Table 6.3-3 EVALUATION OF BREAKER INDEX

River Mouth	Beach Slope	Coefficients		Wave Period	Breaker Index by Breaker height				
	m	a	b	T (sec)	5 m	4 m	3 m	2 m	1 m
Perlis	1/1000	0.823	0.788	6	0.776	0.778	0.781	0.783	0.785
				8	0.781	0.782	0.784	0.785	0.786
				10	0.783	0.784	0.785	0.786	0.787
Kedah	1/1000	0.823	0.788	6	0.776	0.778	0.781	0.783	0.785
				8	0.781	0.782	0.784	0.785	0.786
				10	0.783	0.784	0.785	0.786	0.787
Tg.Piandang	1/ 500	1.631	0.795	6	0.772	0.777	0.781	0.786	0.791
				8	0.782	0.785	0.787	0.790	0.793
				10	0.787	0.789	0.790	0.792	0.794
Beruas	1/ 500	1.631	0.795	6	0.772	0.777	0.781	0.786	0.791
				8	0.782	0.785	0.787	0.790	0.793
				10	0.787	0.789	0.790	0.792	0.794
Kuantan	1/ 500	1.631	0.795	6	0.772	0.777	0.781	0.786	0.791
				8	0.782	0.785	0.787	0.790	0.793
				10	0.787	0.789	0.790	0.792	0.794
Kerten	1/ 300	2.685	0.805	6	0.772	0.777	0.781	0.786	0.791
				8	0.782	0.785	0.787	0.790	0.793
				10	0.787	0.789	0.790	0.792	0.794
Marang	1/ 100	7.571	0.856	6	0.772	0.777	0.781	0.786	0.791
				8	0.782	0.785	0.787	0.790	0.793
				10	0.787	0.789	0.790	0.792	0.794
Terenggan	1/ 100	7.571	0.856	6	0.772	0.777	0.781	0.786	0.791
				8	0.782	0.785	0.787	0.790	0.793
				10	0.787	0.789	0.790	0.792	0.794
Oya	1/ 400	2.030	0.799	6	0.772	0.777	0.781	0.786	0.791
				8	0.782	0.785	0.787	0.790	0.793
				10	0.787	0.789	0.790	0.792	0.794
Papar	1/ 100	7.571	0.856	6	0.772	0.777	0.781	0.786	0.791
				8	0.782	0.785	0.787	0.790	0.793
				10	0.787	0.789	0.790	0.792	0.794

Table 6.3-4 WAVE HEIGHT COEFFICIENTS FOR REFRACTED DEEPWATER WAVES FOR MERSING

Ocean Wave Characteristic		Depth = 5 m				Depth = 4 m				Depth = 3 m				Depth = 2 m				Depth = 1 m			
Direction °N	Period (sec)	Direction °N	Kr	Ks	K=Kr*Ks	Direction °N	Kr	Ks	K=Kr*Ks	Direction °N	Kr	Ks	K=Kr*Ks	Direction °N	Kr	Ks	K=Kr*Ks	Direction °N	Kr	Ks	K=Kr*Ks
0	6.0	34.8	0.642	0.958	0.615	41.6	0.623	0.984	0.613	47.4	0.607	1.031	0.626	51.4	0.598	1.110	0.663	55.4	0.587	1.277	0.749
	8.0	32.6	0.835	1.099	0.918	36.6	0.826	1.143	0.944	45.4	0.810	1.206	0.977	55.0	0.788	1.318	1.039	58.9	0.775	1.544	1.197
	10.0	38.3	0.658	1.217	0.800	41.6	0.668	1.270	0.849	44.4	0.788	1.353	1.067	46.3	0.707	1.484	1.049	45.2	0.708	1.750	1.239
30	6.0	50.9	0.798	0.946	0.755	54.8	0.786	0.970	0.762	58.4	0.774	1.015	0.786	60.6	0.763	1.091	0.833	62.2	0.750	1.257	0.943
	8.0	51.1	0.638	1.056	0.674	54.7	0.653	1.098	0.717	57.6	0.604	1.159	0.700	60.2	0.600	1.260	0.756	62.1	0.676	1.467	0.991
	10.0	66.1	0.707	1.196	0.845	64.9	0.648	1.252	0.811	64.3	0.520	1.331	0.692	64.4	0.520	1.464	0.761	65.1	0.588	1.685	0.991
60	6.0	68.4	1.051	0.945	0.993	70.6	1.046	0.971	1.016	73.3	1.038	1.016	1.055	74.3	1.025	1.094	1.121	72.5	1.001	1.266	1.267
	8.0	66.8	0.840	1.063	0.893	68.7	0.836	1.107	0.926	72.7	0.830	1.168	0.970	76.4	0.814	1.272	1.035	71.7	0.786	1.490	1.171
	10.0	65.5	0.736	1.203	0.885	65.9	0.733	1.261	0.925	66.3	0.730	1.333	0.973	70.0	0.721	1.467	1.058	68.2	0.701	1.719	1.205
90	6.0	83.8	0.751	0.946	0.710	82.0	0.896	0.970	0.870	80.8	0.889	1.012	0.900	78.9	0.869	1.089	0.946	78.4	0.833	1.258	1.048
	8.0	70.0	0.770	1.040	0.801	68.2	0.700	1.079	0.755	68.4	0.700	1.151	0.806	72.1	0.690	1.236	0.853	66.5	0.660	1.469	0.970
	10.0	60.0	0.730	1.172	0.856	68.5	0.720	1.217	0.876	67.2	0.720	1.302	0.937	64.0	0.701	1.426	1.000	61.3	0.650	1.651	1.073
120	6.0	88.9	0.751	0.942	0.707	87.7	0.743	0.970	0.721	87.8	0.677	1.020	0.691	86.5	0.731	1.091	0.798	83.0	0.694	1.262	0.876
	8.0	83.8	0.734	1.045	0.767	82.6	0.776	1.090	0.846	84.0	0.600	1.153	0.692	81.6	0.665	1.254	0.834	79.0	0.620	1.475	0.915
	10.0	84.5	0.721	1.179	0.850	81.4	0.765	1.244	0.952	79.8	0.630	1.335	0.841	81.2	0.650	1.454	0.945	72.5	0.720	1.724	1.241

Table 6.3-5 (1/6) BREAKDOWN OF LONGSHORE TRANSPORT RATE CALCULATION (KUANTAN)

Shoreline Orientation = 52° N

Ocean Wave Characteristics				Breaking Wave Characteristics				Longshore Energy	Longshore Transport
Direction °N	Period (sec)	Height (m)	Percent (%)	Depth (m)	Height (m)	Direction °N	Angle<1 (deg.)	Flux Factor (J/m/s)	Rate (1000m3/y
30	6	0.50	5.5	0.28	0.22	115	27	2.8	0.5
(NNE)		1.25	7.2	0.71	0.55	110	32	40.1	7.1
		2.25	1.4	1.27	0.99	105	37	36.9	6.5
		3.25	0.3	1.84	1.44	99	43	20.6	3.6
		4.00	0.1	2.53	1.98	89	53	14.7	2.6
	8	0.50	0.3	0.38	0.30	105	37	0.4	0.1
		1.25	3.1	0.95	0.74	103	39	40.3	7.1
		2.25	2.0	1.58	1.23	100	42	92.9	16.4
		3.25	0.5	2.25	1.76	96	46	56.7	10.0
		4.00	0.2	2.84	2.22	89	53	39.0	6.9
	10	0.50	0.2	0.53	0.41	104	38	0.6	0.1
		1.25	1.3	1.27	0.99	102	40	34.8	6.2
		2.25	1.2	2.24	1.75	97	45	134.6	23.8
		3.25	0.5	3.49	2.72	83	59	150.9	26.7
		4.00	0.3	4.36	3.40	78	64	138.9	24.6
	Sub-total		24.1			North to South		804.3	142.4
						South to North		0.0	0.0
60	6	0.50	3.7	0.40	0.31	105	37	5.3	0.9
(ENE)		1.25	3.1	1.00	0.78	103	39	44.9	7.9
		2.25	0.4	1.78	1.39	101	41	25.0	4.4
		3.25	0.1	2.60	2.03	93	49	16.1	2.9
		4.00	0.0	3.25	2.54	87	55	0.0	0.0
	8	0.50	0.3	0.66	0.51	84	58	1.4	0.3
		1.25	1.3	1.37	1.07	91	51	41.9	7.4
		2.25	0.5	2.16	1.69	97	45	51.5	9.1
		3.25	0.1	3.15	2.45	96	46	26.2	4.6
		4.00	0.0	4.03	3.15	91	51	0.0	0.0
	10	0.50	0.1	0.32	0.25	76	66	0.1	0.0
		1.25	0.5	0.79	0.62	82	60	3.6	0.6
		2.25	0.3	1.57	1.23	93	49	13.8	2.4
		3.25	0.1	2.36	1.84	98	44	12.8	2.3
		4.00	0.0	2.90	2.26	97	45	0.0	0.0
	Sub-total		10.5			North to South		242.5	42.9
						South to North		0.0	0.0
90	6	0.50	2.0	0.39	0.30	88	54	2.6	0.5
(E)		1.25	0.8	0.96	0.75	93	49	10.8	1.9
		2.25	0.1	2.14	1.67	101	41	9.9	1.8
		3.25	0.0	3.02	2.36	99	43	0.0	0.0
		4.00	0.0	3.75	2.92	95	47	0.0	0.0
	8	0.50	0.1	0.82	0.64	113	29	0.8	0.1
		1.25	0.2	1.72	1.34	109	33	10.6	1.9
		2.25	0.1	2.75	2.15	98	44	18.8	3.3
		3.25	0.0	3.72	2.90	94	48	0.0	0.0
		4.00	0.0	4.42	3.45	91	51	0.0	0.0
	10	0.50	0.0	0.66	0.51	111	31	0.0	0.0
		1.25	0.0	1.53	1.19	102	40	0.0	0.0
		2.25	0.0	2.68	2.09	94	48	0.0	0.0
		3.25	0.0	3.73	2.91	89	53	0.0	0.0
		4.00	0.0	4.45	3.47	85	57	0.0	0.0
	Sub-total		3.3			North to South		53.5	9.5
						South to North		0.0	0.0
120	6	0.50	2.0	0.54	0.43	103	39	6.4	1.1
(ESE)		1.25	0.7	1.30	1.01	113	29	17.1	3.0
		2.25	0.0	2.21	1.72	123	19	0.0	0.0
		3.25	0.0	3.11	2.42	124	18	0.0	0.0
		4.00	0.0	3.72	2.90	124	18	0.0	0.0
	8	0.50	0.0	0.41	0.32	101	41	0.0	0.0
		1.25	0.1	1.03	0.80	109	33	1.5	0.3
		2.25	0.0	1.71	1.33	119	23	0.0	0.0
		3.25	0.0	2.40	1.87	123	19	0.0	0.0
		4.00	0.0	2.93	2.28	125	17	0.0	0.0
	10	0.50	0.0	0.43	0.34	98	44	0.0	0.0
		1.25	0.0	1.06	0.83	104	38	0.0	0.0
		2.25	0.0	1.74	1.36	111	31	0.0	0.0
		3.25	0.0	2.43	1.90	111	31	0.0	0.0
		4.00	0.0	2.95	2.30	108	34	0.0	0.0
	Sub-total		2.8			North to South		25.0	4.4
						South to North		0.0	0.0
150	6	0.50	3.8	0.35	0.27	105	37	3.9	0.7
(SSE)		1.25	2.2	0.87	0.68	111	31	20.5	3.6
		2.25	0.1	1.49	1.16	118	24	3.0	0.5
		3.25	0.0	2.12	1.66	124	18	0.0	0.0
		4.00	0.0	2.68	2.09	124	18	0.0	0.0
	8	0.50	0.1	0.34	0.27	101	41	0.1	0.0
		1.25	0.5	0.85	0.67	109	33	4.6	0.8
		2.25	0.0	1.43	1.12	118	24	0.0	0.0
		3.25	0.0	1.98	1.55	126	16	0.0	0.0
		4.00	0.0	2.39	1.86	125	17	0.0	0.0
	10	0.50	0.0	0.38	0.30	121	21	0.0	0.0
		1.25	0.1	0.96	0.75	121	21	0.9	0.2
		2.25	0.0	1.55	1.21	121	21	0.0	0.0
		3.25	0.0	2.13	1.66	121	21	0.0	0.0
		4.00	0.0	2.55	1.99	122	20	0.0	0.0
	Sub-total		6.8			North to South		33.0	5.8
						South to North		0.0	0.0
Grand-total			47.5			North to South		1,158.2	205.0
						South to North		0.0	0.0

Table 6.3-5 (2/6) BREAKDOWN OF LONGSHORE TRANSPORT RATE CALCULATION (KERTEH)

Shoreline Orientation = 37° N

Ocean Wave Characteristics				Breaking Wave Characteristics				Longshore Energy Flux Factor	Longshore Transport Rate
Direction °N	Period (sec)	Height (m)	Percent (%)	Depth (m)	Height (m)	Direction °N	Angle<1 (deg.)	(J/m/s)	(1000m3/yr)
30 (NNE)	6	0.50	5.5	0.30	0.23	114	13	1.8	0.3
		1.25	7.2	0.75	0.59	105	22	37.0	6.5
		2.25	1.4	1.35	1.05	93	34	41.2	7.3
		3.25	0.3	1.95	1.52	81	46	23.8	4.2
		4.00	0.1	2.64	2.06	74	53	16.3	2.9
	8	0.50	0.3	0.32	0.25	131	-4	(0.0)	(0.0)
		1.25	3.1	0.80	0.62	120	7	6.8	1.2
		2.25	2.0	1.55	1.21	101	26	70.5	12.5
		3.25	0.5	2.45	1.91	85	42	69.8	12.4
		4.00	0.2	3.25	2.54	78	49	56.4	10.0
	10	0.50	0.2	0.37	0.29	114	13	0.1	0.0
		1.25	1.3	0.93	0.72	107	20	10.5	1.9
		2.25	1.2	1.65	1.28	98	29	53.5	9.5
		3.25	0.5	2.47	1.92	90	37	68.4	12.1
		4.00	0.3	3.15	2.45	87	40	77.6	13.7
Sub-total			24.1			North to South		533.8	94.5
						South to North		(0.0)	(0.0)
60 (ENE)	6	0.50	3.7	0.39	0.30	107	20	3.4	0.6
		1.25	3.1	0.97	0.76	100	27	35.0	6.2
		2.25	0.4	2.16	1.69	86	41	40.6	7.2
		3.25	0.1	3.34	2.60	78	49	30.2	5.3
		4.00	0.0	4.22	3.29	69	58	0.0	0.0
	8	0.50	0.3	0.67	0.53	97	30	1.5	0.3
		1.25	1.3	1.52	1.18	94	33	50.3	8.9
		2.25	0.5	2.57	2.00	89	38	76.9	13.6
		3.25	0.1	3.62	2.83	83	44	37.3	6.6
		4.00	0.0	4.40	3.43	80	47	0.0	0.0
	10	0.50	0.1	1.08	0.84	115	12	0.7	0.1
		1.25	0.5	2.42	1.89	95	32	60.7	10.7
		2.25	0.3	3.76	2.94	89	38	119.5	21.2
		3.25	0.1	4.90	3.82	87	40	77.9	13.8
		4.00	0.0	5.72	4.46	87	40	0.0	0.0
Sub-total			10.5			North to South		534.0	94.5
						South to North		0.0	0.0
90 (E)	6	0.50	2.0	0.60	0.47	120	7	2.0	0.4
		1.25	0.8	1.47	1.14	110	17	17.6	3.1
		2.25	0.1	2.57	2.00	100	27	12.9	2.3
		3.25	0.0	3.70	2.89	95	32	0.0	0.0
		4.00	0.0	4.58	3.57	94	33	0.0	0.0
	8	0.50	0.1	0.61	0.47	121	6	0.1	0.0
		1.25	0.2	1.49	1.16	110	17	4.5	0.8
		2.25	0.1	2.62	2.04	100	27	13.5	2.4
		3.25	0.0	3.77	2.94	94	33	0.0	0.0
		4.00	0.0	4.65	3.63	94	33	0.0	0.0
	10	0.50	0.0	0.64	0.50	120	7	0.0	0.0
		1.25	0.0	1.57	1.22	111	16	0.0	0.0
		2.25	0.0	2.74	2.14	100	27	0.0	0.0
		3.25	0.0	3.92	3.06	93	34	0.0	0.0
		4.00	0.0	4.83	3.77	94	33	0.0	0.0
Sub-total			3.3			North to South		50.6	9.0
						South to North		0.0	0.0
120 (ESE)	6	0.50	2.0	0.83	0.65	132	-5	(3.5)	(0.6)
		1.25	0.7	1.82	1.42	121	6	9.7	1.7
		2.25	0.0	2.94	2.29	119	8	0.0	0.0
		3.25	0.0	3.95	3.08	120	7	0.0	0.0
		4.00	0.0	4.73	3.69	119	8	0.0	0.0
	8	0.50	0.0	0.98	0.77	117	10	0.0	0.0
		1.25	0.1	1.97	1.54	118	9	2.5	0.4
		2.25	0.0	3.07	2.40	117	10	0.0	0.0
		3.25	0.0	4.07	3.17	115	12	0.0	0.0
		4.00	0.0	4.82	3.76	113	14	0.0	0.0
	10	0.50	0.0	1.20	0.94	118	9	0.0	0.0
		1.25	0.0	2.45	1.91	112	15	0.0	0.0
		2.25	0.0	3.80	2.97	110	17	0.0	0.0
		3.25	0.0	5.06	3.95	109	18	0.0	0.0
		4.00	0.0	6.01	4.69	108	19	0.0	0.0
Sub-total			2.8			North to South		12.3	2.2
						South to North		(3.5)	(0.6)
150 (SSE)	6	0.50	3.8	0.62	0.49	129	-2	(1.1)	(0.2)
		1.25	2.2	1.45	1.13	129	-2	(4.8)	(0.9)
		2.25	0.1	2.43	1.89	129	-2	(0.7)	(0.1)
		3.25	0.0	3.35	2.62	128	-1	0.0	0.0
		4.00	0.0	4.06	3.16	128	-1	0.0	0.0
	8	0.50	0.1	0.80	0.62	123	4	0.1	0.0
		1.25	0.5	1.80	1.41	121	6	7.3	1.3
		2.25	0.0	2.99	2.34	118	9	0.0	0.0
		3.25	0.0	4.13	3.22	123	4	0.0	0.0
		4.00	0.0	4.96	3.87	123	4	0.0	0.0
	10	0.50	0.0	0.78	0.61	132	-5	0.0	0.0
		1.25	0.1	1.75	1.37	112	15	3.0	0.5
		2.25	0.0	2.84	2.22	107	20	0.0	0.0
		3.25	0.0	3.83	2.99	113	14	0.0	0.0
		4.00	0.0	4.60	3.59	114	13	0.0	0.0
Sub-total			6.8			North to South		10.4	1.8
						South to North		(6.7)	(1.2)
Grand-total			47.5			North to South		1,141.1	202.0
						South to North		(10.1)	(1.8)

Note <1 : Angle between wave crest and shoreline

Table 6.3-5 (3/6) BREAKDOWN OF LONGSHORE TRANSPORT RATE CALCULATION (MARANG)

Shoreline Orientation = 325° N

Ocean Wave Characteristics				Breaking Wave Characteristics				Longshore Energy Flux Factor (J/m/s)	Longshore Transport Rate (1000m3/yr)
Direction °N	Period (sec)	Height (m)	Percent (%)	Depth (m)	Height (m)	Direction °N	Angle<1 (deg.)		
0	6	0.50	1.0	0.58	0.45	33	22	2.6	0.5
(N)		1.25	0.7	1.41	1.10	29	26	19.4	3.4
		2.25	0.1	2.43	1.89	25	30	11.8	2.1
		3.25	0.0	3.37	2.63	24	31	0.0	0.0
		4.00	0.0	4.05	3.16	24	31	0.0	0.0
	8	0.50	0.0	0.76	0.59	42	13	0.0	0.0
		1.25	0.2	1.55	1.21	41	14	4.2	0.7
		2.25	0.1	2.57	2.01	38	17	9.0	1.6
		3.25	0.0	3.61	2.82	34	21	0.0	0.0
		4.00	0.0	4.36	3.40	33	22	0.0	0.0
	10	0.50	0.0	0.49	0.38	46	9	0.0	0.0
		1.25	0.0	1.19	0.93	44	11	0.0	0.0
		2.25	0.0	3.03	2.36	35	20	0.0	0.0
		3.25	0.0	4.10	3.20	35	20	0.0	0.0
		4.00	0.0	4.87	3.80	35	20	0.0	0.0
	Sub-total		2.1			North to South		47.2	8.3
						South to North		0.0	0.0
30	6	0.50	2.4	0.71	0.55	33	22	10.5	1.9
(NNE)		1.25	4.1	1.61	1.25	32	23	144.0	25.5
		2.25	1.1	2.82	2.20	32	23	159.4	28.2
		3.25	0.2	3.95	3.08	33	22	64.0	11.3
		4.00	0.0	5.05	3.94	33	22	0.0	0.0
	8	0.50	0.2	0.93	0.73	40	15	1.3	0.2
		1.25	1.9	2.04	1.59	43	12	70.3	12.5
		2.25	2.0	3.31	2.58	45	10	208.0	36.8
		3.25	0.6	4.50	3.51	40	15	195.1	34.5
		4.00	0.1	5.36	4.18	35	20	62.7	11.1
	10	0.50	0.0	1.11	0.87	47	8	0.0	0.0
		1.25	0.9	2.28	1.78	42	13	44.8	7.9
		2.25	1.0	3.70	2.89	38	17	218.9	38.7
		3.25	0.6	4.98	3.89	39	16	261.7	46.3
		4.00	0.2	5.93	4.62	40	15	131.2	23.2
	Sub-total		15.3			North to South		1,571.9	278.2
						South to North		0.0	0.0
60	6	0.50	3.7	0.73	0.57	55	0	0.2	0.0
(ENE)		1.25	5.9	1.68	1.31	67	-12	(132.3)	(23.4)
		2.25	1.0	2.87	2.24	68	-13	(92.7)	(16.4)
		3.25	0.1	4.00	3.12	64	-9	(15.2)	(2.7)
		4.00	0.0	4.84	3.77	62	-7	0.0	0.0
	8	0.50	0.2	0.90	0.70	52	3	0.3	0.0
		1.25	3.2	1.93	1.50	63	-8	(67.0)	(11.9)
		2.25	1.9	3.19	2.48	68	-13	(221.4)	(39.2)
		3.25	0.3	4.34	3.39	64	-9	(53.0)	(9.4)
		4.00	0.1	5.15	4.02	61	-6	(19.0)	(3.4)
	10	0.50	0.1	1.03	0.80	56	-1	(0.0)	(0.0)
		1.25	1.3	2.17	1.69	57	-2	(9.8)	(1.7)
		2.25	0.9	3.53	2.75	60	-5	(58.1)	(10.3)
		3.25	0.5	4.75	3.71	61	-6	(72.1)	(12.8)
		4.00	0.1	5.62	4.39	61	-6	(23.7)	(4.2)
	Sub-total		19.3			North to South		0.5	0.1
						South to North		(764.3)	(135.3)
90	6	0.50	3.4	0.77	0.60	73	-18	(15.8)	(2.8)
(E)		1.25	2.6	1.70	1.33	81	-26	(114.8)	(20.3)
		2.25	0.2	2.82	2.20	79	-24	(29.8)	(5.3)
		3.25	0.0	3.88	3.03	79	-24	0.0	0.0
		4.00	0.0	4.68	3.65	80	-25	0.0	0.0
	8	0.50	0.0	0.76	0.60	66	-11	0.0	0.0
		1.25	0.9	1.68	1.31	71	-16	(26.3)	(4.7)
		2.25	0.4	2.80	2.18	70	-15	(39.6)	(7.0)
		3.25	0.1	3.81	2.97	69	-14	(20.2)	(3.6)
		4.00	0.0	4.56	3.56	70	-15	0.0	0.0
	10	0.50	0.0	0.88	0.69	63	-8	0.0	0.0
		1.25	0.2	1.93	1.50	65	-10	(5.4)	(1.0)
		2.25	0.2	3.16	2.46	68	-13	(24.0)	(4.2)
		3.25	0.0	4.30	3.35	70	-15	0.0	0.0
		4.00	0.0	5.16	4.03	70	-15	0.0	0.0
	Sub-total		8.0			North to South		0.0	0.0
						South to North		(275.8)	(48.8)
120	6	0.50	2.1	0.70	0.55	62	-7	(3.0)	(0.5)
(ESE)		1.25	1.1	1.66	1.30	81	-26	(45.1)	(8.2)
		2.25	0.0	2.88	2.24	89	-34	0.0	0.0
		3.25	0.0	3.93	3.07	92	-37	0.0	0.0
		4.00	0.0	4.72	3.68	95	-40	0.0	0.0
	8	0.50	0.1	0.58	0.45	62	-7	(0.1)	(0.0)
		1.25	0.2	1.40	1.09	75	-20	(4.4)	(0.8)
		2.25	0.0	2.47	1.92	84	-29	0.0	0.0
		3.25	0.0	3.49	2.72	84	-29	0.0	0.0
		4.00	0.0	4.18	3.26	84	-29	0.0	0.0
	10	0.50	0.0	0.77	0.60	72	-17	0.0	0.0
		1.25	0.0	1.70	1.33	80	-25	0.0	0.0
		2.25	0.0	2.84	2.22	82	-27	0.0	0.0
		3.25	0.0	3.86	3.01	82	-27	0.0	0.0
		4.00	0.0	4.61	3.60	84	-29	0.0	0.0
	Sub-total		3.5			North to South		0.0	0.0
						South to North		(53.5)	(9.5)
Grand-total			48.2			North to South		1,619.6	286.7
						South to North		(1,093.6)	(193.6)

Note <1 : Angle between wave crest and shoreline

Table 6.3-5 (4/6) BREAKDOWN OF LONGSHORE TRANSPORT RATE CALCULATION (TERENGGANU)

Shoreline Orientation = 325° N

Ocean Wave Characteristics				Breaking Wave Characteristics				Longshore Energy Flux Factor	Longshore Transport Rate
Direction °N	Period (sec)	Height (m)	Percent (%)	Depth (m)	Height (m)	Direction °N	Angle<1 (deg.)	(J/m/s)	(1000m3/yr)
0	6	0.50	1.0	0.66	0.52	34	21	3.6	0.6
(N)		1.25	0.7	1.53	1.20	26	29	25.7	4.5
		2.25	0.1	2.59	2.02	20	35	15.2	2.7
		3.25	0.0	3.57	2.78	18	37	0.0	0.0
		4.00	0.0	4.28	3.34	18	37	0.0	0.0
	8	0.50	0.0	0.79	0.62	41	14	0.0	0.0
		1.25	0.2	1.72	1.34	37	18	6.9	1.2
		2.25	0.1	2.77	2.16	35	20	12.4	2.2
		3.25	0.0	3.72	2.90	34	21	0.0	0.0
		4.00	0.0	4.42	3.45	32	23	0.0	0.0
	10	0.50	0.0	0.94	0.73	46	9	0.0	0.0
		1.25	0.0	2.04	1.59	43	12	0.0	0.0
		2.25	0.0	3.36	2.62	41	14	0.0	0.0
		3.25	0.0	4.57	3.56	38	17	0.0	0.0
		4.00	0.0	5.48	4.28	35	20	0.0	0.0
	Sub-total		2.1				North to South	63.8	11.3
							South to North	0.0	0.0
30	6	0.50	2.4	0.84	0.66	53	2	1.2	0.2
(NNE)		1.25	4.1	1.84	1.43	44	11	106.9	18.9
		2.25	1.1	3.01	2.34	44	11	97.5	17.3
		3.25	0.2	4.12	3.21	43	12	42.7	7.6
		4.00	0.0	5.02	3.92	47	8	0.0	0.0
	8	0.50	0.2	0.91	0.71	64	-9	(0.7)	(0.1)
		1.25	1.9	1.97	1.54	41	14	70.5	12.5
		2.25	2.0	3.18	2.48	39	16	292.4	51.7
		3.25	0.6	4.31	3.37	36	19	210.4	37.2
		4.00	0.1	5.16	4.03	38	17	50.1	8.9
	10	0.50	0.0	1.17	0.91	42	13	0.0	0.0
		1.25	0.9	2.37	1.85	40	15	56.9	10.1
		2.25	1.0	3.78	2.95	47	8	119.1	21.1
		3.25	0.6	5.08	3.96	47	8	146.2	25.9
		4.00	0.2	6.04	4.71	47	8	77.6	13.7
	Sub-total		15.3				North to South	1,271.4	225.0
							South to North	(0.7)	(0.1)
60	6	0.50	3.7	0.77	0.60	88	-33	(26.0)	(4.6)
(ENE)		1.25	5.9	1.73	1.35	68	-13	(154.6)	(27.4)
		2.25	1.0	2.89	2.26	59	-4	(30.8)	(5.4)
		3.25	0.1	4.00	3.12	58	-3	(4.2)	(0.7)
		4.00	0.0	4.81	3.75	58	-3	0.0	0.0
	8	0.50	0.2	0.88	0.69	87	-32	(1.9)	(0.3)
		1.25	3.2	1.92	1.50	67	-12	(100.0)	(17.7)
		2.25	1.9	3.18	2.48	60	-5	(93.7)	(16.6)
		3.25	0.3	4.35	3.39	58	-3	(15.9)	(2.8)
		4.00	0.1	5.19	4.05	58	-3	(8.3)	(1.5)
	10	0.50	0.1	1.00	0.78	85	-30	(1.3)	(0.2)
		1.25	1.3	2.12	1.65	66	-11	(45.9)	(8.1)
		2.25	0.9	3.48	2.72	60	-5	(48.2)	(8.5)
		3.25	0.5	4.73	3.69	58	-3	(35.3)	(6.2)
		4.00	0.1	5.65	4.40	58	-3	(10.1)	(1.8)
	Sub-total		19.3				North to South	0.0	0.0
							South to North	(576.4)	(102.0)
90	6	0.50	3.4	0.85	0.66	80	-25	(25.7)	(4.5)
(E)		1.25	2.6	1.85	1.44	77	-22	(127.2)	(22.5)
		2.25	0.2	3.08	2.40	81	-26	(39.1)	(6.9)
		3.25	0.0	4.21	3.29	83	-28	0.0	0.0
		4.00	0.0	5.08	3.96	83	-28	0.0	0.0
	8	0.50	0.0	1.08	0.85	71	-16	0.0	0.0
		1.25	0.9	2.25	1.75	76	-21	(68.8)	(12.2)
		2.25	0.4	3.53	2.76	79	-24	(105.2)	(18.6)
		3.25	0.1	4.81	3.75	79	-24	(56.1)	(9.9)
		4.00	0.0	5.73	4.47	79	-24	0.0	0.0
	10	0.50	0.0	1.02	0.80	63	-8	0.0	0.0
		1.25	0.2	2.16	1.68	70	-15	(10.3)	(1.8)
		2.25	0.2	3.51	2.74	73	-18	(41.4)	(7.3)
		3.25	0.0	4.75	3.71	76	-21	0.0	0.0
		4.00	0.0	5.68	4.43	78	-23	0.0	0.0
	Sub-total		8.0				North to South	0.0	0.0
							South to North	(473.7)	(83.8)
120	6	0.50	2.1	0.77	0.60	42	13	7.1	1.2
(ESE)		1.25	1.1	1.69	1.32	64	-9	(18.2)	(3.2)
		2.25	0.0	2.69	2.10	75	-20	0.0	0.0
		3.25	0.0	3.66	2.86	84	-29	0.0	0.0
		4.00	0.0	4.44	3.46	90	-35	0.0	0.0
	8	0.50	0.1	0.81	0.63	79	-24	(0.7)	(0.1)
		1.25	0.2	1.78	1.39	81	-26	(9.9)	(1.8)
		2.25	0.0	2.95	2.30	86	-31	0.0	0.0
		3.25	0.0	4.01	3.13	89	-34	0.0	0.0
		4.00	0.0	4.81	3.75	90	-35	0.0	0.0
	10	0.50	0.0	0.90	0.70	74	-19	0.0	0.0
		1.25	0.0	1.96	1.53	83	-28	0.0	0.0
		2.25	0.0	3.34	2.61	84	-29	0.0	0.0
		3.25	0.0	4.56	3.56	85	-30	0.0	0.0
		4.00	0.0	5.44	4.25	86	-31	0.0	0.0
	Sub-total		3.5				North to South	7.1	1.2
							South to North	(28.8)	(5.1)
Grand-total			48.2				North to South	1,342.2	237.6
							South to North	(1,079.6)	(191.1)

Note <1 : Angle between wave crest and shoreline

Table 6.3-5 (5/6) BREAKDOWN OF LONGSHORE TRANSPORT RATE CALCULATION (OYA)

Shoreline Orientation = 272° N

Ocean Wave Characteristics				Breaking Wave Characteristics				Longshore Energy Flux Factor	Longshore Transport Rate
Direction °N	Period (sec)	Height (m)	Percent (%)	Depth (m)	Height (m)	Direction °N	Angle<1 (deg.)	(J/m/s)	(1000m3/yr)
300 (WNW)	6	0.50	1.5	0.68	0.53	354	8	2.4	0.4
		1.25	1.1	1.57	1.23	342	20	33.3	5.9
		2.25	0.2	2.69	2.10	332	30	30.8	5.5
		3.25	0.0	3.78	2.95	325	37	0.0	0.0
		4.00	0.0	4.58	3.57	322	40	0.0	0.0
	8	0.50	0.2	0.97	0.76	346	16	1.5	0.3
		1.25	0.5	2.07	1.61	340	22	32.4	5.7
		2.25	0.2	3.40	2.65	335	27	52.0	9.2
		3.25	0.0	4.64	3.62	330	32	0.0	0.0
		4.00	0.0	5.52	4.30	326	36	0.0	0.0
	10	0.50	0.0	1.10	0.86	328	34	0.0	0.0
		1.25	0.1	2.23	1.74	337	25	8.4	1.5
		2.25	0.1	3.61	2.82	336	26	29.5	5.2
		3.25	0.2	4.97	3.88	335	27	134.1	23.7
		4.00	0.0	6.00	4.68	334	28	0.0	0.0
Sub-total			4.1				West to East	324.4	57.4
							East to West	0.0	0.0
330 (NNW)	6	0.50	1.4	0.72	0.56	10	-8	(2.5)	(0.4)
		1.25	1.2	1.64	1.28	0	2	3.5	0.6
		2.25	0.2	2.82	2.20	348	14	18.9	3.4
		3.25	0.0	3.91	3.05	342	20	0.0	0.0
		4.00	0.0	4.92	3.84	325	37	0.0	0.0
	8	0.50	0.1	0.93	0.73	2	-0	(0.0)	(0.0)
		1.25	0.9	2.00	1.56	354	8	20.1	3.6
		2.25	0.4	3.27	2.55	347	15	58.1	10.3
		3.25	0.1	4.49	3.50	342	20	41.5	7.3
		4.00	0.0	5.34	4.16	340	22	0.0	0.0
	10	0.50	0.0	0.99	0.77	5	-3	0.0	0.0
		1.25	0.3	2.12	1.66	357	5	5.0	0.9
		2.25	0.4	3.60	2.81	344	18	85.9	15.2
		3.25	0.1	4.89	3.81	340	22	55.0	9.7
		4.00	0.1	5.81	4.53	338	24	91.1	16.1
Sub-total			5.2				West to East	379.1	67.1
							East to West	(2.5)	(0.4)
0 (N)	6	0.50	2.1	0.81	0.63	6	-4	(2.6)	(0.5)
		1.25	2.4	1.78	1.39	1	1	6.8	1.2
		2.25	0.7	2.95	2.30	360	2	12.3	2.2
		3.25	0.2	4.08	3.18	359	3	9.0	1.6
		4.00	0.0	4.92	3.84	358	4	0.0	0.0
	8	0.50	0.2	0.95	0.74	5	-3	(0.3)	(0.0)
		1.25	2.4	2.03	1.58	7	-5	(36.5)	(6.5)
		2.25	1.4	3.36	2.62	359	3	40.5	7.2
		3.25	0.3	4.60	3.59	358	4	28.9	5.1
		4.00	0.1	5.51	4.30	356	6	20.4	3.6
	10	0.50	0.1	1.05	0.82	5	-3	(0.2)	(0.0)
		1.25	0.9	2.23	1.74	5	-3	(11.7)	(2.1)
		2.25	1.2	3.67	2.86	359	3	46.7	8.3
		3.25	0.7	5.00	3.90	357	5	95.7	16.9
		4.00	0.3	6.00	4.68	356	6	86.1	15.2
Sub-total			13.9				West to East	346.4	61.3
							East to West	(51.2)	(9.1)
30 (NNE)	6	0.50	4.6	0.79	0.61	0	2	2.0	0.4
		1.25	5.5	1.75	1.36	13	-11	(126.8)	(22.4)
		2.25	1.2	2.87	2.24	19	-17	(139.0)	(24.6)
		3.25	0.1	3.93	3.07	20	-18	(27.3)	(4.8)
		4.00	0.1	4.71	3.68	21	-19	(44.1)	(7.8)
	8	0.50	0.3	0.85	0.66	6	-4	(0.4)	(0.1)
		1.25	3.1	1.84	1.44	6	-4	(27.5)	(4.9)
		2.25	2.0	3.03	2.36	10	-8	(128.1)	(22.7)
		3.25	0.6	4.13	3.22	11	-9	(96.5)	(17.1)
		4.00	0.1	4.94	3.85	11	-9	(26.1)	(4.6)
	10	0.50	0.2	1.00	0.78	5	-3	(0.3)	(0.0)
		1.25	1.2	2.12	1.65	6	-4	(15.0)	(2.7)
		2.25	1.2	3.41	2.66	7	-5	(62.2)	(11.0)
		3.25	0.5	4.63	3.61	7	-5	(61.1)	(10.8)
		4.00	0.3	5.53	4.31	7	-5	(58.8)	(10.4)
Sub-total			21.0				West to East	2.0	0.4
							East to West	(813.1)	(143.9)
60 (ENE)	6	0.50	3.8	0.61	0.48	40	-38	(16.0)	(2.8)
		1.25	3.1	1.38	1.08	35	-33	(93.9)	(16.6)
		2.25	0.5	2.27	1.77	30	-28	(48.1)	(8.5)
		3.25	0.1	3.21	2.50	31	-29	(23.4)	(4.1)
		4.00	0.0	4.00	3.12	34	-32	0.0	0.0
	8	0.50	0.2	0.90	0.70	36	-34	(2.1)	(0.4)
		1.25	1.3	1.87	1.46	23	-21	(62.9)	(11.1)
		2.25	0.7	3.06	2.38	22	-20	(108.1)	(19.1)
		3.25	0.1	4.21	3.28	25	-23	(38.7)	(6.9)
		4.00	0.1	5.04	3.93	26	-24	(62.5)	(11.1)
	10	0.50	0.1	1.04	0.81	5	-3	(0.2)	(0.0)
		1.25	0.3	2.24	1.75	16	-14	(16.1)	(2.9)
		2.25	0.3	3.73	2.91	19	-17	(65.7)	(11.6)
		3.25	0.1	5.11	3.98	19	-17	(49.5)	(8.8)
		4.00	0.0	6.13	4.78	19	-17	0.0	0.0
Sub-total			10.7				West to East	0.0	0.0
							East to West	(587.3)	(103.9)
Grand-total			54.0				West to East	1,051.8	186.2
							East to West	(1,454.1)	(257.4)

Note <1 : Angle between wave crest and shoreline

Table 6.3-5 (6/6) BREAKDOWN OF LONGSHORE TRANSPORT RATE CALCULATION (PAPAR)

Shoreline Orientation = 220° N

Ocean Wave Characteristics				Breaking Wave Characteristics				Longshore Energy Flux Factor	Longshore Transport Rate
Direction °N	Period (sec)	Height (m)	Percent (%)	Depth (m)	Height (m)	Direction °N	Angle<1 (deg.)	(J/m/s)	(1000m3/yr)
300 (WNW)	6	0.50	1.1	0.82	0.64	308	2	0.8	0.1
		1.25	1.1	1.76	1.38	304	6	15.0	2.7
		2.25	0.1	2.88	2.24	301	9	6.7	1.2
		3.25	0.0	3.98	3.10	298	12	0.0	0.0
		4.00	0.0	4.80	3.74	296	14	0.0	0.0
	8	0.50	0.2	1.04	0.81	296	14	1.5	0.3
		1.25	0.6	2.21	1.72	295	15	33.0	5.8
		2.25	0.3	3.54	2.76	296	14	49.1	8.7
		3.25	0.0	4.69	3.66	298	12	0.0	0.0
		4.00	0.0	5.53	4.31	298	12	0.0	0.0
	10	0.50	0.0	1.09	0.85	290	20	0.0	0.0
		1.25	0.1	2.23	1.74	300	10	3.8	0.7
		2.25	0.1	3.60	2.81	300	10	12.6	2.2
		3.25	0.0	4.95	3.86	297	13	0.0	0.0
		4.00	0.0	5.95	4.64	294	16	0.0	0.0
	Sub-total		3.6			West to East		122.6	21.7
						East to West		0.0	0.0
330 (NNW)	6	0.50	1.1	0.79	0.62	331	-21	(6.2)	(1.1)
		1.25	0.9	1.75	1.37	333	-23	(39.2)	(6.9)
		2.25	0.1	2.89	2.26	334	-24	(15.6)	(2.8)
		3.25	0.1	3.98	3.11	329	-19	(29.6)	(5.2)
		4.00	0.0	4.86	3.79	334	-24	0.0	0.0
	8	0.50	0.1	0.82	0.64	349	-39	(0.9)	(0.2)
		1.25	0.5	1.84	1.44	339	-29	(29.2)	(5.2)
		2.25	0.4	3.04	2.37	330	-20	(62.6)	(11.1)
		3.25	0.1	4.09	3.19	326	-16	(27.4)	(4.9)
		4.00	0.0	4.90	3.82	325	-15	0.0	0.0
	10	0.50	0.0	0.80	0.62	358	-48	0.0	0.0
		1.25	0.2	2.10	1.64	339	-29	(16.0)	(2.8)
		2.25	0.3	3.44	2.69	330	-20	(64.2)	(11.4)
		3.25	0.1	4.68	3.65	324	-14	(34.0)	(6.0)
		4.00	0.0	5.59	4.36	322	-12	0.0	0.0
	Sub-total		3.9			West to East		0.0	0.0
						East to West		(325.0)	(57.5)
0 (N)	6	0.50	1.8	0.70	0.55	355	-45	(11.0)	(1.9)
		1.25	0.8	1.58	1.23	358	-48	(37.5)	(6.6)
		2.25	0.0	2.60	2.03	357	-47	0.0	0.0
		3.25	0.0	3.55	2.77	353	-43	0.0	0.0
		4.00	0.0	4.27	3.33	350	-40	0.0	0.0
	8	0.50	0.1	0.90	0.70	357	-47	(1.1)	(0.2)
		1.25	0.2	1.88	1.47	356	-46	(14.5)	(2.6)
		2.25	0.0	3.02	2.36	351	-41	0.0	0.0
		3.25	0.1	4.14	3.23	348	-38	(50.3)	(8.9)
		4.00	0.0	4.98	3.89	346	-36	0.0	0.0
	10	0.50	0.0	0.99	0.77	357	-47	0.0	0.0
		1.25	0.4	2.10	1.64	354	-44	(38.3)	(6.8)
		2.25	0.0	3.41	2.66	350	-40	0.0	0.0
		3.25	0.0	4.70	3.67	347	-37	0.0	0.0
		4.00	0.0	5.67	4.42	345	-35	0.0	0.0
	Sub-total		3.4			West to East		0.0	0.0
						East to West		(152.7)	(27.0)
Grand-total			10.9			West to East		122.6	21.7
						East to West		(477.7)	(84.6)

Note <1 : Angle between wave crest and shoreline

Table 6.4-1 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 6.5-1 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 6.7-1 TYPICAL CROSS SECTION OF BREAKWATER AND COST COMPARISON

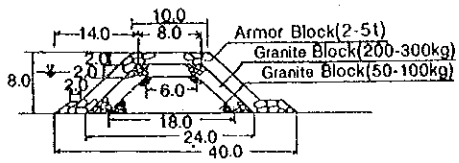
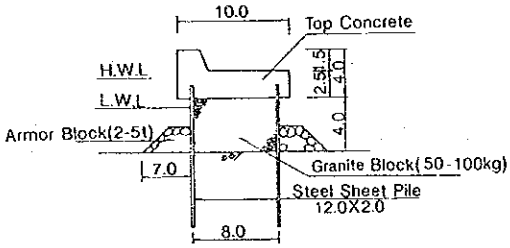
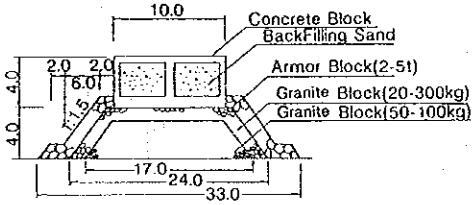
Structural Type / Structure Figure	Item	Q'ty	Volume	Unit Price (RM)	Cost (RM)
(1) Rubble Mound Type	Armor Block (2-5t)	1	96 m3	95	9,120
	Granite Block (200-300kg)	1	48 m3	60	2,880
	Granite Block (50-100kg)	1	48 m3	60	2,880
	Total Cost				14,880
(2) Sheet Pile with Top Concrete	Concrete	1	29.875 m3	400	11,950
	Steel Sheet Pile	2	2 m	3,800	7,600
	Armor Block (2-5t)	2	22 m3	95	2,090
	Granite Block	1	32 m3	60	1,920
	Total Cost				23,560
(3) Rubble Mound with Caisson	Concrete	1	15.64 m3	400	6,256
	Back Filling Sand	2	24.36 m3	5	122
	Armor Block	2	30 m3	95	2,850
	Granite Block (200-300kg)	1	72 m3	60	4,320
	Granite Block (50-100kg)	1	40.5 m3	60	2,430
	Total Cost				15,978

Table 6.7-2 TYPICAL CROSS SECTION OF JETTY AND COST COMPARISON

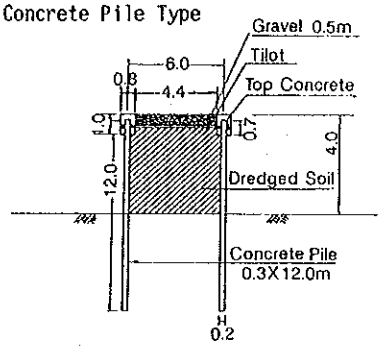
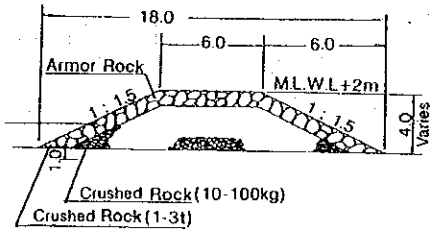
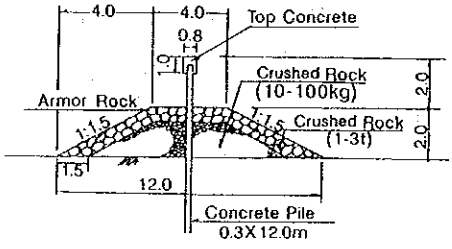
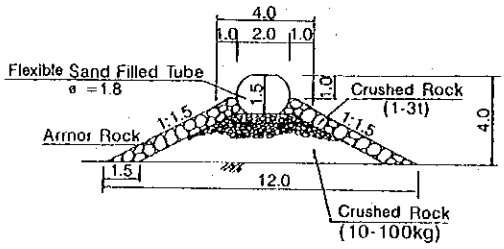
Structural Type / Structure Figure	Item	Q'ty	Volume	Unit Price (RM)	Cost (RM)
(1) Concrete Pile Type 	Gravel	1	2.2 m3	60	132
	Concrete	2	1.32 m3	400	528
	Concrete Pile	2	2 pier	2,900	5,800
	Dredged Soil	1	20.7 m3	5	104
	Total Cost				6,564
(2) Rubble Mound Type 	Crushed Rock (1-3t)	1	23.63 m3	95	2,245
	Crushed Rock (10-100kg)	1	24.38 m3	60	1,463
	Total Cost				3,708
(3) Rubble Mound with Concrete Pile 	Concrete Pile	1	1 pier	2,900	2,900
	Concrete	1	0.65 m3	400	260
	Crushed Rock (1-3t)	1	6.25 m3	95	594
	Crushed Rock (1-100kg)	1	9.75 m3	60	585
	Total Cost				4,339
(4) Rubble Mound with Sand Filled Tube 	Flexible Sand Filled Tube	1	1 m	2,200	2,200
	Crushed Rock (1-3t)	1	8 m3	95	760
	Crushed Rock (1-100kg)	1	15 m3	60	900
	Total Cost				3,860

Table 6.7-3 TYPICAL CROSS SECTION OF SUBMERGED JETTY AND COST COMPARISON

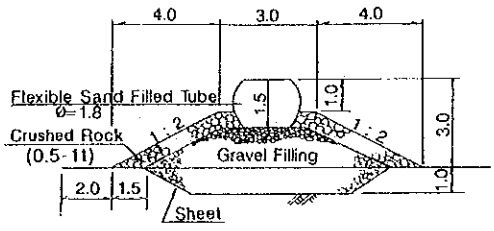
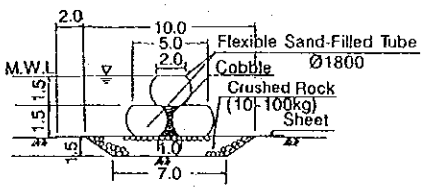
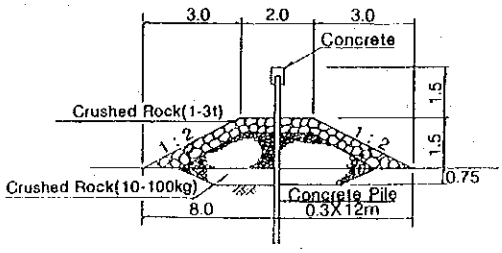
Structural Type / Structure Figure	Item	Q'ty	Volume	Unit Price (RM)	Cost (RM)
(1) Submerged Rubble Mound with Concrete Pile	Sheet	1	21 m2	35	735
	Crushed Rock (60-300kg)	1	5 m3	95	475
	Cobblestone Filling	1	29.25 m3	60	1,755
	Flexible Sand-Filled Tube	1	1 m	2,200	2,200
	Total Cost				5,165
(2) Submerged Sand Filled Tube	Sheet	1	17 m2	35	595
	Crushed Rock (60-300kg)	1	12.75 m3	60	765
	Cobblestone Filling	1	0.75 m3	60	45
	Flexible Sand-Filled Tube	3	3 m	2,200	6,600
	Total Cost				8,005
(3) Submerged Rubble Mound Concrete Pile	Sheet	1	21 m2	35	735
	Concrete Pile	1	1 pier	2,900	2,900
	Concrete	1	0.65 m3	400	260
	Crushed Rock (1-3t)	1	3 m3	95	285
	Crushed Rock (10-100kg)	1	20.5 m3	60	1,230
	Total Cost				5,410

Table 6.7-4 TYPICAL CROSS SECTION OF TRAINING WALL AND GROIN

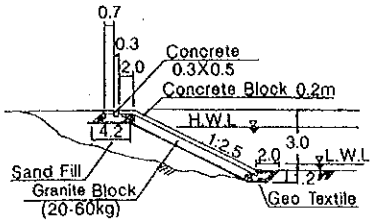
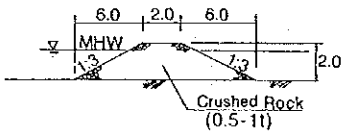
Structural Type / Structure Figure	Item	Q'ty	Volume	Unit Price (RM)	Cost (RM)
Training Wall	Concrete	1	0.15 m3	250	38
	Concrete Block	1	2.1 m3	150	315
	Geotextile	1	13.6 m	35	476
	Granite Block	1	11.2 m3	60	672
	Total Cost				1,501
Groin	Crushed Rock (0.5-1.0t)	1	16 m3	95	1,520
					
	Total Cost				1,520

Table 6.7-5 BREAKDOWN OF ESTIMATED DREDGING UNIT COST

Case	Work Item	Unit Cost (RM)	Percent (%)
Inner Channel	1. Pump Dredging Operation	3.00	49.8
(L < 1,500 m)	2. Anchoring Boat Operation	0.31	5.1
	3. Transportation Pipe	0.15	2.5
	4. Floater	0.55	9.1
* Muddy Soil *	5. Rubber Joint	0.22	3.6
	6. Installation & Withdrawal (Floater)	0.15	2.5
	7. Anchoring Facility	0.48	8.0
	8. Installation & Withdrawal (Trans. Pipe)	0.32	5.3
	9. Disposal of Dredged Material	0.85	14.1
		6.03	100.0
		(6.0)	
	1. Pump Dredging Operation	3.67	72.4
	2. Anchoring Boat Operation	0.38	7.5
	3. Transportation Pipe	0.09	1.8
* Sandy Soil *	4. Floater	0.33	6.5
	5. Rubber Joint	0.13	2.6
	6. Installation & Withdrawal (Floater)	0.07	1.4
	7. Anchoring Facility	0.24	4.7
	8. Installation & Withdrawal (Trans. Pipe)	0.16	3.2
		5.07	100.00
		(5.0)	
Offshore Channel			
(1,500 m < L &	1. Pump Dredging Operation	3.44	50.0
L < 3,000 m)	2. Anchoring Boat Operation	0.35	5.1
	3. Transportation Pipe	0.22	3.2
	4. Floater	0.83	12.1
* Muddy Soil *	5. Rubber Joint	0.33	4.8
	6. Installation & Withdrawal (Floater)	0.20	2.9
	7. Anchoring Facility	0.24	3.5
	8. Installation & Withdrawal (Trans. Pipe)	0.42	6.1
	9. Disposal of Dredged Material	0.85	12.4
		6.88	100.0
		(7.0)	
	1. Pump Dredging Operation	4.13	69.6
	2. Anchoring Boat Operation	0.42	7.1
	3. Transportation Pipe	0.13	2.2
* Sandy Soil *	4. Floater	0.50	8.4
	5. Rubber Joint	0.20	3.4
	6. Installation & Withdrawal (Floater)	0.10	1.7
	7. Anchoring Facility	0.24	4.0
	8. Installation & Withdrawal (Trans. Pipe)	0.21	3.5
	9. Disposal of Dredged Material	5.93	100.00
		(6.0)	

L : Length of sand transportation pipeline.

Table 6.8-1 UNNAVIGABLE DURATION BY SIZE OF FISHING BOAT

Representative River Mouths	Boat Size *1				Tidal Sta. Referred to
	Small	Medium	Large	Deepsea	
I. % of hours with water depth affecting navigation					
1. Perlis	51.1%	82.7%	96.1%	100.0%	Pulau Lankawi
5. Kedah	26.0%	60.7%	82.7%	99.3%	Pulau Lankawi
14. Tg. Piandang	40.9%	83.3%	98.3%	100.0%	Kedah Pier
19. Beruas	18.5%	54.9%	80.2%	99.8%	Lumut
53. Kuantan	2.4%	20.7%	47.2%	84.8%	Tanjung Gelang
57. Kerteh	29.1%	69.6%	87.7%	99.4%	Tanjung Gelang
61. Marang	39.4%	82.3%	97.0%	100.0%	Chendaring
62. Terengganu	0.0%	1.7%	16.6%	67.3%	Chendaring
80. Oya	3.9%	40.9%	83.0%	100.0%	Kota Kinabalu
90. Papar	40.9%	92.6%	100.0%	100.0%	Kota Kinabalu
II. Hours with water depth affecting navigation in the daytime (hrs./day) [I. x 24 hours /2]					
1. Perlis	6.13	9.92	11.53	12.00	
5. Kedah	3.12	7.28	9.92	11.92	
14. Tg. Piandang	4.91	10.00	11.80	12.00	
19. Beruas	2.22	6.59	9.62	11.98	
53. Kuantan	0.29	2.48	5.66	10.18	
57. Kerteh	3.49	8.35	10.52	11.93	
61. Marang	4.73	9.88	11.64	12.00	
62. Terengganu	0.00	0.20	1.99	8.08	
80. Oya	0.47	4.91	9.96	12.00	
90. Papar	4.91	11.11	12.00	12.00	
III. Unnavigable duration (hrs./day) [II./2]					
1. Perlis	3.07	4.96	5.77	6.00	
5. Kedah	1.56	3.64	4.96	5.96	
14. Tg. Piandang	2.45	5.00	5.90	6.00	
19. Beruas	1.11	3.29	4.81	5.99	
53. Kuantan	0.14	1.24	2.83	5.09	
57. Kerteh	1.75	4.18	5.26	5.96	
61. Marang	2.36	4.94	5.82	6.00	
62. Terengganu	0.00	0.10	1.00	4.04	
80. Oya	0.23	2.45	4.98	6.00	
90. Papar	2.45	5.56	6.00	6.00	

Note *1: Small size : less than 10.0 GRT
Medium size: 10.0 - 39.9 GRT
Large size : 40.0 - 69.9 GRT
Deepsea : 70.0 GRT or above

Table 6.8-2 METHODOLOGY AND FORMULA OF FISHERY BENEFIT CALCULATION

Item	Boat Size *1			
	Small	Medium	Large	Deepsea
I. Unit Values for Benefit Calculation				
a. No. of boats	n1	n2	n3	n4
b. No. of trips per year	265	266	92	18
c. Hours per trip	8	10	38	68
d. No. of fishermen per boat	1.5	4	9	15
e. Annual catch (RM/boat)	20,000	101,000	399,000	363,000
f. Running cost per hour (RM)	0.97	4.11	14.42	73.82
g. Cooling cost per hour (RM)	0.20	1.20	5.26	23.19
h. Opportunity cost per fisherman (RM/hr.)	1.7	1.7	1.7	1.7
i. Value decrease ratio per hour	0.01	0.01	0.01	0.01
j. Unnavigable duration (hrs./trip)	h1	h2	h3	h4

II. Benefit Calculation		
1. Small fishing boats		
1.1 Increase of annual catch	a.*e.*[(c.+j.)/c.-1]	= n1*20000*[(8+h1)/8-1]
1.2 Increase of annual running cost	a.*f.*b.*j.	= n1*0.20*265*h1
1.3 Increase of annual cooling cost	a.*g.*b.*j.	= n1*0.97*265*h1
1.4 Annual benefit	1.1-(1.2+1.3)	= n1*h1*2190
2. Medium fishing boats		
2.1 Annual saving of fishermen's opportunity cost	a.*b.*d.*j.*h.	= n2*266*4*h2*1.7
2.2 Annual saving of cooling cost	a.*b.*j.*g.	= n2*266*h2*1.20
2.3 Annual value of fish freshness to be improved	a.*e.*j.*i.	= n2*101000*h2*0.01
2.4 Annual Benefit	2.1+2.2+2.3	= n2*h2*3138
3. Large fishing boats		
3.1 Annual saving of fishermen's opportunity cost	a.*b.*d.*j.*h.	= n3*92*9*h3*1.7
3.2 Annual saving of cooling cost	a.*b.*j.*g.	= n3*92*h3*5.26
3.3 Annual value of fish freshness to be improved	a.*e.*j.*i.	= n3*399000*h3*0.01
3.4 Annual Benefit	3.1+3.2+3.3	= n3*h3*5882
4. Deep see fishing boats		
4.1 Annual saving of running cost	a.*b.*(j.*0.8)*f.	= n4*18*(h4*0.8)*73.82
4.2 Annual saving of fishermen's opportunity cost	a.*b.*d.*(j.*0.8)*h.	= n4*18*15*(h4*0.8)*1.7
4.3 Annual saving of cooling cost	a.*b.*(j.*0.8)*g.	= n4*18*(h4*0.8)*23.19
4.4 Annual value of fish freshness to be improved	a.*e.*(j.*0.8)*i.	= n4*363000*(h4*0.8)*0.01
4.5 Annual Benefit	4.1+4.2+4.3+4.4	= n4*h4*4668

Note *1 Small size : less than 10.0 GRT
Medium size: 10.0 - 39.9 GRT
Large size : 40.0 - 69.9 GRT
Deepsea : 70.0 GRT or above

Source : Annual Fisheries Statistics, 1990
Interview with LKIM and local fishermen

Table 6.8-3 CALCULATION OF SEA TRANSPORT BENEFIT

River Mouths	Destination	Type	Hours Affected	Annual Net Product w/o Project (RM)	Annual Net Product w/ Project (RM)	Annual Benefit (RM)
Perlis	Langkawi	P.F.	21%	4,345,000	5,500,000	1,155,000
		C.F.	21%	453,460	574,000	120,540
					Total	1,275,540
Kedah	Langkawi	P.F.	15%	4,768,500	5,610,000	841,500
		C.F.	15%	3,850,500	4,530,000	679,500
					Total	1,521,000
Marang	Kapas	P.F.	10%	2,332,800	2,592,000	259,200
Mersing	Tioman	P.F.	10%	2,592,000	2,880,000	288,000
Terengganu	----	C.B.	12%	5,485,333	6,233,333	748,000

P.F. : passenger ferry C.F. : cargo ferry C.B. : cargo boat

Note :
Dredging works are briskly carried out at Perlis and Kedah river mouths to assure the navigation of ferry boats. The without project situation for these river mouths is thus assumed to be what would be without dredging. Net annual products are estimated as shown below.

River Mouth	Type	R. Trip Charge (RM)	Passengers, Cars / Trip	Annual R. Trips	Annual Product (RM)	Net Annual Product (40%) (RM)
Perlis (w/ Project)	P.F.	20	125	5,500	13,750,000	5,500,000
	C.F.	100	25	574	1,435,000	574,000
Kedah (w/ Project)	P.F.	60	125	1,870	14,025,000	5,610,000
	C.F.	300	25	1,510	11,325,000	4,530,000
Marang (w/o Project)	P.F.	30	12	16,200	5,832,000	2,332,800
Mersing (w/o Project)	P.F.	100	12	5,400	6,480,000	2,592,000
Terengganu (w/o Project)		---	---	680	13,713,333 *	5,485,333

* : Estimated from the figures of deep sea fishing boats which are similar to cargo boats in terms of size (running cost) and trip pattern.

Source : Marine Department (HQ, Perlis, Kedah and Terengganu)

Table 6.9-1 ENVIRONMENTAL IMPACT MATRIX

ENVIRONMENTAL COMPONENTS		PROJECT ACTIVITIES /	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Land	Landforms								D	D		D	D	D	D		U			
	Flood Plains/Swamps				D	D	D	D	D		D	D					U			
	Land use					E				U	U	D	D	D		D			U	U
	Buffer zone					D		D		U	D	D	U	U						
Surface water	Shoreline				D			D		D							D			
	Bottom interface					D	D	U	D	D							D			
	Flow variation				D	D	D	D	D	U	D	D	D				D			
	Water quality				D	D	U	D	U	U	U	U	U				U		U	U
	Drainage pattern				D	D	D	D	D	U	D	D	D	D	U		U			
	Flooding				E	E	U	E	E	U	U	U	U				U			
	Existing use				U			U	U		U	U								
Ground water	Existing use				U			U	U		U	U								
Atmosphere	Air quality																			
Noise	Intencity															U		U		U
	Duration															U		U		U
Species	Terrestrial vegetation											D	U	U	U					
	Terrestrial wildlife											U	U	U	U					
	Other terrestrial fauna											U	U	U	U					
	Aquatic/marine flora				D	U	U	D	D	U			U				D			
	Fish				D	U	U	D	D	U			U				D			
	Other aquatic/marine fauna				D	U	U	D	D	U			U				D			
Habitats	Terrestrial habitats											U	U	U	U					
	Terrestrial communities											U	U	U	U					
	Aquatic estuarine habitat				D	D	D	D	D	U	U	U	D				U			
	Marine habitat				U			D		D										
	Aquatic estuarine communities				D	D	D	D	D	U	U	U	D				U			
	Marine communities				U			D		D										
Health	Physical safety																	U		
Socio/economic	Employment				E	E	E	U	E	E	E						U		E	E
	Amenities																			U
Aesthetic	Landscape				D	U	D		D	D	U	U	U							

D: Adverse Impact, U: Uncertain, E: Enhance

Project Activities

1: Engineering Investigation
2: Hydrological Survey
3: Oceanographic Survey
4: Breakwaters and Jetties
5: Training Walls
6: Groins
7: Dredging
8: River Works
9: Coastal Works (e.g. rock revetment)
10: Excavation
11: Drainage Alternative (diversion of outlet)
12: Reclamation
13: Access Road
14: Base Camp
15: Maintenance Dredging
16: Transportation
17: Fishery Development
18: Recreation

Table 7.1-1 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 7.1-2 COMBINATION OF COUNTERMEASURES

River Mouth	Case No.	Combination of Applicable Counteremeasures							
		Capital Dredging	Mainte-nance 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 7.1-3 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 7.1-4 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 7.1-5 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		1.60			161.5
6 Kerteh	1.75	6.00	-1.28	1.15		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		1.10			4.4
				0.50					9.5

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

Table 7.1-6 COST COMPARISON IN NPV OF ALTERNATIVE CASES

Unit : '000 RM

River Mouth	Case No.	Combination of Applicable Counteremeasures								NPV of Project Cost
		Capital Dredging	Maintenance Dredging	Breakwater	Jetty	Training Wall	River Groin	Coastal Groin	Reservoir	
Perlis	Case-1	10,134	2,526	-	-	-	-	-	-	49,395
	Case-2	10,134	974	-	19,570	-	-	-	-	58,342
Kedah	Case-1	8,347	2,327	-	-	-	-	-	-	44,223
	Case-2	8,347	898	-	19,840	-	-	-	-	55,279
Tg. Piandan	Case-1	2,668	508	-	-	-	-	-	-	10,738
	Case-2	2,668	196	-	8,499	-	-	-	-	19,991
Beruas	Case-1	4,464	897	-	-	-	-	-	-	18,660
	Case-2	4,464	346	-	7,095	-	-	-	-	22,202
Kuantan	Case-1	3,706	1,302	-	-	-	-	-	-	23,502
	Case-2	3,706	-	-	12,596	-	-	2,475	-	25,452
Kerteh	Case-1	1,395	601	-	-	1,275	-	-	-	12,194
	Case-2	1,395	-	-	4,719	-	-	450	50	8,974
Marang	Case-1	534	198	10,060	-	975	240	-	-	19,040
	Case-2	534	-	10,060	11,525	-	240	300	41	17,335
Terengganu	Case-1	8,702	836	16,671	-	-	1,080	-	-	46,667
	Case-2	8,702	-	16,671	23,980	-	1,080	675	-	51,624
Oya	Case-1	157	157	-	-	1,950	-	-	-	5,134
	Case-2	157	-	-	6,164	-	-	300	-	9,090
Papar	Case-1	1,100	230	-	-	600	150	-	-	5,756
	Case-2	1,100	-	-	1,083	-	150	450	8	3,742

Table 7.1-7 ANNUAL FISHERY BENEFITS OF THE REPRESENTATIVE RIVER MOUTHS

No.	River Mouth	Minimum Water Depth (m)	Unnavigable Hours				No. of Boats				Annual Benefit (thousand RM) *1				
			S	M	L	D	S	M	L	D	S	M	L	D	Total
1.	Perlis	1.0	3.07	4.96	5.77	6.00	151	205	46	30	1,015	3,191	1,561	840	6,607
2.	Kedah	1.5	1.56	3.64	4.96	5.96	154	266	73	42	526	3,038	2,130	1,168	6,862
3.	Tg. Piandang	1.5	0.87	3.21	5.00	5.99	480	5	0	0	915	50	0	0	965
4.	Beruas	1.8	0.35	2.03	3.29	5.73	284	357	10	3	218	2,274	194	80	2,766
5.	Kuantan	2.0	0.14	1.24	2.83	5.09	1	38	61	63	0	148	1,015	1,497	2,660
6.	Kerteh	1.2	1.48	3.88	5.09	5.95	44	7	0	0	143	85	0	0	228
7.	Marang	0.9	2.36	4.94	5.82	6.00	139	48	0	0	718	744	0	0	1,462
8.	Terengganu	2.5	0.00	0.10	1.00	4.04	38	49	10	10	0	15	59	189	263
9.	Oya	1.8	0.23	2.45	4.98	6.00	78	22	2	0	39	169	59	0	267
10.	Papar	1.5	0.90	4.15	5.75	6.00	123	0	0	0	242	0	0	0	242

S : Small boat (less than 10 GRT) M : Medium boat (10.0 - 39.9 GRT)
L : Large boat (40.0 - 69.9 GRT) D : Deep sea fishing boat (70.0 GRT and above)

Note
*1 : Calculation formulas are as follows:

Small boat; n*h*2190
Medium boat; n*h*3138
Large boat; n*h*5882
Deep sea boat;n*h*4668

where;
n : Number of boats
h : Unnavigable hours

Table 7.1-8 ANNUAL BENEFITS OF THE REPRESENTATIVE RIVER MOUTHS

Unit : '000 RM

No.	River Mouth	Annual Fishery Benefit *1					Sea Transport Benefit	Flood Mitigation Benefit	Total
		S	M	L	D	Total			
1.	Perlis	1,015	3,191	1,561	840	6,607	1,276	---	7,883
2.	Kedah	526	3,038	2,130	1,168	6,862	1,521	---	8,383
3.	Tg. Piandang	915	50	0	0	965	---	---	965
4.	Beruas	218	2,274	194	80	2,766	---	---	2,766
5.	Kuantan	0	148	1,015	1,497	2,660	---	---	2,660
6.	Kerteh	143	85	0	0	228	---	---	228
7.	Marang	718	744	0	0	1,462	230	---	1,692
8.	Terengganu	0	15	59	189	263	748	37	1,048
9.	Oya	39	169	59	0	267	---	---	267
10.	Papar	242	0	0	0	242	---	---	242

S : Small boat (less than 10 GRT) M : Medium boat (10.0 - 39.9 GRT)
L : Large boat (40.0 - 69.9 GRT) D : Deepsea fishing boat (70.0 GRT and above)

Table 7.1-9 ENVIRONMENTAL IMPACT MATRIX FOR PERLIS RIVER MOUTH

Environmental Components		Project Activities							
		1	2	3	4	5	6	7	8
Land	Landform				D		D		
	Flood plains/Swamps				U		U		
	Land use							U	
	Buffer zone				U		U		
Surface water	Shoreline				D		D		
	Bottom interface				D		D		
	Flow variation				U		U		
	Water quality				D		D	U	
	Drainage pattern				U		U		
	Flooding				E		E		
Species	Aquatic/marine flora				D		D		
	Fish				D		D	U	
	Other aquatic/marine fauna				D		D		
Habitats	Aquatic estuarine habitat				D		D	U	
	Marine habitat				D		D		
	Aquatic estuarine communities				D		D	U	
	Marine communities				D		D		
Social/Economic	Employment				U		U	E	

D: Adverse Impact, U: Uncertain, E: Enhance

Project Activities

1: Breakwaters and Jetties
2: Training Walls
3: Groins
4: Dredging
5: Reservoir
6: Maintainance Dredging
7: Fishery Development
8: Recreation

Table 7.2-1 ENVIRONMENTAL IMPACT MATRIX FOR KEDAH RIVER MOUTH

Environmental Components		Project Activities							
		1	2	3	4	5	6	7	8
Land	Landform				D		D		
	Flood plains/Swamps				U		U		
	Land use							U	
	Buffer zone				U		U		
Surface water	Shoreline				D		D		
	Bottom interface				D		D		
	Flow variation				U		U		
	Water quality				D		D	U	
	Drainage pattern				U		U		
	Flooding				E		E		
Species	Aquatic/marine flora				D		D		
	Fish				D		D	U	
	Other aquatic/marine fauna				D		D		
Habitats	Aquatic estuarine habitat				D		D	U	
	Marine habitat				D		D		
	Aquatic estuarine communities				D		D	U	
	Marine communities				D		D		
Social/Economic	Employment				U		U	E	

D: Adverse Impact, U: Uncertain, E: Enhance

Project Activities

1: Breakwaters and Jetties
2: Training Walls
3: Groins
4: Dredging
5: Reservoir
6: Maintainance Dredging
7: Fishery Development
8: Recreation

Table 7.3-1 ENVIRONMENTAL IMPACT MATRIX FOR TG. PIANDANG RIVER MOUTH

Environmental Components		Project Activities							
		1	2	3	4	5	6	7	8
Land	Landform				D		D		
	Flood plains/Swamps				U		U		
	Land use							U	
	Buffer zone				U		U		
Surface water	Shoreline				D		D		
	Bottom interface				D		D		
	Flow variation				U		U		
	Water quality				D		D	U	
	Drainage pattern				U		U		
	Flooding				U		U		
Species	Aquatic/marine flora				D		D		
	Fish				D		D	U	
	Other aquatic/marine fauna				D		D		
Habitats	Aquatic estuarine habitat				D		D	U	
	Marine habitat				D		D		
	Aquatic estuarine communities				D		D	U	
	Marine communities				D		D		
Social/Economic	Employment				U		U	E	

D: Adverse Impact, U: Uncertain, E: Enhance

Project Activities

1: Breakwaters and Jetties
2: Training Walls
3: Groins
4: Dredging
5: Reservoir
6: Maintainance Dredging
7: Fishery Development
8: Recreation

Table 7.4-1 ENVIRONMENTAL IMPACT MATRIX FOR BERUAS RIVER MOUTH

Environmental Components		Project Activities							
		1	2	3	4	5	6	7	8
Land	Landform				D		D		
	Flood plains/Swamps				U		U		
	Land use							U	
	Buffer zone				U		U		
Surface water	Shoreline				D		D		
	Bottom interface				D		D		
	Flow variation				U		U		
	Water quality				D		D	U	
	Drainage pattern				U		U		
	Flooding				E		E		
Species	Aquatic/marine flora				D		D		
	Fish				D		D	U	
	Other aquatic/marine fauna				D		D		
Habitats	Aquatic estuarine habitat				D		D	U	
	Marine habitat				D		D		
	Aquatic estuarine communities				D		D	U	
	Marine communities				D		D		
Social/Economic	Employment				U		U	E	

D: Adverse Impact, U: Uncertain, E: Enhance

Project Activities

1: Breakwaters and Jetties
2: Training Walls
3: Groins
4: Dredging
5: Reservoir
6: Maintainance Dredging
7: Fishery Development
8: Recreation

Table 7.5-1 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 7.5-2 ENVIRONMENTAL IMPACT MATRIX FOR KUANTAN RIVER MOUTH

Environmental Components		Project Activities							
		1	2	3	4	5	6	7	8
Land	Landform				D		D		
	Flood plains/Swamps				U		U		
	Land use							U	
	Buffer zone				U		U		
Surface water	Shoreline				D		D		
	Bottom interface				D		D		
	Flow variation				U		U		
	Water quality				D		D	U	
	Drainage pattern				U		U		
	Flooding				U		U		
Species	Aquatic/marine flora				D		D		
	Fish				D		D	U	
	Other aquatic/marine fauna				D		D		
Habitats	Aquatic estuarine habitat				D		D	U	
	Marine habitat				D		D		
	Aquatic estuarine communities				D		D	U	
	Marine communities				D		D		
Social/Economic	Employment				U		U	E	

D: Adverse Impact, U: Uncertain, E: Enhance

Project Activities

1: Breakwaters and Jetties
2: Training Walls
3: Groins
4: Dredging
5: Reservoir
6: Maintainance Dredging
7: Fishery Development
8: Recreation

Table 7.6-1 ENVIRONMENTAL IMPACT MATRIX FOR KERTEH RIVER MOUTH

Environmental Components		Project Activities							
		1	2	3	4	5	6	7	8
Land	Landform	U			D	D			
	Flood plains/Swamps				U				
	Land use					U		U	
	Buffer zone	U			U	U			
Surface water	Shoreline	D			D	U			
	Bottom interface	U			D	U			
	Flow variation	D			U	U			
	Water quality	U			D	U		U	
	Drainage pattern	U			U	U			
	Flooding	E			U	U			
Species	Aquatic/marine flora	U			D	U			
	Fish	U			D	U		U	
	Other aquatic/marine fauna	U			D	U			
Habitats	Aquatic estuarine habitat				D	D		U	
	Marine habitat				D	U			
	Aquatic estuarine communities				D	D		U	
	Marine communities				D	U			
Aesthetic Landscape		U				U			
Social/Economic Employment					U			E	

D: Adverse Impact, U: Uncertain, E: Enhance

Project Activities

1: Breakwaters and Jetties
2: Training Walls
3: Groins
4: Dredging
5: Reservoir
6: Maintainance Dredging
7: Fishery Development
8: Recreation

Table 7.7-1 ENVIRONMENTAL IMPACT MATRIX FOR MARANG RIVER MOUTH

Environmental Components		Project Activities							
		1	2	3	4	5	6	7	8
Land	Landform	U			D	D			
	Flood plains/Swamps		U	U	U				
	Land use					U		U	U
	Buffer zone	U	U	U	U	U			U
Surface water	Shoreline	D			D	U			
	Bottom interface	U	U	U	D	U			
	Flow variation	D	D	D	U	U			
	Water quality	U	U	U	D	U		U	U
	Drainage pattern	U	U	U	U	U			
	Flooding	E	E	U	U	U			
Species	Aquatic/marine flora	U	U	U	D	U			
	Fish	U	U	U	D	U		U	U
	Other aquatic/marine fauna	U	U	U	D	U			
Habitats	Aquatic estuarine habitat	U	D	D	D	D		U	
	Marine habitat		U		D	U			
	Aquatic estuarine communities		U	U	D	D		U	
	Marine communities	U	U		D	U			
Aesthetic Landscape		U	U	U		U			U
Social/Economic	Employment				U			E	E

D: Adverse Impact, U: Uncertain, E: Enhance

Project Activities

1: Breakwaters and Jetties
2: Training Walls
3: Groins
4: Dredging
5: Reservoir
6: Maintainance Dredging
7: Fishery Development
8: Recreation

Table 7.8-1 ENVIRONMENTAL IMPACT MATRIX FOR TERENGGANU RIVER MOUTH

Environmental Components		Project Activities							
		1	2	3	4	5	6	7	8
Land	Landform	U			D		D		
	Flood plains/Swamps			U	U		U		
	Land use							U	U
	Buffer zone	U		U	U		U		U
Surface water	Shoreline	D			D		D		
	Bottom interface	U		U	D		D		
	Flow variation	D		D	U		U		
	Water quality	U		U	D		D	U	U
	Drainage pattern	U		U	U		U		
	Flooding	E		U	U		U		
Species	Aquatic/marine flora	U		U	D		D		
	Fish	U		U	D		D	U	U
	Other aquatic/marine fauna	U		U	D		D		
Habitats	Aquatic estuarine habitat	U		D	D		D	U	
	Marine habitat				D		D		
	Aquatic estuarine communities			U	D		D	U	
	Marine communities	U			D		D		
Aesthetic Landscape		U	U	U		U			U
Social/Economic Employment					U		U	E	E

D: Adverse Impact, U: Uncertain, E: Enhance

Project Activities

1: Breakwaters and Jetties
2: Training Walls
3: Groins
4: Dredging
5: Reservoir
6: Maintainance Dredging
7: Fishery Development
8: Recreation

Table 7.9-1 ENVIRONMENTAL IMPACT MATRIX FOR OYA RIVER MOUTH

Environmental Components		Project Activities							
		1	2	3	4	5	6	7	8
Land	Landform				D		D		
	Flood plains/Swamps		U		U		U		
	Land use							U	
	Buffer zone		U		U		U		
Surface water	Shoreline				D		D		
	Bottom interface		U		D		D		
	Flow variation		D		U		U		
	Water quality		U		D		D	U	
	Drainage pattern		U		U		U		
	Flooding		U		U		U		
Species	Aquatic/marine flora		U		D		D		
	Fish		U		D		D	U	
	Other aquatic/marine fauna		U		D		D		
Habitats	Aquatic estuarine habitat		D		D		D	U	
	Marine habitat				D		D		
	Aquatic estuarine communities		U		D		D	U	
	Marine communities				D		D		
Aesthetic Landscape			U						
Social/Economic Employment					U		U	E	

D: Adverse Impact, U: Uncertain, E: Enhance

Project Activities

1: Breakwaters and Jetties
2: Training Walls
3: Groins
4: Dredging
5: Reservoir
6: Maintainance Dredging
7: Fishery Development
8: Recreation

Table 7.10-1 ENVIRONMENTAL IMPACT MATRIX FOR PAPAR RIVER MOUTH

Environmental Components		Project Activities							
		1	2	3	4	5	6	7	8
Land	Landform	U			D	D			
	Flood plains/Swamps			U	U				
	Land use					U		U	
	Buffer zone	U		U	U	U			
Surface water	Shoreline	D			D	U			
	Bottom interface	U		U	D	U			
	Flow variation	D		D	U	U			
	Water quality	U		U	D	U		U	
	Drainage pattern	U		U	U	U			
	Flooding	E		U	U	U			
Species	Aquatic/marine flora	U		U	D	U			
	Fish	U		U	D	U		U	
	Other aquatic/marine fauna	U		U	D	U			
Habitats	Aquatic estuarine habitat	U		D	D	D		U	
	Marine habitat				D	U			
	Aquatic estuarine communities			U	D	D		U	
	Marine communities	U			D	U			
Aesthetic Landscape		U		U		U			
Social/Economic Employment					U			E	

D: Adverse Impact, U: Uncertain, E: Enhance

Project Activities

1: Breakwaters and Jetties
2: Training Walls
3: Groins
4: Dredging
5: Reservoir
6: Maintainance Dredging
7: Fishery Development
8: Recreation

Table 8.1-1 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	Hersing	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 Jang	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	0.00500	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	Muar	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 8.1-2(1/2) BENEFITS OF THE MASTER PLAN OBJECTIVE RIVER MOUTHS
(under the present condition)

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 --> 34,969
Significant category --> 4,297

Table 8.1-2(2/2) BENEFITS OF THE MASTER PLAN OBJECTIVE RIVER MOUTHS
(in the target year 2005)

Group	No.	Serial No.	Name			Design Boat Size (GRT)	Annual Benefit ('000RM) Fishery	Sea Trans.	Flood Mit.	Total
A	1	45	Mersing		#	150	1,591	388		1,978
A	2	48	Rompin		#	70	192			192
A	3	61	Marang	*	#	40	1,968	349		2,316
A	4	81	Mukah		#	70	1,861			1,861
A	5	82	Balingian			40	85			85
A	6	84	Tatau			40	390			390
B	7	44	Sedili Besar		#	150	13			13
B	8	46	Endau		#	200	2,257			2,257
B	9	50	Nenasi		#	70	148			148
B	10	52	Terus			40	81			81
B	11	53	Kuantan	*	#	200	3,580			3,580
B	12	55	Kemaman		#	100	114			114
B	13	58	Paka		#	40	20			20
B	14	59	Dungun		#	100	118			118
B	15	60	Mercang			40	163			163
B	16	92	Tuaran			40	226			226
C	17	56	Kemasik			40	311			311
C	18	57	Kerteh	*		40	307			307
C	19	87	Sibuti			40	1			1
D	20	1	Perlis	*	#	150	8,892	1,717		10,609
D	21	25	Langat			40	0			0
D	22	99	Umas-umas			40	0			0
E	23	2	Baru		#	40	689			689
E	24	3	Sanglang		#	40	190			190
E	25	4	Jerlun		#	40	31			31
E	26	6	Yan		#	40	537			537
E	27	8	Cenang		#	40	227			227
E	28	12	Pinang		#	40	1,300			1,300
E	29	13	Bayan Lepas			40	653			653
E	30	14	Tg. Piandang	*	#	40	1,297			1,297
E	31	20	Batu			40	82			82
E	32	22	Lekir			40	148			148
E	33	24	Kapar Besar			40	437			437
E	34	26	Sepan Kecil			40	0			0
E	35	27	Sepang			40	0			0
E	36	30	Linggi		#	40	191			191
E	37	31	Baru			40	210			210
E	38	32	Melaka		#	40	23			23
E	39	33	Duyong			40	39			39
E	40	34	Umbai			40	67			67
E	41	35	Merlimau			40	90			90
E	42	37	Parit Jawa			40	327			327
E	43	40	Senggarang			40	42			42
E	44	41	Rengit			40	292			292
E	45	42	Benut			40	129			129
E	46	43	Pontian Kecil		#	40	849			849
E	47	98	Tawau		#	40	501			501
F	48	69	Sematan			40	5			5
F	49	70	Kayan			40	1			1
F	50	80	Oya	*	#	40	359			359
G	51	11	Kerian		#	40	42			42
G	52	15	Gula		#	70	205			205
G	53	16	Sangga			40	0			0
G	54	17	Larut			40	57			57
G	55	18	Terong			40	0			0
G	56	19	Beruas	*	#	100	3,721			3,721
G	57	23	Selangor		#	40	79			79
G	58	36	Muar			40	0			0
G	59	39	Batu Pahat			40	27			27
G	60	76	Buntal			40	423			423
G	61	77	Bako			40	66			66
G	62	78	Sadong		#	40	28			28
G	63	89	Padas		#	40	57			57
G	64	100	Kalabakan			40	0			0
H	65	51	Pahang		#	70	140		7	147
H	66	62	Terengganu	*	#	150	354	1,007	37	1,397
H	67	67	Kelantan		#	100	491		42	533
H	68	95	Sugut			40	0		0	0
I	69	38	Sarang Buaya			40	1			1
I	70	63	Merang			40	279			279
I	71	66	Pak Amat			40	300			300
I	72	90	Papar	*		40	326			326
J	73	5	Kedah	*	#	150	9,237	2,047		11,284
J	74	9	Muda		#	40	136			136
J	75	88	Lawas			40	218			218

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

All the river mouths -->	52,817
Critical category -->	47,033
Significant category -->	5,783

Table 8.1-3 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 8.3-1 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 8.3-2(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 8.3-2(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 8.3-2(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 8.3-2(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 8.3-3 COST DISBURSEMENT SCHEDULE OF THE FIRST PHASE PROJECT

(Unit : '000 RM)

Case	Item	Malaysia Plan			
		7th	8th	9th	10th
(Total costs are equalized.)					
Case 1-1	No. of River Mouths	21	35	35	35
	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
Case 1-2	No. of River Mouths	14	24	35	35
	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
Case 1-3	No. of River Mouths	9	21	26	35
	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.)					
Case 2-1	No. of River Mouths	19	35	35	35
	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
Case 2-2	No. of River Mouths	14	27	35	35
	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
Case 2-3	No. of River Mouths	10	19	27	35
	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 8.3-4 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	MD
	5	Kedah	Kedah	8,437	2,327	MD
First Priority	14	Tg. Piandang	Perak	2,668	508	DID
	19	Beruas	Perak	4,465	897	DID
(The First Half	30	Linggi	Melaka	345	140	DID
of the 7th	46	Endau	Johor	1,726	785	DID
Malaysia Plan)	53	Kuantan	Pahang	3,706	1,302	DID
	59	Dungun	Terengganu	534	343	MD
	61	Marang	Terengganu	12,639	73	DID
	67	Kelantan	Kelantan	4,810	28	MD
				49,464	8,929	
	9	Muda	P.Pinang	1,044	641	DID
Second Priority	23	Selangor	Selangor	920	519	DID
	32	Melaka	Melaka	118	58	DID
(The Latter Half	43	Pontian Kecil	Johor	795	393	DID
of the 7th	44	Sedili Besar	Johor	841	525	DID
Malaysia Plan)	51	Pahang	Pahang	10,024	59	DID
	55	Kemaman	Terengganu	94	85	DID
	81	Mukah	Sarawak	35,080	204	DID
	98	Tawau	Sabah	560	228	DID
				49,476	2,712	
	2	Baru	Perlis	1,396	613	DID
Third Priority	3	Sanglang	Kedah	382	189	DID
	8	Cenang	Kedah	2,092	850	DID
(The First Half	12	Pinang	P.Pinang	1,817	738	DID
of the 8th	45	Mersing	Johor	42,322	241	MD
Malaysia Plan)	50	Nenasi	Pahang	474	428	DID
	80	Oya	Sarawak	2,107	168	DID
	89	Padas	Sabah	226	127	DID
				50,816	3,354	
	4	Jerlun	Kedah	286	141	DID
Forth Priority	6	Yan	Kedah	2,086	880	DID
	11	Kerian	P.Pinang	397	224	DID
(The Latter Half	15	Gula	Perak	3,241	1,696	DID
of the 8th	48	Rompin	Pahang	16,614	98	DID
Malaysia Plan)	58	Paka	Terengganu	122	122	DID
	62	Terengganu	Terengganu	26,452	943	MD
	78	Sadong	Sarawak	1,008	568	DID
				50,206	4,672	

Table 8.3-5 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

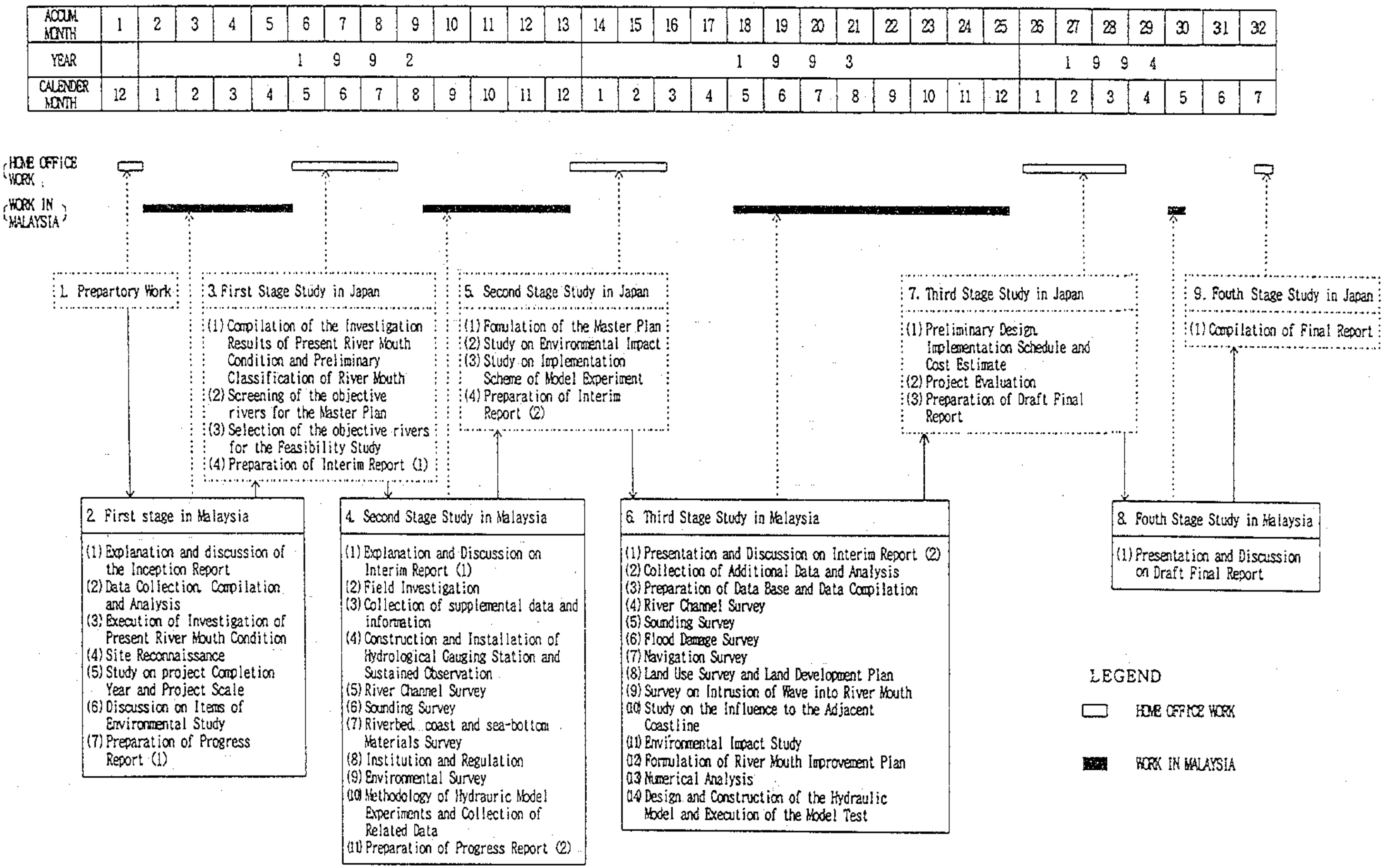
Table 9.2-1 ACTIVITIES RELATED TO RIVER MOUTH

Function	Activities	Related Facilities	Related Law and Regulation		Agencies Concerned
			Federal	State	
Drainage Outlet of River Flow	Flood Discharge and Maintenance Discharge	Dike, Revetment, Groin, Gate, Pump, etc.	Drainage Works Ordinance	Water Enactment	DID, JKR
Navigation Access	Navigation for Fishing Boat and Commercial Boat	Navigation Canal and Navigation Facilities	Merchant Shipping Ordinance	River Launches Enactment	MOT, MD, DOF, DID, JKR, Navy
Port for Boat and Mooring Place	Fishing Boat and Commercial Boat	Jetty, Breakwater, Loading and Unloading Facilities Mooring Facilities	Merchant Shipping Ordinance	River Launches Enactment	MD, LKIM, DOF, DID, JKR
Land Development Zone	Agriculture, Residential Area, Industrial Area, Aquaculture and Resort Area	Intake facilities, Drainage Facilities, Land Reclamation, Leisure Facilities	Land Conservation Act, National Land Code, Land Acquisition Act, Town and Country Planning Act		Most Agencies concerned with development
Mining	Sand Mining	Sand Mining Facilities		Mining Enactment	State Government
Natural Preservation Zone	Preservation of Ecology System	Natural Preservation Facilities	Environmental Quality Act, Protection of Wild Life Act, Land Conservation Act, National Land Code, National Parks Act	Water Enactment, Forest Enactment, Mining Enactment	Most Agencies concerned with development

Table 9.4-1 RELATED LAWS AND AGENCIES IN JAPAN

Function	Related Law and Regulation	Agencies Concerned
Drainage Outlet of River Flow	River Law Flood Fighting Act	Ministry of Construction Meteorological Agency
Navigation Access	Port and Harbour Law, Fishing Port and Harbour Law, Maritime Traffic Safety Law	Ministry of Transportation, Ministry of Agriculture, Forestry and Fisheries, Local Government
Port for Boat and Mooring Place	Port and Harbour Law, Fishing Port and Harbour Law	Ministry of Transportation, Ministry of Agriculture, Forestry and Fisheries, Local Government
Land Development Zone	Basic Land Act, National Land Use Planning Act, City Planning Law, State Water Reclamation Law	Most Agencies concerned with Development
Mining	Sand and Gravel Mining Law	Ministry of Transportation, Local Government
Natural Preservation Zone	Natural Environment Preservation Act, Basic Act for Environment Pollution Control, Water Pollution Control Act, Natural Park Act	Environment Agency, Most Agencies concerned with Development

FIGURES

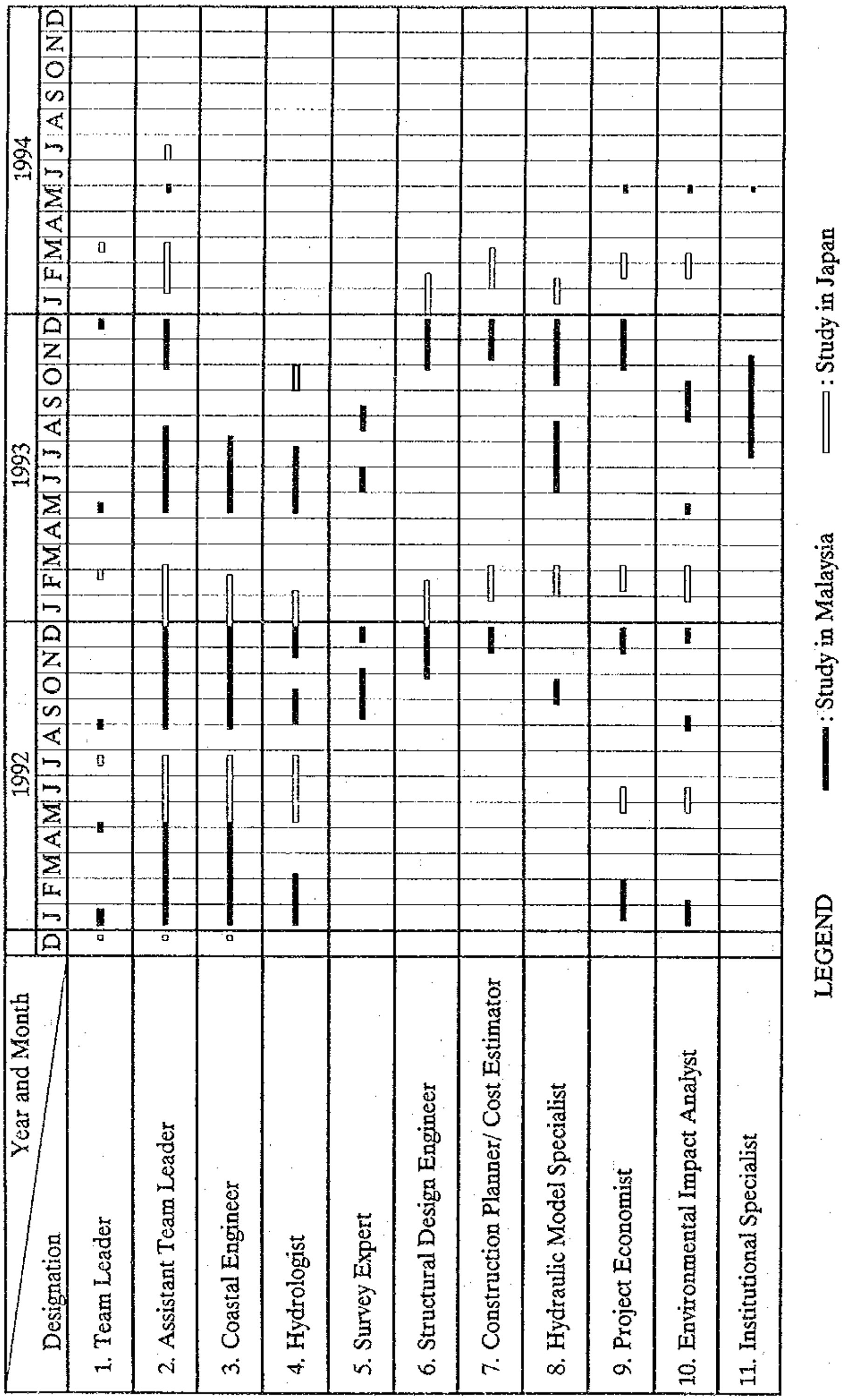


THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA

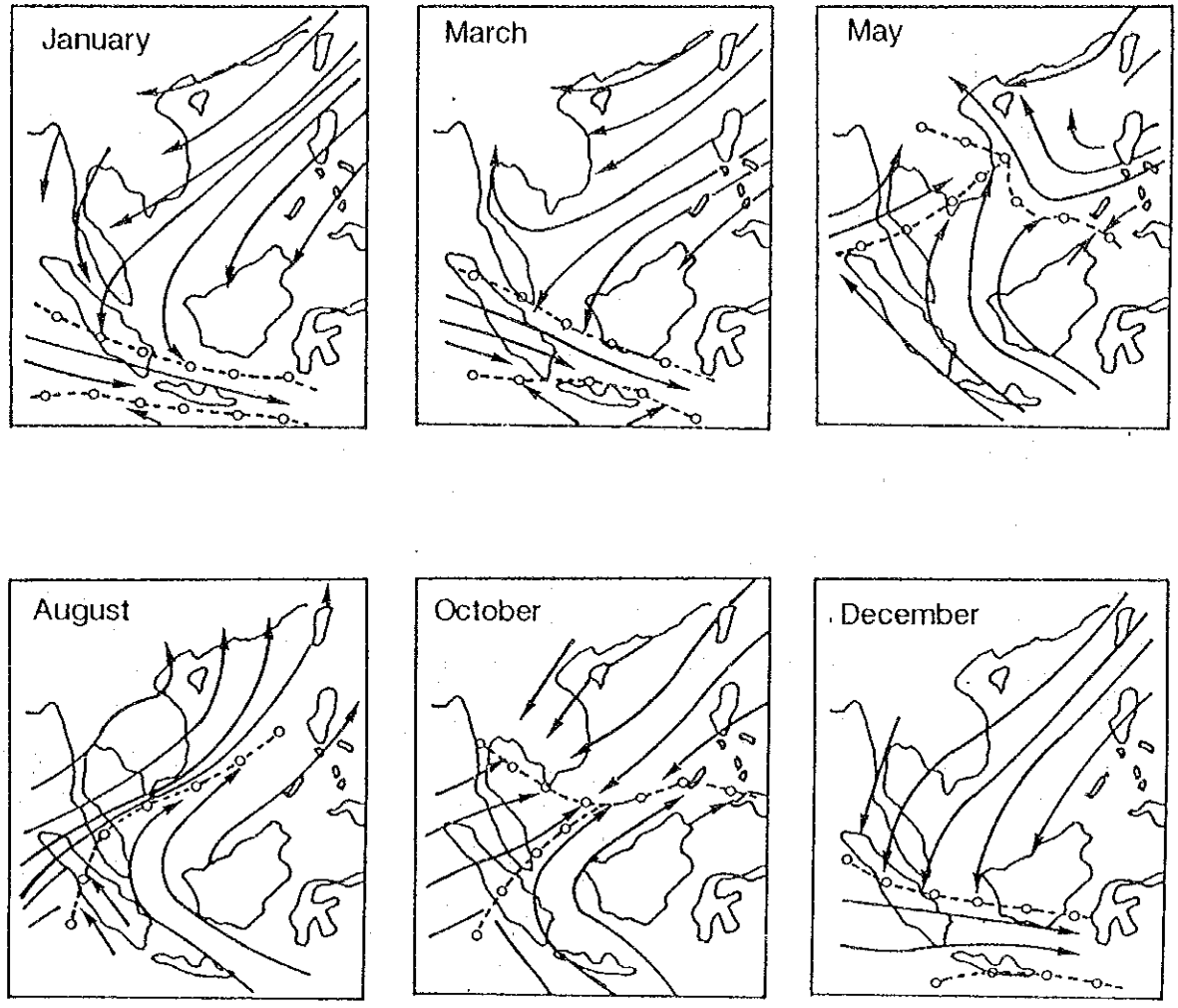
JAPAN INTERNATIONAL COOPERATION AGENCY

STUDY FLOW CHART (TENTATIVE)

Fig.1.2-1



THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	STAFFING SCHEDULE
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. 1.2 - 2



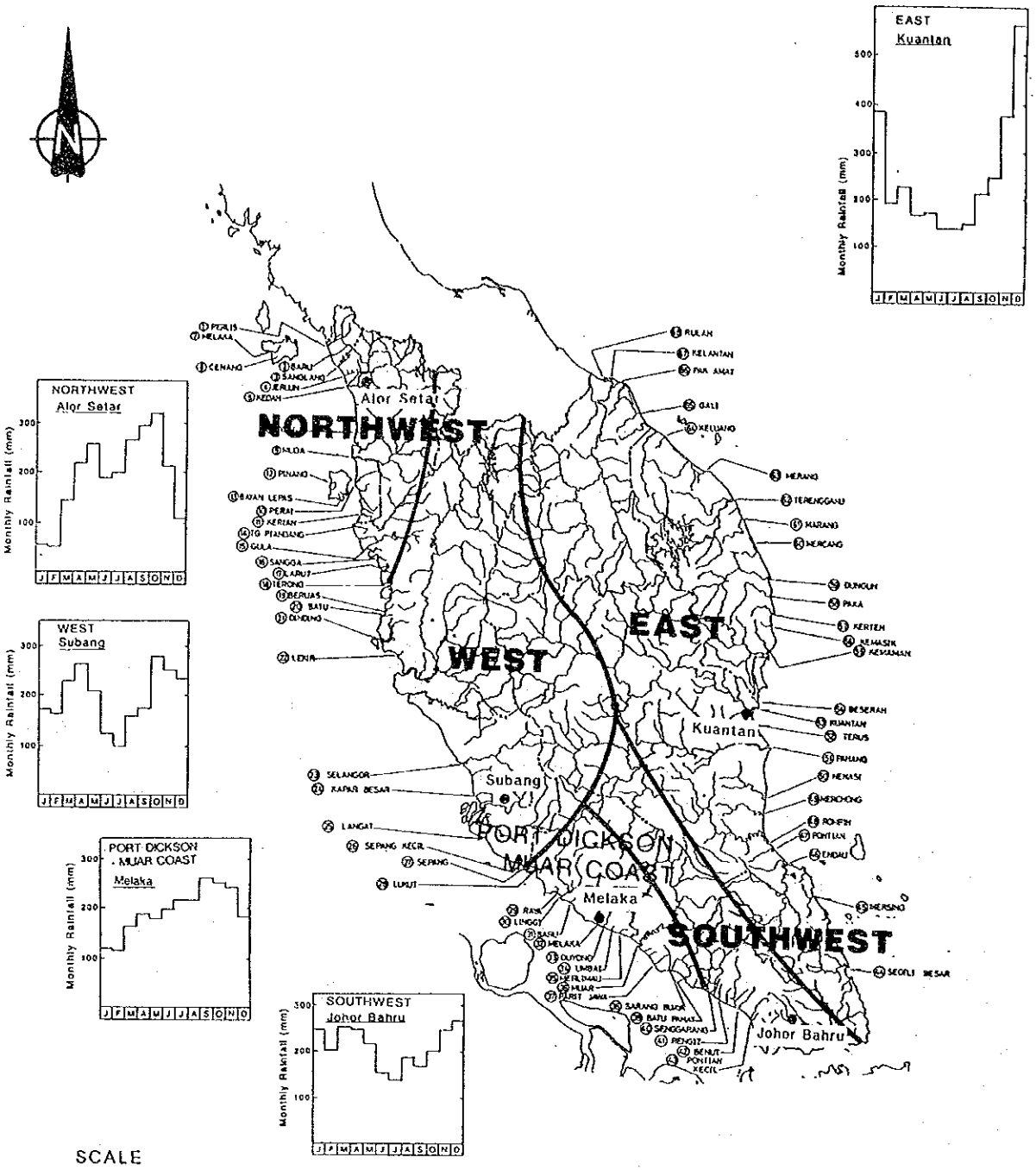
LEGEND

Wind movement

Wind boundary

DATA SOURCE : National Water Resources Study, 1982, JICA

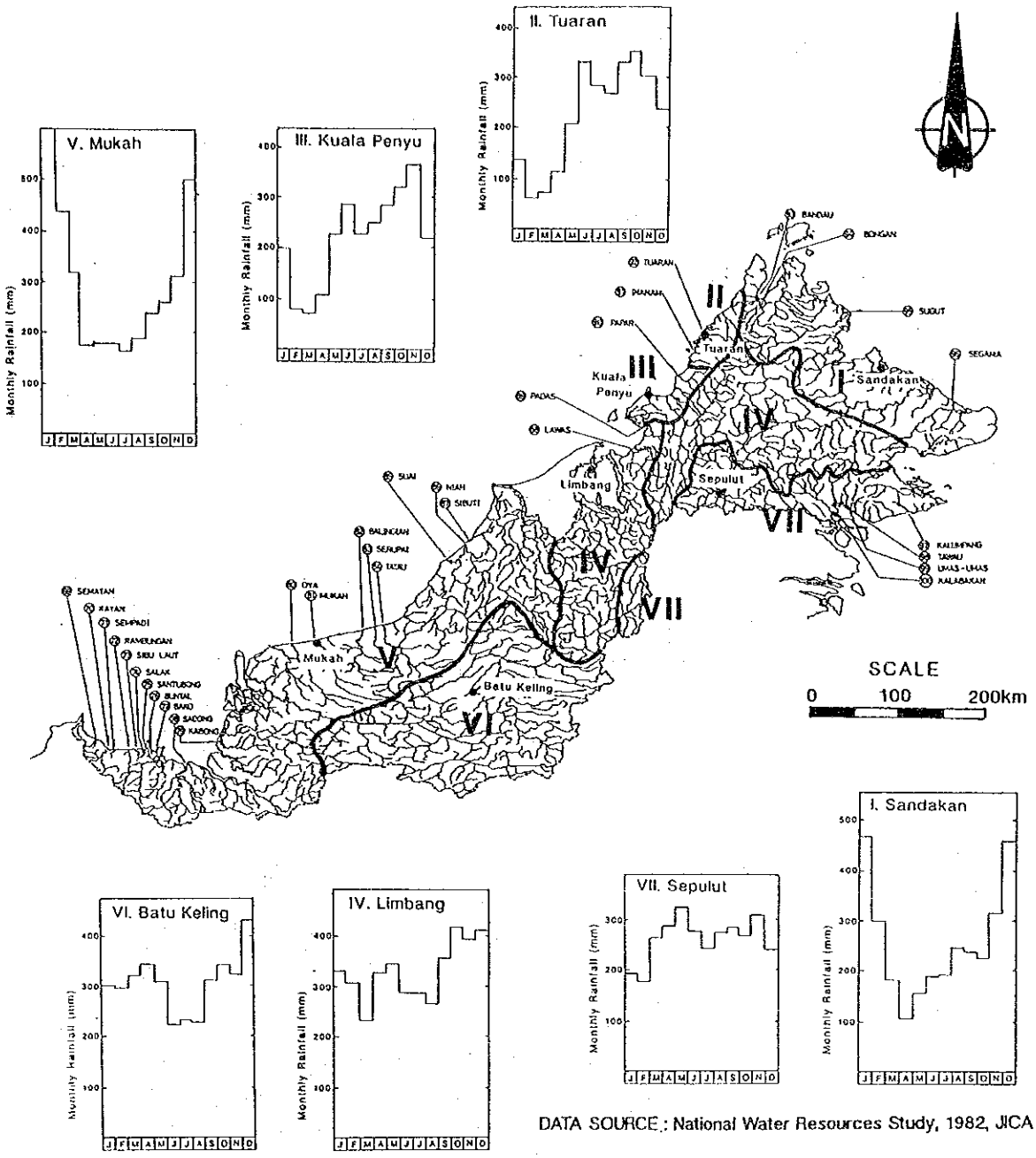
THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	WIND FLOW PATTERN IN SOUTHEAST ASIA
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.2.2-1



DATA SOURCE : National Water Resources Study, 1982. JICA

No.	Region	Rainfall Pattern
1	Northwest	This region has two rainfall peaks during the two intermonsoon seasons and low rainfall during the northeast monsoon.
2	West	This region has two rainfall peaks during the two intermonsoon seasons and low rainfall during the southwest monsoon.
3	Port Dickson - Muar Coast	This region has a build-up of rainfall during the southwest monsoon and the second intermonsoon season.
4	Southwest	This region has a rather even rainfall distribution throughout a year.
5	East	Heavy rainfall concentrates during the northwest monsoon season between November and February.

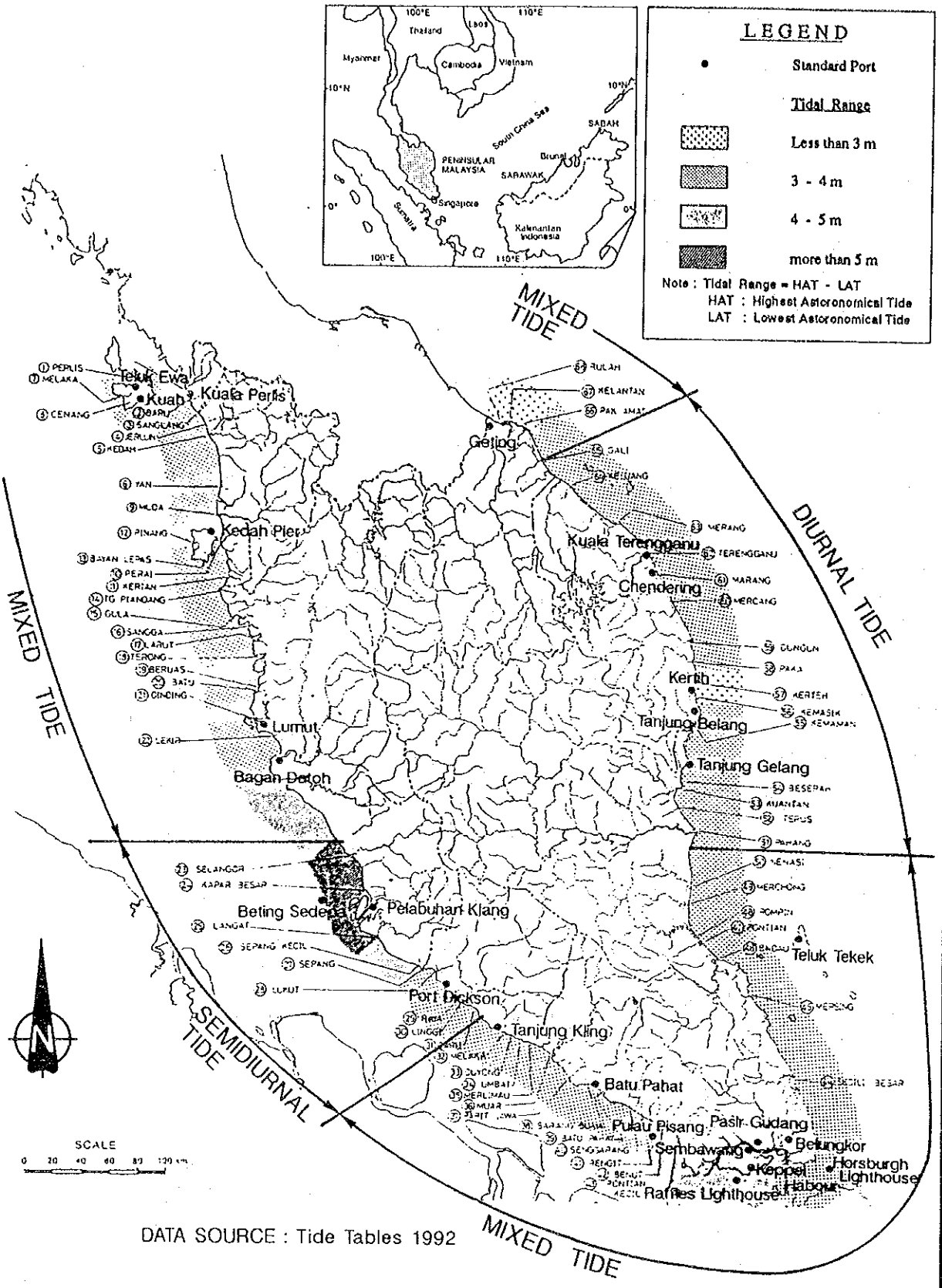
THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	RAINFALL REGIONS (PENINSULAR MALAYSIA)
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.2.2-2(1/2)



DATA SOURCE.: National Water Resources Study, 1982, JICA

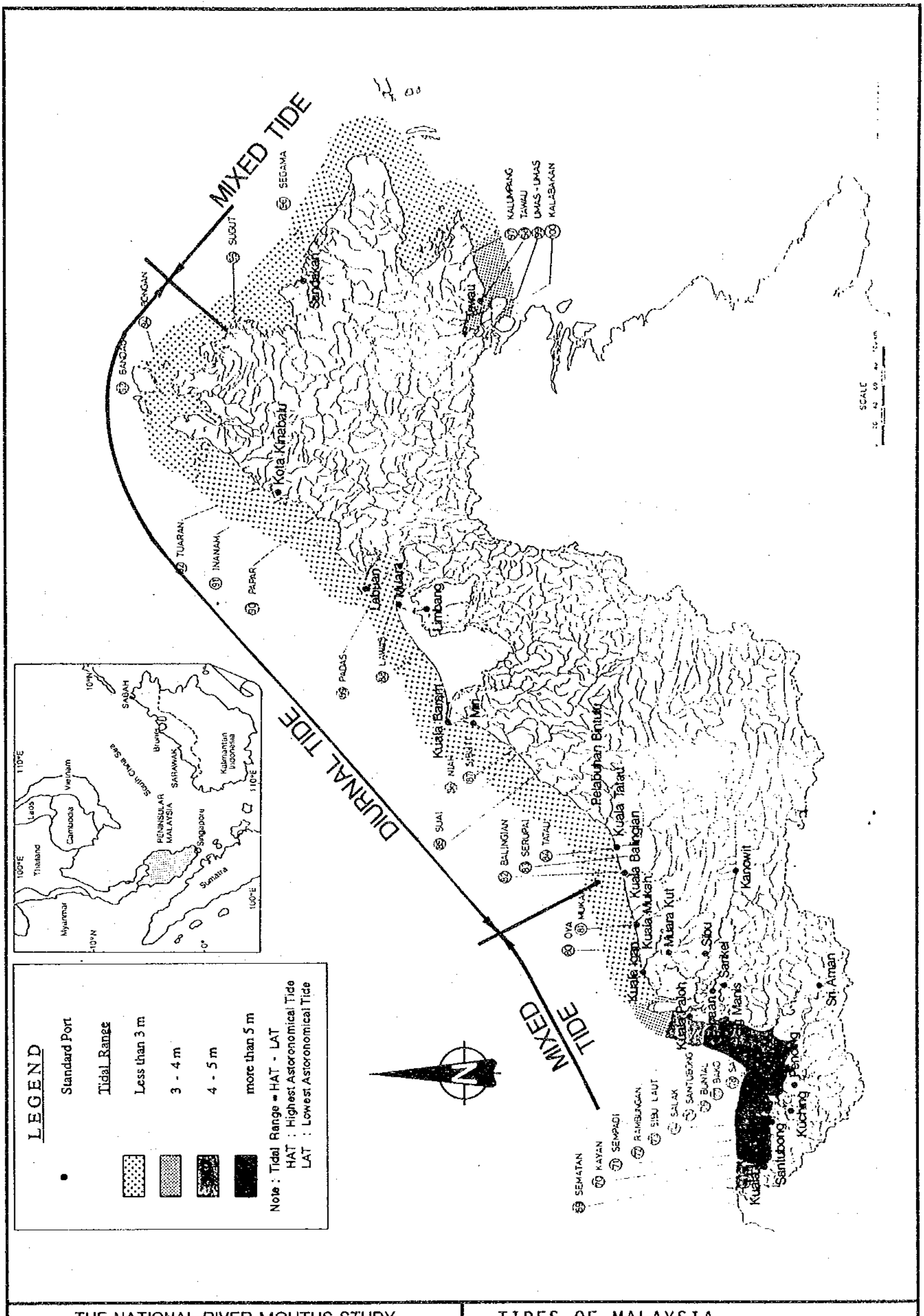
Region	Rainfall Pattern
I	High rainfall concentrates between November and February due to the northeast monsoon.
II	Two rainfall peaks appear in May and October. The heights of the two peaks are almost same.
III	Two rainfall peaks appear in May and October but that of October is bigger.
IV	High rainfall concentrates between September and October, followed by comparatively high rainfall months of November and December.
V	A high rainfall peak appears between November and February. In the other months rainfall distributes evenly.
VI	This type has an even distribution of rainfall throughout a year.
VII	Comparatively heavy rainfall is experienced in the southeast monsoon season.

THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	RAINFALL REGIONS (SABAH AND SARAWAK)
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.2.2-2(2/2)

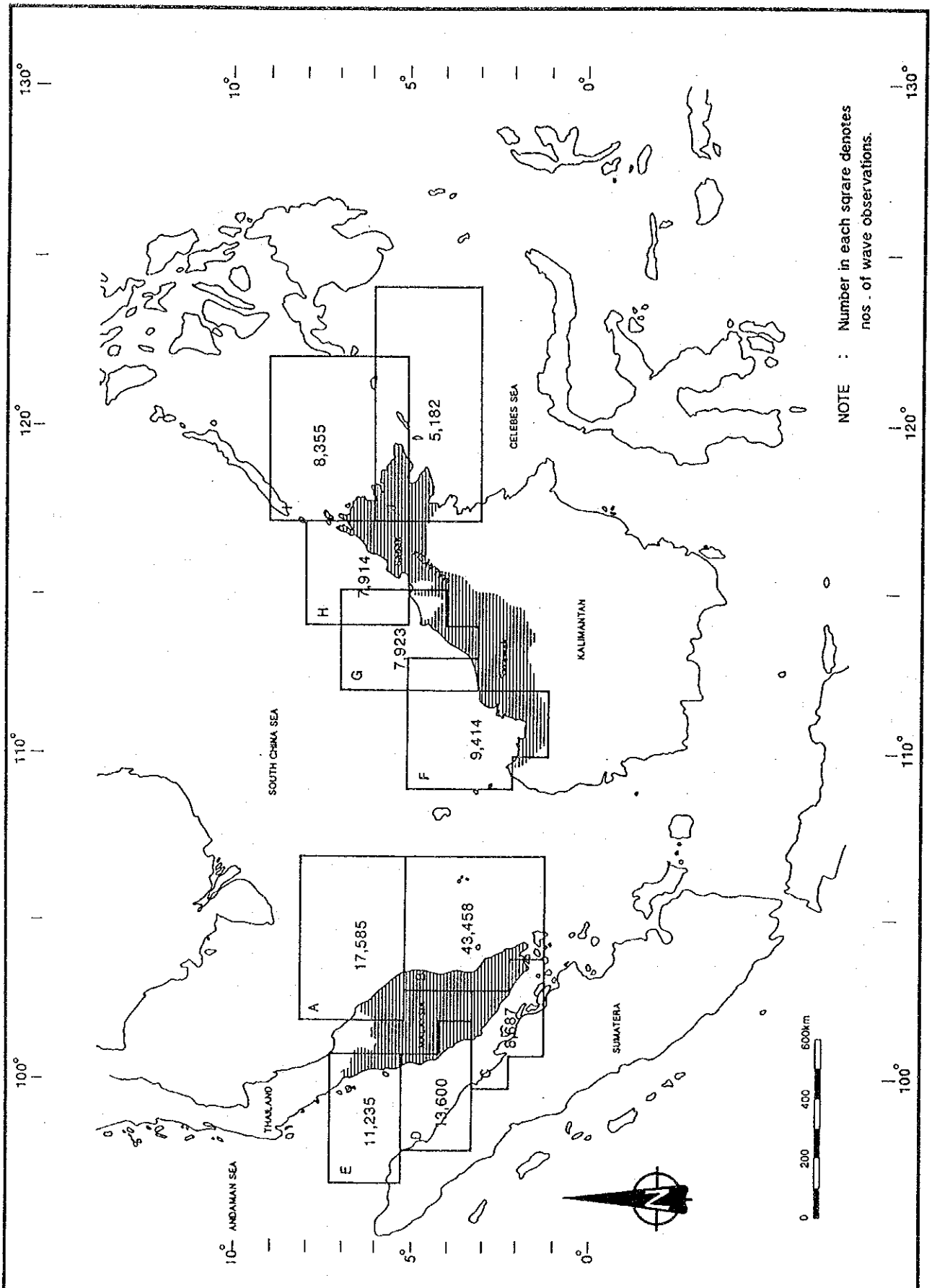


DATA SOURCE : Tide Tables 1992

THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	TIDES OF MALAYSIA (PENINSULAR MALAYSIA)
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.2.3-1(1/2)



THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	TIDES OF MALAYSIA (SABAH AND SARAWAK)
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.2.3-1(2/2)

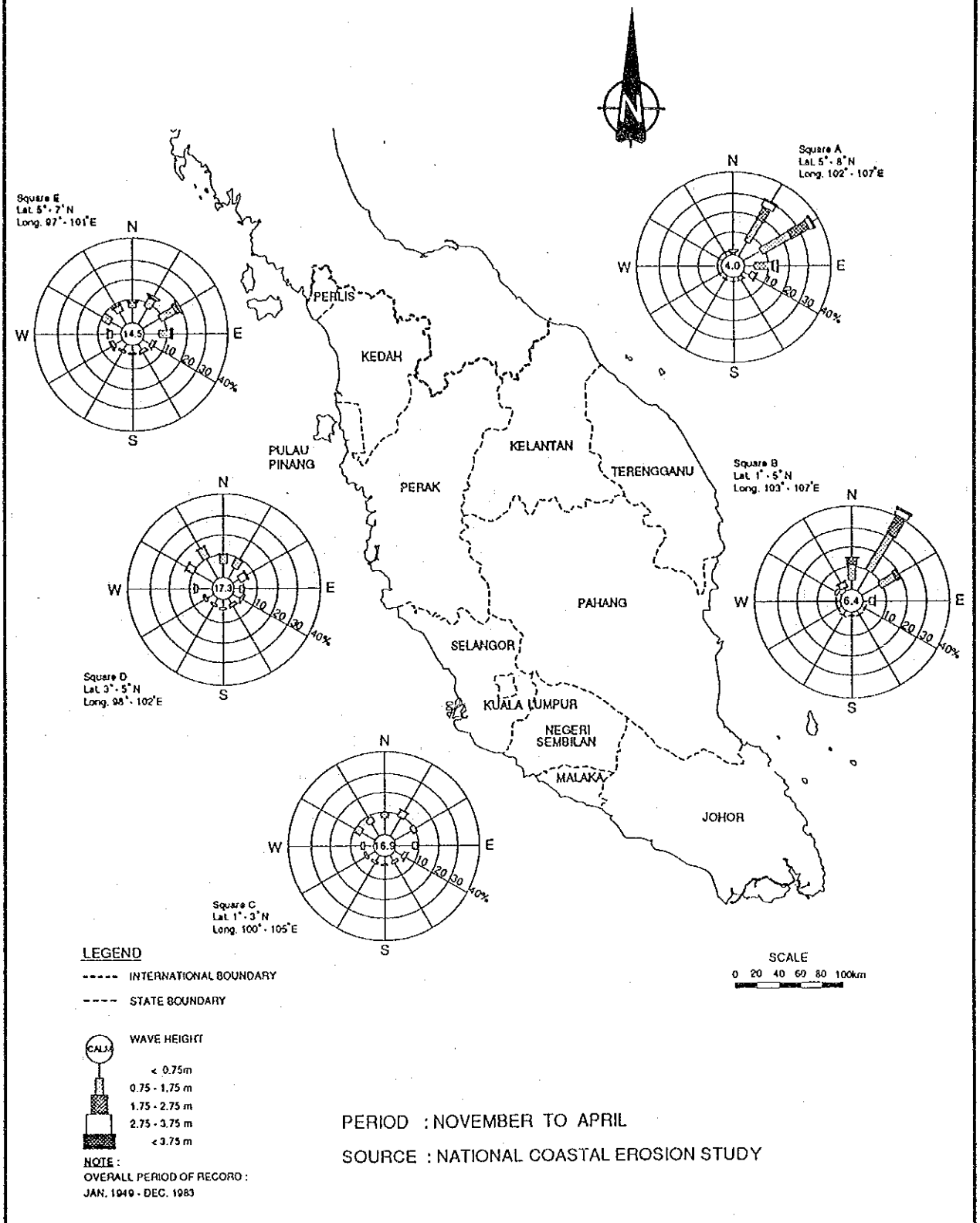


THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA

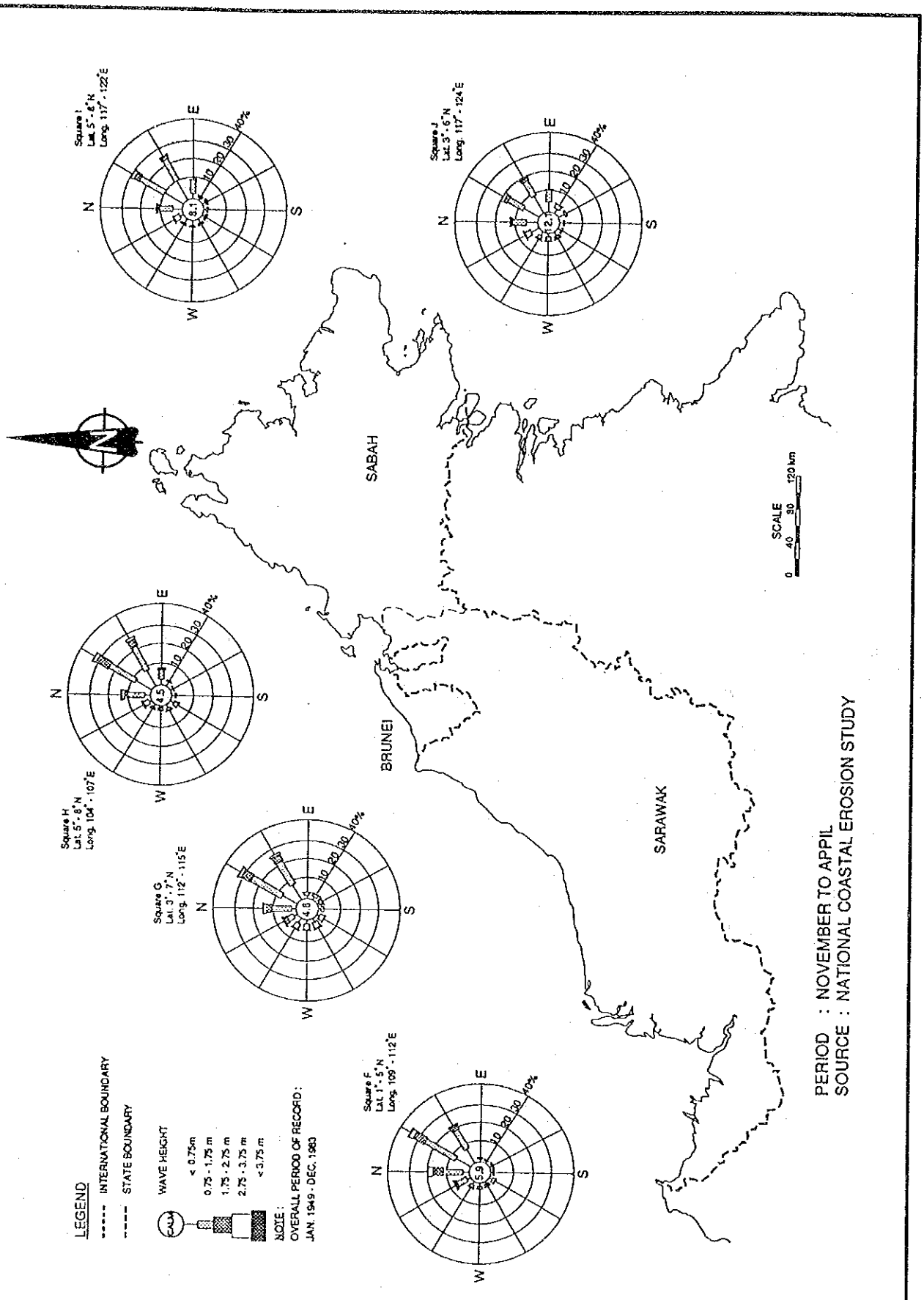
JAPAN INTERNATIONAL COOPERATION AGENCY

TEN SEA AREAS FOR STATISTICAL ANALYSIS OF DEEPWATER WAVES

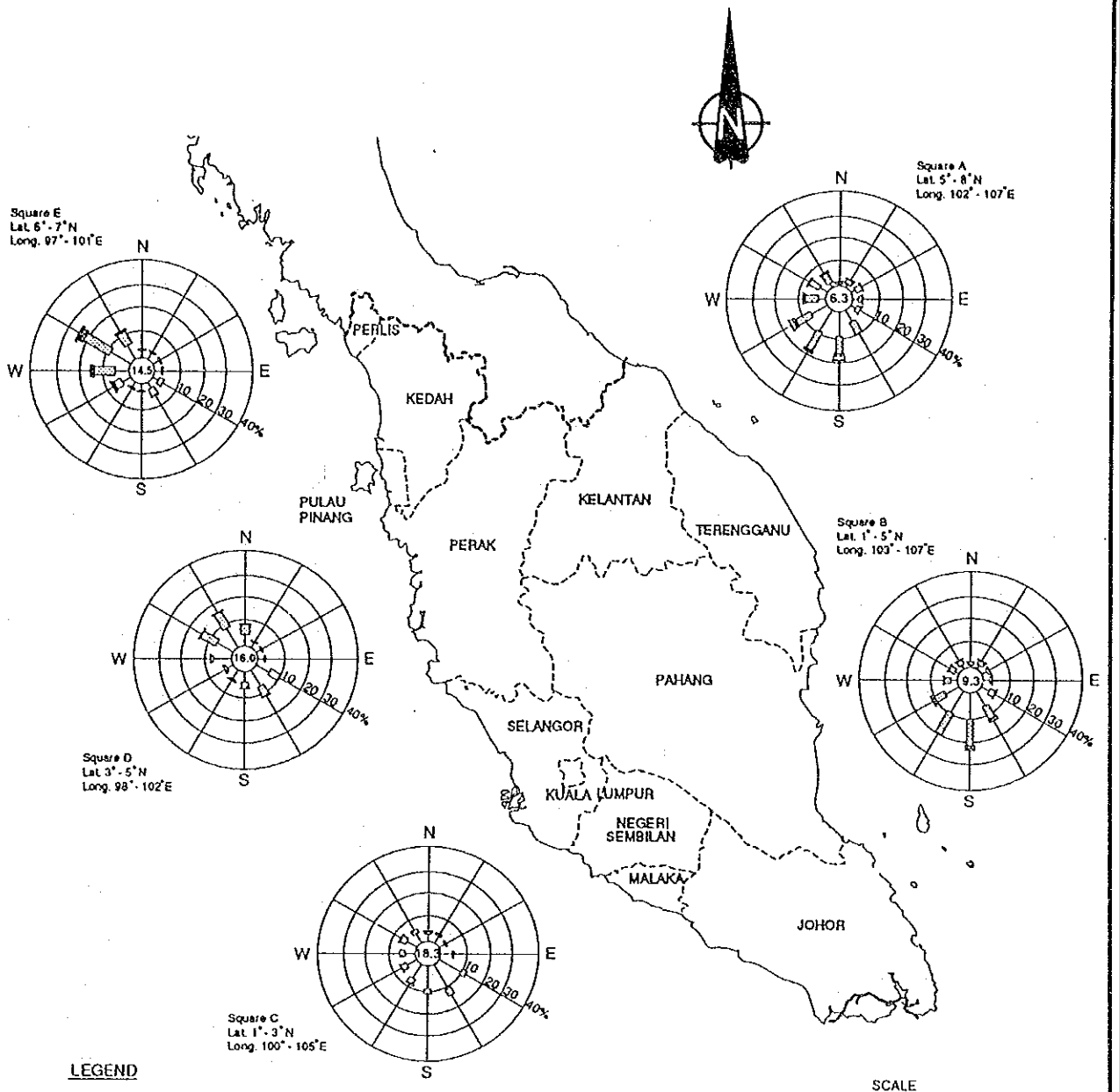
Fig.2.3-2



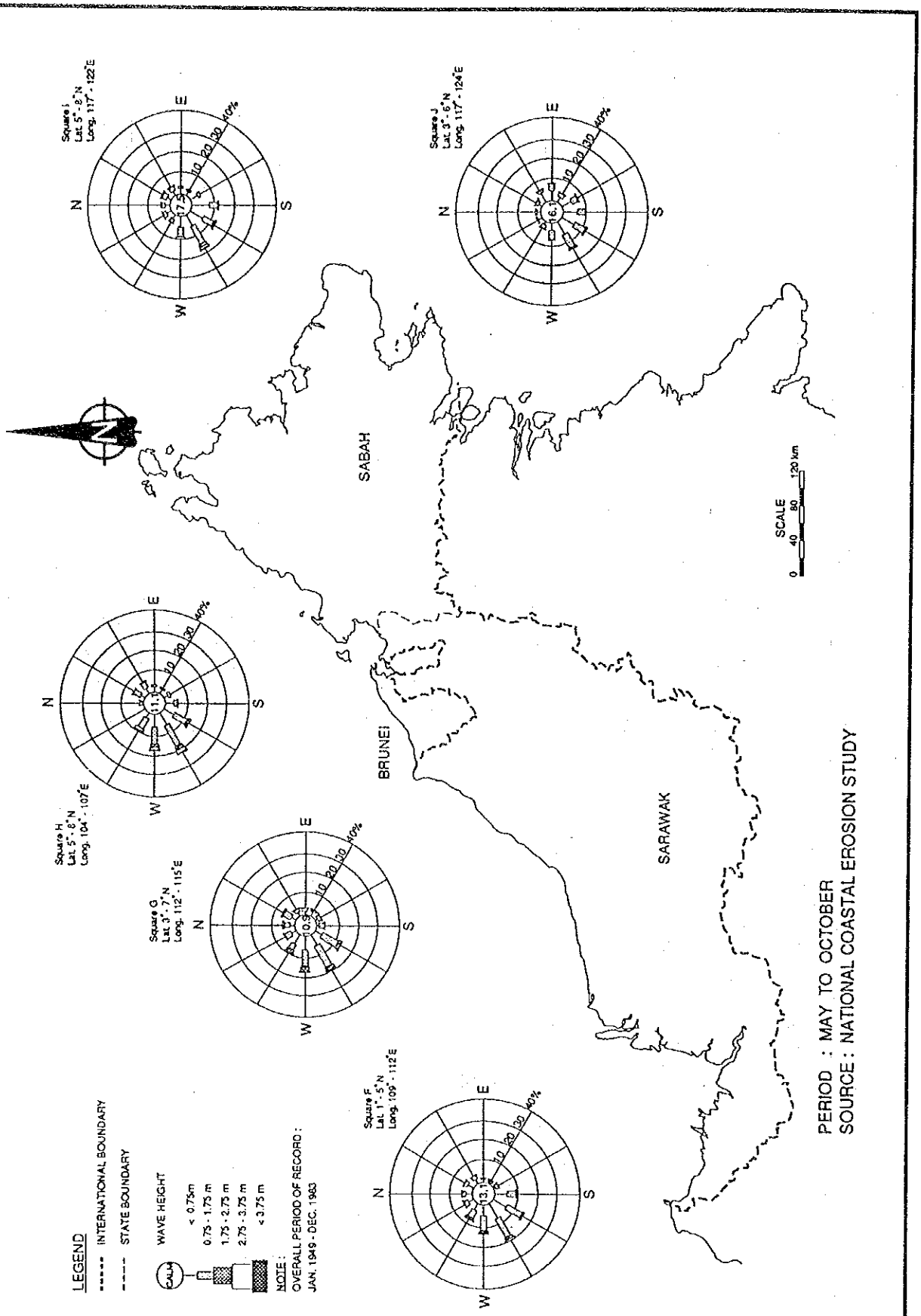
THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	WAVE ROSES DURING NORTHEAST MONSOON (PENINSULAR MALAYSIA)
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.2.3-3(1/2)



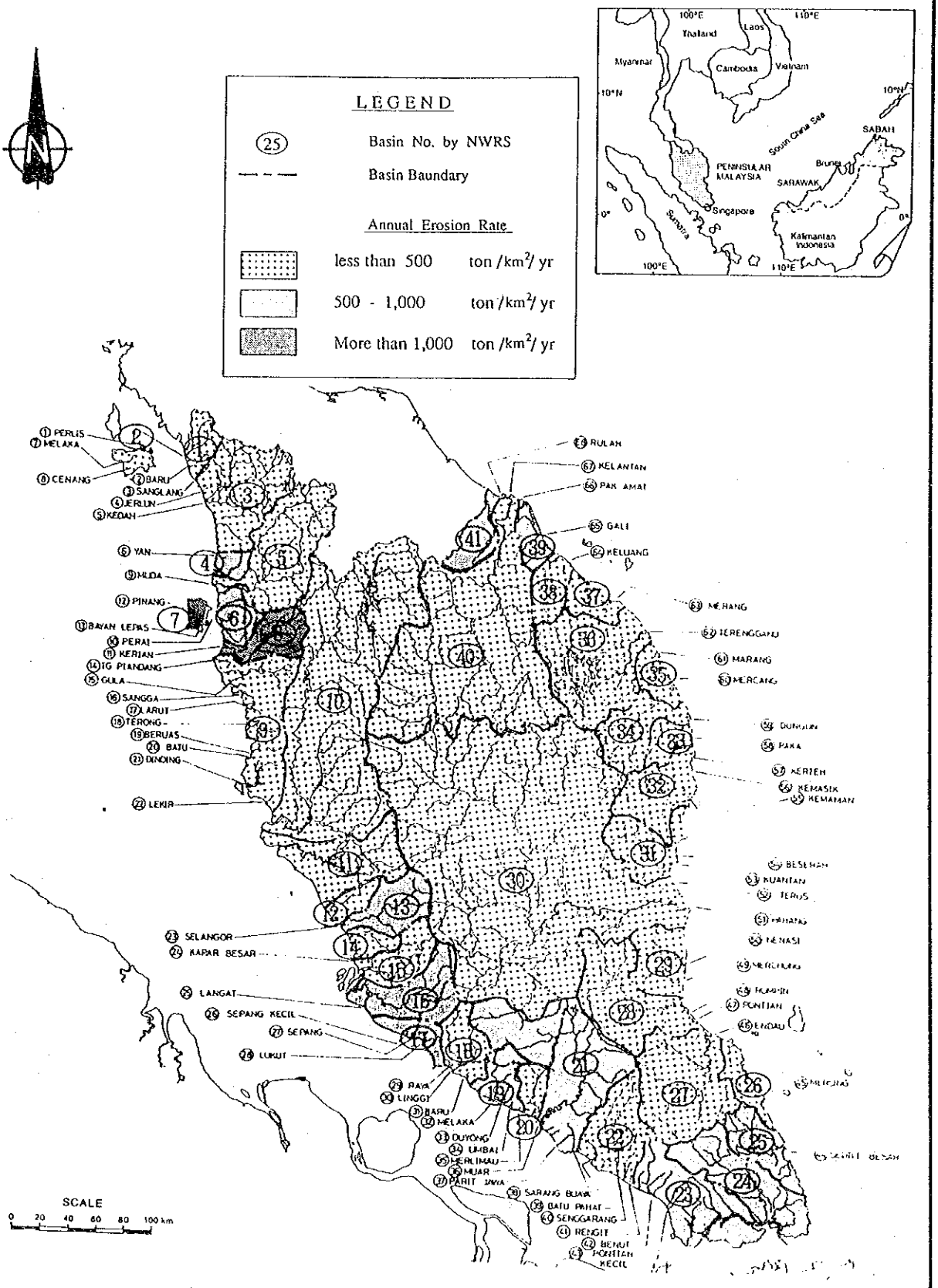
THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	WAVE ROSES DURING NORTHEAST MONSOON (SABAH AND SARAWAK)
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.2.3-3(2/2)



THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	WAVE ROSES DURING SOUTHWEST MONSOON (PENINSULAR MALAYSIA)
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.2.3-4(1/2)

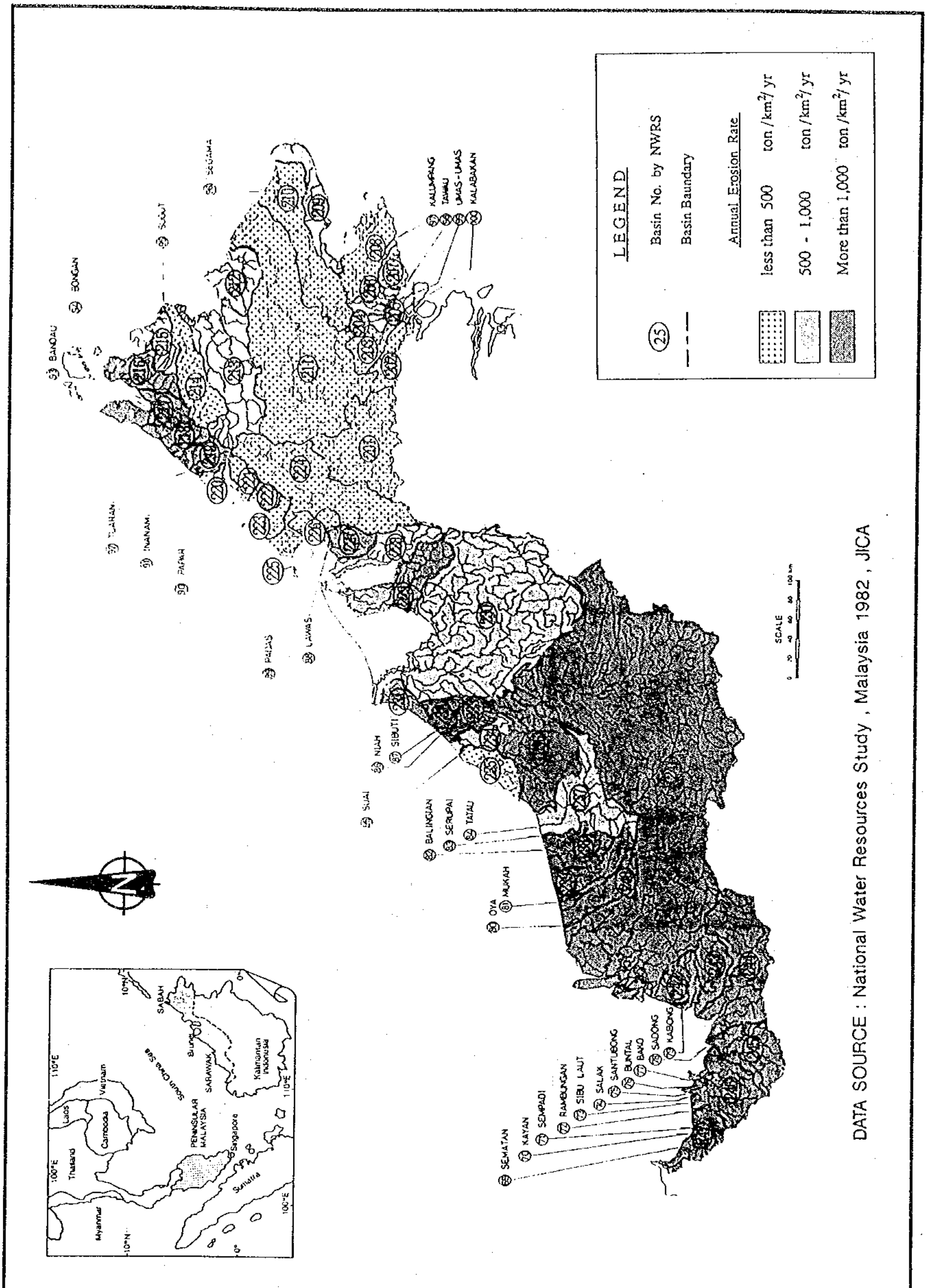


THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	WAVE ROSES DURING SOUTHWEST MONSOON (SABAH AND SARAWAK)
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.2.3-4(2/2)

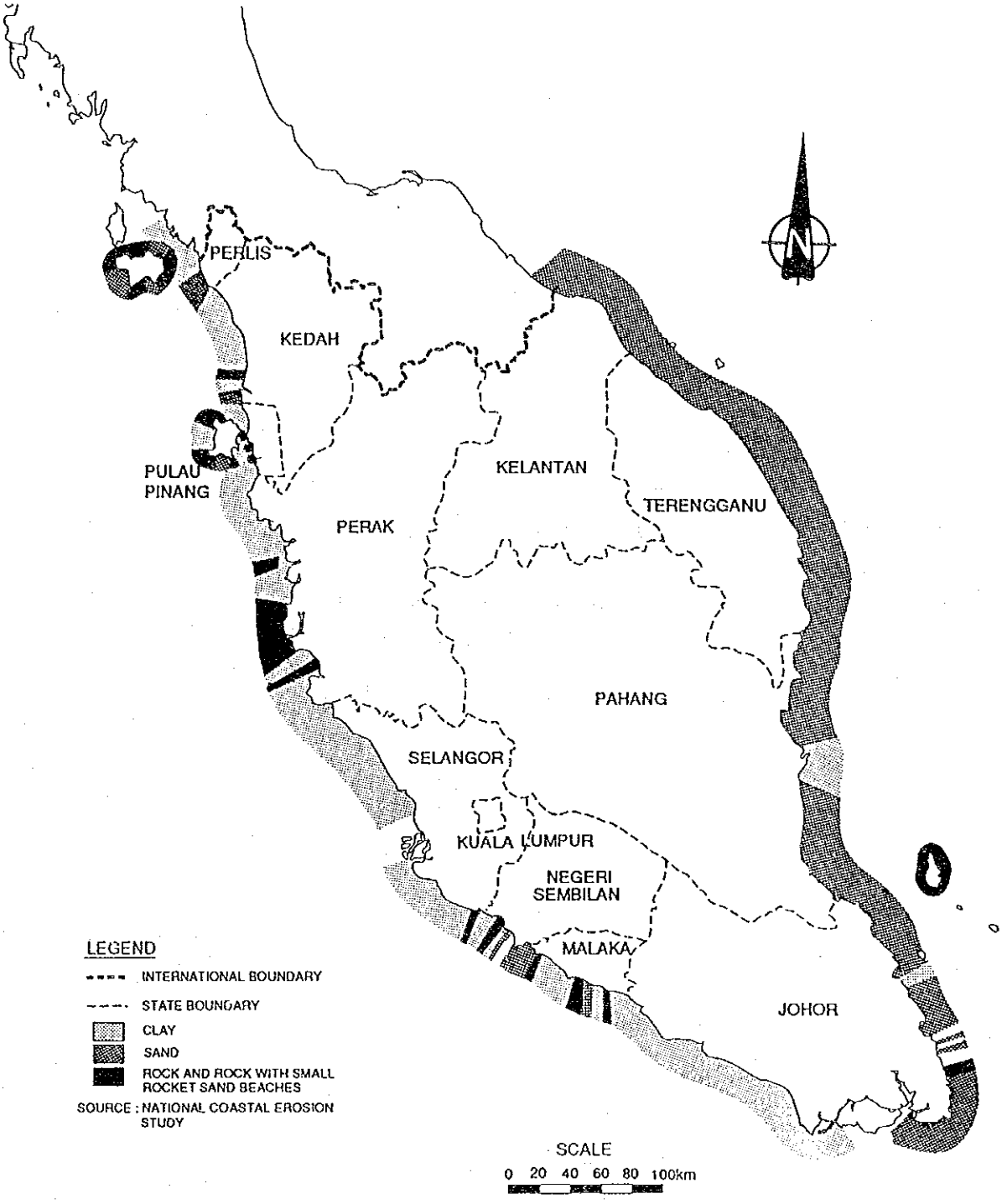


DATA SOURCE : National Water Resources Study , Malaysia 1982 , JICA

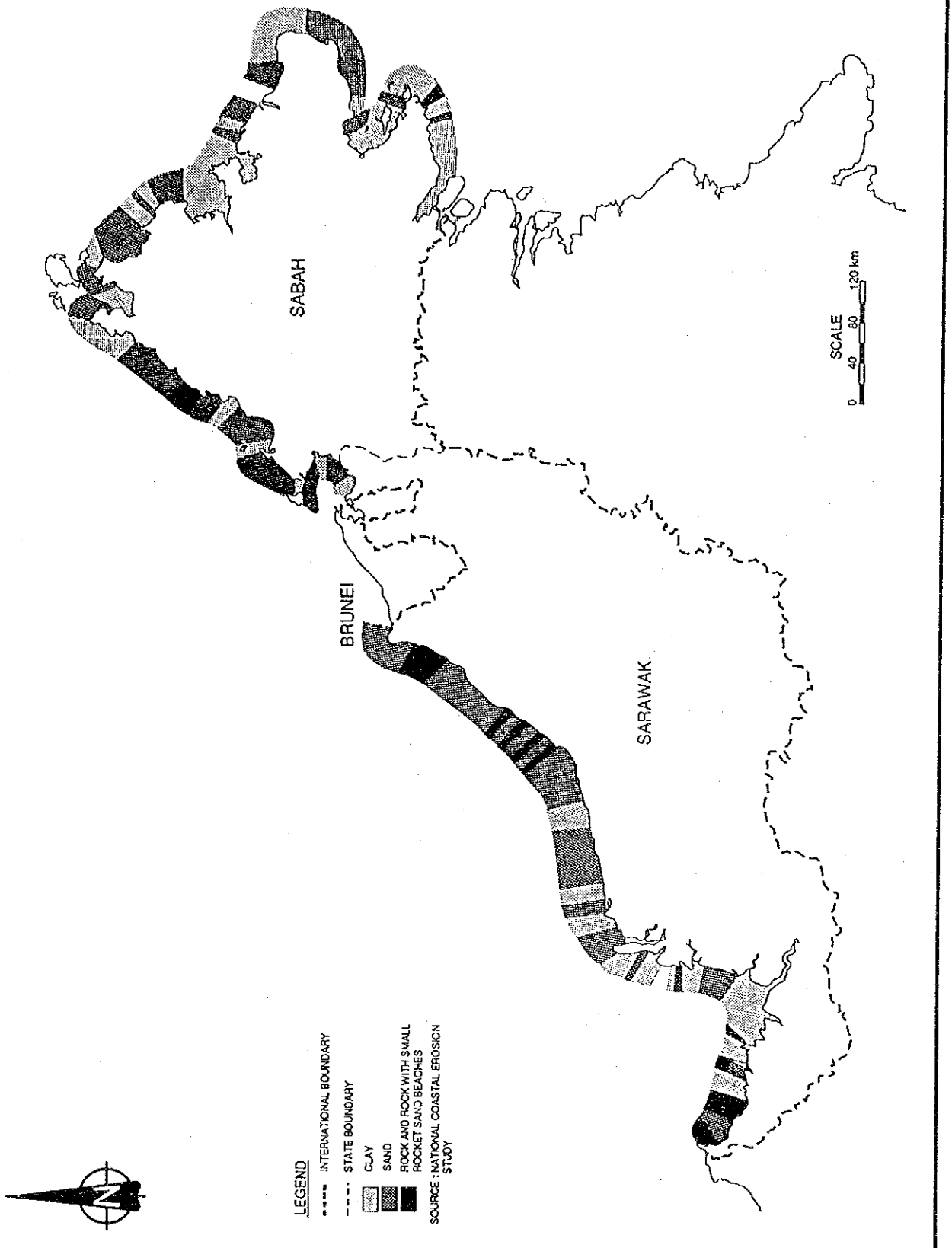
THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA JAPAN INTERNATIONAL COOPERATION AGENCY	ANNUAL EROSION RATE BY MAJOR RIVER BASIN (PENINSULAR MALAYSIA) Fig.2.4-1(1/2)



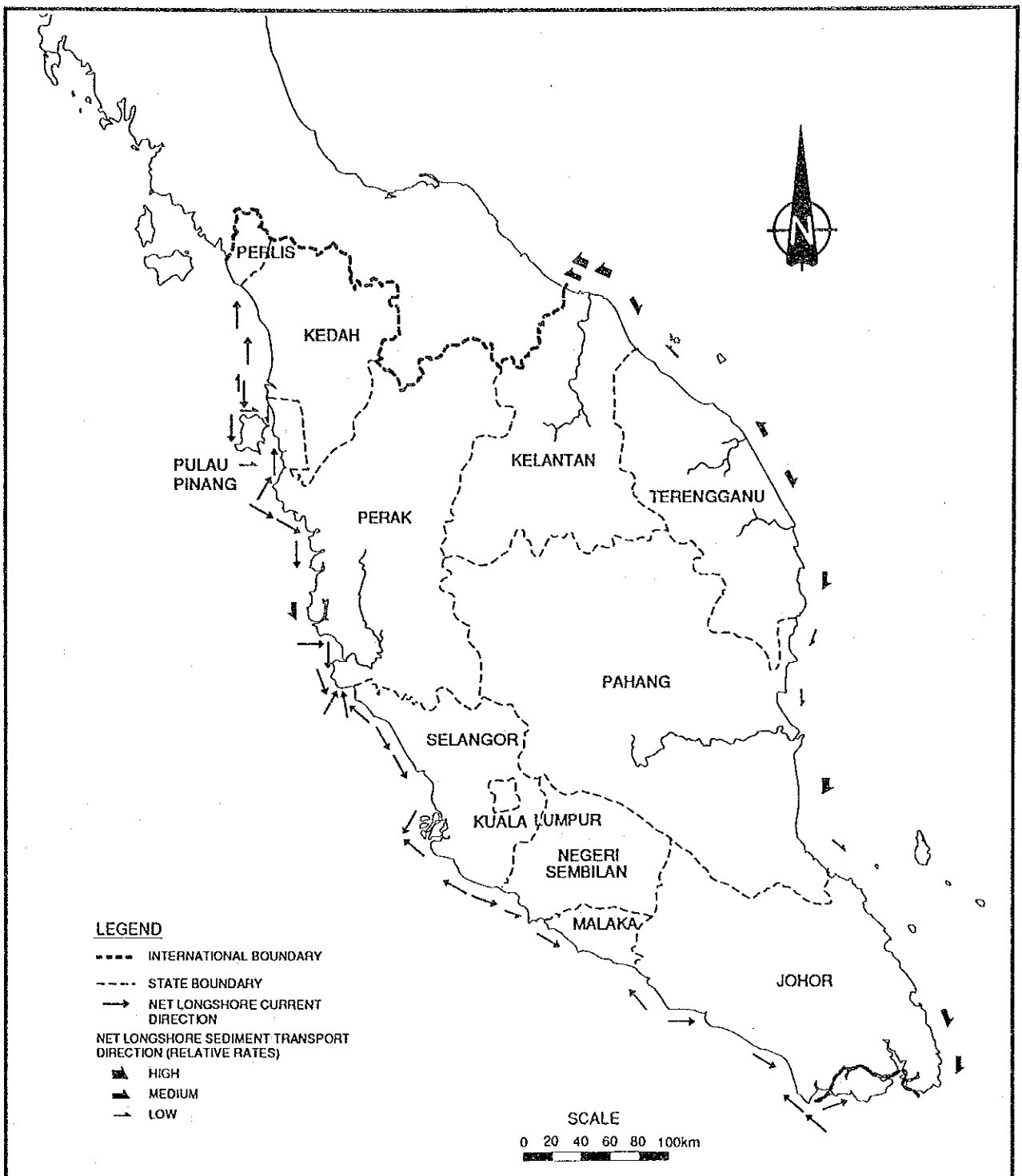
THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	ANNUAL EROSION RATE BY MAJOR RIVER BASIN (SABAH AND SARAWAK) Fig.2.4-1(2/2)
JAPAN INTERNATIONAL COOPERATION AGENCY	



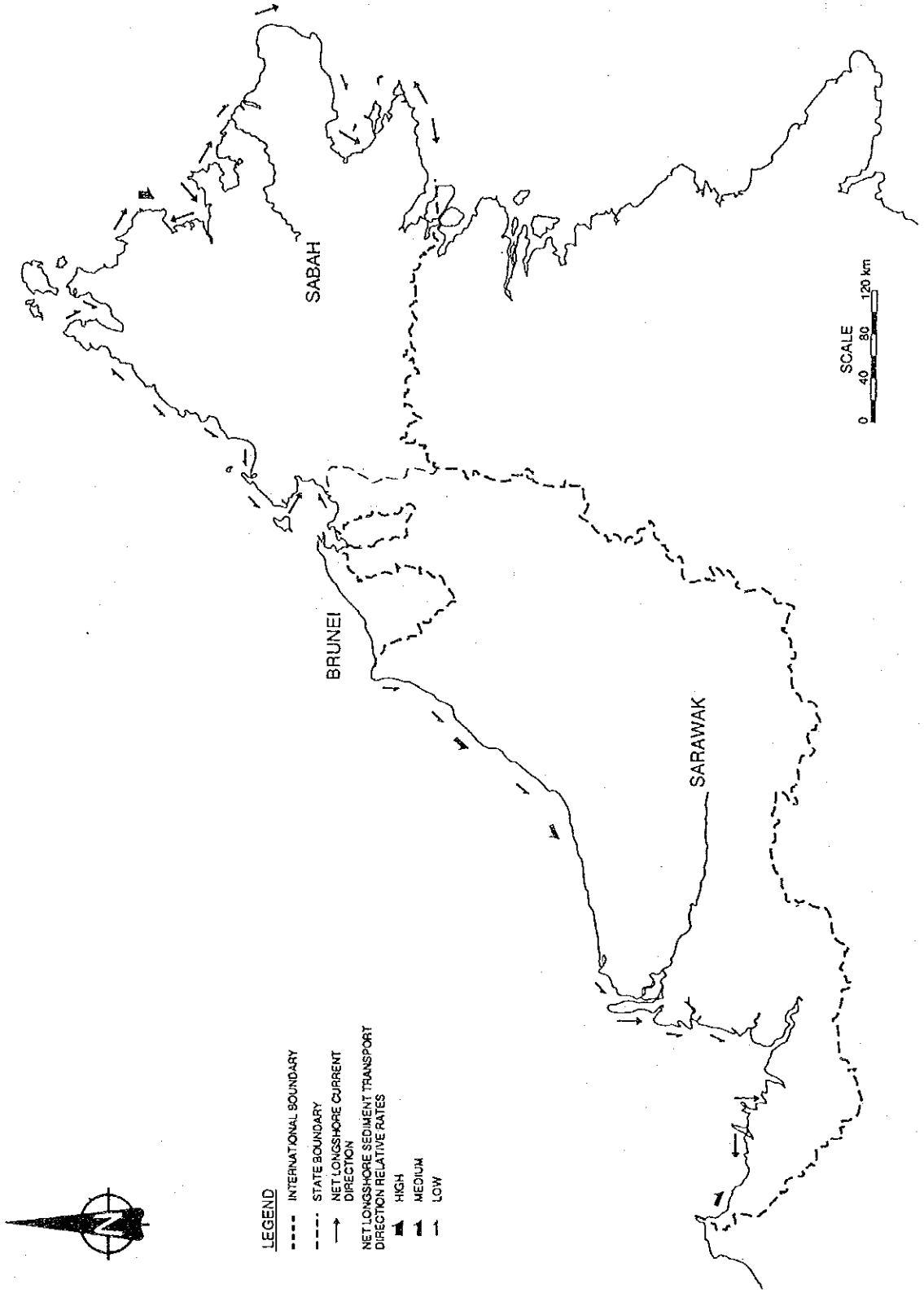
THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	DISTRIBUTION OF SHORELINE MATERIAL (PENINSULAR MALAYSIA)
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.2.5-1(1/2)



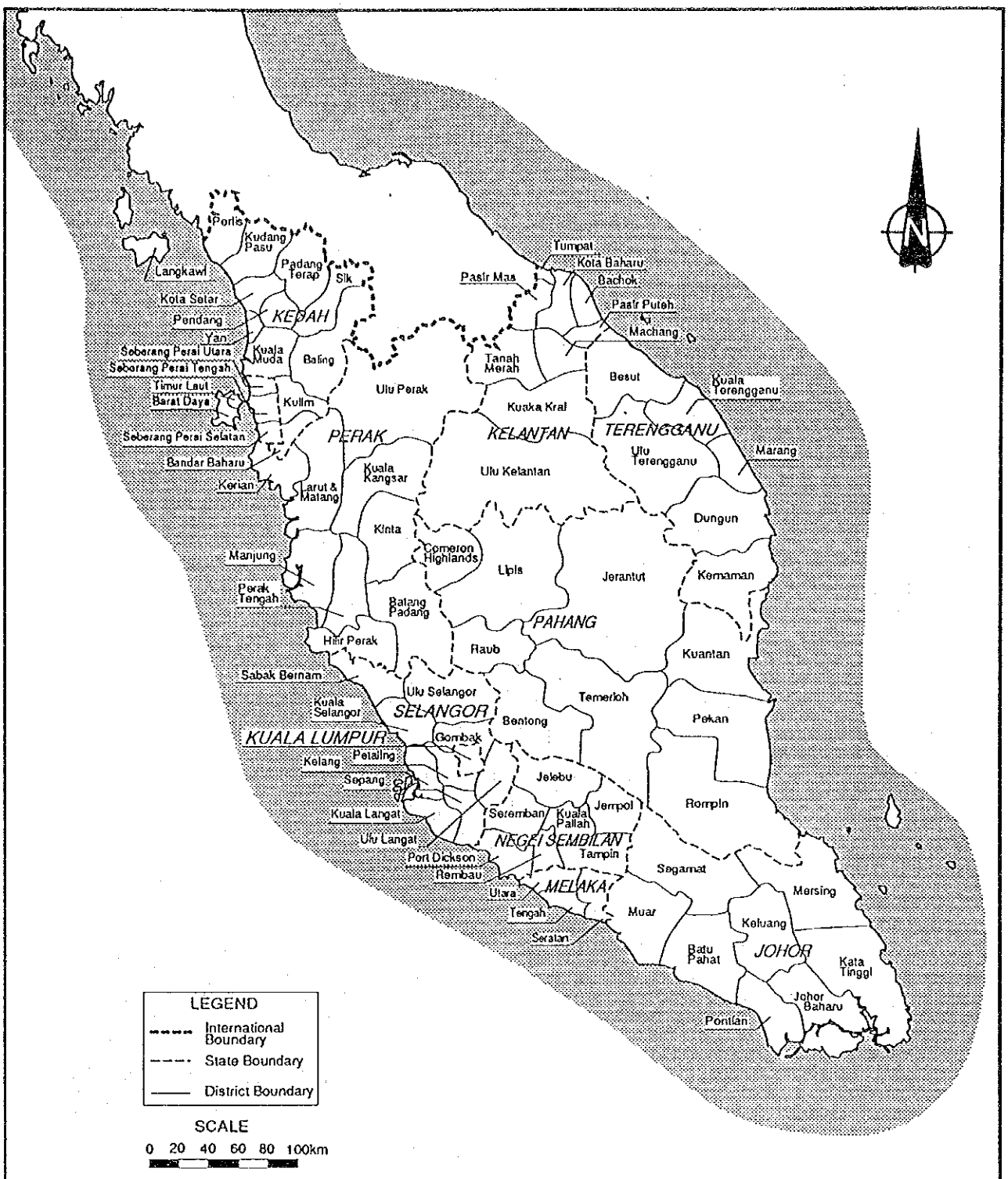
THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	DISTRIBUTION OF SHORELINE MATERIAL (SABAH AND SARAWAK) Fig.2.5-1(2/2)
JAPAN INTERNATIONAL COOPERATION AGENCY	



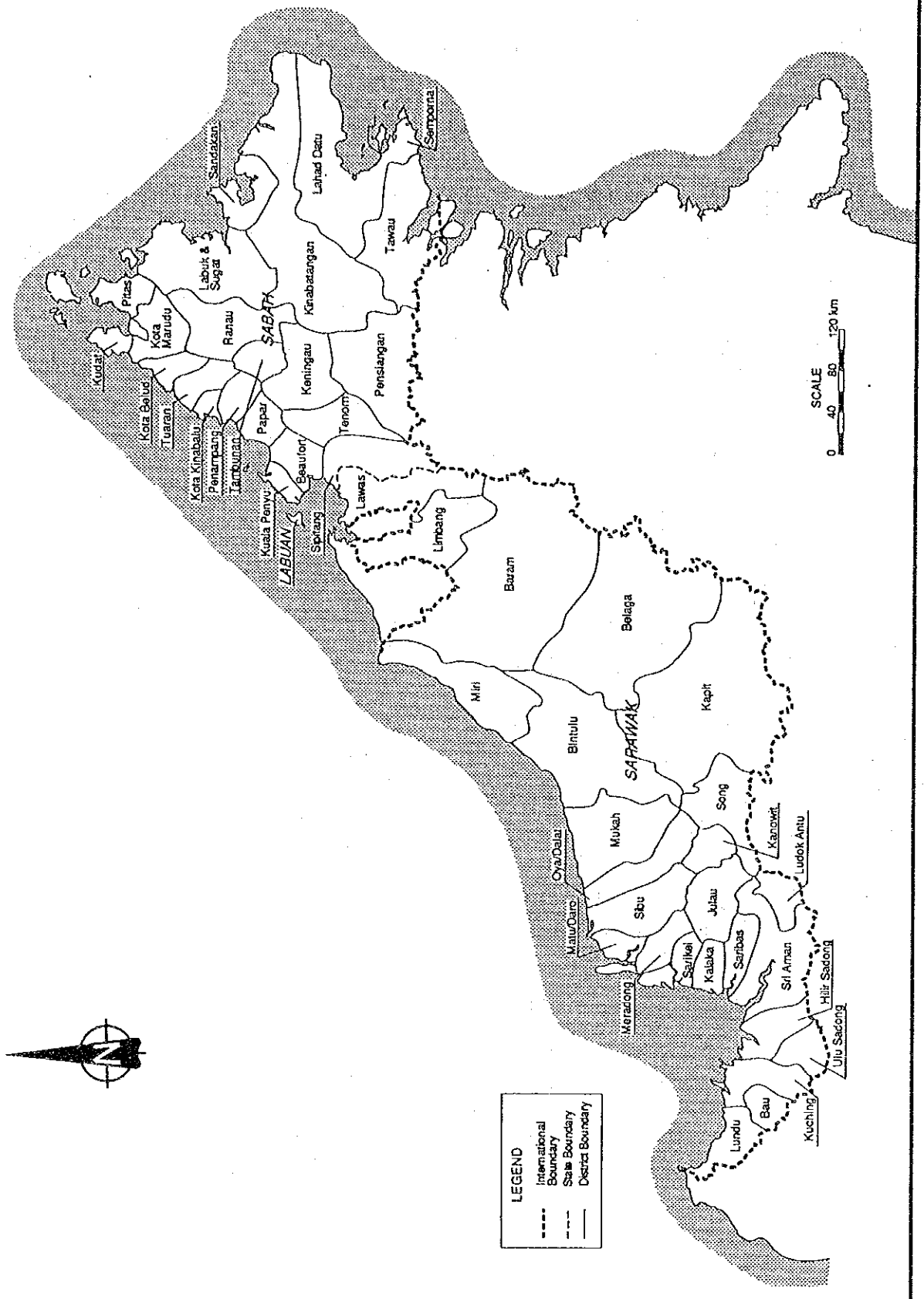
THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	NET LONGSHORE SEDIMENT TRANSPORT AND RELATIVE RATES (PENINSULAR MALAYSIA) Fig.2.5-2(1/2)
JAPAN INTERNATIONAL COOPERATION AGENCY	



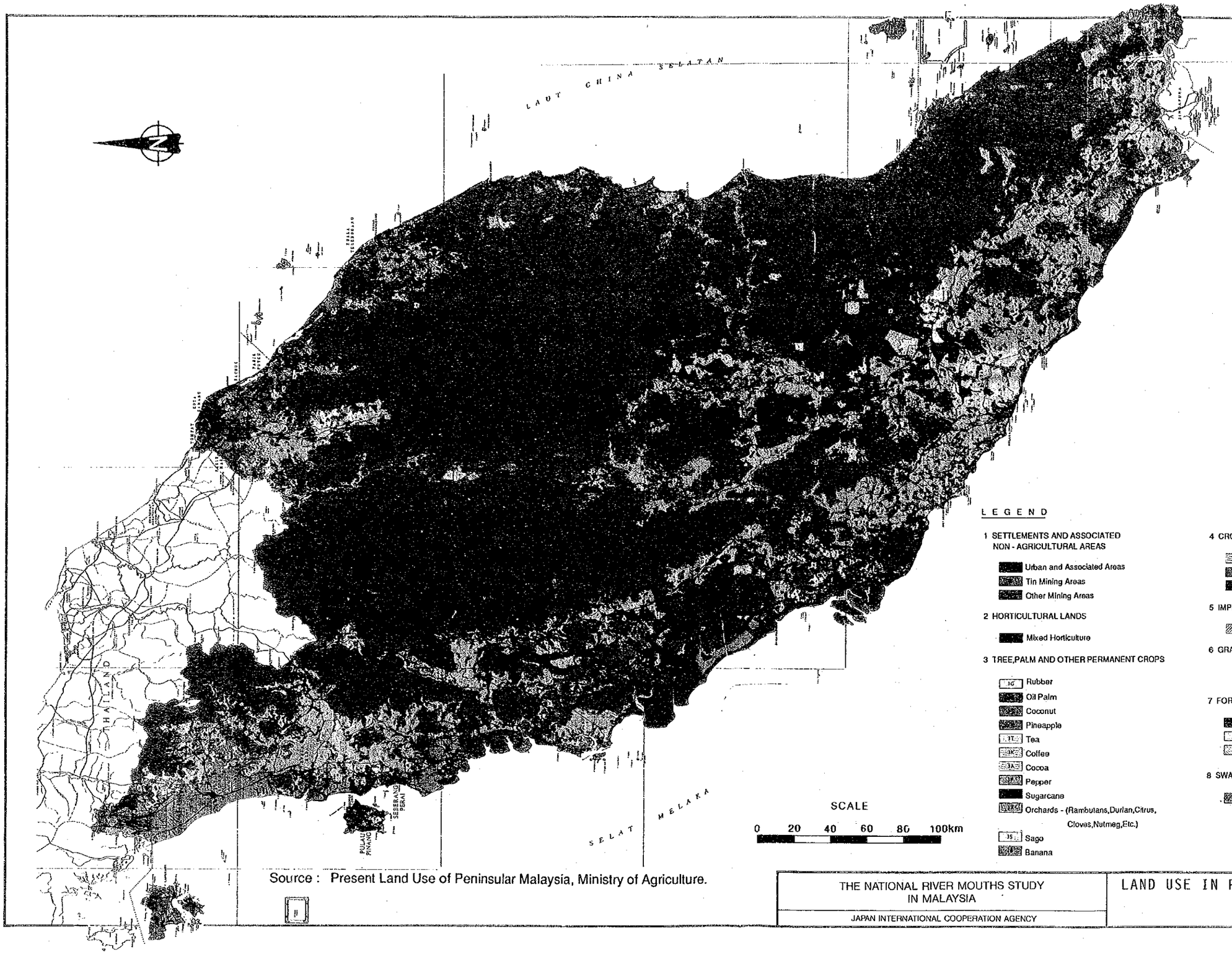
THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	NET LONGSHORE SEDIMENT TRANSPORT AND RELATIVE RATES (SABAH AND SARAWAK) Fig.2.5-2(2/2)
JAPAN INTERNATIONAL COOPERATION AGENCY	



THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	STATE AND ADMINISTRATIVE DISTRICTS (PENINSULAR MALAYSIA)
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.2.6-1(1/2)

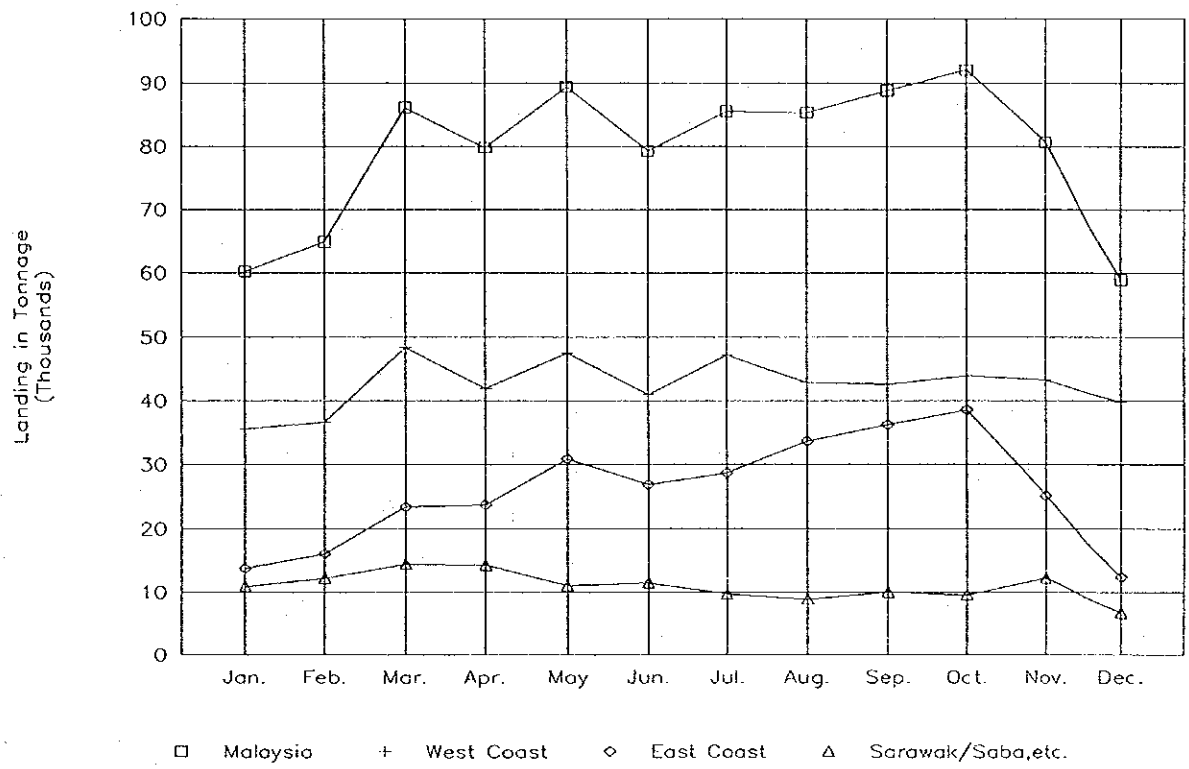


THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA JAPAN INTERNATIONAL COOPERATION AGENCY	STATE AND ADMINISTRATIVE DISTRICTS (SABAH AND SARAWAK) Fig.2.6-1(2/2)

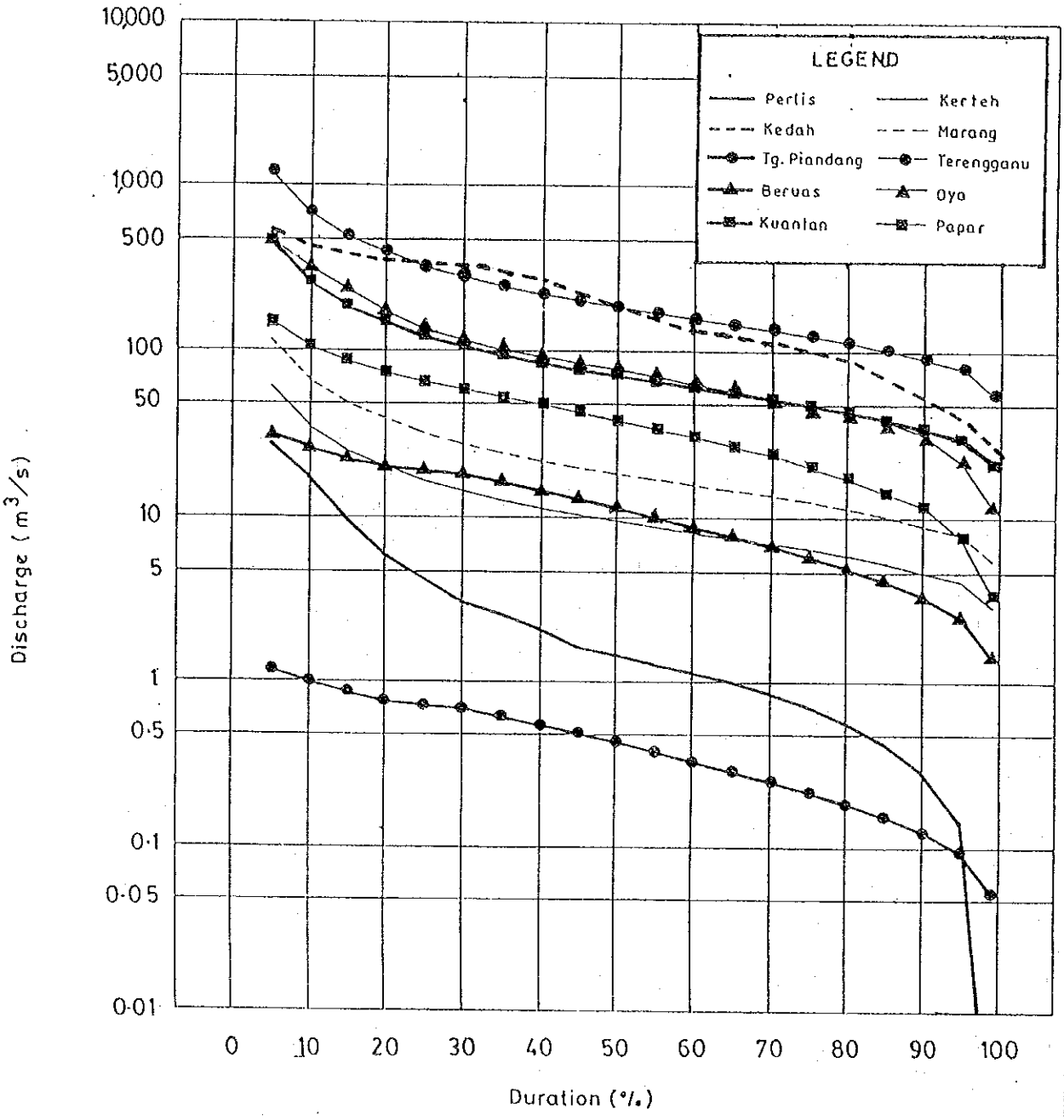


Source : Present Land Use of Peninsular Malaysia, Ministry of Agriculture.

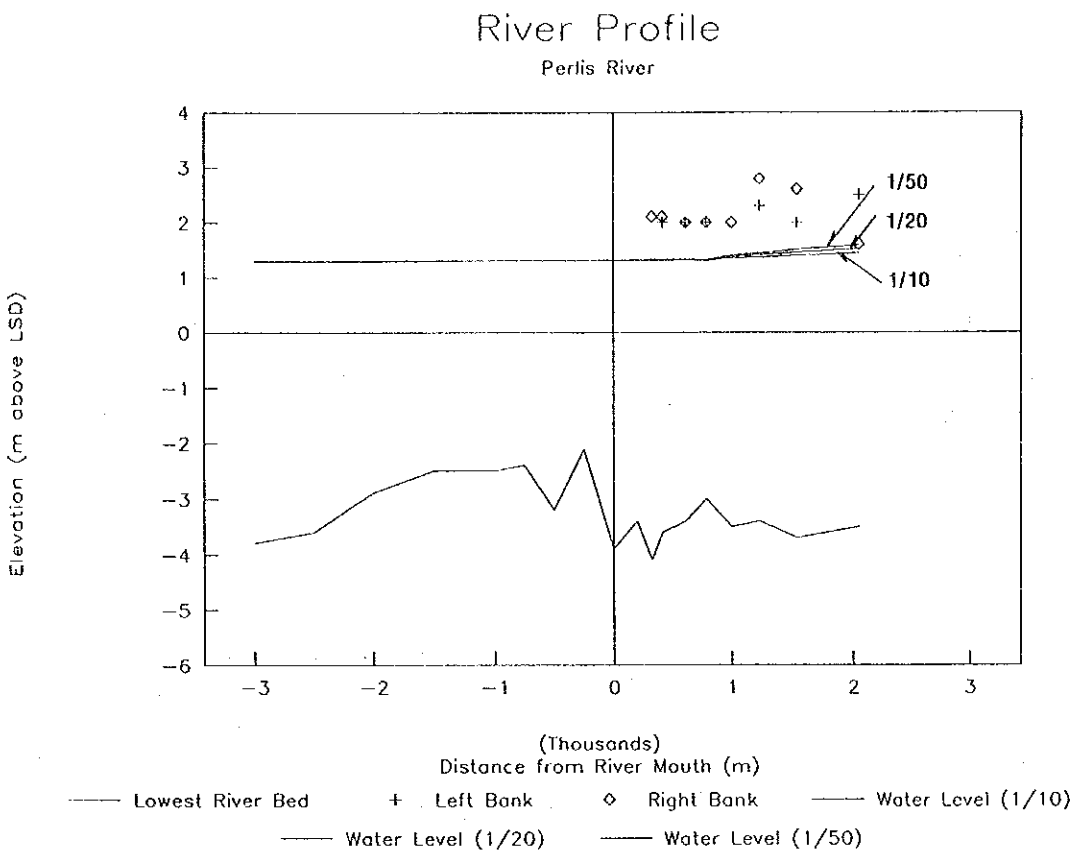
THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA JAPAN INTERNATIONAL COOPERATION AGENCY	LAND USE IN PENINSULAR MALAYSIA Fig.2.6-2

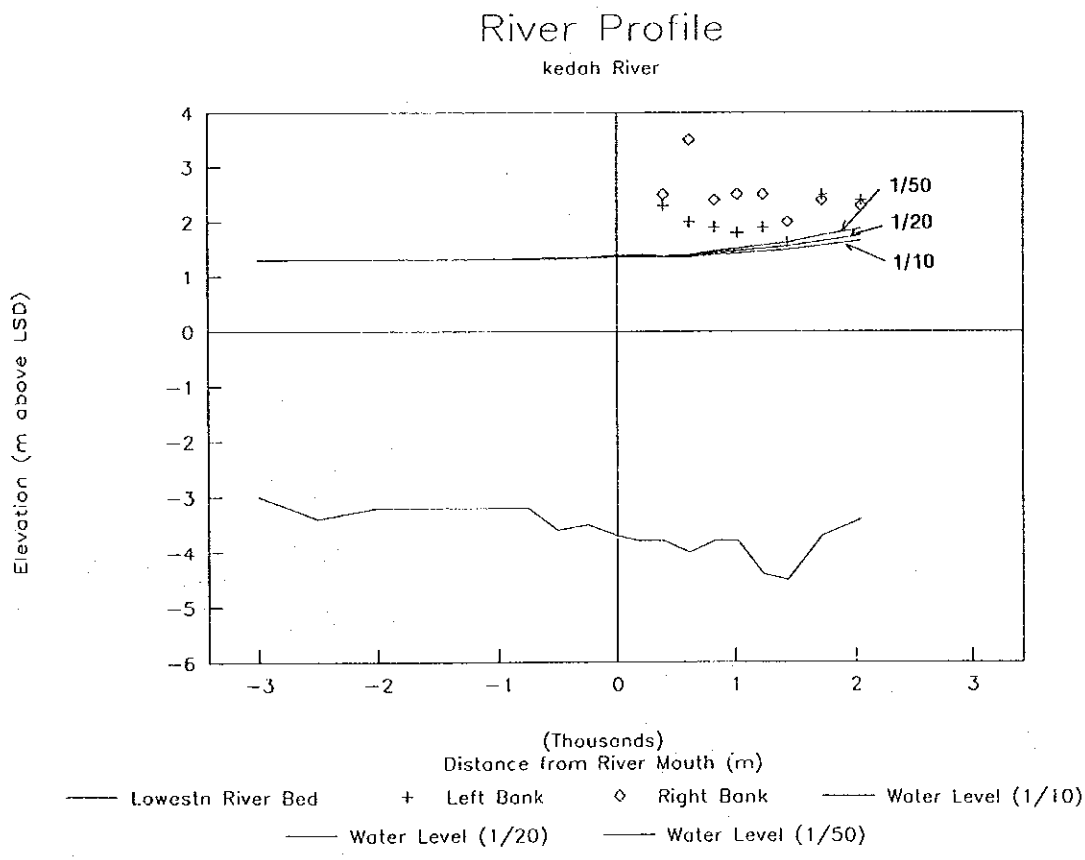


THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA JAPAN INTERNATIONAL COOPERATION AGENCY	MARINE FISH LANDINGS BY MONTH, 1990 Fig.2.7-1



THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA JAPAN INTERNATIONAL COOPERATION AGENCY	ESTIMATED DURATION CURVE FOR REPRESENTATIVE RIVER MOUTH Fig.6.2-1

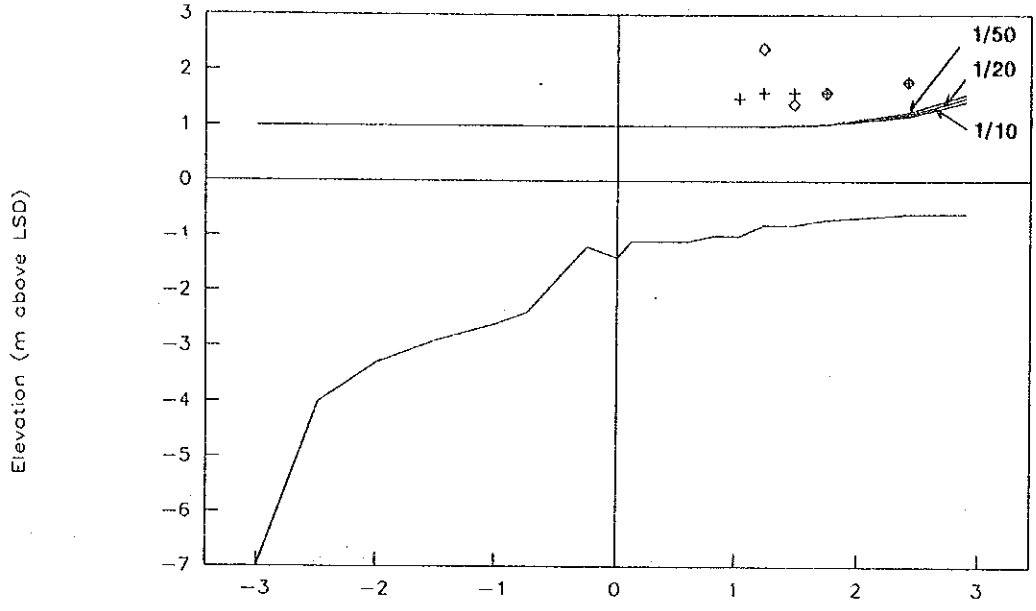




THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	ESTIMATED WATER LEVEL PROFILE (PERLIS AND KEDAH)
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.6.2-2(1/5)

River Profile

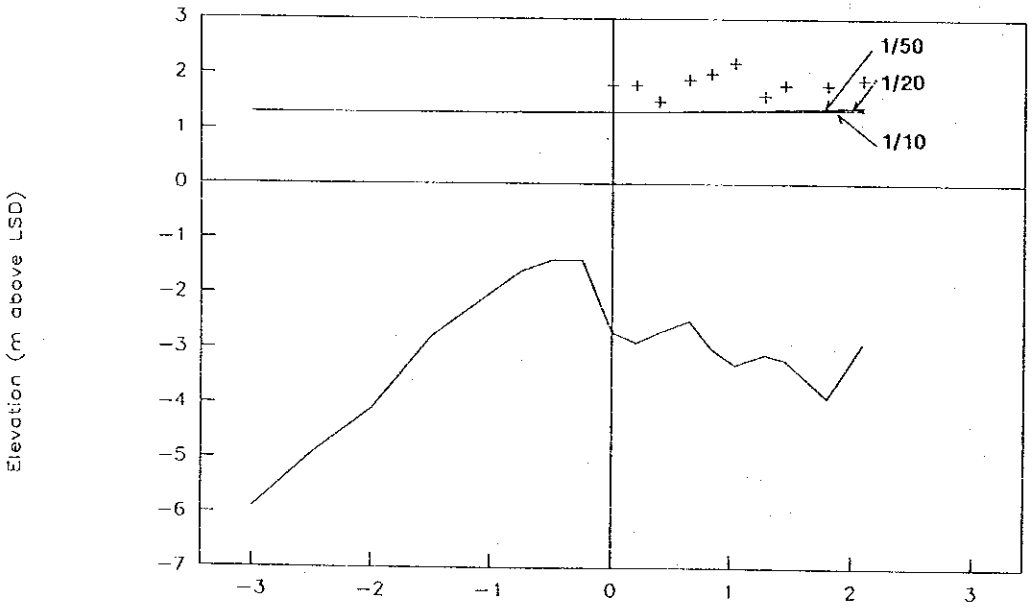
Tg.Piandang River



Lowest River Bed + Left Bank ◇ Right Bank Water Level (1/10)
Water Level (1/20) Water Level (1/50)

River Profile

Beruas River

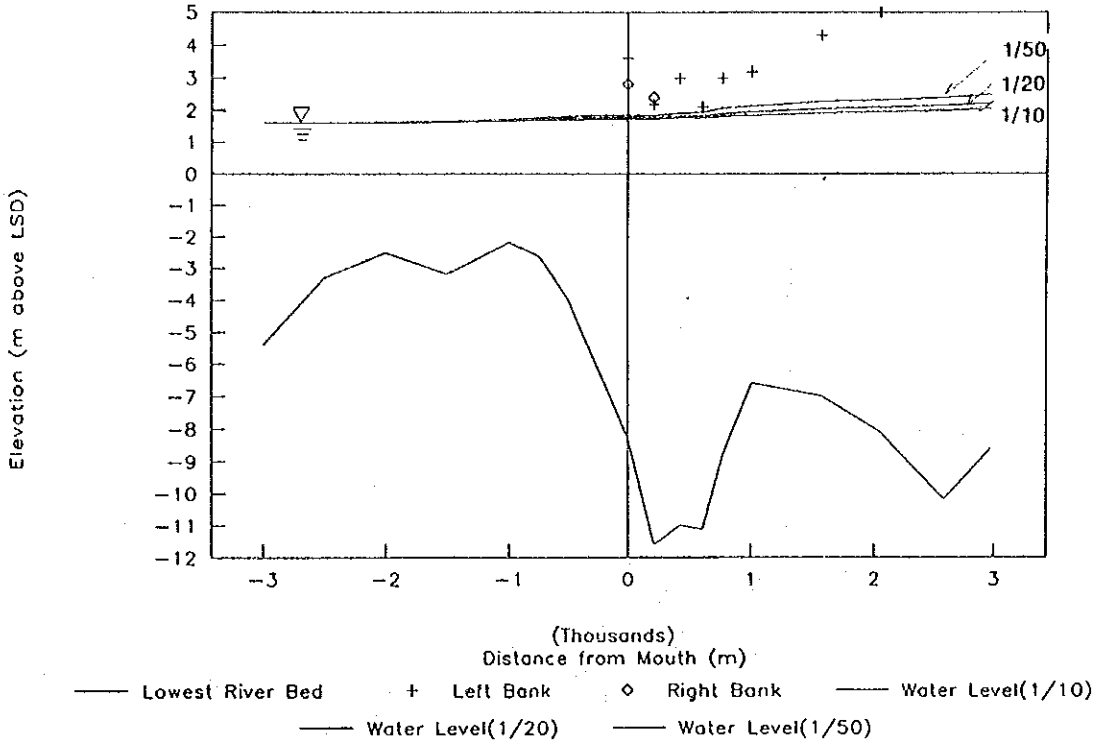


Lowest River Bed + Left Bank ◇ Right Bank Water Level (1/10)
Water Level (1/20) Water Level (1/50)

THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	ESTIMATED WATER LEVEL PROFILE (TG. PIANDANG AND BERUAS)
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.6.2-2(2/5)

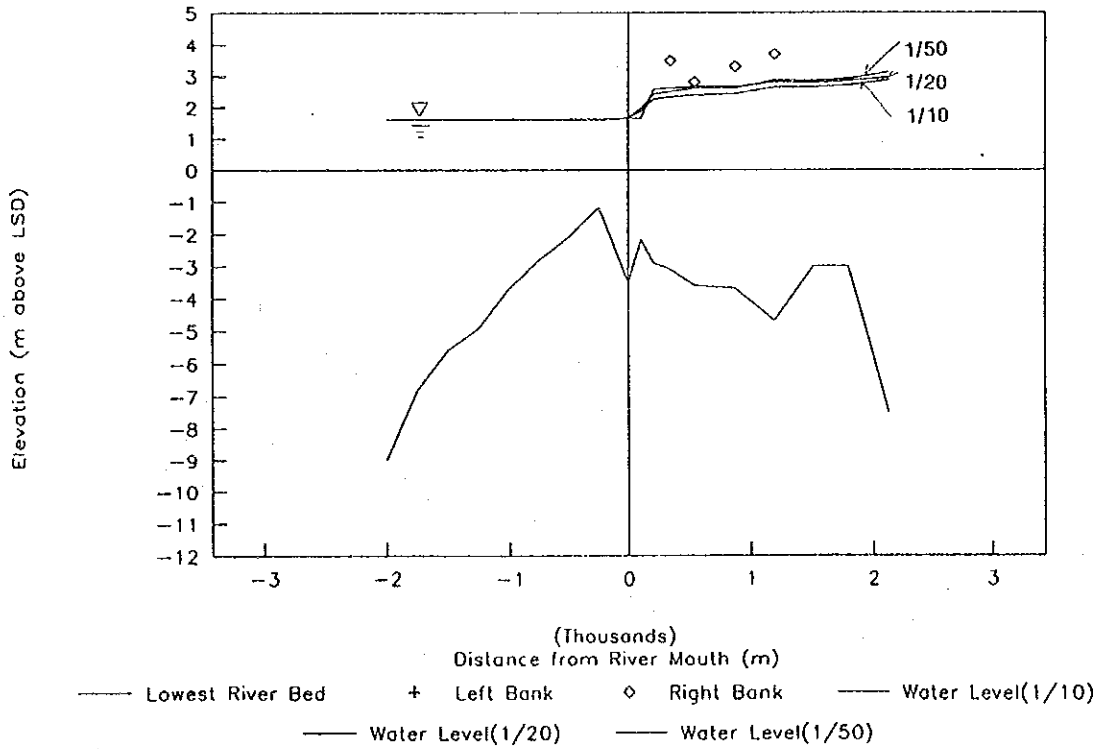
River Profile

Kuantan River



River Profile

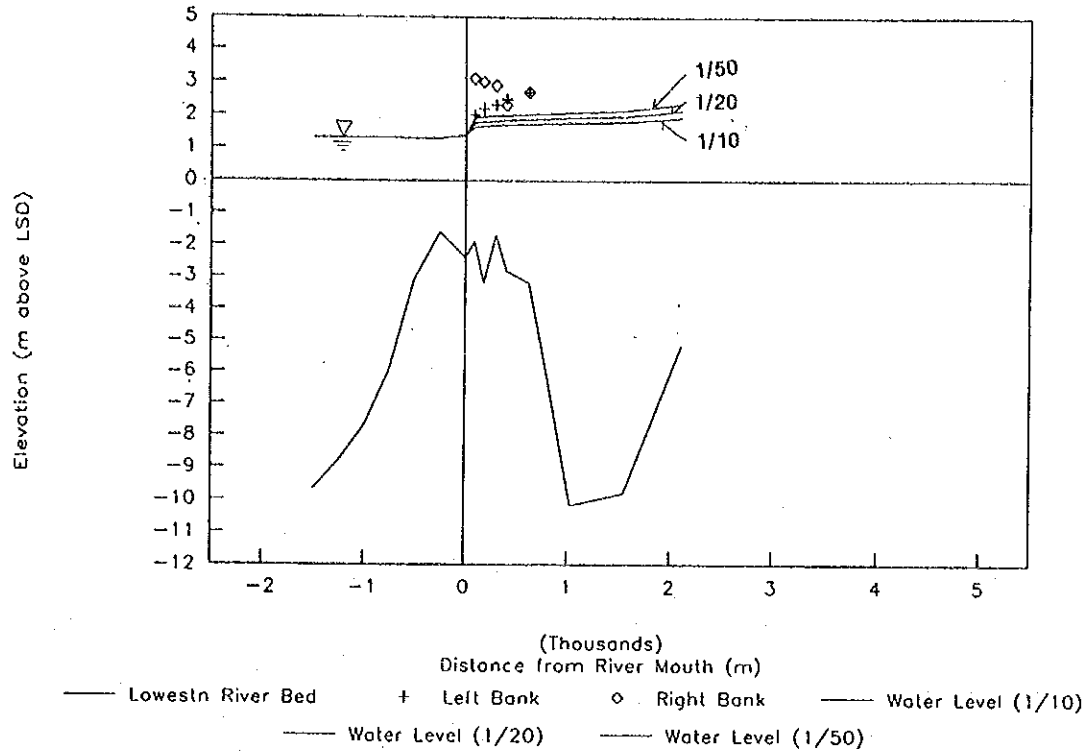
Kerteh River



THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	ESTIMATED WATER LEVEL PROFILE (KUANTAN AND KERTEH)
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.6.2-2(3/5)

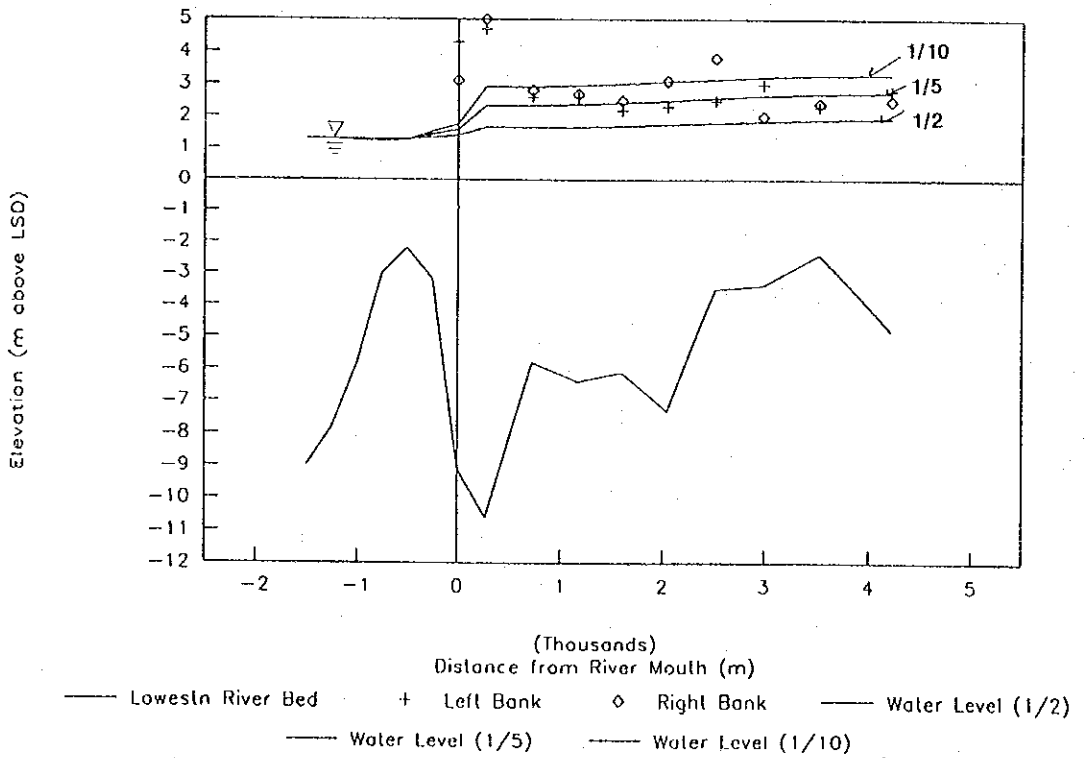
River Profile

Marang River



River Profile

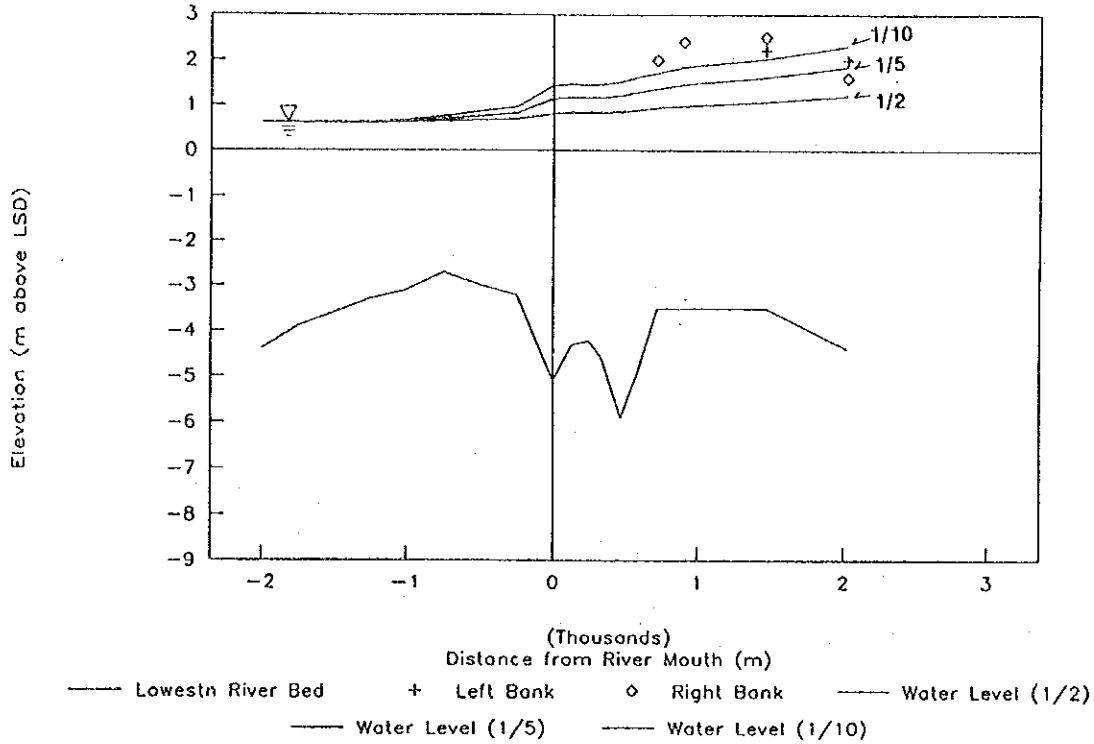
Terengganu River



THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	ESTIMATED WATER LEVEL PROFILE (MARANG AND TERENGGANU)
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.6.2-2(4/5)

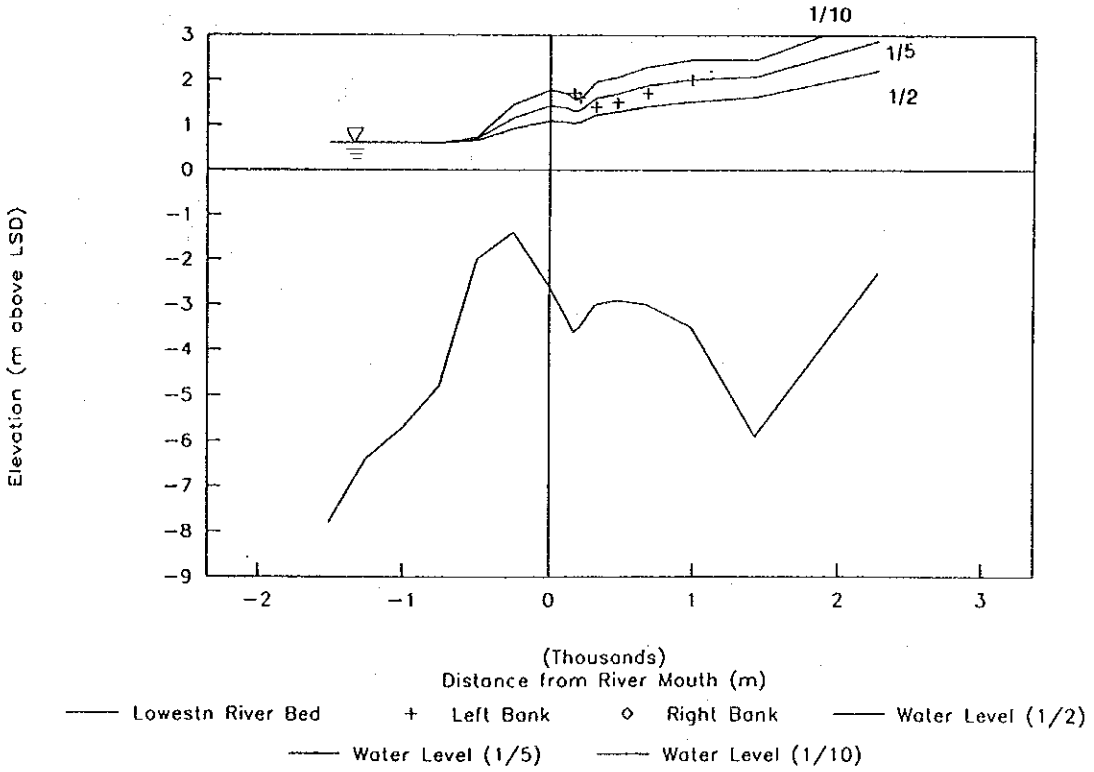
River Profile

Oya River

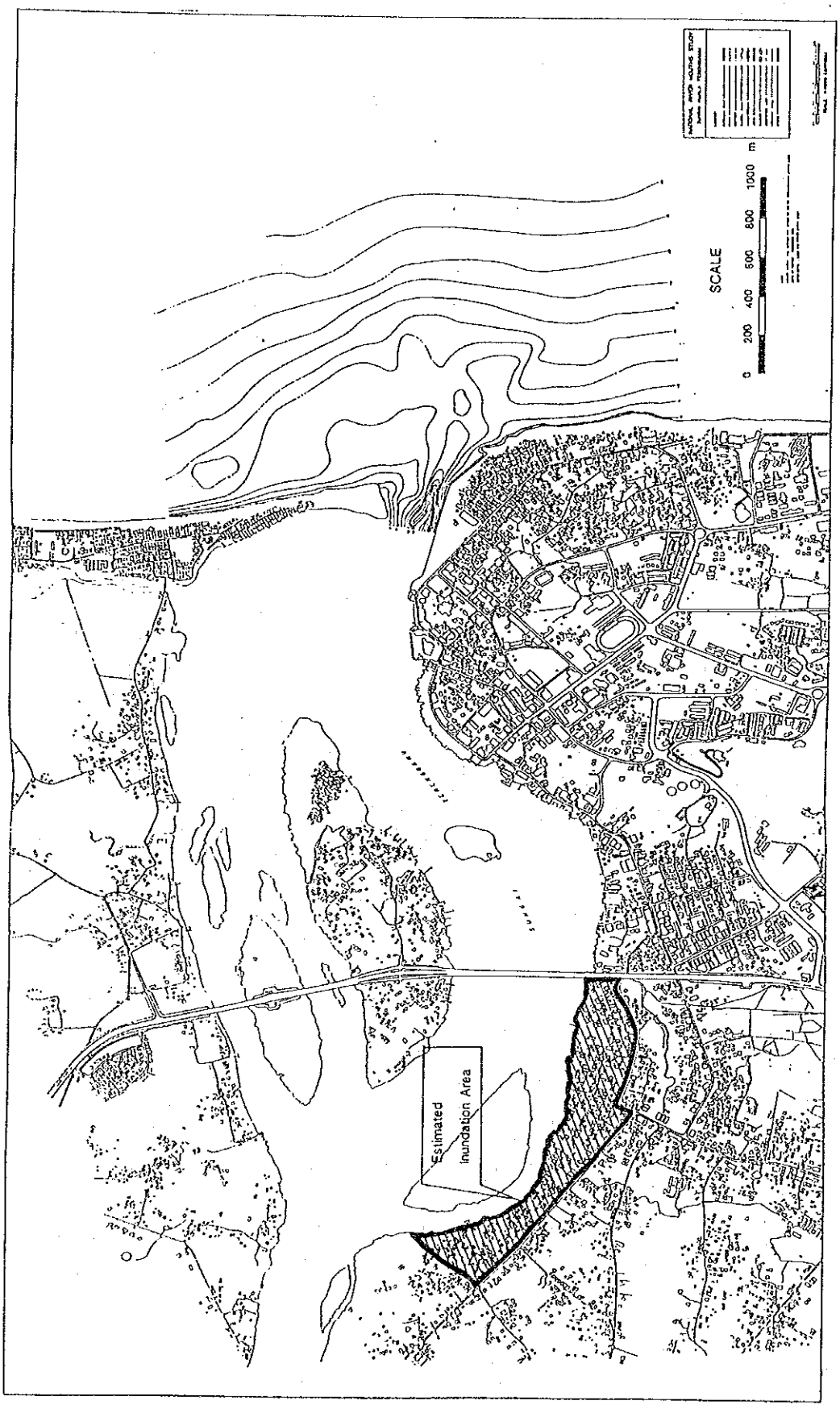


River Profile

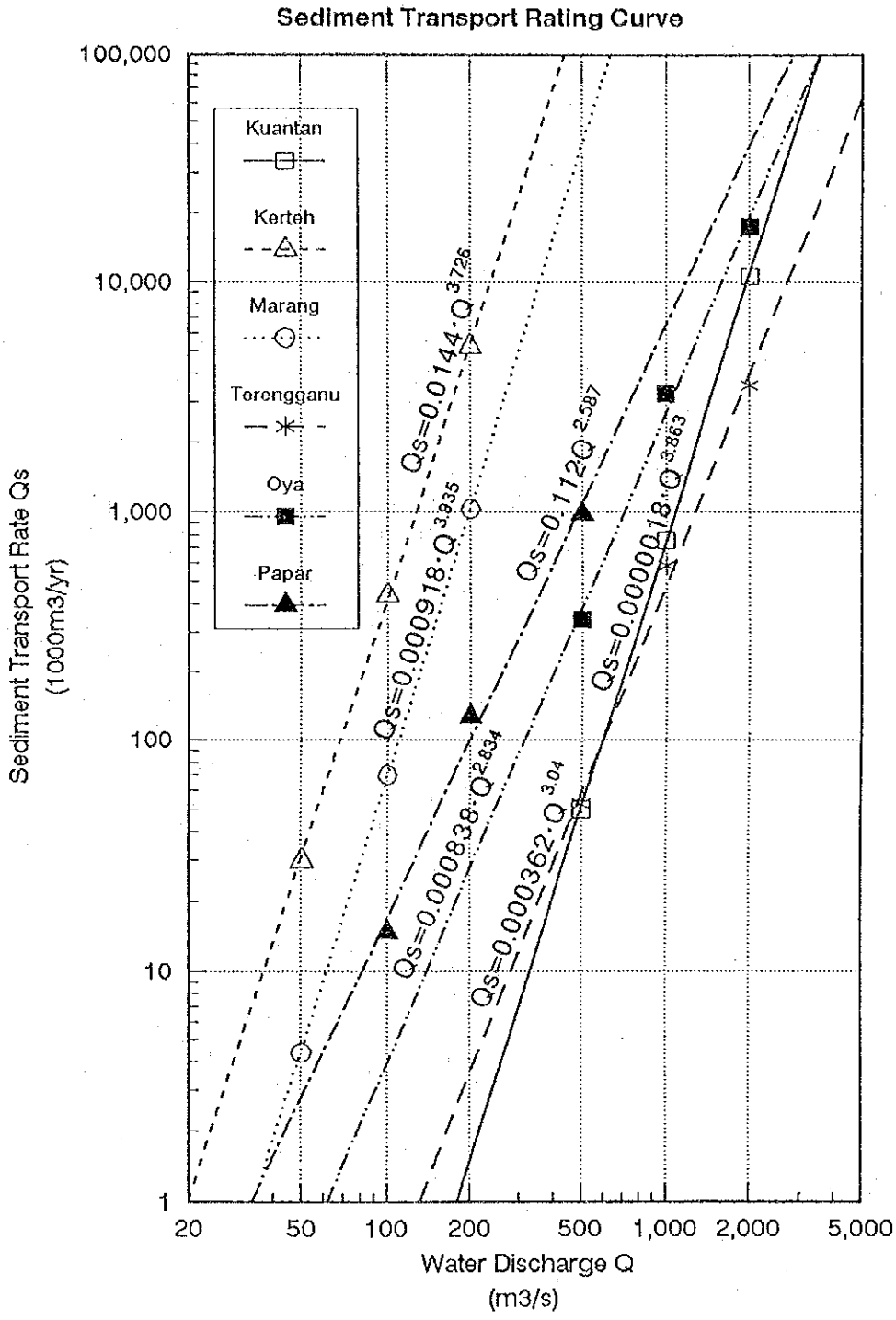
Papar River



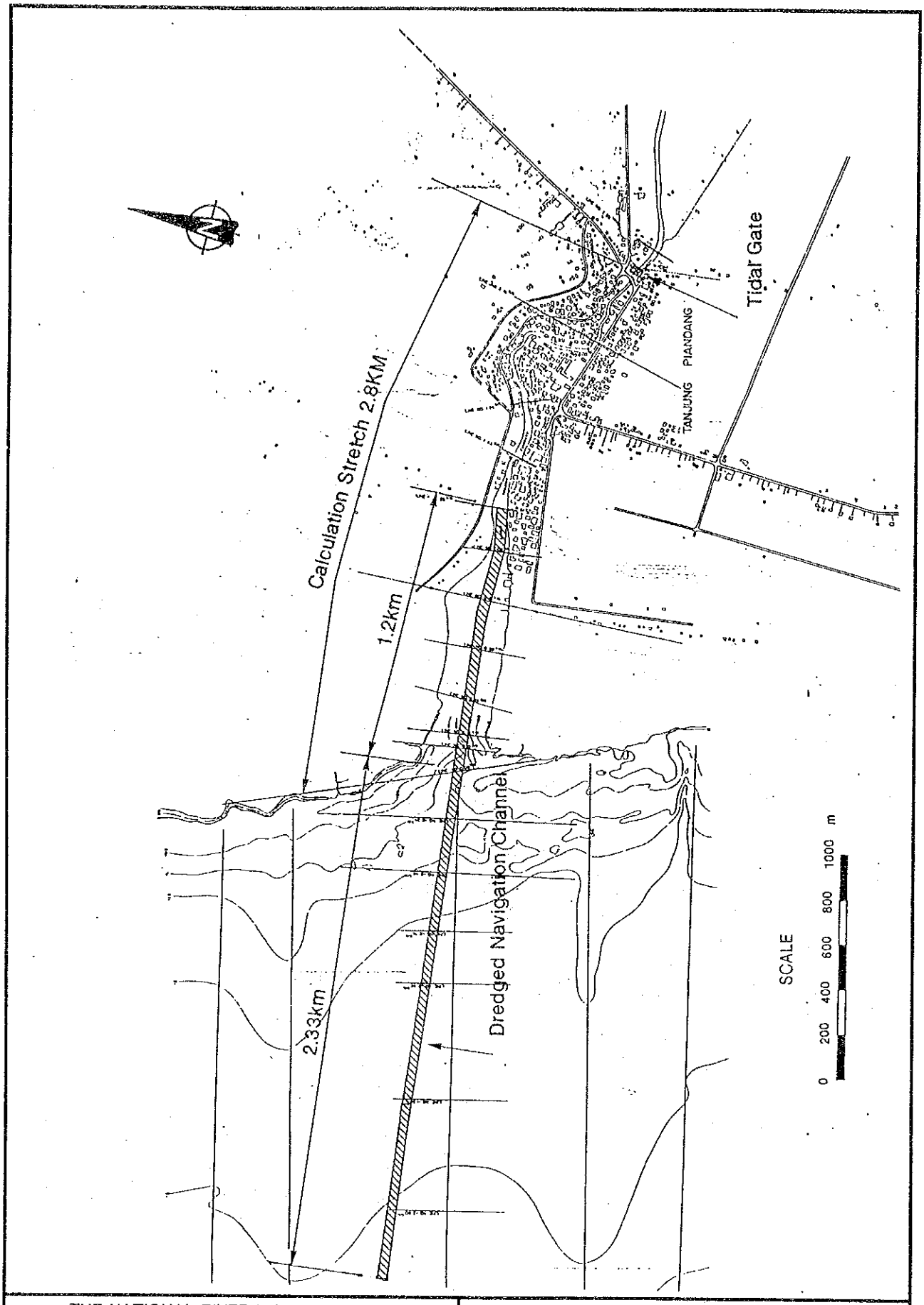
THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	ESTIMATED WATER LEVEL PROFILE (OYA AND PAPAR)
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.6.2-2(5/5)



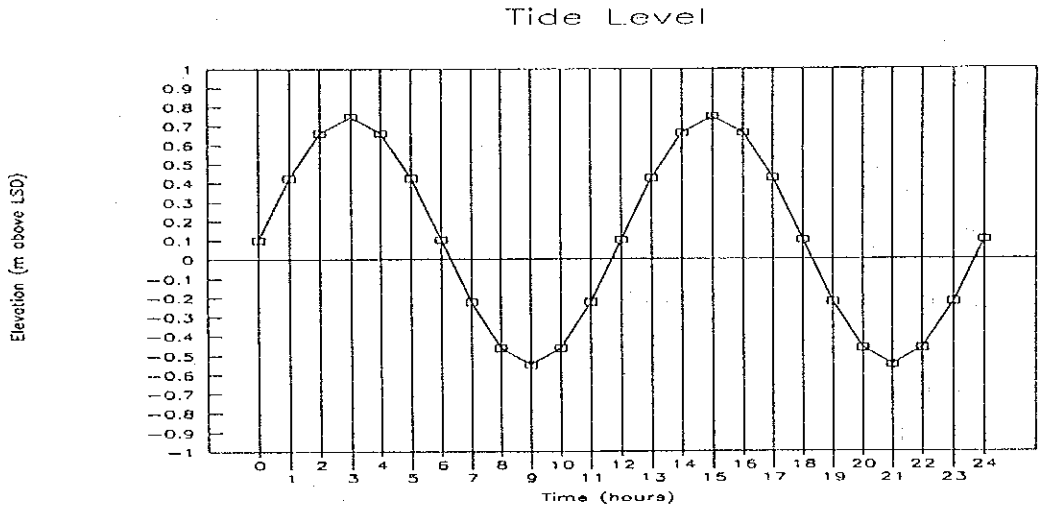
THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA JAPAN INTERNATIONAL COOPERATION AGENCY	FLOOD INUNDATION AREA NEAR TERENGGANU RIVER MOUTH Fig.6.2-3

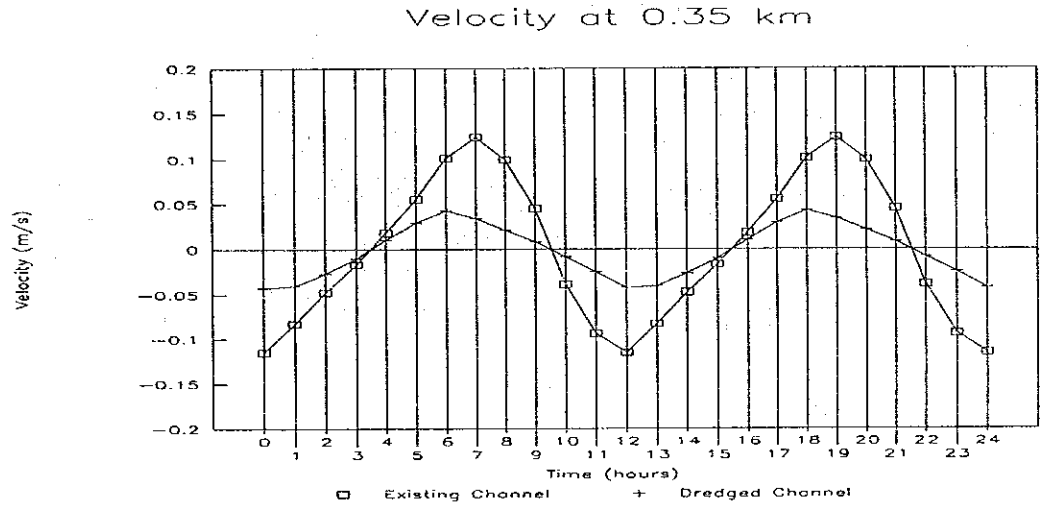


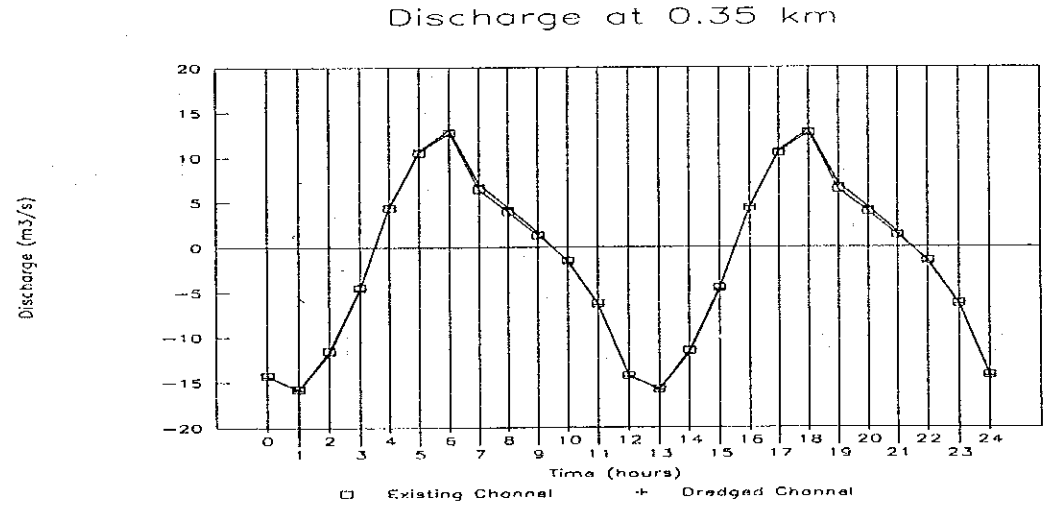
THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	SEDIMENT RATING CURVES
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.6.2-4



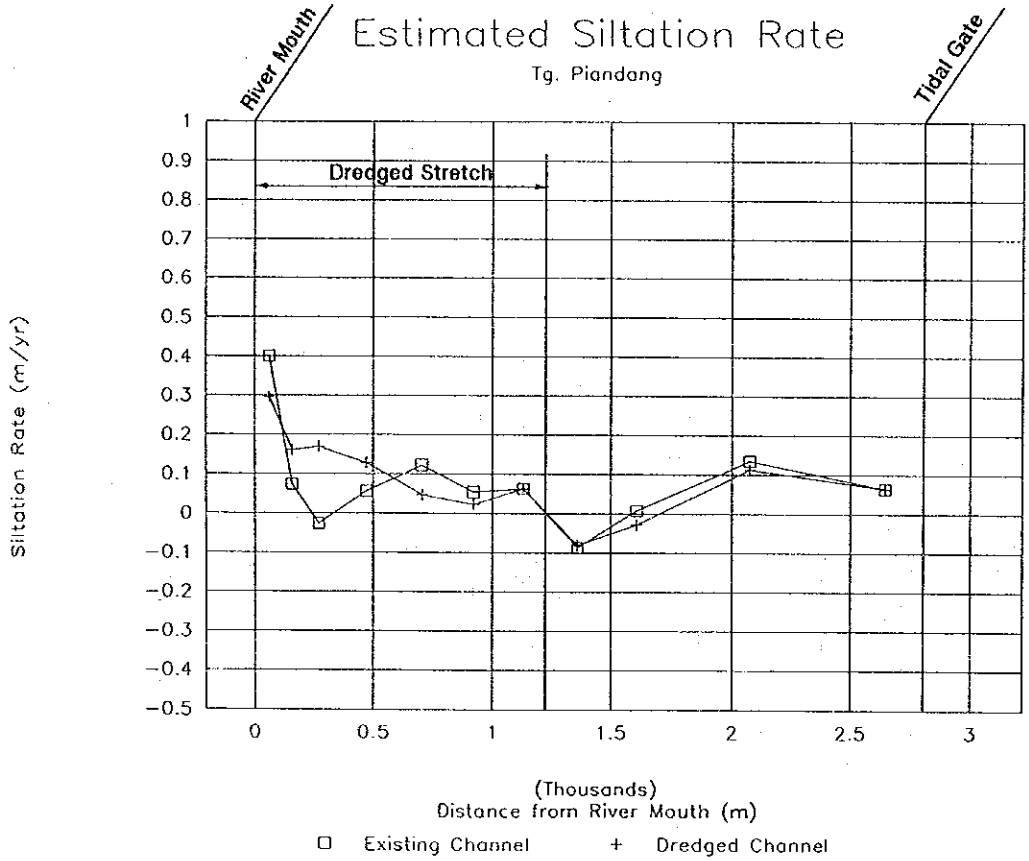
THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA JAPAN INTERNATIONAL COOPERATION AGENCY	TARGET STRETCH FOR ONE-DIMENSIONAL DISPERSION ANALYSIS Fig.6.2-5



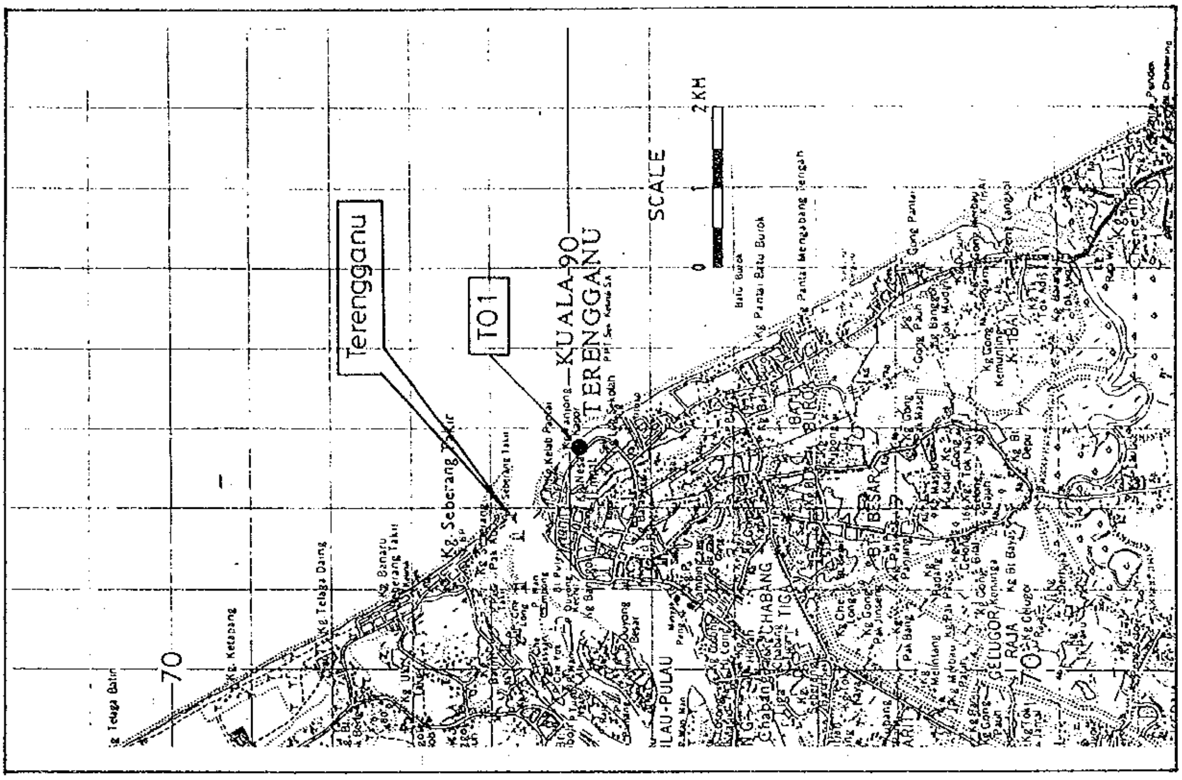




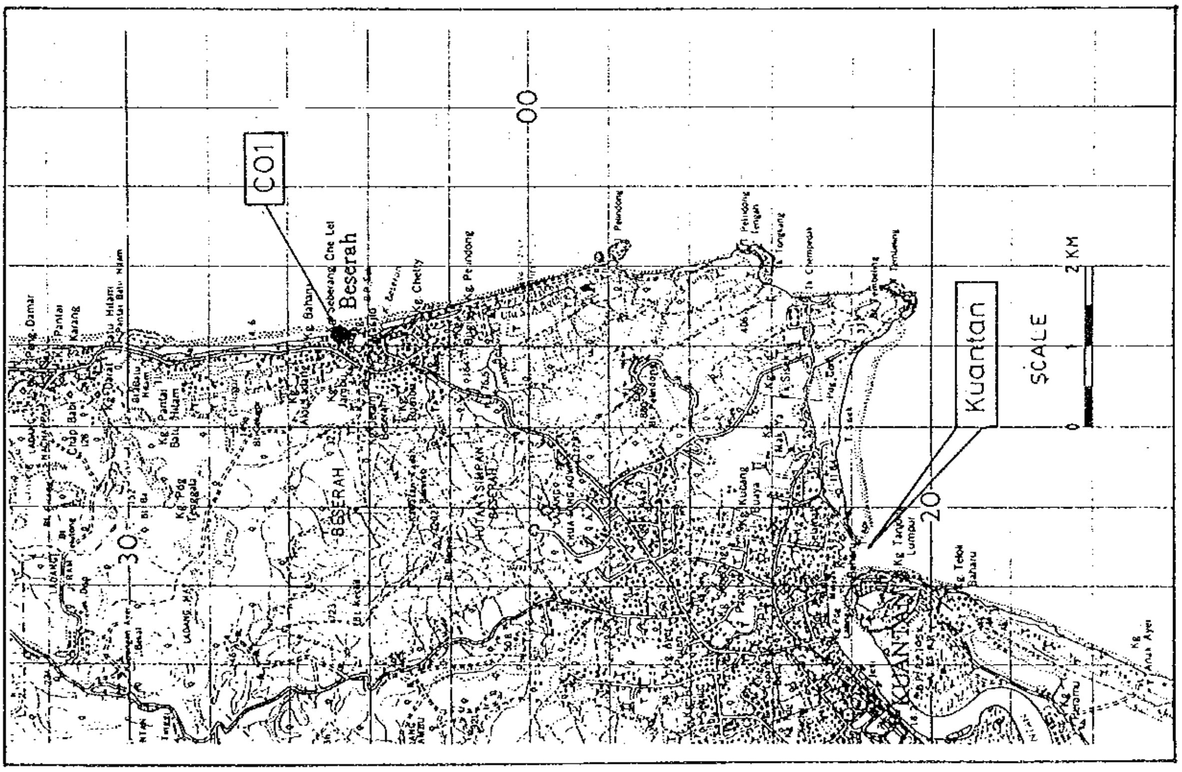
THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	RESULT OF UNSTEADY FLOW ANALYSIS
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.6.2-6



THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	ESTIMATED SILTATION RATE
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.6.2-7



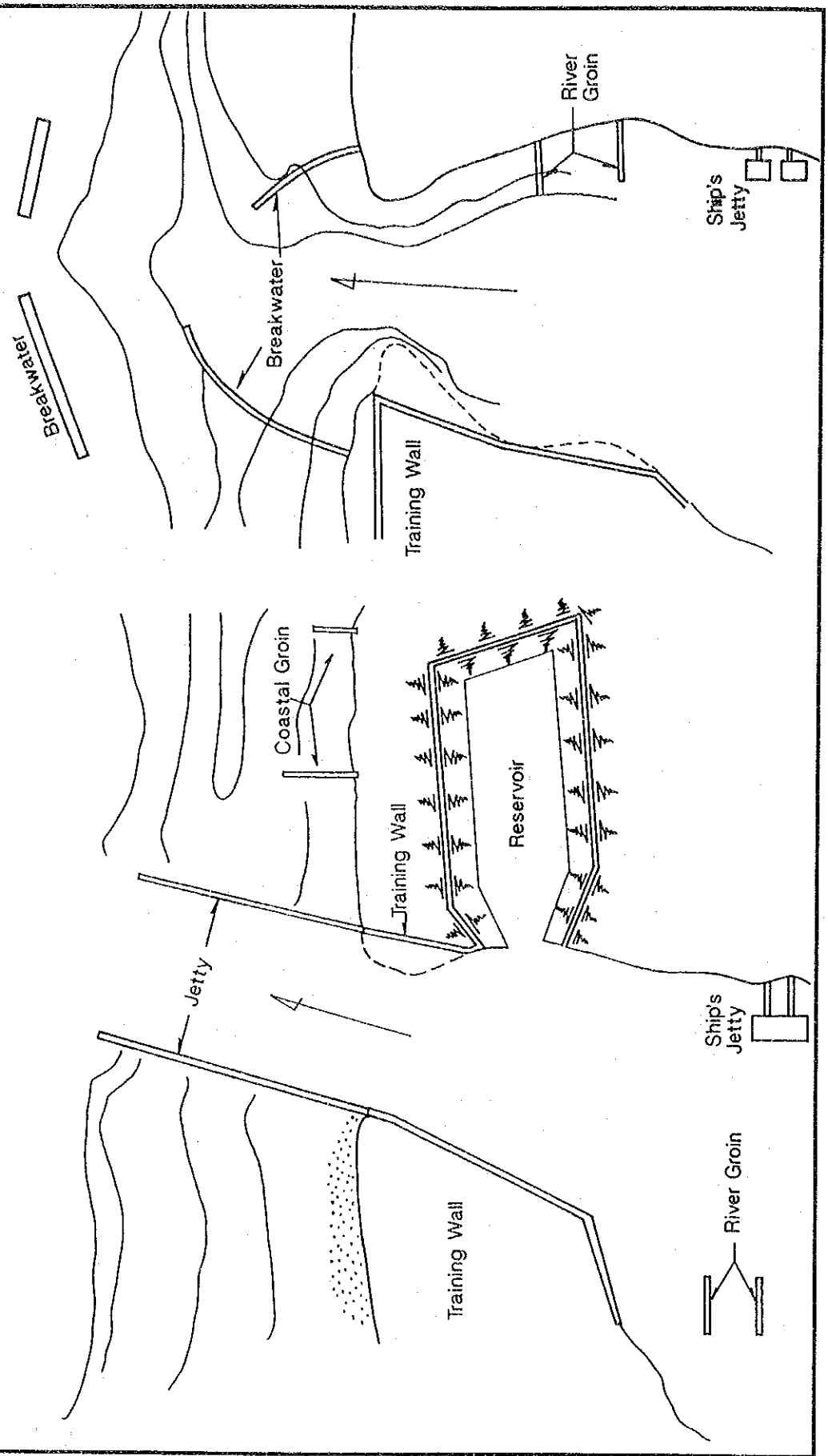
T01 Station



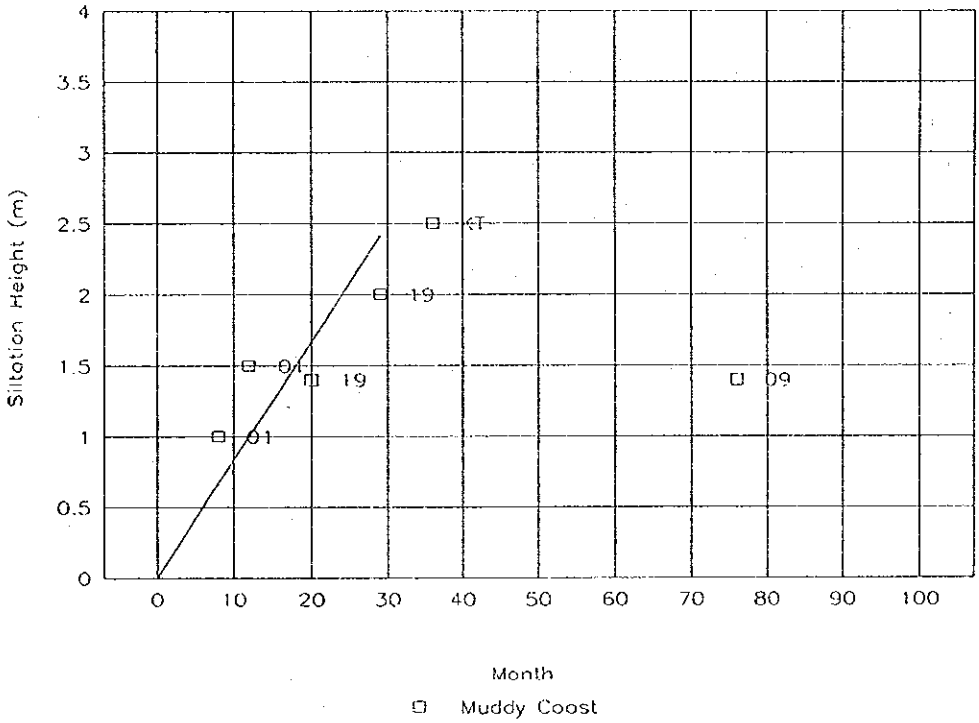
C01 Station

THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	LOCATION OF LEO PROGRAM STATIONS C01 AND T01
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.6.3-1

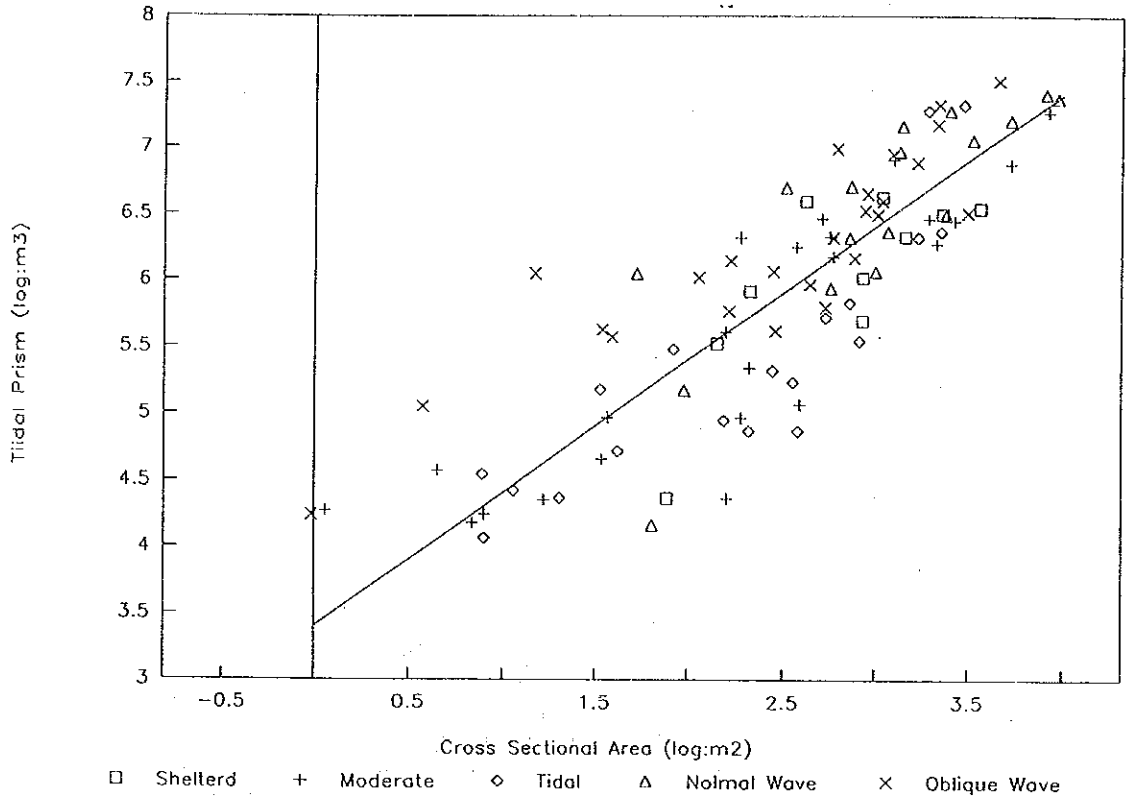
General Figures

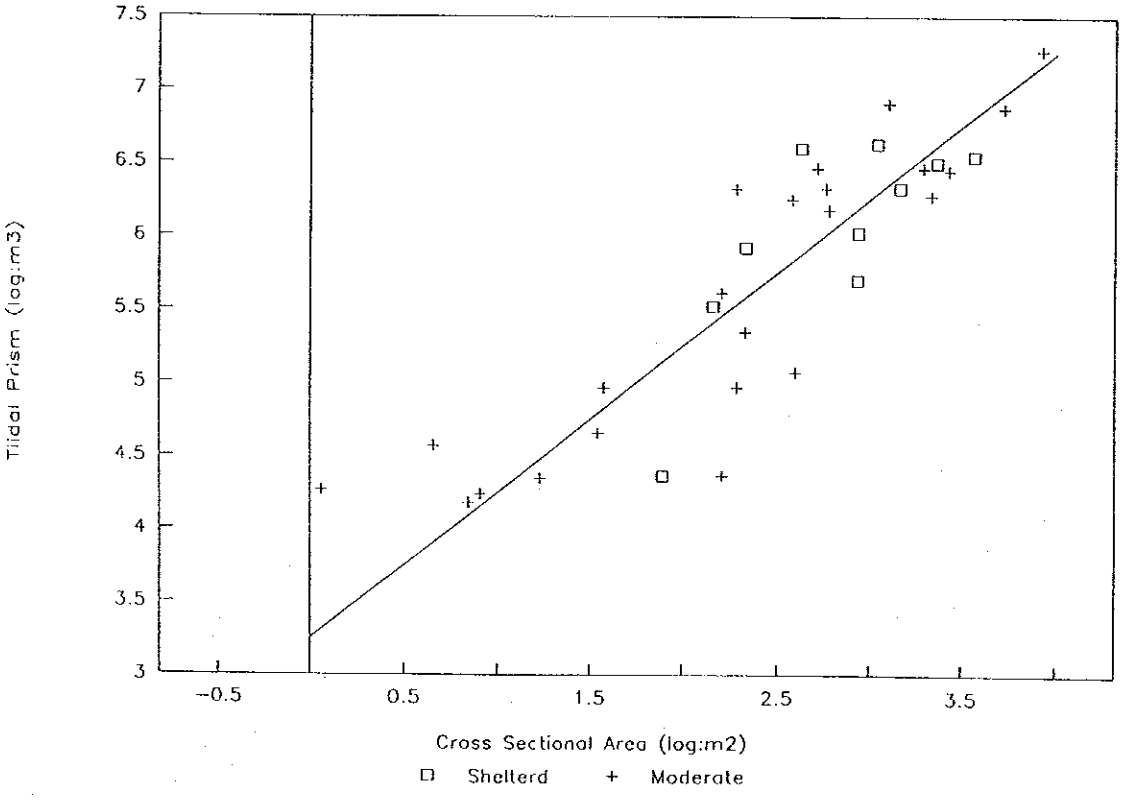


THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA JAPAN INTERNATIONAL COOPERATION AGENCY	GENERAL FIGURES OF PROPOSED STRUCTURES Fig.6.4-1

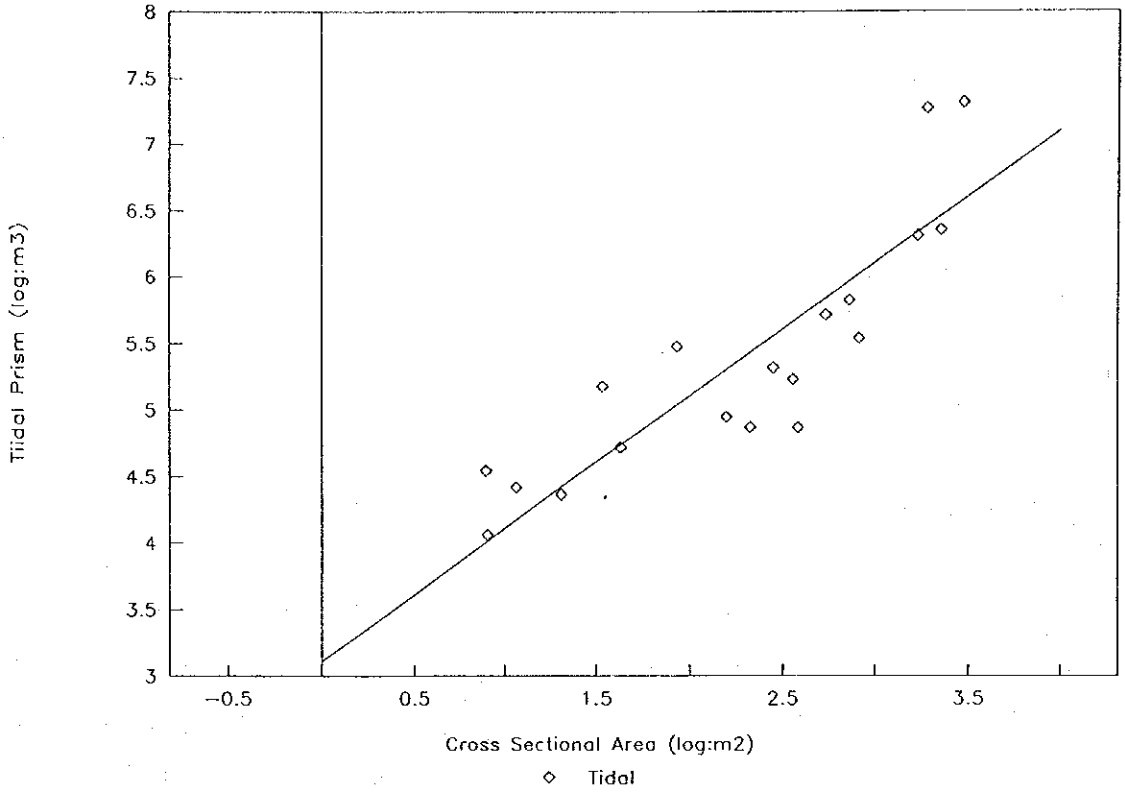


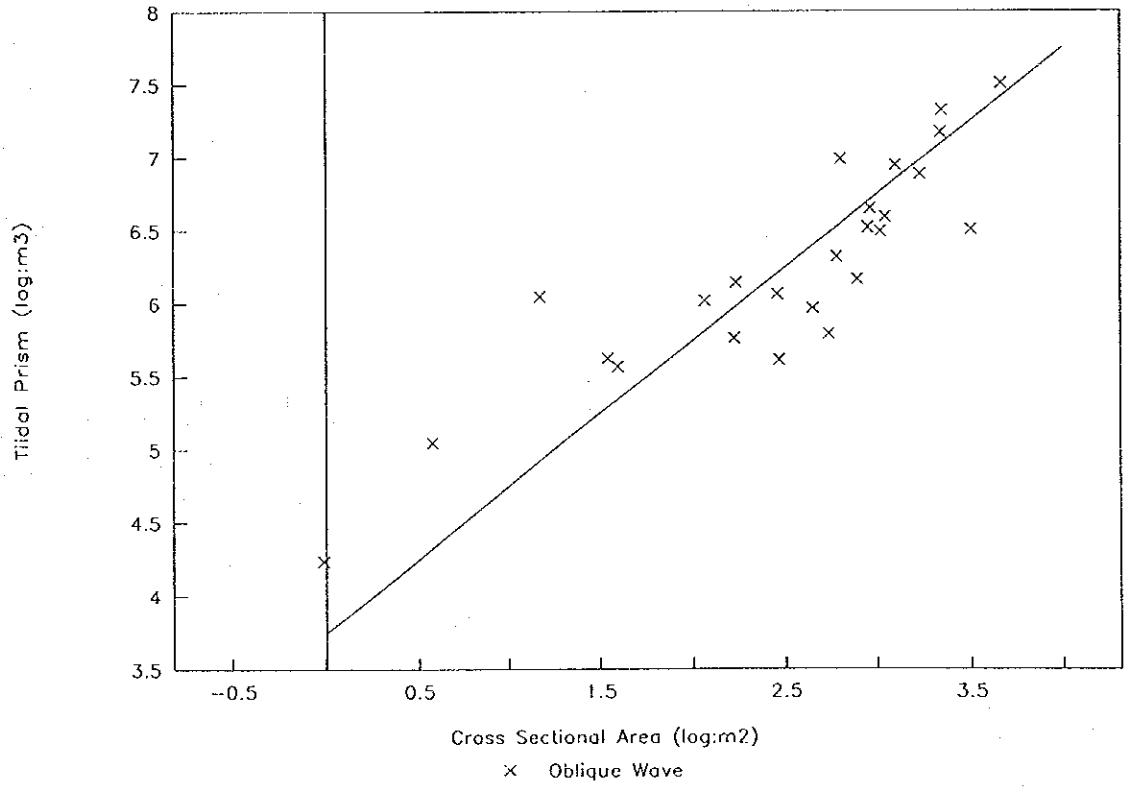
THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	SILTATION RATE PLOT FOR MUDDY COAST
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.6.5-1



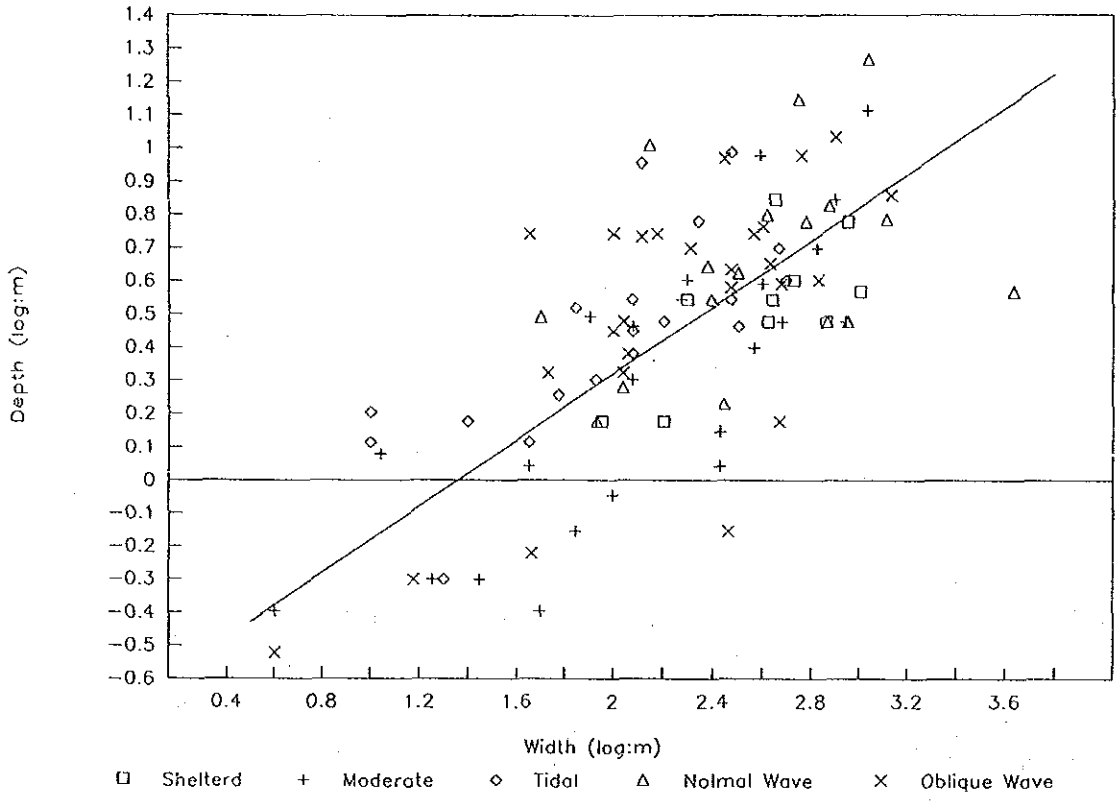


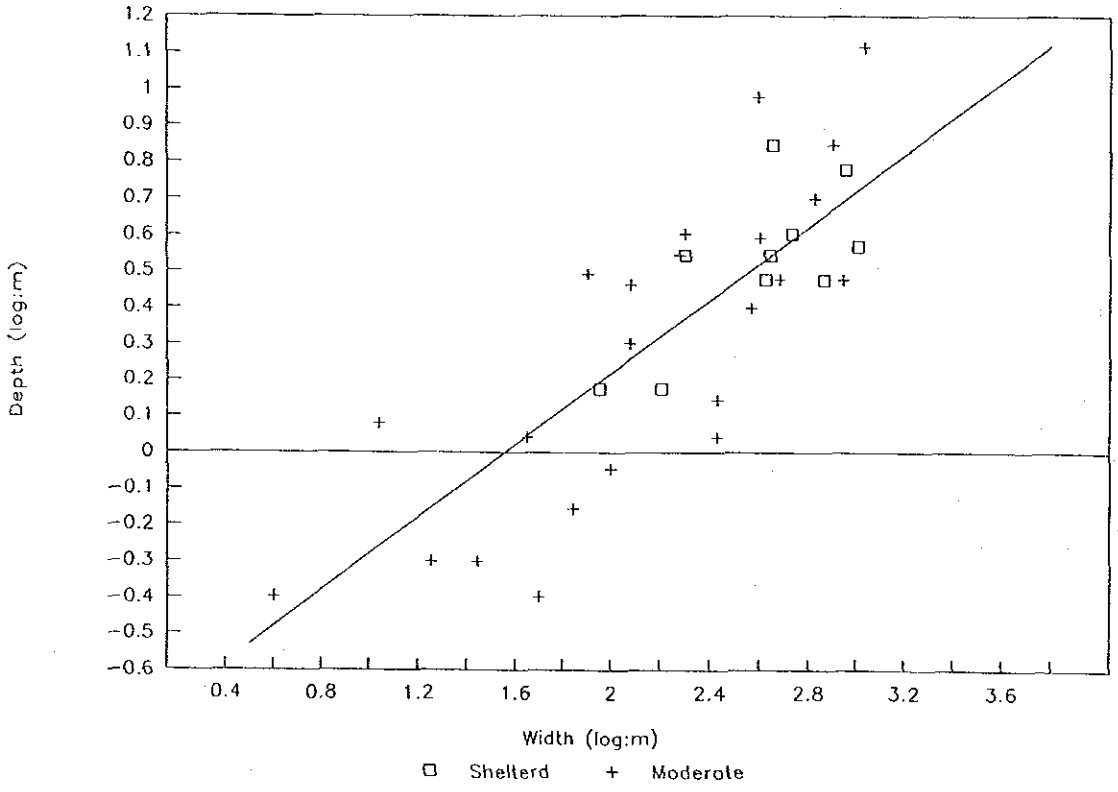
THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA JAPAN INTERNATIONAL COOPERATION AGENCY	RELATION BETWEEN TIDAL PRISM AND CROSS SECTIONAL AREA Fig.6.5-2 (1/2)



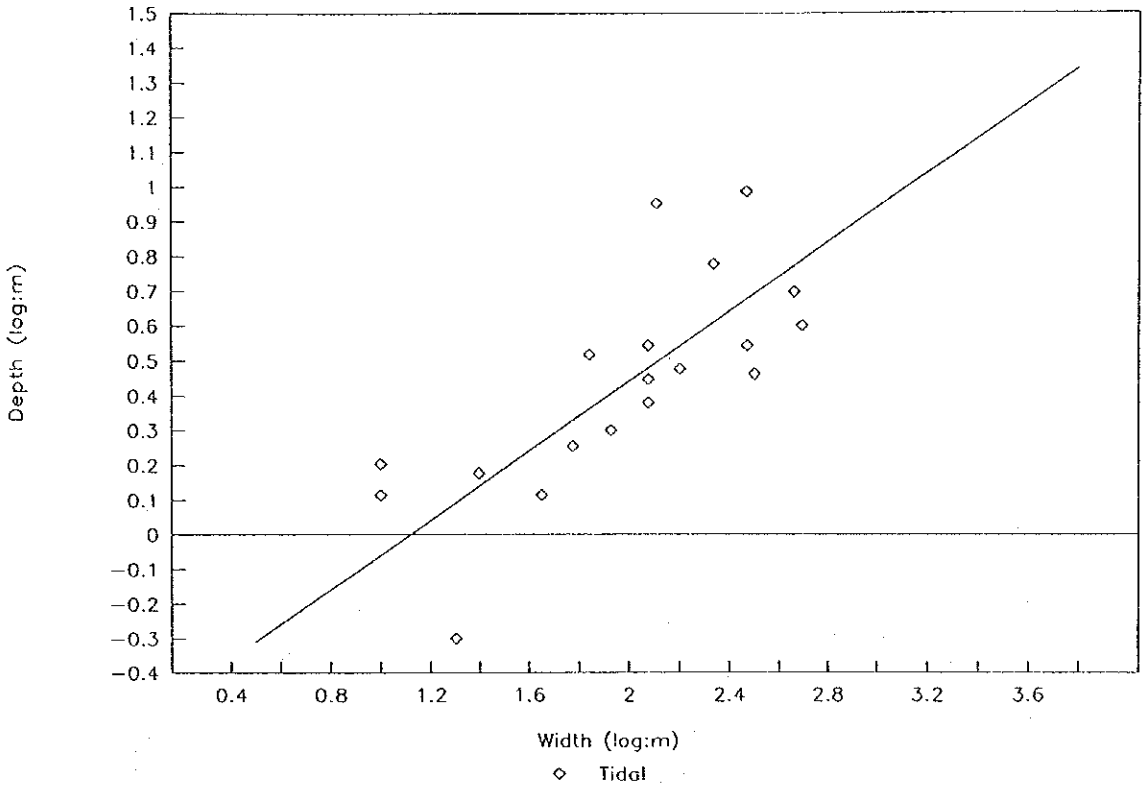


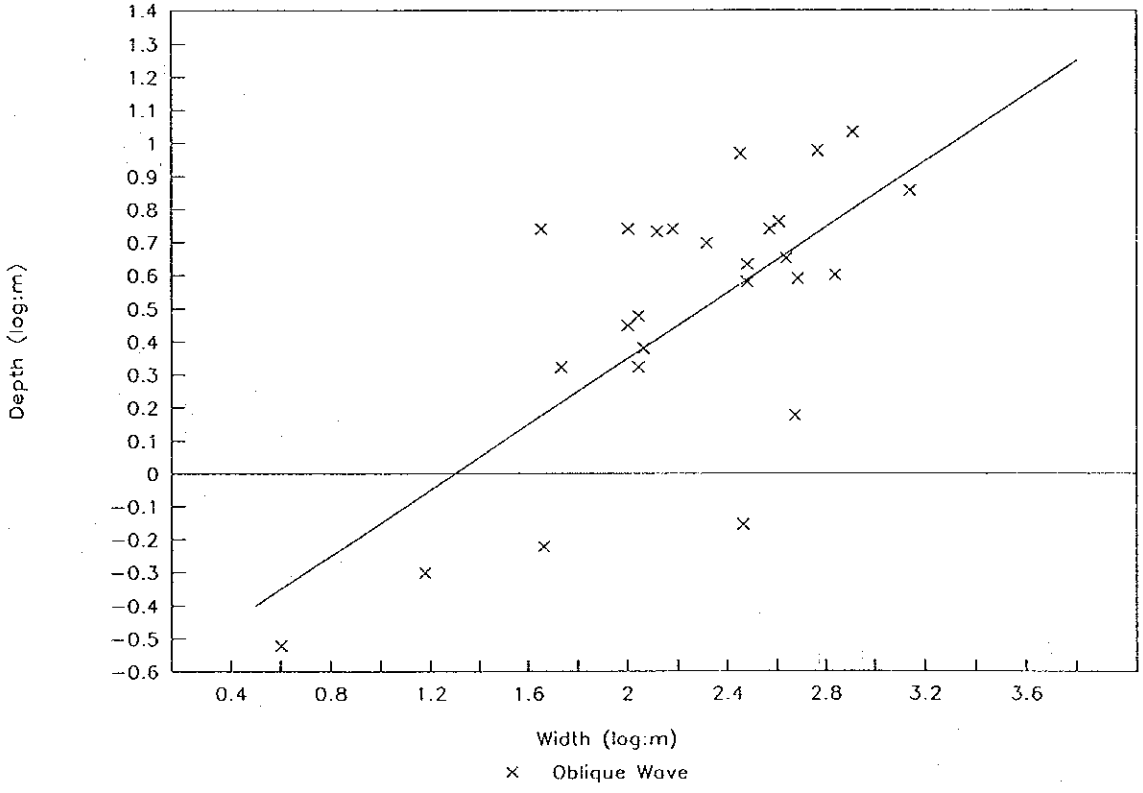
THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA JAPAN INTERNATIONAL COOPERATION AGENCY	RELATION BETWEEN TIDAL PRISM AND CROSS SECTIONAL AREA Fig.6.5-2 (2/2)



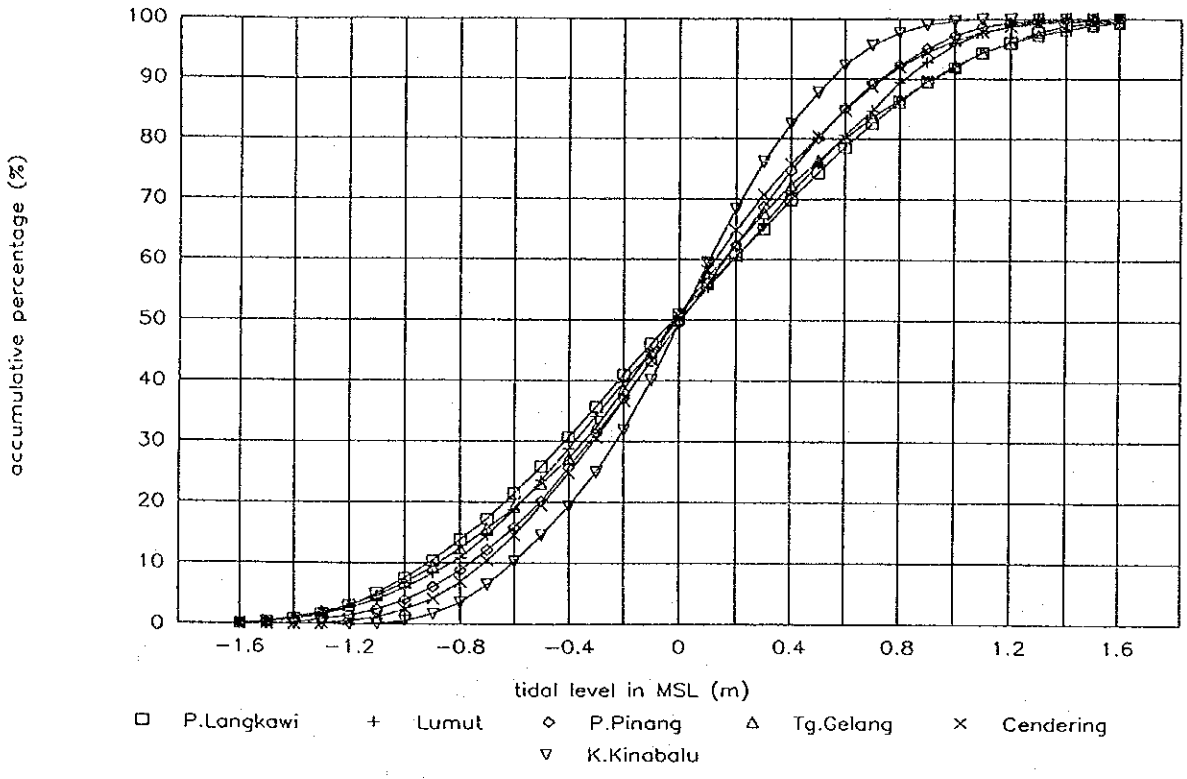


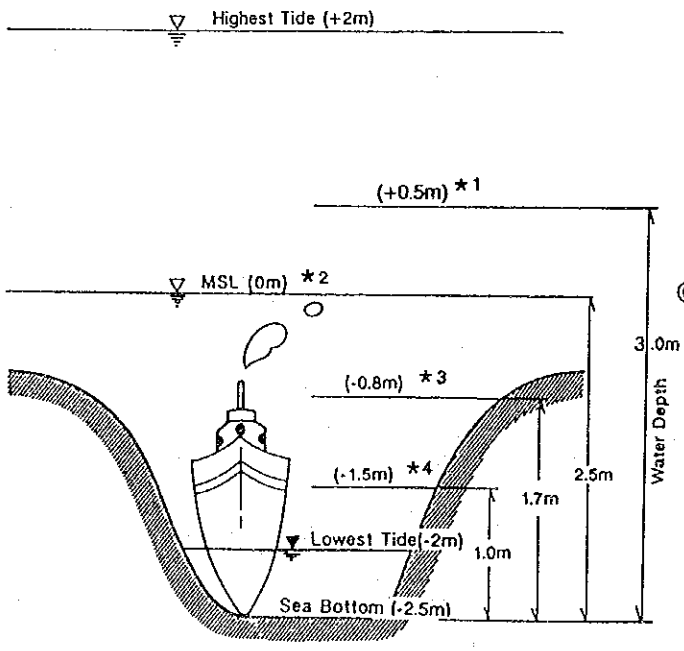
THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	RELATION BETWEEN WIDTH AND DEPTH
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.6.5-3 (1/2)

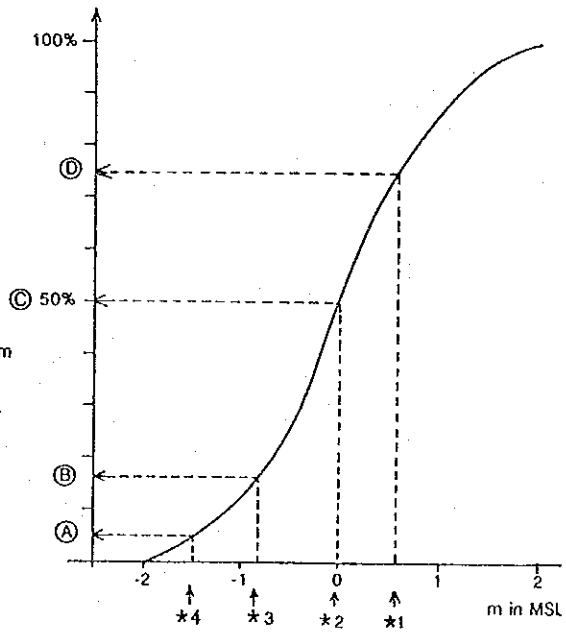




THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	RELATION BETWEEN WIDTH AND DEPTH
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.6.5-3 (2/2)

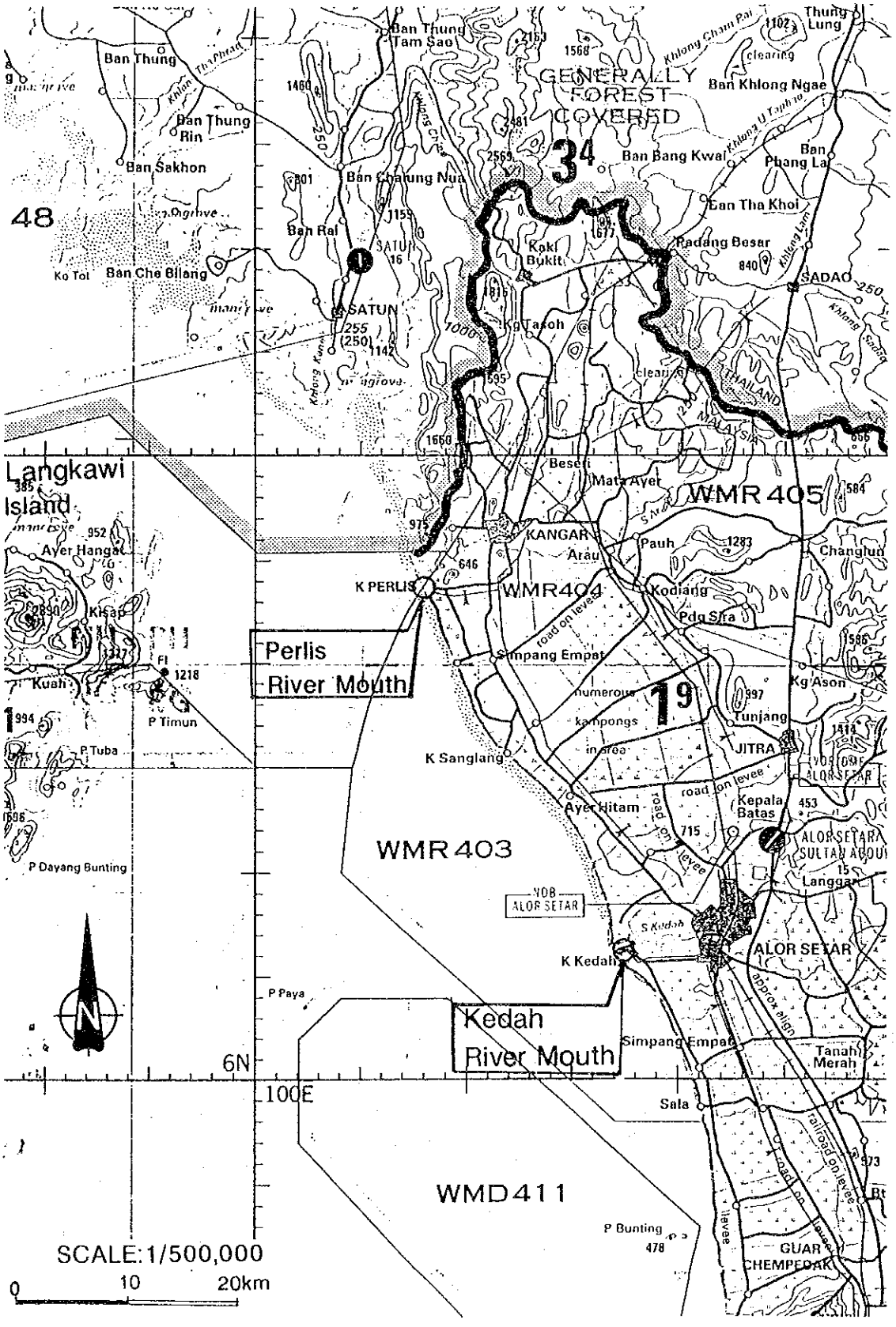




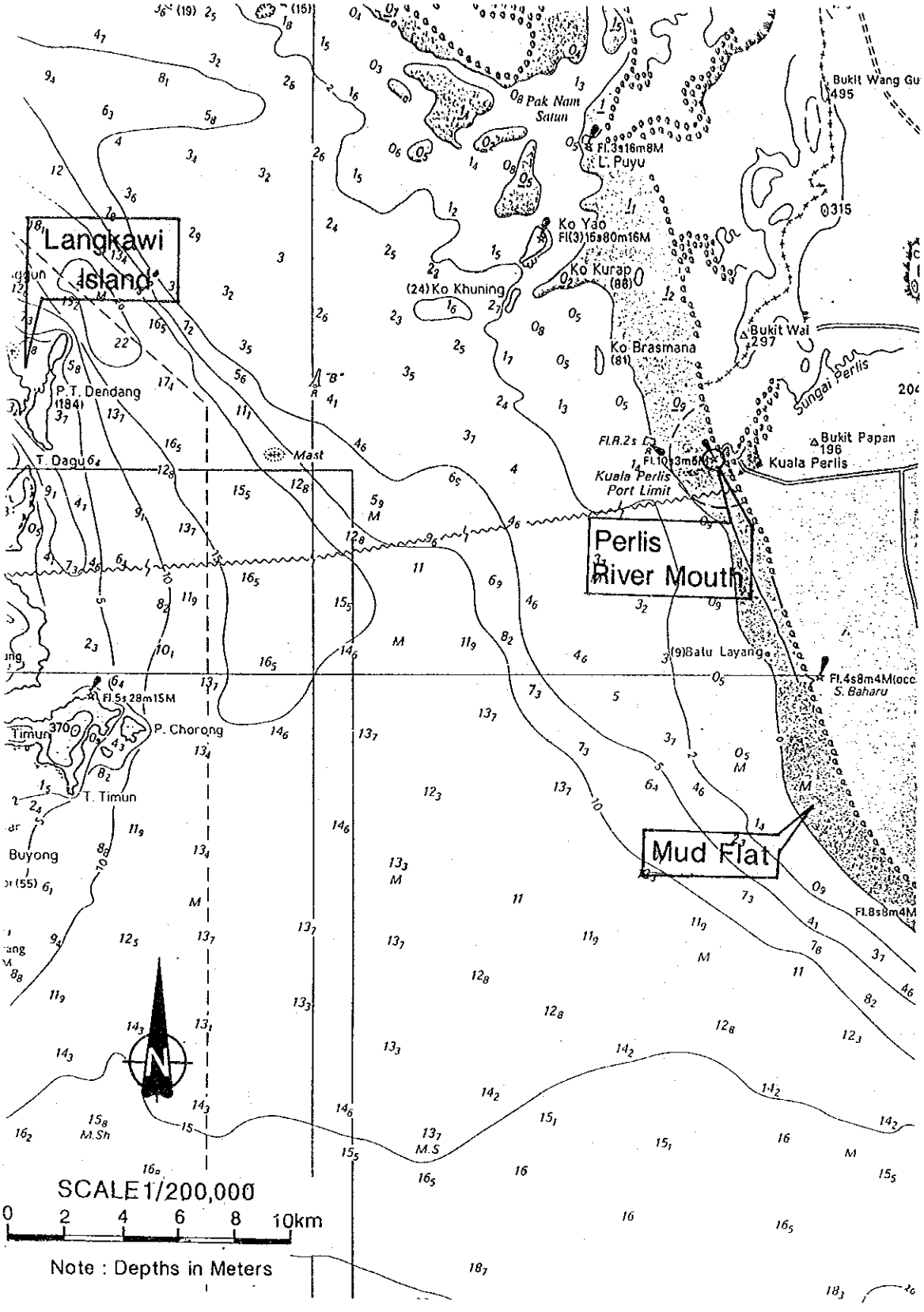


Boat Size	Required Water Depth	Period Affected (%)
Small	1.0 m	A
Medium	1.7 m	B
Large	2.2 m	C
Deepsea	3.0 m	D

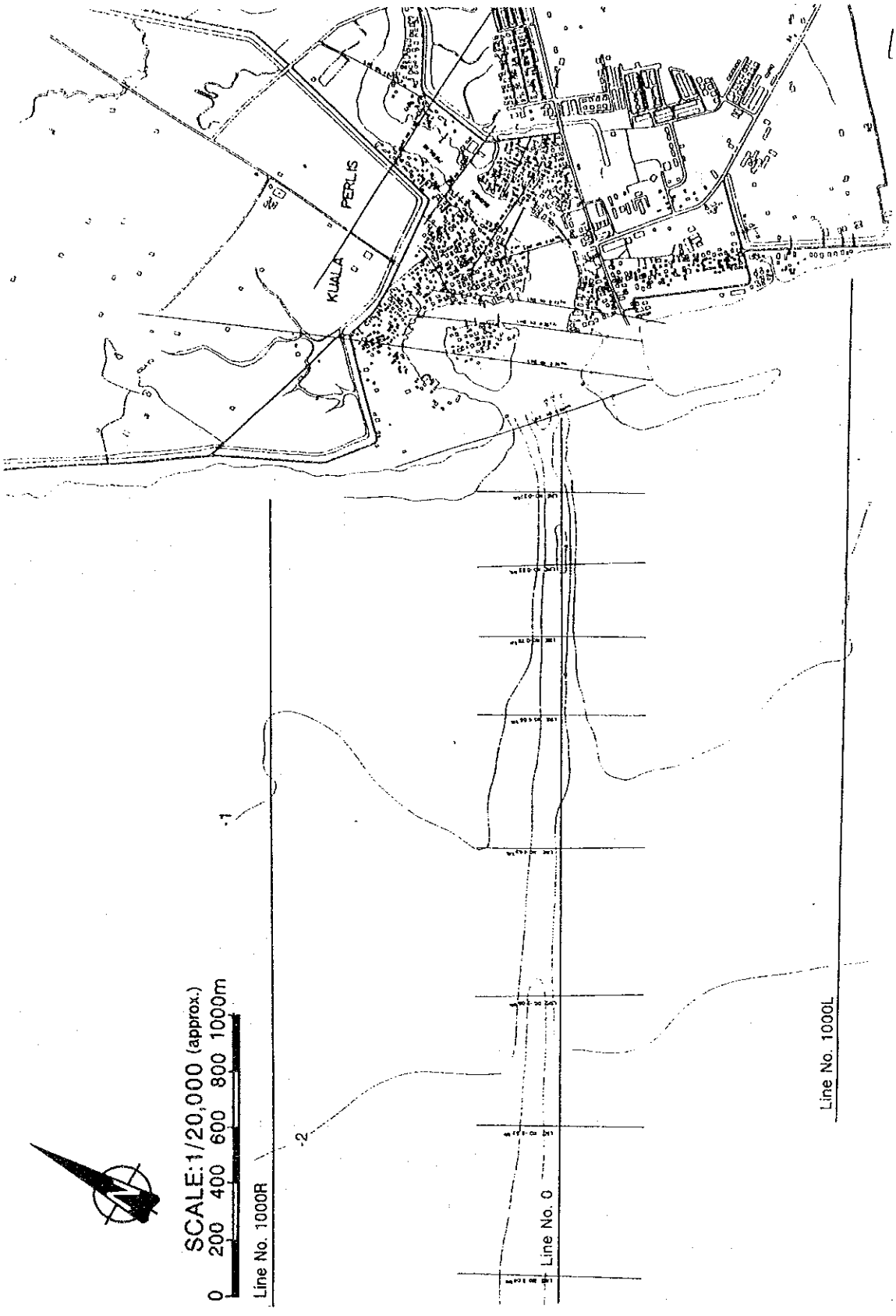
THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	FREQUENCY DISTRIBUTION OF HOURLY TIDAL LEVELS AT DIFFERENT STATIONS Fig.6.8-1
JAPAN INTERNATIONAL COOPERATION AGENCY	



THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA JAPAN INTERNATIONAL COOPERATION AGENCY	TOPOGRAPHICAL MAP AROUND PERLIS AND KEDAH RIVER MOUTH Fig.7.1-1

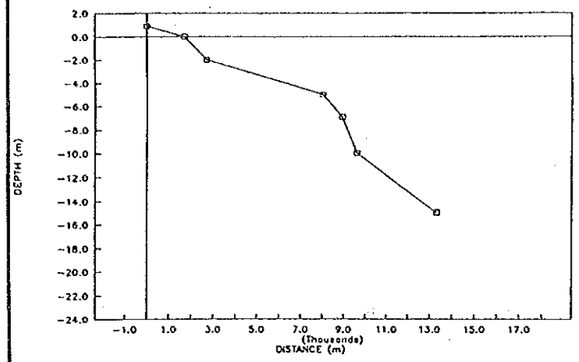


THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA JAPAN INTERNATIONAL COOPERATION AGENCY	NAVIGATION CHART IN PERLIS RIVER MOUTH AREA Fig.7.1-2

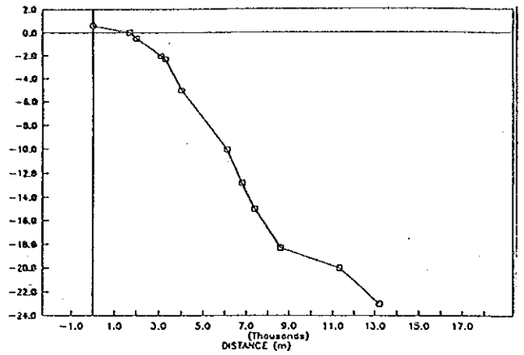


THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA JAPAN INTERNATIONAL COOPERATION AGENCY	DEPTH CHART OF PERLIS RIVER MOUTH SURVEYED IN 1992 Fig.7.1-3

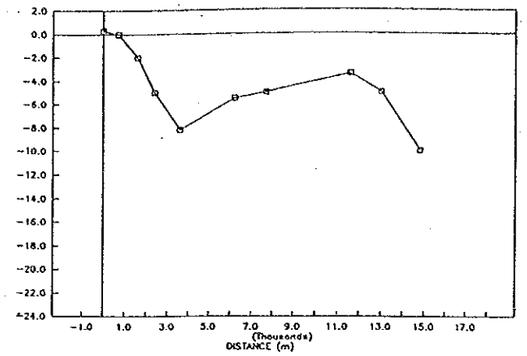
PERLIS



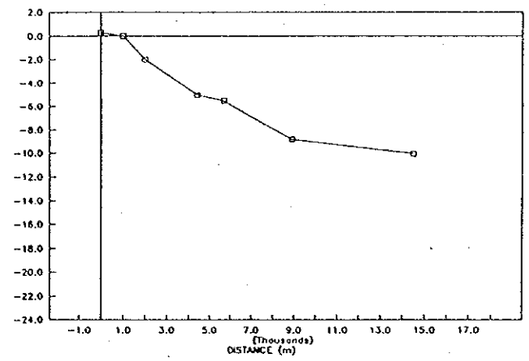
KEDAH



TANJUNG PIANDANG



BERUAS



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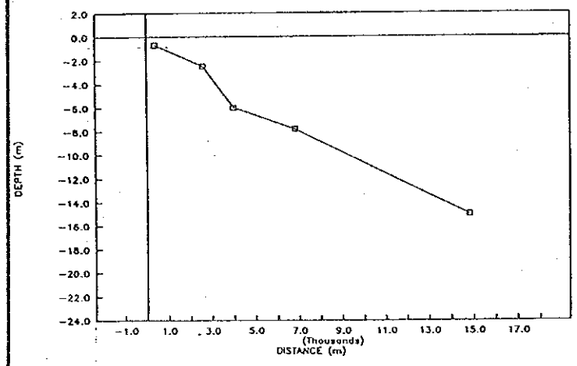
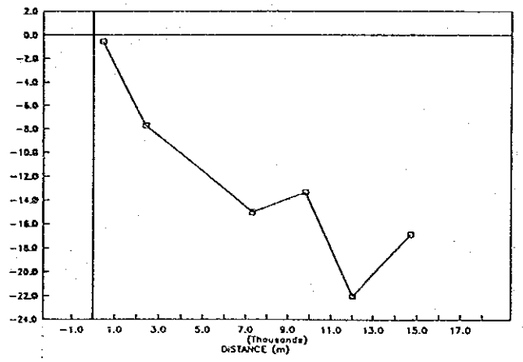
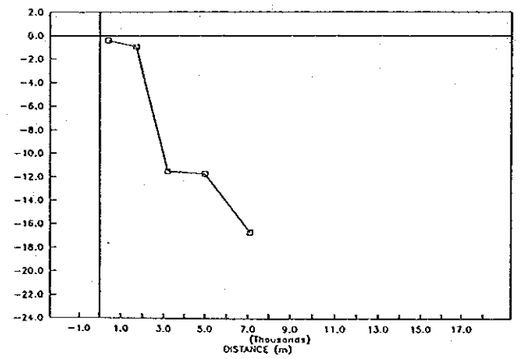


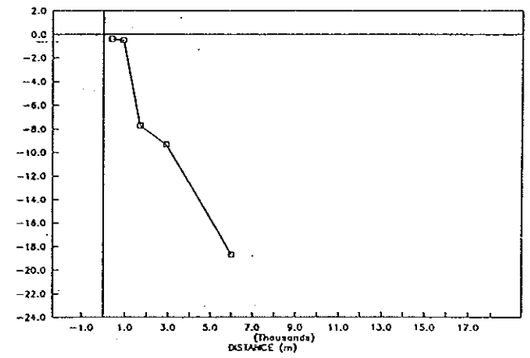
KERTEH



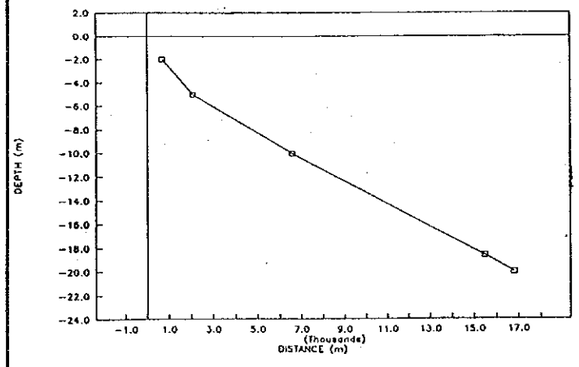
MARANG



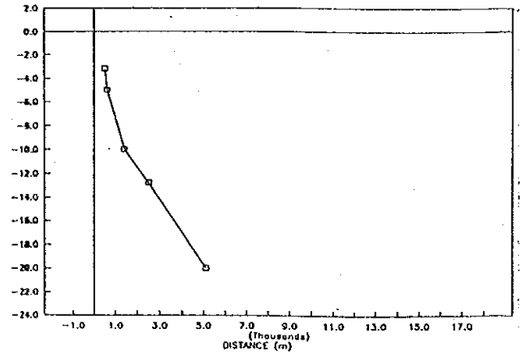
TERENGGANU



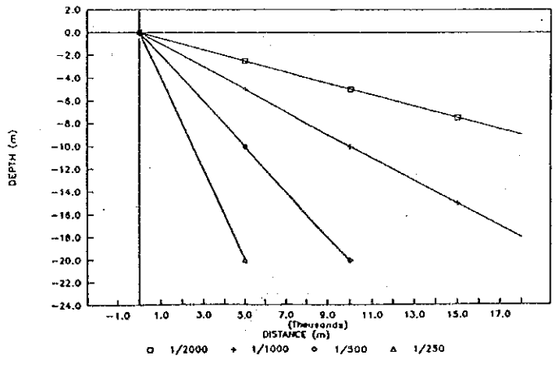
OYA



PAPAR

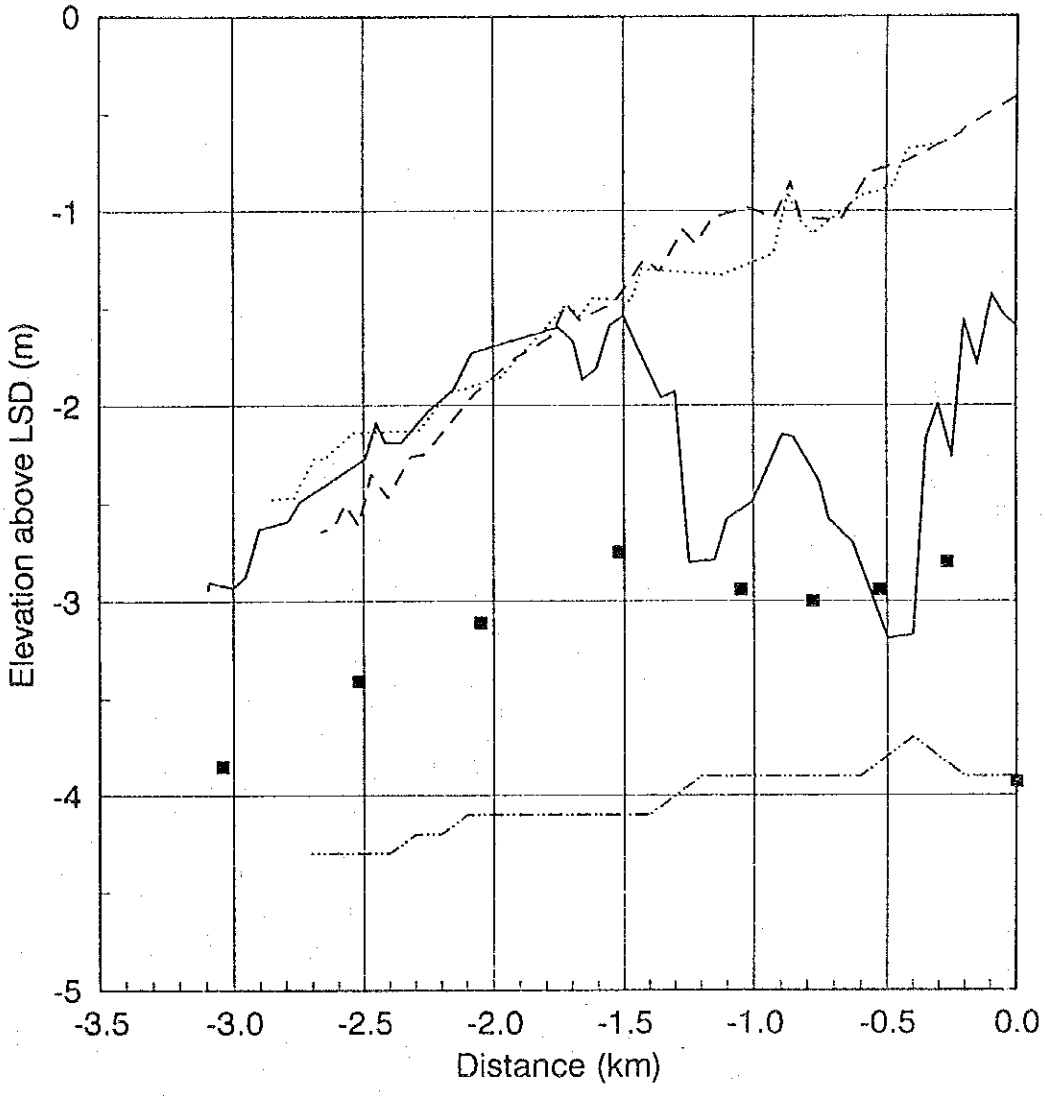


LEGEND

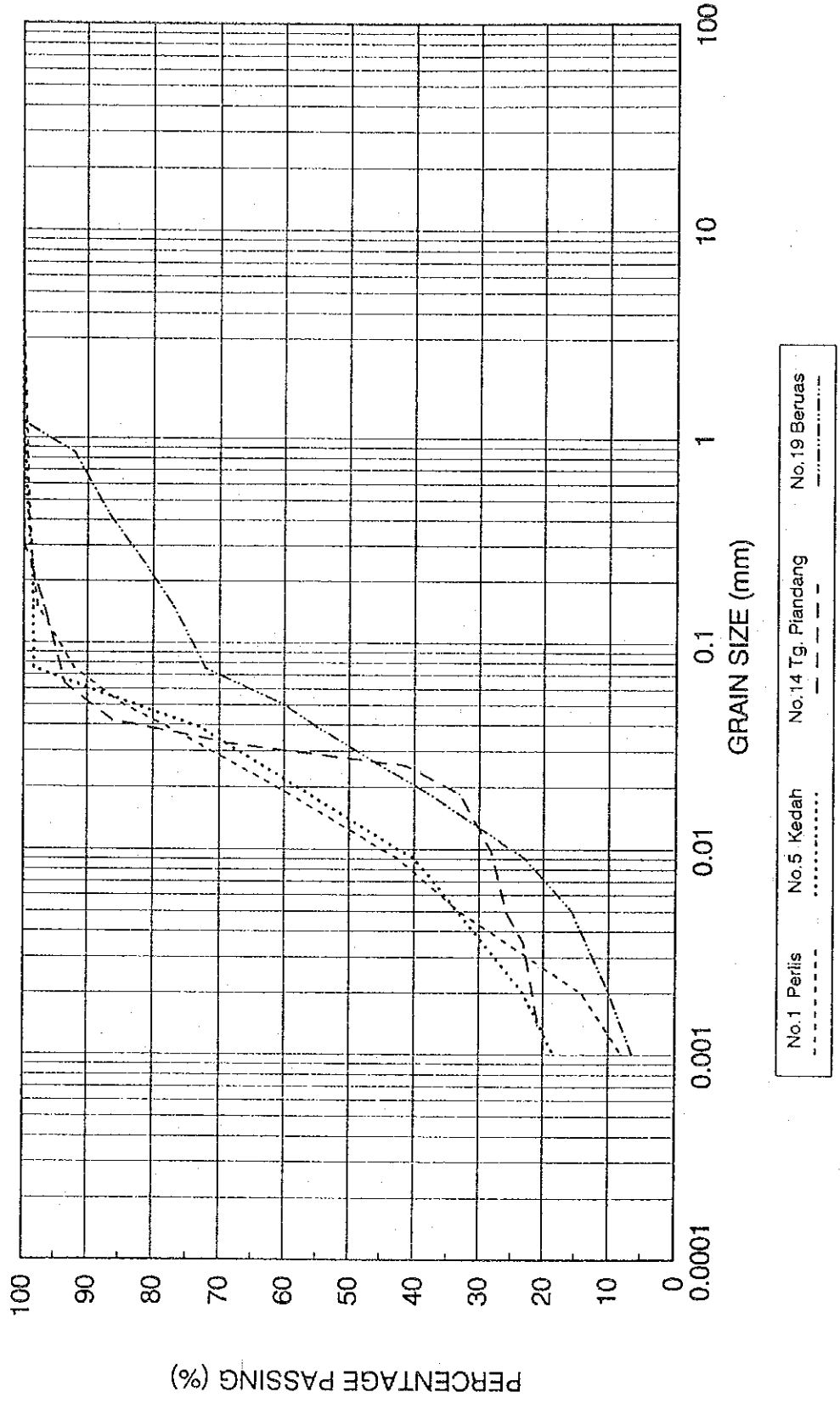


Note : Datum is Chart Datum

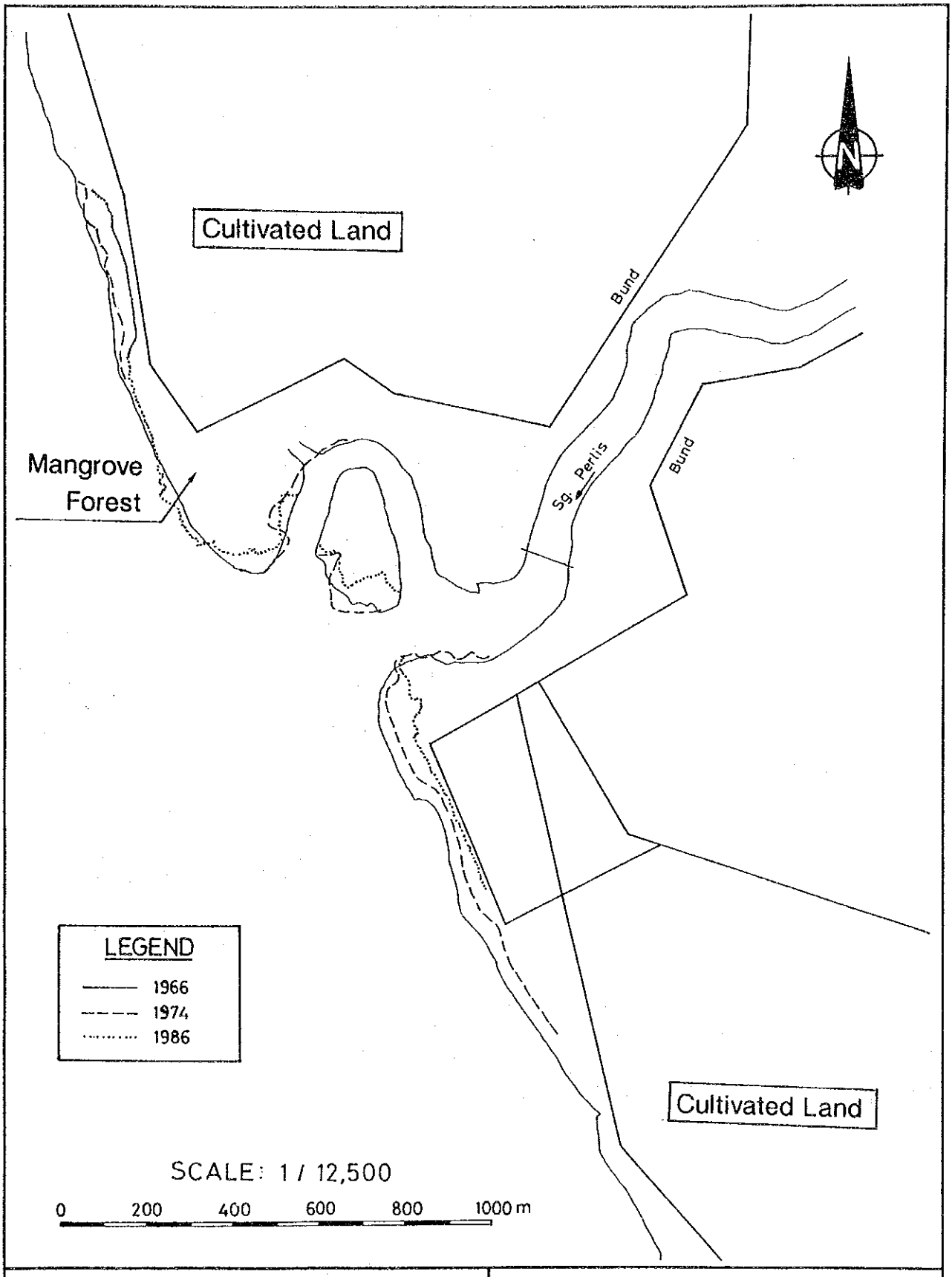
THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	SHORE PROFILE AT REPRESENTATIVE RIVER MOUTH
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.7.1-4



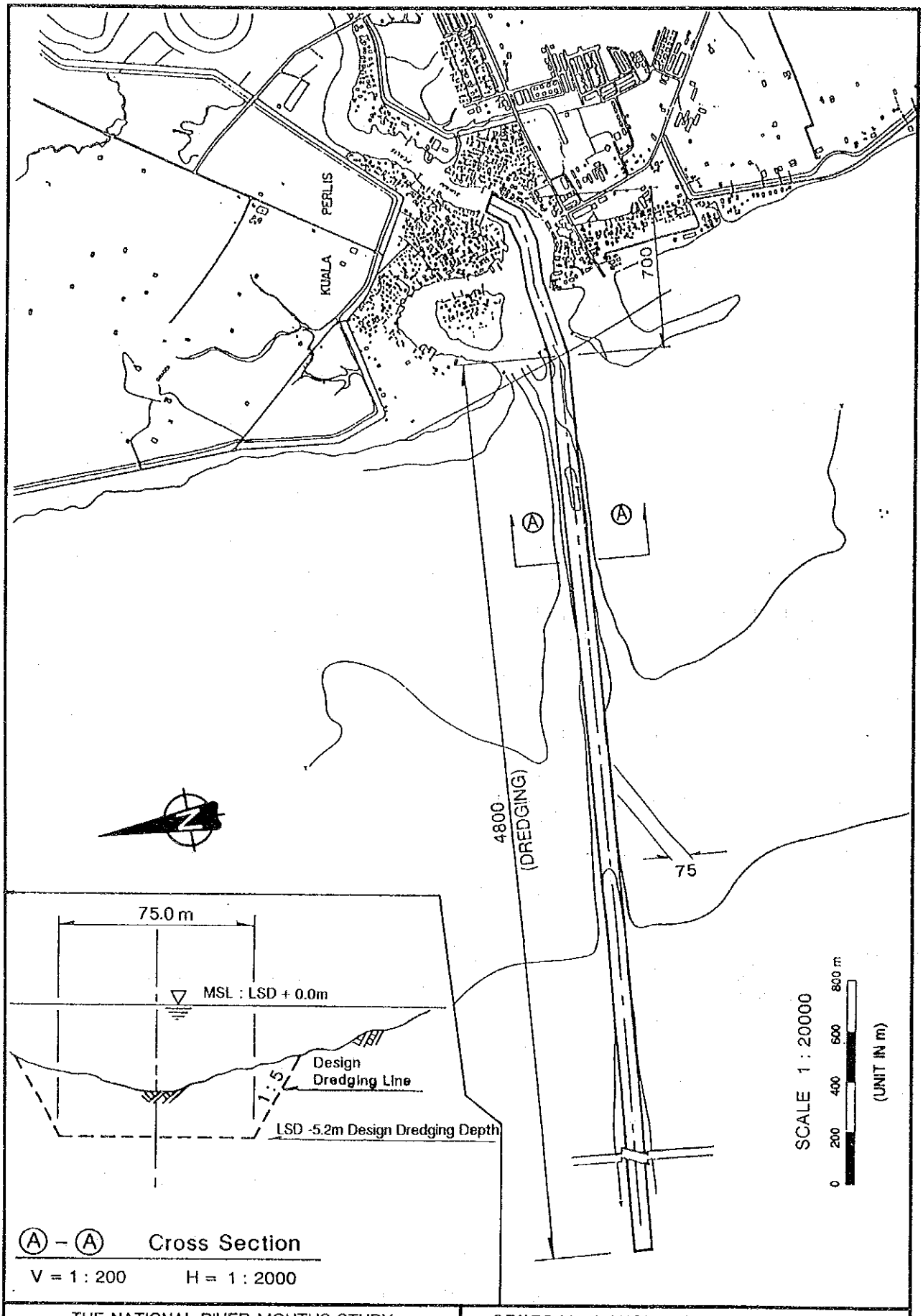
THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	OUTER CHANNEL PROFILE AT PERLIS RIVER MOUTH
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.7.1-5



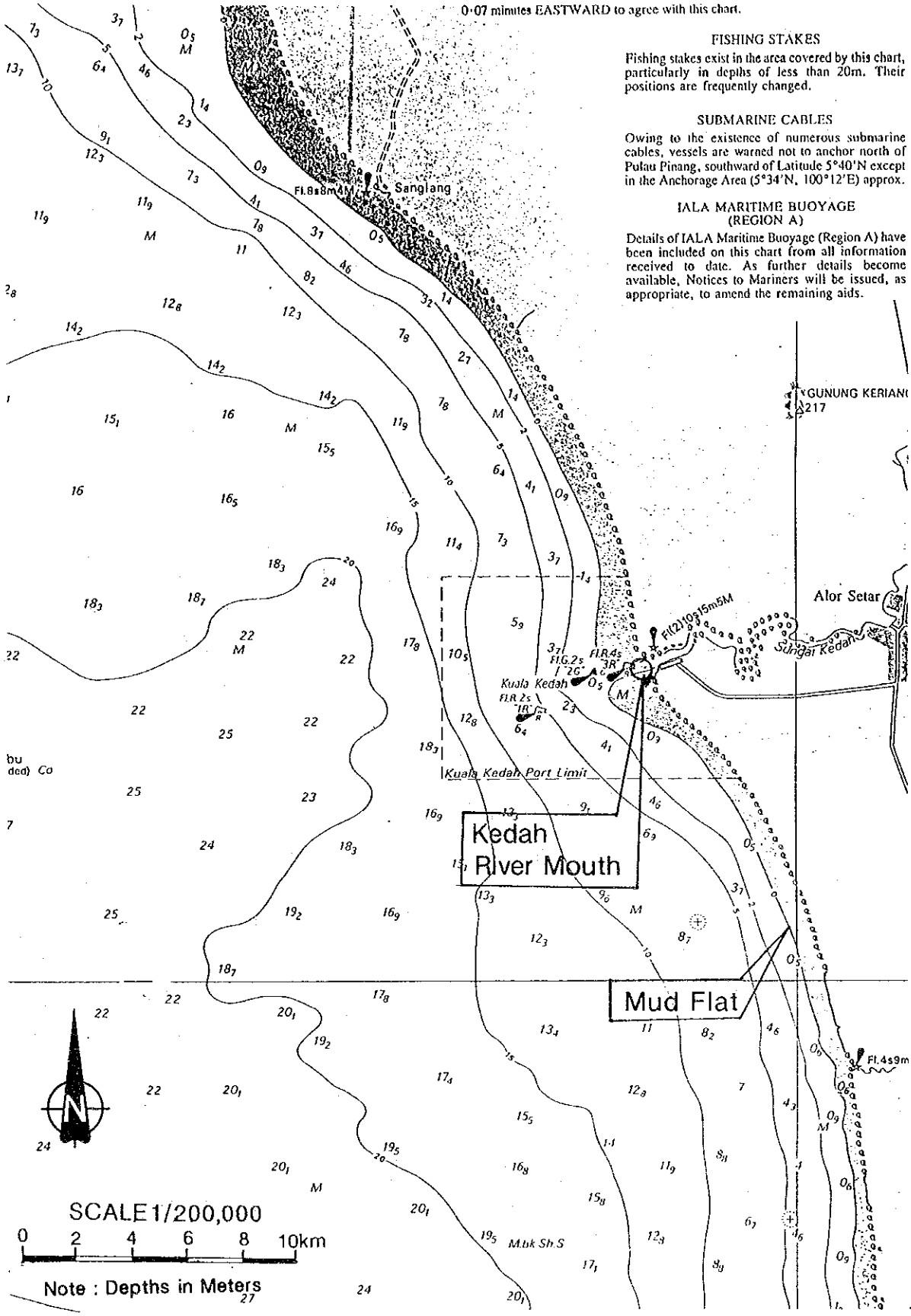
THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA JAPAN INTERNATIONAL COOPERATION AGENCY	GRADATION CURVE OF BED MATERIAL FOR REPRESENTATIVE RIVER MOUTH IN MUDDY COAST Fig.7.1-6



THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA JAPAN INTERNATIONAL COOPERATION AGENCY	TRANSITION OF COASTLINE AT PERLIS RIVER MOUTH Fig.7.1-7



THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA JAPAN INTERNATIONAL COOPERATION AGENCY	GENERAL LAYOUT OF OPTIMUM COUNTERMEASURES AT PERLIS RIVER MOUTH Fig.7.1-8



THE NATIONAL RIVER MOUTHS STUDY IN MALAYSIA	NAVIGATION CHART IN KEDAH RIVER MOUTH AREA
JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.7.2-1