEETING WILL BE HELD BY THE MOBILE DISTRICT, ; ARMY CORPS OF ENGINEERS, TO PRESENT THE RESULTS : ITS STUDY TO DETERMINE IF IMPROVEMENT OF THE :EP-DRAFT PORTION ON THE FEDERAL NAVIGATION PRO-CT FOR PASCAGOULA HARBOR, MISSISSIPPI, IS FEASIBLE.

'HEN? AUGUST 14, 1984
7:00 PM

'HERE? GULF COAST JUNIOR COLLEGE
AUDITORIUM
GAUTIER, MISSISSIPPI

'HO? ALL INTERESTED PARTIES

SEE ATTACHED SHEETS FOR ADDITIONAL INFORMATION

SECTION E-3

PUBLIC MEETING ANNOUNCMENT

PASCAGOULA BAR PILOTS ASSOCIATION

2805 FRONT STREET
POST OFFICE BOX 2..
PASCAGOULA, MISSISSIPPI 3956?
TELEPHONE (601) 7?2-1131

... E. BROWN
... C ...
... FORD

CAPT. DONALD ...
CAPT. JACOB A. ...
CAPT. CHARLES ...

April 14, 1983

Captain of the Port
United States Coast Guard
P.O. Box 2924
1900 First National Bank Bldg.
Mobile, Alabama 36652

Dear Sir:

Pascagoula Bar Pilots Strongly recommends the construction of two sets of ranges in Bayou Casotte for outgoing traffic. One set located in the flat, South of Beacon #8, helping very much in the passage of the Chevron Shipping berths. Various small beacons are destroyed simply because of the small vessels not knowing where they are in this narrow channel. The second set located to the west of Buoys 29 and 27 or in this vicinity on the flat (spoil area).

We are expecting an increase in shipping, making it necessary to sail large ships at night. This part of the channel is only 225 feet wide. This part of the channel, because of its narrow width, has a constant silting on the edge of the channel making it appear to be a narrow thin line of deep water "37 feet" sloping up towards the edge of the channel outbound. With a 123 foot beam ship moving slightly either way you are touching bottom. The existing beacons and buoys are not placed in straight lines making it very difficult to navigate.

We would appreciate consideration of the construction of these ranges.

Yours truly,
PASCAGOULA BAR PILOTS ASSOCIATION

Captain J. D. Collier
P... ...

...

CC: ...

ENCLOSURE 3

The Port Authority concurs with the pilots that he establishment of outbound ranges for both legs f the channel is essential for the safe navigation f vessels in Pascagoula.

We would be very happy to make arrangements with hevron so that your people could ride the vessels hile transitting the channels.

We thank you for your continued cooperation.

Sincerely yours,

JACKSON COUNTY PORT AUTHORITY

PAUL D. PELLA
Port Director

mg
c: Pascagoula Bar Pilot's Association

ACKSON OUNTY ORT UTHORITY

3033 PASCAGOULA STREET · PASCAGOULA, MISSISSIPPI 39567 · TELEPHONE 762-4041

May 11, 1983

Captain Wm. J. Ecker
Marine Safety Office
U. S. Coast Guard
P. O. Box 2924
Mobile, AL 36625

Dear Captain Ecker:

During our last conversation, I discussed with you the proposed additions to the Aids to Navigation for the Port of Pascagoula, Mississippi.

The Pascagoula Bar Pilot's Association contacted us concerning the establishment of two (2) outbound ranges for the Bayou Casotte harbor.

The Bayou Casotte harbor is the busiest area of our Port. In 1980, 75% of our traffic was in this channel - approximately 450 vessels. Of these vessels, 50% were in excess of 700' in length and beams ranging up to 125'. The future for the channel becomes more critical in that Chevron, U.S.A. plans to commence shipping coke in late 1983. The vessels that will be coming to the coke dock will have a beam of as much as 140' and a length of 830'. Since the channels are only 225' wide, and not taking into account the shoaling that is caused by the tidal conditions, the total attention of the pilots is required to ensure that the vessel stays in the center of the channel. With the only existing ranges in each of the legs being behind an outbound vessel, it necessitates the pilot leaving the wheelhouse to walk to the wing of the bridge to look back on the range, which many times is restricted by the haze caused by local industries.

LOSURE

3531
JUL 07 1983

Subj: Aids to Navigation in the Bayou Casotte Channel

5. (cont.) definitely on the upsurge primarily involving vessels of greater size who have less margin for error from the centerline of the channel, the presence of at least one additional downbound range would significantly enhance the safety of the passage and avoid the necessity of continually looking back at the existing upbound range.

6. Your consideration and further action in this matter would be appreciated.

W. J. ECKER

Encl: (1) Jackson County Port Authority letter dated 11 May 1983
(2) Pascagoula Bar Pilots Association letter dated 14 April 1983
(3) LTJG KENWORTHY'S memo dated 14 June 1983

OFFICE DIVISION											
OUT											

DEPT. OF TRANSP., U.S.C.G., CG-3584 (Rev. 2-68) GPO 950-715 CLEARANCE SHEET

Commanding Officer
Marine Safety Office
Suite 1900
First National Bank Bld
Mobile, AL 36602

3531
JUL 07 1983

From: Commanding Officer, CG Marine Safety Office, Mobile, AL
To: Commanding Officer, CG Group, Mobile, AL

Subj: Aids to Navigation in the Bayou Casotte Channel

1. During the course of the past few months, I have had several occasions to visit the Port of Pascagoula Bayou/Casotte to meet with the Port Director and waterway user groups in the area. On each occasion, the question was raised concerning the need for additional aids in the Bayou Casotte Channel in the form of outbound ranges. To each inquiry, I suggested the problem be documented in writing so that it could be given further study by this office. Enclosures (1) and (2) are letters from the Port Director and the President of the Pascagoula Bar Pilot's Association highlighting their need for downbound ranges in subject channel.

2. Recently, an officer from this unit had an opportunity to transit the Bayou Casotte channel aboard a Chevron Tank Vessel in connection with a ship riding program designed to observe Chevron's offshore lightering operation. During the passage, he took photographs of the area and discussed the subject with the on-board bar pilot. His report, along with the photos, are included with this letter as enclosure (3).

3. As the multi-million dollar expansion to the Chevron Refinery complex in Bayou Casotte nears completion, vessel traffic in this waterway will continue the already noted rise in frequency of transit of tank vessels to include bulk carriers shipping coke from the refinery. Barge traffic will also escalate dramatically in connection with the growth of refinery output. Presently, in support of the expansion that is partially completed, a continuous lightering operation is underway approximately fifty miles offshore to supply the needed throughput of crude oil, with several tank vessels outfitted and dedicated to this shuttle service.

4. Bayou Casotte channel has two upbound ranges and the pilots would naturally prefer to see two sets of downbound ranges located in the vicinity of Beacon #11 for the Bayou Casotte harbor passage and another range located near buoys #29 and 27 for the Bayou Casotte Channel itself. The preferred range, should funding of both ranges be unfeasible, is the range for the lower Bayou Casotte channel in the flats at Bouys #29 and 27.

5. Recognizing funding constraints for a project of this nature, I would support and urge the adoption of the preferred range. With vessel traffic in this area

ENCLOSURE 1

16000
FEB 24 1984

largest vessel that the present turning basin can accommodate. The largest vessel to utilize the Bayou Casotte turning basin was 784' in length, however the turning basin can accommodate a vessel up to 950' in length. These constraints should be noted when planning any channel enlargement or dredging proposal.

The Coast Guard does place operational restrictions on the channel and the ports of Bayou Casotte and Pascagoula in unusual or in potentially hazardous situations. Unusually large tows or vessels fall into this category. For example, whenever a mobile drilling unit maneuvers in or out of the harbor, the Captain of the Port must be notified of its dimensions and advised of the sufficiency of towing vessels to ensure safe transport. The pilots and harbormaster are notified and a Local Notice to Mariners is broadcast to inform other vessel traffic of the situation. On other occasions, a safety or security zone may be appropriate when certain types of ships transit the channel. These situations occur infrequently and adequate notice can usually be given to all involved parties in order to minimize disruption of normal port operations. More information on this subject can be found in 33 CFR 160.111, and 33 CFR 127 and 165.

An LNG terminal was considered by Tenneco Corporation in the Bayou Casotte channel. However it is understood that this project has been placed on hold due to unpredictable market conditions, although the land is still available for future construction. If an LNG facility were eventually constructed, it would be pertinent to remember that the size of the vessels would be limited by the dimensions of the turning basin and that a moving safety zone could be established during the inbound or outbound transit of such a vessel. Also during the transit, the channel could be closed to all other traffic until the movement was completed.

Finally, it would be advantageous if two sets of downbound ranges were planned, one in the vicinity of Beacon #11 for the Bayou Casotte harbor passage and a second located near buoys #29 and #27 for the Bayou Casotte Channel itself. These will be necessary in the interest of safety due to the expected rise in frequency of transit of tank vessels and barges as a result of multi-million dollar expansion of the Chevron Refinery. For your information, I have enclosed copies of previous correspondence concerning this issue, including input from the Pascagoula Port Authority and Bar Pilots Association.

Should you have any further questions regarding this matter, please feel free to contact LCDR SABOL of my staff at the above listed number.

Sincerely,

W. [illegible]. ECKER
Captain, U.S. Coast Guard
Captain of the Port
Mobile, AL

DEPARTMENT OF TRANSPORTATION

UNITED STATES COAST GUARD

Captain of the Port
1900 First National Bank
P. O. Box [illegible]
Mobile, AL 3665[illegible]
205/690-2286

16000

FEB 24 1984

Department of the Army
Corps of Engineers
P. O. Box 2288
Mobile, Alabama 36628

Subj: Pascagoula/Bayou Casotte Harbor Deepening Study

Ref: (a) Your ltr of 10 Nov 83
(b) Your ltr of 15 Dec 83

Dear Sir:

This office voices no objection to the deepening or widening of the Pascagoula/Bayou Casotte Harbor Channel complex and offer the following comments releative to navigation charts and the lead time necessary for change and reproduction of same:

(a) That the center of the channel remain the center and any widening, deepening or dredging be done with this in mind.

(b) That if the center of the channel must be moved in certain areas, this office be notified and all plans and proposals be made available at that time.

It would be appreciated if a copy of the intended dredging areas and proposed channel widening be forwarded to this office when plans are finalized. This would allow for more specific recommendations concerning channel safety, vessel maneuverability, traffic management, operational restrictions and aids to navigation.

With respect to channel safety, records available to this office indicate that approximately 40 deep draft vessels and 100 barges enter the ports of Pascagoula and Bayou Casotte monthly. With the exception of a few intermittent and minor barge groundings, there have not been any significant maritime accidents within the recent past.

Traffic management activities are managed by the Pascagoula Bar Pilots Association on a daily and routine basis. Both the Pascagoula and Bayou Casotte channels are too narrow to permit simultaneous passage of both upbound and downbound large seagoing vessels and therefore both channels are functionally restricted to oneway vessel movement. This pattern is controlled through bridge-to-bridge radio communication among the pilots themselves. Should an unusual situation arise which would differ substantially from normal operations, appropriate action could be taken by this office in a timely fashion to insure vessel and port safety.

The largest vessel to utilize the Pascagoula turning basin was 845' in length with a 134' beam. According to the Pascagoula Harbormaster, this is about the

16510/HIPC
Ser [illegible]
23 DEC 1983

Subj: Pascogula Harbor feasibility Study

6. Deepening the channel will require the temporary removal of any aids to navigation effecting the safe operation of the dredge when working near the aid. The cost of this would be minimal for the lighted buoys but approximately the same as indicated above for the fixed structures.

W. A. WULFF
By direction

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

ADDRESS REPLY TO
COMMANDER (oan)
EIGHTH COAST GUARD DIST.
HALE BOGGS FEDERAL BLD
500 CAMP ST.
NEW ORLEANS, LA 70130

(FTS) 682-6234

16510/HIPC
Ser 033
23 DEC 1983

From: Commander, Eighth Coast Guard District
To: District Engineer, U. S. Army Corps of Engineers District, Mobile

Subj: Pascagoula Harbor Feasibility Study

1. We have reviewed the aids to navigation from the entrance at Horn Island Pass to Bayou Casotte as requested in your letter of 10 November 1983.

2. The present aids to navigation system marking the existing channel from the entrance to the junction at Bayou Casotte consists of thirty-one (31) lighted buoys and three (3) sets of range lights. To offer the optimum aids to navigation for this existing channel, the establishment of a Radar Beacon (RACON) on the entrance buoy is anticipated in 1985 to improve the identification of the buoy as ships make landfall.

3. Bayou Casotte Channel is marked with fourteen (14) lateral lights and two (2) sets of inbound range lights. A high knockdown rate of the lateral lights has been experienced in this channel due to the wind and current setting ships, tugs, and barges down on the lights. To offer the users a range to judge the set of their vessels and reduce the collision record of these lights, a project to establish reciprocal outbound ranges for the existing channel has been approved and construction is expected to commence in 1984. Widening this channel will require the relocation of these lateral lights, and the cost for their reconstruction will be approximately $30,000.

4. There are no future plans for additional aids to navigation for the Pascagoula Channel from the junction at Bayou Casotte, which is marked with thirteen (13) lateral lights, three (3) lighted buoys, and two (2) sets of range lights. If this channel is widened, the lateral aids will have to be relocated at a cost of approximately $28,000.

5. It is recommended, if any of the channels are widened, that the width increase be taken from both sides of the channel to accommodate the existing centerline ranges. The expense of relocating the range lights would far exceed that of relocating the lateral markers. This proposal will also expedite the construction of the outbound ranges for Bayou Casotte. Therefore, it is requested that your intentions concerning the widening of any channel be forwarded to this office when known.

Tennessee Gas Transmission
A Tenneco Company

Roger N. Stark
Vice President

Tenneco Building
P. O. Box 2511
Houston, Texas 77001
(713) 757-2576

August 2, 1984

Mr. Lawrence R. Green
Chief, Planning Division
Department of the Army
P. O. Box 2288
Mobile, Alabama 36628

Dear Mr. Green:

The property referred to in your letter dated July 12, 1984 is presently owned by Tennessee Gas but is subject to being reverted in ownership to the Jackson County Port Authority, et.al. in the event certain construction conditions are not met.

Provided Tennessee Gas is still the owner of the property at the time your Channel Project is authorized and ready to go forward, Tennessee would be willing to accept the disposition of suitable fill on the property subject to mutual arrangements having been agreed upon as to location, amount, etc.

If we can be of further assistance to you regarding this matter feel free to contact me or Victor V. Staffa at this same address.

Best regards,

Roger N. Stark

RNS/ked
cc: Mr. Paul D. Pella
Port of Pascagoula

eliminated from further consideration. Channel modifications considered in detail were widening and/or deepening the channel on essentially the existing alignment, with minor alignment changes where clearly needed.

Two alternatives for disposal of dredged material which could be considered as separate elements of any overall plan were evaluated. Those were:

<u>I. Horn Island Pass and Outer Bar.</u> Formerly treated as two channel segments for maintenance purposes, these were combined into one segment to facilitate hopper dredging and disposal of the sandy material from that segment in the area designated Area D off shore of Horn Island (see attached map). So that hopper dredging would be feasible in the pass, the impoundment basin on the east side of the channel at Petit Bois Island would be reconfigured to a deepened channel reach in about the same location.

<u>II. Inner Harbors.</u> Tests have shown that recently deposited sediments in both inner harbors, Pascagoula River and Bayou Casotte, are contaminated and therefore should be placed in upland disposal areas. The new work dredging in Pascagoula River, a relatively minor amount, and future maintenence material, would be placed in the Double Barrel or Singing River Island disposal areas. Maintenence material from Bayou Casotte would be placed on Greenwood Island.

The remaining elements all concerned disposal options for the Mississippi Sound Channels. Those were:

<u>III. Sound Channels-New Work to Gulf, Operation and Maintenance (O&M) Present Practice.</u> As indicated, in this element the new work dredging in Mississippi Sound between the mouths of Pascagoula River and Bayou Casotte and the beginning of Horn Island Pass Channel, would be placed in dump barges and transported to deep water in the Gulf of Mexico. Future maintenance dredging would be placed in open water alongside the channel and on Singing River Island as is current practice.

<u>IV. Sound Channels-New Work to Gulf, O&M to Gulf.</u> This element is the same as the previous one, except that the material from all future maintenence dredging would be transported to deep water in the gulf.

<u>V. Sound Channels-Bayou Casotte New Work to Tenneco, Main Channel to Singing River Island, O&M Present Practice.</u> An early consideration was to dispose of the Bayou Casotte new work material on the Chevron property south of the present refinery. However, the area available consisted of high quality wetlands; therefore, this option was not environmentally acceptable. The site was transferred to the Tenneco property, which is a previously used disposal area with the old dike system still in place. Use of Singing River Island for new work deposition would require enlarging it beyond its present limits. Analysis of this alternative indicates that the island could be enlarged to the southwest without further effect on the circulation in the sound.

VI. Sound Channels-Bayou Casotte New Work to Grand Batture, Main Channel to Singing River Island, O&M Present Practice. Rebuilding the eroded Grand Batture Island chain offered substantial benefits from eliminating the erosion of the marsh which had once been protected by that formation and by the creation of an extensive salt marsh on the lee side of the site. Preliminary calculations revealed that the pumping distance and material quantities were too great, to include channel segments beyond the Bayou Casotte leg. To stabilize the deposited material and prevent future erosion, riprap armor on the south face would be required. As evaluation progressed it became obvious that any plan including this element would have a cost that greatly exceeded any other combination under consideration.

VII. Sound Channels - Bayou Casotte New Work to Tenneco, Main Channel to Gulf, O&M to Gulf. This element combines portions of elements IV and V.

PLAN FORMULATION

These elements were combined into complete plans for final evaluation. Elements I and II were common to all plans. Economic optimization calculations indicated a nominal channel depth of 42 feet. In addition, widening the Bayou Casotte channel to a width compatible with the other deep-draft portions of the project was justified. The selected plan is the most economical alternative and also would cause the least amount of environmental damage.

THE SELECTED PLAN

Depth, Width, and Alignment. A nominal depth of 44 feet for the entrance channel and 42 feet for all the channels north of the entrance limit was selected. Allowances of 2 feet for advanced maintenance and 2 feet for dredging tolerance were made in computing dredging quantities. The existing width of 350 feet in the Pascagoula Channel is adequate for the present and projected grain traffic. The Bayou Casotte channel would be modified by widening from 225 feet to 350 feet.

The modified channel dimensions would be constructed along the existing alignment, with minor exceptions. The Bayou Casotte Channel would be widened on both sides of the existing centerline. The Entrance Channel would begin at deep water, or about at the 46-foot depth contour, in the Gulf of Mexico, and end at the bend north of Petit Bois Island, which would also be the beginning of the Sound channels. The modified portion of the Pascagoula Channel would end just downstream of the grain elevator. The Bayou Casotte Channel modification would include a new turning basin just inside the mouth of the bayou and would end at the northern limit of that basin.

A map of the proposed project is attached at the end of this brochure. Economic and physical data pertaining to the selected plan are summarized in the following tables.

Table 1

DREDGING QUANTITIES AND DISPOSAL AREAS
FOR CONSTRUCTION OF THE SELECTED PLAN
(cubic yards)

Reach	Quantity	Disposal Area
Pascagoula River Channel (Main Channel)		
Inner Harbor	451,000	Double Barrel, Singing River Island, or Greenwood Island
Mississippi Sound	3,870,000	Gulf
Bayou Casotte Channel and Turning Basin	6,943,000	Tenneco and Gulf
Total Pipeline Dredging	11,264,000	
Gulf Entrance Channel		
Total Hopper Dredging	2,058,000	Gulf Site D
Total Dredging Quantity for Construction	13,322,000	

Table 2

ESTIMATED FIRST COST AND ANNUAL CHARGES
FOR THE SELECTED PLAN

	First Cost	Annual Charge
FEDERAL	$29,696,000	$2,649,000
NON-FEDERAL	10,831,000	898,000
TOTAL	$40,527,000	$3,547,000

The non-federal first cost includes relocating the existing pipelines and cables which cross the channels in Mississippi Sound.

The entire Bayou Casotte Channel modification, including the proposed new turning basin, is subject to additional cost sharing. Under the established policy for channels where the benefits of modification accrue to a single user, but a reasonable prospect exists for future multiple use, local interests shall contribute 50 percent of the total annual cost of the modification improvement until multiple use develops. The total annual cost includes interest and amortization on the first cost as well as operation and maintenance costs. The total first cost for the Bayou Casotte improvment was estimated as follows:

TOTAL FEDERAL FIRST COST FOR BAYOU CASOTTE	$11,987,000
Interest and Amortization on First Cost	994,000
Estimated Annual Maintenance Cost	48,000
TOTAL ANNUAL COSTS SUBJECT TO FURTHER COST-SHARING	$1,042,000
LOCAL INTERESTS SHARE OF ANNUAL COST (50%)	$521,000

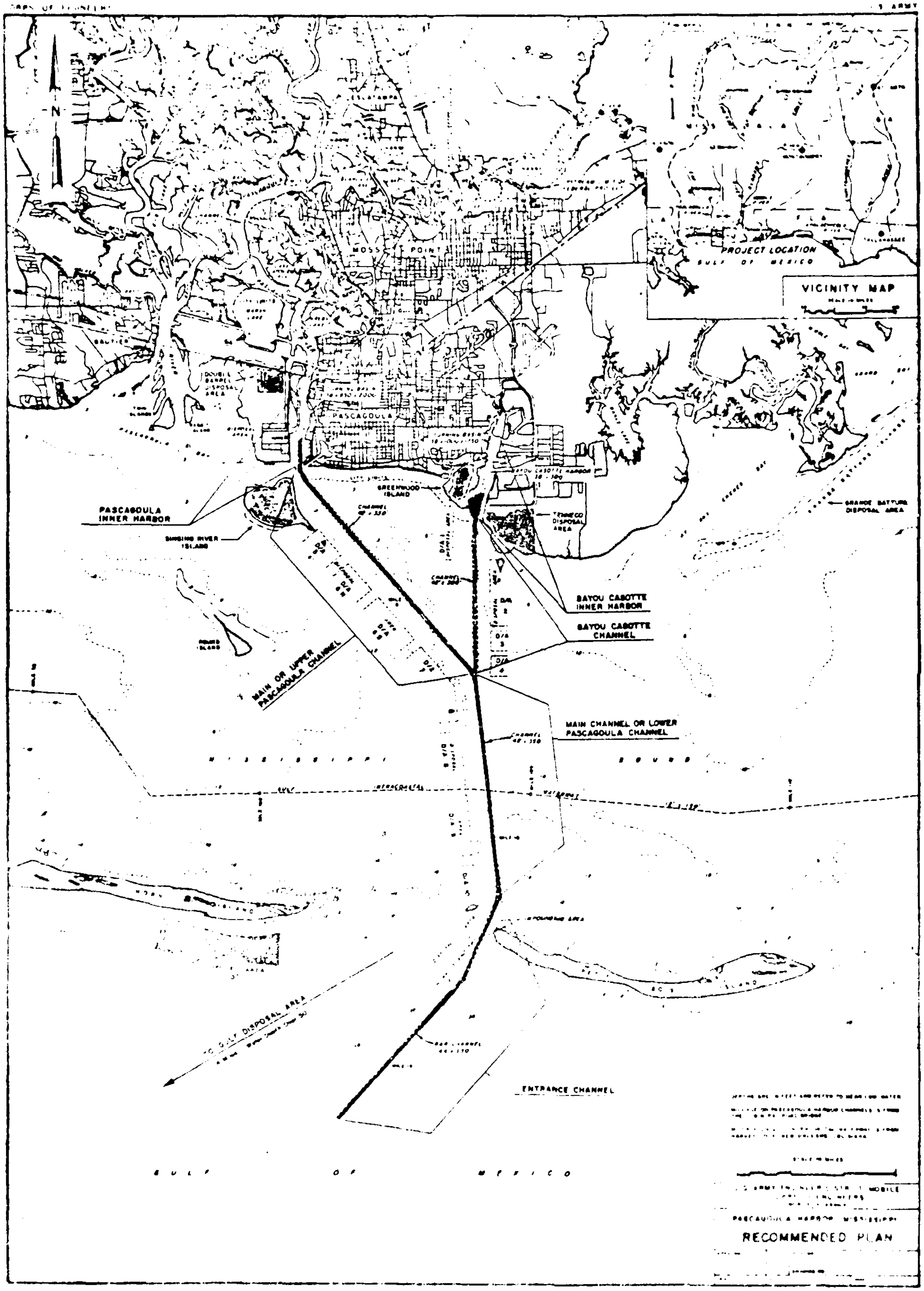
The amount shown would be assumed by local interests in addition to the total non-Federal charges shown in the previous table. In effect, local interests assume that amount of the Federal annual charges until such time as multiple use develops, at which time those charges will revert to the Federal Government.

BENEFITS

Average annual equivalent benefits for the proposed improvements are listed below:

Grain exports	$ 2,922,000
Crude oil imports	15,715,000
LNG imports	4,596,000
Turning Basin	1,218,000
TOTAL BENEFITS	$23,233,000

The proposed improvments would have a benefit/cost ratio of 6.9.



N
MOSS POINT
PASCAGOULA
PROJECT LOCATION
GULF OF MEXICO
VICINITY MAP
DOUBLE BARREL DISPOSAL AREA
GREENWOOD ISLAND
PASCAGOULA INNER HARBOR
SINGING RIVER ISLAND
TENNECO DISPOSAL AREA
GRANDE BATTURE DISPOSAL AREA
BAYOU CASOTTE INNER HARBOR
BAYOU CASOTTE CHANNEL
MAIN OR UPPER PASCAGOULA CHANNEL
MAIN CHANNEL OR LOWER PASCAGOULA CHANNEL
MISSISSIPPI SOUND
TO GULF DISPOSAL AREA
ENTRANCE CHANNEL
GULF OF MEXICO
PASCAGOULA HARBOR, MISSISSIPPI
RECOMMENDED PLAN

SECTION E-4

LIST OF ATTENDEES AT
FINAL PUBLIC MEETING

List of Attendees
Final Public Meeting
Pascagoula Harbor, Mississippi
14 August 1984

Dr. Ed Cake
Gulf Coast Research Laboratory
P.O. Drawer AG
Ocean Springs, MS 39564

Charles Torjusen
Pascagoula Bar Pilots Assn.
P O. Box 2156
Pascagoula, MS 39567

Paul D. Pella, Port Director
Jackson County Port Authority
3033 Pascagoula Street
Pascagoula, MS 39567

Bill Boyd, Industrial Development Director,
Jackson County Port Authority
P.O. Box 70
Pascagoula, MS 39567

Clyde L. Brown
10808 Pascagoula Street
Pascagoula, MS 39567

Jason Burnett
2617 Auburn Dr.
Gautier, MS 39553

James D. Collier
Pascagoula Bar Pilots Assn.
4208 Bluefish
Pascagoula, MS 39567

Edward A. Khayat
P.O. Box 664
Moss Point, MS 39563

Larry E. Goldman
U.S. Fish and Wildlife Service
P.O. Box 1190
Daphne AL 36526

Roger Clark
Jackson County Planning Commmision
660 Covent Ave.
Pascagoula, MS 39567

Douglas Holder
Jackson County Board of Supervisors
11000 Highway 57
Ocean Springs, MS 39564

James L. Burnett
2617 Auburn Dr.
Gautier, MS 39553

Natalie Chambers
WQID Radio
P.O. Box 4606
Biloxi, MS 39533

Gary L. Cuevas
Miss. Bureau of Marine Resources
P.O. Drawer 959
Long Beach, MS 39560

. F. Dantzler
[illegible] Service Inc.
ascagoula, MS 39567

John L. Flint
Acme Mechanical Contractors
3305 Old Mobile Highway
Pasc[illegible] 39567

[illegible] Fulton
[illegible]8 Reynolds Circle
ascagoula, MS 39567

Jim Ford
Pascagoula Bar Pilots Assn.
P.O. Box 1914
Pascagoula, MS 39567

irk Gibbon
713 Marvann Dr.
autier, MS 39553

Joe Gill, Jr.
Chief, Wetlands Division
Bureau of Marine Resources
P.O. Drawer 959
Long Beach, MS 39560

ermes [illegible]. Hague, President,
ascagoula City Port Commission
07 Mill Road
ascagoula, MS 39567

John T. Hoffmeyer
Chevron Shipping Co.
P.O. Box 1300
Pascagoula, MS 39567

ames W. Hunter
ississippi Export Railroad Co.
.O. Box 743
oss Point, MS 39563

A. J. Keenan
Fuel Services Inc.
P.O. Box 969
Pascagoula, MS 39567

avid Trevin
224 Lucas
autier, MS 39553

John B. McMaster
Chevron U.S.A. Inc.
P.O. Box 1300
Pascagoula, MS 39567

iz Ford, Manager
ausen and Tidemann Inc.
.O. Box 628
ascagoula, MS 39567

Charles McVea Jr.
Colle Towing Co. Inc.
P.O. Box 340
Pascagoula, MS 39567

im Morris
ureau of Pollution Control
.O. Box 10385
ackson, MS 39209

Cecil E. Palmer
Michael Baker Inc.
P.O. Box 9997
Jackson, MS 39206

. A. Paul, Chief Engr.
ississippi Export Railroad
.O. Box 743
ascagoula, MS 39567

Humphrey Planner
NAACP
3518 Bellview Street
Moss Point, MS 39563

Paul Ruhter, General Mgr.
Chevron, USA
Pascagoula Refinery
P.O. Box 1300
Pascagoula, MS 39567

Tom Thornhill
U.S. Fish and Wildlife Service
P.O. Box 1190
Daphne, AL 36526

Theodore R. Simons
Gulf Island National Sea Shore
3500 Park Road
Ocean Springs, MS 39564

Michael Torjusen, Harbor Master
Jackson County Port Authority
P.O. Box 70
Pascagoula, MS 39567

James G. Whiteside
Chevron USA Inc.
P.O. Box 1300
Pascagoula MS 39567

Richard L. Camp
Mississippi Dredging, Inc.
1509 Beach Blvd.
Pascagoula, MS 39567

Billy R. Anderson
U.S. Customs Service
903 Tucker Ave.
Pascagoula, MS 39567

Bennie A. Rohr
1006 Resca de la Palma
Pascagoula, MS 39567

Johnny Scott
P.O. Box 849
Pascagoula, MS 39567

Autry D. Slay, President
Mississippi Dredging Inc.
2736 Camino Granoe
Gautier, MS 39553

Bob Wallace
Chevron USA
P.O. Box 1300
Pascagoula, MS 39567

Jack Rodenbaugh
Mississippi Chemical Co.
P.O. Box 848
Pascagoula, MS 39567

Douglas G. Allred, Plant Mgr.
Louis Dreyfus Corporation
P.O. Box 938
Pascagoula, MS 36567

SECTION E-5

SUMMARY OF PUBLIC MEETING
HELD 14 AUGUST 1984

SUMMARY

PUBLIC MEETING HELD AT PASCAGOULA, MISSISSIPPI

14 August 1984

on

PASCAGOULA HARBOR, MISSISSIPPI

The meeting was opened by Mr. Lawrence R. Green, Chief, Planning Division, Mobile District, who welcomed the attendees and introduced the study team members present, as well as other Corps personnel. He then introduced Mr. Roger A. Burke, Chief, Coastal Branch, Planning Division, who made a slide presentation which covered the Corps planning process and constraints, presented the details of the final alternatives, and discussed the rationale of the selected plan. Mr. Green then briefly discussed the protocol which governs a formal Corps of Engineers Public Meeting and opened the floor for public comments.

Mr. Roger Clark, Director of the Jackson County Planning Commission, representing both himself and Mr. Douglas Holden, Supervisor of District 5, who had to leave, made a statement in favor of the proposed plan.

Mr. Paul Pella, Port Director, Jackson County Port Authority, made a statement supporting the proposed improvements.

Mr. Larry E. Goldman, US Fish and Wildlife Service, expressed that agencies' opposition to the proposed plan, since it would result in the filling of about 200 acres of wetlands, which they consider unacceptable. They recommend the adoption of Plan B, in which all dredged material would be placed in the gulf. Mr. Goldman's entire statement is attached.

Mr. Charles Torjusen, Pascagoula Bar Pilots Association, supported the proposed plan, including the 350-foot channel width for all present and anticipated future traffic, except for the entrance channel. He indicated that the pilots have problems now with the larger ships under frequently occurring adverse conditions of wind, tide, and currents. He requested that the entrance channel be widened to 600 feet from the Gulf of Mexico through Horn Island Pass.

Mr. Edward A. Khayat, Consultant, presented a statement in favor of the proposed improvement.

Dr. Ed Cake, Gulf Coast Research Laboratory, made a statement favoring the improvement of the channel. However, he would prefer that no wetlands be unfavorably impacted and that the use of shallow water disposal in Mississippi Sound be discontinued because of possible adverse effects.

[illegible] of dredged material from the project [illegible]
[illegible] Round Island, which has seriously eroded in recent time. He [illegible] that there would be a minimal impact on shallow water benthos since [illegible] sion has been recent.

[illegible]nie Rohr, National Marine Fisheries Service, Pascagoula Laboratory, [illegible] spoke in favor of using dredged material from the proposed work to [illegible] Round Island. He suggested that the island be restored to its [illegible]l general elevation and that it be reforested to help stabilize the [illegible]d form.

[illegible]eing no further formal statements, the floor was opened for [illegible]ion.

Cake suggested that the proposed Area D disposal site off Horn [illegible] be moved to an area east of the existing tip of that island.

[illegible], Environmental Studies and Evaluation Section, [illegible] suggested site had been considered [illegible] the Mississippi Sound study. The [illegible] of that effort indicated that material placed in that location [illegible] to the northwest into Mississippi Sound with possible adverse [illegible] on the grass beds in that vicinity. For that reason, the area was [illegible] the present location.

[illegible]l Pella asked what our projected timetable was for construction and [illegible] to know what they could do to speed it up.

[illegible]ger Burke responded that, given the normal review and authorization [illegible]s, the earliest construction could be completed around 1990.

[illegible]d is a copy of the meeting notice, which was also used as an [illegible] at the meeting, a list of attendees, and those letters [illegible]ing formal statements which were handed in at the meeting or mailed [illegible]rwards.

SECTION E-6

CORRESPONDENCE FOLLOWING PUBLIC MEETING

P. O. Box 149, Pascagoula, Mississippi 39568-0149 601-935-1122

August 10, 1984

nel Patrick J. Kelley
rict Engineer
Corps of Engineers, Mobile District
. Box 2288
le, Alabama 36628

Colonel Kelley:

the record, Ingalls Shipbuilding Division wishes to document concurrence in the Corps of Engineers proposal to widen and en the Pascagoula ship channel, which is the subject of a ic hearing scheduled for August 14, 1984.

proposed expansion of the Pascagoula channel would signifi- ly enhance future shipbuilding and ship overhaul/repair vities here at Ingalls Shipbuilding and, consequently, ove the overall economic conditions of the Gulf Coast area.

trend in U.S. Naval shipbuilding has been to larger and more lex ships. As we look to the future (the 1980-1990's and nd), we expect this trend to continue. More specifically to lls Shipbuilding, a major part of our company's future ship- ding activities involves the construction of the Navy's newest s of assault ships known as LHD. These ships are the second gest in the Navy's fleet, second only to the modern day air- t carrier. As many as 11 of these new vessels are planned the next 10 years. Widening and deepening of the Pascagoula nel would definitely facilitate the sea trial requirements connection with this major program. The LHD is a 40,000 ton with a beam of 106 feet. While current channel conditions adequate, we are concerned that without channel improvements terms of depth and width) the proposed increased traffic in channel from other activities could have an adverse effect he timely navigation of the LHD's during sea trials.

proposed channel improvements are certain to have a positive uence on future drill rig construction and repair activities cipated for this area, not just at Ingalls but at other panies engaged in this type business.

AD-A154 885 PASCAGOULA HARBOR MISSISSIPPI FEASIBILITY REPORT ON IMPROVEMENT OF THE FE..(U) CORPS OF ENGINEERS MOBILE AL MOBILE DISTRICT MAR 85 COE-SAM/PD-N-84/012 6/6

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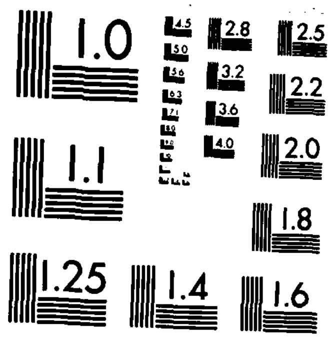


MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

August 10, 1984

Ingalls also expects to continue its participation in the Navy's program to reactivate the Iowa class battleships. Some channel improvements are almost certain in order to assure our continued work in this area.

In support of the equivalent benefit requirements for the planned improvements, we wish to emphasize the overall national defense interest represented by the Navy's shipbuilding activities in this area. Ingalls, today, has nearly $3-billion in Navy shipbuilding construction under way, thus the proposed channel improvements have a general public interest that can easily be identified. From an employment standpoint, Ingalls currently is at about 10,000 employees and we expect to increase to about the 13,000 level in about 18 months.

We would be most pleased to provide any additional information in our support of deepening and widening the Pascagoula channel.

Sincerely,

Jerry St. Pe', Vice President
Public/Industrial Relations

JStP/el

FUEL SERVICES, INC.

POST OFFICE BOX 969

PASCAGOULA, MISSISSIPPI 39567

August 13, 1984

A. F. DANTZLER
PRESIDENT

OFFICE 601-762-4611
DOCK 601-762-0636
GULFPORT BRANCH
601-868-3374

District Engineer
U. S. Corps of Engineers

Dear Sir:

I am writing you on behalf of Fuel Services, Inc. who operates in the Pascagoula Harbor and adjacent waterways in bunkering both deep sea and shallow draft ships. We, also, operate a launch service.

Both of these operations are very sensitive to the draft restrictions that now exist at Pascagoula. Your proposed deepening of the Channel from 38 Ft. controlled depth to 42 Ft. and the widening of the Bayou Casotte Channel would certainly be a big factor in the economic and development of the Pascagoula area as well as our Company.

We have been in business for the past 21 years and have watched the ships become larger and have deeper drafts during this time. I am sure you are familiar with what the records indicate has happened to the Jackson County Grain Elevator's volume of business over the last three years,as the draft limitation has moved the cargo that formerly used Pascagoula to New Orleans or Mobile due to the deeper controlled drafts.

In our business, we have occasion to talk to ship owners regarding their bunkering needs around the world and are continually being advised that their ships will call less and less at Pascagoula due to the draft limitations. Our Company's bunkering business has decreased over the last three years by approximately 60%. While some of this is due to economic conditions world wide, a large amount is due to the draft limitations.

I urge your support in achieving the 42 Ft. controlled depth channel that you are recommending.

If there is any information we can furnish you, please feel free to call on us at any time.

Yours very truly,
FUEL SERVICES, INC.

A. F. Dantzler

Jackson County Planning Commission

August 14, 1984

District Engineer
U. S. Army Corps of Engineers
Mobile District - ATTN: SAMPD-N
P. O. Box 2288
Mobile, Alabama 36628-0001

RE: Deep-Draft Navigations Channel
Improvements - Pascagoula Harbor

Dear Sir:

Jackson County, Mississippi has sought for the past many years numerous methods to enhance the port facilities in Bayou Casotte and in the Pascagoula River. These enhancements are imperative to the future of our local economic growth. The highest priority for the port and river harbor improvements is of course the proposed channel deepening and widening which your study has addressed. Therefore, as Planning Director for Jackson County I strongly support this plan as a benefit to the people of our area and as a support for our local economy for the future.

I realize that these type projects must cross many hurdles before implementation can be realized which underlines the need for initiating any and all mechanisms to expedite this process.

Thank you for your attention to this project and we appreciate the U. S. Army Corps of Engineers making this project come closer to being a reality.

Sincerely,

Roger L. Clark
Roger L. Clark
Director

RLC/sm

600 CONVENT AVENUE
PASCAGOULA, MISSISSIPPI 39567
TELEPHONE (601) 769-7900, EXT 27_, 271
CODES AND ZONING
EXTENTION 211

PASCAGOULA BAR PILOTS ASSOCIATION

2805 FRONT STREET
POST OFFICE BOX 2156
PASCAGOULA, MISSISSIPPI 39567
TELEPHONE (601) 762-1151

CAPT. THEODORE E. BROWN
CAPT. JAMES D. COLLIER
CAPT. JAMES I. FORD

CAPT. DONALD A. FOSTER
CAPT. JACOB A. FOSTER
CAPT. CHARLES T. TORJUSEN, JR.

August 14, 1984

U.S. Corps of Engineers
Mobile District
Post Office Box 2288
Mobile, Alabama 36628

Dear Sirs:

In reference to the feasibility study for the Pascagoula Harbor Navigational Project the Pascagoula Bar Pilots Association supports the widening of the Bayou Casotte Ship Channel to 350 feet. At the present time our two largest ships are the Ralph B. Johnson (785' x 106') and the Chevron Frankfurt (755' x 123'). For the future we are anticipating LNG vessels of approximately 900' in length and 140 feet in beam. We strongly recommend that the Bar Channel from the Sea Bouy to Petit Bois Island be widened to a minimum of 600 feet in order to accomodate longer and wider ships than those currently being handled. Under present conditions, the Bar Channel is not adequate to accomodate the larger ships anticipated for the future.

Very truly yours,
PASCAGOULA BAR PILOTS

CAPTAIN J.D. COLLIER, PRESIDENT

mmt

HANSEN & TIDEMANN, INC.
Steamship Agents/Chartering Brokers

312 Pascagoula Moss Point Bank Building
P. O. Box 623
Pascagoula, Mississippi 39567
Telephone (601) 762-9154
TWX: 510-990-3172
Cable address, all offices: "HANDT"

14th August, 1984 BY HAND

Department of the Army
Mobile District, Corps of Engineers
P. O. Box 2288
Mobile, Alabama 36628

Attention: Coastal Branch

Gentlemen:

This letter is to support, in principle, the recommendations of the Corps of Engineers arising from the feasibility study for the improvement of the deep-draft portion on the Federal Navigation project for the Port of Pascagoula, Mississippi.

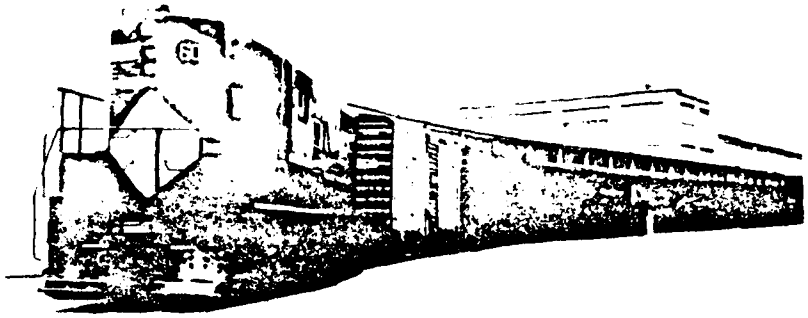
However, we, along with others, do recommend that serious consideration be given to the feasibility of increasing the width of the Pascagoula Bar Channel from the present 350 feet to 600 feet.

Very truly yours,

HANSEN & TIDEMANN, INC.

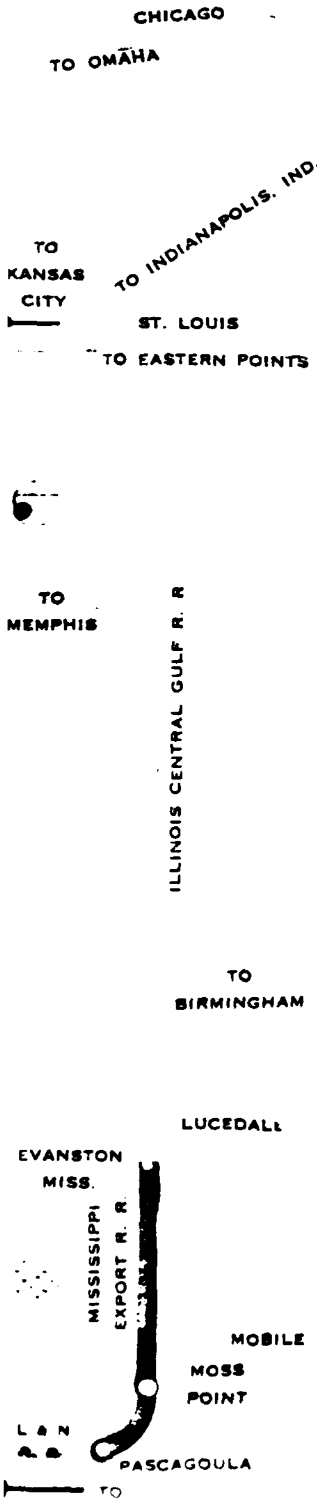
L. Ford

Houston, Texas
Galveston, Texas
Corpus Christi, Texas
Beaumont, Texas
New Orleans, La.
Mobile, Alabama
Pascagoula, Miss.
Port Arthur, Texas
New York, New York
Baltimore, Maryland
Charleston, S.C.
Savannah, Georgia



T. M. von Sprecken, Jr.
Vice President - General Manager

Mississippi Export Railroad Company



Post Office Box 743
Moss Point, Mississippi 39563

August 14, 1984

Department of the Army
Mobile District, Corps of Engineers
Post Office Box 2288
Mobile, Alabama 36628

Dear Sir:

I want to give full support to the forty-two foot (42') channels at Pascagoula and Bayou Casotte harbors for the benefit of Jackson County and this area of the Gulf Coast.

Very truly yours,

Vice President-General Manager

TMvSjr:dw

United States Department of the Interior
FISH AND WILDLIFE SERVICE
P. O. Drawer 1190
Daphne, AL 36526

August 15, 1984

Colonel Patrick J. Kelly
District Engineer
U. S. Army Corps of Engineers
P. O. Box 2288
Mobile, AL 36628

Dear Colonel Kelly:

Attached is a copy of the statement I presented on August 14 at a public meeting held by the Mobile District concerning proposed navigation improvements at Pascagoula, Mississippi. We had previously furnished you with a Draft Fish and Wildlife Coordination Act report for this project. We are anxious to continue working with the District towards resolution of differences over which alternative plan should be selected for implementation.

Sincerely,

Larry E. Goldman
Field Supervisor

Attachment

PUBLIC HEARING STATEMENT OF THE U. S. DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE REGARDING THE
PASCAGOULA HARBOR PROJECT, MISSISSIPPI

COLONEL KELLY, LADIES AND GENTLEMEN:

MY NAME IS LARRY GOLDMAN. I AM SUPERVISOR OF THE DAPHNE, ALABAMA FIELD OFFICE OF THE U.S. FISH AND WILDLIFE SERVICE. THIS STATEMENT IS THE OFFICIAL POSITION OF THE SERVICE AND IS BEING PRESENTED ON BEHALF OF MR. JAMES W. PULLIAM, JR., REGIONAL DIRECTOR, ATLANTA, GA.

THE FISH AND WILDLIFE SERVICE IS THE FEDERAL AGENCY RESPONSIBLE FOR PRESERVING, PROTECTING AND ENHANCING THE NATION'S FISH AND WILDLIFE RESOURCES. THE FISH AND WILDLIFE COORDINATION ACT AUTHORIZES THE SERVICE TO INVESTIGATE ALL PROPOSED FEDERAL WATER RESOURCE DEVELOPMENT PROJECTS SUCH AS PASCAGOULA HARBOR AND PROVIDE COMMENTS AND RECOMMENDATIONS TO ACTION AGENCIES LIKE THE CORPS OF ENGINEERS RELATIVE TO PROJECT IMPACTS ON FISH AND WILDLIFE, AND THE BEST MEANS TO AVOID OR MITIGATE DAMAGES TO THOSE RESOURCES.

OUR INVESTIGATIONS REVEAL THAT HABITATS WITHIN THE PROPOSED PROJECT AREA SUPPORT A RICH DIVERSITY OF FISH AND WILDLIFE. THE LARGE TRACTS OF MARSHES EAST OF BAYOU CASOTTE AND THOSE ASSOCIATED WITH THE PASCAGOULA RIVER SYSTEM PROVIDE EXTREMELY IMPORTANT HABITAT FOR

GRATORY WATERFOWL, WADING BIRDS, FURBEARING MAMMALS, RAPTORS, AND NGBIRDS. THOUSANDS OF MIGRATORY BIRDS UTILIZE THESE AREAS EACH AR. THE IMPORTANCE OF THESE TWO MAJOR WETLAND TRACTS IS FURTHER IPHASIZED BY THE FACT THAT THE FISH AND WILDLIFE SERVICE HAS)ENTIFIED THEM AS AREAS DESERVING HIGH CONSIDERATION FOR RESERVATION. OF 33 CATEGORIES OF WETLANDS DESIGNATED OVER THE ENTIRE IITED STATES THESE WERE RANKED 9TH.

IESE AND OTHER MARSHES WITHIN THE PROJECT AREA ALSO PROVIDE VITAL OOD AND COVER FOR MANY SPECIES OF IMPORTANT SPORT AND COMMERCIAL IN ND SHELLFISHES SUCH AS SEATROUT, REDFISH, MENHADEN, BLUE CRAB, YSTERS, AND SHRIMP. OVER 95 PERCENT OF MARINE FISHES ARE DEPENDENT N WETLANDS DURING A PORTION OF THEIR LIFE. IN ESSENCE, THE ULTI-MILLION DOLLAR SEAFOOD INDUSTRY OF THIS AREA IS LARGELY EPENDENT ON THESE AND OTHER COASTAL WETLANDS. IN 1983 THE COMMERCIAL ISHERY LANDINGS AT THE PORT OF PASCAGOULA ALONE TOTALED MORE THAN 380 ILLION POUNDS WORTH OVER 23 MILLION DOLLARS AT THE DOCK. IN DDITION, MANY MANDAYS OF HUNTING AND SPORT FISHING ARE ALSO PROVIDED Y SUCH WETLAND HABITATS. THIS NOT ONLY ALLOWS FOR PERSONAL ENJOYMENT UT ALSO CONTRIBUTES TO THE LOCAL ECONOMY.

ETLANDS ALSO HELP TO FILTER AND ASSIMILATE POLLUTANTS FROM WATERS. HIS IS AN EXTREMELY IMPORTANT FUNCTION IN VIEW OF THE HIGHLY NDUSTRIALIZED NATURE OF THE PROJECT AREA.

THE FISH AND WILDLIFE SERVICE IS CONCERNED ABOUT SEVERAL EXISTING ENVIRONMENTAL PROBLEMS THAT COULD BE AGGRAVATED BY THE PROJECT. THESE ARE THE FILLING OF WETLANDS AND SHALLOW WATERS, DREDGING OF WETLANDS, DISPOSAL OF DREDGED MATERIAL IN SHALLOW WATER, AND DEGRADED WATER QUALITY. IN THE PAST, THOUSANDS OF ACRES OF PRODUCTIVE COASTAL WETLANDS AND SHALLOW WATERBOTTOMS HAVE BEEN DREDGED OR FILLED WITHIN THE PROJECT AREA. SHALLOW WATER DISPOSAL OF DREDGED MATERIAL WITHIN MISSISSIPPI SOUND IS AN ONGOING MAINTENANCE DREDGING PRACTICE WHICH RESUSPENDS POLLUTANTS, INCREASES TURBIDITY, AND COVERS BENTHIC ORGANISMS. WATER QUALITY PROBLEMS ARE ALSO COMMON AS EVIDENCED BY PREVIOUS FISH KILLS, THE CLOSING OF MAJOR OYSTER REEFS IN PASCAGOULA BAY, AND THE PRESENCE OF CONTAMINANTS IN DREDGED MATERIAL.

THESE RESOURCE PROBLEMS CAN BE REDUCED OR ELIMINATED THROUGH PRUDENT PROJECT PLANNING AND DEVELOPMENT. THE SERVICE BELIEVES THE PASCAGOULA HARBOR PROJECT IS A VEHICLE THAT COULD BE USED TO BEGIN SOME ENVIRONMENTAL RECOVERY. HOWEVER, THIS WOULD DEPEND ON THE ALTERNATIVE SELECTED. WHILE SOME ALTERNATIVES COULD IMPROVE THESE ENVIRONMENTAL CONDITIONS IF IMPLEMENTED, OTHERS COULD ADD TO THE ONGOING RESOURCE PROBLEMS.

THE FISH AND WILDLIFE SERVICE BELIEVES THAT ALTERNATIVE PLAN B SHOULD BE THE SELECTED PLAN. WE RECOMMEND PLAN B BECAUSE IT WOULD INVOLVE NO PERMANENT FILLING OF WETLANDS, ELIMINATE THE CURRENT PRACTICE OF DISPOSING CHANNEL MAINTENANCE DREDGING MATERIAL INTO THE SHALLOW OPEN

ERS OF THE SOUND, TAKE ALL NEW WORK AND MAINTENANCE MATERIAL TO PER WATERS OF THE GULF, AND WOULD REQUIRE ONLY MINOR MITIGATION. COMMEND THE CORPS OF ENGINEERS FOR THE DESIGN OF SUCH A PLAN AN ONGLY URGE THAT IT BE SELECTED.

LE THE CORPS' RECOMMENDED ALTERNATIVE (PLAN E) DOES PROVIDE FO E DEEP GULF DISPOSAL, IT ALSO REQUIRES THAT OVER 200 ACRES OF LANDS BE FILLED. THE FISH AND WILDLIFE SERVICE CANNOT SUPPORT SUCH AMAGING PROJECT WHILE OTHER LESS HARMFUL ALTERNATIVES THAT WOULD VIDE COMPARABLE ECONOMIC GAINS ARE FEASIBLE. THE BENEFIT/COST IO OF THE CORPS' SELECTED PLAN E IS 6.7 AS COMPARED TO 6.4 FOR PLAN SURELY THE VALUE OF ENVIRONMENTAL QUALITY OF THE PASCAGOULA ARE T HAVE ENOUGH WEIGHT IN ORDER TO MAKE UP THIS SMALL DIFFERENCE IN IEFIT/COST RATIOS. FOR THESE REASONS, THE FISH AND WILDLIFE SERVICE IEVES THAT PLAN B SHOULD BE SELECTED.

IER ALTERNATIVES ARE LESS DESIRABLE THAN PLAN B. PLAN C IS THE MOST IAGING AND SHOULD BE ELIMINATED. PLAN A, WHILE NOT REQUIRING A LAND FILL, DOES ALLOW FOR THE CONTINUATION OF THE ONGOING SHALLOW N WATER DISPOSAL WITHIN THE SOUND. WE FEEL IT SHOULD BE CONSIDERED FURTHER STUDY. PLAN D, WHICH IS DESIGNED TO RENOURISH THE GRAND TURE ISLANDS, INCLUDES EXCESSIVE AMOUNTS OF FILLING. WHILE THE AND NOURISHMENT CONCEPT HAS BENEFICIAL IMPACTS, THE AMOUNT OF FILL ULD BE REDUCED AND THE PLAN AS MODIFIED CONSIDERED FOR FURTHER IDY.

LANS WHICH INVOLVE UNAVOIDABLE IMPACTS HAVE BEEN EVALUATED BY THE ISH AND WILDLIFE SERVICE, AND APPROPRIATE MITIGATION FOR EACH LTERNATIVE HAS BEEN IDENTIFIED AS OUTLINED BY OUR MITIGATION POL OR ENVIRONMENTALLY SOUND ALTERNATIVES LIKE PLAN B, THIS WOULD BE INOR. FOR OTHER PLANS IT COULD REQUIRE EXTENSIVE DEGREES OF ITIGATION IN THE FORM OF HABITAT REPLACEMENT.

N SUMMARY, THE FISH AND WILDLIFE SERVICE BELIEVES THAT EVERY EFFORT HOULD BE TAKEN BY THE FEDERAL GOVERNMENT TO ASSURE THAT THIS PROJECT S CONSTRUCTED IN THE MOST ENVIRONMENTALLY SOUND MANNER WITHIN BOUNDS F REASONABLE EXPENDITURES. IN OUR VIEW PLAN B, WHICH HAS A EFIT/COST RATIO APPROACHING THAT OF THE SELECTED PLAN, IS A EASONABLE ALTERNATIVE AND ONE WHICH CAN HELP TO IMPROVE MANY OF THE NVIRONMENTAL PROBLEMS FOUND IN THE AREA. IF ACTIONS ARE NOT TAKEN OW TO CORRECT ONGOING ENVIRONMENTAL PROBLEMS AND PREVENT OTHERS FROM EVELOPING, THIS AREA COULD EXPERIENCE SIMILAR ADVERSE IMPACTS AS HOSE OF THE CHESAPEAKE BAY. MILLIONS OF DOLLARS ARE NOW BEING XPENDED BY THE FEDERAL GOVERNMENT JUST TO STUDY THE PROBLEMS THERE ROUGHT ON BY POLLUTION, WETLAND DESTRUCTION, AND HAPHAZARD EVELOPMENT. MILLIONS AND MILLIONS MORE ARE ESTIMATED TO BE ECESSARY IF ANY SUCCESSFUL RESTORATION OF THAT AREA IS POSSIBLE. OPEFULLY WE CAN LEARN FROM OTHERS' MISTAKES. BY MAINTAINING THE ETLAND RESOURCES WITHIN THIS PROJECT AREA, IMPROVING DISPOSAL ETHODS, AND ENHANCING WATER QUALITY, WE WILL NOT ONLY HELP TO FULFILL

Tennessee Gas Transmission
A Tenneco Company

To meet this schedule, construction would need to begin as early as 1989 or 1990. To complete the base load LNG receiving terminal, a construction schedule of 4 to 5 years would be required.

It is important to note that before most terminal facility construction can begin, the dredge spoil must be allowed time to settle and compact itself. Depending on the spoil and the dewatering techniques used, this could take several years.

Regarding dredge spoil disposal on our land, please refer to a letter to you from Roger N. Stark dated August 2, 1984. In general, Mr. Stark states that TGP would be willing to accept the dredge spoils subject to mutual agreements on timing, quantity, and quality.

It is to our advantage to accept as much high quality spoil as possible. However, the timing must be such that all the spoil is placed for some time period prior to plant construction.

Based on the above optimistic scenario, the 1990 to 1995 time frame would not be appropriate for placing spoil on the site. However, should the project be delayed, the 1990 to 1995 time frame could be appropriate. As the Corps of Engineer's dredging plans proceed, we can jointly review our schedules to determine how we might accommodate each other.

May I suggest that since the Corps has to have several other spoil dumping locations other than our plant site, due to the fact that TGP will not accept the poorer quality spoil, that you proceed on the basis that TGP will accept at least the quality spoil in the 1990 to 1995 time frame.

I want to emphasise that our plans are tentative. As soon as we know more definite project plans, we will advise you.

Attached please find a preliminary plot plan of the proposed LNG facility. Note the location of the turning basin with respect to the ship channel. If the Corps dredged a turning basin north of our property near Chevron, we would not be able to use it with our existing layout.

TGP's plans anticipate dredging only the turning basin as shown on the enclosed plot plan, and do not include changing or dredging the ship channel itself. Obviously, if the channel were deeper and wider, we could minimize tug assistance and the related costs.

Sincerely,

Victor V. Staffa

Victor V. Staffa

VVS/fh

nessee Gas Transmission
· ·c Company

February 13, 1985

Lawrence R. Green
ef, Planning Division
artment of the Army
ps of Engineers
O. Box 2288
ile, AL 36628

ar Mr. Green:

hope this letter answers all of your questions asked in your February 8 tter and over a telephone conversation with Darron Granger on oruary 11.

e property, generally known as the Pascagoula LNG site, consists of a tal of 623.7 acres more or less.

e overall total acreage is broken down as follows:

(1) Land owned in fee by Tennessee Gas Pipeline Company ("TGP") a division of Tenneco Inc., was purchased in October, 1980 from the Pascagoula Port Authority. 205.4 ± acres

(2) Contiguous accreted property, owned by the State of Mississippi, leased for 99 years by Jackson County and subleased to Tennessee Gas Pipeline Company for 99 years. 96 ± acres

(3) Spoil island and submerged bottom lands owned by the State of Mississippi, leased for 99 years by Jackson County and subleased to Tennessee Gas Pipeline Company for 99 years. 322.3 ± acres

r the extension of the warranty deed presently being prepared, there is condition that TGP shall commence construction of an industrial plant by tober 1990. If this construction schedule is not met and the agreement not extended, the Port Authority is obligated to repurchase the site.

r plans to begin construction are dependent upon many factors including rket competitive cost of the imported gas, contracts with foreign vernments to purchase their gas, and U. S. regulatory approvals.

are continually reviewing market and overall project economics to termine which ones should be considered. Although it is impossible to fine a firm project in-service date for Pascagoula, current planning dicates the earliest, or most optimistic scenario, this plant could be stream is about 1995.

investigation for Tenneco. The long, straight, narrow channels connected by minor turns in areas of soft bottoms would likely result in similar findings. It would be suggested, however, that some form of real time man-in-the-loop simulation be conducted to verify those conclusions in application in the unique conditions existing in the Mississippi Sound.

If you have further questions, please feel free to contact me directly.

Sincerely,

Joseph J. Puglisi
Managing Director, CAORF

JJP:bw:MA0187:46

not all pilots perform at the same levels of competence and, for safe operation, the channel design should be adequate for those with lesser -but acceptable- skills. It is recommended that on-line (CAORF) runs be made so that results incorporating the human factor can be obtained.

Some of the objectives of an on-line simulation program could be:

- o Validate the conclusions of the off-line simulation
- o Identify specific limiting wind directions and velocities
- o Validate the adequacy of harbor navigation aids. If the study suggests alternative configurations, CAORF could be used to help select the best choice.
- o Use Pascagoula Bar Pilots as test subjects so that selected pilots could gain some familiarization prior to beginning LNG operations in the port. [Also, the Pascagoula Bar Pilots' strategies could be incorporated in the evaluation of the port design.]
- o Determine the number of tugs, their size, location, and the operational strategy to be used during an approach to the Bayou Casotte Terminal."

The investigation of LNG transits into Pascagoula was one of the first port development studies conducted at CAORF. Subsequent studies have verified the adequacy of off-line simulation for screening variables associated with a port design. These same studies have also verified the importance of conducting real time man-in-the-loop simulation prior to finalizing port designs. The variability of pilot strategies and human performance is especially critical when attempting to minimize channel dimension increases while insuring adequate safety for future vessel operations.

In many ways, the conclusions of the Mobile Study may be as relevant to your investigations of Pascagoula as the earlier

- Wind appeared to be a significant concern in handling the LNG vessel. Low speed combined with 25 knots or more of wind could create excessive conditions for vessel transits. Although not reported in the study, there was also an indication that the LNG vessel is particularly sensitive to relative winds very near the stern. This condition would not be expected to occur often in practice but would represent a condition for further real time study.

- There appeared to be a sufficiently flexible range of control strategies for successful negotiation of the Horn Island Pass turns. More definitive examination of vessel performance and turns could be obtained through more detailed examination of pilot controlled transits.

Recommendations:

- It was indicated that the first area to consider widening would be the Bayou Casotte Channel. This could be especially important for slow speed and tug assisted operations associated with final port approaches.

- Widening or connecting the turns in Horn Island Pass could provide an additional measure of safety after widening the Bayou Casotte Channel. Finally, bottom clearance squat computations conducted independently of the simulation indicate that deepening may be required for guaranteed clearance at low water if void schedules require entry at all stages of tide.

I would like to repeat, verbatim, the final recommendation which suggests the need for additional on-line CAORF simulation programs to verify, validate, and elaborate on the conclusions of this off-line simulation program.

> "While off-line simulation is capable of sophisticated representation of vessel operations under a variety of conditions, it does not include the effects of human limitations, experience, judgement, etc. The ability of an experienced pilot to anticipate the effect of a cross current, to bias his position to compensate for wind and current effects, etc., can strongly influence the trackkeeping performance of the vessel. Furthermore,

maneuverability of LNG vessels in the Pascagoula Channel system with that of an 80,000 DWT Chevron tanker which made a transit of the channels on an almost weekly basis. The hypothesis was that if the LNG tanker swept path and ship controllability did not differ significantly from that of the 80,000 DWT tanker, Tenneco would have a preliminary indication that LNG vessel transits were feasible. Tenneco understood that additional real time man-in-the-loop simulation would be required to refine the study results.

Simulation Models:

The mathematical model used for this investigation was a plan view (radar type) representation of the ship outline in the channels with a simple steering and propulsion control panel. The display had a predictor feature which solved the equations of motion based on the conditions present at advanced incremental positions ahead of the actual position of ownship. Using this predictor, it was possible to make a large number of runs through the channel under a variety of conditions in a minimum time period. In all, over 60 scenarios were run and evaluated during the course of the study. The method used was the most efficient means of conducting a large screening experiment with as close to an optimal autopilot as could practically be employed.

Tug Model Usage:

With regard to your question on the tug usage, it is important to note that tug forces and tug usage were not evaluated as an integral part of the investigation, rather the effectiveness of tugs in counteracting the effects of wind and current were evaluated independently to obtain an order of magnitude indication of the size and quantity of tugs which might be necessary to assist operation of vessels in the channel system in the future. There was no tug usage in any of the simulation runs made during the course of this investigation.

Results and Conclusions:

The major conclusions of this investigation were that:

- The performance of the LNG vessel relative to the 80,000 DWT oil tanker implied that routine LNG vessel transits can be made through existing Pascagoula Harbor channels under conditions similar to those under which current oil tanker transits are being made.

US Department
of Transportation
Maritime Administration

National Maritime
Research Center

Kings Point, New York 11024

30 January 1985

Mr. Walter Burdin
PD-N
U.S. Army Corps of Engineers
Mobile District
P.O. Box 2288
Mobile, Alabama 36628

Dear Mr. Burdin:

In response to your questions regarding CAORF Technical Report Number 24-7914-01, entitled "Investigation of Limiting Channel Conditions for LNG Vessel Transit into the Port of Pascagoula, Mississippi", dated November 7, 1979, I have asked the principal investigators for this study to provide me with a characterization of the study effort performed. In addition, I have asked for their assessment of the generalizability of the 1979 study to the Mobile District's current evaluation of the Pascagoula and Bayou Casotte Channels. A summary of their comments follows.

Project Overview:

In 1979, the Tennessee Gas Transmission Company, a Tenneco subsidiary, was completing a market evaluation for establishing an LNG ship unloading and transfer facility in the Port of Pascagoula, Mississippi. In their initial screening process, they were concentrating on transportation and economic analyses which focused attention on vessel operating costs, port turnaround time, and weather conditions affecting transits of LNG vessels between ports. At the end of their study timetable, Tenneco's project team realized that they had not examined whether or not the existing port would be adequate for LNG transits to the proposed transfer facility. Tenneco contacted CAORF and requested that we conduct an initial screening experiment which would give a first indication of the viability of existing harbor channels for LNG vessel transit.

In view of Tenneco's time constraints, it was determined that a mathematical simulation of a variety of wind and current conditions would be used for the study. The purpose of the study was to identify potential problem areas and compare the

Therefore, we fully endorse the completion of the feasibility report, and we will forward to you our estimates of pipeline relocation cost as soon as they are completed.

Yours very truly,

PE Richter/JTH

JTH/JBM/mg

cc: Mr. Paul Pella, Port Director, Jackson County Port Authority

Chevron

Chevron U.S.A. Inc.
Pascagoula Refinery
P.O. Box 1300, Pascagoula, MS 39567

P. E. Ruhter
General Manager

August 27, 1984

District Engineer
Mobile District, U.S. Army Corps
of Engineers
P. O. Box 2288
Mobile, AL 36628

Attention: SAMPD-N

Dear Sir:

Chevron U.S.A. Inc. wishes to provide additional information with respect to the proposed channel improvement project in the vicinity of Pascagoula, Mississippi. As a result of our meeting on August 21, 1984, with Messrs. Burke and Burdin of the Coastal Branch, Planning Division, we are developing a Chevron estimate of the costs of relocating our underwater pipelines to accommodate the channel depths cited in your feasibility study. This further engineering study by Chevron may show a reduced cost for this work.

In our August 14, 1984 letter, we stated that we are faced with the construction in the near future of new vessels to serve our Pascagoula Refinery. However, we would like to emphasize that the example stated is one of several alternatives which our current long-range plan is considering. Projections may, of course, change over the years, and since the project construction schedule covers a period of many years, it is probable that upon project completion larger ships (80,000 DWT, or more) would be attractive. A deeper and wider channel would be of benefit to our oil movement operations. It would give Chevron the opportunity to use larger and more efficient vessels.

Aside from the oil movement operations, an additional benefit which would be realized as soon as the channel improvements were completed is the transportation savings to be realized from use of larger vessels for shipment of petroleum coke manufactured at the Refinery. Shippers of this commodity have already communicated to us their interest in an improved channel.

As stated in our letter to you of August 14, Chevron's view is that a deeper channel through Horn Island Pass into Bayou Casotte would offer economic incentives to users of the port.

Chevron

Chevron U.S.A. Inc.
Pascagoula Refinery
P.O. Box 1300, Pascagoula, MS 39567

P. E. Ruhter
General Manager

August 14, 1984

Colonel Patrick J. Kelly
District Engineer, Mobile District
U.S. Army Corps of Engineers
P. O. Box 2288
Mobile, AL 36628

Dear Colonel Kelly:

We have briefly reviewed the draft feasibility report and draft environmental impact statement covering deepening the navigation channels in the vicinity of Pascagoula, Mississippi. Chevron U.S.A. Inc. has a genuine interest in a deeper navigation channel through Horn Island Pass into Bayou Casotte. A deeper channel would offer transportation economies to Chevron if project completion occurred at essentially the same time as lightering vessel replacements are built and placed in service. We understand that project completion might take place in or about 1995 (Volume II, page C-82 of your report). However, lightering vessel replacement will be required well before that time, and we would build and use vessels specially designed for the existing channel configuration. No significant benefits would accrue to Chevron from a deeper channel until the subsequent generation of lightering vessels was built, probably after the turn of the century.

There are two areas covered in the study for which we need further information and explanation. These are:

1. The boundaries of the proposed dredge spoils area along the south edge of Chevron's property, and
2. Details concerning the relocation of our underwater pipelines where they cross the navigation channels under discussion.

Yours very truly,

P. E. Ruhter

JBMc/jws:mg

cc: Mr. Paul Pella, Jackson County Port Authority

U.S. Department
of Transportation
United States Coast Guard

COMMANDER
EIGHTH COAST GUARD DISTRICT
HALE BOGGS FEDERAL BLDG.

500 CAMP ST.
NEW ORLEANS, LA. 70130
STAFF SYMBOL: (dpl)
PHONE: FTS 682-2961

16475
5 September 1984

From: Commander, Eighth Coast Guard District
To: District Engineer, U. S. Army Corps of Engineers, Mobile

Subj: PASCAGOULA HARBOR, MISSISSIPPI DRAFT FEASIBILITY REPORT

1. Thank you for the opportunity to review the feasibility report on the Pascagoula Harbor project. In the letter of 23 December 1983 from our Aids to Navigation Branch, we provided costs for aids to navigation relocation as you requested in your letter of 10 November 1983. We also recommended that if any of the channels are widened, that the width increases be taken equally from both sides of the channel. This would allow the existing centerline ranges to remain in use. The costs associated with the relocation of the range lights would be much higher than the costs to relocate the lateral aids.

2. Our position on this project has not changed. I also request that you continue to keep our Aids to Navigation Branch informed of the status of this project.

T. A. TANSEY
By direction

FIRST CHEMICAL CORPORATION
P O BOX 1427, PASCAGOULA, MISSISSIPPI 39567
TELEPHONE (601) 762-0870/TWX 510-990 3361

September 5, 1984

US Army Corps of Engineers, Mobile District
Attention: SAMPD-N
Post Office Box 2288
Mobile, Alabama 36628-0001

RE: Feasibility study of the deep-draft channel portion of the Pascagoula Harbor Navigation Project

Dear Sir:

First Chemical Corporation operates a chemical plant in Jackson County, Mississippi, and utilizes the Bayou Casotte Channel and Jackson County Port Authority terminal "F" for unloading inbound raw materials and loading outbound products.

First Chemical has recognized for many years the economic advantages of waterborne commerce. The selected plan to deepen the channel to 42 feet with a 350 foot width expands the opportunities for First Chemical to utilize the Bayou Casotte Port. With a deeper and wider channel, future growth and expansion by First Chemical will not be impeded by restrictions and congestion in the Bayou Casotte Port.

The feasibility study has adequately justified the modifications to the Bayou Casotte Channel as proposed in the selected plan.

Sincerely,

FIRST CHEMICAL CORPORATION

Carl Rensink
Vice President Productions

CDR/blt

Jackson County
PORT AUTHORITY

August 30, 1984

Colonel Patrick J. Kelley
District Engineer
U.S. Corps of Engineers, Mobile District
Post Office Box 2288
Mobile, Alabama 36628

Subject: Pascagoula Harbor Mississippi
Improvements of the Federal
Deep Draft Navigation
Channel

Dear Colonel Kelley:

The Jackson County Port Authority and the Jackson County Board of Supervisors are extremely interested and committed to improving the channels and harbors within its jurisdiction.

We have studied the "Feasibility Report" dated July 1984. We are prepared to comply to the requirements of law for this type of project and agree to comply with the items set out in the responsibilities section of the report.

Sincerely,
JACKSON COUNTY PORT AUTHORITY

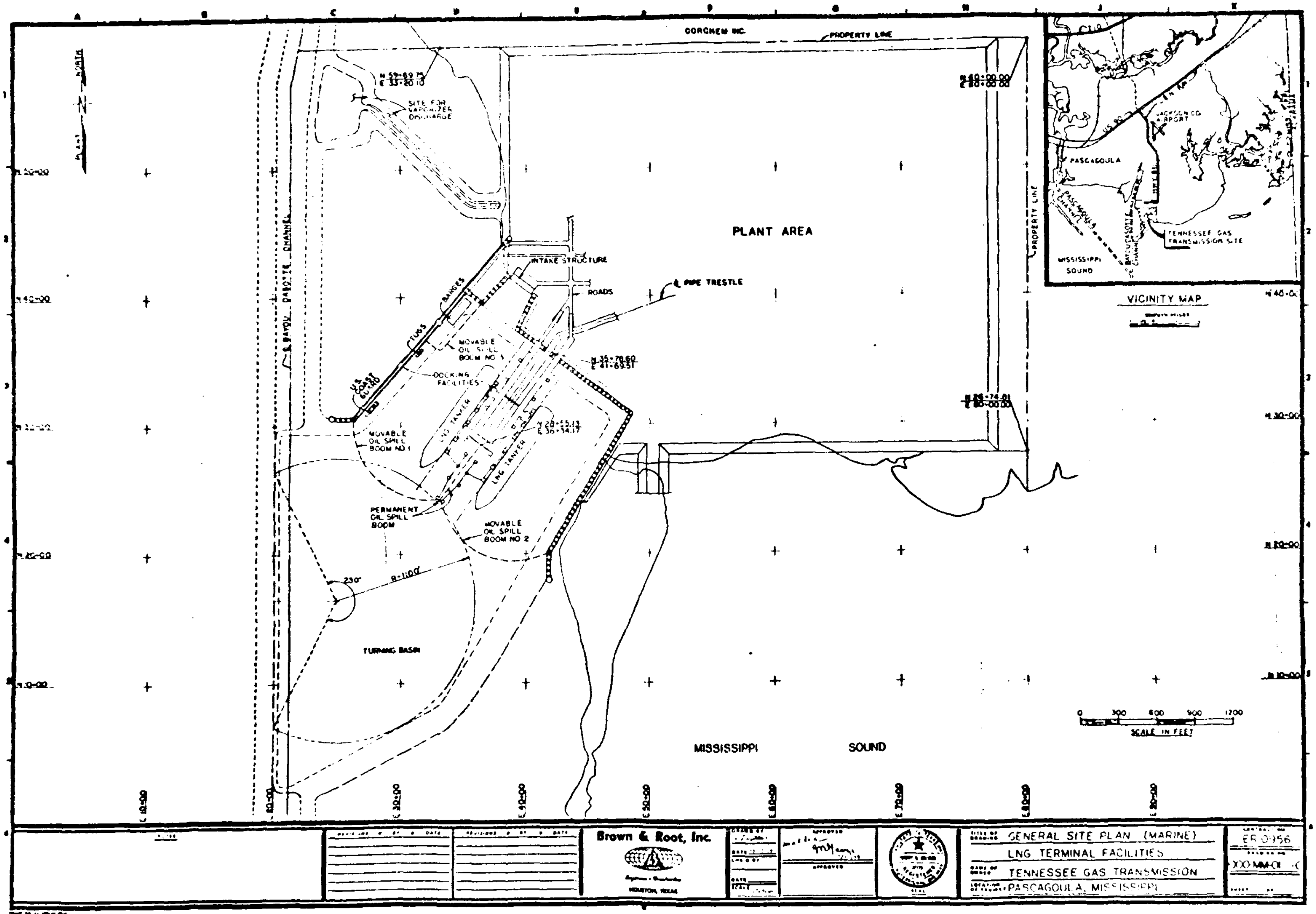
Paul D. Pella
PAUL D. PELLA
PORT DIRECTOR

JACKSON COUNTY BOARD OF SUPERVISORS
VICE-PRESIDENT
Fred Robinson, Jr.

PDP:mmt

Post Office Box 70 Pascagoula, Mississippi 39567 Phone 601/762-4041

OUR MANDATED OBLIGATION TO PROTECT FISH AND WILDLIFE RESOURCES BUT WILL ALSO ASSIST IN PRESERVING THE ENVIRONMENTAL AND ECONOMICAL QUALITY OF THIS AREA. THE FISH AND WILDLIFE SERVICE WILL CONTINUE WORK WITH THE CORPS OF ENGINEERS AND THE VARIOUS OTHER STATE AND FEDERAL AGENCIES IN ATTEMPTS TO MEET THESE INTENDED OBJECTIVES.


DORCHEM INC.
PROPERTY LINE
PLANT AREA
SITE FOR VAPORIZER DISCHARGE
N 59+69.75
E 33+20.10
N 60+00.00
E 80+00.00
N 35+79.60
E 41+69.51
N 28+74.81
E 80+00.00
N 28+45.13
E 36+54.17
INTAKE STRUCTURE
ROADS
℄ PIPE TRESTLE
BARGES
TUGS
U.S. COAST GUARD
MOVABLE OIL SPILL BOOM NO. 1
DOCKING FACILITIES
LNG TANKER
PERMANENT OIL SPILL BOOM
MOVABLE OIL SPILL BOOM NO 2
230'
R-1100'
TURNING BASIN
℄ BAYOU CASOTTE CHANNEL
MISSISSIPPI SOUND
SCALE IN FEET
0 300 600 900 1200
VICINITY MAP
PASCAGOULA
JACKSON CO. AIRPORT
PASCAGOULA CHANNEL
BAYOU CASOTTE CHANNEL
TENNESSEE GAS TRANSMISSION SITE
MISSISSIPPI SOUND
US 90
HWY 611
NORTH
PLANT
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E 50+00
E 60+00
E 70+00
E 80+00
E 90+00
Brown & Root, Inc.
HOUSTON, TEXAS
GENERAL SITE PLAN (MARINE)
LNG TERMINAL FACILITIES
TENNESSEE GAS TRANSMISSION
PASCAGOULA, MISSISSIPPI
ER 0356

Jackson County
PORT AUTHORITY

March 7, 1985

Colonel Patrick J. Kelly
District Engineer
Corps of Engineers
Mobile District
P. O. Box 2288
Mobile, AL 36628

ATTN: Mr. Walter Burdin

Dear Colonel Kelly:

RE: Proposed Improvement for Federal Navigation Project Pascagoula, Mississippi

It has been brought to our attention that in developing the Turning Basin Bayou Casotte Harbor, several acres of wetlands will be destroyed. The Jackson County Port Authority would propose for mitigation purposes to exchange this wetland by setting aside (preservation) six (6) acres along the Southern or Southwestern edge of Greenwood Island.

Sincerely,

JACKSON COUNTY PORT AUTHORITY

Paul D. Pella

PAUL D. PELLA
Port Director

mng

Post Office Box 70 • Pascagoula, Mississippi 39567 • Phone 601/762-4041

END

FILMED

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