TABLES

Table 5.1-1(1/2) DATA ON RIVER MOUTH PROBLEM

Serial	Name	Flood Problem	Commercial Navigation Problem	No. of Commercial Boat	Complaint from Fishermen	No. of Fishing Boat	Population of Fishermen
1	Perlis*	-	yes	20	yes	432	(2333)
2	Baru	-	-	-	yes**	104	(561)
3	Sanglang	-	-	-	-	238	(762)
4	Jerlun	-	-	-	-	63	(202)
5	Kedah*	-	yes	77	yes	536	(1716)
6	Yan	-	-	-	yes**	154	(493)
7	Melaka	-	-	-	-	3	(10)
8	Cenang	-	-	-	yes**	44	(141)
9	Muda*	-	-	-	yes**	201	(504)
10	Perai	-	-	16	-	(26)	50
11	Kerian	yes	-	-	yes**	245	693
12	Pinang	-	-	-	yes**	182	700
13	Bayan Lepas	-	-	-	yes	122	50
14	Tg. Piandang	-	-	-	yes**	486	1042
15	Gula	-	-	-	yes	216	308
16	Sangga	-	-	-	yes	39	76
17	Larut	-	-	-	yes	752	140
18	Terong	-	-	-	-	5	166
19	Beruas*	-	-	-	yes**	(655)	1595
20	Batu	-	-	-	yes**	16	21
21	Dinding*	-	-	***	-	40	83
22	Lekir	-	-	-	-	26	(55)
23	Selangor	-	-	-	yes**	189	(397)
24	Kapar Besar	-	-	-	-	77	(67)
25	Langat	-	-	-	yes**	34	(158)
26	Sepan Kecil	-	-	-	yes**	23	(26)
27	Sepang	-	-	-	-	105	(95)
28	Lukut	-	-	-	-	35	79
29	Raya	-	-	-	-	(5)	(10)
30	Linggi	-	-	-	-	63	(20)
31	Baru	-	-	-	yes**	92	170
32	Melaka	-	-	***	yes**	111	311
33	Duyong	-	-	-	yes	32	95
34	Umbai	-	-	-	yes	38	62
35	Merlimau	-	-	-	yes	35	69
36	Muar	-	-	-	-	167	(251)
37	Parit Jawa	-	-	-	-	117	(176)
38	Sarang Buaya	-	-	-	-	35	(53)
39	Batu Pahat	-	-	-	-	64	(96)
40	Senggarang	-	-	-	yes	35	(53)
41	Rengit	-	-	-	yes	57	(86)
42	Benut	-	-	-	-	61	(92)
43	Pontian Kecil	-	-	-	-	247	(370)
44	Sedili Besar	-	-	-	-	311	(467)
45	Mersing*	-	yes	154	yes	290	(435)
46	Endau	-	-	-	-	218	(327)
47	Pontian	-	-	-	-	17	28
48	Rompin	-	-	-	-	107	405
49	Merchong	-	-	-	-	4	11
50	Nenasi	-	-	-	-	75	228

Source: DID, MD and Investigation Survey Results
Note: * Dredging has been conducted or is scheduled.
** Complaint is very strong.
*** Data is not available.
Figures in parenthesis are estimated value based on interview survey or statistical data.

Table 5.1-1(2/2) DATA ON RIVER MOUTH PROBLEM

Serial	Name	Flood Problem	Commercial Navigation Problem	No. of Commercial Boat	Complaint from Fishermen	No. of Fishing Boat	Population of Fishermen
51	Pahang	-	-	-	-	164	666
52	Terus	-	-	-	-	(34)	86
53	Kuantan	-	-	45	-	163	(570)
54	Beserah	-	-	-	-	6	(21)
55	Kemaman	yes	-	8	-	97	1338
56	Kemasik	-	-	-	yes	42	175
57	Kerteh*	-	-	23	yes	53	140
58	Paka	-	-	-	-	83	267
59	Dungun*	-	-	***	-	66	848
60	Mercang*	yes	-	-	yes	23	50
61	Marang*	-	-	-	yes**	188	715
62	Terengganu*	yes	yes	161	yes	107	(417)
63	Merang*	-	-	-	-	34	66
64	Keluang	-	-	-	-	(10)	(39)
65	Gali	-	-	-	-	(8)	15
66	Pak Amat*	yes	-	-	yes**	28	30
67	Kelantan*	yes	-	***	-	208	(666)
68	Rulah	-	-	-	-	(15)	35
69	Sematan	-	-	-	-	4	97
70	Kayan	-	-	-	-	(45)	(104)
71	Sempadi	-	-	-	-	7	49
72	Rambungun	-	-	-	-	0	27
73	Sibu Laut	-	-	-	-	0	47
74	Salak	-	-	-	-	8	54
75	Santubong	-	-	-	-	0	50
76	Buntal	-	-	-	-	5	122
77	Bako	-	-	-	-	(92)	93
78	Sadong	-	-	-	-	(867)	751
79	Kabong	-	-	***	-	(207)	239
80	Oya	-	-	-	-	(104)	292
81	Mukah	-	-	-	-	(199)	556
82	Balingian	-	-	-	-	(33)	92
83	Serupadi	-	-	-	-	(3)	(7)
84	Tatau	-	-	-	-	(43)	142
85	Suai	-	-	-	-	(4)	12
86	Niah	-	-	-	-	(4)	12
87	Sibuti	-	-	-	-	(31)	99
88	Lawas	-	-	-	-	(161)	167
89	Padas	yes	-	-	-	400	509
90	Papar	yes	-	-	yes	123	34
91	Inanam	-	-	-	-	21	50
92	Tuaran	-	-	-	-	120	120
93	Bandau	-	-	-	-	54	54
94	Bongan	-	-	-	-	47	42
95	Sugut	-	-	-	-	211	211
96	Segama	-	-	***	-	26	28
97	Kalumpang	-	-	-	-	10	105
98	Tawau	-	-	-	-	60	400
99	Umas-umas	-	-	***	-	15	60
100	Kalabakan	-	-	***	-	5	98

Source: DID, MD and Investigation Survey Results
Note: * Dredging has been conducted or is scheduled.
** Complaint is very strong.
*** Data is not available.
Figures in parenthesis are estimated value based on interview survey or statistical data.

Table 5.1-2(1/2) RECORD OF DREDGING WORKS

Serial	Name	DID	Marine Department*1
1	Perlis	-	1986, '87, '90, '91, ('92)
2	Baru	-	-
3	Sanglang	-	-
4	Jerlun	-	-
5	Kedah	-	(1992)
6	Yan	-	-
7	Melaka	-	-
8	Cenang	-	-
9	Muda	1986	-
10	Perai	-	-
11	Kerian	-	-
12	Pinang	-	-
13	Bayan Lepas	-	-
14	Tg. Piandang	-	-
15	Gula	-	-
16	Sangga	-	-
17	Larut	-	-
18	Terong	-	-
19	Beruas	1988-90	-
20	Batu	-	-
21	Dinding	-	1986
22	Lekir	-	-
23	Selangor	-	-
24	Kapar Besar	-	-
25	Langkat	-	-
26	Sepan Kecil	-	-
27	Sepang	-	-
28	Lukut	-	-
29	Raya	-	-
30	Linggi	-	-
31	Baru	-	-
32	Melaka	-	-
33	Duyong	-	-
34	Umbai	-	-
35	Merlimau	-	-
36	Muar	-	-
37	Parit Jawa	-	-
38	Sarang Buaya	-	-
39	Batu Pahat	-	-
40	Senggarang	-	-
41	Rengit	-	-
42	Benut	-	-
43	Pontian Kecil	-	-
44	Sedili Besar	-	-
45	Mersing	-	1981, ('92)
46	Endau	-	-
47	Pontian	-	-
48	Rompin	-	-
49	Merchong	-	-
50	Nenasi	-	-

Note: *1 Figures in parenthesis show scheduled year of dredging works.
Source: DID, MD

Table 5.1-2(2/2) RECORD OF DREDGING WORKS

Serial	Name	DID	Marine Department*1
51	Pahang	-	-
52	Terus	(1993)	-
53	Kuantan	-	-
54	Beserah	-	-
55	Kemaman	-	-
56	Kemasik	-	-
57	Kerteh	1991	-
58	Paka	-	-
59	Dungun	-	1989, '90
60	Mercang	1991	-
61	Marang	1979	-
62	Terengganu	-	1976, '87, '88, '91, ('92)
63	Merang	1975, '76, '77	-
64	Keluang	-	-
65	Gali	-	-
66	Pak Amat	1991	
67	Kelantan	1991	1986, '88, '89, ('92)
68	Rulah	-	-
69	Semantan	-	-
70	Kayan	-	-
71	Sempadi	-	-
72	Rambungun	-	-
73	Sibu Laut	-	-
74	Salak	-	-
75	Santubong	-	-
76	Buntal	-	-
77	Bako	-	-
78	Sadong	-	-
79	Kabong	-	-
80	Oya	-	-
81	Mukah	-	-
82	Balingian	-	-
83	Serupadi	-	-
84	Tatau	-	-
85	Suai	-	-
86	Niah	-	-
87	Sibuti	-	-
88	Lawas	-	-
89	Padas	-	-
90	Papar	-	-
91	Inanam	-	-
92	Tuaran	-	-
93	Bandau	-	-
94	Bongan	-	-
95	Sugut	-	-
96	Segama	-	-
97	Kalumpang	-	-
98	Tawau	-	-
99	Umas-umas	-	-
100	Kalabakan	-	-

Note: *1 Figures in parenthesis show scheduled year of dredging works.
Source: DID, MD

Table 5.1-3 RIVER MOUTH IMPROVEMENT AND RELATED STRUCTURES

Serial	Name	Structures for River Mouth Improvement *1	Related Structures *2
1	Perlis	-	DM
2	Baru	-	TG
3	Sanglang	-	TG
4	Jerlun	-	TG
5	Kedah	-	TG, DM
6	Yan	-	TG
7	Melaka	-	-
8	Cenang	BW	TG
9	Muda	-	TG
10	Perai	-	TG
11	Kerian	-	TG
12	Pinang	-	-
13	Bayan Lepas	-	-
14	Tg. Piandang	-	TG
15	Gula	-	-
16	Sangga	-	-
17	Larut	-	-
18	Terong	-	-
19	Beruas	-	-
20	Batu	-	-
21	Dinding	-	-
22	Lekir	-	-
23	Selangor	-	-
24	Kapar Besar	-	-
25	Langkat	-	-
26	Sepan Kecil	-	-
27	Sepang	-	-
28	Lukut	-	TG
29	Raya	-	TG
30	Linggi	-	TG
31	Baru	-	-
32	Melaka	BW	DM
33	Duyong	-	TG
34	Umbai	-	TG
35	Merlimau	-	-
36	Muar	-	-
37	Parit Jawa	-	TG
38	Sarang Buaya	-	TG
39	Batu Pahat	-	DM
40	Senggarang	-	TG
41	Rengit	-	TG
42	Benut	-	DM
43	Pontian Keci	-	-
44	Sedili Besar	-	-
45	Mersing	-	-
46	Endau	-	DM
47	Pontian	-	DM
48	Rompin	-	-
49	Merchong	-	-
50	Nenasi	-	-
51	Pahang	-	DM, GR, RV
52	Terus	-	-
53	Kuantan	-	-
54	Beserah	-	-
55	Kemaman	JT	-
56	Kemasik	TL	-
57	Kerteh	-	-
58	Paka	-	DM
59	Dungun	-	DM, RV
60	Mercang	-	-
61	Marang	-	-
62	Terengganu	RV	DM
63	Merang	-	-
64	Keluang	-	-
65	Gali	BW	-
66	Pak Amat	-	-
67	Kelantan	-	DM, RV, GR
68	Rulah	-	-
69	Semantan	-	-
70	Kayan	-	-
71	Sempadi	-	-
72	Rambungun	-	-
73	Sibu Laut	-	-
74	Salak	-	-
75	Santubong	-	-
76	Buntal	-	-
77	Bako	-	-
78	Sadong	-	-
79	Kabong	-	-
80	Oya	-	-
81	Mukah	-	-
82	Balingian	-	-
83	Serupadi	-	-
84	Tatau	-	-
85	Suai	-	-
86	Niah	-	-
87	Sibuti	-	-
88	Lawas	-	-
89	Padas	-	-
90	Papar	-	-
91	Inanam	-	RV
92	Tuaran	-	-
93	Bandau	-	-
94	Bongan	-	-
95	Sugut	-	-
96	Segama	-	-
97	Kalumpang	-	-
98	Tawau	-	-
99	Umas-umas	-	-
100	Kalabakan	-	-

Note: *1 BW: Breakwater JT: Jetty TL: Training Levee RV: Revetment
*2 TG: Tidal Gate GR: Groyne RV: Revetment DM: Dam

Table 5.2-1 (1/3) CLASSIFICATION OF 100 RIVER MOUTHS BASED ON NATURAL CONDITION

Serial	River Mouth	Coastal Geomor-phology *1	Wave *2	Tide *3	Catchment Area of the River *4	River Course Pattern *5	Shoreline Formation *6	Coastal Material *7	River Mouth Condition *8
1	Perlis	SC	LW	LP	LC	MD	ST	SM	OP
2	Baru	SC	LW	SP	MC	SR	ST	MU	OP
3	Sanglang	SC	LW	SP	MC	SR	ST	MU	OP
4	Jerlun	SC	LW	SP	MC	SR	ST	MS	OP
5	Kedah	PR	LW	LP	LC	MD	CV	MU	OP
6	Yan	SI	LW	SP	MC	MD	ST	SM	OP
7	Melaka	HL	LW	SP	MC	MD	CV	SA	PC
8	Cenang	SI	LW	SP	MC	MD	ST	SA	PC
9	Muda	PR	LW	LP	LC	MD	ST	SA	PC
10	Perai	PR, SI	LW	LP	LC	MD	ST	MU	OP
11	Kerian	ES	LW	LP	LC	MD	CC	MU	OP
12	Pinang	SC	LW	SP	MC	SR	ST	MU	OP
13	Bayan Lepas	HL	LW	SP	MC	SR	ST	SM	OP
14	Tg. Piandang	PR	LW	SP	LC	SR	ST	MU	OP
15	Gula	EB	LW	LP	MC	MD	CC	MU	OP
16	Sangga	ES	LW	LP	LC	MD	CC	MU	OP
17	Larut	ES	LW	LP	LC	MD	CC	MU	OP
18	Terong	ES	LW	LP	MC	MD	CC	MU	OP
19	Beruas	HL	LW	LP	LC	MD	CC	MU	OP
20	Batu	HL	LW	SP	MC	MD	ST	MU	OP
21	Dinding	HL, SI	LW	LP	LC	SR	ST	SA	OP
22	Lekir	SC	LW	SP	MC	SR	ST	MU	OP
23	Selangor	SC	LW	LP	LC	MD	CC	MU	OP
24	Kapar Besar	SI	LW	SP	LC	SR	ST	MU	OP
25	Langat	SC	LW	LP	LC	MD	ST	MS	OP
26	Sepan Kecil	SC	LW	SP	MC	MD	ST	MU	SS
27	Sepang	SC	LW	SP	MC	MD	ST	SM	PC
28	Lukut	HL	LW	SP	LC	MD	ST	MU	OP
29	Raya	HL	LW	SP	MC	SR	ST	MU	SS
30	Linggi	HL	LW	LP	LC	SR	ST	MU	SS
31	Baru	SC	LW	SP	MC	SR	ST	SA	PC
32	Melaka	SC	LW	SP	LC	SR	CV	MS	OP
33	Duyong	SC	LW	SP	MC	MD	ST	MU	OP
34	Umbai	SC	LW	SP	MC	MD	ST	MU	OP
35	Merlimau	SC	LW	SP	MC	MD	ST	MU	OP
36	Muar	ES	LW	LP	LC	MD	CC	MU	OP
37	Parit Jawa	SC	LW	SP	MC	SR	ST	MU	OP
38	Sarang Buaya	SC	LW	SP	LC	SR	ST	MU	OP
39	Batu Pahat	ES, HL	LW	LP	LC	MD	CC	MU	OP
40	Senggarang	SC	LW	SP	MC	SR	ST	MU	OP

Note is in the last page, Table 4.1-1(3/3).

Table 5.2-1 (2/3) CLASSIFICATION OF 100 RIVER MOUTHS BASED ON NATURAL CONDITIONS

Serial	River Mouth	Coastal Geomorphology *1	Wave *2	Tide *3	Catchment Area of the River *4	River Course Pattern *5	Shoreline Formation *6	Coastal Material *7	River Mouth Condition *8
41	Rengit	SC	LW	SP	LC	SR	ST	MU	OP
42	Benut	SC	LW	SP	LC	SR	ST	MU	OP
43	Pontian Kecil	SC	LW	SP	MC	MD	ST	MU	OP
44	Sedili Besar	HL	WO	LP	LC	MD	OB	SA	PC
45	Mersing	SI	WO	LP	LC	MD	ST	SA	SS
46	Endau	HL	WO	LP	LC	MD	ST	SA	SS
47	Pontian	SC	WS	SP	LC	MD	OB	SA	SS
48	Rompin	SC	WS	LP	LC	MD	OB	SA	SS
49	Merchong	PT	WO	SP	LC	MD	OB	SA	PC
50	Nenasi	PT	WO	LP	LC	MD	OB	SM	PC
51	Pahang	DL	WS	LP	LC	MD	OB	SA	PC
52	Terus	PT	WO	LP	MC	MD	OB	SA	CL
53	Kuantan	HL	WO	LP	LC	MD	OB	SA	SS
54	Beserah	PT	WO	SP	MC	MD	OB	SA	SS
55	Kemaman	HL	WO	LP	LC	MD	OB	SA	SS
56	Kemasik	SI	WO	SP	MC	MD	OB	SA	PC
57	Kerteh	HL	WO	SP	MC	MD	OB	SA	CL
58	Paka	HL, PT	WO	LP	LC	MD	OB	SA	SS
59	Dungun	HL	WO	LP	LC	MD	OB	SA	SS
60	Mercang	PT	WO	LP	LC	MD	ST	SA	CL
61	Marang	SC	WS	LP	LC	MD	ST	SA	PC
62	Terengganu	PR	WS	LP	LC	MD	OB	SA	PC
63	Merang	PR	WO	SP	LC	MD	ST	SA	CL
64	Keluang	HL	WO	LP	MC	MD	ST	SA	OP
65	Gali	SC	WS	SP	MC	SR	ST	SA	OP
66	Pak Amat	SC	WO	SP	MC	MD	ST	SA	CL
67	Kelantan	DL	WO	LP	LC	MD	CV	SA	PC
68	Rulah	DL, PT	WO	SP	MC	MD	OB	SM	PC
69	Sematan	ES	WO	LP	LC	MD	OB	SM	PC
70	Kayan	ES	WO	LP	LC	MD	OB	SM	PC
71	Sempadi	ES	WO	LP	MC	MD	CC	SM	OP
72	Rambunban	ES	WS	LP	LC	MD	CC	SM	OP
73	Sibu Laut	ES	WS	LP	LC	MD	CC	SM	OP
74	Salak	ES, HL	LW	LP	MC	MD	CC	SM	OP
75	Santubong	ES, HL	LW	LP	MC	MD	CC	SM	OP
76	Buntal	ES, HL	LW	LP	MC	MD	CC	MU	OP
77	Bako	ES, HL	LW	LP	MC	MD	CC	MU	OP
78	Sadong	ES	LW	LP	LC	MD	CC	SM	OP
79	Kabong	ES	LW	LP	LC	MD	CC	SM	OP
80	Oya	SC	WO	LP	LC	MD	CC	SA	OP

Note is in the last page, Table 4.1-1(3/3).

Table 5.2-1 (3/3) CLASSIFICATION OF 100 RIVER MOUTHS BASED ON NATURAL CONDITIONS

Serial	River Mouth	Coastal Geomor-phology *1	Wave *2	Tide *3	Catchment Area of the River *4	River Course Pattern *5	Shoreline Formation *6	Coastal Material *7	River Mouth Condition *8
81	Mukah	SC	WS	LP	LC	MD	CC	SA	OP
82	Balingian	SC	WS	LP	LC	MD	CC	SA	OP
83	Serupadi	SC	WS	SP	LC	SR	CC	SA	OP
84	Tatau	SC	WS	LP	LC	MD	OB	SA	PC
85	Suai	SC	WO	SP	LC	MD	OB	SA	PC
86	Niah	SC	WO	SP	LC	MD	OB	SA	PC
87	Sibuti	SC	WO	SP	LC	MD	OB	SA	PC
88	Lawas	PR	LW	LP	LC	MD	CV	SA	OP
89	Padas	ES	LW	LP	LC	MD	ST	SM	OP
90	Papar	PR, PT	WO	SP	LC	MD	OB	SA	PC
91	Inanam	EB	WO	SP	MC	MD	ST	SA	OP
92	Tuaran	SC	WO	LP	LC	MD	ST	SA	OP
93	Bandau	EB	LW	SP	LC	MD	ST	MU	OP
94	Bongan	EB	LW	SP	LC	MD	ST	MU	OP
95	Sugut	PR	WS	LP	LC	MD	ST	MS	OP
96	Segama	ES	WO	LP	LC	MD	ST	MS	OP
97	Kalumpang	ES	LW	LP	LC	MD	CC	MS	OP
98	Tawau	SI	LW	SP	LC	MD	ST	SA	PC
99	Umas-umas	EB	LW	LP	LC	MD	ST	MU	OP
100	Kalabakan	EB	LW	LP	LC	MD	CC	MU	OP

Note:

*1 SC: Straight Coast, PR: Protruding Coast, EB: Embayed Coast
ES: Estuary, HL: Headland, SI: Sheltered by Island
DL: Delta Formation, PT: Sand Spit

*2 WS: High Straight Wave, WO: High Oblique Wave, LW: Low Wave

*3 LP: Large Tidal Prism, SP: Small Tidal Prism

*4 LC: Large Catchment Area, MC: Small Catchment Area

*5 SR: Straight River, MD: Meandering River

*6 CV: Convex Shoreline, ST: Straight Shoreline, CC: Concave Shoreline
OB: One Side Bar

*7 SA: Sandy, MU: Muddy, SM: Mixed (Sand is predominant)
MS: Mixed (Mud is predominant)

*8 CL: Completely Closed by Sand Bar, PC: Partially Closed by Sand Bar
SS: Shallowed by Submerged Bar, OP: Open to the Sea

Table 5.2-2(1/2) CLASSIFICATION OF 100 RIVER MOUTHS BASED ON SOCIOECONOMIC CONDITION

Serial	Name	Land Use Condition *1	Navigation Condition *2
1	Perlis	UR, VI, AG	F, C
2	Baru	VI, AG	F
3	Sanglang	VI, AG	F
4	Jerlun	VI, AG	F
5	Kedah	UR, VI, AG	F, C
6	Yan	VI, AG	F
7	Melaka	VI, AG	F
8	Cenang	VI, AG	F
9	Muda	VI, SW, AG	F
10	Perai	UR, SW, AG	F, C
11	Kerian	VI, SW, AG	F
12	Pinang	UR, VI, AG	F
13	Bayan Lepas	VI, AG	F
14	Tg. Piandang	VI, AG, SW	F
15	Gula	VI, SW, AG	F
16	Sangga	VI, SW	F
17	Larut	VI, SW	F
18	Terong	VI, SW	F
19	Beruas	UR, SW, AG	F
20	Batu	VI, SW	F
21	Dinding	VI, SW, AG	F, C
22	Lekir	VI, SW, AG	F
23	Selangor	UR, SW, AG	F
24	Kapar Besar	VI, SW, AG	F
25	Langkat	VI, SW	F
26	Sepan Kecil	VI, FO, AG	F
27	Sepang	VI,FO, AG	F
28	Lukut	VI, FO	F
29	Raya	VI, SW, AG	F
30	Linggi	VI, SW	F
31	Baru	VI, AG	F
32	Melaka	UR	F, C
33	Duyong	VI, SW, AG	F
34	Umbai	VI, SW, AG	F
35	Merlimau	VI, SW, AG	F
36	Muar	UR, SW, AG	F
37	Parit Jawa	VI, AG	F
38	Sarang Buaya	VI, SW, AG	F
39	Batu Pahat	UR, SW, AG	F
40	Senggarang	VI, AG	F
41	Rengit	VI, SW, AG	F
42	Benut	VI, SW, AG	F
43	Pontian Kecil	VI, SW, AG	F
44	Sedili Besar	VI, SW	F
45	Mersing	UR, SW, AG	F, C
46	Endau	VI, SW, AG	F
47	Pontian	VI, SW, AG	F
48	Rompin	VI, SW, AG	F
49	Merchong	VI, SW	F
50	Nenasi	VI, SW	F

Note: *1 UR: Urban Area VI: Village AG: Agriculture FO: Forest
SW: Swampy Area UN: Unused Land
*2 F: Fishing Boat Only F,C: Fishing and Commercial Boat

Table 5.2-2(2/2) CLASSIFICATION OF 100 RIVER MOUTHS BASED ON SOCIOECONOMIC CONDITION

Serial	Name	Land Use Condition *1	Navigation Condition *2
51	Pahang	UR, SW, AG	F
52	Terus	VI, SW	F
53	Kuantan	UR, SW	F, C
54	Beserah	VI	F
55	Kemaman	UR, SW	F, C
56	Kemasik	VI, SW	F
57	Kerteh	VI, SW	F, C
58	Paka	VI, SW	F
59	Dungun	UR, SW, AG	F, C
60	Mercang	VI	F
61	Marang	VI	F
62	Terengganu	UR, AG	F, C
63	Merang	VI, FO	F
64	Keluang	VI, SW, FO	F
65	Gali	VI, FO	F
66	Pak Amat	VI, AG	F
67	Kelantan	UR, FO, AG	F, C
68	Rulah	VI, AG	F
69	Semantan	VI, SW	F
70	Kayan	VI, SW	F
71	Sempadi	VI, SW	F
72	Rambungun	VI, SW	F
73	Sibu Laut	VI, SW	F
74	Salak	VI, SW	F
75	Santubong	VI, SW	F
76	Buntal	VI, SW	F
77	Bako	VI, SW	F
78	Sadong	VI, SW	F
79	Kabong	VI, SW	F, C
80	Oya	VI, SW	F
81	Mukah	VI, SW	F
82	Balingian	VI, FO	F
83	Serupadi	VI, FO, AG	F
84	Tatau	VI, FO, AG	F
85	Suai	VI	F
86	Niah	VI, SW, AG	F
87	Sibuti	VI, FO, AG	F
88	Lawas	VI, SW, FO	F
89	Padas	VI, SW	F
90	Papar	VI, SW	F
91	Inanam	VI, UN	F
92	Tuaran	VI, SW, UN	F
93	Bandau	VI, SW	F
94	Bongan	SW	F
95	Sugut	SW	F
96	Segama	SW	F, C
97	Kalumpang	SW	F
98	Tawau	UR	F
99	Umas-umas	SW	F, C
100	Kalabakan	SW	F, C

Note: *1 UR: Urban Area VI: Village AG: Agriculture FO: Forest
SW: Swampy Area UN: Unused Land
*2 F: Fishing Boat Only F,C: Fishing and Commercial Boat

Table 5.2-3 DRAFT OF BOAT BY SIZE

Size of Boat	Displacement Tonnage (ton)	Draft (m)
Small	less than 10	1.0
Medium	10 - 25	1.5
	25 - 40	1.9
Large	40 - 70	2.5
	more than 70	3.0 or more

Source: DID

Table 5.2-4 CRITERIA TO JUDGE SERIOUSNESS OF NAVIGATION

Seriousness of Navigation	Size of Major Boat	River Mouth Depth
Very Serious	Large	less than 3.0m
	Medium	less than 2.0m
	Small	less than 1.0m
Serious	Large	3.0m - 4.0m
	Medium	2.0m - 3.0m
	Small	1.0m - 2.0m
Fair	Large	more than 4.0m
	Medium	more than 3.0m
	Small	more than 2.0m

Table 5.2-5(1/2) PHYSICAL CONDITION AT RIVER MOUTHS

Serial	Name	River Width at River Mouth (m)	Observed Water Depth (m)	Expected Minimum Depth (m)	Size of Boat *1	Physical Condition *2
1	Perlis	513	1.8	0.6	L	VS
2	Baru	100	0.3	0.2	L	VS
3	Sanglang	120	1.0	0.8	L	VS
4	Jerlun	130	1.4	1.1	M	VS
5	Kedah	1,220	2.3	1.8	L	VS
6	Yan	13	0.4	0.1	M	VS
7	Melaka	70	0.0	0.0	M	VS
8	Cenang	23	0.0	0.0	M	VS
9	Muda	200	3.2	1.0	M	VS
10	Perai	210	2.9	2.3	M	SE
11	Kerian	780	2.2	1.8	L	VS
12	Pinang	52	0.0	0.0	M	VS
13	Bayan Lepas	30	0.0	0.3	L	VS
14	Tg. Piandang	300	0.2	0.2	M	VS
15	Gula	379	1.4	1.1	M	VS
16	Sangga	915	2.0	1.6	M	VS
17	Larut	120	1.5	1.2	L	VS
18	Terong	265	3.6	2.9	M	SE
19	Beruas	140	1.1	0.9	L	VS
20	Batu	5	0.1	0.1	S	VS
21	Dinding	1,105	12.3	3.9	M	FA
22	Lekir	70	0.0	0.0	M	VS
23	Selangor	483	1.5	1.2	M	VS
24	Kapar Besar	571	0.0	0.0	M	VS
25	Langat	473	2.7	2.2	M	SE
26	Sepan Kecil	162	2.3	1.8	S	SE
27	Sepang	141	8.0	2.6	M	SE
28	Lukut	30	0.0	0.0	M	VS
29	Raya	10	0.6	0.5	M	VS
30	Linggi	320	0.0	0.0	M	VS
31	Baru	115	0.1	0.0	M	VS
32	Melaka	85	1.5	1.2	L	VS
33	Duyong	45	0.7	0.6	M	VS
34	Umbai	25	0.6	0.5	M	VS
35	Merlimau	10	0.5	0.4	M	VS
36	Muar	1,780	2.6	2.1	M	SE
37	Parit Jawa	100	0.6	0.5	M	VS
38	Sarang Buaya	150	1.4	1.1	M	VS
39	Batu Pahat	2,120	1.3	1.0	M	VS
40	Senggarang	70	0.7	0.6	M	VS
41	Rengit	120	0.6	0.5	M	VS
42	Benut	300	1.0	0.8	M	VS
43	Pontian Kecil	120	1.2	1.0	M	VS
44	Sedili Besar	210	5.5	1.8	M	VS
45	Mersing	122	2.5	0.8	L	VS
46	Endau	850	4.2	1.3	L	VS
47	Pontian	255	2.8	0.9	M	VS
48	Rompin	607	5.4	1.7	L	VS
49	Merchong	115	2.3	0.7	M	VS
50	Menasi	45	5.2	1.7	L	VS

Note: *1 L: Large Size Boat with displacement tonnage of more than 40 and with inboard en
M: Medium Size Boat with displacement tonnage of less than 40 and with inboard e
S: Small Size Boat; boats with outboard engines.
*2 VS: Very Serious SE: Serious FA: Fair

Table 5.2-5(2/2) PHYSICAL CONDITION AT RIVER MOUTHS

Serial	Name	River Width at River Mouth (m)	Observed Water Depth (m)	Expected Minimum Depth (m)	Size of Boat *1	Physical Condition *2
51	Pahang	415	5.7	1.8	L	VS
52	Terus	570	1.1	0.4	S	VS
53	Kuantan	284	8.0	2.6	L	VS
54	Beserah	4	0.0	0.0	M	VS
55	Kemaman	575	9.6	1.9	L	VS
56	Kemasik	15	0.1	0.0	M	VS
57	Kerteh	54	1.7	0.5	M	VS
58	Paka	161	4.9	1.6	M	VS
59	Dungun	428	4.1	1.3	L	VS
60	Mercang	46	0.6	0.2	M	VS
61	Marang	244	1.6	0.5	M	VS
62	Terengganu	141	10.2	3.3	L	SE
63	Merang	440	0.7	0.2	M	VS
64	Keluang	146	2.0	0.6	S	VS
65	Gali	86	1.2	0.4	S	VS
66	Pak Amat	113	0.4	0.1	L	VS
67	Kelantan	367	5.2	1.7	L	VS
68	Rulah	468	1.2	0.4	M	VS
69	Sematan	633	4.6	1.5	M	VS
70	Kayan	1,650	5.3	1.7	M	VS
71	Sempadi	730	1.6	0.5	M	VS
72	Rambungun	676	10.9	3.5	S	FA
73	Sibu Laut	1,209	16.2	5.2	S	FA
74	Salak	1,362	6.0	1.9	S	FA
75	Santubong	869	6.5	2.1	S	SE
76	Buntal	556	0.7	0.6	L	VS
77	Bako	1,834	1.5	1.2	S	SE
78	Sadong	4,500	4.4	1.4	M	VS
79	Kabong	919	10.4	3.3	M	FA
80	Oya	1,399	3.6	1.2	M	VS
81	Mukah	272	3.7	1.2	M	VS
82	Balingian	780	2.9	0.9	M	VS
83	Serupadi	59	2.5	0.8	S	VS
84	Tatau	334	3.7	1.2	L	VS
85	Suai	135	4.7	1.5	S	SE
86	Niah	305	3.2	1.0	M	VS
87	Sibuti	112	4.9	1.6	L	VS
88	Lawas	541	3.2	1.0	M	VS
89	Padas	190	2.4	0.8	M	VS
90	Papar	100	2.0	0.6	M	VS
91	Inanam	360	1.1	0.4	M	VS
92	Tuaran	470	1.7	0.5	M	VS
93	Bandau	1,020	3.9	3.1	M	FA
94	Bongan	200	0.6	0.5	M	VS
95	Sugut	130	3.2	2.6	M	SE
96	Segama	1,170	5.6	4.5	M	FA
97	Kalumpang	390	8.0	6.4	M	FA
98	Tawau	30	0.0	0.0	M	VS
99	Umas-umas	450	6.3	2.5	L	VS
100	Kalabakan	900	5.4	2.2	M	SE

Note: *1 L: Large Size Boat with displacement tonnage of more than 40 and with inboard en
M: Medium Size Boat with displacement tonnage of less than 40 and with inboard e
S: Small Size Boat; boats with outboard engines.
*2 VS: Very Serious SE: Serious FA: Fair

Table 5.2-6 COMPARISON OF WATER DEPTH AT TWO SEASONS

River Mouth	Water Depth at River Mouth (m)		Ratio (%)
	Apr. '92 Survey (1)	Oct. '92 Survey (2)	(1)/(2)
Perlis	1.8	2.6	69
Kedah	2.3	2.4	96
Tg. Piandang	0.2	0.3	67
Beruas	1.1	1.6	69
Kuantan	8.0	7.3	110
Kerteh	1.7	1.8	94
Marang	1.6	1.7	94
Terengganu	10.2	8.5	120
Oya	3.6	4.0	90
Papar	2.0	1.9	105
Average			91

Table 5.2-7 COMPARISON BETWEEN WATER DEPTH AT RIVER MOUTH AND MINIMUM WATER DEPTH

Category	River Mouth	Water Depth (m) at River Mouth (1)	Water Depth (m) Minimum (2)	Ratio (%) (2)/(1)
Muddy Coast	Perlis	2.6	1.5	58
	Kedah	2.4	1.7	71
	Tg. Piandang	0.3	0.3	100
	Beruas	1.6	0.7	44
	Average			68
Sandy Coast	Kuantan	7.3	1.4	19
	Kerteh	1.8	0.7	39
	Marang	1.7	0.6	35
	Terengganu	8.5	2.5	29
	Oya	4.0	1.5	38
	Papar	1.9	0.4	21
	Average			30

Table 5.2-8 COMBINATION OF SERIOUSNESS IN EACH ASPECT FOR CATEGORIZATION

Category	Combination	Physical Aspect	Economic Aspect	Social Aspect
Category 1 (Critical)	Combination-1	Very Serious	Very Serious	Any
	Combination-2	Very Serious	Serious	Very Serious
	Combination-3	Serious	Very Serious	Very Serious or Serious
Category 2* (Significant)	Combination-1	Very Serous or Serious	Very Serous or Serious	Any
	Combination-2	Very Serious	Fair	Very Serious or Serious
	Combinaiton-3	Fair	Very Serious or Serious	Very Serious or Serious
Category 3 (Acceptable)		The Other River Mouth		

Note: * Combination is applied to river mouths excluding those in Category 1.

Table 5.2-9(1/2) CATEGORIZATION OF RIVER MOUTH

Serial	Name	Record of Dredging	Physical Aspect *1	Economic Aspect *1	Social Aspect *1	Compehensive Evaluation (Category) *2
1	Perlis	yes	VS	VS	SE	1
2	Baru	-	VS	VS	VS	1
3	Sanglang	-	VS	VS	FA	1
4	Jerlun	-	VS	VS	FA	1
5	Kedah	yes	VS	VS	SE	1
6	Yan	-	VS	VS	VS	1
7	Melaka	-	VS	FA	FA	3
8	Cenang	-	VS	SE	VS	1
9	Muda	yes	VS	SE	VS	1
10	Perai	-	SE	FA	FA	3
11	Kerian	-	VS	VS	VS	1
12	Pinang	-	VS	VS	VS	1
13	Bayan Lepas	-	VS	FA	SE	2
14	Tg. Piandang	-	VS	VS	VS	1
15	Gula	-	VS	VS	SE	1
16	Sangga	-	VS	SE	SE	2
17	Larut	-	VS	SE	SE	2
18	Terong	-	SE	SE	FA	2
19	Beruas	yes	VS	VS	VS	1
20	Batu	-	VS	FA	VS	2
21	Dinding	yes	FA	SE	FA	3
22	Lekir	-	VS	SE	FA	2
23	Selangor	-	VS	VS	VS	1
24	Kapar Besar	-	VS	SE	FA	2
25	Langat	-	SE	SE	VS	2
26	Sepan Kecil	-	SE	FA	VS	2
27	Sepang	-	SE	SE	FA	2
28	Lukut	-	VS	SE	SE	2
29	Raya	-	VS	FA	FA	3
30	Linggi	-	VS	FA	FA	3
31	Baru	-	VS	SE	VS	1
32	Melaka	-	VS	VS	VS	1
33	Duyong	-	VS	SE	SE	2
34	Umbai	-	VS	SE	SE	2
35	Merlimau	-	VS	SE	SE	2
36	Muar	-	SE	VS	FA	2
37	Parit Jawa	-	VS	SE	FA	2
38	Sarang Buaya	-	VS	SE	FA	2
39	Batu Pahat	-	VS	SE	FA	2
40	Senggarang	-	VS	SE	SE	2
41	Rengit	-	VS	SE	SE	2
42	Benut	-	VS	SE	FA	2
43	Pontian Kecil	-	VS	VS	SE	1
44	Sedili Besar	-	VS	VS	FA	1
45	Mersing	yes	VS	VS	SE	1
46	Endau	-	VS	VS	FA	1
47	Pontian	-	VS	FA	FA	3
48	Rompin	-	VS	VS	FA	1
49	Merchong	-	VS	FA	FA	3
50	Nenasi	-	VS	VS	FA	1

Note: *1 VS: Very Serious SE: Serious FA: Fair
*2 1: Critical 2: Significant 3: Acceptable

Table 5.2-9(2/2) CATEGORIZATION OF RIVER MOUTH

Serial	Name	Record of Dredging	Physical Aspect *1	Economic Aspect *1	Social Aspect *1	Compehensive Evaluation (Category) *2
51	Pahang	-	VS	VS	FA	1
52	Terus	-	VS	SE	FA	2
53	Kuantan	-	VS	VS	VS	1
54	Beserah	-	VS	FA	FA	3
55	Kemaman	-	VS	VS	FA	1
56	Kemasik	-	VS	SE	SE	2
57	Kerteh	yes	VS	SE	SE	2
58	Paka	-	VS	VS	FA	1
59	Dungun	yes	VS	VS	FA	1
60	Mercang	yes	VS	FA	SE	2
61	Marang	yes	VS	VS	VS	1
62	Terengganu	yes	SE	VS	SE	1
63	Merang	yes	VS	SE	FA	2
64	Keluang	-	VS	FA	FA	3
65	Gali	-	VS	FA	FA	3
66	Pak Amat	yes	VS	FA	VS	2
67	Kelantan	yes	VS	VS	FA	1
68	Rulah	-	VS	FA	FA	3
69	Sematan	-	VS	SE	FA	2
70	Kayan	-	VS	SE	FA	2
71	Sempadi	-	VS	FA	FA	3
72	Rambungun	-	FA	FA	FA	3
73	Sibu Laut	-	FA	FA	FA	3
74	Salak	-	FA	SE	FA	3
75	Santubong	-	SE	FA	FA	3
76	Buntal	-	VS	SE	FA	2
77	Bako	-	SE	SE	FA	2
78	Sadong	-	VS	VS	FA	1
79	Kabong	-	FA	VS	FA	3
80	Oya	-	VS	VS	FA	1
81	Mukah	-	VS	VS	FA	1
82	Balingian	-	VS	SE	FA	2
83	Serupadi	-	VS	FA	FA	3
84	Tatau	-	VS	SE	FA	2
85	Suai	-	SE	FA	FA	3
86	Niah	-	VS	FA	FA	3
87	Sibuti	-	VS	SE	FA	2
88	Lawas	-	VS	SE	FA	2
89	Padas	-	VS	VS	FA	1
90	Papar	-	VS	FA	SE	2
91	Inanam	-	VS	FA	FA	3
92	Tuaran	-	VS	SE	FA	2
93	Bandau	-	FA	SE	FA	3
94	Bongan	-	VS	FA	FA	3
95	Sugut	-	SE	VS	FA	2
96	Segama	-	FA	FA	FA	3
97	Kalumpang	-	FA	SE	FA	3
98	Tawau	-	VS	VS	FA	1
99	Umas-umas	-	VS	SE	FA	2
100	Kalabakan	-	SE	SE	FA	2

Note: *1 VS: Very Serious SE: Serious FA: Fair
*2 1: Critical 2: Significant 3: Acceptable

Table 5.2-10(1/3) LIST OF RIVER MOUTHS BY CATEGORY
(Category-1 : Critical)

Serial	Name	Physical Condition *2	Economic Condition *2	Social Condition *2
1	Perlis*1	VS	VS	SE
2	Baru	VS	VS	VS
3	Sanglang	VS	VS	FA
4	Jerlun	VS	VS	FA
5	Kedah*1	VS	VS	SE
6	Yan	VS	VS	VS
8	Cenang	VS	SE	VS
9	Muda*1	VS	SE	VS
11	Kerian	VS	VS	VS
12	Pinang	VS	VS	VS
14	Tg. Piandang	VS	VS	VS
15	Gula	VS	VS	SE
19	Beruas*1	VS	VS	VS
23	Selangor	VS	VS	VS
31	Baru	VS	SE	VS
32	Melaka	VS	VS	VS
43	Pontian Kecil	VS	VS	SE
44	Sedili Be.	VS	VS	FA
45	Mersing*1	VS	VS	SE
46	Endau	VS	VS	FA
48	Rompin	VS	VS	FA
50	Nenasi	VS	VS	FA
51	Pahang	VS	VS	FA
53	Kuantan	VS	VS	SE
55	Kemaman	VS	VS	FA
58	Paka	VS	VS	FA
59	Dungun*	VS	VS	FA
61	Marang*1	VS	VS	VS
62	Terengganu*1	SE	VS	SE
67	Kelantan*1	VS	VS	FA
78	Sadong	VS	VS	FA
80	Oya	VS	VS	FA
81	Mukah	VS	VS	FA
89	Padas	VS	VS	FA
98	Tawau	VS	VS	FA

Note: *1 Dredging has been conducted
*2 VS: Very Serious SE: Serious FA: Fair

Table 5.2-10(2/3) LIST OF RIVER MOUTHS BY CATEGORY
(Category-2 : Significant)

Serial	Name	Physical Condition *2	Economic Condition *2	Social Condition *2
13	Bayan Lepas	VS	FA	SE
16	Sangga	VS	SE	SE
17	Larut	VS	SE	SE
18	Terong	SE	SE	FA
20	Batu	VS	FA	VS
22	Lekir	VS	SE	FA
24	Kapar Besar	VS	SE	FA
25	Langkat	SE	SE	VS
26	Sepan Ke.	SE	FA	VS
27	Sepang	SE	SE	FA
28	Lukut	VS	SE	SE
33	Duyong	VS	SE	SE
34	Umbai	VS	SE	SE
35	Merlimau	VS	SE	SE
36	Muar	SE	VS	FA
37	Parit Jawa	VS	SE	FA
38	Sarang Buaya	VS	SE	FA
39	Batu Pahat	VS	SE	FA
40	Senggarang	VS	SE	SE
41	Rengit	VS	SE	SE
42	Benut	VS	SE	FA
52	Terus	VS	SE	FA
56	Kemasik	VS	SE	SE
57	Kerteh	VS	SE	SE
60	Mercang	VS	FA	SE
63	Merang	VS	SE	FA
66	Pak Amat	VS	FA	VS
69	Sematan	VS	SE	FA
70	Kayan	VS	SE	FA
76	Buntal	VS	SE	FA
77	Bako	SE	SE	FA
82	Balingian	VS	SE	FA
84	Tatau	VS	SE	FA
87	Sibuti	VS	SE	FA
88	Lawas	VS	SE	FA
90	Papar	VS	FA	SE
92	Tuaran	VS	SE	FA
95	Sugut	SE	VS	FA
99	Umas-umas	VS	SE	FA
100	Kalabakan	SE	SE	FA

Note: *1 Dredging has been conducted
*2 VS: Very Serious SE: Serious FA: Fair

Table 5.2-10(3/3) LIST OF RIVER MOUTHS BY CATEGORY
(Category-3 : Acceptable)

Serial	Name	Physical Condition *2	Economic Condition *2	Social Condition *2
7	Melaka	VS	FA	FA
10	Perai	SE	FA	FA
21	Dingding*1	FA	SE	FA
29	Raya	VS	FA	FA
30	Linggi	VS	FA	FA
47	Pontian	VS	FA	FA
49	Merchong	VS	FA	FA
54	Beserah	VS	FA	FA
64	Keluang	VS	FA	FA
65	Gali	VS	FA	FA
68	Rulah	VS	FA	FA
71	Sempadi	VS	FA	FA
72	Rambungun	FA	FA	FA
73	Sibu Laut	FA	FA	FA
74	Salak	FA	SE	FA
75	Santubong	SE	FA	FA
79	Kabong	FA	VS	FA
83	Serupadi	VS	FA	FA
85	Suai	SE	FA	FA
86	Niah	VS	FA	FA
91	Inanam	VS	FA	FA
93	Bandau	FA	SE	FA
94	Bongan	VS	FA	FA
96	Segama	FA	FA	FA
97	Kalumpang	FA	SE	FA

Note: *1 Dredging has been conducted
*2 VS: Very Serious SE: Serious FA: Fair

Table 5.2-11(1/2) GROUPING OF RIVER MOUTHS FOR THE MASTER PLAN

No.	Geo -morphology	Wave	Tidal Prism	River Mouth			
				Numbers	Serial	Name	State
1	Straight	High/Straight	Large	6	45	Mersing	Johor
					48	Rompin	Pahang
					61	Marang	Terengganu
					81	Mukah	Sarawak
					82	Balingian	Sarawak
					84	Tatau	Sarawak
2	Straight	High/Oblique	Large	10	44	Sedili Besar	Johor
					46	Endau	Johor
					50	Nenasi	Pahang
					52	Terus	Pahang
					53	Kuantan	Pahang
					55	Kemaman	Terengganu
					58	Paka	Terengganu
					59	Dungun	Terengganu
					60	Mercang	Terengganu
					92	Tuaran	Sabah
3	Straight	High/Oblique	Small	3	56	Kemasik	Terengganu
					57	Kerteh	Terengganu
					87	Sibuti	Sarawak
4	Straight	Low	Large	4	1	Perlis	Perlis
					21	Dinding	Perak
					25	Langat	Selangor
					99	Umas-Umas	Sabah
5	Straight	Low	Small	26	2	Baru	Perlis
					3	Sanglang	Kedah
					4	Jerlun	Kedah
					6	Yan	Kedah
					7	Melaka	Kedah
					8	Cenang	Kedah
					12	Pinang	P. Pinang
					13	Bayan Lepas	P. Pinang
					14	Tg. Piandang	Perak
					20	Batu	Perak
					22	Lekir	Perak
					24	Kapar Besar	Selangor
					26	Sepang Kecil	Selangor
					27	Sepang	Selangor
					28	Lukut	N. Sembilian
					31	Baru	Melaka
					32	Melaka	Melaka
					33	Duyong	Melaka
					34	Umbai	Melaka
					35	Merlimau	Melaka
					37	Parit Jawa	Johor
					40	Senggarang	Johor
					41	Rengit	Johor
					42	Benut	Johor
					43	Pontian Kecil	Johor
					98	Tawau	Sabah

Table 5.2-11(2/2) GROUPING OF RIVER MOUTHS FOR THE MASTER PLAN

No.	Geo-morphology	Wave	Tidal Prism	River Mouth Numbers	Serial	Name	State
6	Estuary	High/Oblique	Large	3	69	Sematan	Sarawak
					70	Kayan	Sarawak
					80	Oya	Sarawak
7	Estuary	Low	Large	14	11	Kerian	P. Pinang
					15	Gula	Perak
					16	Sangga	Perak
					17	Larut	Perak
					18	Terong	Perak
					19	Beruas	Perak
					23	Selangor	Selangor
					36	Muar	Johor
					39	Batu Pahat	Johor
					76	Buntal	Sarawak
					77	Bako	Sarawak
					78	Sadong	Sarawak
					89	Padas	Sabah
					100	Kalabakan	Sabah
8	Protruding	High/Straight	Large	4	51	Pahang	Pahang
					62	Terengganu	Terengganu
					67	Kelantan	Kelantan
					95	Sugut	Sabah
9	Protruding	High/Oblique	Small	3	63	Merang	Terengganu
					66	Pak Amat	Kelantan
					90	Papar	Sabah
10	Protruding	Low	Large	3	5	Kedah	Kedah
					9	Muda	P. Pinang
					88	Lawas	Sarawak
			Total	76			

Table 5.2-12(1/2) AVAILABILITY OF PRINCIPAL DATA BY RIVER MOUTH

Serial	Name	State	Detailed Topo-map	Available Nos. of Aerophoto	Bathym. Survey Results	LEO Prog. Applica-bility	Discharge (Q) and Sediment(S)	River Survey	Bed Material Data	No. of Avail. Data
1	Perlis	Perlis	-	4	'92	R01	Q / S	-	-	4
2	Baru	Perlis	-	4	-	-	-	-	-	1
3	Sanglang	Kedah	-	4	-	-	-	-	-	1
4	Jerlun	Kedah	-	4	-	-	-	-	-	1
5	Kedah	Kedah	-	4	'90-91	K01	-	-	-	3
6	Yan	Kedah	-	3	-	-	-	-	-	1
7	Melaka	Kedah	-	3	-	-	-	-	-	1
8	Cenang	Kedah	-	3	-	-	-	-	-	1
9	Muda	P.Pinang	-	4	-	-	Q / S	-	-	2
10	Perai	P.Pinang	-	4	-	SP1	-	'87-'88	-	3
11	Kerian	P.Pinang	-	4	-	-	Q / S	'88 *1	-	3
12	Pinang	P.Pinang	-	3	-	-	-	-	-	1
13	Bayan Lepas	P.Pinang	-	3	-	-	-	-	-	1
14	Tg. Piandang	Perak	-	4	-	-	-	-	-	1
15	Gula	Perak	-	4	-	-	-	-	-	1
16	Sangga	Perak	-	3	-	-	-	-	-	1
17	Larut	Perak	-	3	-	-	-	-	-	1
18	Terong	Perak	-	2	-	-	-	-	-	1
19	Beraus	Perak	-	3	-	-	-	-	-	1
20	Batu	Perak	-	3	-	-	-	-	-	1
21	Dinding	Perak	-	3	-	-	-	-	-	1
22	Lekir	Perak	-	3	-	-	-	-	-	1
23	Selangor	Selangor	-	4	-	-	Q / S	-	-	2
24	Kapar Besar	Selangor	-	3	-	-	-	-	-	1
25	Langat	Selangor	-	3	-	-	Q / S	-	-	2
26	Sepan Kecil	Selangor	-	3	-	-	-	-	-	1
27	Sepang	Selangor	-	3	-	-	-	-	-	1
28	Lukut	N.Sembilan	-	3	-	-	-	-	-	1
29	Raya	N.Sembilan	-	3	-	-	-	-	-	1
30	Linggi	N.Sembilan	-	3	-	-	Q	-	-	2
31	Baru	Melaka	-	3	-	-	-	-	-	1
32	Melaka	Melaka	-	3	-	M01	Q / S	-	-	3
33	Duyong	Melaka	-	3	-	-	-	-	-	1
34	Umbai	Melaka	-	3	-	-	-	-	-	1
35	Merlimau	Melaka	-	3	-	-	-	-	-	1
36	Muar	Johor	-	3	-	-	Q	-	-	2
37	Parit Jawa	Johor	-	3	-	-	-	-	-	1
38	Sarang Buaya	Johor	-	3	-	-	-	-	-	1
39	Batu Pahat	Johor	-	3	-	-	Q / S	-	-	2
40	Senggarang	Johor	-	3	-	-	-	-	-	1
41	Rengit	Johor	-	3	-	J03	-	-	-	2
42	Benut	Johor	-	3	-	-	Q	-	-	2
43	Pontian Kecil	Johor	-	3	-	J02	-	-	-	2
44	Sedili Besar	Johor	-	3	-	-	-	-	-	1
45	Mersing	Johor	-	3	'91	J01	-	-	'84 *2	4
46	Endau	Johor	-	3	-	-	Q	-	-	2
47	Pontian	Pahang	-	3	-	-	-	-	-	1
48	Rompin	Pahang	-	3	-	-	-	-	-	1
49	Merchong	Pahang	-	3	-	-	-	-	-	1
50	Nenasi	Pahang	-	3	'82 *3	-	-	-	-	2

Note: *1 F/S on Flood Mitigation and Agricultural Development Projects in the Kerian River Basin, Dec. 1988
*2 Report on Mission to Malaysia, 26 March to 11 April 1984, ESCAP
*3 Hydrographic Survey for the Approaches to Kuala Bebar, Nenasi, Pekan, Pahang; Bathymetric map 1/2,000, Nov.-Dec., 1982, JPT

Table 5.2-12(2/2) AVAILABILITY OF PRINCIPAL DATA BY RIVER MOUTH

Serial	Name	State	Detailed Topo-map	Available Nos. of Aerophoto	Bathym. Survey Results	LEO Prog. Applica-bility	Discharge (Q) and Sediment(S)	River Survey	Bed Material Data	No. of Avail. Data
51	Pahang	Pahang	-	3	-	-	Q / S	-	-	2
52	Terus	Pahang	-	3	-	-	-	-	-	1
53	Kuantan	Pahang	-	3	'90	-	Q	'90	Yes *4	5
54	Beserah	Pahang	-	3	-	C01	-	-	-	2
55	Kemaman	Terengganu	-	3	'89 *5	-	Q / S	-	-	3
56	Kemasik	Terengganu	1/4000 '86	3	-	-	-	Yes	-	3
57	Kerteh	Terengganu	1/4000 '86	3	-	-	-	Yes	-	3
58	Paka	Terengganu	-	3	-	-	-	-	-	1
59	Dungun	Terengganu	-	3	'88-90	-	Q / S	-	-	3
60	Mercang	Terengganu	-	3	-	-	-	-	-	1
61	Marang	Terengganu	-	3	'89 *5	-	-	-	-	2
62	Terengganu	Terengganu	-	3	'89-90	T01	Q	-	-	4
63	Merang	Terengganu	-	3	-	-	-	-	-	1
64	Keluang	Terengganu	-	3	-	-	-	-	-	1
65	Gali	Kelantan	-	4	Yes	-	-	Yes	-	3
66	Pak Amat	Kelantan	-	4	-	-	-	-	-	1
67	Kelantan	Kelantan	-	4	'89-90	D02	Q / S	Yes	-	5
68	Rulah	Kelantan	-	4	-	D01	-	-	-	2
69	Semantan	Sarawak	-	10	-	-	-	-	-	1
70	Kayan	Sarawak	-	11	-	-	-	-	-	1
71	Sempadi	Sarawak	-	8	-	-	-	-	-	1
72	Rambungun	Sarawak	-	8	-	-	-	-	-	1
73	Sibu Laut	Sarawak	-	8	-	-	-	-	-	1
74	Salak	Sarawak	-	9	-	-	-	-	-	1
75	Santubong	Sarawak	-	10	-	-	-	-	-	1
76	Buntal	Sarawak	-	10	-	-	-	-	-	1
77	Bako	Sarawak	-	6	-	-	-	-	-	1
78	Sadong	Sarawak	-	7	-	-	Q	-	-	2
79	Kabong	Sarawak	-	8	-	-	Q	-	-	2
80	Oya	Sarawak	-	5	-	-	-	-	-	1
81	Mukah	Sarawak	-	8	-	-	-	-	-	1
82	Balingian	Sarawak	-	3	-	-	-	-	-	1
83	Serupadi	Sarawak	-	3	-	-	-	-	-	1
84	Tatau	Sarawak	-	5	-	-	-	-	-	1
85	Suai	Sarawak	-	6	-	-	-	-	-	1
86	Niah	Sarawak	-	5	-	-	-	-	-	1
87	Sibuti	Sarawak	-	5	-	-	-	-	-	1
88	Lawas	Sabah	-	8	-	-	-	-	-	1
89	Padas	Sabah	-	2	-	-	Q	-	-	2
90	Papar	Sabah	-	2	-	-	Q	-	-	2
91	Inanam	Sabah	-	2	-	-	-	-	-	1
92	Tuaran	Sabah	-	2	-	-	Q	-	-	2
93	Bandau	Sabah	-	2	-	-	-	-	-	1
94	Bongan	Sabah	-	2	-	-	-	-	-	1
95	Sugut	Sabah	-	2	-	-	Q	-	-	2
96	Segama	Sabah	-	2	-	-	Q	-	-	2
97	Kalumpang	Sabah	-	2	-	-	-	-	-	1
98	Tawau	Sabah	-	2	-	-	-	-	-	1
99	Umas-umas	Sabah	-	2	-	-	-	-	-	1
100	Kalabakan	Sabah	-	2	-	-	-	-	-	1

Note: *4 Proposal for Maintenance Dredging of Fishing Ports and River Mouths in Peninsular Malaysia
*5 Hydrographic Survey and Data Collection Work at Kuala Kemaman and Kuala Marang, Terengganu; Bathymetric map, Feb. 1989, JPT

Table 5.2-13(1/2) SELECTION OF REPRESENTATIVE RIVER MOUTHS

Group and Definition				River Mouth						
No.	Geomor-phology	Wave	Tidal Prism	Serial	Name	State	Cate-gory	High Priority *1	Avail. Data *2	Representative *3
1	Straight	High /Straight	Large	45	Mersing	Johor	1	*	4	
				48	Rompin	Pahang	2		1	
				61	Marang	Terengganu	1	*	2	Representative
				81	Mukah	Sarawak	2		1	
				82	Balingian	Sarawak	2		1	
				84	Tatau	Sarawak	2		1	
2	Straight	High /Oblique	Large	44	Sedili Besar	Johor	2		1	
				46	Endau	Johor	2		2	
				50	Nenasi	Pahang	2		2	
				52	Terus	Pahang	2		1	
				53	Kuantan	Pahang	1	*	5	Representative
				55	Kemaman	Terengganu	2		3	
				58	Paka	Terengganu	2		1	
				59	Dungun	Terengganu	1		3	
				60	Mercang	Terengganu	1		1	
				92	Tuaran	Sabah	2		2	
3	Straight	High /Oblique	Small	56	Kemasik	Terengganu	2		3	
				57	Kerteh	Terengganu	1		3	Representative
				87	Sibuti	Sarawak	2		1	
4	Straight	Low	Large	1	Perlis	Perlis	1	*	4	Representative
				21	Dinding	Perak	1		1	
				25	Langat	Selangor	1		2	
				99	Umas-Umas	Sabah	2		1	
5	Straight	Low	Small	2	Baru	Perlis	1	*	1	
				3	Sanglang	Kedah	2		1	
				4	Jerlun	Kedah	2		1	
				6	Yan	Kedah	1		1	
				7	Melaka	Kedah	2		1	
				8	Cenang	Kedah	1		1	
				12	Pinang	P. Pinang	1		1	
				13	Bayan Lepas	P. Pinang	2		1	
				14	Tg. Piandang	Perak	1		1	Representative
				20	Batu	Perak	1		1	
				22	Lekir	Perak	2		1	
				24	Kapar Besar	Selangor	2		1	
				26	Sepang Kecil	Selangor	1		1	
				27	Sepang	Selangor	2		1	
				28	Lukut	N. Sembilian	2		1	
				31	Baru	Melaka	1		1	
				32	Melaka	Melaka	1	*	3	
				33	Duyong	Melaka	2		1	
				34	Umbai	Melaka	2		1	
				35	Merlimau	Melaka	2		1	
				37	Parit Jawa	Johor	2		1	
				40	Senggarang	Johor	2		1	
				41	Rengit	Johor	2		2	
				42	Benut	Johor	2		2	
				43	Pontian Kecil	Johor	1		2	
				98	Tawau	Sabah	2		1	

Note: *1 The river mouth with "*" mark is given high priority in the State.
*2 Number of available data (see Table 6.1-2).
*3 The representative river mouth has been selected on the basis of the contents of Category, Priority and Available Data as presented in the left columns, as well as considering the physical representativeness of the river mouth in the group.

Table 5.2-13(2/2) SELECTION OF REPRESENTATIVE RIVER MOUTHS

Group and Definition				River Mouth						
No.	Geomor-phology	Wave	Tidal Prism	Serial	Name	State	Cate-gory	High Priority *1	Avail. Data *2	Representative *3
6	Estuary	High /Oblique	Large	69	Sematan	Sarawak	2		1	
				70	Kayan	Sarawak	2		1	
				80	Oya	Sarawak	2		1	Representative
7	Estuary	Low	Large	11	Kerian	P. Pinang	1		3	
				15	Gula	Perak	1		1	
				16	Sangga	Perak	2		1	
				17	Larut	Perak	2		1	
				18	Terong	Perak	2		1	
				19	Beruas	Perak	1	*	1	Representative
				23	Selangor	Selangor	1	*	2	
				36	Muar	Johor	2		2	
				39	Batu Pahat	Johor	2		2	
				76	Buntal	Sarawak	2		1	
				77	Bako	Sarawak	2		1	
				78	Sadong	Sarawak	2		2	
				89	Padas	Sabah	2		2	
				100	Kalabakan	Sabah	2		1	
8	Protrudg.	High /Straight	Large	51	Pahang	Pahang	2		2	
				62	Terengganu	Terengganu	1	*	4	Representative
				67	Kelantan	Kelantan	1	*	5	
				95	Sugut	Sabah	2		2	
9	Protrudg.	High /Oblique	Small	63	Merang	Terengganu	1		1	
				66	Pak Amat	Kelantan	1		1	
				90	Papar	Sabah	2		2	Representative
10	Protrudg.	Low	Large	5	Kedah	Kedah	1	*	3	Representative
				9	Muda	P. Pinang	1	*	2	
				88	Lawas	Sarawak	2		1	

Note: *1 The river mouth with "*" mark is given high priority in the State.
*2 Number of available data (see Table 6.1-2).
*3 The representative river mouth has been selected on the basis of the contents of Category, Priority and Available Data as presented in the left columns, as well as considering the physical representativeness of the river mouth in the group.

Table 5.2-14 REPRESENTATIVE RIVER MOUTH OF EACH GROUP

Serial	River Mouth	Group No.	Coastal Geomor-phology	External Force		Catchment Area (km2)	River Length (km)	Stretch of Tidal Influ-ence (Km)	Average River Width (m)
				Wave	Tidal Prism				
1.	Perlis	4	Straight	Low	Large	600	45	20	60
5.	Kedah	10	Protruding	Low	Large	3060	110	12	200
14.	Tg. Piandang	5	Straight	Low	Small	9	10	1	25
19.	Beruas	7	Estuary	Low	Large	240	45	7	50
53.	Kuantan	2	Straight	High & Oblique	Large	1710	80	25	130
57.	Kerteh	3	Straight	High & Oblique	Small	240	40	5	30
61.	Marang	1	Straight	High & Straight	Large	460	50	20	80
62.	Terengganu	8	Protruding	High & Straight	Large	4650	180	22	200
80.	Oya	6	Estuary	High & Oblique	Large	1820	150	25	150
90.	Papar	9	Protruding	High & Oblique	Small	770	70	6	30

Table 5.2-15 OBJECTIVE OF APPLICABLE COUNTERMEASURES

Counter-measures	Provision of Navigation Channel	Maintenance/ Assurance of Navigation Cannel	Protection of Wave Intrusion to River Mouth	River Mouth Stabilization	River Channel Stabilization	Protection of Coastal Erosion
Dredging	yes	yes	-	-	-	-
Agitation Dredging	-	yes	-	-	-	-
Breakwater	-	-	yes	-	-	-
Jetty	-	yes	-	yes		-
Training Wall	-	-	-	yes	-	-
River Groin	-	-	-	-	yes	-
Coastal Groin	-	-	-	-	-	yes
Reservoir	-	yes	-	-	-	-

Table 5.2-16 AVAILABLE INFORMATION OF DREDGING BY RIVER MOUTH

River Mouth Serial	Name	Available Information
1.	Perlis	Bathymetric survey results from MD - Outer channel: April 1990 March 1991 February 1992 - Inner channel: February 1992
-	Kurung Tengar	Bathymetric survey results from DID
5.	Kedah	Bathymetric survey results from MD - Outer channel: March 1991 - Inner channel: June 1990
9.	Muda	Bathymetric survey results from DID
14.	Tg. Piandang	Bathymetric survey results from MD - Inner channel: July 1988
19.	Beruas	Bathymetric survey results from DID - Longitudinal profile for a. Original ground before dredging b. Channel bed after dredging in 1988-90 c. Channel bed in March 10, 1992
45.	Mersing	Bathymetric survey results from MD - Outer channel: July 1991 - Inner channel: July 1991 Bathymetric survey results - Longitudinal profile a. Ground in May 1980 before dredging b. Ground immediately after dredging in July 1981 c. Channel bed in April 1982 nine months after dredging

Table 5.247 SILTATION RATE IN OUTER CHANNEL OF SANDY RIVER MOUTH

Serial No.	River Mouth	Siltation Rate by Sediment Source (1000 m3/yr)				
		Longshore Transport			Transport by River	Total
		Qr	Ql	Qr + Ql		
53	Kuantan	205	0	205	12	217
57	Kerteh	202	2	204	11	215
60	Marang	287	194	481	37	518
61	Terengganu	238	191	429	230	659
80	Oya	186	257	443	72	515
90	Papar	22	85	107	9	116

Note ; Qr : Longshore transport rate from observer's left to right
Ql : Longshore transport rate from observer's right to left

Table 5.2-18(1/2) ESTIMATION OF TIDAL PRISM FOR 100 RIVER MOUTHS

Serial	Name of River	Catchment Area (km2)	L (km)	B (m)	Tide (m)	P (1000m3)	W (m)	D (m)	A (m2)	Cf
1	Perlis	600	15	60	3.5	1,040	420	3.0	860	s
2	Baru	80	1	20	3.5	23	90	1.5	78	s
3	Sanglang	80	1	20	3.5	23	80	3.1	161	m
4	Jerlun	40	6.3	30	3.5	218	120	2.9	212	m
5	Kedah	3,060	12	200	3.5	2,772	200	4.0	2,697	m
6	Yan	10	1.3	10	3.5	15	11	1.2	7	m
7	Melaka	40	3.2	6	3.5	22	50	0.4	17	m
8	Cenang	10	3.2	10	3.5	37	18	0.5	4	m
9	Muda	4,300	10.2	150	3.5	1,767	190	3.5	376	m
10	Perai	450	20	170	3.5	3,927	200	3.5	423	s
11	Kerian	1,420	28	130	3.5	4,204	730	3.0	1,103	s
12	Pinang	20	2	40	3.5	92	45	1.1	37	m
13	Bayan Lepas	7	1	15	3.5	17	28	0.5	8	m
14	Tg. Piandang	9	3.2	25	3.5	92	270	1.1	191	m
15	Gula	30	14	130	3.5	2,102	370	2.5	572	m
16	Sangga	170	8.3	300	3.5	2,876	880	3.0	1,964	m
17	Larut	170	9	200	3.5	2,079	270	1.4	190	m
18	Terong	60	10	250	3.5	2,888	670	5.0	514	m
19	Beruas	240	7	50	3.5	404	120	2.0	159	m
20	Bat	70	1.6	10	3.5	18	4	0.4	1	m
21	Dinding	370	20	800	3.5	18,480	1,080	13.0	8,442	m
22	Lekir	5	1.3	30	3.5	45	70	0.7	35	m
23	Selangor	1,820	34	130	5.5	8,022	480	3.0	1,270	m
24	Kapar Besar	110	6.4	10	5.5	116	100	0.9	390	m
25	Langat	1,815	90	140	4.5	18,711	465	5.0	1,924	t
26	Sepang Kecil	50	7.7	15	4.5	172	160	3.0	358	t
27	Sepang	90	15	30	4.5	668	130	9.0	729	t
28	Lukut	120	15	20	3.5	347	220	6.0	828	t
29	Raya	10	2	5	3.5	12	10	1.6	8	t
30	Linggi	1,270	18	100	3.5	2,079	300	9.7	1,716	t
31	Baru	25	1.5	15	3.5	26	20	0.5	12	t
32	Melaka	500	13	20	3.5	300	85	2.0	85	t
33	Duyong	40	6.5	20	3.5	150	45	1.3	34	t
34	Umabai	20	2	10	3.5	23	25	1.5	21	t
35	Merlimau	30	6	5	3.5	35	10	1.3	8	t
36	Muar	6,160	120	150	3.5	20,790	500	4.0	3,007	t
37	Parit Jawa	80	0.3	150	3.5	52	60	1.8	43	t
38	Sarng Buaya	170	3.2	20	3.5	74	120	2.8	383	t
39	Batu Pahat	2,230	40	50	3.5	2,310	320	2.9	2,287	t
40	Senggarang	70	5.1	15	3.5	88	70	3.3	156	t
41	Rengit	100	3.2	20	3.5	74	120	2.4	211	t
42	Benut	440	7	50	4.5	520	300	3.5	541	t
43	Pontian Kecil	40	7	20	4.5	208	120	3.5	280	t
44	Sedili Besar	1,445	70	120	3.5	9,702	205	5.0	623	wl
45	Mersing	250	20	50	3.5	1,155	110	3.0	284	wl
46	Endau	4,740	85	150	3.5	14,726	300	4.3	2,179	wl
47	Pontian	240	25	30	3.5	866	250	3.5	576	wn
48	Rompin	3,980	100	80	3.5	9,240	600	6.0	1,360	wn
49	Merchong	500	25	20	3.5	578	115	2.4	166	wl
50	Nenasi	860	30	40	3.5	1,386	45	5.5	170	wl

L: Stretch of tidal influence, B: Mean width of the stretch, Tide: Astronomical maximum tidal range
P: Tidal Prism, W: Width at the mouth, D: Maximum depth at the mean sea water level,
A: Cross-sectional area at the mouth, Cf: Classification, s: Sheltared, m: Moderate, t: Tidal Prism,
wn: Normal Wave, wl: Oblique Wave

Table 5.2-18(2/2) ESTIMATION OF TIDAL PRISM FOR 100 RIVER MOUTHS

Serial	Name of River	Catchment Area (km2)	L (km)	B (m)	Tide (m)	P (1000m3)	W (m)	D (m)	A (m2)	Cf
51	Pahang	29,140	25	500	3.5	14,437	415	6.3	1,405	wn
52	Terus	40	18	70	3.5	1,455	100	2.8	776	wl
53	Kuantan	1,710	26	130	3.5	3,904	280	9.3	1,106	wl
54	Beserah	20	1.5	10	3.5	17	4	0.3	1	wl
55	Kemaman	1,775	25	110	3.5	3,176	575	9.5	3,157	wl
56	Kemasik	40	4.5	30	2.5	111	15	0.5	4	wl
57	Kerteh	240	17	30	2.5	421	54	2.1	35	wl
58	Paka	850	20	90	3.5	2,079	150	5.5	595	wl
59	Dungun	1,875	22	130	3.5	3,303	430	4.5	881	wl
60	Mercang	150	16	60	3.5	1,109	46	0.6	15	wl
61	Marang	460	12	80	3.5	1,109	110	1.9	54	wn
62	Terengganu	4,650	22	200	3.5	5,082	140	10.2	742	wn
63	Merang	210	8	40	3.5	370	290	0.7	40	wl
64	Keluang	80	10	90	3.5	1,040	110	2.1	115	wl
65	Gali	10	2.5	5	3.5	14	86	1.5	65	wn
66	Pak Amat		10	60	2.5	495	113	0.8	67	wl
67	Kelantan	12,900	18	300	2.5	4,455	367	5.5	909	wl
68	Rulah						468	1.5	319	wl
69	Sematan	210	17	350	4.5	8,836	400	5.8	1,253	wl
70	Kayan	1,020	47	300	4.5	20,938	1,360	7.2	2,214	wl
71	Sempadi	90	14	300	5.5	7,623	680	4.0	1,692	wl
72	Rambungan	120	25	250	5.5	11,343	560	14.0	3,372	wn
73	Sibu Laut	120	43	300	5.5	23,413	1,100	18.5	9,443	wn
74	Salak	80	35	250	5.5	15,881	1,300	6.1	5,295	wn
75	Santubong	60	23	450	5.5	18,785	750	6.7	2,528	wn
76	Buntal	40	21	130	5.5	4,955	280	1.7	330	wn
77	Bako	40	17	100	5.5	3,086	900	3.0	2,422	wn
78	Sadong	3,100	20	700	5.5	25,410	4,320	3.7	8,177	wn
79	Kabong	1,500	35	500	5.5	31,762	800	10.8	4,591	wl
80	Oya	1,820	25	150	2.5	3,094	480	3.9	1,035	wl
81	Mukah	2,150	25	100	2.5	2,063	240	4.4	730	wn
82	Balingian	2,520	28	100	2.5	2,310	740	3.0	1,178	wn
83	Serupai	200	6	30	2.5	149	50	3.1	96	wn
84	Tatau	4,780	14	100	2.5	1,155	320	4.2	1,011	wn
85	Suai	1,400	15	75	2.5	928	130	5.4	443	wl
86	Niah	1,270	15	50	2.5	619	300	3.8	538	wl
87	Sibuti	830	10	50	2.5	413	100	5.5	290	wl
88	Lawas	930	17	150	2.5	2,104	540	4.0	1,459	s
89	Padas	8,600	10	100	2.5	825	440	3.5	214	s
90	Papar	770	5	30	2.5	124	100	2.6	153	wl
91	Inanam	10	8	70	2.5	462	360	1.7	353	wl
92	Tauran	970	12	130	2.5	1,287	370	2.5	570	wl
93	Bandau	290	15	40	2.5	495	1,020	3.7	858	s
94	Bongan	470	8	50	2.5	330	160	1.5	144	s
95	Sugut	2,900	18	100	2.5	1,485	400	3.9	592	m
96	Segama	4,300	9	1,000	2.5	7,425	800	7.0	5,309	m
97	Kalumpang	970	15	150	2.5	1,856	390	9.5	2,155	m
98	Tawau	130	2	20	3.5	46				s
99	Umas-Umas	370	18	150	3.5	3,119	450	7.0	2,308	s
100	Kalabakan	1,340	25	120	3.5	3,465	900	6.0	3,691	s

L: Stretch of tidal influence, B: Mean width of the stretch, Tide: Astronomical maximum tidal range
P: Tidal Prism, W: Width at the mouth, D: Maximum depth at the mean sea water level,
A: Cross-sectional area at the mouth, Cf: Classification, s: Sheltared, m: Moderate, t: Tidal Prism,
wn: Normal Wave, wl: Oblique Wave

Table 5.3-1 COMBINATION OF COUNTERMEASURES

River Mouth	Case No.	Combination of Applicable Counteremeasures							
		Capital Dredging	Maintenance Dredging	Break Water	Jetty	Training Wall	River Groin	Coastal Groin	Reservoir
Perlis	Case-1	yes	yes	-	-	-	-	-	-
	Case-2	yes	yes	-	yes*1	-	-	-	-
Kedah	Case-1	yes	yes	-	-	-	-	-	-
	Case-2	yes	yes	-	yes*1	-	-	-	-
Tg. Piandang	Case-1	yes	yes	-	-	-	-	-	-
	Case-2	yes	yes	-	yes*1	-	-	-	-
Beruas	Case-1	yes	yes	-	-	-	-	-	-
	Case-2	yes	yes	-	yes*1	-	-	-	-
Kuantan	Case-1	yes	yes	-	-	-	-	-	-
	Case-2	yes	-	-	yes	-	-	yes	-
Kerteh	Case-1	yes	yes	-	-	yes	-	-	-
	Case-2	yes	-	-	yes	-	-	yes	yes
Marang	Case-1	yes	yes	yes	-	yes	yes	-	-
	Case-2	yes	-	yes	yes	-	yes	yes	yes
Terengganu	Case-1	yes	yes	yes	-	-	yes	-	-
	Case-2	yes	-	yes	yes	-	yes	yes	-
Oya	Case-1	yes	yes	-	-	yes	-	-	-
	Case-2	yes	-	-	yes	-	-	yes	-
Papar	Case-1	yes	yes	-	-	yes	yes	-	-
	Case-2	yes	-	-	yes	-	yes	yes	yes

Note *1: Submerged jetty

Table 5.3-2 DESIGN WIDTH AND DEPTH OF DREDGING CHANNEL

River Mouth	Design Boat Size (GRT)	Design Boat Beam (m)	Design Channel Dimension Width (m)	Design Channel Dimension Bottom Level (LSD m)
1 Perlis	150	7.50	75.0	-5.2
2 Kedah	150	7.50	75.0	-5.2
3 Tg. Piandang	40	4.20	45.0	-3.7
4 Beruas	100	6.09	65.0	-4.4
5 Kuantan	200	7.30	75.0	-5.3
6 Kerteh	40	4.20	45.0	-3.8
7 Marang	40	4.20	45.0	-3.5
8 Terengganu	150	7.50	75.0	-4.7
9 Oya	40	4.20	45.0	-3.5
10 Papar	40	4.20	45.0	-3.6

Table 5.3-3 CAPITAL AND MAINTENANCE DREDGING VOLUME

River Mouth	Capital Dredging Length Outer (km)	Capital Dredging Length Inner (km)	Capital Dredging Volume Outer (1000 m3)	Capital Dredging Volume Inner (1000 m3)	Capital Dredging Volume Total (1000 m3)	Maintenance Dredging Volume Outer (1000 m3)	Maintenance Dredging Volume Outer Sub.Jetty (1000 m3)
1 Perlis	4.80	0.70	1,289.7	184.4	1,474.1	360.9	162.4
2 Kedah	4.00	1.40	1,004.4	219.4	1,223.8	332.4	149.6
3 Tg.Piandang	2.33	1.20	188.6	224.7	413.3	72.5	32.6
4 Beruas	2.17	1.58	359.8	324.3	684.1	128.2	57.7
5 Kuantan	3.80	0.00	617.7	0.0	617.7	217.0	
6 Kerteh	0.96	1.40	120.2	158.7	278.9	120.2	
7 Marang	0.55	0.87	39.6	67.1	106.7	39.6	
8 Terengganu	1.10	2.87	167.1	813.2	980.3	167.1	
9 Oya	1.30	0.00	31.3	0.0	31.3	31.3	
10 Papar	0.45	1.03	46.0	133.9	179.9	46.0	

Table 5.3-4 DESIGN FEATURES OF BREAKWATER AND JETTY BY RIVER MOUTH

River Mouth	Design Wave		Toe		Design Elevation *1			Volume of Structure	
	Height (m)	Period (s)	Depth (m)	Length (km)	Breakwater (LSD m)	Jetty (LSD m)	Sub.Jetty (LSD m)	Breakwater (1000m3)	Jetty (1000m3)
1 Perlis	0.75	6.00	-2.65	6.00			0.00		103.0
2 Kedah	0.75	6.00	-2.65	5.00			0.00		104.4
3 Tg. Piandang	0.75	6.00	-2.35	2.90			0.10		44.7
4 Beruas	0.75	6.00	-2.35	1.30			0.20		16.1
				1.50					21.2
5 Kuantan	1.75	6.00	-1.49	3.00	4.23	1.60			161.5
6 Kerteh	1.75	6.00	-1.28	1.15	4.23	1.60			60.5
7 Marang	1.75	8.00	-1.17	0.78	3.93	1.30		129.0	72.0
				0.42				21.9 *2	53.9
8 Terengganu	1.75	8.00	-0.94	1.60	3.93	1.30		205.1	170.6
				0.90				68.7 *2	136.8
9 Oya	2.75	8.00	-1.32	1.05		0.60			17.9
				1.90					61.1
10 Papar	1.75	6.00	-1.27	0.70	3.73	1.10			4.4
				0.50					9.5

Note *1 : Top Elevation of Structure.
*2 : Combination with Jetty and Breakwater

Table 5.3-5 COST COMPARISON IN NPV OF ALTERNATIVE CASES AT PERLIS RIVER MOUTH

Perlis River Case-1 Cap.+Main. Dredging
Case-2 Cap.+Main. Dredging +Sub. Jetty

		Volume (m3)	Unit Cost (RM)	Cost (RM)
Capital Dredging				
Outer	:	1,289,700	7.0	9,027,900
Inner	:	184,400	6.0	1,106,400
Maintenance Dredging (without Sub. Jetty)	:	360,900	7.0	2,526,300
Maintenance Dredging (with Sub. Jetty)	:	162,400	6.0	974,400
Submerged Jetty	:	103,000	190.0	19,570,000
Interest		8%		

Net Present Value of Construction Cost

Unit : '000 Ringgit

Year	Case-1 Capital Dredging	Case-1 Maintenance Dredging	Case-1 Total	Case-2 Capital Dredging	Case-2 Maintenance Dredging	Case-2 Submerged Jetty*1	Case-2 Total
1	10,134		10,134	10,134		9,785	19,919
2		2,526	2,526		1,750	9,785	11,535
3		2,526	2,526		974	117	1,092
4		2,526	2,526		974	117	1,092
5		2,526	2,526		974	117	1,092
6		2,526	2,526		974	117	1,092
7		2,526	2,526		974	117	1,092
8		2,526	2,526		974	117	1,092
9		2,526	2,526		974	117	1,092
10		2,526	2,526		974	117	1,092
11		2,526	2,526		974	117	1,092
12		2,526	2,526		974	117	1,092
13		2,526	2,526		974	117	1,092
14		2,526	2,526		974	117	1,092
15		2,526	2,526		974	117	1,092
16		2,526	2,526		974	5,871	6,845
17		2,526	2,526		974	5,871	6,845
18		2,526	2,526		974	117	1,092
19		2,526	2,526		974	117	1,092
20		2,526	2,526		974	117	1,092
21		2,526	2,526		974	117	1,092
22		2,526	2,526		974	117	1,092
23		2,526	2,526		974	117	1,092
24		2,526	2,526		974	117	1,092
25		2,526	2,526		974	117	1,092
26		2,526	2,526		974	117	1,092
27		2,526	2,526		974	117	1,092
28		2,526	2,526		974	117	1,092
29		2,526	2,526		974	117	1,092
30		2,526	2,526		974	117	1,092
NPV of Direct Cost			35,485				41,912
NPV of Project Cost *2			49,395				58,342

*1 : Construction Period for Submerged Jetty will be 2 Years.
*2 : (NPV of Direct Cost)x1.392, including others cost (see sub-section 6.8.2).

Table 5.3-6 COST COMPARISON IN NPV OF ALTERNATIVE CASES AT KEDAH RIVER MOUTH

Kedah River Case-1 Cap.+Main. Dredging
Case-2 Cap.+Main. Dredging+Sub. Jetty

		Volume (m3)	Unit Cost (RM)	Cost (RM)
Capital Dredging				
Outer	:	1,004,400	7.0	7,030,800
Inner	:	219,400	6.0	1,316,400
Maintenance Dredging (without Sub. Jetty)	:	332,400	7.0	2,326,800
Maintenance Dredging (with Sub. Jetty)	:	149,600	6.0	897,600
Submerged Jetty	:	104,420	190.0	19,839,800
Interest	:	8%		

Net Present Value of Construction Cost

Unit : '000 Ringgit

Year	Case-1 Capital Dredging	Case-1 Maintenance Dredging	Case-1 Total	Case-2 Capital Dredging	Case-2 Maintenance Dredging	Case-2 Submerged Jetty*1	Case-2 Total
1	8,347		8,347	8,347		9,920	18,267
2		2,327	2,327		1,612	9,920	11,532
3		2,327	2,327		898	119	1,017
4		2,327	2,327		898	119	1,017
5		2,327	2,327		898	119	1,017
6		2,327	2,327		898	119	1,017
7		2,327	2,327		898	119	1,017
8		2,327	2,327		898	119	1,017
9		2,327	2,327		898	119	1,017
10		2,327	2,327		898	119	1,017
11		2,327	2,327		898	119	1,017
12		2,327	2,327		898	119	1,017
13		2,327	2,327		898	119	1,017
14		2,327	2,327		898	119	1,017
15		2,327	2,327		898	119	1,017
16		2,327	2,327		898	5,952	6,850
17		2,327	2,327		898	5,952	6,850
18		2,327	2,327		898	119	1,017
19		2,327	2,327		898	119	1,017
20		2,327	2,327		898	119	1,017
21		2,327	2,327		898	119	1,017
22		2,327	2,327		898	119	1,017
23		2,327	2,327		898	119	1,017
24		2,327	2,327		898	119	1,017
25		2,327	2,327		898	119	1,017
26		2,327	2,327		898	119	1,017
27		2,327	2,327		898	119	1,017
28		2,327	2,327		898	119	1,017
29		2,327	2,327		898	119	1,017
30		2,327	2,327		898	119	1,017
NPV of Direct Cost			31,769				39,712
NPV of Project Cost *2			44,223				55,279

*1 : Construction Period for Submerged Jetty will be 2 Years.
*2 : (NPV of Direct Cost)x1.392, including others cost (see sub-section 6.8.2).

Table 5.3-7 COST COMPARISON IN NPV OF ALTERNATIVE CASES AT TG. PIANDANG RIVER MOUTH

Tg.Piandang River Case-1 Cap.+Main. Dredging
Case-2 Cap.+Main. Dredging + Sub. Jetty

		Volume (m3)	Unit Cost (RM)	Cost (RM)
Capital Dredging				
Outer	:	188,600	7.0	1,320,200
Inner	:	224,700	6.0	1,348,200
Maintenance Dredging(without Sub. Jetty)	:	72,500	7.0	507,500
Maintenance Dredgung(with Sub. Jetty)	:	32,600	6.0	195,600
Maintenance Dredging (with Sub. Jetty and Reservoir)	:	11,410	6.0	68,460
Submerged Jetty	:	44,730	190.0	8,498,700
Reservoir	:	4,500	60.0	270,000
Interest	8%			

Net Present Value of Construction Cost

Unit : '000 Ringgit

Year	Case-1 Capital Dredging	Case-1 Maintenance Dredging	Case-1 Total	Case-2 Capital Dredging	Case-2 Maintenance Dredging	Case-2 Submerged Jetty	Case-2 Total
1	2,668		2,668	2,668		8,499	11,167
2		508	508		196	51	247
3		508	508		196	51	247
4		508	508		196	51	247
5		508	508		196	51	247
6		508	508		196	51	247
7		508	508		196	51	247
8		508	508		196	51	247
9		508	508		196	51	247
10		508	508		196	51	247
11		508	508		196	51	247
12		508	508		196	51	247
13		508	508		196	51	247
14		508	508		196	51	247
15		508	508		196	51	247
16		508	508		196	5,099	5,295
17		508	508		196	51	247
18		508	508		196	51	247
19		508	508		196	51	247
20		508	508		196	51	247
21		508	508		196	51	247
22		508	508		196	51	247
23		508	508		196	51	247
24		508	508		196	51	247
25		508	508		196	51	247
26		508	508		196	51	247
27		508	508		196	51	247
28		508	508		196	51	247
29		508	508		196	51	247
30		508	508		196	51	247
NPV of Direct Cost			7,714				14,361
NPV of Project Cost *1			10,738				19,991

*1 : (NPV of Direct Cost)x1.392, including others cost (see sub-section 6.8.2).

Table 5.3-8 COST COMPARISON IN NPV OF ALTERNATIVE CASES AT BERUAS RIVER MOUTH

Beruas River Case-1 Cap.+Main. Dredging
Case-2 Cap.+Main. Dredging + Sub. Jetty

		Volume (m3)	Unit Cost (RM)	Cost (RM)
Capital Dredging				
Outer	:	359,800	7.0	2,518,600
Inner	:	324,300	6.0	1,945,800
Maintenance Dredging (without Sub. Jetty)	:	128,200	7.0	897,400
Maintenance Dredging (with Sub. Jetty)	:	57,700	6.0	346,200
Submereged Jetty	:	37,340	190.0	7,094,600
Interest	:	8%		

Net Present Value of Construction Cost

Unit : '000 Ringgit

Year	Case-1 Capital Dredging	Case-1 Maintenance Dredging	Case-1 Total	Case-2 Capital Dredging	Case-2 Maintenance Dredging	Case-2 Submerged Jetty	Case-2 Total
1	4,464		4,464	4,464		7,095	11,559
2		897	897		346	43	389
3		897	897		346	43	389
4		897	897		346	43	389
5		897	897		346	43	389
6		897	897		346	43	389
7		897	897		346	43	389
8		897	897		346	43	389
9		897	897		346	43	389
10		897	897		346	43	389
11		897	897		346	43	389
12		897	897		346	43	389
13		897	897		346	43	389
14		897	897		346	43	389
15		897	897		346	43	389
16		897	897		346	4,257	4,603
17		897	897		346	43	389
18		897	897		346	43	389
19		897	897		346	43	389
20		897	897		346	43	389
21		897	897		346	43	389
22		897	897		346	43	389
23		897	897		346	43	389
24		897	897		346	43	389
25		897	897		346	43	389
26		897	897		346	43	389
27		897	897		346	43	389
28		897	897		346	43	389
29		897	897		346	43	389
30		897	897		346	43	389
NPV of Direct Cost			13,406				15,950
NPV of Project Cost *1			18,660				22,202

*1 : (NPV of Direct Cost)x1.392, including others cost (see sub-section 6.8.2).

Table 5.3-9 DESIGN FEATURES OF TRAINING WALL, GROIN AND RESERVOIR BY RIVER MOUTH

River Mouth	Training Wall Length (m)	Groin Length			Reservoir	
		River (m)	Coastal (m)	Total (m)	Area (km2)	Length (km)
1 Perlis	-	-	-	-	-	-
2 Kedah	-	-	-	-	-	-
3 Tg. Piandang	-	-	-	-	-	-
4 Beruas	-	-	-	-	-	-
5 Kuantan	-	-	1,650	1,650	-	-
6 Kerteh	850	-	300	300	0.308	5.0
7 Marang	650	160	200	360	0.116	4.1
8 Terengganu	-	720	450	1,170	-	-
9 Oya	1,300	-	200	200	-	-
10 Papar	400	100	300	400	0.060	0.8

Table 5.3-10 COST COMPARISON IN NPV OF ALTERNATIVE CASES AT KUANTAN RIVER MOUTH

Kuantan River Case-1 Cap.+Main. Dredging
Case-2 Cap. Dredging + Jetty

		Volume (m3)	Unit Cost (RM)	Cost (RM)
Capital Dredging				
Outer	:	617,700	6.0	3,706,200
Inner	:	0	5.0	0
Maintenance Dredging (without Sub. Jetty)	:	217,000	6.0	1,302,000
Jetty	:	161,490	78.0	12,596,220
Groin	:	1,650	1,500.0	2,475,000
Interest	:	8%		

Net Present Value of Construction Cost

Unit : '000 Ringgit

Year	Case-1 Capital Dredging	Case-1 Maintenance Dredging	Case-1 Total	Case-2 Capital Dredging	Case-2 Jetty*1	Case-2 Total
1	3,706		3,706	3,706	7,536	11,242
2		1,302	1,302	651	7,536	8,187
3		1,302	1,302		90	90
4		1,302	1,302		90	90
5		1,302	1,302		90	90
6		1,302	1,302		90	90
7		1,302	1,302		90	90
8		1,302	1,302		90	90
9		1,302	1,302		90	90
10		1,302	1,302		90	90
11		1,302	1,302		90	90
12		1,302	1,302		90	90
13		1,302	1,302		90	90
14		1,302	1,302		90	90
15		1,302	1,302		90	90
16		1,302	1,302		90	90
17		1,302	1,302		90	90
18		1,302	1,302		90	90
19		1,302	1,302		90	90
20		1,302	1,302		90	90
21		1,302	1,302		90	90
22		1,302	1,302		90	90
23		1,302	1,302		90	90
24		1,302	1,302		90	90
25		1,302	1,302		90	90
26		1,302	1,302		90	90
27		1,302	1,302		90	90
28		1,302	1,302		90	90
29		1,302	1,302		90	90
30		1,302	1,302		90	90
NPV of Direct Cost			16,884			18,285
NPV of Project Cost *2			23,502			25,452

*1 : Construction Period for Jetty will be 2 Years.
*2 : (NPV of Direct Cost)x1.392, including others cost (see sub-section 6.8.2).

Table 5.3-11 COST COMPARISON IN NPV OF ALTERNATIVE CASES AT KERTEH RIVER MOUTH

Kerteh River Case-1 Cap.+Main. Dredging + Training Wall
Case-2 Cap. Dredging + Jetty + Groin + Reservoir

		Volume (m3)	Unit Cost (RM)	Cost (RM)
Capital Dredging				
Outer	:	120,200	5.0	601,000
Inner	:	158,700	5.0	793,500
Maintenance Dredging (without Jetty)	:	120,200	5.0	601,000
Jetty	:	60,500	78.0	4,719,000
Reservoir	:	5,000	10.0	50,000
Training Wall	:	850	1,500.0	1,275,000
Groin	:	300	1,500.0	450,000
Interest	:	8%		

Net Present Value of Construction Cost

Unit : '000 Ringgit

Year	Case-1 Capital Dredging	Case-1 Training Wall	Case-1 Total	Case-2 Capital Dredging	Case-2 Jetty	Case-2 Total
1	1,395	1,275	2,670	1,395	5,219	6,614
2	601	8	609		31	31
3	601	8	609		31	31
4	601	8	609		31	31
5	601	8	609		31	31
6	601	8	609		31	31
7	601	8	609		31	31
8	601	8	609		31	31
9	601	8	609		31	31
10	601	8	609		31	31
11	601	8	609		31	31
12	601	8	609		31	31
13	601	8	609		31	31
14	601	8	609		31	31
15	601	8	609		31	31
16	601	8	609		31	31
17	601	8	609		31	31
18	601	8	609		31	31
19	601	8	609		31	31
20	601	8	609		31	31
21	601	8	609		31	31
22	601	8	609		31	31
23	601	8	609		31	31
24	601	8	609		31	31
25	601	8	609		31	31
26	601	8	609		31	31
27	601	8	609		31	31
28	601	8	609		31	31
29	601	8	609		31	31
30	601	8	609		31	31
NPV of Direct Cost			8,760			6,447
NPV of Project Cost *1			12,194			8,974

*1 : (NPV of Direct Cost)x1.392, including others cost (see sub-section 6.8.2).

Table 5.3-12 COST COMPARISON IN NPV OF ALTERNATIVE CASES AT MARANG RIVER MOUTH

Marang River
Case-1 Cap. + Main Dredging + Breakwater + Training Wall + Groin
Case-2 Cap. Dredging + Breakwater + Jetty + Groin + Reservoir

		Volume (m3)	Unit Cost (RM)	Cost (1000RM)
Capital Dredging				
Outer	:	39,600	5.0	198
Inner	:	67,100	5.0	336
Maintenance Dredging	:	39,600	5.0	198
Breakwater	:	128,970	78.0	10,060
Jetty (with Breakwater)	:	147,753	78.0	11,525
Training Wall	:	650	1,500.0	975
Groin	:	360	1,500.0	540
Reservoir	:	4100	10.0	41
Interest	:	8%		

Net Present Value of Construction Cost

Unit : '000 Ringgit

Year	Case-1 Capital Dredging	Case-1 Structure Cost	Case-1 Total	Case-2 Capital Dredging	Case-2 Structure Cost	Case-2 Total
1	534	11,575	12,108	534	12,106	12,639
2	198	69	267		73	73
3	198	69	267		73	73
4	198	69	267		73	73
5	198	69	267		73	73
6	198	69	267		73	73
7	198	69	267		73	73
8	198	69	267		73	73
9	198	69	267		73	73
10	198	69	267		73	73
11	198	69	267		73	73
12	198	69	267		73	73
13	198	69	267		73	73
14	198	69	267		73	73
15	198	69	267		73	73
16	198	69	267		73	73
17	198	69	267		73	73
18	198	69	267		73	73
19	198	69	267		73	73
20	198	69	267		73	73
21	198	69	267		73	73
22	198	69	267		73	73
23	198	69	267		73	73
24	198	69	267		73	73
25	198	69	267		73	73
26	198	69	267		73	73
27	198	69	267		73	73
28	198	69	267		73	73
29	198	69	267		73	73
30	198	69	267		73	73
NPV of Direct Cost			13,974			12,453
NPV of Project Cost *1			19,452			17,335

*1 : (NPV of Direct Cost)x1.392, including others cost (see sub-section 6.8.2).

Table 5.3-13 COST COMPARISON IN NPV OF ALTERNATIVE CASES AT TRENGGANU RIVER MOUTH

Terengganu River
Case-1 Cap.+ Main. Dredging + Breakwater + Groin (1)
Case-2 Cap. Dredging + Breakwater + Jetty + Groin (2)

		Volume (m3)	Unit Cost (RM)	Cost (1000RM)
Capital Dredging				
Outer	:	167,100	5.0	836
River Mouth	:	760,000	5.0	3,800
Inner	:	813,200	5.0	4,066
Maintenance Dredging	:	167,100	5.0	836
Breakwater	:	213,725	78.0	16,671
*Breakwater (Part)	:	68,713	78.0	5,360
Jetty	:	307,430	78.0	23,980
Groin (1)	:	720	1,500.0	1,080
Groin (2)	:	1,170	1,500.0	1,755
Interest	:	8%		

Net Present Value of Construction Cost

Unit : '000 Ringgit

Year	Case-1 Capital Dredging	Case-1 Structure*1 Cost	Case-1 Total	Case-2 Capital Dredging	Case-2 Structure*2 Cost	Case-2 Total
1	8,702	8,875	17,577	8,702	10,365	19,066
2	836	8,875	9,711	557	10,365	10,922
3	836	107	942	279	10,365	10,643
4	836	107	942		187	187
5	836	107	942		187	187
6	836	107	942		187	187
7	836	107	942		187	187
8	836	107	942		187	187
9	836	107	942		187	187
10	836	107	942		187	187
11	836	107	942		187	187
12	836	107	942		187	187
13	836	107	942		187	187
14	836	107	942		187	187
15	836	107	942		187	187
16	836	107	942		187	187
17	836	107	942		187	187
18	836	107	942		187	187
19	836	107	942		187	187
20	836	107	942		187	187
21	836	107	942		187	187
22	836	107	942		187	187
23	836	107	942		187	187
24	836	107	942		187	187
25	836	107	942		187	187
26	836	107	942		187	187
27	836	107	942		187	187
28	836	107	942		187	187
29	836	107	942		187	187
30	836	107	942		187	187
NPV of Direct Cost			33,525			37,086
NPV of Project Cost *3			46,667			51,624

*1 : Construction Period for Breakwater will be 2 Years.
*2 : Construction Period for Breakwater and Jetty will be 3 Years.
*3 : (NPV of Direct Cost)x1.392, including others cost (see sub-section 6.8.2).

Table 5.3-14 COST COMPARISON IN NPV OF ALTERNATIVE CASES AT OYA RIVER MOUTH

Oya River Case-1 Cap. + Main. Dredging + Training Wall
Case-2 Cap. Dredging + Jetty

		Volume (m3)	Unit Cost (RM)	Cost (1000RM)
Capital Dredging				
Outer	:	31,300	5.0	157
Inner	:	0	5.0	0
Maintenance Dredging (without Sub. Jetty)	:	31,300	5.0	157
Jetty	:	79,020	78.0	6,164
Training Wall	:	1,300	1,500.0	1,950
Interest	:	8%		

Net Present Value of Construction Cost

Unit : '000 Ringgit

Year	Case-1 Dredging Cost	Case-1 Structure Cost	Case-1 Total	Case-2 Dredging Cost	Case-2 Structure Cost	Case-2 Total
1	157	1,950	2,107	157	6,164	6,320
2	157	12	168		37	37
3	157	12	168		37	37
4	157	12	168		37	37
5	157	12	168		37	37
6	157	12	168		37	37
7	157	12	168		37	37
8	157	12	168		37	37
9	157	12	168		37	37
10	157	12	168		37	37
11	157	12	168		37	37
12	157	12	168		37	37
13	157	12	168		37	37
14	157	12	168		37	37
15	157	12	168		37	37
16	157	12	168		37	37
17	157	12	168		37	37
18	157	12	168		37	37
19	157	12	168		37	37
20	157	12	168		37	37
21	157	12	168		37	37
22	157	12	168		37	37
23	157	12	168		37	37
24	157	12	168		37	37
25	157	12	168		37	37
26	157	12	168		37	37
27	157	12	168		37	37
28	157	12	168		37	37
29	157	12	168		37	37
30	157	12	168		37	37
NPV of Direct Cost			3,688			6,234
NPV of Project Cost*1			5,134			8,678

*1 : (NPV of Direct Cost)x1.392, including others cost (see sub-section 6.8.2).

Table 5.3-15 COST COMPARISON IN NPV OF ALTERNATIVE CASES AT PAPAR RIVER MOUTH

Papar River Case-1 Cap.+Main. Dredging + Training Wall + Groin
Case-2 Cap.Dredging + Jetty + Groin + Reservoir

		Volume (m3)	Unit Cost (RM)	Cost (1000RM)
Capital Dredging				
Outer	:	46,000	5.0	230
Inner	:	143,200	5.0	716
Maintenance Dredging (without Sub. Jetty)	:	46,000	5.0	230
Jetty	:	13,880	78.0	1,083
Groin	:	400	1,500.0	600
Training Wall	:	400	1,500.0	600
Reservoir	:	800	10.0	8
Interest	:	8%		

Net Present Value of Construction Cost

Unit : '000 Ringgit

Year	Case-1 Dredging Cost	Case-1 Structure Cost	Case-1 Total	Case-2 Dredging Cost	Case-2 Structure Cost	Case-2 Total
1	946	1,200	2,146	946	1,691	2,637
2	230	7	237		10	10
3	230	7	237		10	10
4	230	7	237		10	10
5	230	7	237		10	10
6	230	7	237		10	10
7	230	7	237		10	10
8	230	7	237		10	10
9	230	7	237		10	10
10	230	7	237		10	10
11	230	7	237		10	10
12	230	7	237		10	10
13	230	7	237		10	10
14	230	7	237		10	10
15	230	7	237		10	10
16	230	7	237		10	10
17	230	7	237		10	10
18	230	7	237		10	10
19	230	7	237		10	10
20	230	7	237		10	10
21	230	7	237		10	10
22	230	7	237		10	10
23	230	7	237		10	10
24	230	7	237		10	10
25	230	7	237		10	10
26	230	7	237		10	10
27	230	7	237		10	10
28	230	7	237		10	10
29	230	7	237		10	10
30	230	7	237		10	10
NPV of Direct Cost			4,438			2,546
NPV of Project Cost *1			6,177			3,544

*1 : (NPV of Direct Cost)x1.392, including others cost (see sub-section 6.8.2).

Table 5.4-1 NET PRESENT VALUE OF PROJECT COST FOR THE MASTER PLAN OBJECTIVE RIVER MOUTHS

No.	Serial	Name	Slope	GRT	Length (m)	Width (m)	Depth (m)	KL	Vo (1000m3)	Vi (1000m3)	V (1000m3)	Vm (1000m3)	Jv (1000m)	NPV (1000RM)
1	45	Mersing	0.00162	150	1,914	75	3.10	444.9	165.1	279.8	444.9	143.5	514.1	56,547
	48	Rompin	0.00187	70	775	65	1.45	73.1	27.1	46.0	73.1	27.1	208.3	23,077
	61	Marang		40	550	45	1.67	41.3	39.6	67.1	106.7	39.6	147.8	17,335
	81	Mukan	0.00120	70	1,625	65	1.95	206.0	76.4	129.5	206.0	76.4	436.5	46,853
	82	Balingian	0.00098	40	1,806	45	1.77	143.9	53.4	90.5	143.9	53.4	485.2	51,500
	84	Tatau	0.00189	40	778	45	1.47	51.5	19.1	32.4	51.5	19.1	208.9	22,997
2	44	Sedili Besar	0.00180	150	1,167	75	2.10	183.7	183.7	0.0	183.7	87.5		8,635
	46	Endau	0.00165	200	1,745	75	2.88	377.0	377.0	0.0	377.0	130.9		13,520
	50	Nenasi	0.00132	70	1,098	65	1.45	103.5	103.5	0.0	103.5	71.4		6,772
	52	Terus	0.00135	40	1,681	45	2.27	171.8	171.8	0.0	171.8	75.7		7,546
	53	Kuantan		200	3,800	75	2.17	617.7	617.7	0.0	617.7	285.0		23,503
	55	Kemaman	0.00456	100	316	45	1.44	20.5	20.5	0.0	20.5	14.2		1,346
	58	Paka	0.00194	40	552	45	1.07	26.6	26.6	0.0	26.6	20.3		1,904
	59	Dungun	0.00232	100	879	65	2.04	116.6	116.6	0.0	116.6	57.2		5,624
	60	Mercang	0.00550	40	449	45	2.47	49.9	49.9	0.0	49.9	20.2		2,038
	92	Tuaran	0.00370	40	586	45	2.17	57.3	57.3	0.0	57.3	26.4		2,616
3	56	Kemasik	0.00194	40	1,376	45	2.67	165.4	71.3	94.1	165.4	71.3	86.7	11,271
	57	Kerteh		40	960	45	2.63	113.5	120.2	158.7	278.9	120.2	60.5	8,974
	87	Sibuti	0.00156	40	686	45	1.07	33.0	14.2	18.8	33.0	14.2	43.2	5,272
4	1	Perlis		150	4,800	75	3.54	1274.9	1,289.7	184.4	1,474.1	360.0		49,395
	25	Langat	0.00532	40	88	45	0.47	1.9	1.6	0.2	1.9	1.6		177
	99	Umas-Umas	0.00370	40	46	45	0.17	0.4	0.3	0.0	0.4	0.3		33
5	2	Baru	0.00127	40	1,945	45	2.47	216.2	98.6	117.5	216.2	87.5		10,608
	3	Sang lang	0.00266	40	703	45	1.87	59.2	27.0	32.2	59.2	27.0		3,211
	4	Jerlun	0.00250	40	628	45	1.57	44.4	20.2	24.1	44.4	20.2		2,403
	6	Yan	0.00092	40	2,793	45	2.57	323.1	147.4	175.6	323.1	125.7		15,343
	8	Cenang	0.00099	40	2,697	45	2.67	324.0	147.9	176.2	324.0	121.4		14,919
	12	Pinang	0.00114	40	2,342	45	2.67	281.4	128.4	153.0	281.4	105.4		12,953
	13	Bayan Lepas	0.00091	40	2,604	45	2.37	277.8	126.7	151.0	277.8	117.2		14,111
	14	Tg.Piandang		40	2,330	45	2.60	272.8	188.6	224.7	413.3	104.9		10,738
	20	Batu	0.00070	40	3,671	45	2.57	424.6	193.8	230.8	424.6	165.2		20,165
	22	Lekir	0.00097	40	2,753	45	2.67	330.7	150.9	179.8	330.7	123.9		15,226
	24	Kapar Besar	0.00150	40	1,780	45	2.67	213.9	97.6	116.3	213.9	80.1		9,844
	26	Sepang Kecil	0.03750	40	23	45	0.87	0.9	0.4	0.5	0.9	0.4		47
	27	Sepang	0.05465	40	1	45	0.07	0.0	0.0	0.0	0.0	0.0		0
	30	Linggi	0.00600	40	445	45	2.67	53.5	24.4	29.1	53.5	20.0		2,458
	31	Baru	0.00552	40	484	45	2.67	58.1	26.5	31.6	58.1	21.8		2,678
	32	Melaka	0.00533	40	276	45	1.47	18.2	8.3	9.9	18.2	8.3		987
	33	Duyong	0.00385	40	538	45	2.07	50.1	22.9	27.2	50.1	22.9		2,721
	34	Umbai	0.00423	40	513	45	2.17	50.1	22.9	27.2	50.1	22.9		2,723
	35	Merlimau	0.00667	40	340	45	2.27	34.8	15.9	18.9	34.8	15.3		1,829
	37	Parit Jawa	0.00280	40	775	45	2.17	75.7	34.5	41.1	75.7	34.5		4,102
	40	Senggarang	0.00288	40	719	45	2.07	67.0	30.6	36.4	67.0	30.6		3,637
	41	Rengit	0.00150	40	1,447	45	2.17	141.3	64.5	76.8	141.3	64.5		7,669
	42	Benut	0.00064	40	2,922	45	1.87	245.9	112.2	133.7	245.9	112.2		13,342
	43	Pontian Kecil	0.00102	40	1,637	45	1.67	123.0	56.1	66.9	123.0	56.1		6,672
	98	Tawau	0.00370	40	722	45	2.67	86.7	39.6	47.1	86.7	32.5		3,994
6	69	Sematan	0.00109	40	1,073	45	1.17	56.5	10.2	46.3	56.5	10.2	65.2	1,673
	70	Kayan	0.00133	40	729	45	0.97	31.8	5.7	26.1	31.8	5.7	44.3	941
	80	Oya		40	1,300	45	2.97	173.5	31.3	142.2	173.5	15.5	79.0	5,134
7	11	Kerian	0.00056	40	1,554	45	0.87	60.8	32.0	28.8	60.8	32.0		3,733
	15	Gula	0.00055	70	3,727	65	2.05	496.7	261.2	235.4	496.7	242.3		28,571
	16	Sangga	0.00043	40	2,488	45	1.07	119.8	63.0	56.8	119.8	63.0		7,350
	17	Larut	0.00044	40	3,341	45	1.47	221.0	116.2	104.8	221.0	116.2		13,558
	18	Terong	0.00094	40	(245)	45	-0.23	2.5	1.3	1.2	2.5	1.3		152
	19	Beruas		100	2,170	65	2.81	395.9	359.8	324.3	684.1	141.1		18,661
	23	Selangor	0.00069	40	2,130	45	1.47	140.9	74.1	66.8	140.9	74.1		8,646
	36	Huar	0.00095	40	600	45	0.57	15.4	8.1	7.3	15.4	8.1		1,070
	39	Batu Pahat	0.00500	40	334	45	1.67	25.1	13.2	11.9	25.1	13.2		1,540
	76	Buntal	0.00080	40	2,588	45	2.07	241.0	126.8	114.3	241.0	116.4		13,746
	77	Bako	0.00065	40	2,262	45	1.47	149.6	78.7	70.9	149.6	78.7		9,182
	78	Sadong	0.00047	40	2,702	45	1.27	154.4	81.2	73.2	154.4	81.2		9,474
	89	Padas	0.00455	40	411	45	1.87	34.6	18.2	16.4	34.6	18.2		2,123
	100	Kalabakan	0.00370	40	127	45	0.47	2.7	1.4	1.3	2.7	1.4		164
8	51	Pahang	0.00210	70	643	65	1.35	56.4	9.6	46.8	56.4	9.6	124.9	13,624
	62	Terengganu		150	1,100	75	3.29	271.6	167.1	813.2	980.3	8.4	213.7	46,667
	67	Kelantan	0.00535	100	307	65	1.64	32.7	5.6	27.1	32.7	5.6	59.6	6,799
	95	Sugut	0.00370	40	19	45	0.07	0.1	0.0	0.0	0.1	0.0	3.7	406
9	38	Sarang Buaya	0.00200	40	785	45	1.57	55.5	11.6	43.9	55.5	11.6	24.2	2,954
	63	Merang	0.00205	40	1,205	45	2.47	133.9	28.0	105.9	133.9	28.0	37.2	4,848
	66	Pak Amat	0.00128	40	2,008	45	2.57	232.2	48.6	183.6	232.2	48.6	61.9	8,139
	90	Papar		40	450	45	3.30	66.9	46.0	173.9	219.9	46.0	13.9	3,742
10	5	Kedah		150	4,000	75	3.02	906.5	1,004.4	219.4	1,223.8	300.0		44,224
	9	Muda	0.00082	40	2,037	45	1.67	153.0	125.6	27.4	153.0	91.6		10,567
	88	Lawas	0.00143	40	1,168	45	1.67	87.8	72.0	15.7	87.8	52.6		6,066

Vo : Dredging volume for outer channel. Vi : Dredging volume for inner channel,
V : Total dreding volume of each river. Jv : Length of structures.

Table 5.4-2 BENEFITS OF THE MASTER PLAN OBJECTIVE RIVER MOUTHS

Group	No.	Serial No.	Name			Design Boat Size (GRT)	Annual Benefit ('000RM) Fishery	Sea Trans.	Flood Mit.	Total
A	1	45	Mersing		#	150	1,182	288		1,470
A	2	48	Rompin		#	70	143			143
A	3	61	Marang	*	#	40	1,462	259		1,721
A	4	81	Mukah		#	70	1,383			1,383
A	5	82	Balingian			40	63			63
A	6	84	Tatau			40	290			290
B	7	44	Sedili Besar		#	150	10			10
B	8	46	Endau		#	200	1,677			1,677
B	9	50	Nenasi		#	70	110			110
B	10	52	Terus			40	60			60
B	11	53	Kuantan	*	#	200	2,660			2,660
B	12	55	Kemaman		#	100	85			85
B	13	58	Paka		#	40	15			15
B	14	59	Dungun		#	100	88			88
B	15	60	Mercang			40	121			121
B	16	92	Tuaran			40	168			168
C	17	56	Kemasik			40	231			231
C	18	57	Kerteh	*		40	228			228
C	19	87	Sibuti			40	1			1
D	20	1	Perlis	*	#	150	6,607	1,276		7,883
D	21	25	Langat			40	0			0
D	22	99	Umas-umas			40	0			0
E	23	2	Baru		#	40	512			512
E	24	3	Sanglang		#	40	141			141
E	25	4	Jerlun		#	40	23			23
E	26	6	Yan		#	40	399			399
E	27	8	Cenang		#	40	169			169
E	28	12	Pinang		#	40	966			966
E	29	13	Bayan Lepas			40	485			485
E	30	14	Tg. Piandang	*	#	40	964			964
E	31	20	Batu			40	61			61
E	32	22	Lekir			40	110			110
E	33	24	Kapar Besar			40	325			325
E	34	26	Sepan Kecil			40	0			0
E	35	27	Sepang			40	0			0
E	36	30	Linggi		#	40	142			142
E	37	31	Baru			40	156			156
E	38	32	Melaka		#	40	17			17
E	39	33	Duyong			40	29			29
E	40	34	Umbai			40	50			50
E	41	35	Merlimau			40	67			67
E	42	37	Parit Jawa			40	243			243
E	43	40	Senggarang			40	31			31
E	44	41	Rengit			40	217			217
E	45	42	Benut			40	96			96
E	46	43	Pontian Kecil		#	40	631			631
E	47	98	Tawau		#	40	372			372
F	48	69	Sematan			40	4			4
F	49	70	Kayan			40	1			1
F	50	80	Oya	*	#	40	267			267
G	51	11	Kerian		#	40	31			31
G	52	15	Gula		#	70	152			152
G	53	16	Sangga			40	0			0
G	54	17	Larut			40	42			42
G	55	18	Terong			40	0			0
G	56	19	Beruas	*	#	100	2,765			2,765
G	57	23	Selangor		#	40	59			59
G	58	36	Muar			40	0			0
G	59	39	Batu Pahat			40	20			20
G	60	76	Buntal			40	314			314
G	61	77	Bako			40	49			49
G	62	78	Sadong		#	40	21			21
G	63	89	Padas		#	40	42			42
G	64	100	Kalabakan			40	0			0
H	65	51	Pahang		#	70	104		7	111
H	66	62	Terengganu	*	#	150	263	748	37	1,048
H	67	67	Kelantan		#	100	365		42	407
H	68	95	Sugut			40	0		0	0
I	69	38	Sarang Buaya			40	1			1
I	70	63	Merang			40	207			207
I	71	66	Pak Amat			40	223			223
I	72	90	Papar	*		40	242			242
J	73	5	Kedah	*	#	150	6,863	1,521		8,384
J	74	9	Muda		#	40	101			101
J	75	88	Lawas			40	162			162

* : Representative river mouth
\# : River mouths in critical category

All the river mouths --> 39,266
Critical category --> 30,132
Significant category --> 9,134

Table 5.4-3 COST-BENEFIT RATIOS OF THE MASTER PLAN OBJECTIVE RIVER MOUTHS

Group	No.	Serial No.	Name			Design Boat Size (GRT)	Fishery Benefit ('000RM)	Sea Trans. Benefit ('000RM)	Flood Mit. Benefit ('000RM)	Benefit NPV ('000RM)	Eco. Cost NPV ('000RM)	B/C
A	1	45	Mersing		#	150	1,182	288		19,477	49,762	0.39
A	2	48	Rompin		#	70	143			1,895	20,307	0.09
A	3	61	Marang	*	#	40	1,462	259		22,802	15,254	1.49
A	4	81	Mukah		#	70	1,383			18,324	41,231	0.44
A	5	82	Balingian			40	63			835	45,320	0.02
A	6	84	Tatau			40	290			3,842	20,238	0.19
B	7	44	Sedili Besar		#	150	10			132	7,598	0.02
B	8	46	Endau		#	200	1,677			22,219	11,898	1.87
B	9	50	Nenasi		#	70	110			1,457	5,959	0.24
B	10	52	Terus			40	60			795	6,641	0.12
B	11	53	Kuantan	*	#	200	2,660			35,244	20,682	1.70
B	12	55	Kemaman		#	100	85			1,126	1,185	0.95
B	13	58	Paka		#	40	15			199	1,676	0.12
B	14	59	Dungun		#	100	88			1,166	4,949	0.24
B	15	60	Mercang			40	121			1,603	1,793	0.89
B	16	92	Tuaran			40	168			2,226	2,302	0.97
C	17	56	Kemasik			40	231			3,061	9,918	0.31
C	18	57	Kerteh	*		40	228			3,021	7,897	0.38
C	19	87	Sibuti			40	1			13	4,639	0.00
D	20	1	Perlis	*	#	150	6,607	1,276		104,446	43,468	2.40
D	21	25	Langat			40	0			0	156	0.00
D	22	99	Umas-umas			40	0			0	29	0.00
E	23	2	Baru		#	40	512			6,784	9,335	0.73
E	24	3	Sanglang		#	40	141			1,868	2,826	0.66
E	25	4	Jerlun		#	40	23			305	2,114	0.14
E	26	6	Yan		#	40	399			5,287	13,502	0.39
E	27	8	Cenang		#	40	169			2,239	13,129	0.17
E	28	12	Pinang		#	40	966			12,799	11,398	1.12
E	29	13	Bayan Lepas			40	485			6,426	12,417	0.52
E	30	14	Tg. Piandang	*	#	40	964			12,773	9,450	1.35
E	31	20	Batu			40	61			808	17,745	0.05
E	32	22	Lekir			40	110			1,457	13,399	0.11
E	33	24	Kapar Besar			40	325			4,306	8,663	0.50
E	34	26	Sepan Kecil			40	0			0	42	0.00
E	35	27	Sepang			40	0			0	0	0.00
E	36	30	Linggi		#	40	142			1,881	2,163	0.87
E	37	31	Baru			40	156			2,067	2,357	0.88
E	38	32	Melaka		#	40	17			225	868	0.26
E	39	33	Duyong			40	29			384	2,395	0.16
E	40	34	Umbai			40	50			662	2,396	0.28
E	41	35	Merlimau			40	67			888	1,610	0.55
E	42	37	Parit Jawa			40	243			3,220	3,610	0.89
E	43	40	Senggarang			40	31			411	3,201	0.13
E	44	41	Rengit			40	217			2,875	6,748	0.43
E	45	42	Benut			40	96			1,272	11,741	0.11
E	46	43	Pontian Kecil		#	40	631			8,360	5,871	1.42
E	47	98	Tawau		#	40	372			4,929	3,514	1.40
F	48	69	Sematan			40	4			53	1,472	0.04
F	49	70	Kayan			40	1			13	828	0.02
F	50	80	Oya	*	#	40	267			3,538	4,518	0.78
G	51	11	Kerian		#	40	31			411	3,285	0.13
G	52	15	Gula		#	70	152			2,014	25,142	0.08
G	53	16	Sangga			40	0			0	6,468	0.00
G	54	17	Larut			40	42			556	11,931	0.05
G	55	18	Terong			40	0			0	134	0.00
G	56	19	Beruas	*	#	100	2,765			36,635	16,422	2.23
G	57	23	Selangor		#	40	59			782	7,608	0.10
G	58	36	Muar			40	0			0	942	0.00
G	59	39	Batu Pahat			40	20			265	1,355	0.20
G	60	76	Buntal			40	314			4,160	12,096	0.34
G	61	77	Bako			40	49			649	8,080	0.08
G	62	78	Sadong		#	40	21			278	8,337	0.03
G	63	89	Padas		#	40	42			556	1,868	0.30
G	64	100	Kalabakan			40	0			0	145	0.00
H	65	51	Pahang		#	70	104		7	1,448	11,989	0.12
H	66	62	Terengganu	*	#	150	263	748	37	13,775	41,067	0.34
H	67	67	Kelantan		#	100	365		42	5,270	5,983	0.88
H	68	95	Sugut			40	0		0	0	358	0.00
I	69	38	Sarang Buaya			40	1			13	2,599	0.01
I	70	63	Merang			40	207			2,743	4,267	0.64
I	71	66	Pak Amat			40	223			2,955	7,162	0.41
I	72	90	Papar	*		40	242			3,206	3,293	0.97
J	73	5	Kedah	*	#	150	6,863	1,521		111,084	38,917	2.85
J	74	9	Muda		#	40	101			1,338	9,299	0.14
J	75	88	Lawas			40	162			2,146	5,338	0.40
										519,998	724,299	0.72
										463,065	472,575	0.98
										56,933	251,723	0.23

* : Representative river mouth
\# : River mouths in critical category

All the river mouths -->
Critical category -->
Significant category -->

Table 5.4-4 FACTORS FOR PRIORITIZATION

Serial No.	Name	State	Design Boat Size (GRT)	B/C Ratio	No. of Fishermen	Existence of LKIM Complex	Existence of DOF Fishing Base	Existence of Commercial Boat Jetty
1	Perlis	Perlis	150	2.40	2,333	yes		yes
2	Baru	Perlis	40	0.73	561			
3	Sanglang	Kedah	40	0.66	762			
4	Jerlun	Kedah	40	0.14	202			
5	Kedah	Kedah	150	2.85	1,716	yes	yes	yes
6	Yan	Kedah	40	0.39	493			
8	Cenang	Kedah	40	0.17	141			
9	Muda	P.Pinang	40	0.14	504			
11	Kerian	P.Pinang	40	0.13	693	*1		
12	Pinang	P.Pinang	40	1.12	700			
14	Tg. Piandang	Perak	40	1.35	1,042	*1		
15	Gula	Perak	70	0.08	308			
19	Beruas	Perak	100	2.23	1,595	*1		
23	Selangor	Selangor	40	0.10	397	*1		
30	Linggi	N.Sembilan	40	0.87	120	*1		
32	Melaka	Melaka	40	0.26	311	*1	yes	yes
43	Pontian Kecil	Johor	40	1.42	370	yes		
44	Sedili Besar	Johor	150	0.02	467	yes	yes	
45	Mersing	Johor	150	0.39	435	yes	yes	yes
46	Endau	Johor	200	1.87	327	yes		
48	Rompin	Pahang	70	0.09	405	yes		
50	Nenasi	Pahang	70	0.24	228	yes		
51	Pahang	Pahang	70	0.12	666	yes		
53	Kuantan	Pahang	200	1.70	570	yes	yes	yes
55	Kemaman	Terengganu	100	0.95	1,338	yes		yes
58	Paka	Terengganu	40	0.12	267	yes		
59	Dungun	Terengganu	100	0.24	848	yes		yes
61	Marang	Terengganu	40	1.49	715	yes		yes
62	Terengganu	Terengganu	150	0.34	417	yes	yes	yes
67	Kelantan	Kelantan	100	0.88	666	yes	yes	yes
78	Sadong	Sarawak	40	0.03	751			
80	Oya	Sarawak	40	0.78	292			
81	Mukah	Sarawak	70	0.44	556	yes		
89	Padas	Sabah	40	0.30	509			
98	Tawau	Sabah	40	1.40	400			
				Total	22,105			

Note *1 : LKIM complex is to be constructed.

Table 5.4-5(1/4) INITIAL AND ANNUAL O&M COSTS OF CRITICAL GROUP RIVER MOUTHS IN ORDER OF PRIORITY
(Case 1-1 & 1-3)

(Total costs in 5 years are equalized.) (Unit: '000 RM)

Priority	Serial	Name	State	Initial Cost	O&M Cost (Per Year)
	1	Perlis	Perlis	10,134	2,526
	5	Kedah	Kedah	8,437	2,327
	14	Tg. Piandang	Perak	2,668	508
	19	Beruas	Perak	4,465	897
	46	Endau	Johor	1,726	785
First	51	Pahang	Pahang	10,024	59
	61	Marang	Terengganu	12,639	73
	67	Kelantan	Kelantan	4,810	28
	81	Mukah	Sarawak	35,080	204
				89,983	7,407
	2	Baru	Perlis	1,396	613
	8	Cenang	Kedah	2,092	850
	9	Muda	P.Pinang	1,044	641
	12	Pinang	P.Pinang	1,817	738
	15	Gula	Perak	3,241	1,696
	23	Selangor	Selangor	920	519
Second	32	Melaka	Melaka	118	58
	43	Pontian Kecil	Johor	795	393
	44	Sedili Besar	Johor	841	525
	53	Kuantan	Pahang	3,706	1,302
	62	Terengganu	Terengganu	26,452	943
	59	Dungun	Terengganu	534	343
				42,956	8,621
	3	Sanglang	Kedah	382	189
	6	Yan	Kedah	2,086	880
Third	30	Linggi	Melaka	345	140
	45	Mersing	Johor	42,322	241
	55	Kemaman	Terengganu	94	85
				45,229	1,535
	4	Jerlun	Kedah	286	141
	11	Kerian	P.Pinang	397	224
	48	Rompin	Pahang	16,614	98
Forth	50	Nenasi	Pahang	474	428
	58	Paka	Terengganu	122	122
	78	Sadong	Sarawak	1,008	568
	80	Oya	Sarawak	2,107	168
	89	Padas	Sabah	226	127
	98	Tawau	Sabah	560	228
				21,794	2,104

Table 5.4-5(2/4) INITIAL AND ANNUAL O&M COSTS OF CRITICAL GROUP RIVER MOUTHS IN ORDER OF PRIORITY (Case 1-2)

(Total costs in 5 years are equalized.) (Unit: '000 RM)

Priority	Serial	Name	State	Initial Cost	O&M Cost (Per Year)
	1	Perlis	Perlis	10,134	2,526
	2	Baru	Perlis	1,396	613
	5	Kedah	Kedah	8,437	2,327
	9	Muda	P.Pinang	1,044	641
	12	Pinang	P.Pinang	1,817	738
	14	Tg. Piandang	Perak	2,668	508
First	15	Gula	Perak	3,241	1,696
	19	Beruas	Perak	4,465	897
	23	Selangor	Selangor	920	519
	46	Endau	Johor	1,726	785
	51	Pahang	Pahang	10,024	59
	61	Marang	Terengganu	12,639	73
	67	Kelantan	Kelantan	4,810	28
	81	Mukah	Sarawak	35,080	204
				98,401	11,614
	3	Sanglang	Kedah	382	189
	30	Linggi	Melaka	345	140
	32	Melaka	Melaka	118	58
	43	Pontian Kecil	Johor	795	393
Second	44	Sedili Besar	Johor	841	525
	45	Mersing	Johor	42,322	241
	48	Rompin	Pahang	16,614	98
	55	Kemaman	Terengganu	94	85
	59	Dungun	Terengganu	534	343
	78	Sadong	Sarawak	1,008	568
				63,053	2,640
	4	Jerlun	Kedah	286	141
	6	Yan	Kedah	2,086	880
	8	Cenang	Kedah	2,092	850
	11	Kerian	P.Pinang	397	224
	50	Nenasi	Pahang	474	428
Third	53	Kuantan	Pahang	3,706	1,302
	58	Paka	Terengganu	122	122
	62	Terengganu	Terengganu	26,452	943
	80	Oya	Sarawak	2,107	168
	89	Padas	Sabah	226	127
	98	Tawau	Sabah	560	228
				38,508	5,413

Table 5.4-5(3/4) INITIAL AND ANNUAL O&M COSTS OF CRITICAL GROUP RIVER MOUTHS IN ORDER OF PRIORITY (Case 2-1 & 2-3)

(Initial costs are equalized.) (Unit: '000 RM)

Priority	Serial	Name	State	Initial Cost	O&M Cost (Per Year)
	1	Perlis	Perlis	10,134	2,526
	5	Kedah	Kedah	8,437	2,327
	14	Tg. Piandang	Perak	2,668	508
	19	Beruas	Perak	4,465	897
	30	Linggi	Melaka	345	140
First	46	Endau	Johor	1,726	785
	53	Kuantan	Pahang	3,706	1,302
	59	Dungun	Terengganu	534	343
	61	Marang	Terengganu	12,639	73
	67	Kelantan	Kelantan	4,810	28
				49,464	8,929
	9	Muda	P.Pinang	1,044	641
	23	Selangor	Selangor	920	519
	32	Melaka	Melaka	118	58
	43	Pontian Kecil	Johor	795	393
Second	44	Sedili Besar	Johor	841	525
	51	Pahang	Pahang	10,024	59
	55	Kemaman	Terengganu	94	85
	81	Mukah	Sarawak	35,080	204
	98	Tawau	Sabah	560	228
				49,476	2,712
	2	Baru	Perlis	1,396	613
	3	Sanglang	Kedah	382	189
	8	Cenang	Kedah	2,092	850
	12	Pinang	P.Pinang	1,817	738
Third	45	Mersing	Johor	42,322	241
	50	Nenasi	Pahang	474	428
	80	Oya	Sarawak	2,107	168
	89	Padas	Sabah	226	127
				50,816	3,354
	4	Jerlun	Kedah	286	141
	6	Yan	Kedah	2,086	880
	11	Kerian	P.Pinang	397	224
	15	Gula	Perak	3,241	1,696
Forth	48	Rompin	Pahang	16,614	98
	58	Paka	Terengganu	122	122
	62	Terengganu	Terengganu	26,452	943
	78	Sadong	Sarawak	1,008	568
				50,206	4,672

Table 5.4-5(4/4) INITIAL AND ANNUAL O&M COSTS OF CRITICAL GROUP RIVER MOUTHS IN ORDER OF PRIORITY
(Case 2-2)

(Initial costs are equalized.) (Unit: '000 RM)

Priority	Serial	Name	State	Initial Cost	O&M Cost (Per Year)
	1	Perlis	Perlis	10,134	2,526
	2	Baru	Perlis	1,396	613
	5	Kedah	Kedah	8,437	2,327
	9	Muda	P.Pinang	1,044	641
	12	Pinang	P.Pinang	1,817	738
First	14	Tg. Piandang	Perak	2,668	508
	15	Gula	Perak	3,241	1,696
	19	Beruas	Perak	4,465	897
	23	Selangor	Selangor	920	519
	46	Endau	Johor	1,726	785
	51	Pahang	Pahang	10,024	59
	53	Kuantan	Pahang	3,706	1,302
	61	Marang	Terengganu	12,639	73
	67	Kelantan	Kelantan	4,810	28
				67,027	12,712
	3	Sanglang	Kedah	382	189
	8	Cenang	Kedah	2,092	850
	30	Linggi	Melaka	345	140
	32	Melaka	Melaka	118	58
	43	Pontian Kecil	Johor	795	393
Second	44	Sedili Besar	Johor	841	525
	45	Mersing	Johor	42,322	241
	48	Rompin	Pahang	16,614	98
	50	Nenasi	Pahang	474	428
	55	Kemaman	Terengganu	94	85
	59	Dungun	Terengganu	534	343
	78	Sadong	Sarawak	1,008	568
	98	Tawau	Sabah	560	228
				66,179	4,146
	4	Jerlun	Kedah	286	141
	6	Yan	Kedah	2,086	880
	11	Kerian	P.Pinang	397	224
Third	58	Paka	Terengganu	122	122
	62	Terengganu	Terengganu	26,452	943
	80	Oya	Sarawak	2,107	168
	81	Mukah	Sarawak	35,080	204
	89	Padas	Sabah	226	127
				66,756	2,809

Table 5.4-6 COST DISBURSEMENT SCHEDULE OF THE FIRST PHASE PROJECT

(Unit : '000 RM)

Case	Item	Malaysia Plan 7th	8th	9th	10th
(Total costs are equalized.)					
	No. of River Mouths	21	35	35	35
Case 1-1	Initial Cost	132,939	67,023		
	Maintenance Cost	40,070	89,238	98,335	98,335
	Total Cost	173,009	156,261	98,335	98,335
	No. of River Mouths	14	24	35	35
Case 1-2	Initial Cost	98,401	63,053	38,508	
	Maintenance Cost	29,035	64,670	84,803	98,335
	Total Cost	127,436	127,723	123,311	98,335
	No. of River Mouths	9	21	26	35
Case 1-3	Initial Cost	89,983	42,956	45,229	21,794
	Maintenance Cost	18,518	58,588	83,978	93,075
	Total Cost	108,501	101,544	129,207	114,869
(Initial costs are equalized.)					
	No. of River Mouths	19	35	35	35
Case 2-1	Initial Cost	98,940	101,022		
	Maintenance Cost	29,103	78,270	98,335	98,335
	Total Cost	128,043	179,292	98,335	98,335
	No. of River Mouths	14	27	35	35
Case 2-2	Initial Cost	67,027	66,179	66,756	
	Maintenance Cost	31,780	73,925	91,313	98,335
	Total Cost	98,807	140,104	158,069	98,335
	No. of River Mouths	10	19	27	35
Case 2-3	Initial Cost	49,464	49,476	50,816	50,206
	Maintenance Cost	22,323	51,425	66,590	86,655
	Total Cost	71,787	100,901	117,406	136,861

Note : No. of fishermen : 22,105
Maintenance cost per capita : RM98,335 / 22,105 / 5years = RM 890/person
Average product per capita : RM 22,155
Burden for maintenance : 890 / 22,155 = 4%
Per kilogram of product : RM 2.1/kg x 4% = RM 0.084/kg

Table 5.4-7 PRIORITIZATION OF RIVER MOUTHS FOR FIRST PHASE PROJECT

(Unit: '000 RM)

Priority/ Expected Construction Period	Serial	Name	State	Initial Cost	O&M Cost (Per Year)	Agency Concerned
	1	Perlis	Perlis	10,134	2,526	MOT
	5	Kedah	Kedah	8,437	2,327	MOT
First Priority	14	Tg. Piandang	Perak	2,668	508	MOA
	19	Beruas	Perak	4,465	897	MOA
(The First Half	30	Linggi	Melaka	345	140	MOA
of the 7th	46	Endau	Johor	1,726	785	MOA
Malaysia Plan)	53	Kuantan	Pahang	3,706	1,302	MOA
	59	Dungun	Terengganu	534	343	MOT
	61	Marang	Terengganu	12,639	73	MOA
	67	Kelantan	Kelantan	4,810	28	MOT
				49,464	8,929	
	9	Muda	P.Pinang	1,044	641	MOA
Second Priority	23	Selangor	Selangor	920	519	MOA
	32	Melaka	Melaka	118	58	MOA
(The Latter Half	43	Pontian Kecil	Johor	795	393	MOA
of the 7th	44	Sedili Besar	Johor	841	525	MOA
Malaysia Plan)	51	Pahang	Pahang	10,024	59	MOA
	55	Kemaman	Terengganu	94	85	MOA
	81	Mukah	Sarawak	35,080	204	MOA
	98	Tawau	Sabah	560	228	MOA
				49,476	2,712	
	2	Baru	Perlis	1,396	613	MOA
Third Priority	3	Sanglang	Kedah	382	189	MOA
	8	Cenang	Kedah	2,092	850	MOA
(The First Half	12	Pinang	P.Pinang	1,817	738	MOA
of the 8th	45	Mersing	Johor	42,322	241	MOT
Malaysia Plan)	50	Nenasi	Pahang	474	428	MOA
	80	Oya	Sarawak	2,107	168	MOA
	89	Padas	Sabah	226	127	MOA
				50,816	3,354	
	4	Jerlun	Kedah	286	141	MOA
Forth Priority	6	Yan	Kedah	2,086	880	MOA
	11	Kerian	P.Pinang	397	224	MOA
(The Latter Half	15	Gula	Perak	3,241	1,696	MOA
of the 8th	48	Rompin	Pahang	16,614	98	MOA
Malaysia Plan)	58	Paka	Terengganu	122	122	MOA
	62	Terengganu	Terengganu	26,452	943	MOT
	78	Sadong	Sarawak	1,008	568	MOA
				50,206	4,672	

Table 5.4-8 ANNUAL CASH FLOW OF THE FIRST PHASE PROJECT

Unit : '000 RM

No.	Year	Economic Project Cost*1			Benefit			Annual Cash Flow
		Capital	Maintenance	Total	1st & 2nd Group	3rd & 4th Group	Total	
1	1996	24,240	0	24,240	0	0	0	-24,240
2	1997	24,240	2,852	27,091	6,828	0	6,828	-20,263
3	1998	24,240	5,703	29,943	13,930	0	13,930	-16,013
4	1999	24,240	8,556	32,796	21,312	0	21,312	-11,484
5	2000	24,240	11,408	35,648	28,983	0	28,983	-6,665
6	2001	24,749	14,260	39,009	36,952	0	36,952	-2,057
7	2002	24,749	16,226	40,975	37,690	1,395	39,086	-1,889
8	2003	24,749	18,192	42,941	38,443	2,846	41,289	-1,651
9	2004	24,749	20,159	44,908	39,211	4,354	43,565	-1,343
10	2005	24,749	22,125	46,874	39,994	5,921	45,916	-959
11	2006		24,091	24,091	39,994	7,023	47,017	22,926
12	2007		24,091	24,091	39,994	7,023	47,017	22,926
13	2008		24,091	24,091	39,994	7,023	47,017	22,926
14	2009		24,091	24,091	39,994	7,023	47,017	22,926
15	2010		24,091	24,091	39,994	7,023	47,017	22,926
16	2011		24,091	24,091	39,994	7,023	47,017	22,926
17	2012		24,091	24,091	39,994	7,023	47,017	22,926
18	2013		24,091	24,091	39,994	7,023	47,017	22,926
19	2014		24,091	24,091	39,994	7,023	47,017	22,926
20	2015		24,091	24,091	39,994	7,023	47,017	22,926
21	2016		24,091	24,091	39,994	7,023	47,017	22,926
22	2017		24,091	24,091	39,994	7,023	47,017	22,926
23	2018		24,091	24,091	39,994	7,023	47,017	22,926
24	2019		24,091	24,091	39,994	7,023	47,017	22,926
25	2020		24,091	24,091	39,994	7,023	47,017	22,926
26	2021		24,091	24,091	39,994	7,023	47,017	22,926
27	2022		24,091	24,091	39,994	7,023	47,017	22,926
28	2023		24,091	24,091	39,994	7,023	47,017	22,926
29	2024		24,091	24,091	39,994	7,023	47,017	22,926
30	2025		24,091	24,091	39,994	7,023	47,017	22,926
31	2026		24,091	24,091	39,994	7,023	47,017	22,926
32	2027		24,091	24,091	39,994	7,023	47,017	22,926
33	2028		24,091	24,091	39,994	7,023	47,017	22,926
34	2029		24,091	24,091	39,994	7,023	47,017	22,926
35	2030		24,091	24,091	39,994	7,023	47,017	22,926
36	2031		24,091	24,091	39,994	7,023	47,017	22,926
37	2032		24,091	24,091	39,994	7,023	47,017	22,926
38	2033		24,091	24,091	39,994	7,023	47,017	22,926
39	2034		24,091	24,091	39,994	7,023	47,017	22,926
40	2035		24,091	24,091	39,994	7,023	47,017	22,926

*1 : Conversion rate = 0.88

Internal Rate of Return (IRR) = 11.52%

B/C (annual discount rate ; 8%) = 1.138

Table 5.5-1 FEATURES OF RIVER MOUTH

Coast	Serial	Name	Catchment Area (km2)	No. of Fishing Boats	No. of Fishermen	No. of Commercial Boats	Expected Minimum Water Depth (m)	B/C Ratio
	5	Kedah*	3,060	536	1,716	77	3.0	2.85
Muddy	14	Tg.Piandang	9	486	1,042		1.5	1.73
(West)	19	Beruas*	220	655	1,595	-	0.9	2.23
	23	Selangor	1,820	189	397	-	1.2	0.10
Sandy	1	Perlis*	600	432	2,333	20	0.6	2.40
(West)	9	Muda*	4,300	201	504	-	1.0	0.14
	32	Melaka	500	111	311	**	1.2	0.26
	45	Mersing*	250	290	435	**	0.8	0.39
Sandy	53	Kuantan*	1,710	163	570	45	2.6	1.70
(East)	61	Marang*	360	188	715	-	0.5	1.49
	62	Terengganu*	4,650	107	417	161	3.3	0.34
	67	Kelantan*	12,900	208	666	**	1.7	0.88

* : Dredging work has been conducted or scheduled.

** : Data is not available.

Table 5.5-2 SUMMARY OF UNIT CONSTRUCTION COST

	Work Item	Unit	Calculated Unit Cost (RM)
1.	Dredging by Grab (Clamshell) Dredger for Muddy Soil (Average Hauling Dis. 3.0 km)	cu.m.	8.50
	- for Outer Channel (Hauling dis. = 2.0 km)	cu.m.	7.60
	- for Inner Channel (Hauling dis. = 3.5 km)	cu.m.	9.50
2.	Dredging by Cutter Suction Dredger for Loose Sand (Average Hauling Dis. 600 m)	cu.m.	6.44
3.	Dredging by Breaker and Grab Dredger for Soft Rock	cu.m.	20.00
4.	Excavation for Structure	cu.m.	3.68
5.	Embankment for Bund (Using excavated material nearby Bund)	cu.m.	3.08
6.	Embankment by Using Borrow Pit Material	cu.m.	16.36
7.	Clearing and Grubbing	sq.m.	0.78
8.	Sodding	sq.m.	5.51
9.	Gravel Pavement	sq.m.	4.63
10.	Stone Masonry with Concrete	cu.m.	137.04
11.	Supply,Delivery and Placing Gabion mattress (1.5m x 1.2m x 0.5m)	sq.m.	58.81
12.	Supply,Delivery and Placing Geo-textile Mat	sq.m.	29.34
13.	Concrete without Reinforcing Bar	cu.m.	195.00
14.	Supply,Delivery and Placing Rock/Stone		
	1) Armor Stone 1 , 3 - 5 ton	cu.m.	87.94
	2) Armor Stone 2 , 1 - 3 ton	cu.m.	84.79
	3) Secondary Stone , 300 - 500 kg	cu.m.	63.48
	4) Core Stone 1 , 100 - 300 kg	cu.m.	60.10
	5) Core Stone 2 , 10 - 100 kg	cu.m.	55.31
15.	Wooden Works for Jetty	ea.	16,200
16.	Bank protection for River Mouth Reservoir	m	10.00

NOTE:

1. Unit costs are composed of direct cost and indirect cost. Direct cost includes material, labor and equipment costs, and indirect cost covers overhead contingencies, miscellaneous and profit of the contractor.
2. Unit cost of dredging does not include spoil bank treatment cost.
3. Assumed that rock materials are locally available (within 30 km).

Table 5.5-3 PROJECT COST OF TG. PIANDANG RIVER MOUTH IMPROVEMENT

Work Items	Unit	Quantit	Unit Cost (RM)	Total (RM)
I. Main Construction				1,471,000
1. Preparatory Works (10% of Main & Miscel. Works including Mobilization/Demobil.)	l.s.	1		134,000
2. Main Works				1,215,000
(1) Navigation channel Dredging				
1) Dredging for Muddy Soil (Outer)	cu.m.	56,500	7.60	429,000
2) Dredging for Muddy Soil (Inner)	cu.m.	58,900	9.50	560,000
3) Lighting Equipment and others	l.s.	1	70,000	70,000
(2) Jetty Works for Fishing Boat				
1) Clearing and Grubbing	sq.m.	2,000	0.78	2,000
2) Filling (Using Job Site Materials)	cu.m	300	3.08	1,000
3) Embankment(Using Borrow Pit Materials)	cu.m	300	16.36	5,000
4) Gravel Pavement 20 cm thick	sq.m.	2,800	4.63	13,000
5) Wooden Works for Jetty	ea.	3	16,200	49,000
6) Jetty House	l.s.	1	18,000	18,000
(3) Bank Protection				
1) Stone Masonry (Using concrete)	cu.m	42	137.04	6,000
2) Gabion Mattress (3.0m x 1.2m x 0.5m)	sq.m.	1,050	58.81	62,000
3. Miscellaneous Works (10% of Main Works)	l.s.	1		122,000
II. Compensation	sq.m.	0		0
III. Engineering and Administration Cost (10 % of Main construction)	l.s.	1		147,000
IV. Physical Contingencies (10 % of (I + II + III))	l.s.	1		162,000
Sub - Total				1,780,000
V. Price Escalation				129,000
TOTAL				1,909,000

Note:
- All costs are expressed based on the price level of late 1992 and an annual escalation rate is assumed at 2.4%.
- Assuming that engineering services will commence in 1994 and construction will terminat in 1995.

Table 5.5-4 ANNUAL CASH FLOW OF TG. PIANDANG RIVER MOUTH IMPROVEMENT PROJECT

Unit : '000 RM

No.	Year	Economic Project Cost					Fishery Benefit	Annual Cash Flow
		Construc-tion	Eng. and Admi.	Physical Conti.	Mainte-nance	Total		
1	1994		88.0	8.8		96.8		-96.8
2	1995	1,294.5	59.0	135.3		1,488.8		-1,488.8
3	1996		60.0	6.0	528.0	594.0	899.4	305.4
4	1997		60.0	6.0	528.0	594.0	891.8	297.8
5	1998		60.0	6.0	528.0	594.0	884.2	290.2
6	1999		60.0	6.0	528.0	594.0	876.6	282.6
7	2000		60.0	6.0	528.0	594.0	869.0	275.0
8	2001		60.0	6.0	528.0	594.0	862.0	268.0
9	2002		60.0	6.0	528.0	594.0	855.0	261.0
10	2003		60.0	6.0	528.0	594.0	848.0	254.0
11	2004		60.0	6.0	528.0	594.0	841.0	247.0
12	2005		60.0	6.0	528.0	594.0	834.0	240.0
13	2006		60.0	6.0	528.0	594.0	834.0	240.0
14	2007		60.0	6.0	528.0	594.0	834.0	240.0
15	2008		60.0	6.0	528.0	594.0	834.0	240.0
16	2009		60.0	6.0	528.0	594.0	834.0	240.0
17	2010		60.0	6.0	528.0	594.0	834.0	240.0
18	2011		60.0	6.0	528.0	594.0	834.0	240.0
19	2012		60.0	6.0	528.0	594.0	834.0	240.0
20	2013		60.0	6.0	528.0	594.0	834.0	240.0
21	2014		60.0	6.0	528.0	594.0	834.0	240.0
22	2015		60.0	6.0	528.0	594.0	834.0	240.0
23	2016		60.0	6.0	528.0	594.0	834.0	240.0
24	2017		60.0	6.0	528.0	594.0	834.0	240.0
25	2018		60.0	6.0	528.0	594.0	834.0	240.0
26	2019		60.0	6.0	528.0	594.0	834.0	240.0
27	2020		60.0	6.0	528.0	594.0	834.0	240.0
28	2021		60.0	6.0	528.0	594.0	834.0	240.0
29	2022		60.0	6.0	528.0	594.0	834.0	240.0
30	2023		60.0	6.0	528.0	594.0	834.0	240.0
31	2024		60.0	6.0	528.0	594.0	834.0	240.0
32	2025		60.0	6.0	528.0	594.0	834.0	240.0
33	2026		60.0	6.0	528.0	594.0	834.0	240.0
34	2027		60.0	6.0	528.0	594.0	834.0	240.0
35	2028		60.0	6.0	528.0	594.0	834.0	240.0
36	2029		60.0	6.0	528.0	594.0	834.0	240.0
37	2030		60.0	6.0	528.0	594.0	834.0	240.0
38	2031		60.0	6.0	528.0	594.0	834.0	240.0
39	2032		60.0	6.0	528.0	594.0	834.0	240.0
40	2033		60.0	6.0	528.0	594.0	834.0	240.0

Internal Rate of Return (IRR) = 16.98%

B/C (annual discount rate ; 8%) = 1.173

Table 5.5-5 PROJECT COST OF MARANG RIVER MOUTH IMPROVEMENT

Work Items	Unit	Quantity	Unit Cost (RM)	Total (RM)
I. Main Construction				11,722,000
1. Preparatory Works (10% of Main & Misce. works including Mobilization and Demobilization of Dredger & Vessels)	l.s.	1	1,066,000	1,066,000
2. Main Works				10,149,000
(1) Breakwater				
1) Armor Stone 1 , 3 - 5 ton (Supply,Delivery and Placing Rock)	cu.m.	15,700	87.94	1,381,000
2) Secondary stone , 300 - 500 kg (Supply,Delivery and Placing Rock)	cu.m.	11,200	63.48	711,000
3) Core Stone 1 , 100 - 300 kg (Supply,Delivery and Placing Rock)	cu.m.	11,300	60.10	679,000
4) Supply, Delivery and Placing Geotextile Mat	sq.m.	2,200	29.34	65,000
(2) North Jetty				
1) Armor Stone 2 , 1 - 3 ton (Supply,Delivery and Placing Rock)	cu.m.	19,600	84.79	1,662,000
2) Core Stone 2 , 10 - 100 kg (Supply,Delivery and Placing Rock)	cu.m.	18,800	55.31	1,040,000
3) Supply, Delivery and Placing Geotextile Mat	sq.m.	2,450	29.34	72,000
(3) South Jetty				
1) Armor Stone 2 , 1 - 3 ton (Supply,Delivery and Placing Rock)	cu.m.	12,600	84.79	1,068,000
2) Core Stone 2 , 10 - 100 kg (Supply,Delivery and Placing Rock)	cu.m.	10,900	55.31	603,000
3) Supply ,Delivery and Placing Geotextile Mat	sq.m.	2,250	29.34	66,000
(4) Coastal Groin				
1) Armor Stone 2 , 1 - 3 ton	cu.m.	9,900	84.79	839,000
2) Core Stone , 10 - 100 kg	cu.m	7,800	55.31	431,000
(5) River Groin				
1) Armor Stone 2 , 1 - 3 ton	cu.m.	1,840	84.79	156,000
2) Core Stone , 10 - 100 kg	cu.m.	720	55.31	40,000
(6) Navigation channel Work				
1) Dredging for Loose Sand	cu.m.	109,000	6.44	702,000
2) Dredging for Soft Rock	cu.m.	22,000	20.00	440,000
3) Pipe Line Setting	l.s.	1	133,000	133,000
4) Spoil Bank Treatment	l.s.	1	20,000	20,000
(7) Reservoir	m	4,100	10.00	41,000
3. Miscellaneous Works (5% of Main Works)	l.s.	1		507,000
II. Compensation	sq.m.	0	-	0
III. Engineering and Administration Cost (10 % of Main Construction)	l.s.	1	1,172,000	1,172,000
IV. Contingencies (10 % of I + II + III)	l.s.	1	1,289,000	1,289,000
Sub-Total				14,183,000
V. Price Escalation				1,183,000
TOTAL				15,366,000

Table 5.5-6 ANNUAL DISBURSEMENT SCHEDULE OF MARANG RIVER MOUTH IMPROVEMENT PROJECT

Unit : RM

Description	Amount	First Year (1994)	Second Year (1995)	Third Year (1996)
I. Main Construction	11,722,000	-	6,753,000	4,969,000
1. Preparatory Works	1,066,000	-	614,000	452,000
2. Breakwater				
Armor Stone 1	1,381,000	-	1,381,000	-
Armor Stone 2	0	-	0	-
Secondary Stone	711,000	-	711,000	-
Core Stone 1	679,000	-	679,000	-
Geotextile	65,000	-	65,000	-
3. North Jetty				
Armor Stone 2	1,662,000	-	1,662,000	-
Core Stone 2	1,040,000	-	1,040,000	-
Geotextile	72,000	-	72,000	-
4. South Jetty				
Armor Stone 2	1,068,000	-	-	1,068,000
Core Stone 2	603,000	-	-	603,000
Geotextile	66,000	-	-	66,000
5. Coastal Groin				
Armor Stone 2	839,000	-	-	839,000
Core Stone 2	431,000	-	-	431,000
6. River Groin				
Armor Stone 2	156,000	-	156,000	-
Core Stone 2	40,000	-	40,000	-
7. Navigation Channel Work				
Dredging (Sand)	702,000	-	-	702,000
Dredging (Soft Rock)	440,000	-	-	440,000
Pipe Line Setting	133,000	-	-	133,000
Spoil Bank Treatment	20,000	-	-	20,000
8. Reservoir	41,000		41,000	
9. Miscellaneous Works	507,000	-	292,000	215,000
II. Compensation	-	-	-	-
III. Engineering and Administration Cost	1,172,000	469,000	387,000	316,000
IV. Physical Contingencies	1,289,000	47,000	714,000	529,000
Sub-Total	14,183,000	516,000	7,854,000	5,814,000
V. Price Contingencies	1,183,000	25,000	579,000	579,000
TOTAL	15,366,000	541,000	8,433,000	6,393,000

Note:

(1) All costs are expressed at on the price level of late 1992 and an annual escalation rate is assumed at 2.4%.

(2) Annually recurrent O & M cost after the year 1997 is estimated to be RM 227,000 including administration cost of RM 21,000.

Table 5.5-7 ECONOMIC COST OF MARANG RIVER MOUTH IMPROVEMENT PROJECT

(Unit : RM)

Description	Amount	Firat Year (1994)	Second Year (1995)	Third Year (1996)
I. Main Construction	10,315,360	-	5,942,640	4,372,720
1. Preparatory Works	938,080	-	540,320	397,760
2. Breakwater	2,495,680	-	2,495,680	0
3. North Jetty	2,441,120	-	2,441,120	0
4. South Jetty	1,528,560	-	0	1,528,560
5. Coastal Groin	1,117,600	-	0	1,117,600
6. River Groin	172,480		172,480	0
7. Navigation Channel Work	1,139,600	-	0	1,139,600
8. Reservoir	36,080	-	36,080	0
9. Miscellaneous Works	446,160	-	256,960	189,200
II. Compensation	-	-	0	0
III. Engineering and Administration Cost	1,172,000	469,000	387,000	316,000
IV. Physical Contingency	1,148,736	46,900	632,964	468,872
TOTAL	12,636,096	515,900	6,962,604	5,157,592

Table 5.5-8 ANNUAL CASH FLOW OF MARANG RIVER MOUTH IMPROVEMENT PROJECT

Unit : '000 Ringgit

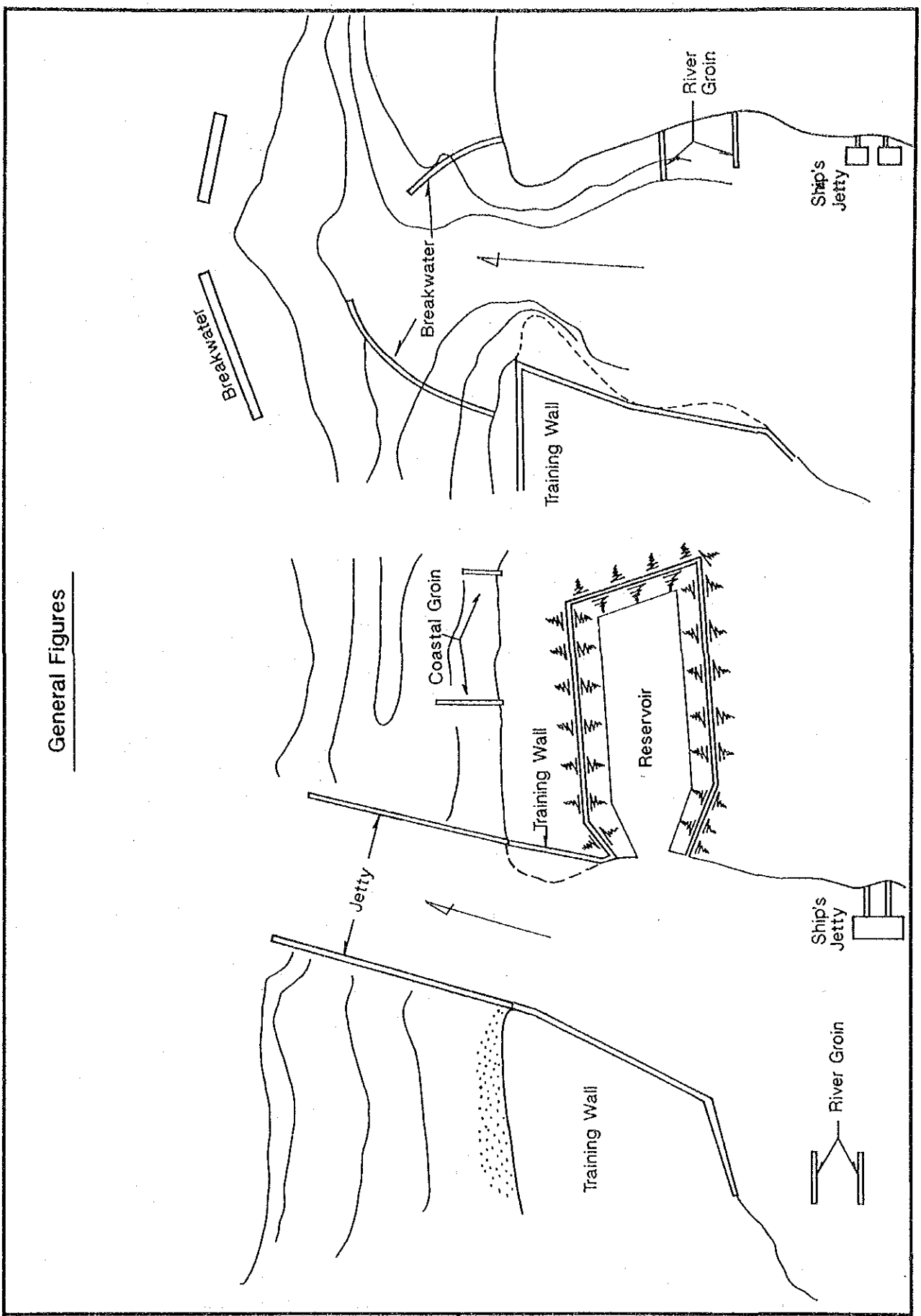
No.	Year	Economic Project Cost					Benefit			Annual Cash Flow
		Construc-tion	Eng. & Admi.	Physical Conti.	Mainte-nance	Total	Fishery	Sea Trans.	Total	
1	1994		469.0	46.9		515.9				-515.9
2	1995	5,942.6	387.0	633.0		6,962.6				-6,962.6
3	1996	4,372.7	316.0	468.9		5,157.6	745.8	183.3	929.1	-4,228.5
4	1997		21.0	2.1	181.3	204.4	1,152.6	281.0	1,433.6	1,229.2
5	1998		21.0	2.1	181.3	204.4	1,186.4	286.0	1,472.4	1,268.0
6	1999		21.0	2.1	181.3	204.4	1,220.2	292.0	1,512.2	1,307.8
7	2000		21.0	2.1	181.3	204.4	1,254.0	298.0	1,552.0	1,347.6
8	2001		21.0	2.1	181.3	204.4	1,287.6	304.0	1,591.6	1,387.2
9	2002		21.0	2.1	181.3	204.4	1,321.2	310.0	1,631.2	1,426.8
10	2003		21.0	2.1	181.3	204.4	1,354.8	316.0	1,670.8	1,466.4
11	2004		21.0	2.1	181.3	204.4	1,388.4	322.0	1,710.4	1,506.0
12	2005		21.0	2.1	181.3	204.4	1,422.0	329.0	1,751.0	1,546.6
13	2006		21.0	2.1	181.3	204.4	1,422.0	329.0	1,751.0	1,546.6
14	2007		21.0	2.1	181.3	204.4	1,422.0	329.0	1,751.0	1,546.6
15	2008		21.0	2.1	181.3	204.4	1,422.0	329.0	1,751.0	1,546.6
16	2009		21.0	2.1	181.3	204.4	1,422.0	329.0	1,751.0	1,546.6
17	2010		21.0	2.1	181.3	204.4	1,422.0	329.0	1,751.0	1,546.6
18	2011		21.0	2.1	181.3	204.4	1,422.0	329.0	1,751.0	1,546.6
19	2012		21.0	2.1	181.3	204.4	1,422.0	329.0	1,751.0	1,546.6
20	2013		21.0	2.1	181.3	204.4	1,422.0	329.0	1,751.0	1,546.6
21	2014		21.0	2.1	181.3	204.4	1,422.0	329.0	1,751.0	1,546.6
22	2015		21.0	2.1	181.3	204.4	1,422.0	329.0	1,751.0	1,546.6
23	2016		21.0	2.1	181.3	204.4	1,422.0	329.0	1,751.0	1,546.6
24	2017		21.0	2.1	181.3	204.4	1,422.0	329.0	1,751.0	1,546.6
25	2018		21.0	2.1	181.3	204.4	1,422.0	329.0	1,751.0	1,546.6
26	2019		21.0	2.1	181.3	204.4	1,422.0	329.0	1,751.0	1,546.6
27	2020		21.0	2.1	181.3	204.4	1,422.0	329.0	1,751.0	1,546.6
28	2021		21.0	2.1	181.3	204.4	1,422.0	329.0	1,751.0	1,546.6
29	2022		21.0	2.1	181.3	204.4	1,422.0	329.0	1,751.0	1,546.6
30	2023		21.0	2.1	181.3	204.4	1,422.0	329.0	1,751.0	1,546.6
31	2024		21.0	2.1	181.3	204.4	1,422.0	329.0	1,751.0	1,546.6
32	2025		21.0	2.1	181.3	204.4	1,422.0	329.0	1,751.0	1,546.6
33	2026		21.0	2.1	181.3	204.4	1,422.0	329.0	1,751.0	1,546.6
34	2027		21.0	2.1	181.3	204.4	1,422.0	329.0	1,751.0	1,546.6
35	2028		21.0	2.1	181.3	204.4	1,422.0	329.0	1,751.0	1,546.6
36	2029		21.0	2.1	181.3	204.4	1,422.0	329.0	1,751.0	1,546.6
37	2030		21.0	2.1	181.3	204.4	1,422.0	329.0	1,751.0	1,546.6
38	2031		21.0	2.1	181.3	204.4	1,422.0	329.0	1,751.0	1,546.6
39	2032		21.0	2.1	181.3	204.4	1,422.0	329.0	1,751.0	1,546.6
40	2033		21.0	2.1	181.3	204.4	1,422.0	329.0	1,751.0	1,546.6

Internal Rate of Return (IRR) = 11.12%

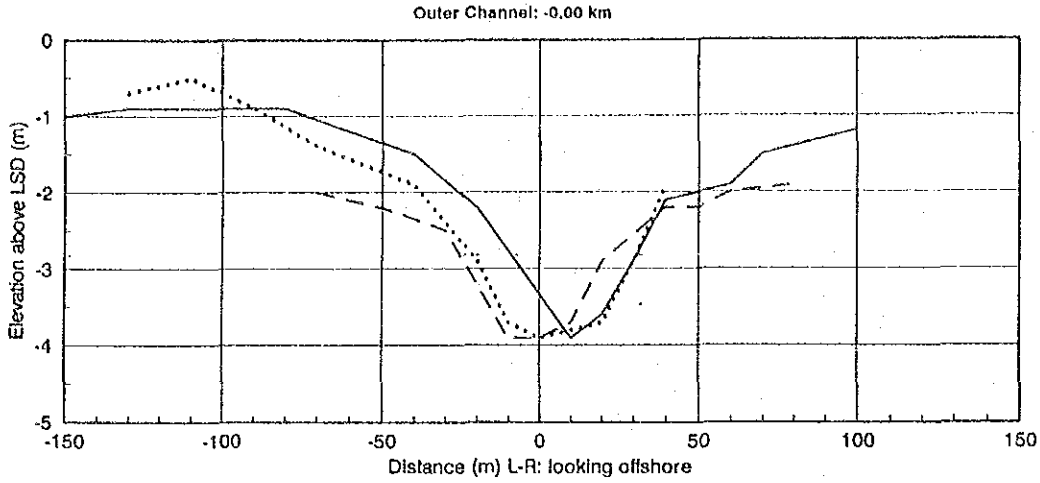
B/C (annual discount rate ; 8%) = 1.302

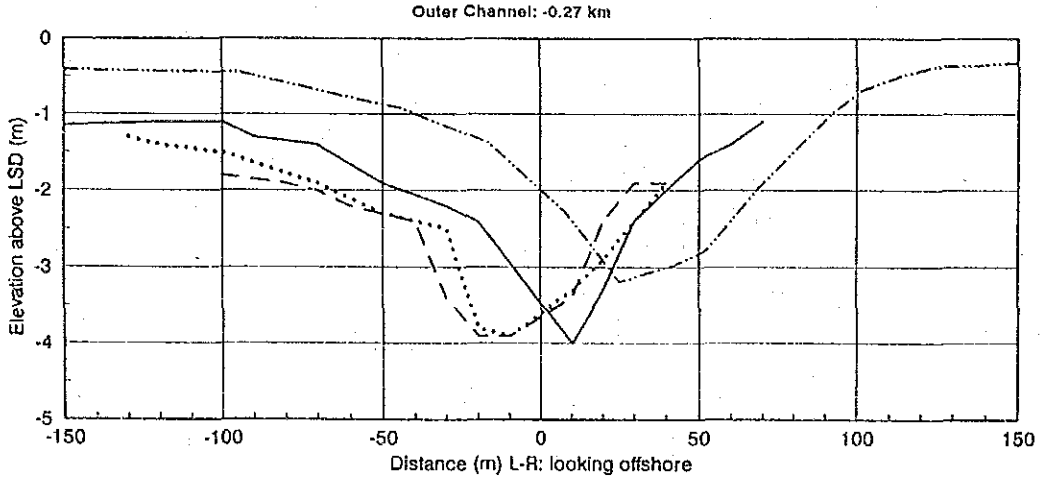
Note : It is assumed that 2/3 (66.6%) of the benefit in 1996 may accrue due to progress of dredging works.

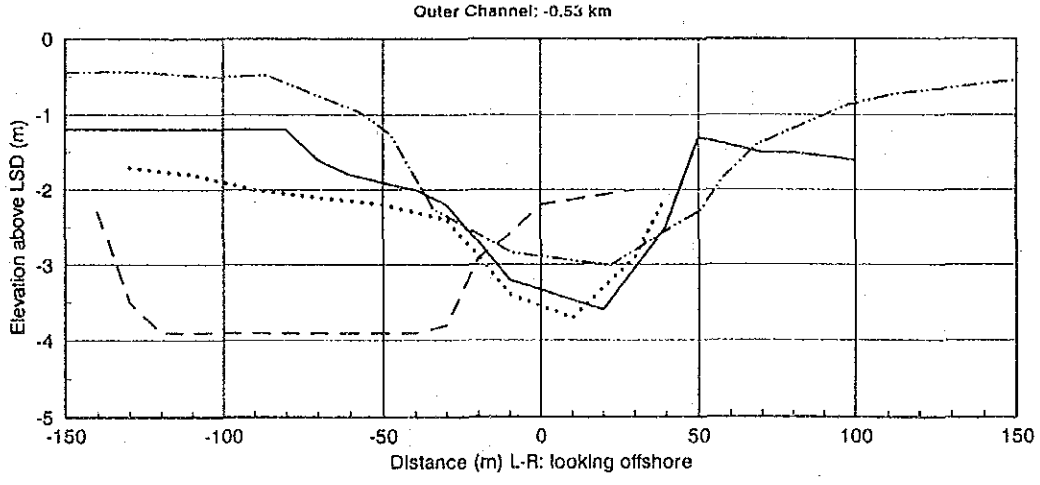
FIGURES

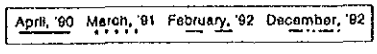


THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	GENERAL FIGURES OF PROPOSED STRUCTURES
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. 5.2-1

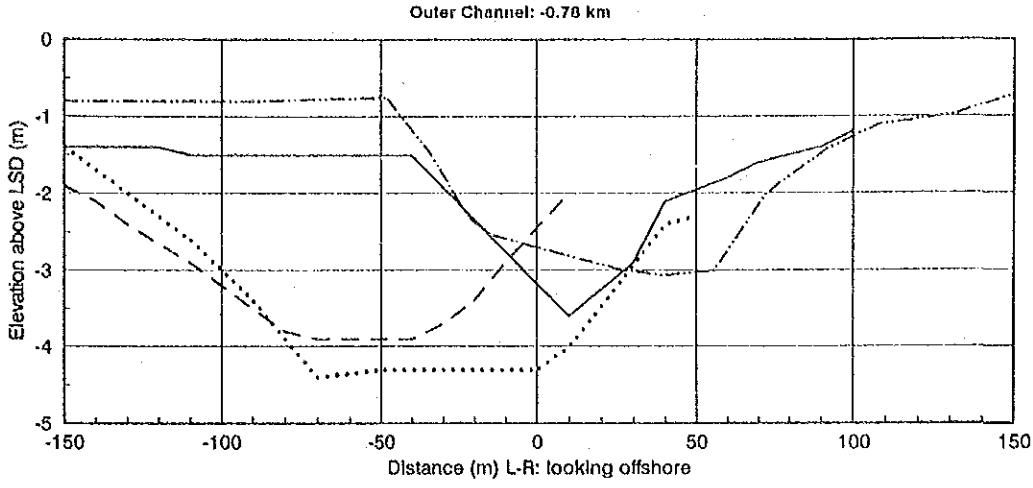


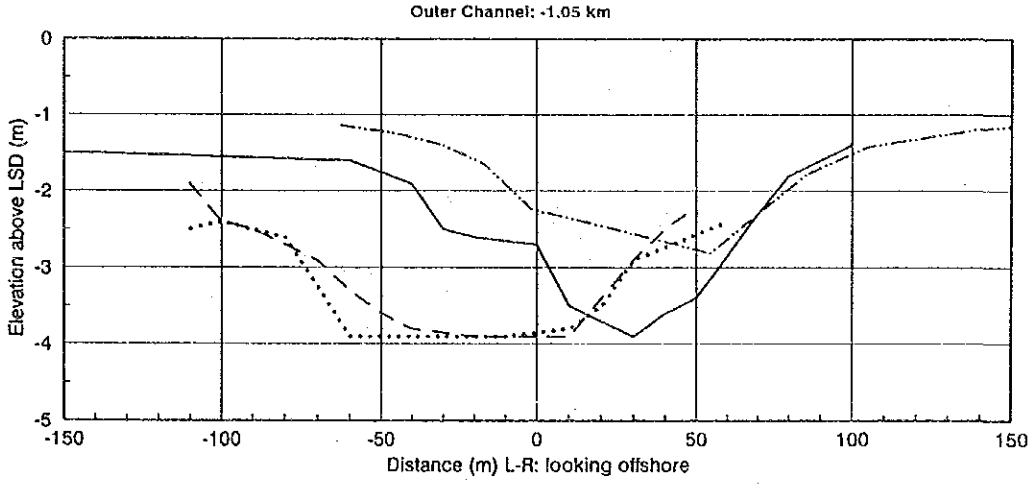


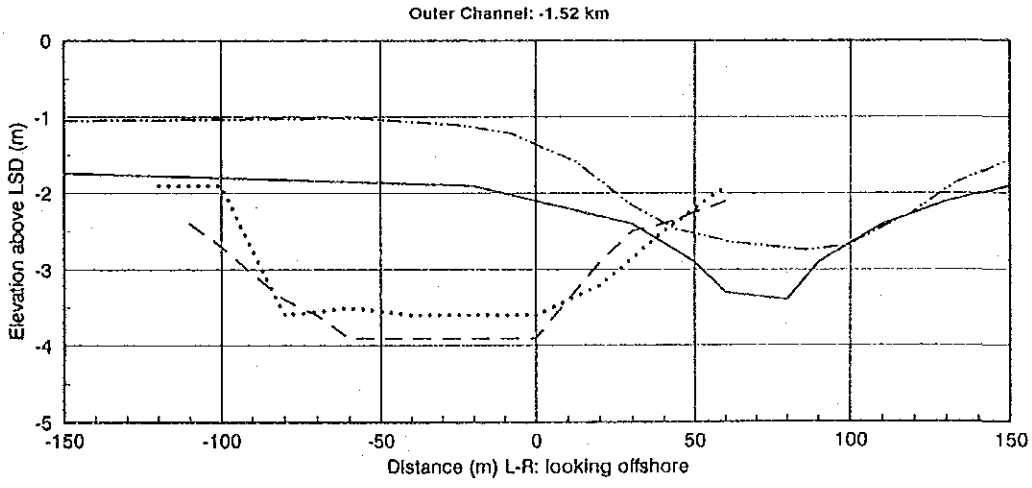




THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	COMPARISON OF OUTER CHANNEL CROSS SECTIONS OF PERLIS RIVER MOUTH
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.5.2-2(1/3)

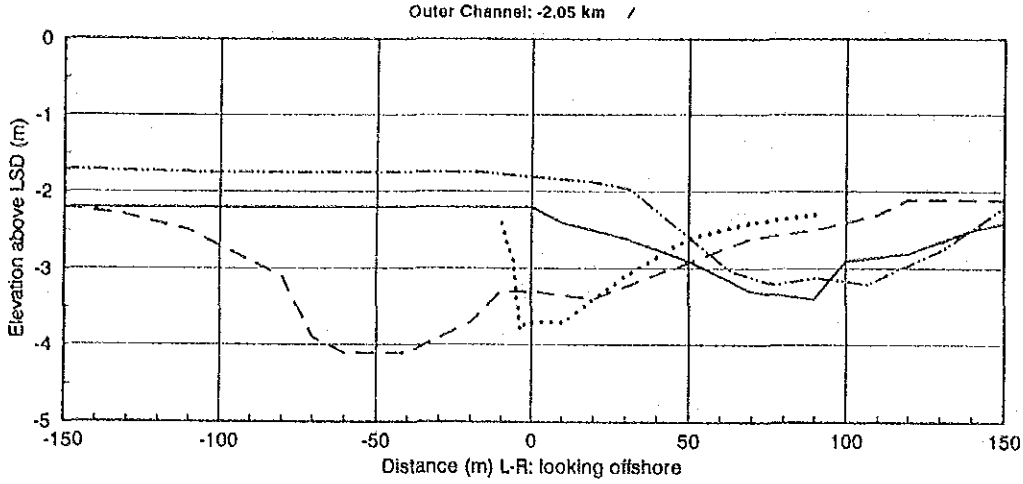


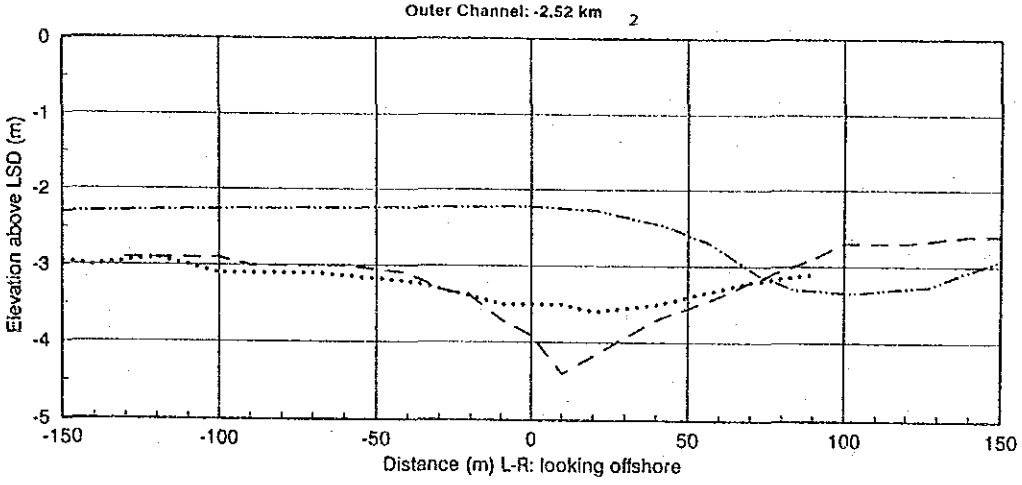


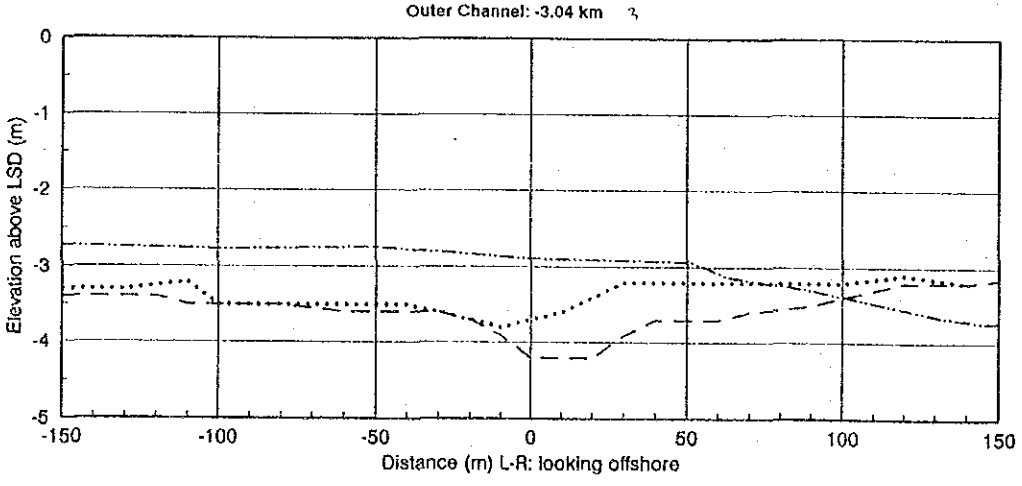


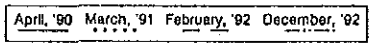
April, '90 March, '91 February, '92 December, '92

THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	COMPARISON OF OUTER CHANNEL CROSS SECTIONS OF PERLIS RIVER MOUTH
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.5.2-2(2/3)

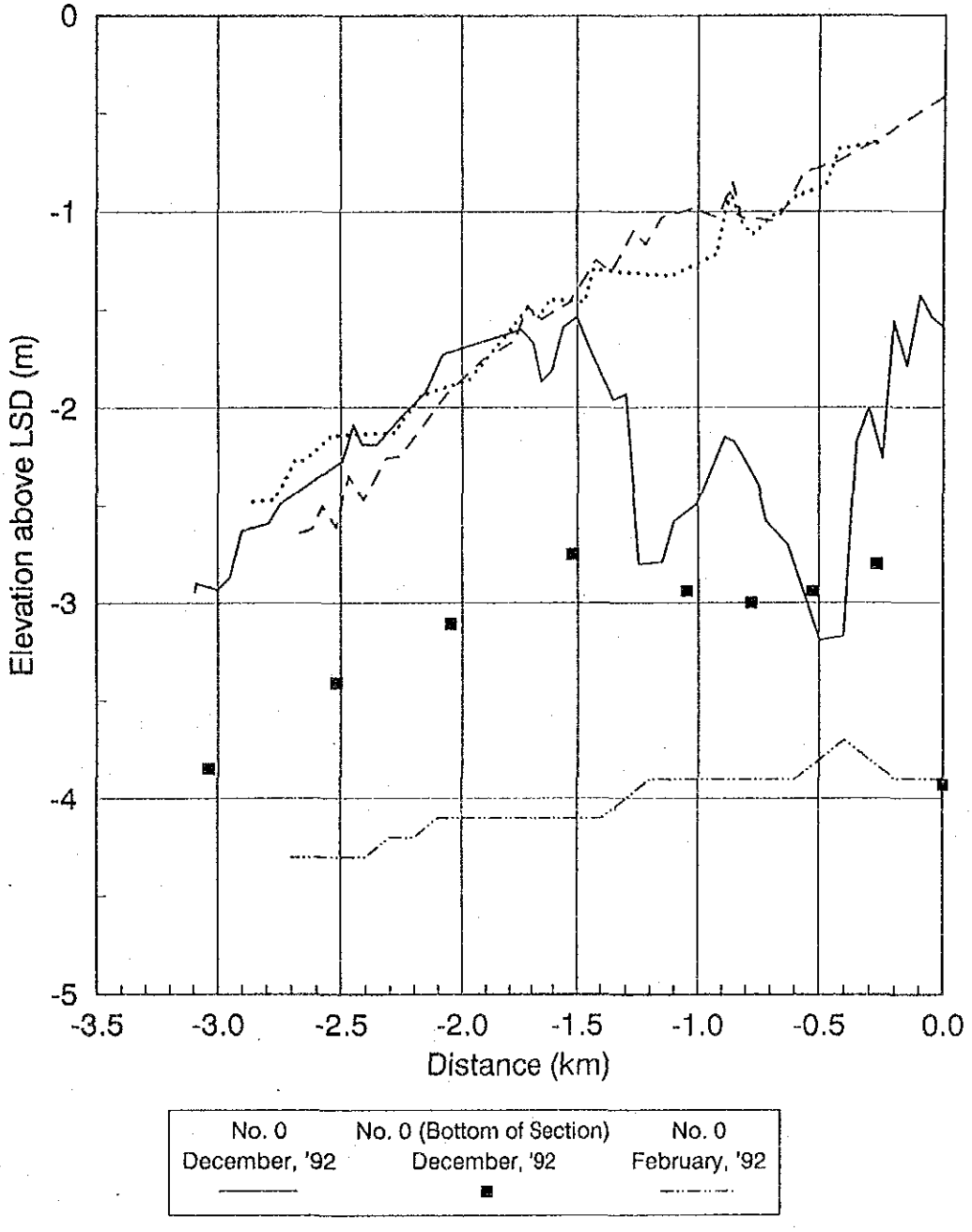




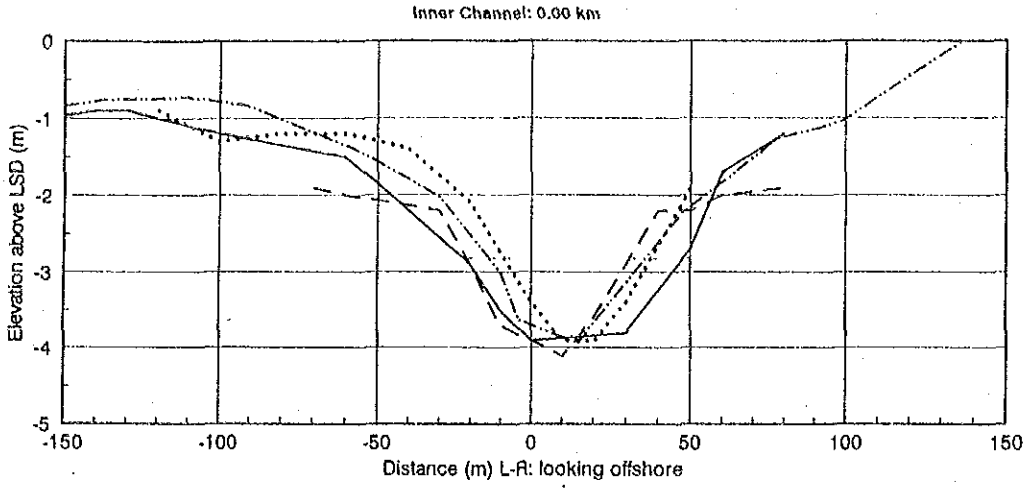


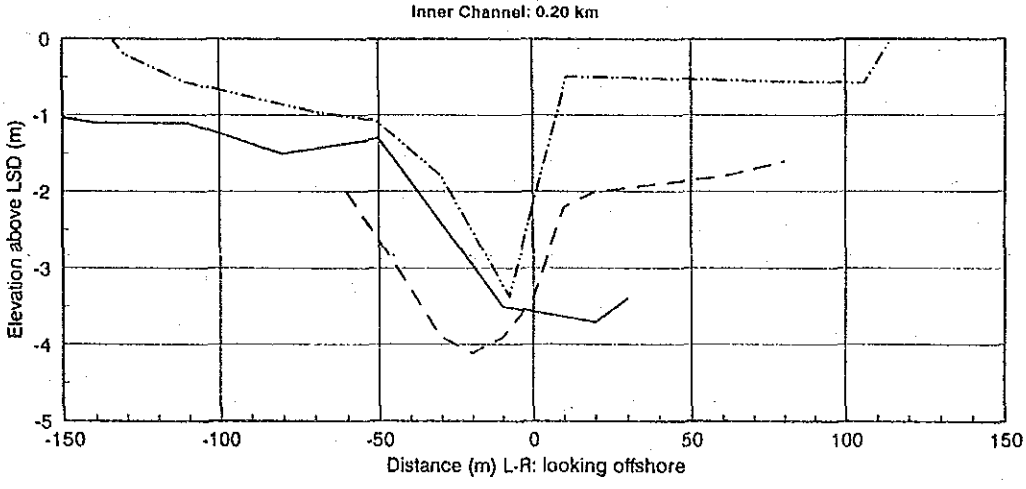


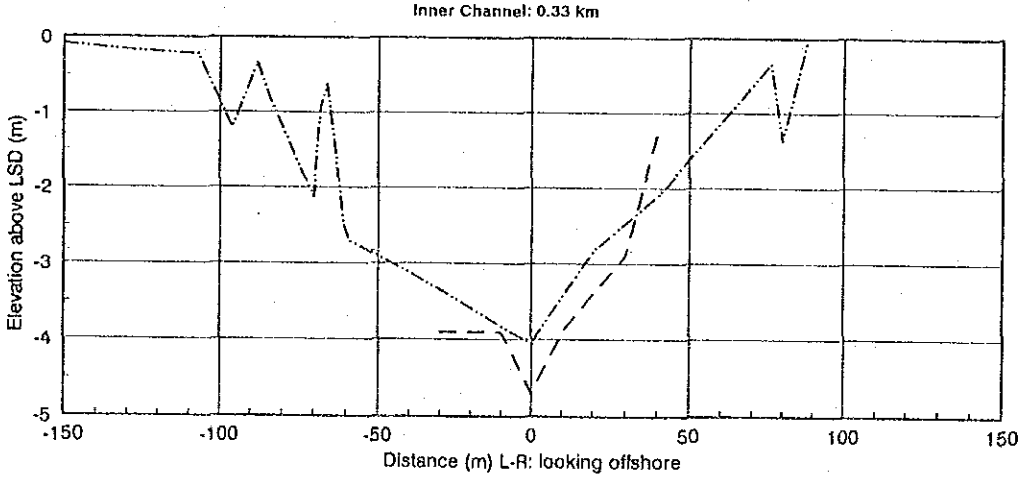
THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	COMPARISON OF OUTER CHANNEL CROSS SECTIONS OF PERLIS RIVER MOUTH
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.5.2-2(3/3)



THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	OUTER CHANNEL PROFILE OF PERLIS RIVER MOUTH SURVEYED IN 1992
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.5.2-3

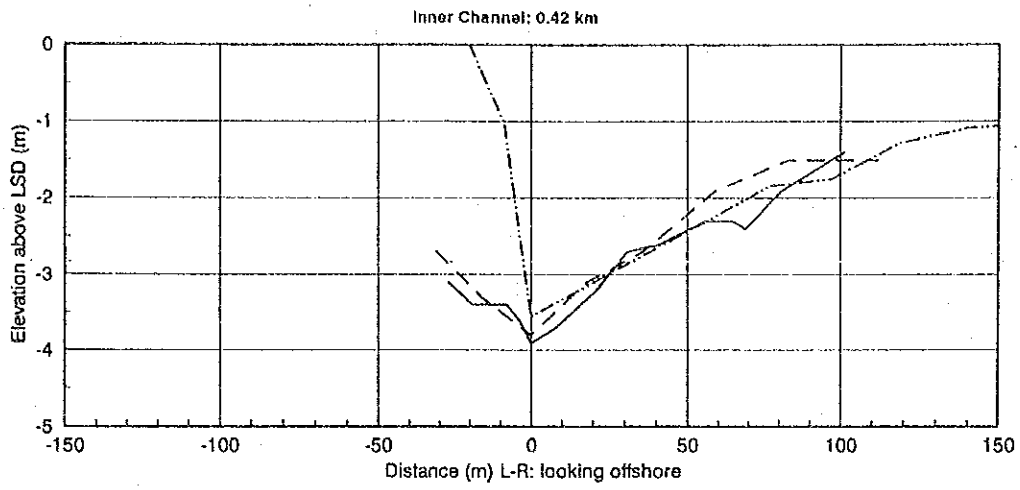


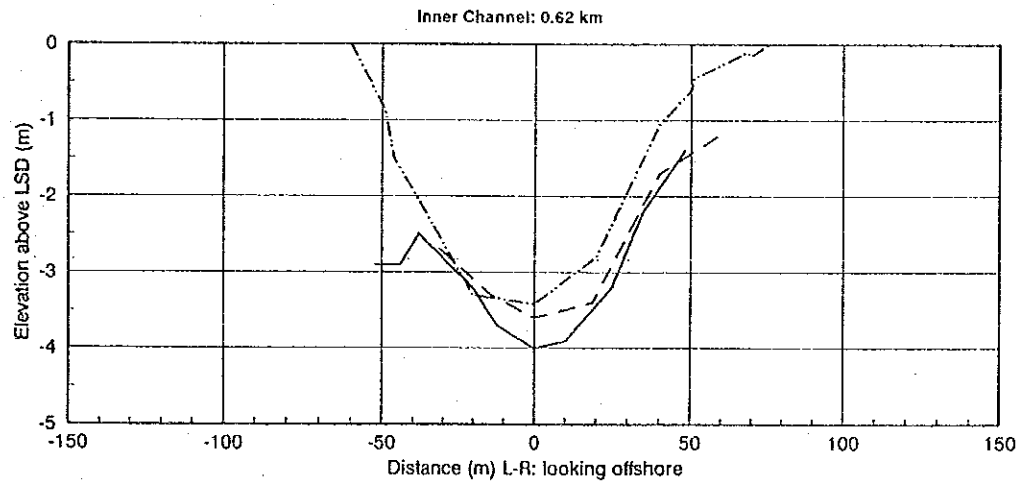


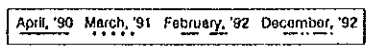


April, '90 March, '91 February, '92 December, '92

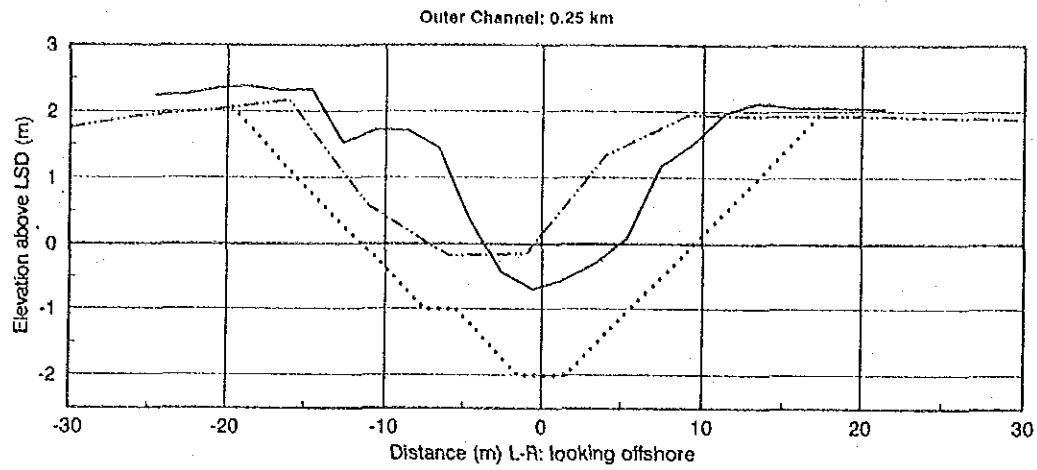
THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	COMPARISON OF INNER CHANNEL CROSS SECTIONS OF PERLIS RIVER MOUTH
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.5.2-4(1/2)

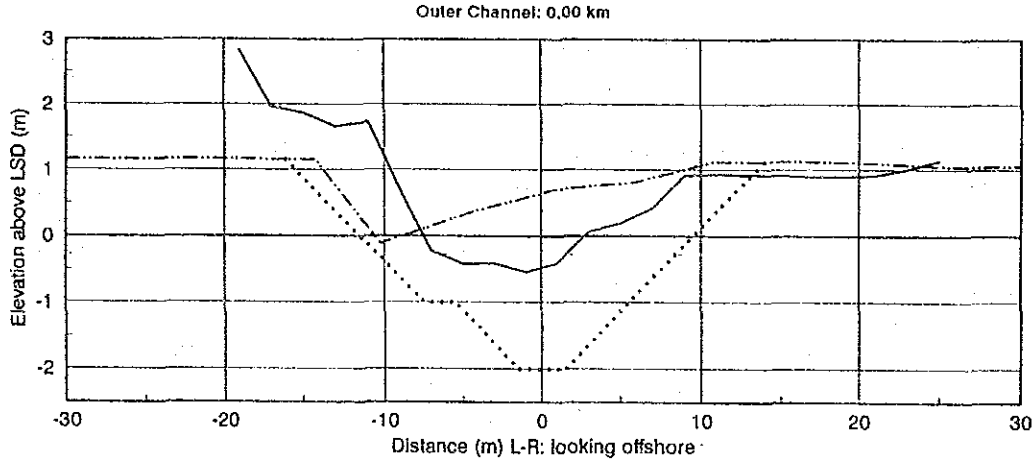


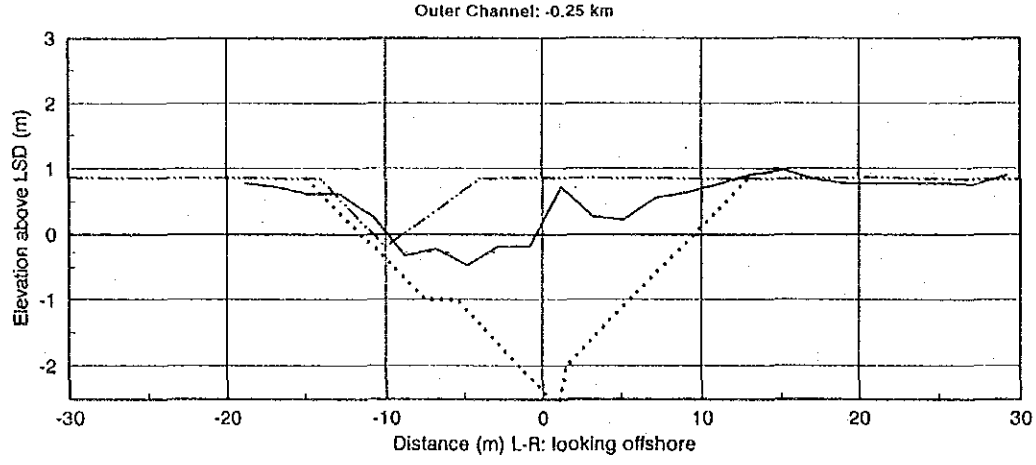


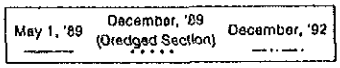


THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	COMPARISON OF INNER CHANNEL CROSS SECTIONS OF PERLIS RIVER MOUTH
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.5.2-4(2/2)

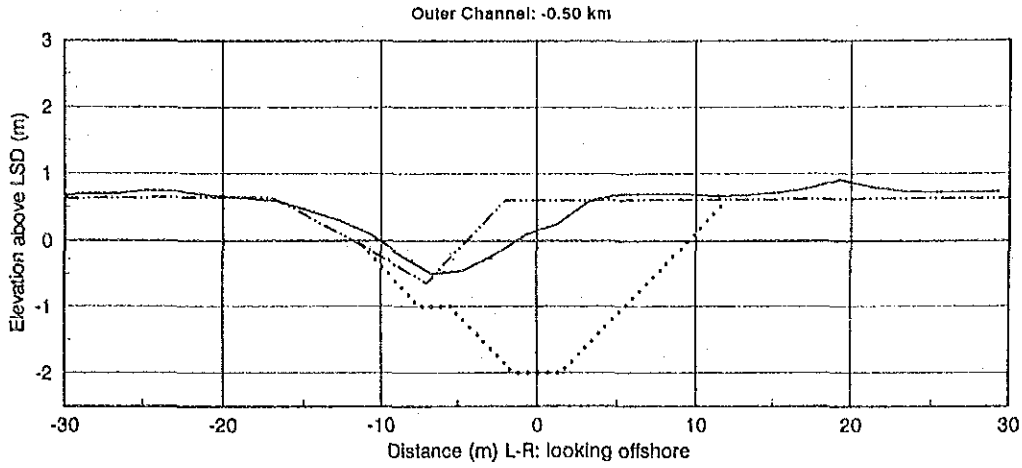


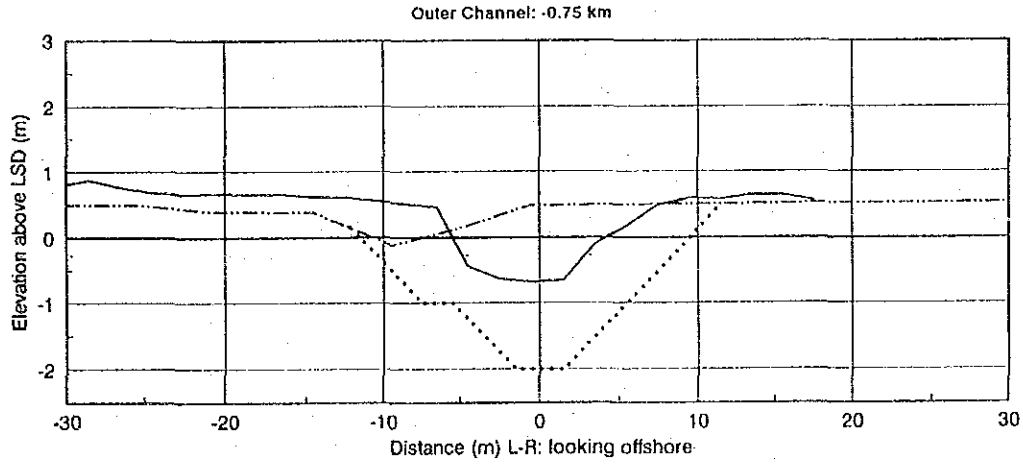


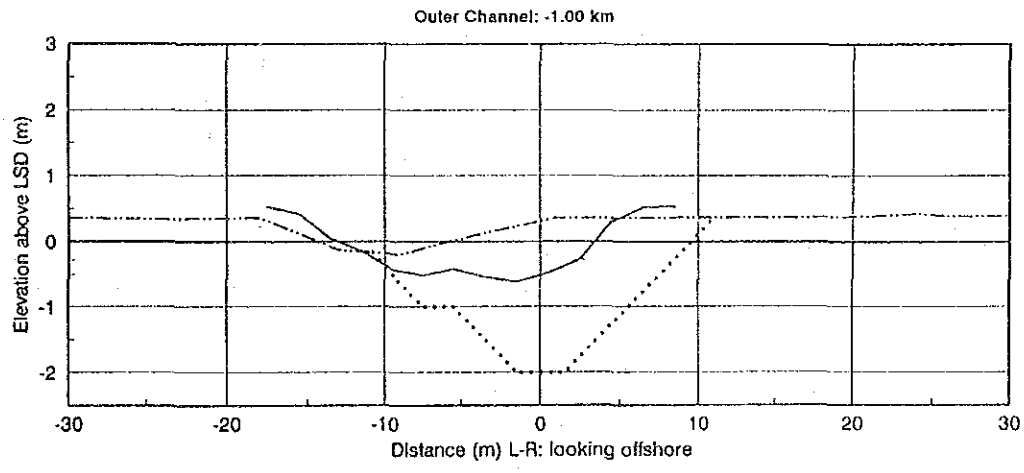


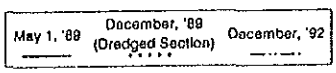


THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	COMPARISON OF OUTER CHANNEL CROSS SECTIONS OF KURUNG TENGAR RIVER MOUTH Fig.5.2-5(1/3)
JAPAN INTERNATIONAL COOPERATION AGENCY	

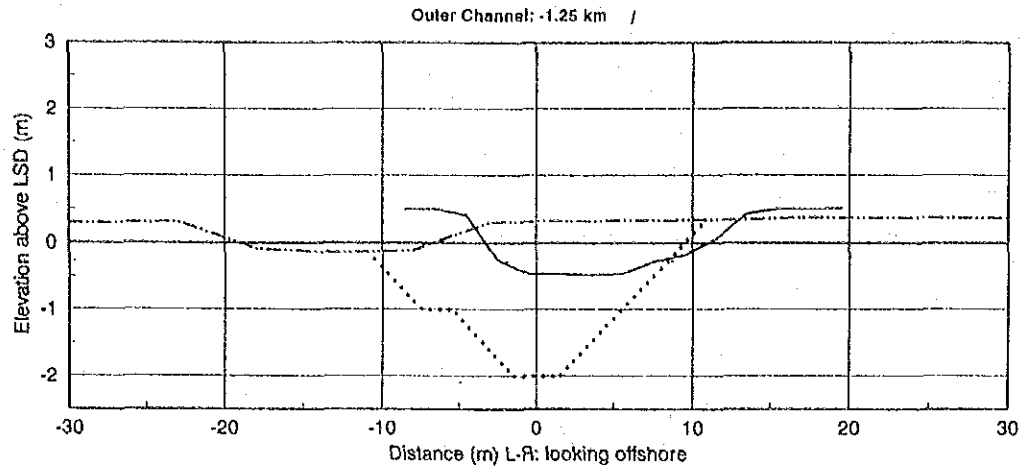


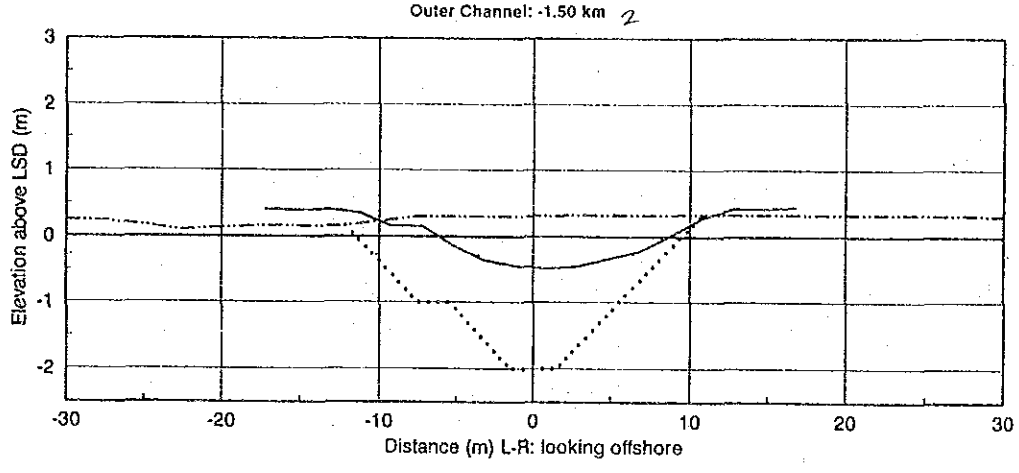


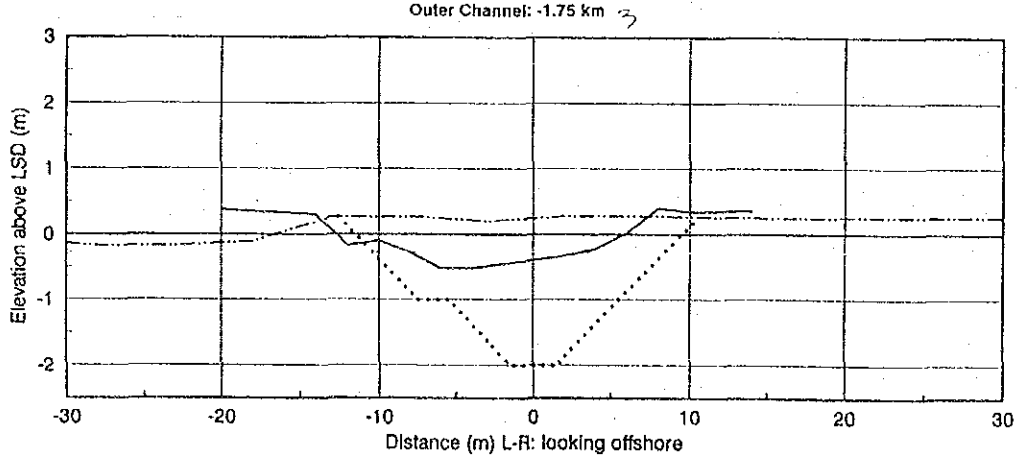


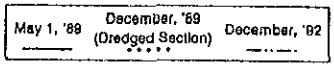


THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA JAPAN INTERNATIONAL COOPERATION AGENCY	COMPARISON OF OUTER CHANNEL CROSS SECTIONS OF KURUNG TENGAR RIVER MOUTH Fig.5.2-5(2/3)

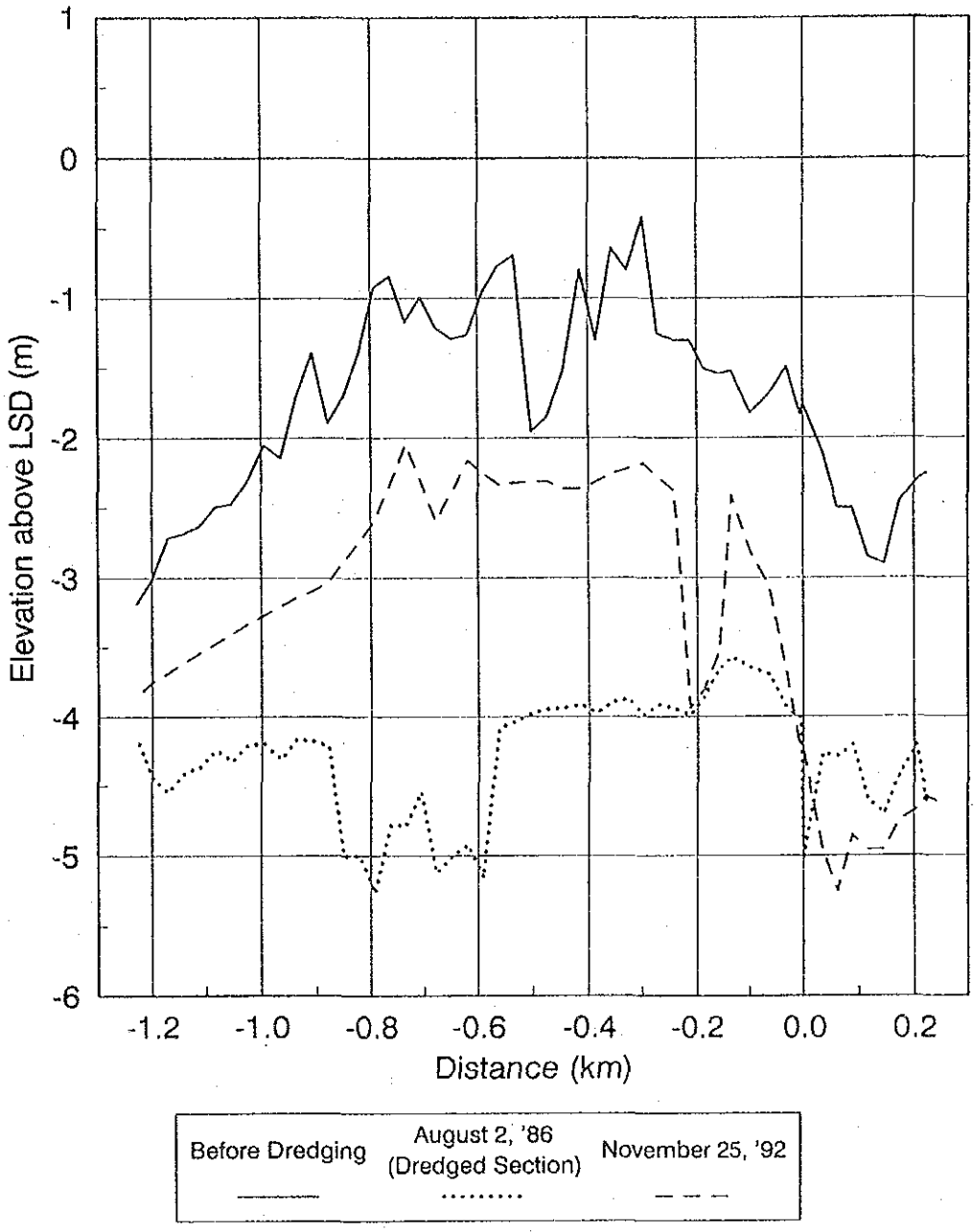




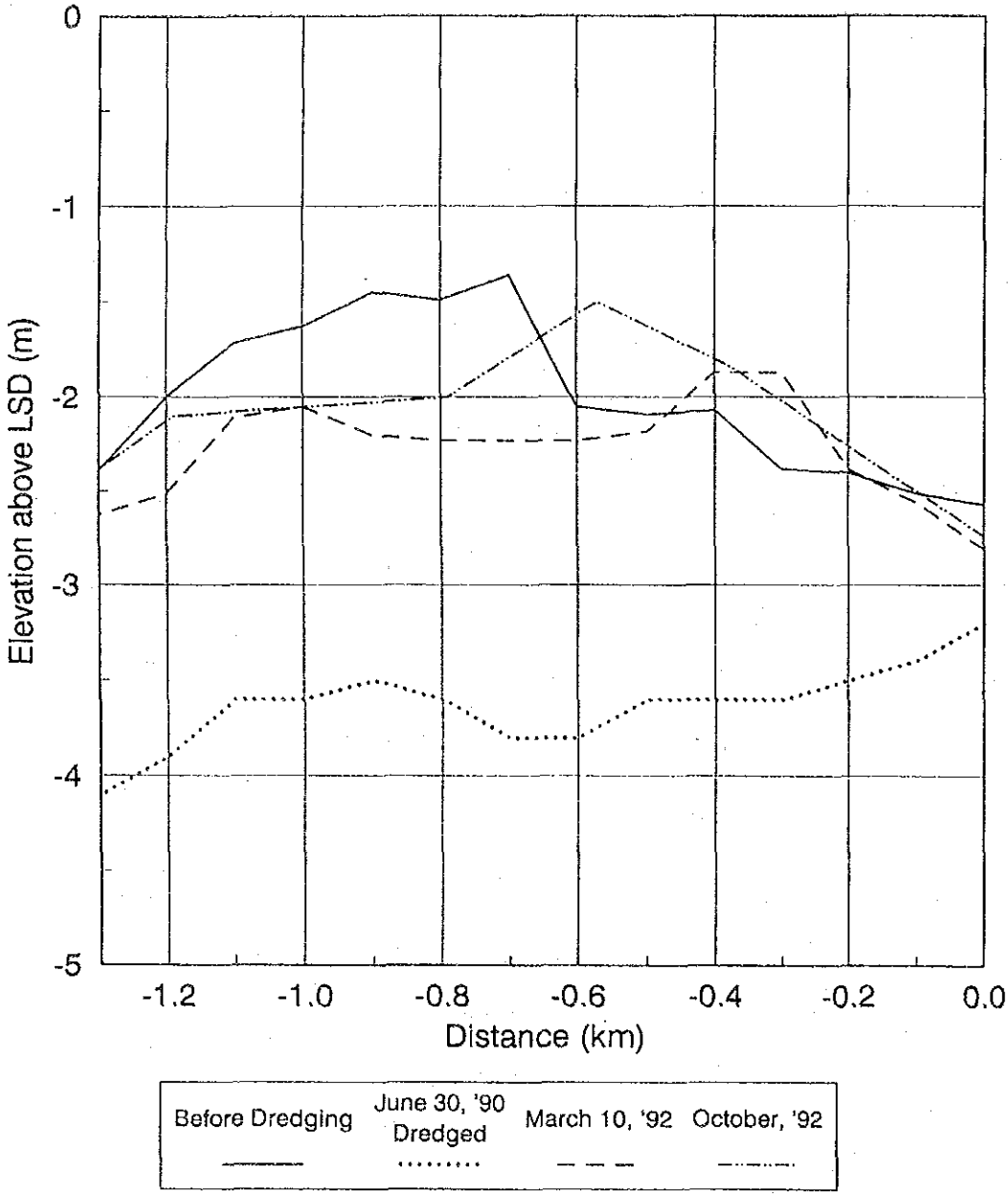




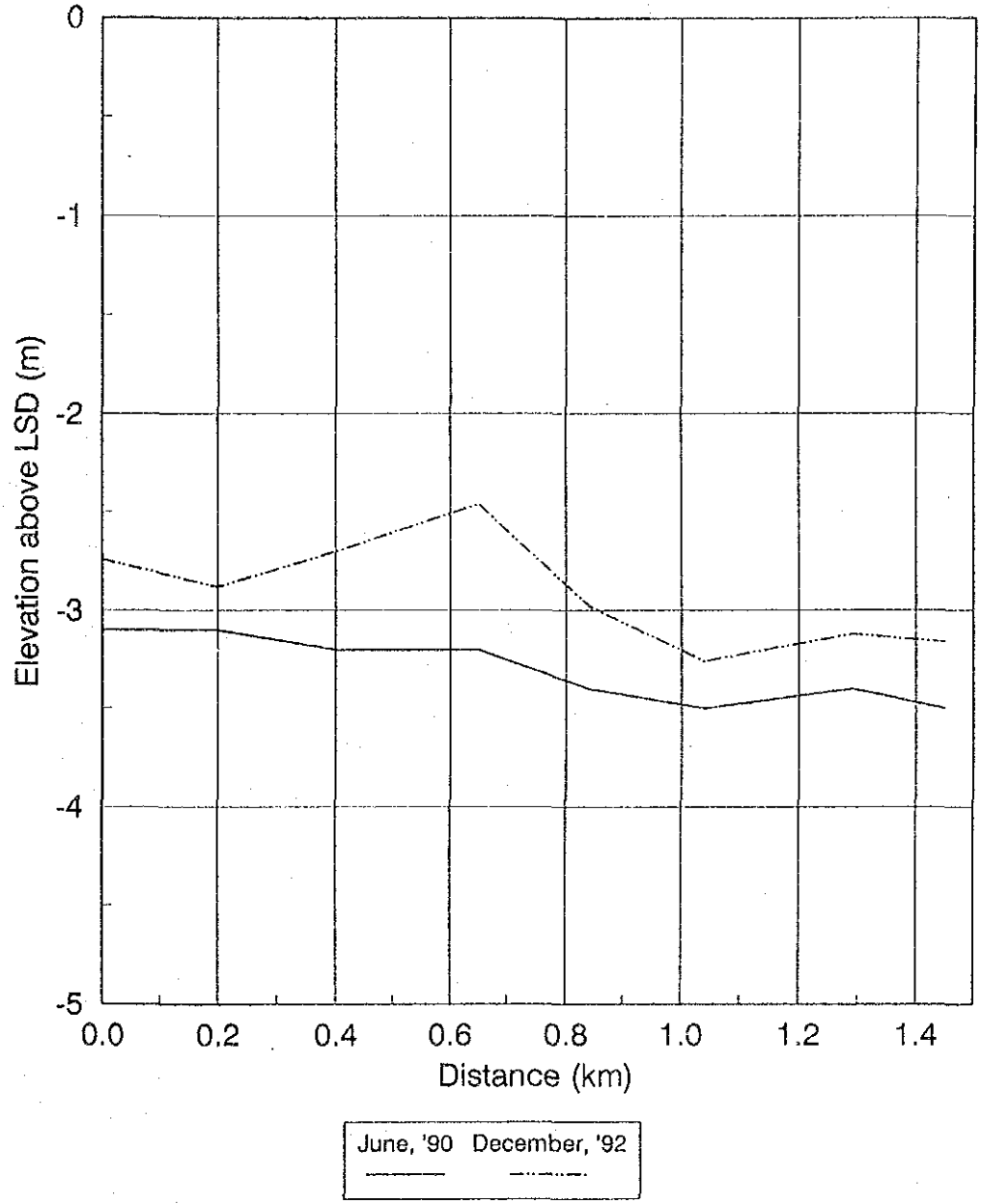
THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA JAPAN INTERNATIONAL COOPERATION AGENCY	COMPARISON OF OUTER CHANNEL CROSS SECTIONS OF KURUNG TENGAR RIVER MOUTH Fig.5.2-5(3/3)



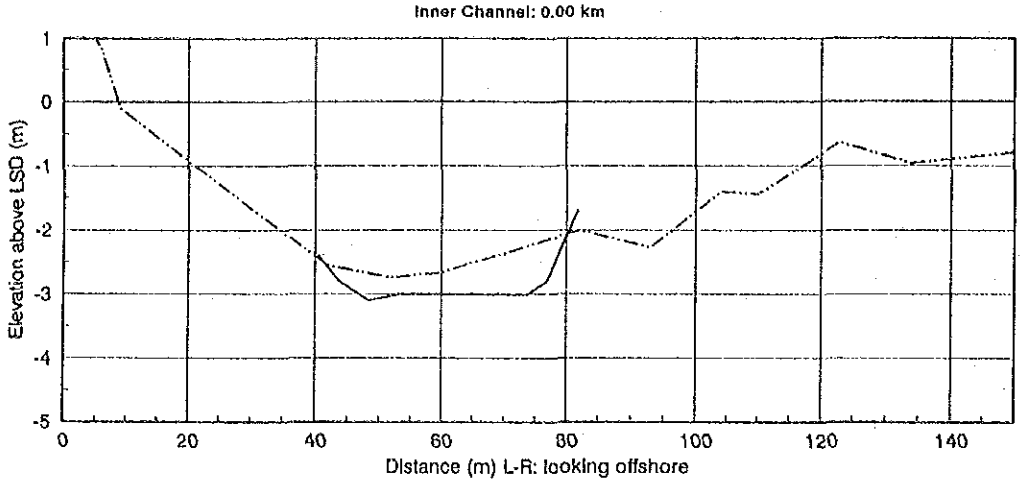
THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA JAPAN INTERNATIONAL COOPERATION AGENCY	COMPARISON OF INNER AND OUTER CHANNEL PROFILE OF MUDA RIVER MOUTH Fig.5.2-6

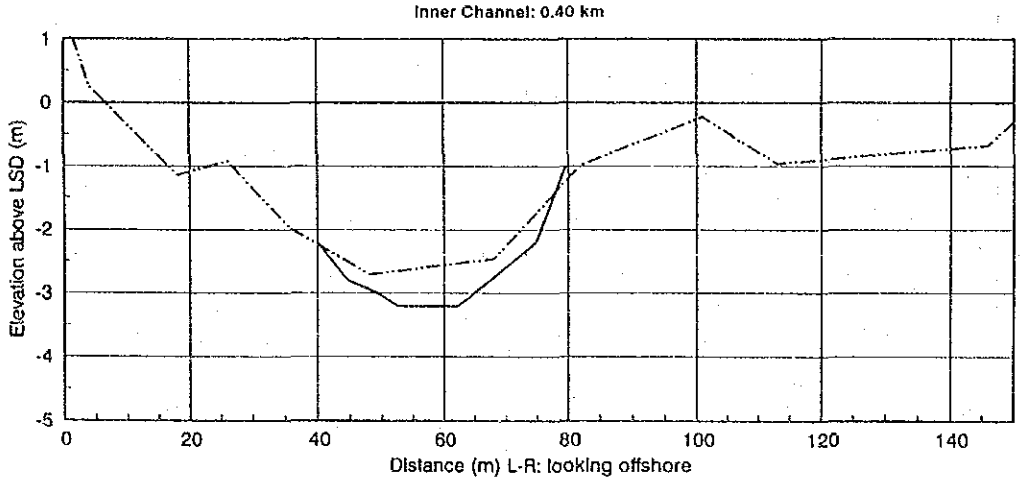


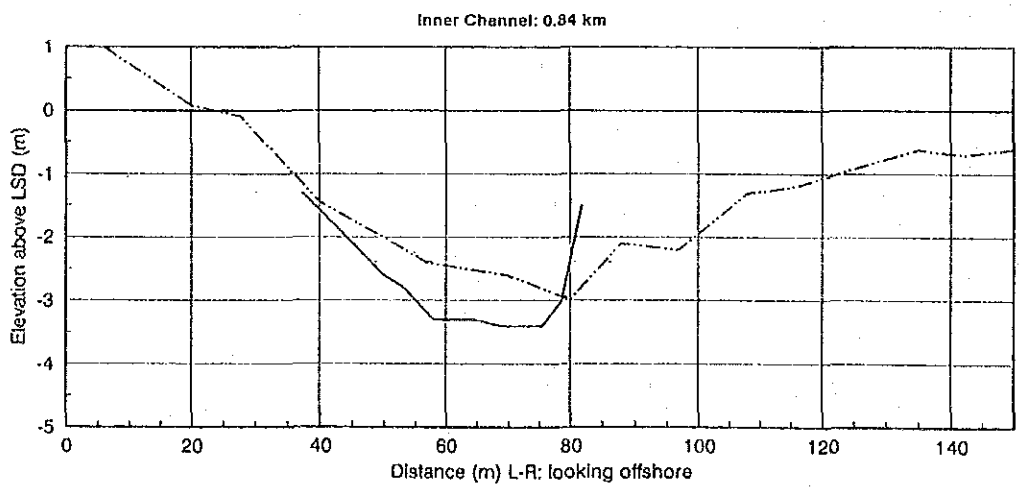
THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	COMPARISON OF OUTER CHANNEL PROFILE OF BERUAS RIVER MOUTH
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.5.2-7

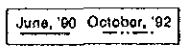


THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	COMPARISON OF INNER CHANNEL PROFILE OF BERUAS RIVER MOUTH
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.5.2-8

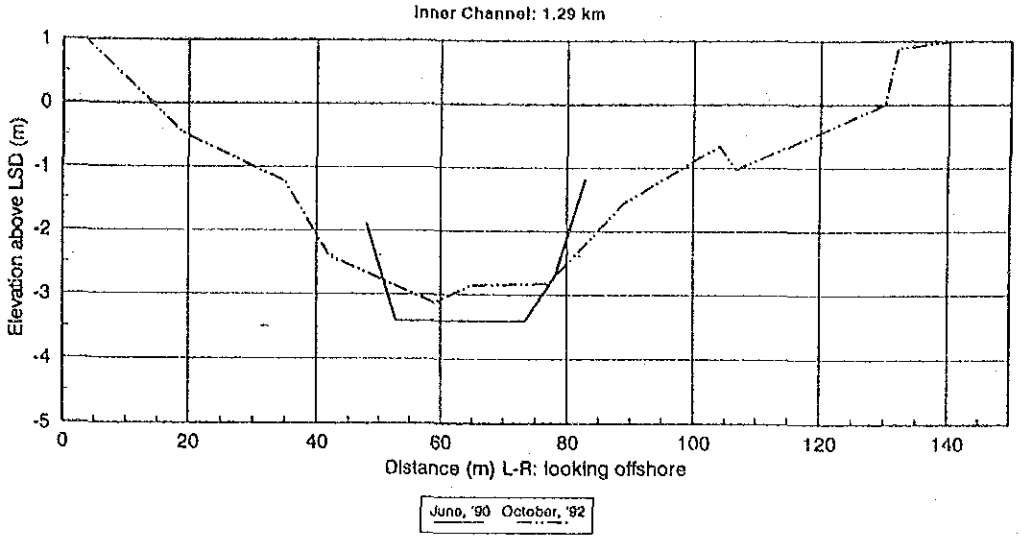




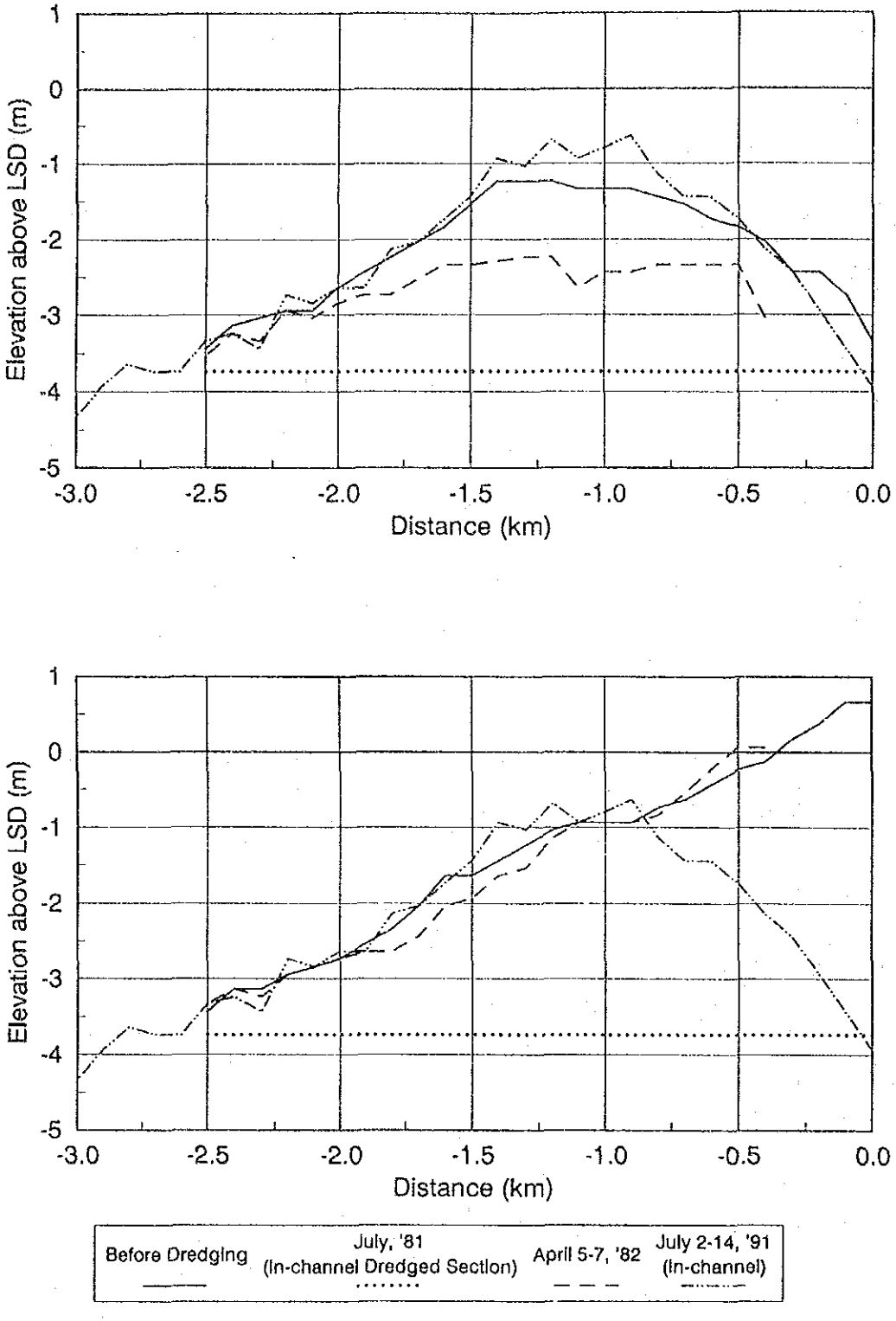




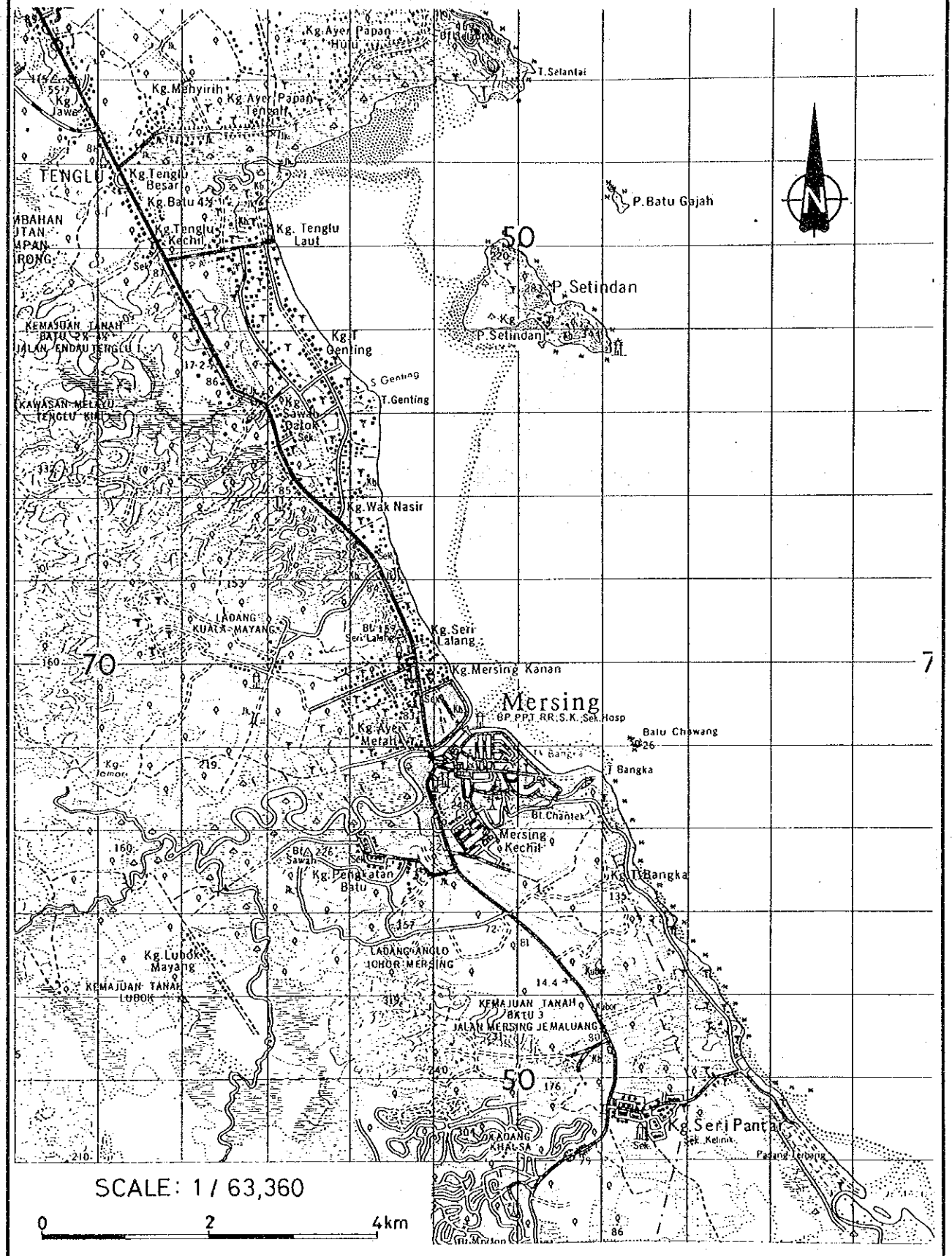
THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	COMPARISON OF INNER CHANNEL CROSS SECTIONS OF BERUAS RIVER MOUTH
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.5.2-9(1/2)



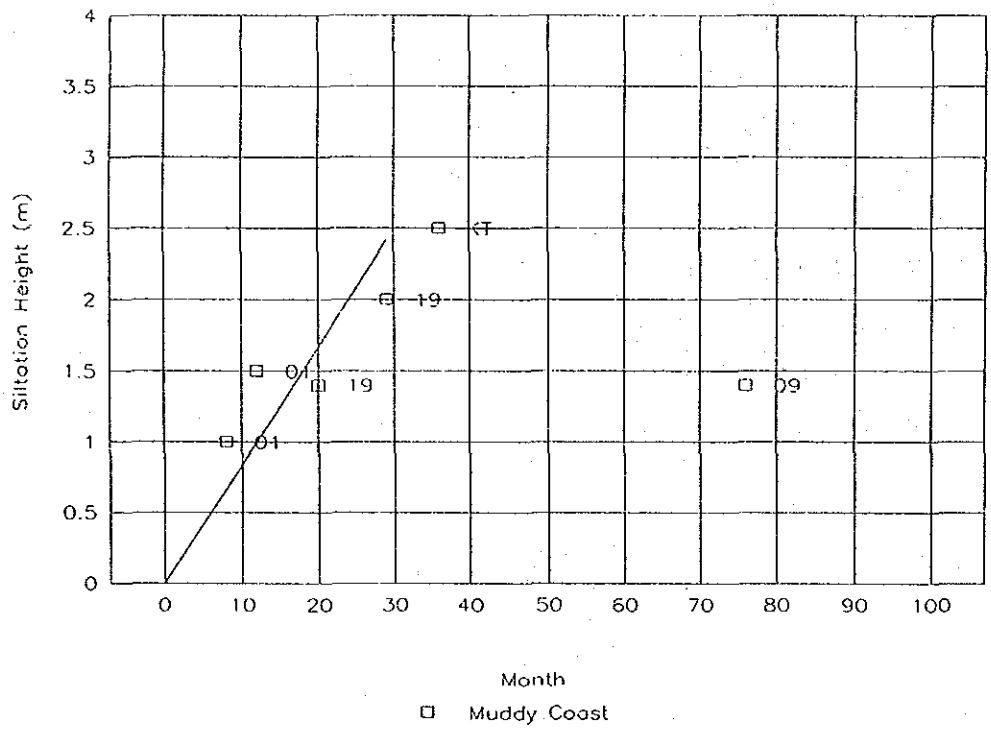
THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	COMPARISON OF INNER CHANNEL CROSS SECTIONS OF BERUAS RIVER MOUTH
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.5.2-9(2/2)



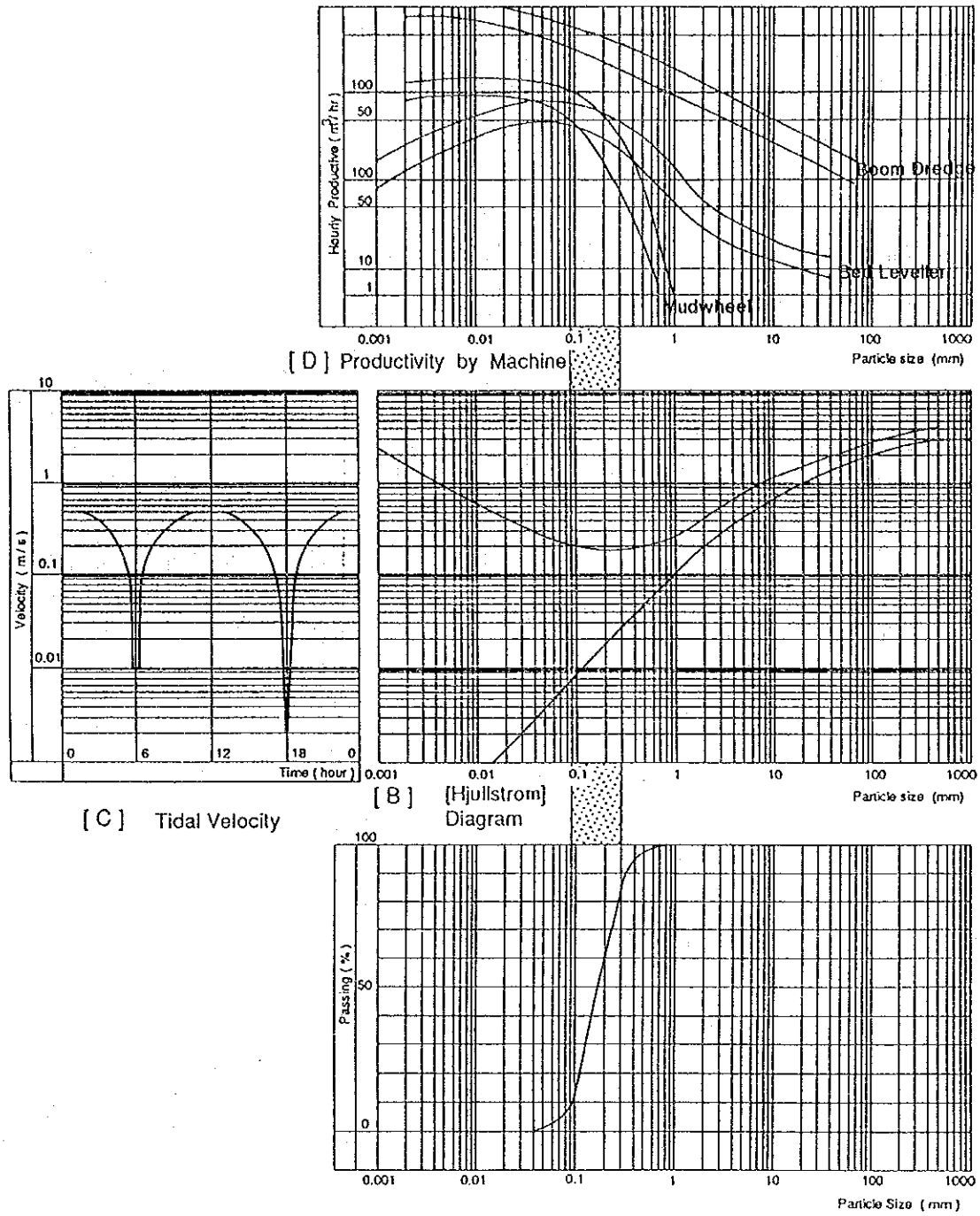
THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	COMPARISON OF OUTER CHANNEL PROFILE OF MERSING RIVER MOUTH
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.5.2-10



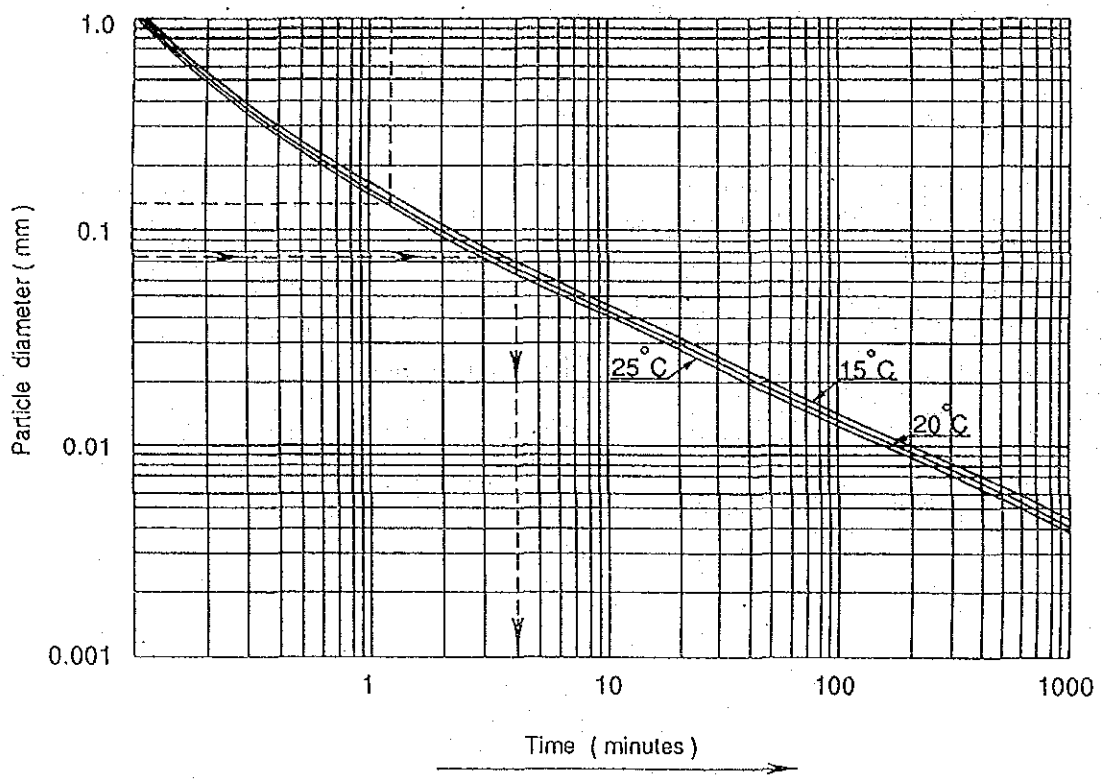
THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	TOPOGRAPHIC MAP FOR MERSING RIVER MOUTH
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.5.2-11



THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	SILTATION RATE PLOT FOR MUDDY COAST
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. 5.2-12

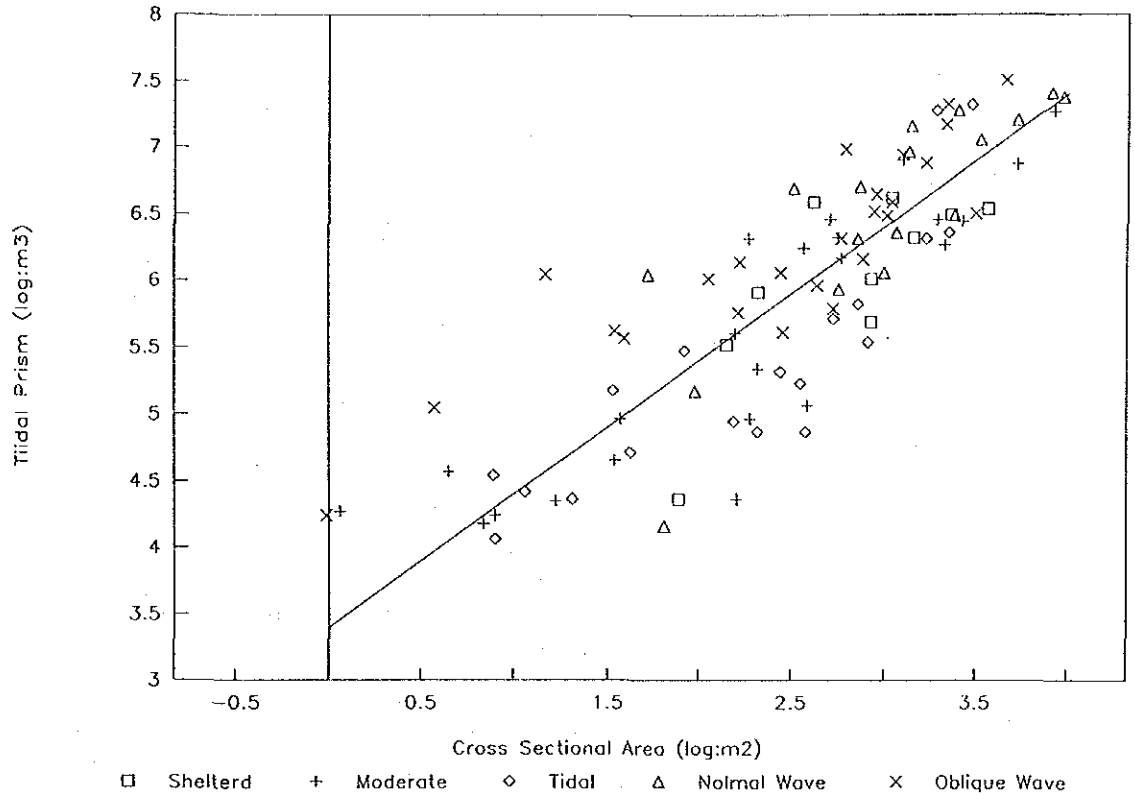


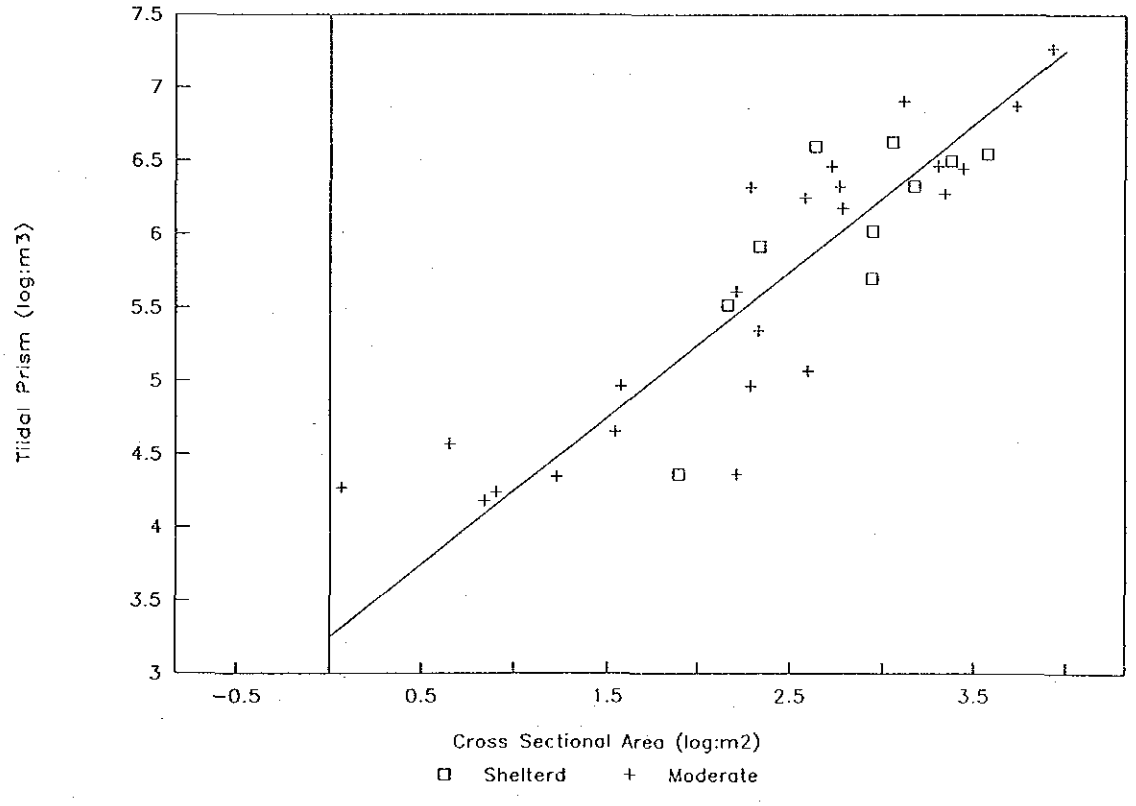
THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	EFFECT OF AGITATION DREDGING
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.5.2-13



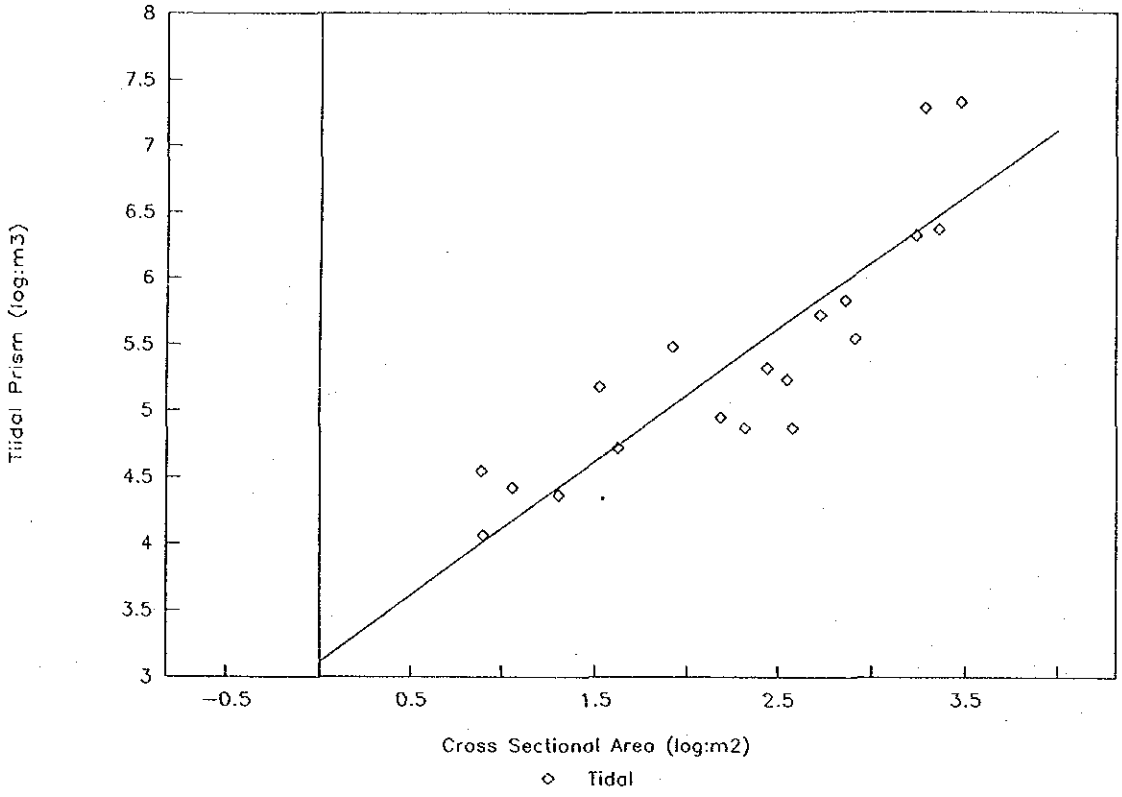
For particle having a spealfic gravity of 2.65 to fall 100 cm

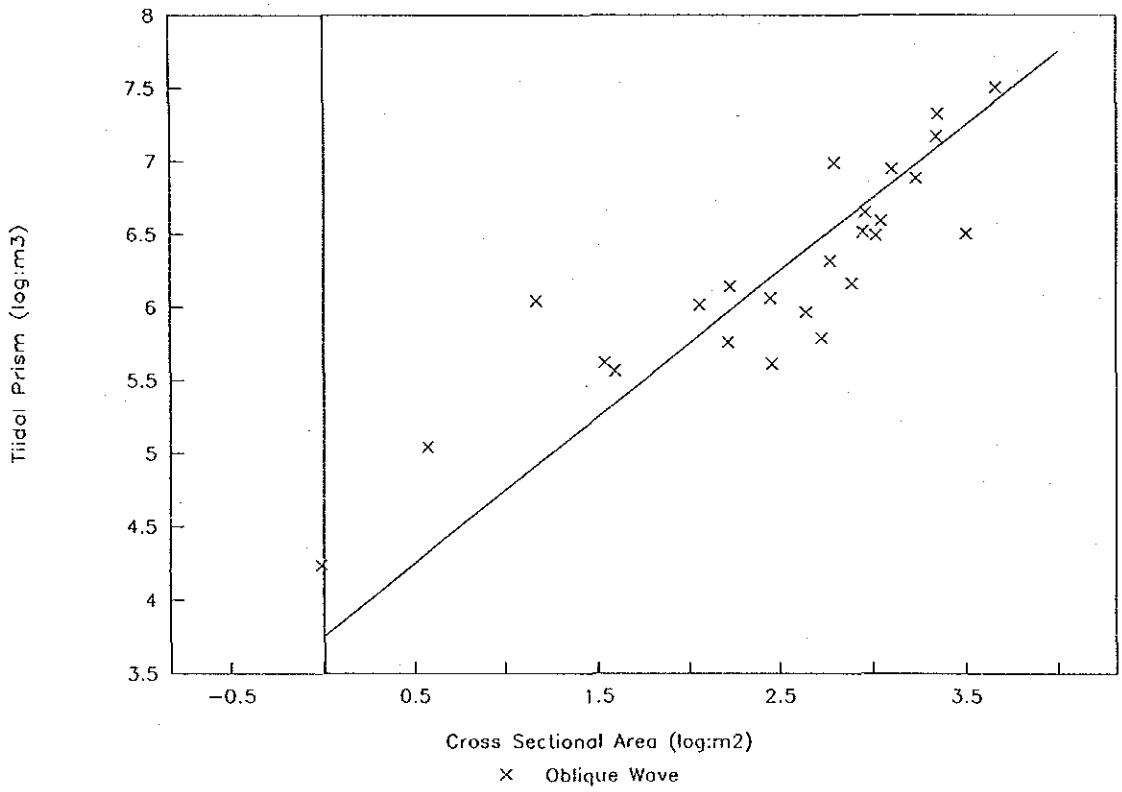
THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	RELATION BETWEEN SIZE OF MATERIAL AND SETTLING TIME
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.5.2-14



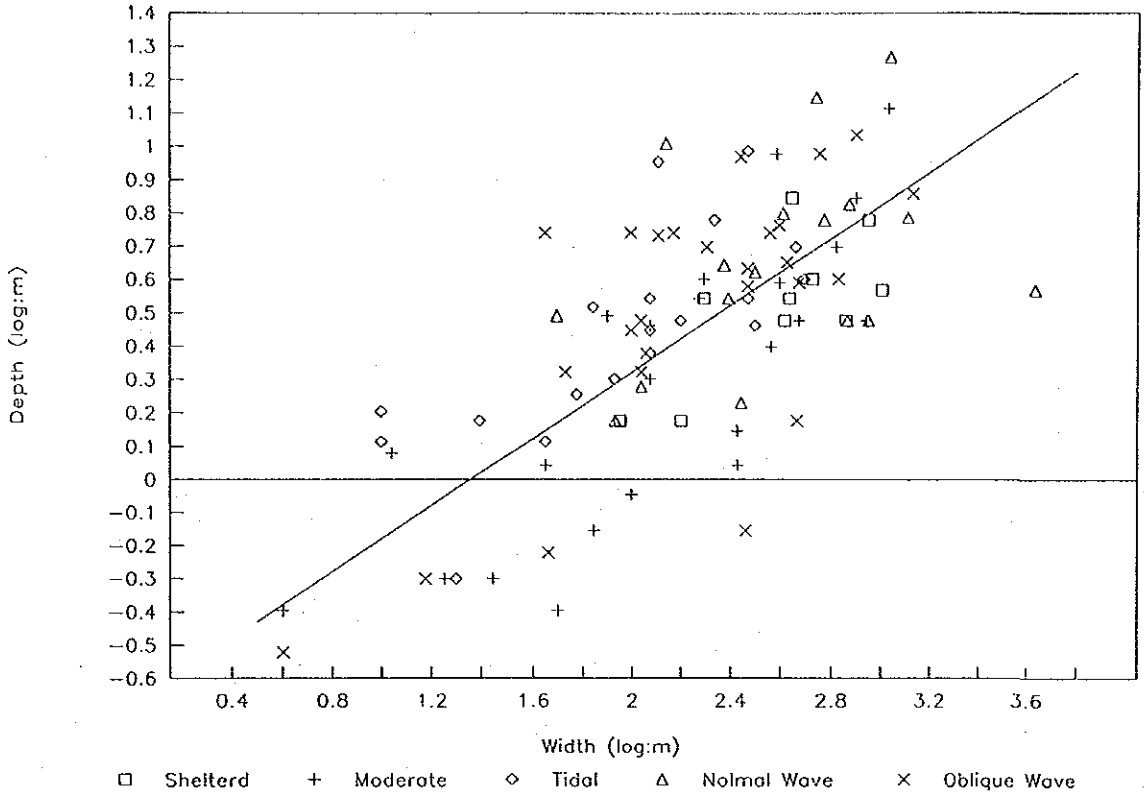


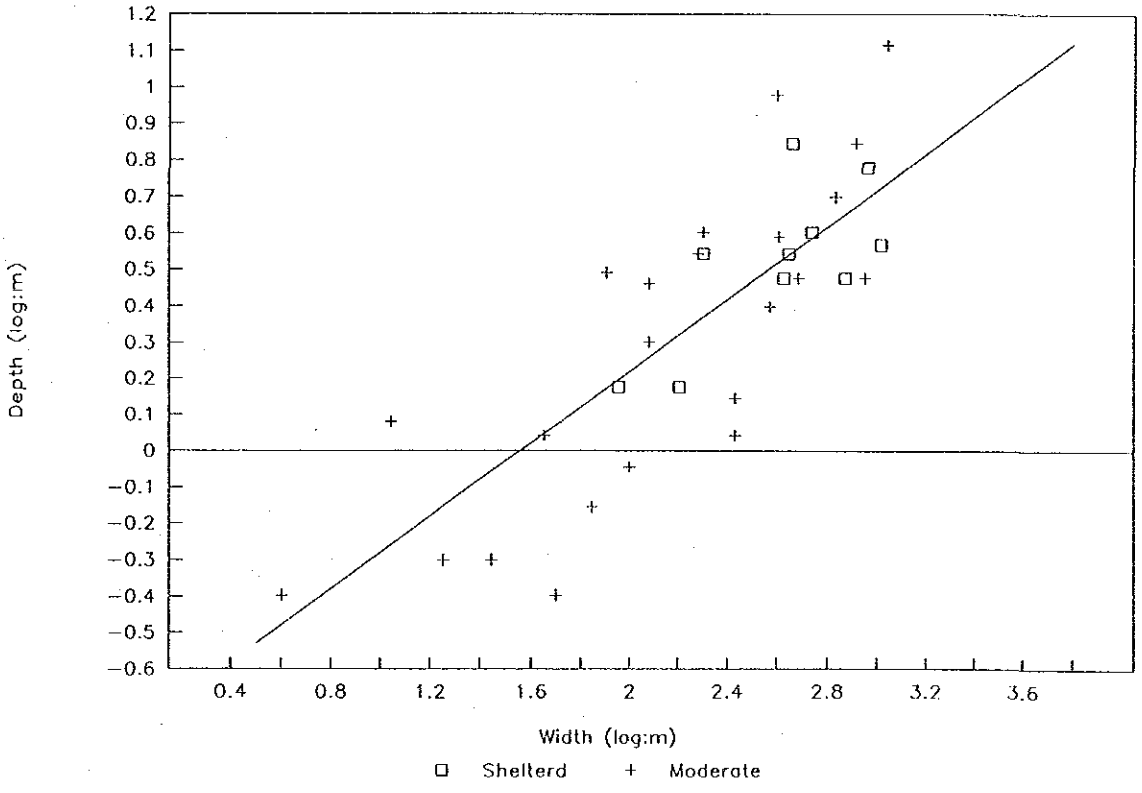
THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	RELATION BETWEEN TIDAL PRISM AND CROSS SECTIONAL AREA
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.5.2-15(1/2)



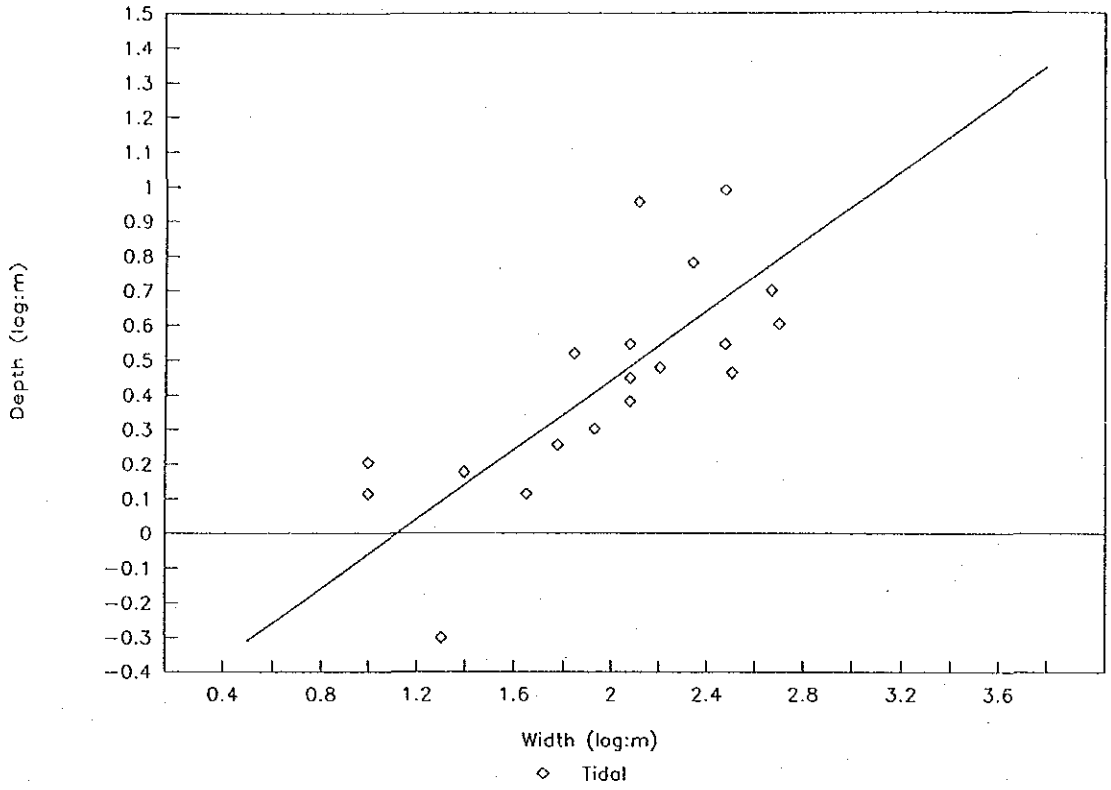


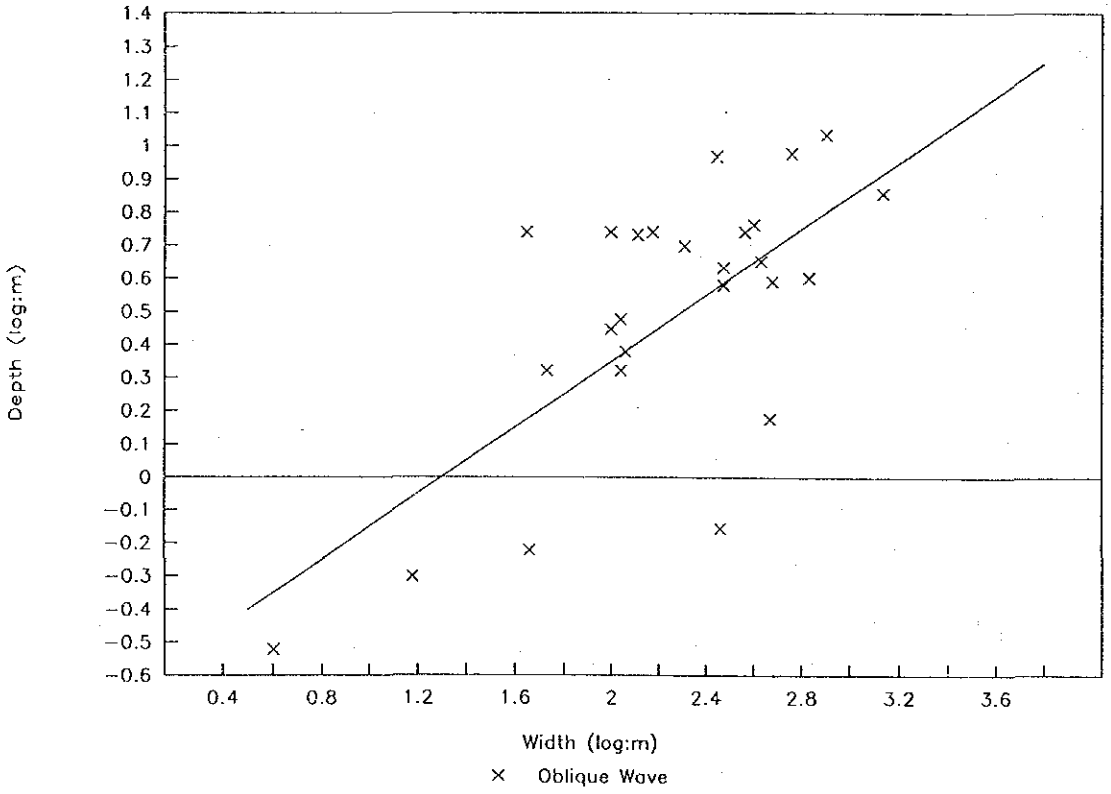
THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA JAPAN INTERNATIONAL COOPERATION AGENCY	RELATION BETWEEN TIDAL PRISM AND CROSS SECTIONAL AREA Fig.5.2-15(2/2)



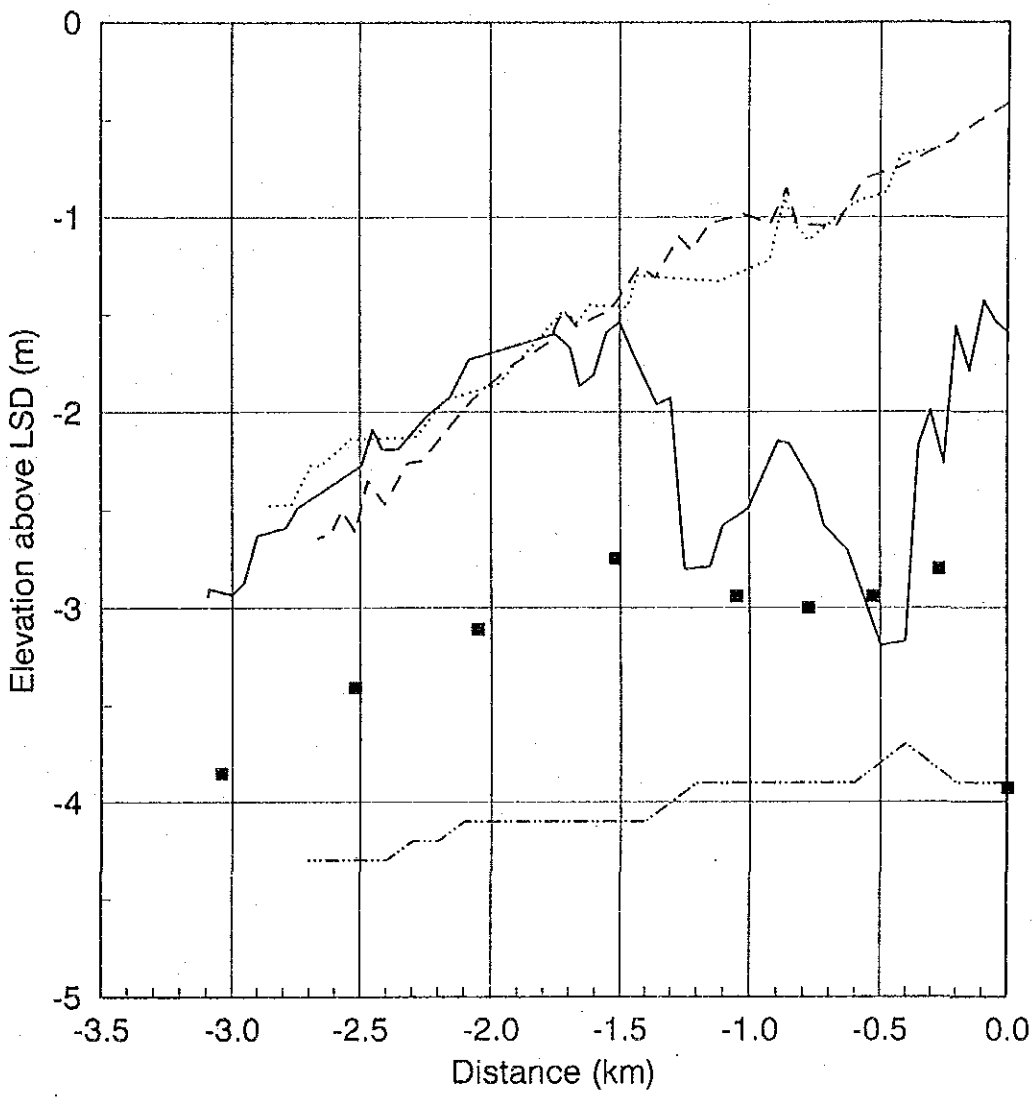


THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	RELATION BETWEEN WIDTH AND DEPTH
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.5.2-16(1/2)



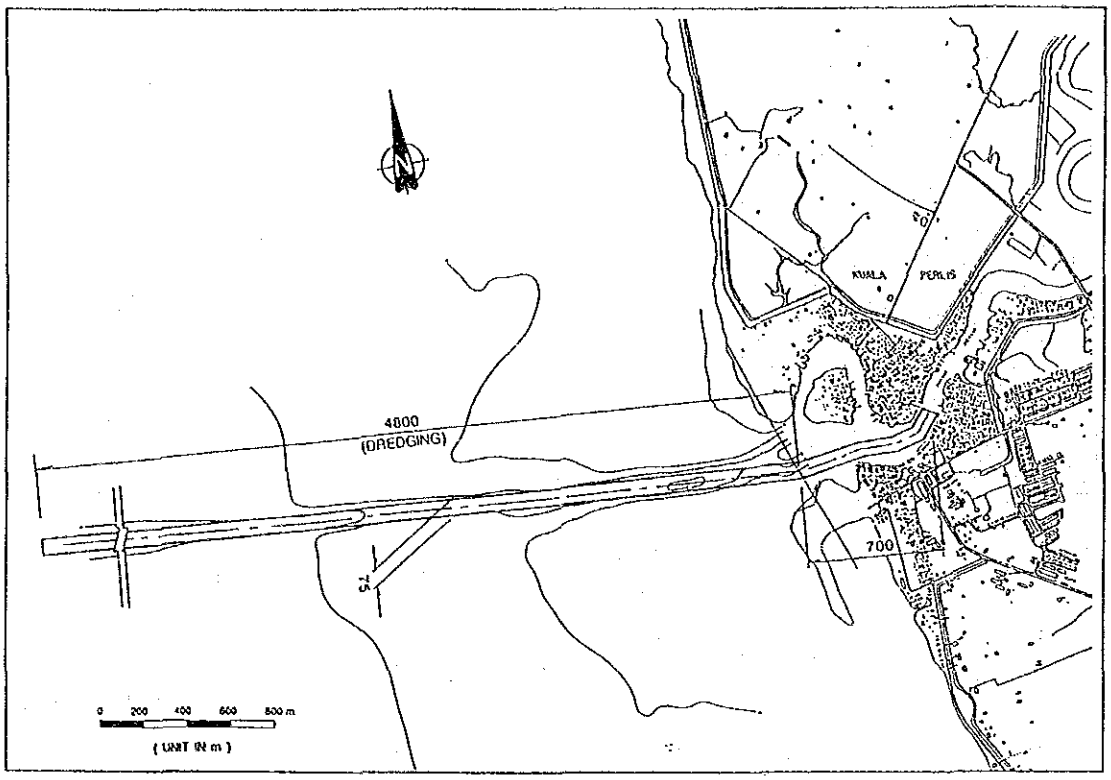


THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	RELATION BETWEEN WIDTH AND DEPTH
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.5.2-16(2/2)

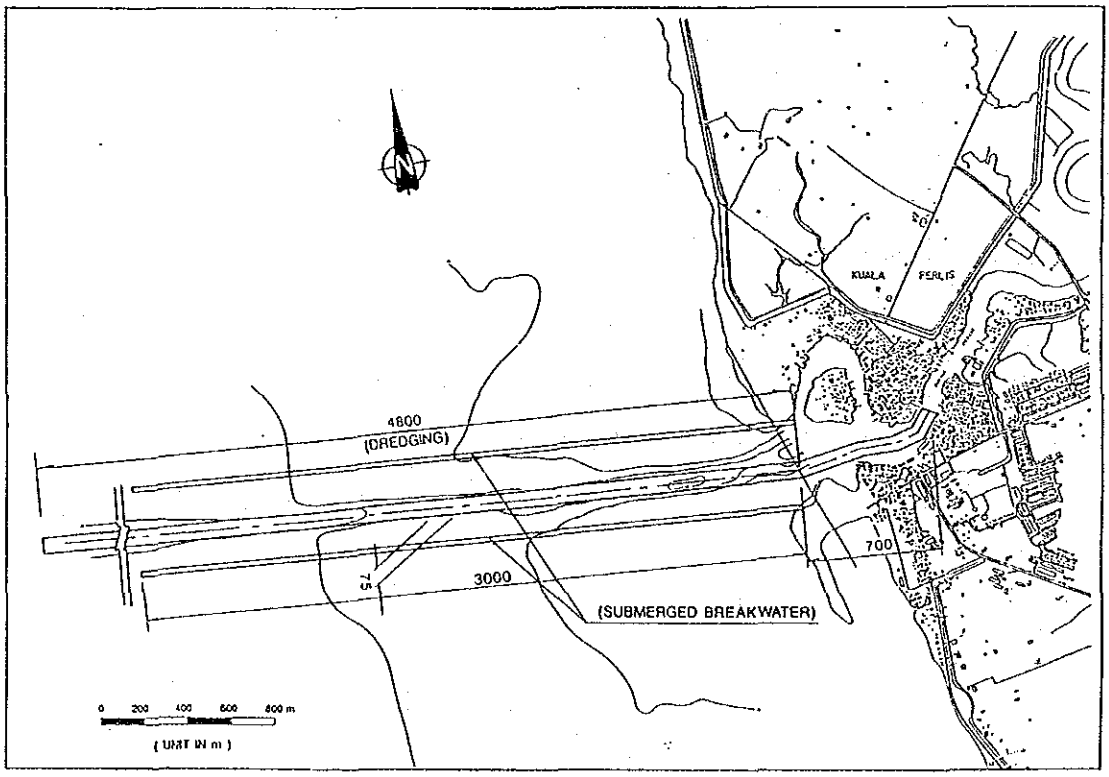


THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	OUTER CHANNEL PROFILE AT PERLIS RIVER MOUTH
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.5.3-1

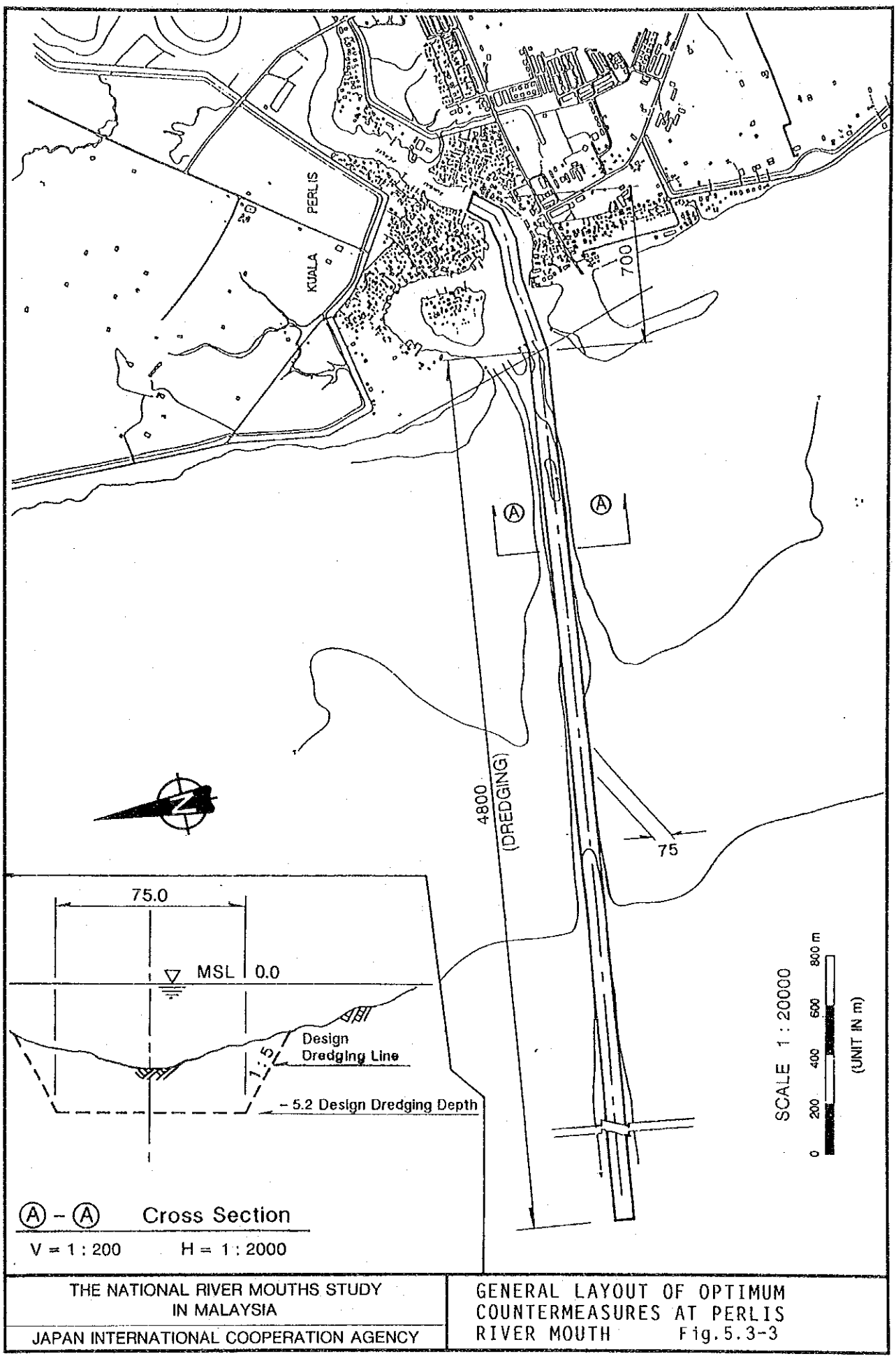
CASE - 1



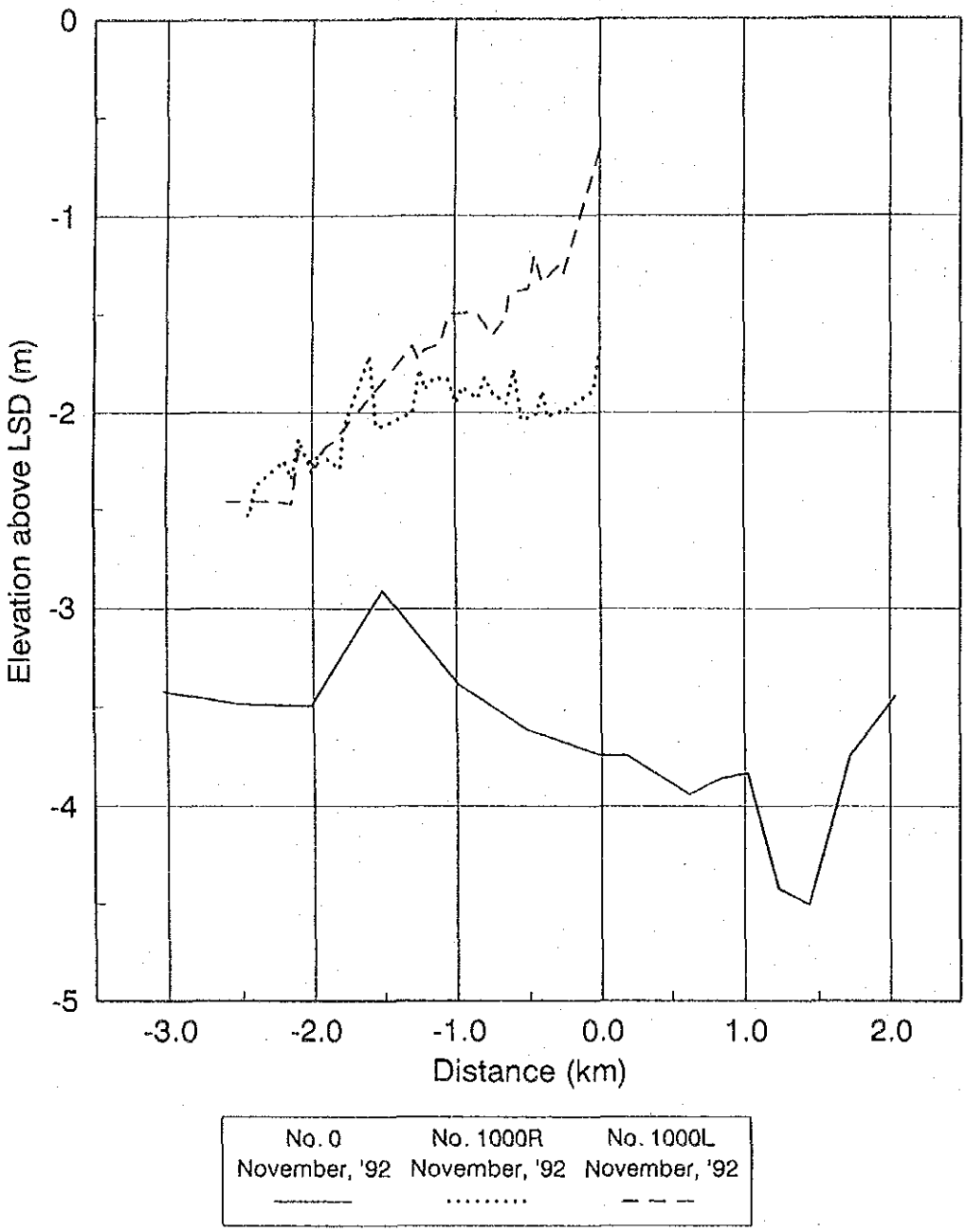
CASE - 2



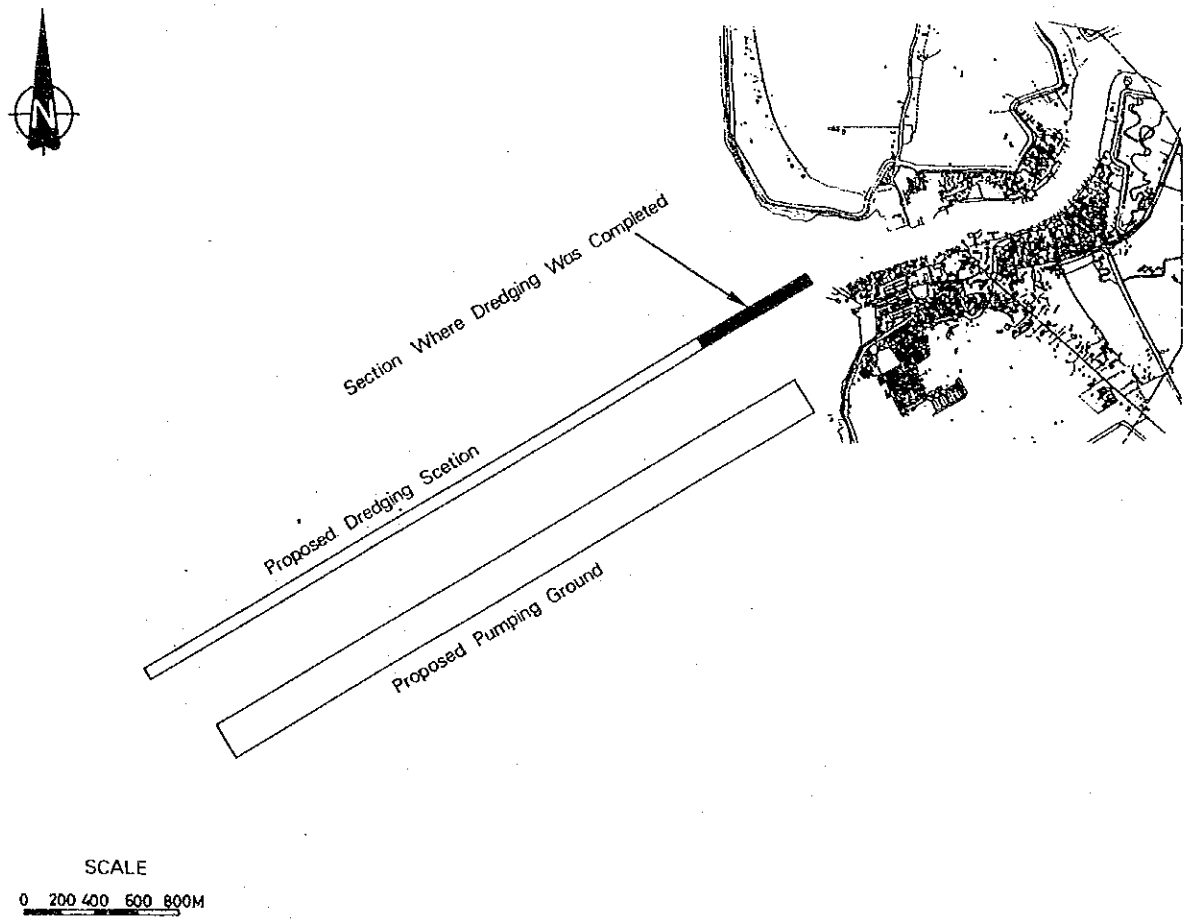
THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	ALTERNATIVE STUDY CASES FOR PERLIS RIVER MOUTH Fig. 5.3-2
JAPAN INTERNATIONAL COOPERATION AGENCY	



THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA JAPAN INTERNATIONAL COOPERATION AGENCY	GENERAL LAYOUT OF OPTIMUM COUNTERMEASURES AT PERLIS RIVER MOUTH Fig.5.3-3

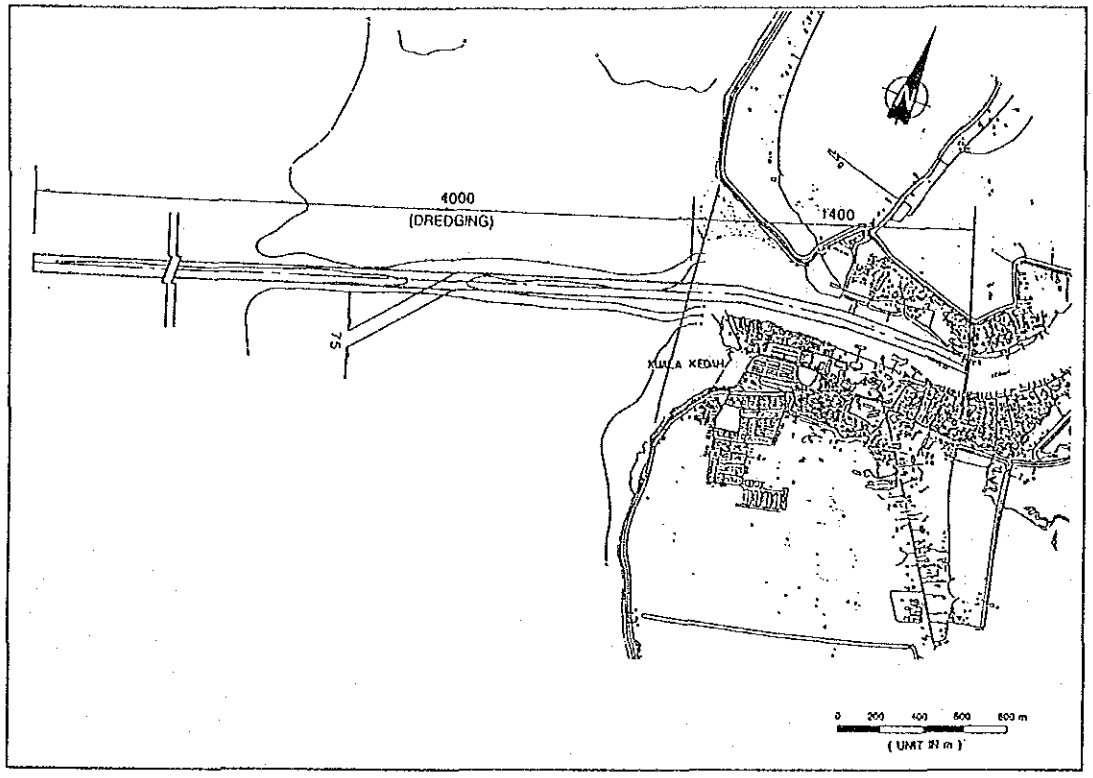


THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA JAPAN INTERNATIONAL COOPERATION AGENCY	INNER AND OUTER CHANNEL PROFILE OF KEDAH RIVER MOUTH Fig.5.3-4

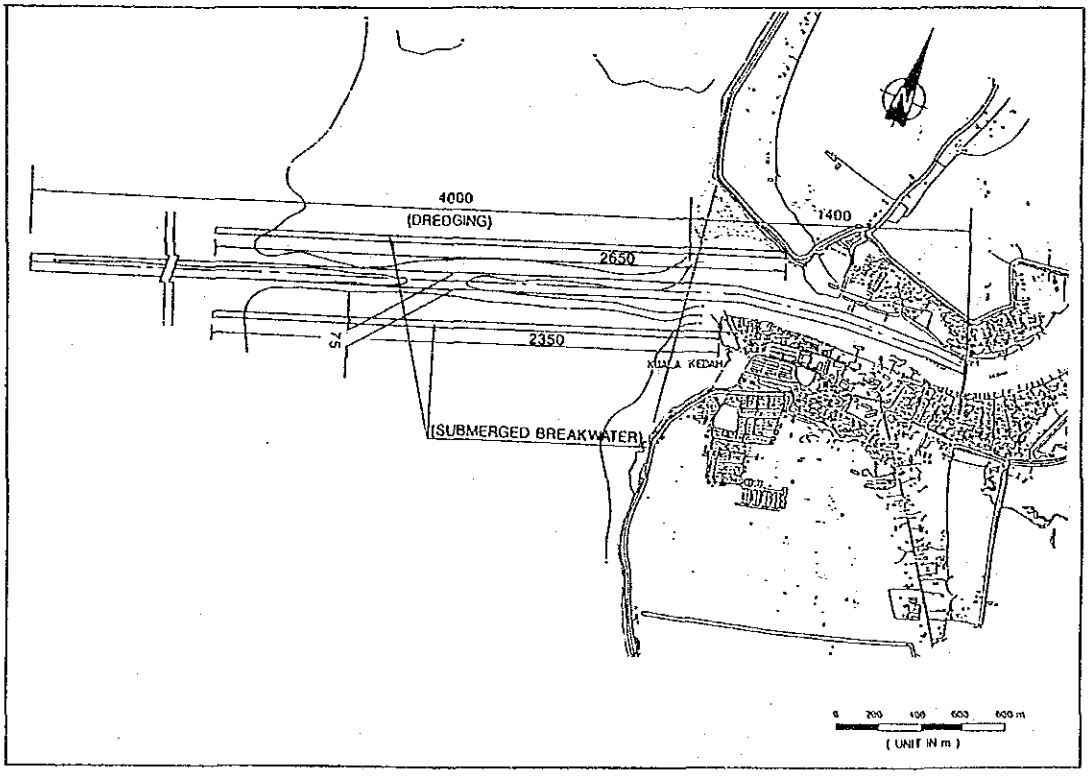


THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	ALIGNMENT OF OUTER CHANNEL DREDGING AT KEDAH RIVER MOUTH
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.5.3-5

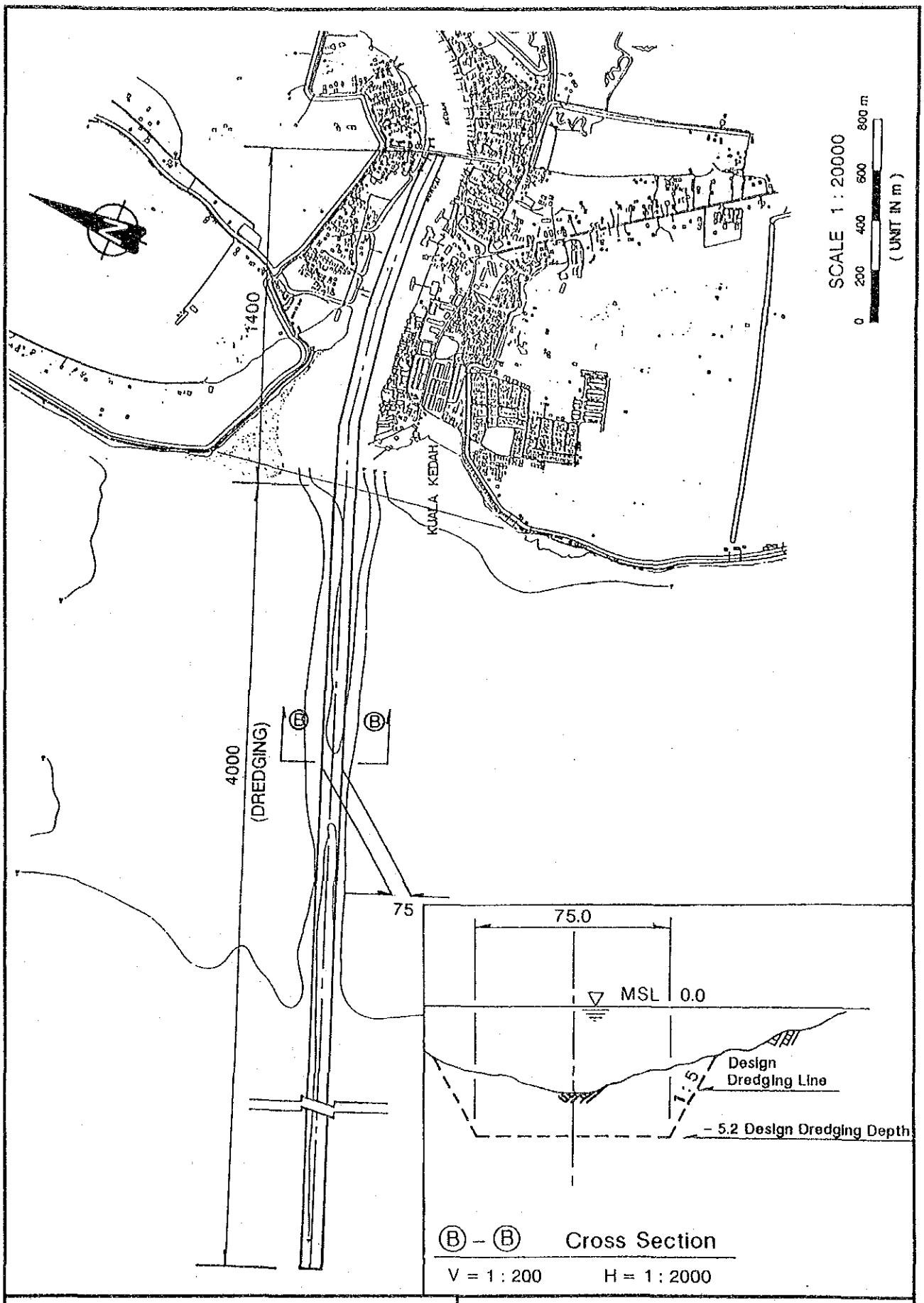
CASE - 1



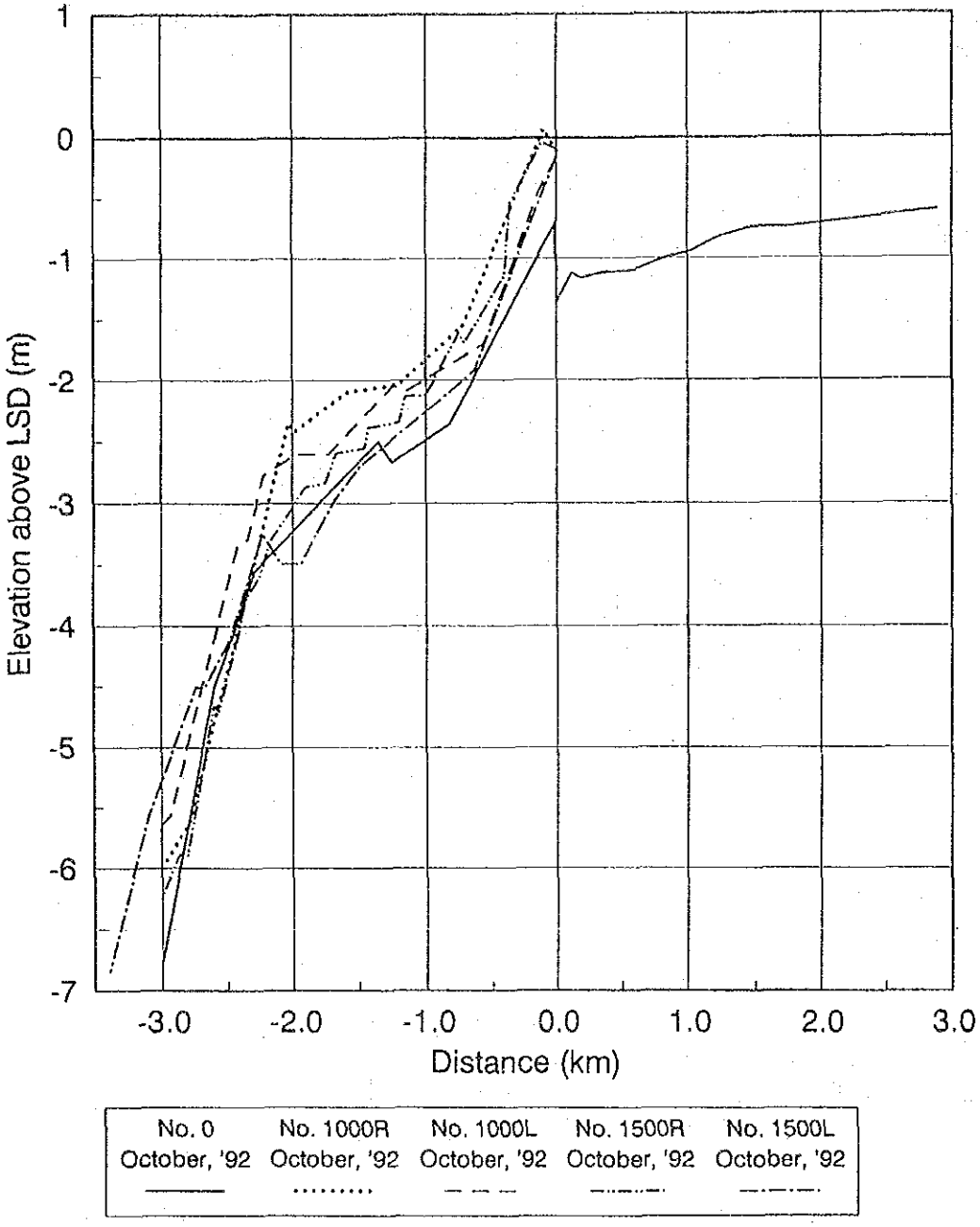
CASE - 2



THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	ALTERNATIVE STUDY CASES FOR KEDAH RIVER MOUTH
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. 5.3-6

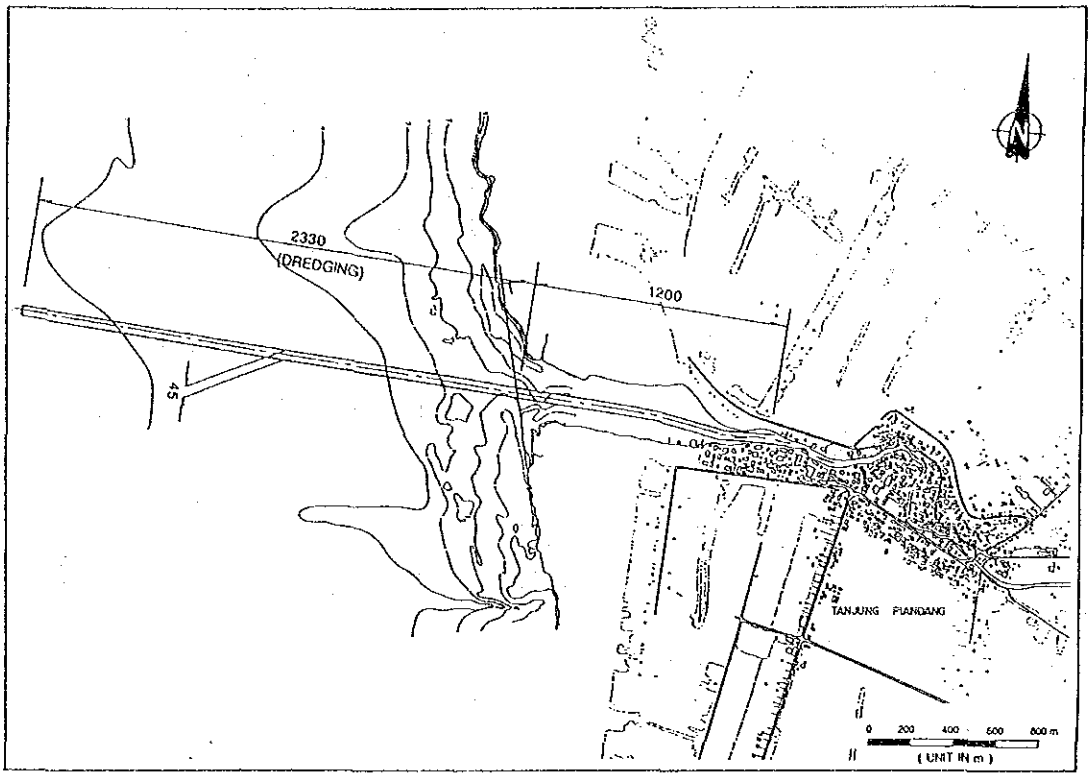


THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA JAPAN INTERNATIONAL COOPERATION AGENCY	GENERAL LAYOUT OF OPTIMUM COUNTERMEASURES AT KEDAH RIVER MOUTH Fig.5.3-7

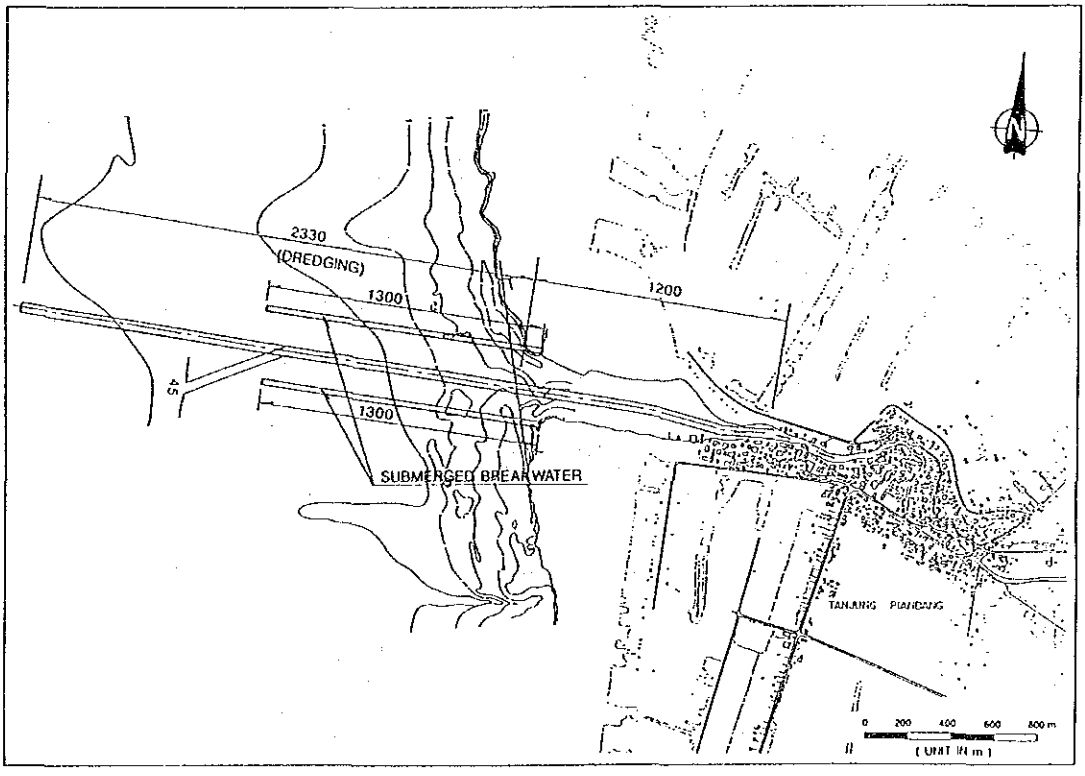


THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA JAPAN INTERNATIONAL COOPERATION AGENCY	INNER AND OUTER CHANNEL PROFILE OF TG. PIANDANG RIVER MOUTH Fig.5.3-8

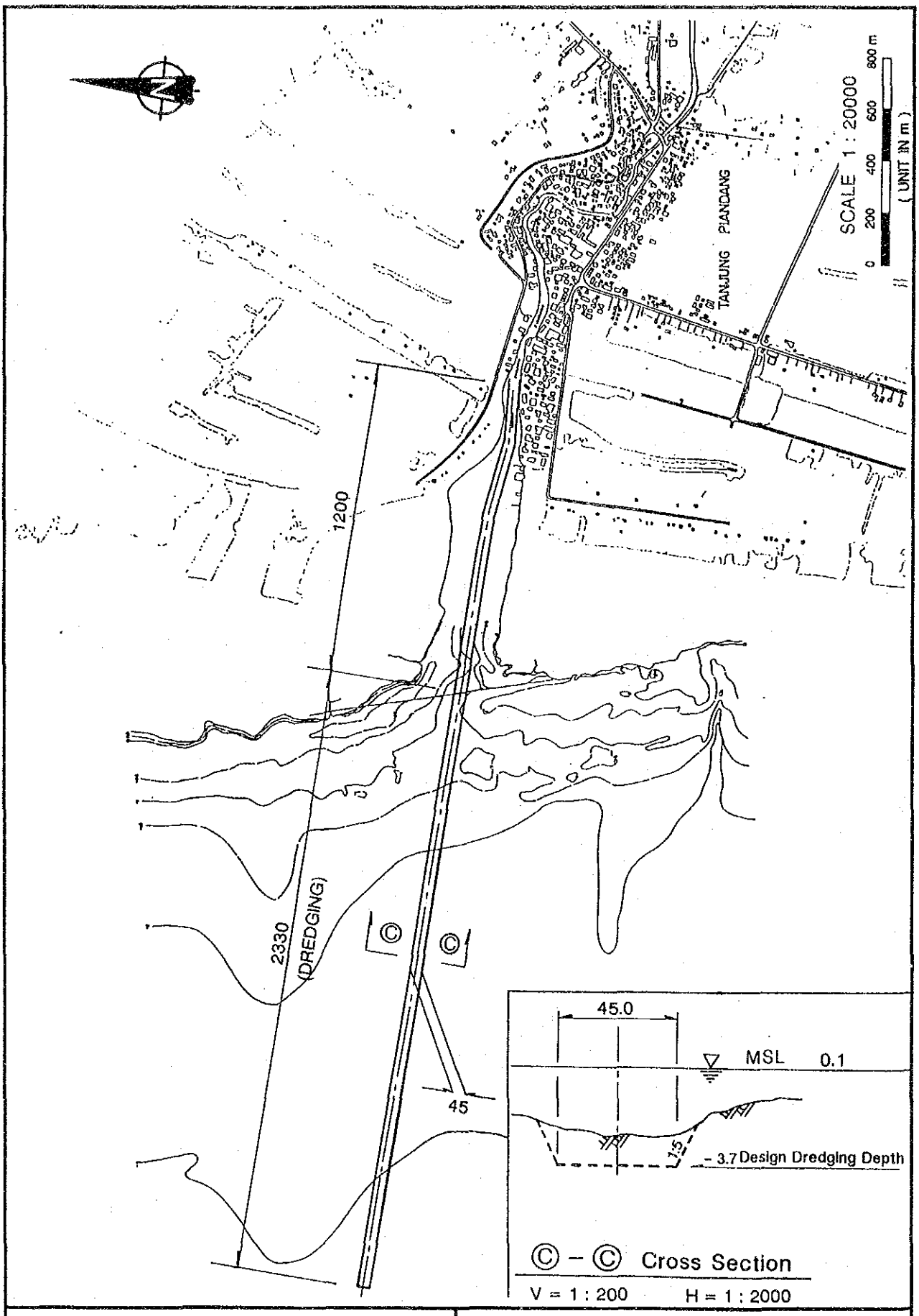
CASE - 1



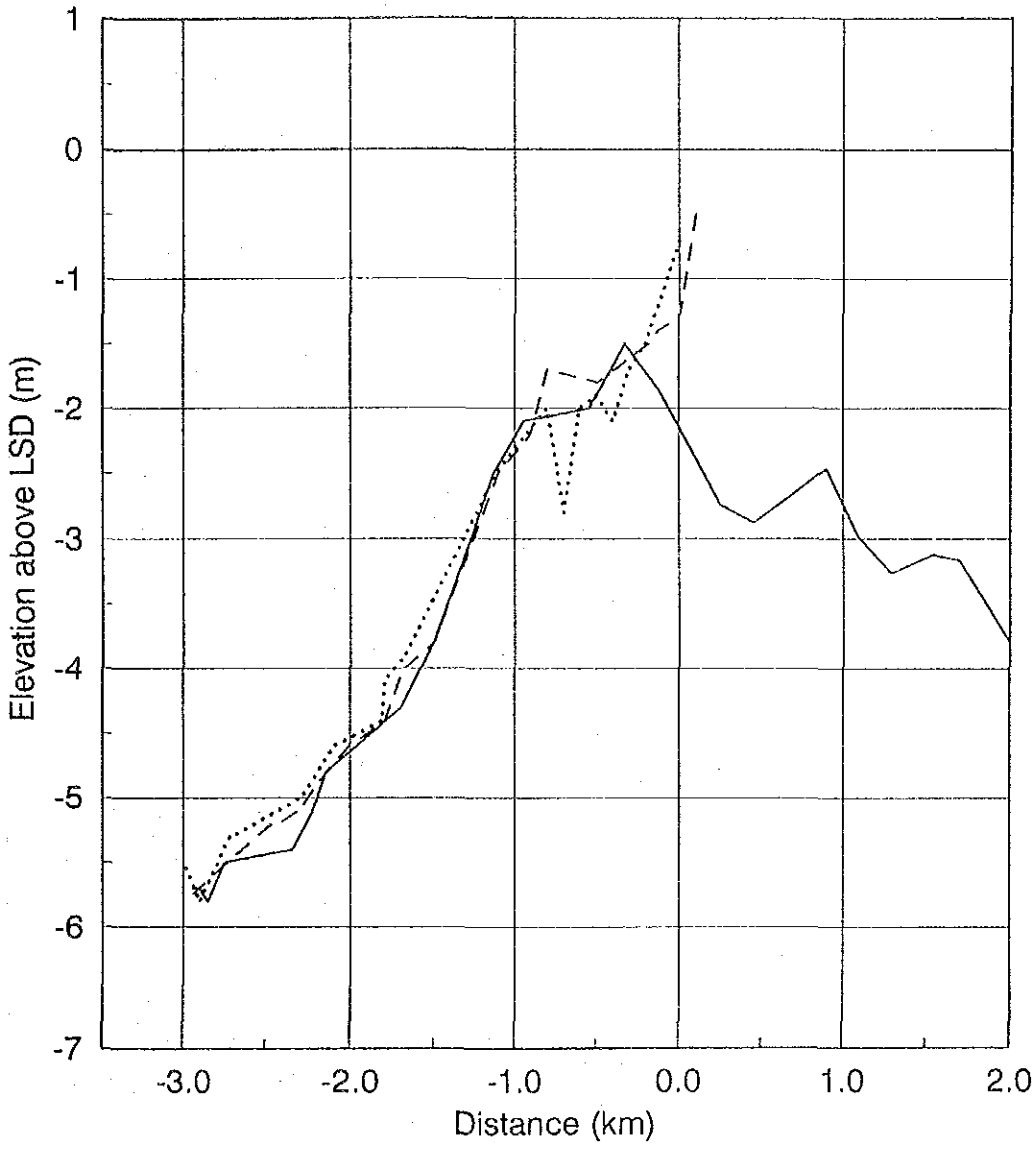
CASE - 2



THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	ALTERNATIVE STUDY CASES FOR TG. PIANDANG RIVER MOUTH Fig. 5.3-9
JAPAN INTERNATIONAL COOPERATION AGENCY	

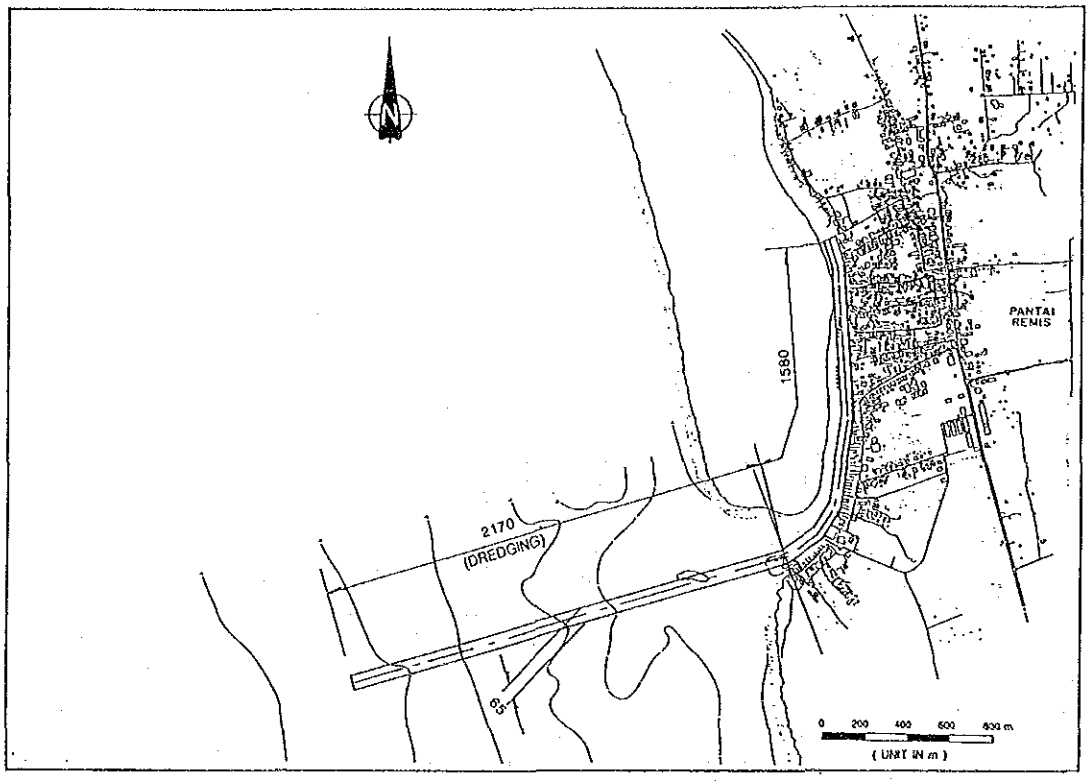


THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	GENERAL LAYOUT OF OPTIMUM COUNTERMEASURES AT TG. PIANDANG RIVER MOUTH Fig.5.3-10
JAPAN INTERNATIONAL COOPERATION AGENCY	

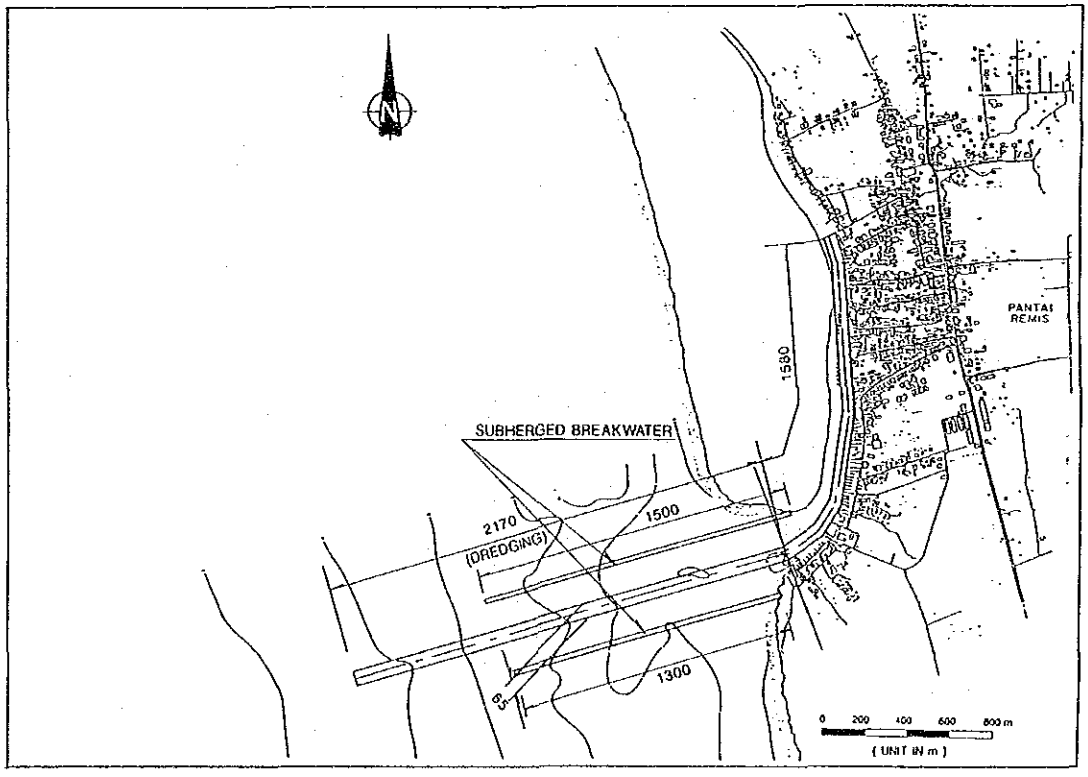


THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA JAPAN INTERNATIONAL COOPERATION AGENCY	INNER AND OUTER CHANNEL PROFILE OF BERUAS RIVER MOUTH Fig.5.3-11

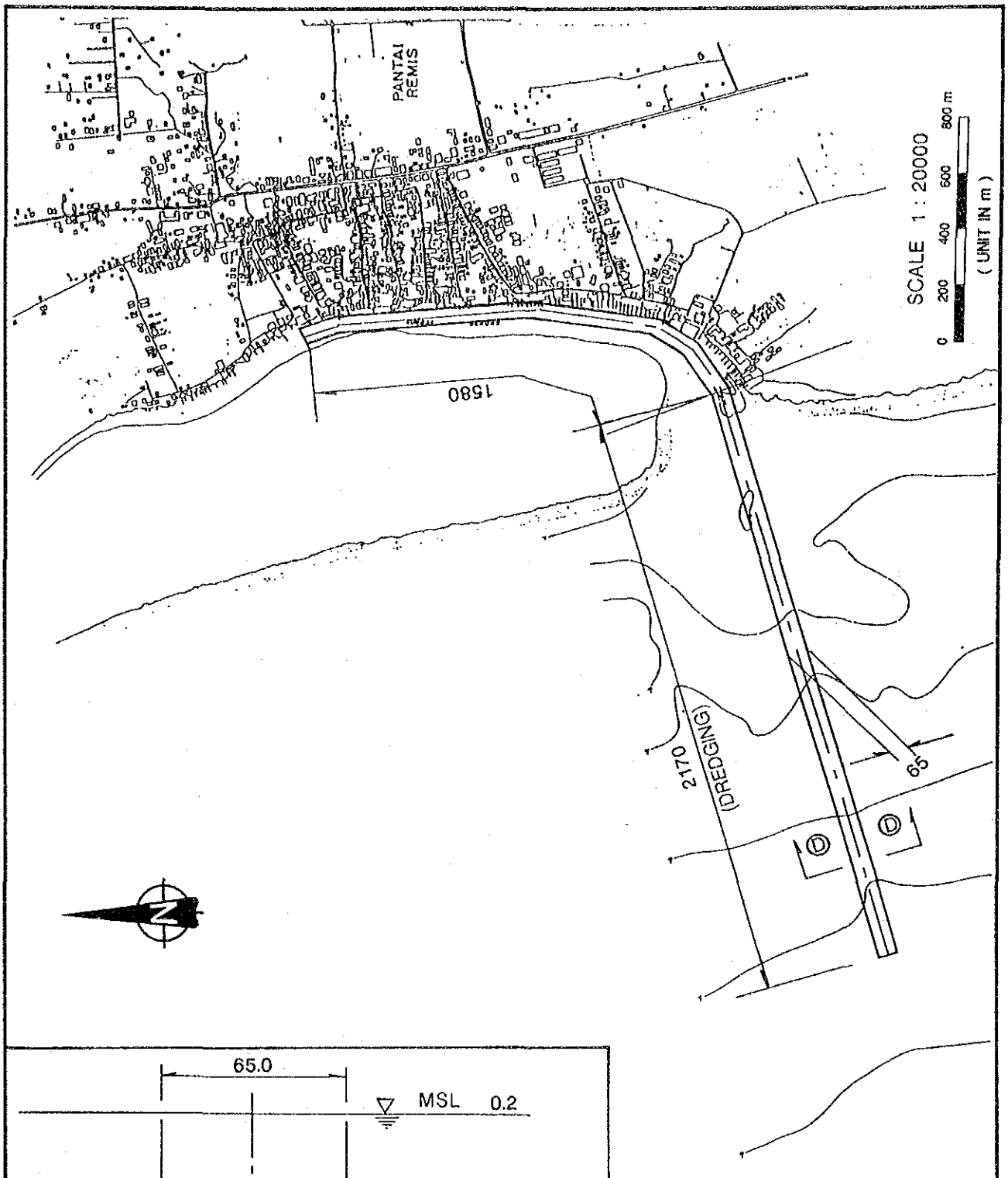
CASE - 1



CASE - 2



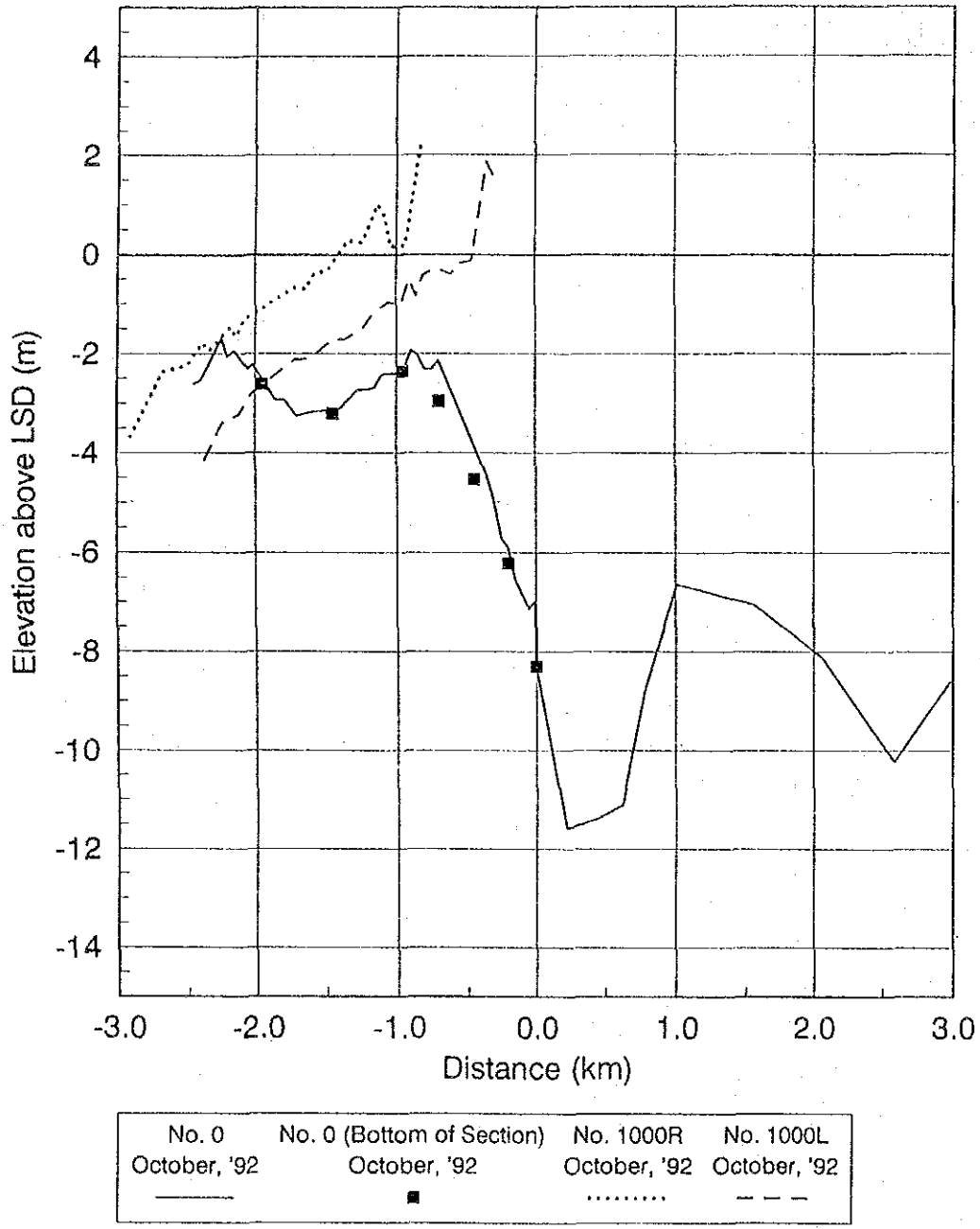
THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	ALTERNATIVE STUDY CASES AT BERUAS RIVER MOUTH
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. 5.3-12



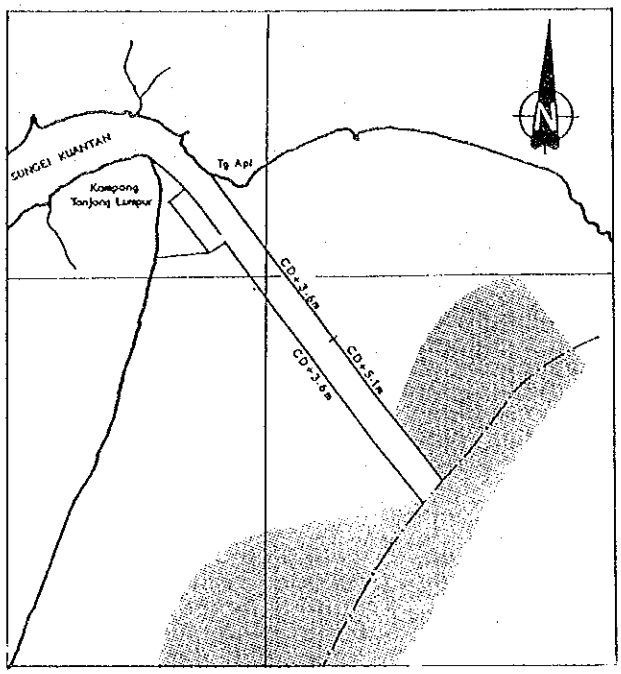
Ⓓ – Ⓓ Cross Section

V = 1 : 200 H = 1 : 2000

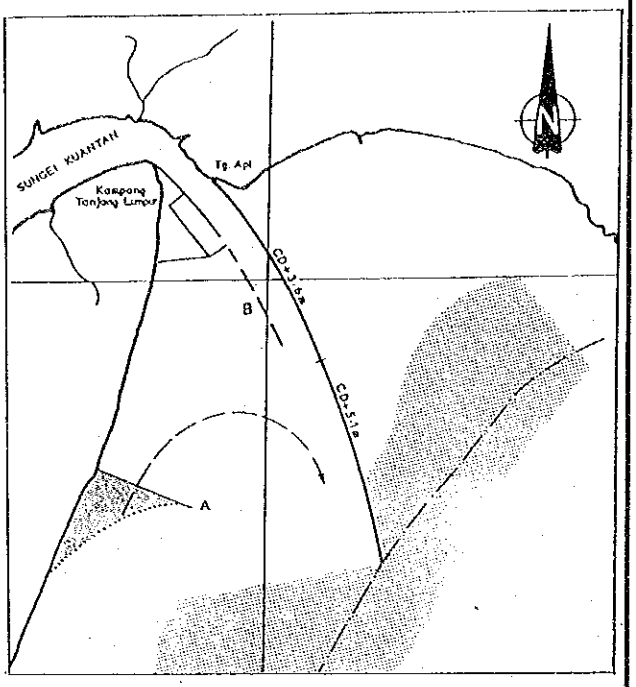
THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	GENERAL LAYOUT OF OPTIMUM COUNTERMEASURES AT BERUAS RIVER MOUTH Fig. 5.3-13
JAPAN INTERNATIONAL COOPERATION AGENCY	



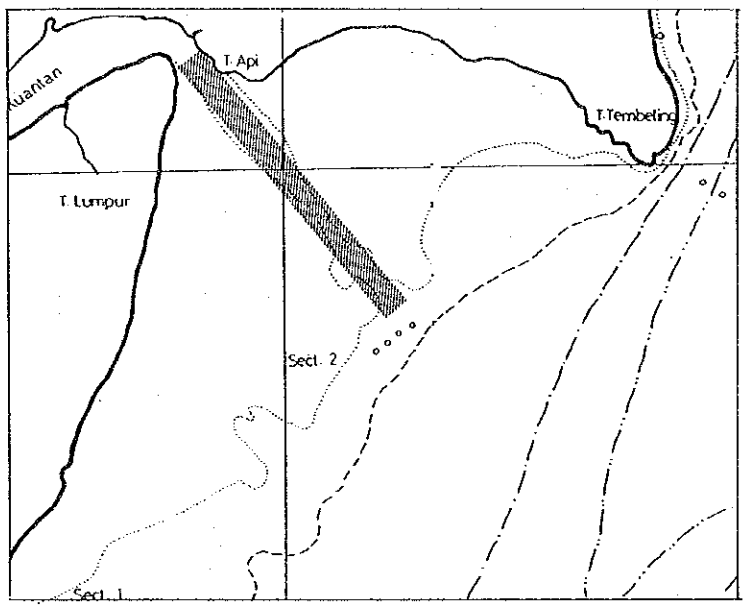
THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA JAPAN INTERNATIONAL COOPERATION AGENCY	INNER AND OUTER CHANNEL PROFILE OF KUANTAN RIVER MOUTH Fig.5.3-14



CASE-1 CONSTRUCTION OF TWO TRAINING DIKE



CASE-2 CONSTRUCTION OF ONE TRAINING DIKE AND ONE BREAKWATER

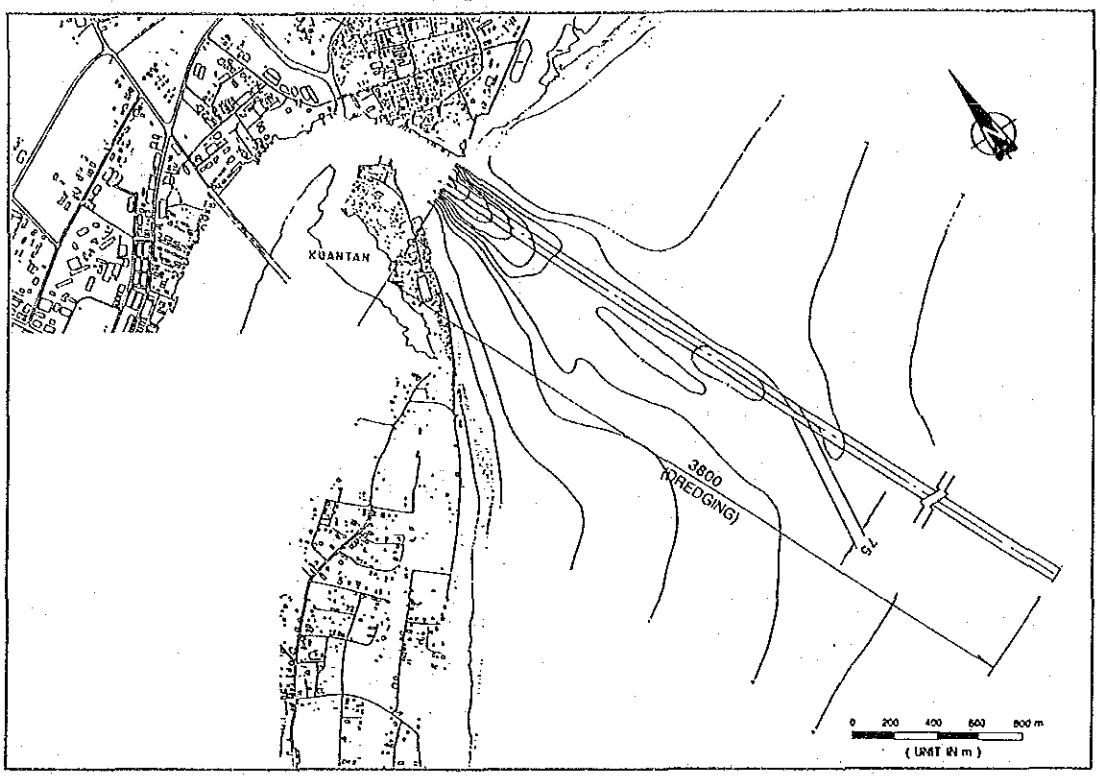


CASE-3 DREDGING

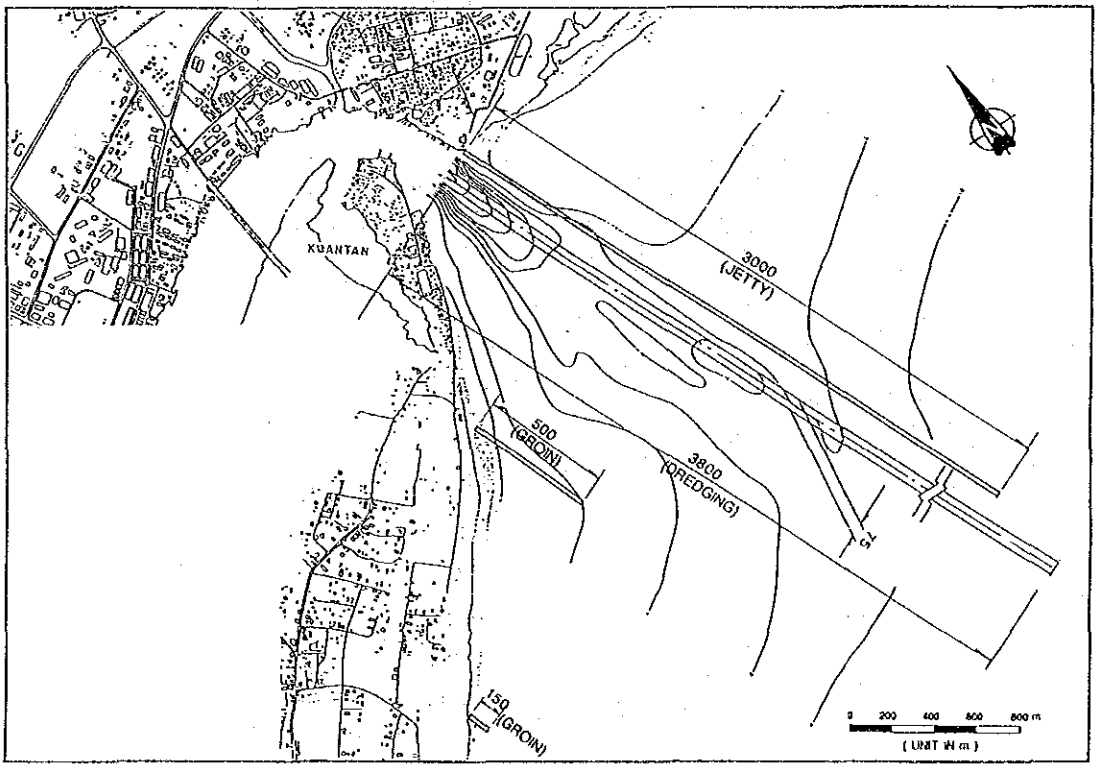
:DREDGING SECTION

THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	ALTERNATIVES FOR NAVIGATION CHANNEL IMPROVEMENT AT KUANTAN RIVER MOUTH Fig.5.3-15
JAPAN INTERNATIONAL COOPERATION AGENCY	

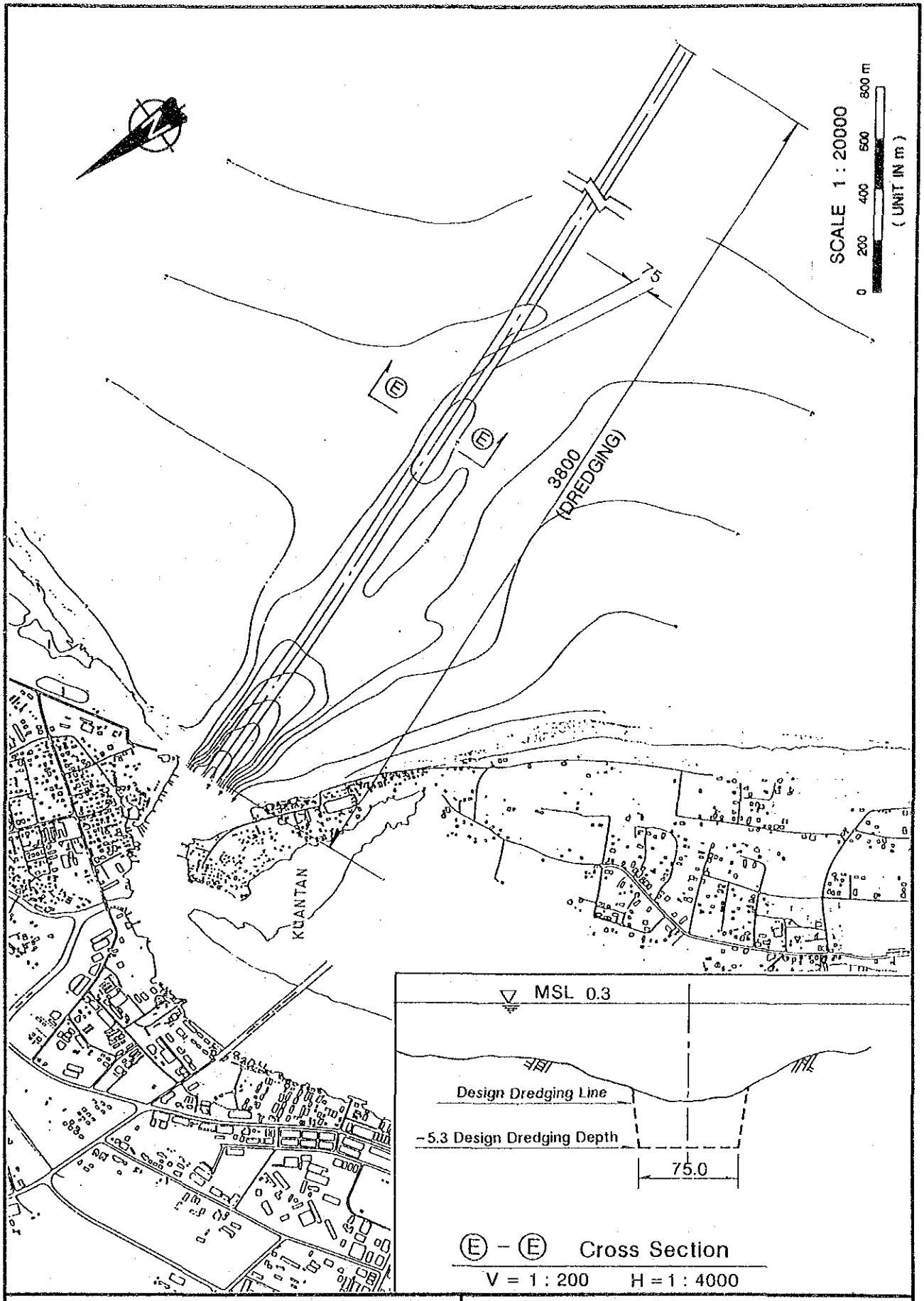
CASE - 1



CASE - 2



THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA JAPAN INTERNATIONAL COOPERATION AGENCY	ALTERNATIVE STUDY CASES FOR KUANTAN RIVER MOUTH Fig. 5.3-16

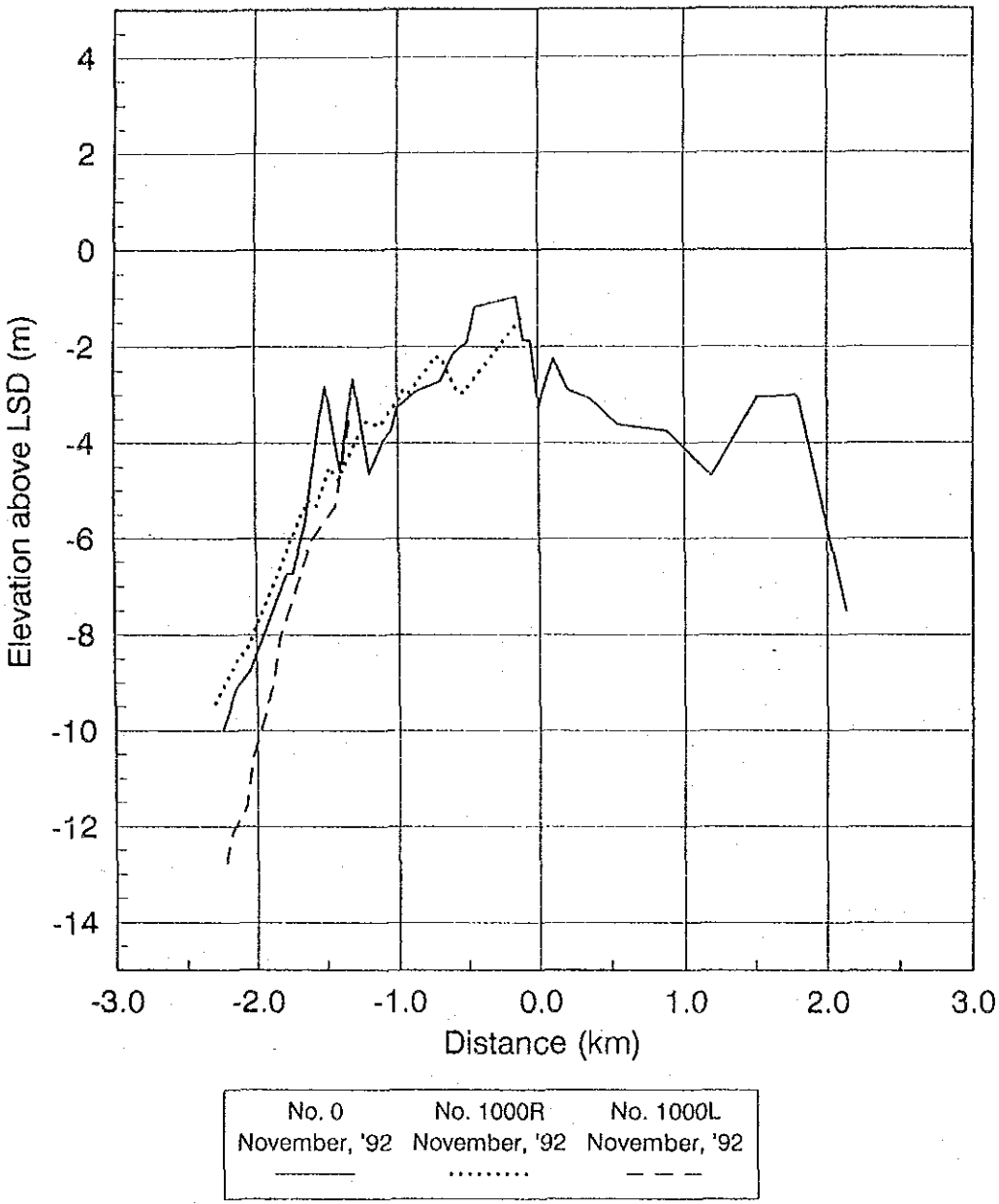


MASTER PLAN ON WATER RESOURCES DEVELOPMENT AND FEASIBILITY STUDY FOR URGENT FLOOD CONTROL AND URBAN DRAINAGE IN SEMARANG CITY AND SUBURBS

JAPAN INTERNATIONAL COOPERATION AGENCY

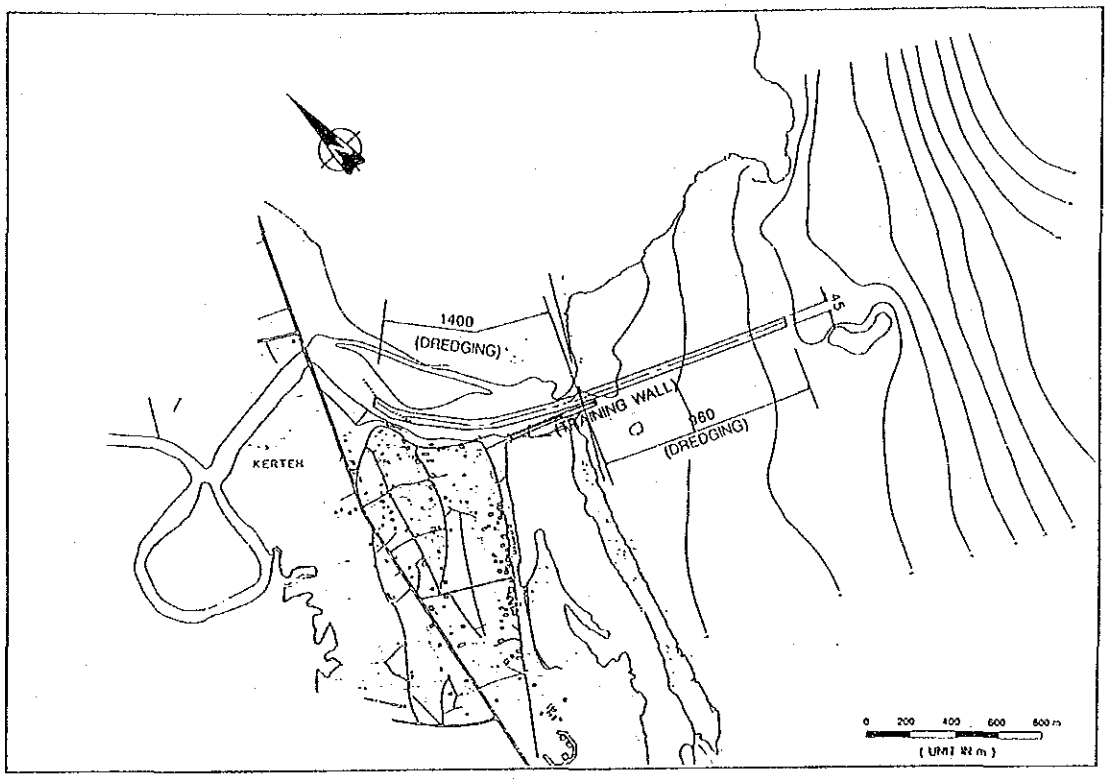
GENERAL LAYOUT OF OPTIMUM COUNTERMEASURES AT KUANTAN RIVER MOUTH

Fig. 5.3-17

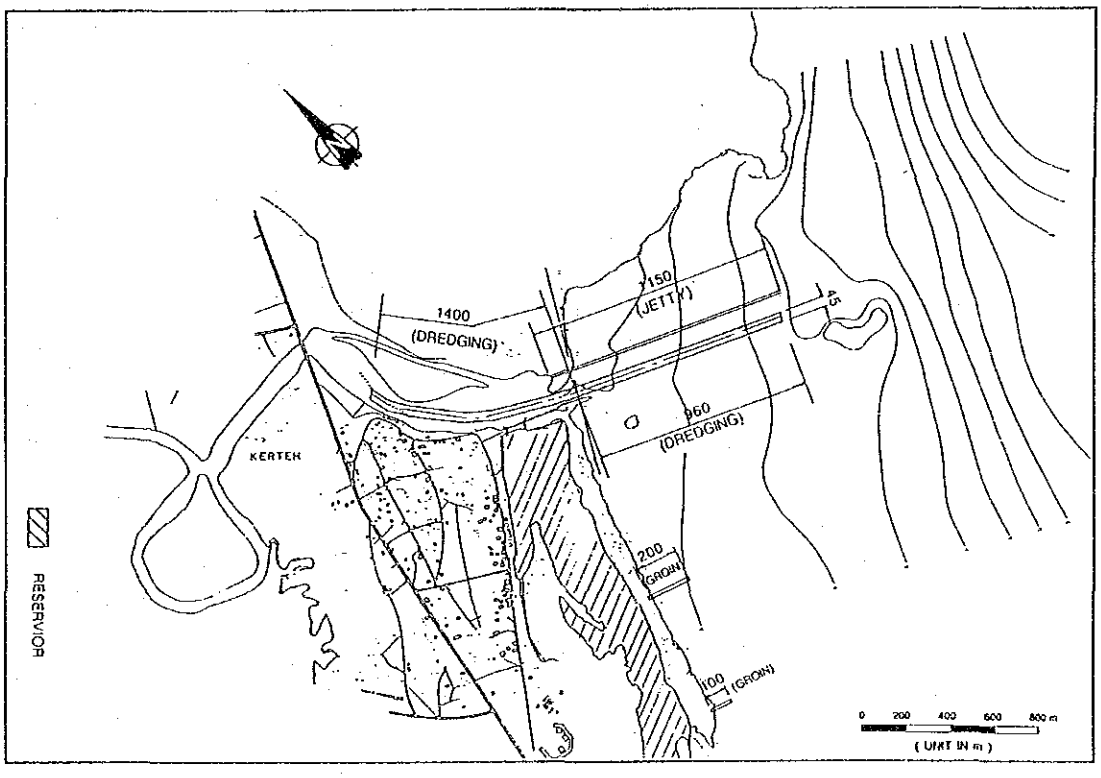


THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA JAPAN INTERNATIONAL COOPERATION AGENCY	INNER AND OUTER CHANNEL PROFILE OF KERTEH RIVER MOUTH Fig.5.3-18

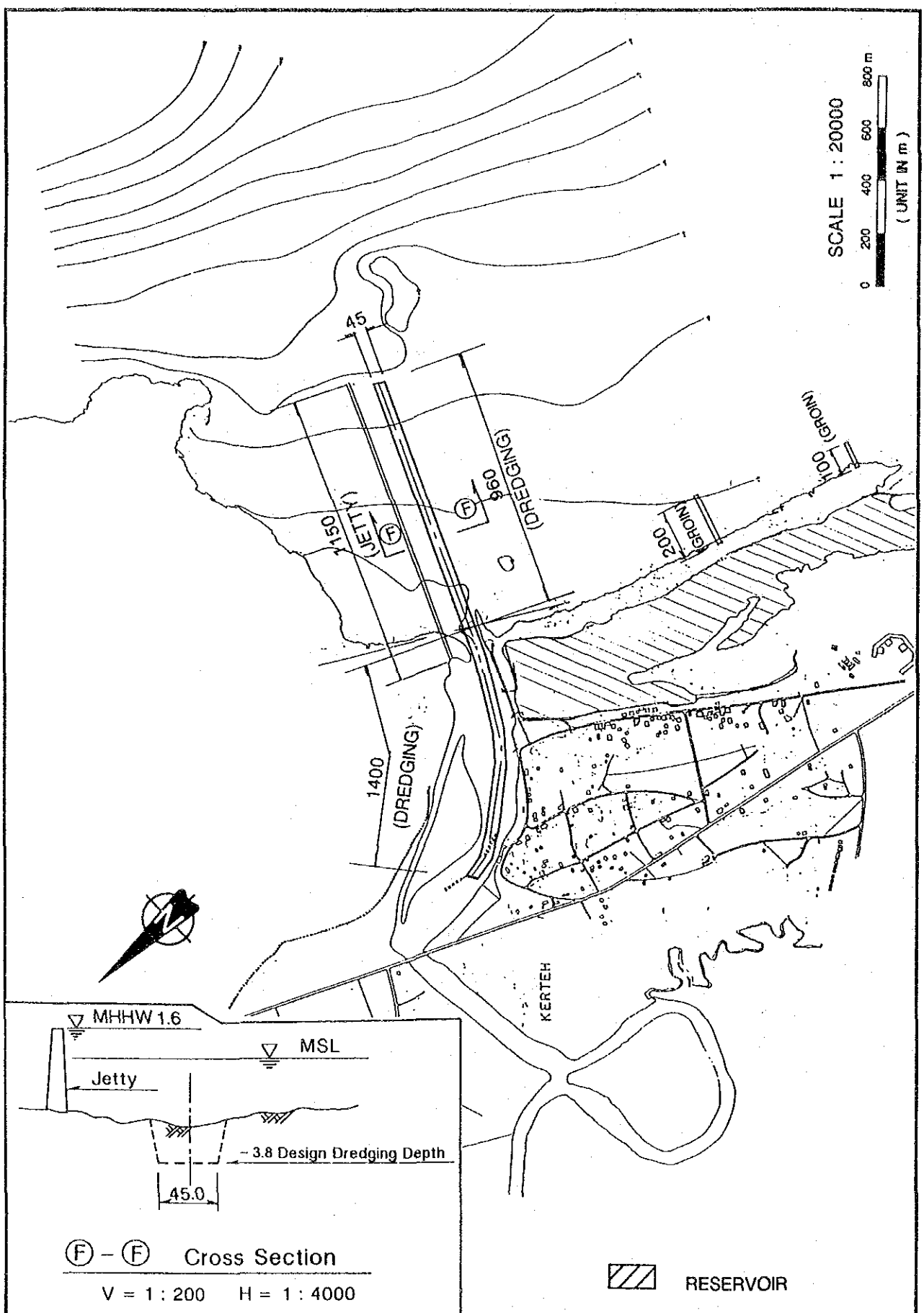
CASE - 1



CASE - 2



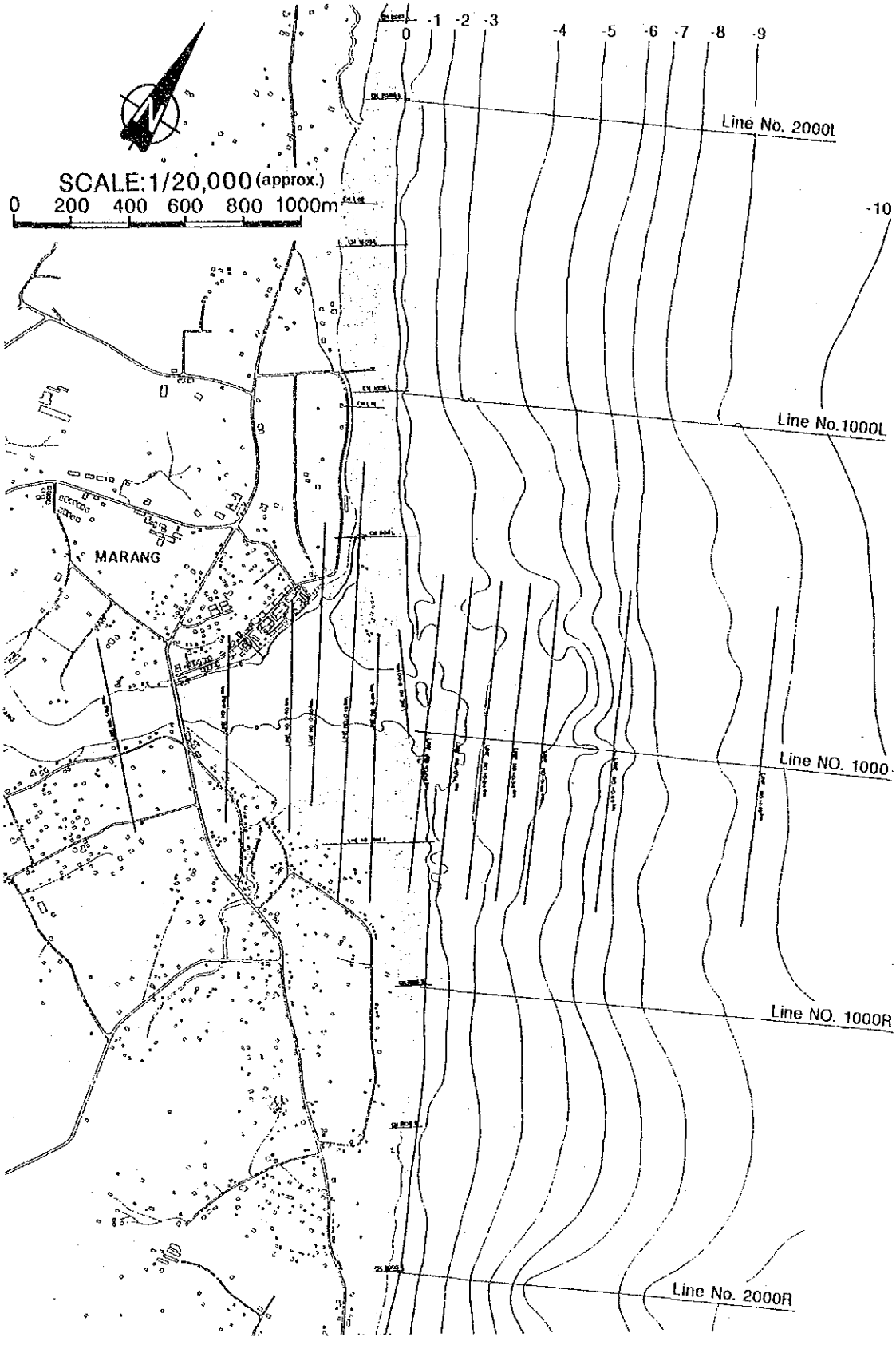
THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA JAPAN INTERNATIONAL COOPERATION AGENCY	ALTERNATIVE STUDY CASES FOR KERTEH RIVER MOUTH Fig. 5.3-19



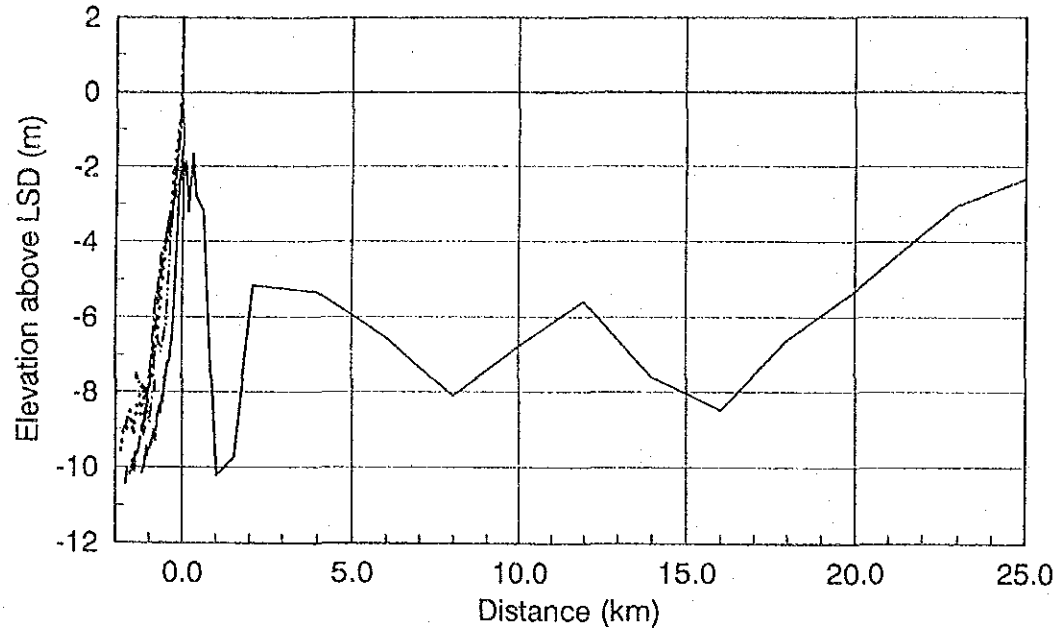
MASTER PLAN ON WATER RESOURCES DEVELOPMENT AND FEASIBILITY STUDY FOR URGENT FLOOD CONTROL AND URBAN DRAINAGE IN SEMARANG CITY AND SUBURBS

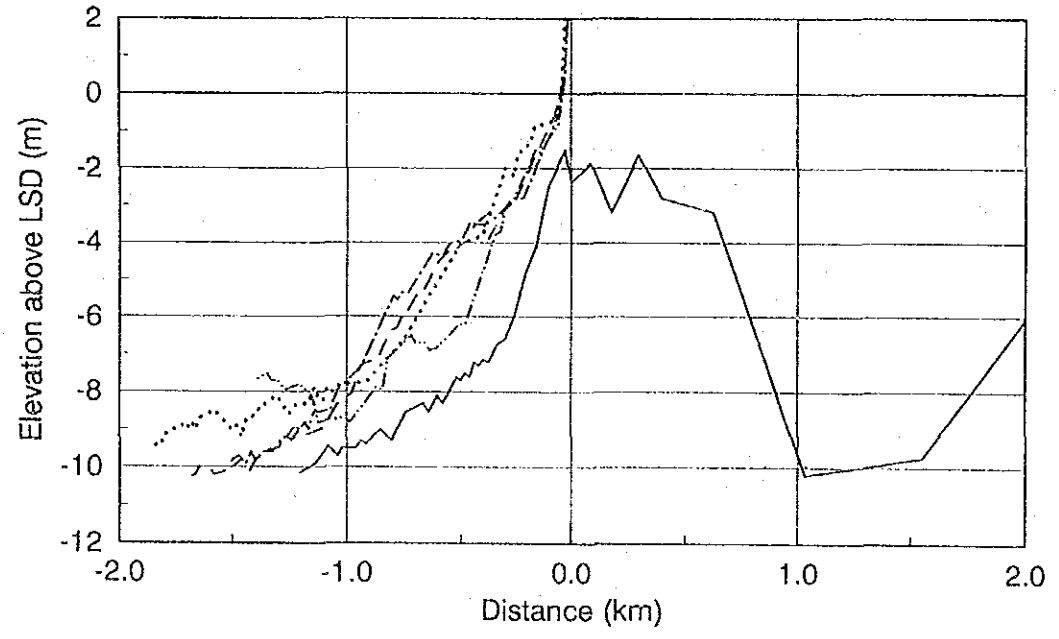
JAPAN INTERNATIONAL COOPERATION AGENCY

GENERAL LAYOUT OF OPTIMUM COUNTERMEASURES AT KERTEH RIVER MOUTH Fig.5.3-20



THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	DEPTH CHART OF MARANG RIVER MOUTH SURVEYED IN 1992
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.5.3-21





No. 0 October, '92	No. 1000R October, '92	No. 1000L October, '92	No. 2000R October, '92	No. 2000L October, '92

THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	INNER AND OUTER CHANNEL PROFILE OF MARANG RIVER MOUTH
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.5.3-22