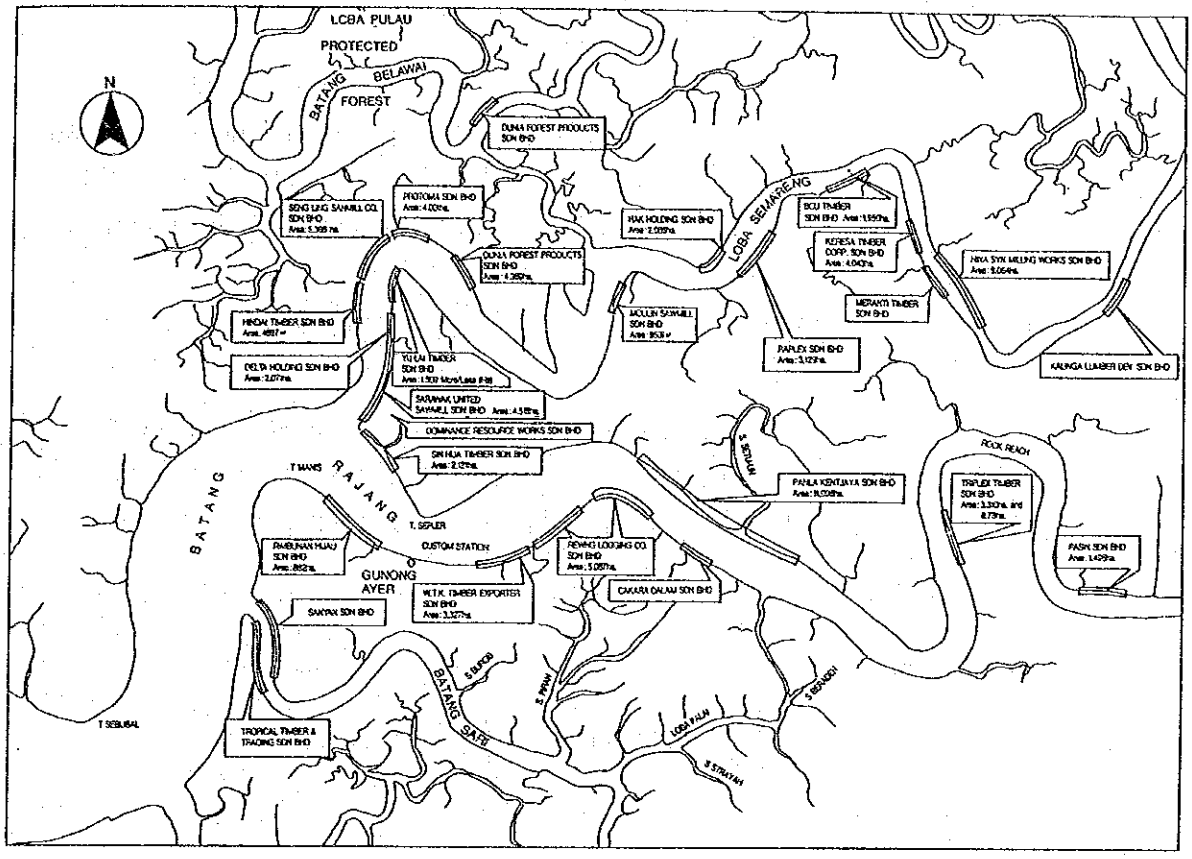


Figure-1.3.2.17 Log ponds near the Tg. Manis

1.3.3 ATMOSPHERE

(1) AIR QUALITY

The proposed Air quality standards for Malaysia is shown in **Table-1.3.3.1**

The Department of Environment has made the observation of air quality under the Air Quality Monitoring Program.

The result of the observation is shown in **Table-1.3.3.2**

Table-1.3.3.1 The Proposed Air Quality Guidelines For Malaysia

RECOMMENDED MALAYSIAN GUIDELINES

(at 25° Celcius and 101.13-Kpa)

POLLUTANT AND METHOD	AVERAGING TIME	MALAYSIA GUIDELINES (ppm)	MALAYSIA GUIDELINES ug/m^3)	TARGET YEAR FOR COMPLIANCE
OZONE	1 hour	0.10	200	1995
AS 2524	8 hour	0.06	120	
CARBON # MONOXIDE	1 hour	30	35	1995
AS 2695	8 hour	9	10	
NITROGEN DIOXIDE	1 hour	0.17	320	1990
AS 2447				
SULFUR	10 minute	0.19	500	1990
DIOXIDE	1 hour	0.13	350	
AS 2523	14 hour	0.04	105	
PARTICLES TSP	24 hour		260	1995
AS 2724.3	1 year		90	
PM_{10}	24 hour		150	1995
AS 2724.6	1 year		50	
LEAD	3 month		1.5	1991
AS 2800 DUSTFALL	1 year	-	(mg/M^2/day)	1995
AS 2724.1			133	

mg/m^3

TSP - Total Suspended Particulate Master

PM_{10} - Particulate Less Than 10 Micrometers

Table below shows the result of air quality measurement.

Table-1.3.3.2 Result of dustfall observation

Station					
RTM, Sibu	Date	5.2.90-1.3.90	5.3.90-3.4.90	3.4.90-3.5.90	3.5.90-29.5.90
	Result	97.2	88.8	19.9	166.1
Shell Timur M'sia Bhd. Sibu	Date		19.3.90-3.4.90	3.4.90-3.5.90	3.5.90-29.5.90
	Result		274.3	135.4	229.6
Rajang Park Sibu	Date	5.2.90-1.3.90	5.3.90-4.4.90	3.4.90-3.5.90	3.5.90-29.5.90
	Result	15.1	172	151.4	64.3
LPN Sibu	Date	5.2.90-1.3.90	5.3.90-3.4.90	3.4.90-3.5.90	3.5.90-29.5.90
	Result	157.4	224.3	80.1	136.9
Jab. Silbikultur Hutan, Sibu	Date			3.4.90-3.5.90	3.5.90-29.5.90
	Result			137.5	176
Pej. Pelajaran Sarikei	Date				4.5.90-29.5.90
	Result				89.9
Rumah Rehat, Sarikei	Date			4.4.90-4.5.90	4.5.90-29.5.90
	Result			227.1	59.2
Majlis Daerah Sarikei	Date		21.3.90-4.4.90	4.4.90-4.5.90	4.5.90-29.5.90
	Result		128.1	112.8	217.7

Station						Average
RTM, Sibu	Date	29.5.90-29.6.90	28.6.90-28.7.90	26.7.90-28.8.90	28.8.90-26.9.90	
	Result	83.6	48.5	342.5	173	127.45
Shell Timur M'sia Bhd. Sibu	Date	29.5.90-29.6.90	28.6.90-28.7.90	26.7.90-28.8.90	28.8.90-26.9.90	
	Result	135.5	118.8	353.7	163	201.47
Rajang Park Sibu	Date	29.5.90-29.6.90	28.6.90-28.7.90	26.7.90-28.8.90	28.8.90-26.9.90	
	Result	75	15.6	133.5	188	101.86
LPN Sibu	Date	29.5.90-29.6.90	28.6.90-28.7.90	26.7.90-28.8.90	28.8.90-26.9.90	
	Result	163	113.4		426	185.87
Jab. Silbikultur Hutan, Sibu	Date	29.5.90-29.6.90	28.6.90-28.7.90	26.7.90-28.8.90	28.8.90-26.9.90	
	Result	41.5	23.8	98.3	64	90.18
Pej. Pelajaran Sarikei	Date	29.5.90-28.6.90	29.6.90-27.7.90	27.7.90-28.8.90	28.8.90-26.9.90	
	Result	85.8	23.1	166	232	119.36
Rumah Rehat, Sarikei	Date	29.5.90-28.6.90	29.6.90-27.7.90	27.7.90-28.8.90	28.8.90-26.9.90	
	Result	105	5.5	117.5	124	106.38
Majlis Daerah Sarikei	Date	29.5.90-28.6.90	29.6.90-27.7.90	27.7.90-28.8.90	28.8.90-26.9.90	
	Result	152.3	86.3	137.3	273	158.21

(2) Air Flow

Regarding the wind data, please refer to Volume I

(3) Climate Changes

Please refer to Meteorology.

(4) Visibility

Same as above.

1.3.4 Noise

There is no noise source around the project site because the site has been covered with natural forest until now.

1.3.5 Species and Population

(1) Terrestrial Vegetation

a) Forest Area

Due to ideal climatic conditions, the tropical rainforest of Sarawak is rich and varied in plant and animal life.

As for the forest area, the total area under natural forest cover in Sarawak is about 8.4 million ha or 70%. Of this forest cover, about 4.5 million ha or 53% are designated as Permanent Forest Estate and 255,173 ha as a Totally Protected Area. The rest is under the Stateland Forest, i.e., the forest lands which are not reserved permanently according to the Forests Ordinance. Nevertheless, the State Government is determined to enlarge the Permanent Forest Estate from 53% to 70% of the total forested area.

The total area under the Permanent Forest Estate and Stateland Forest Area in Sarawak is summarized in **Table-1.3.5.1.**

Table-1.3.5.1 Area of natural forest cover by forest types under Permanent Forest Estate (PFE) and Stateland Forest in Sarawak

Forest Types	PFE(ha)	Stateland(ha)	Total(ha)	Share(%)
Mangrove Forest	36,992	131,064	168,056	1.99
Peat Swamp Forest	761,704	484,038	1,245,742	14.72
Hill Mixed Dipterocarp F.	3,698,916	3,348,260	7,047,176	83.29
Total	4,497,612	3,963,362	8,460,974	100.00
(Share %)	(53.2)	(46.8)	(100)	

* Reference

Total land area of Sarawak 124,449km^2

84,610/124,449=68.0%

44,976/124,449=36.2%

Regarding the share of each forest type, Hill Mixed Dipterocarp Forest accounts for 83.29% of the natural forest, Peat Swamp Forest accounts for 14.72% and Mangrove has only about 2%.

b) Classification of the forest

The natural forests have been classified according to their various ecological and physical conditions. But for the purpose of Management, they are classified into three broad types, namely, Mangrove Forest, Peatswamp Forest and Hill Mixed Dipterocarp Forest.

The characteristics of those forests are as follows.

Mangrove Forest. -- The Mangrove forests are mainly situated at the estuaries and along the banks of rivers and newly formed mud flats along the coast lines. They are economically important as valuable sources of firewood, charcoal, cutch for tanning and poles for piling.

Mangrove forests are the habitat of numerous species of marine life. Coastal fisheries depend on these and they provide much of the protein for the people. In view of the importance of this forest type for the protection and conservation of the coastal ecosystem for forestry and aquaculture, the State Government is drawing up an integrated management plan aiming at optimal multiple use of the resources that can be sustained without causing degradation to the ecosystem.

Peat Swamp Forest. -- Peat Swamp forests in Sarawak occur inland behind the Mangrove forests in the lowlands which are periodically waterlogged from incoming rainwater. They form a coastal belt which at its broadest, in the Rajang Delta and the Baram River, may exceed 80km (50miles) (Anderson, 1958). The coastal belt is divided and intersected by rivers, deltaic channels, and streams draining from the peat itself. The drainage water is black by reflected light and tea-coloured by transmitted light and is highly acidic.

The Peatswamp forests are an extremely valuable forest resource. Selective and systematic harvesting of this forest type began in the 1950's. The emphasis in the management plan of the forests is to provide a sustainable yield supply of timber in perpetuity.

Hill Mixed Dipterocarp Forest. -- The Hill Mixed Dipterocarp forests occupy the largest land area, some 87% of the total and contain the highest number of economically important tree species. Selective and systematic harvesting began in the 1960's. The Dipterocarps (members of the family Dipterocarpaceae) are commercial trees. The Non-Dipterocarps account for

30% of the stemwood volume. The FAO/UNDP Resource Survey in 1968-1972 recorded 606 tree species, of which 179 were Dipterocarps.

The Hill Mixed Dipterocarp forests occupy most of the areas from the inland limit of the Peat Swamp forests to the lower limit of the Montane forests. In their primary state, these forests generally consist of:

(i) emergent trees of some 60m (200ft) in height,
(ii) dominant and co-dominant strata having a height of about 45m (150ft),
(iii) intermediate layers of trees with canopies between 23 to 30m (75-100ft), and
(iv) suppressed vegetation.

c) Permanent Forest Estate

As for the Permanent Forest Estate, the Forests Ordinance provides for the protection and management of the Permanent Forest Estate of Sarawak, and regulates the taking of forest produce. The Permanent Forest Estate is classified as Reserved Land under the Land (Classification) Ordinance of 1948 and consists of three types, namely, Forest Reserves, Protected Forests and Communal Forests. The Forests Ordinance admits rights to the people of Sarawak to take forest produce for their own domestic use and to hunt and fish as is clearly spelt out in Section 65.

d) Totally Protected Area

With regard to Totally Protected Areas, it is a tract of forest land protected for the preservation of the genetic pool of flora and fauna, historical sites and interesting geological features. Scientific studies and research in these forests are encouraged in order to reveal interactions between all forms of organisms as well as human beings and their environments. These forests are also developed and managed for recreational purposes. However, visitors to these areas are prohibited from taking and damaging any form of forest produce, plant and wildlife. Fishing and hunting are also strictly prohibited. National Parks, Wildlife Sanctuaries and Wildlife Rehabilitation Centers fall in the category of Totally Protected Area.

The total area under the Permanent Forest Estate and Totally Protected Area are summarized in **Table-1.3.5.2.**

Table-1.3.5.2 Total area of Permanent Forest Estate (P.F.E) and Totally Protected Area

Classification	Mangrove	Peat Swamp	Hill MDF	Total
P.F.E.	36,992	761,704	3,698,916	4,497,612
(1) Forest Reserves	25,057	357,169	471,553	853,779
(2) Protected Forests	11,909	401,283	3,224,981	3,638,173
(3) Communal Forests	26	3,252	2,382	5,660
T.P.A.			257,342	257,342
(1) National Parks			81,092	81,092
(2) Wildlife Sanctuaries			176,250	176,250
Total	73,984	1,523,408	3,956,258	5,553,650

The existing Permanent Forest Estate and the proposed area to be included in the Estate are shown in the map.

National Parks. -- The National Parks Ordinance (Sarawak Chap. 127) governs the establishment and management of National Parks in Sarawak. Currently, there are seven legally constituted National Parks (**Table-1.3.5.3**) and nine more have been proposed. The locations of the existing and the proposed Parks are shown in the map.

Table-1.3.5.3 Legally constituted National Parks in Sarawak

National Park	Date Constituted	Area (ha)
1. Bako National Park	17 April 1957	2,728
2. Gunung Mulu National Park	10 May 1965	52,865
3. Niah National Park	28 May 1969	3,140
4. Lambir National Park	15 May 1975	6,952
5. Similajau National Park	1 December 1976	7,067
6. Gunung Gading National Park	1 August 1983	5,340
7. Kubah National Park	1 December 1988	2,230

Wildlife Sanctuaries. -- The legislative enactment pertaining to the protection of wildlife in Sarawak is the wildlife Protection Ordinance (Sarawak Chap. 128). Currently, more than 45 species of wildlife are totally protected under the Ordinance and these species are listed in **Table-1.3.5.7.**

To manage and protect the wildlife population in the State, Wildlife Sanctuaries are constituted. The Sanctuaries also relocate wildlife that the general public, knowingly or unknowingly, have kept as pets. Currently, three Wildlife Sanctuaries are in existence, legally constituted under the Ordinance (**Table-1.3.5.4**) and five more are being proposed. The locations of these Sanctuaries are shown in the map.

Table-1.3.5.4 Constituted Wildlife Sanctuaries in Sarawak

Wildlife Sanctuary	Date Constituted	Area (ha)
1. Samunsam Wildlife Sanctuary	2 February 1978	6,092
2. Lanjak-Entimau Wildlife Sanctuary	2 February 1983	168,758
3. Pulau Tukong Are-Banun Wildlife Sanctuary	28 February 1983	1.4

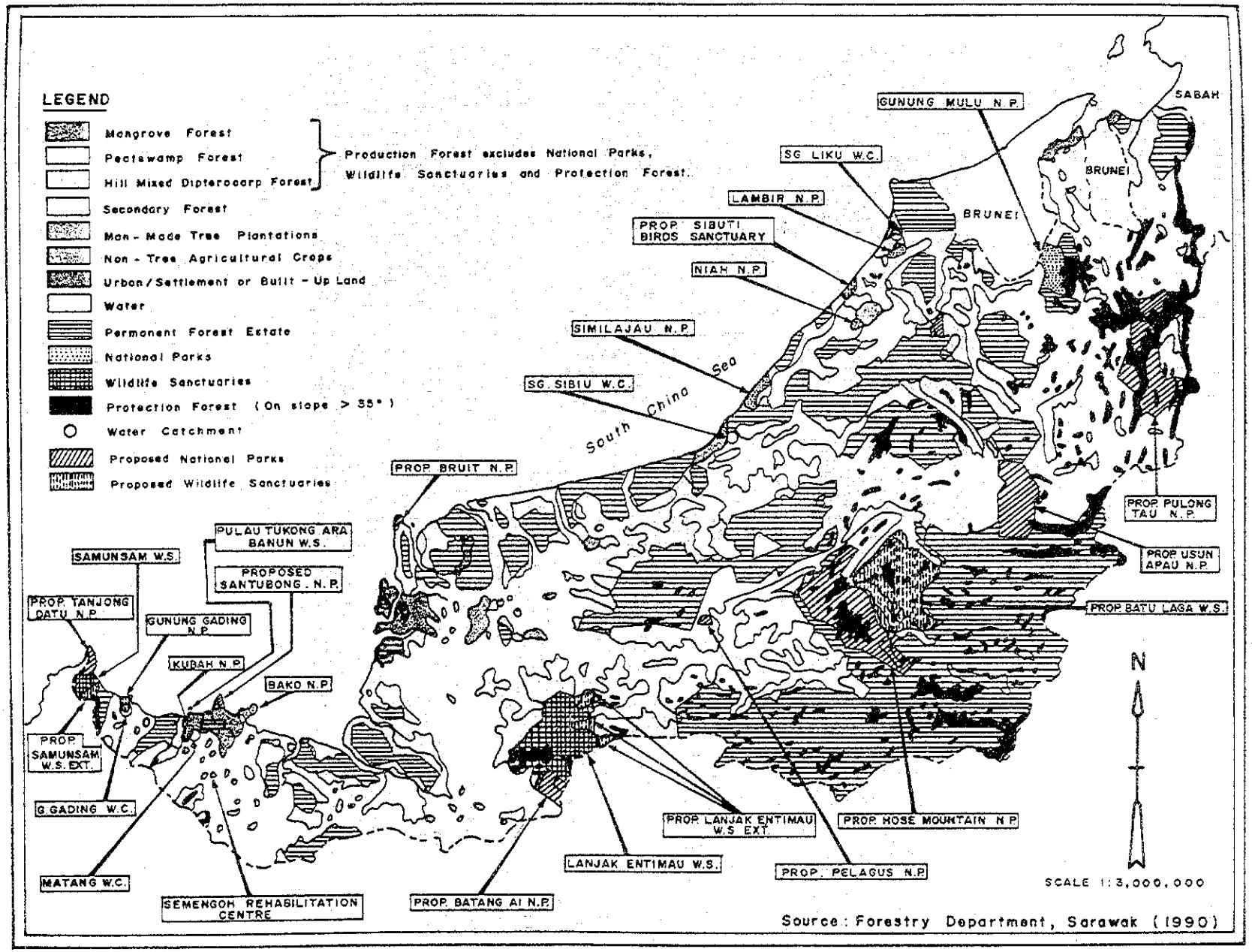


Figure-1.3.5.1 FOREST RESOURCES OF SARAWAK

e) Strata

In general, the natural forests of Sarawak are identified by five canopy layers or strata. The top layer consists of the largest trees which commonly stand as isolated or grouped emergents above a continuous second layer. Under the second canopy is the third lower layer or trees which sometimes merges into the main canopy. The fourth lower layer consists of woody treelets and the lowest layer is made up of forest-floor herbs and small seedlings.

Figure-1.3.5.2 Five canopy layers of the natural forests of Sarawak

f) Flora in the Tg. Manis area

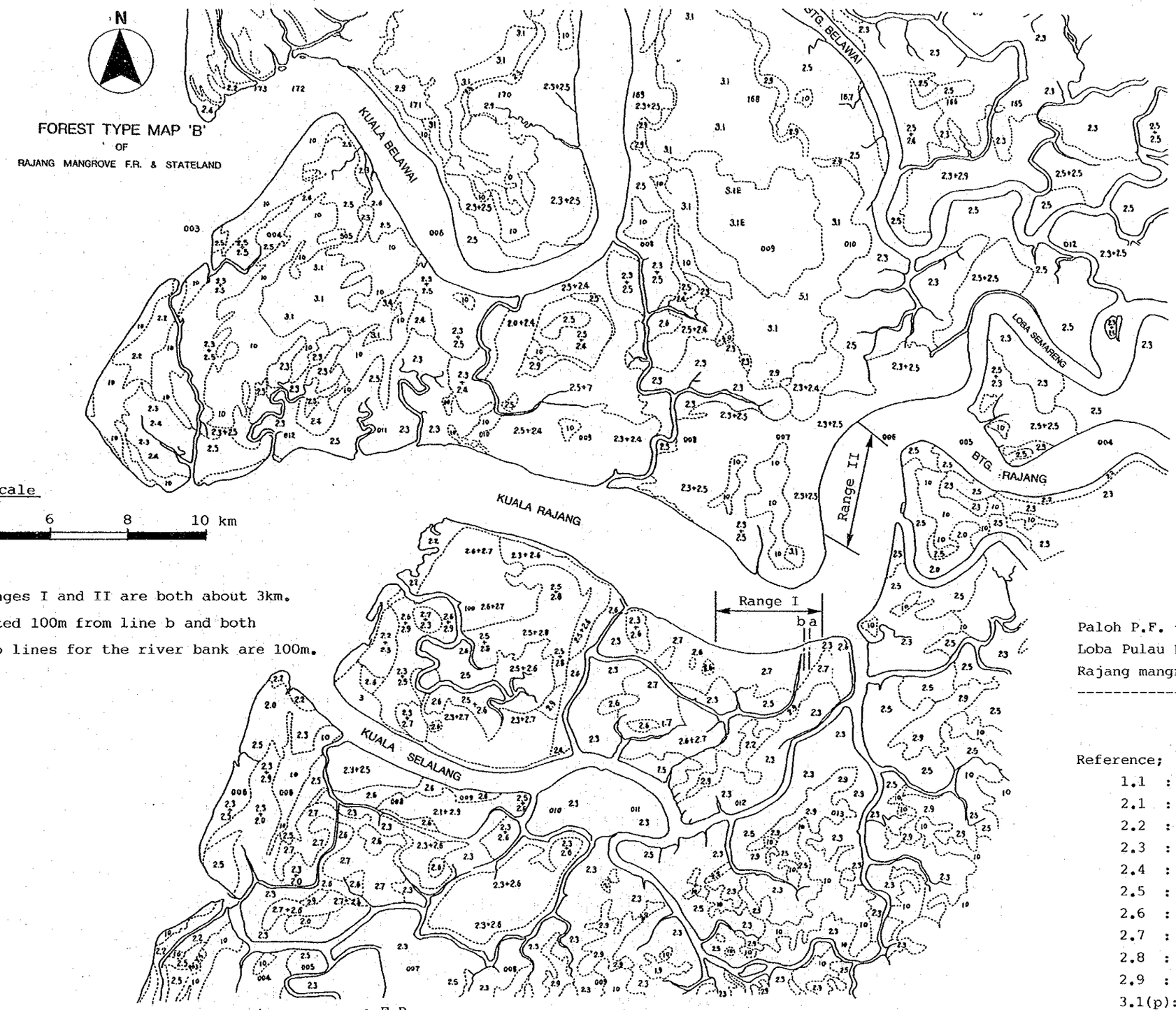
Figure-1.3.5.3 shows the distribution map of forest type of the Rajang Mangrove F.R. & Stateland draughted in 1967 (source: Sarawak Woodchip Co. Sdn. Bhd.)

The result of the survey on flora, which was carried out on 23 and 24 October 1990 by B. Jentra and P. Usop (Forest Dept. in Sibu), is shown in **Table-1.3.5.5** and the locations of the survey are shown in the above-Figure. The species composition of the mangrove forest from river bank upward are as follows;

Nipah palm	-	Nipa palm
Api Api	-	Avicennia
Pedada	-	Sonneratia
Bakau	-	Rhizophora
Berus	-	Bruguiera
Nyireh	-	Xylocarpus
Buta-buta	-	Excoecaria
Fern	-	Fern

According to the information by the Forest Department, protected plants which can be found in and around the project site are as following **Table-1.3.5.6** (Marked plants).

Figure-1.3.5.4 Shows the typical types of Mangrove.



Note:

1. The widths of ranges I and II are both about 3km.
2. Line a is separated 100m from line b and both depths of the two lines for the river bank are 100m.

	Acreage
Paloh P.F.	20,515
Loba Pulau P.F.	22,912
Rajang mangrove F.R.	23,224
total	66,651

Reference;

- 1.1 : Ru Laut Forest
- 2.1 : Pedada Forest
- 2.2 : Api-api Forest
- 2.3 : Bakau Forest
- 2.4 : Nyireh Forest
- 2.5 : Nipah Forest
- 2.6 : Berus Forest
- 2.7 : Putut Forest
- 2.8 : Batu-batu Forest
- 2.9 : Metang Forest
- 3.1(p): Mixed Peatswamp Forest
- 10 : Non Forest

Figure-1.3.5.3 Distribution of forest type of Rajang mangrove F.R. & Staeland draughted in 1976 (source: Sarawak Wooddchip Co. Sdn. Bhd.)

Table-1.3.5.5 Result of the Survey on Flora

Flora / Site	Opposite of Tg. Sebubal From River Bank Upward(M) 20	40	60	80	100	Tg. Sebubal From River Bank Upward(M) 20	40	60	80	100
Avicennia alba (Api Api Hitam)	◎	※	—	—	—	—	/	/	/	/
Bruguiera gymnorrhiza (Berus Kurong)	△	—	※	—	—	—	/	/	/	/
Bruguiera parviflora (Berus Lenggadai)	◎	—	※	※	—	◎	/	/	/	/
Xylocarpus granatum (Nyireh Bunga)	—	—	—	※	※	◎	/	/	/	/
Ceriops tagal (Tengar Semak)	—	—	—	—	※	△	/	/	/	/
Excoecaria agallocha (Buta Buta)	—	—	—	—	※	○	/	/	/	/
Heritiera littoralis (Dungun Daun Kecil)	—	—	—	—	—	○	/	/	/	/
Rhizophora apiculata (Bakau Minyak)	○	※	※	※	※	△	/	/	/	/
Rhizophora mucronata (Bakau Kurap)	○	※	※	—	※	△	/	/	/	/
Sonneratia alba (Pedada)	◎	※	—	—	—	—	/	/	/	/
Nipa palm (Nipah Palm)	—	※	—	—	—	○	/	/	/	/
Fern (Fern)	—	—	—	※	※	—	/	/	/	/

Legend;

◎ : dominant
○ : common
△ : recessive
— : nil
※ : commonly found
/ : not surveyed

notes: 1. The river side, which is from the to the 20m point upward, was surveyed on 23 October 1990.
2. The area inland from the river bank opposite Tg. Sebubal was surveyed on 24 October 1990.
(by B. Jentra and P. Usop-Forest Dept. in Sibu)

Table-1.3.5.6 Protected Plants

PART I
TOTALLY PROTECTED PLANTS

Scientific Name	Common Name
1. All Rafflesia species	Bunga pakma
2. Dipterocarpus oblongifolius river hill	Ensurai

PART II
PROTECTED PLANTS

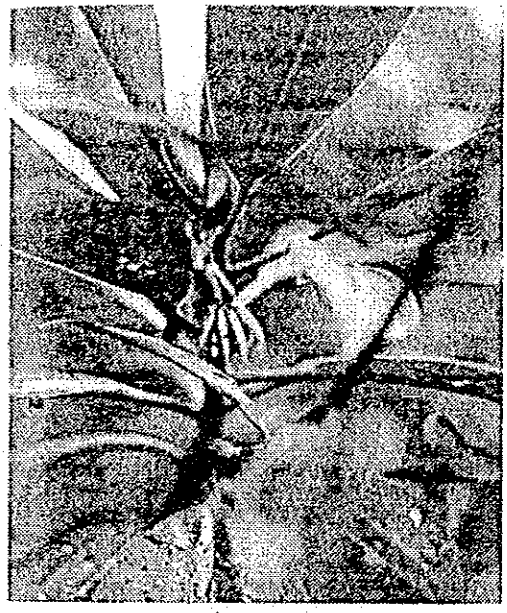
1. Shorea macrophylla	Engkabang jantong
2. Shorea splendida	Engkabang bintang
3. Shorea hemsleyana	Engkabang gading
4. Shorea seminis	Engkabang terendak
5. Shorea palembanica	Engkabang asu
6. Shorea stenoptera	Engkabang rusa
7. All Ficus species	Pokok ara
8. Dyera polyphylla	Jelutong paya
⑨. Sonneratia alba	Perepat
⑩. Sonneratia caseolaris	Pedada
⑪. Avicennia abla	Api-api hitam
⑫. Avicennia lanata	Api-api
⑬. Avicennia officinalis	Api-api merah
⑭. Kumnitzera littorea	Api-api sudu
15. Koompassia excelsa	Terumtum merah
16. Koompassia excelsa	Tapang
17. Kommpassia malaccensis	Menggris
18. Aquilaria malaccensis	Kaya gaharu
19. Aquilaria microcarpa	Engkaras (I), Kayu gaharu
20. Aquilaria malaccensis	Kayu gaharu
21. Aquilaria microcarpa	Kayu gaharu
22. Didesmandra aspera	
㉓. Casuarina equisetifolia	Rhu laut
24. All Rhododendron species	
25. All Nepenthes species	Periok kera
26. All Paphiopedilum species	Slipper orchids
27. All Phalaenopsis species	Moth orchids
28. All Arachnis species	Scorpion orchids
29. Dossinia marmorate	Jewel orchid
30. Haemaria discolor	Jewel orchid
31. Calanthe hispida	
32. Calanthe keratrifolia	
33. Salacca magnifica	
34. Johannesteysmannia altifrons	Ekor buaya
35. Areca borneensis	Pinang
36. Areace jugahpunya	Pinang
37. Pinanga mirabilis	Pinang
38. Pichisermollia subacaulis	Pinang
39. Licuala orbicularis	Biris
40. Eurycoma longifolia	Tongkat ali, Sengkayap
41. Goniothalamus velutinus	Kayu hujan-panas
42. All Monophyllaea species	
43. Antiaris toxicaria	Ipoh
44. All species of Ganua	Ketiau

(Source: Forest Department)

Rhizophora mucronata

Mangrove in Sarawak

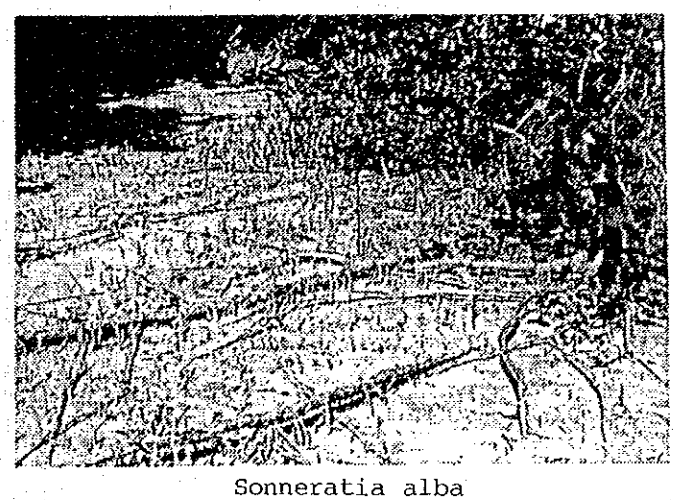
MANGROVE



Bruguiera gymnorrhiza

Rhizophora apiculata

Bruguiera cylindrica



Sonneratia alba

Figure-1.3.5.4 Mangrove

(3) Fauna

1) Protection of wildlife

Totally protected wildlife species in Sarawak are shown in Table-1.3.5.7.

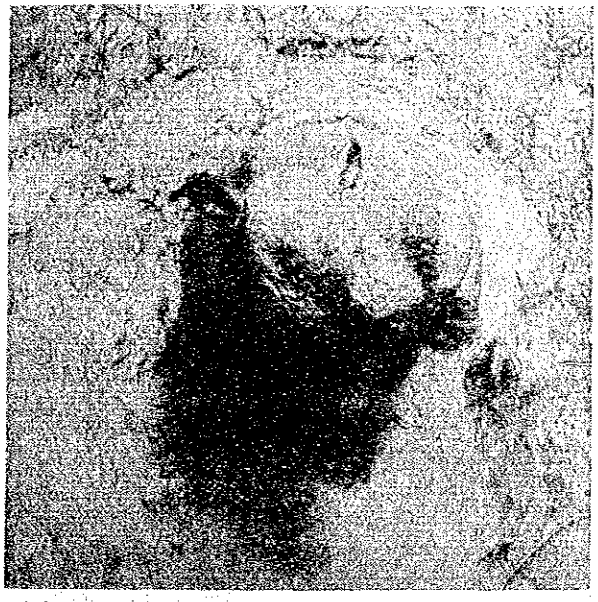
Table-1.3.5.7 Totally protected wildlife species in Sarawak

Wildlife Name	Scientific Name
Long-nose Monkey	*Nasalis larvatus*
Orang utan	*Simia satyrus*
Rhinoceros	*Rhinoceros sumatrensis*
Reef Egret	*Egretta sacra*
Cattle Egret	*Byblcus coromandus*
Storm's Stork	*Ciconia stormi*
Lesser Adjutant Stork	*Leptoptilos javanicus*
White-bellied Sea Eagle	*Haliacetus leucogaster*
Grey-headed Fishing Eagle	*Itchthyophaga itcthyaetus*
Black-naped Tern	*Sterna sumatrana*
Brown-winged Tern	*Sterna anaetheta*
Pied Imperial Pegion	*Ducula bicolor*
Green Turtle	*Chelonia mydas*
Hawksbill Turtle	*Eretmochelys imbricita*
Leatherback Turtle	*Dermochelys coriacea*
Busy-crested Hornbill	*Anorrhinus galeritus*
White-crested Hornbill	*Brenicornis cumatus*
Wrinkled Hornbill	*Aceros Lleucocephalus corrugatus*
Wreathed Hornbill	*Aceros undulatus undulatus*
Black Hornbill	*Anthracoceros malyanus*
Pied Hornbill	*Anthracoceros coronatus*
Rhinoceros Hornbill	*Buceros rhinoceros borneoensis*
Helmeted Hornbill	*Rhinoplax vigil*
Malaysian Peacock Pheasant	*Polyplectron malacense*
Argus Pheasant	*Argusianus argus*
Dugong	*Dugong dugon*
Earless Monitor Lizard	*Lanthanotus borneoensis*
Tarsier	*Tarsius bancanus*
Clouded Leopard	*Neofelis nebulosa*
Slow Loris	*Nyoticebus coucang*
Sundar Island Gibbon	*Hylobates moloch funereus*
Grey Gibbon	*Hylobates moloch meulleri*
North Bornean Gibbon	*Hylobates moloch abbotti*

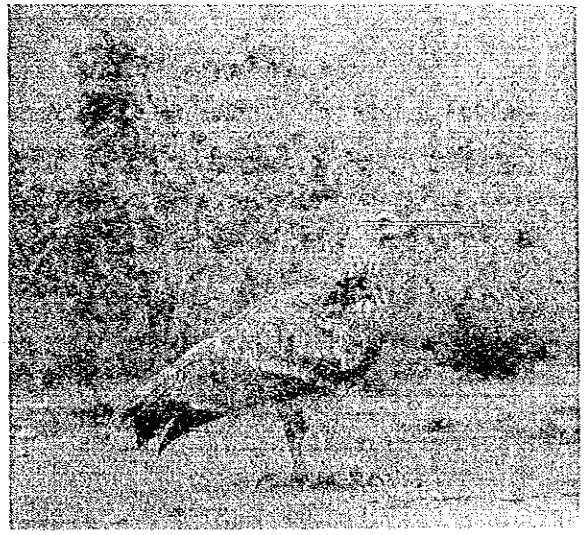
(Source: Forest Dept.)

Long-nose Monkey

Orangutan



Rhinoceros

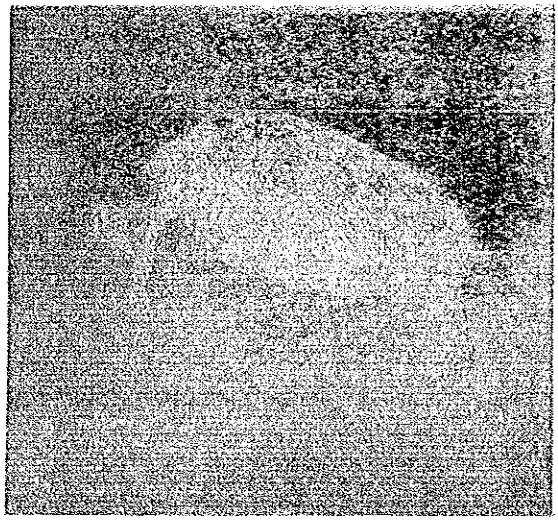


Eagle

Stork

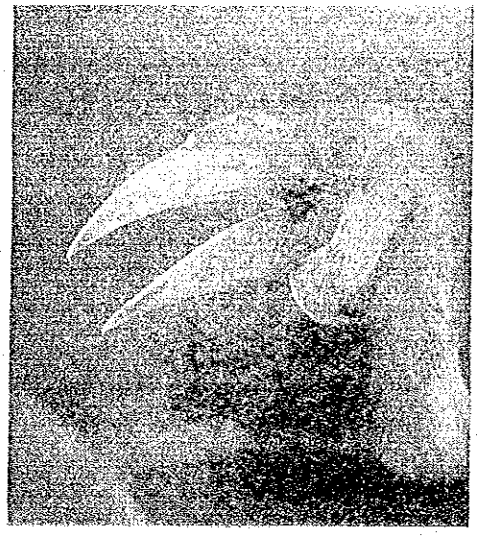
Figure-1.3.5.5

Protected Wildlife (1)

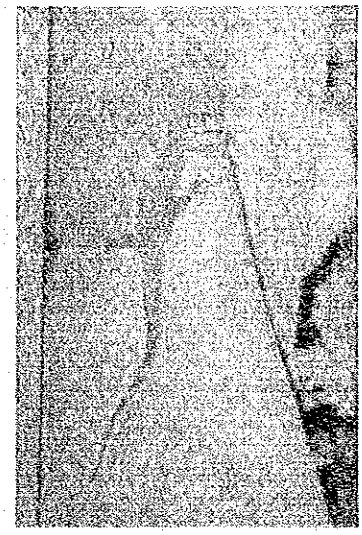


Green turtle

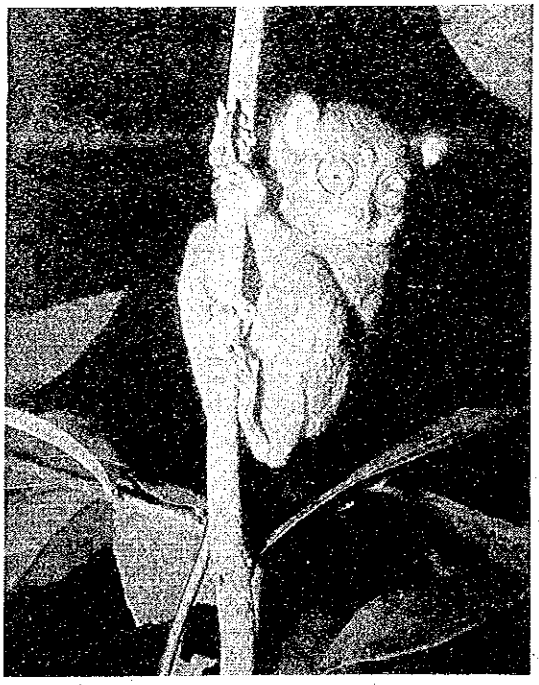
White crested Hornbill



Wreathed Hornbill



Water Monitor Lizard



Tarsier

Bornean Gibbon

Figure-1.3.5.5 Protected Wildlife (2)

(3) Fish

In Sarawak, the fishing industry is very important, and is maintained by the flowing rivers and the surrounding sea.

Therefore, there are many fishing operations in the region along the river.

Table below shows the number of fishing operations in Sarawak by district.

Table-1.3.5.8

BILANGAN PERKAKAS MENANGKAP IKAN MENGIKUT DAERAH DI SARAWAK, 1989

(Number of Fishing Gears In Sarawak By Districts, 1989)

JADUAL (Table)

BUTIR-BUTIR	ALAT PENANGKAP IKAN YANG DIKERJAKAN (FISHING GEARS IN OPERATIONS)																																						
			PUKAT JENIS HANYUT (Drift/Gill Nets)									SELAT (Fishing Stakes)						TALI KAIL (Hooks and Lines)					PERANGKAP (Traps)			PUKAT JENIS BERPUNDI (Bags Nets)				PUKAT JENIS SURUNG (Push/Scoop Nets)									
	P. Tunda	P. Jerut	Rantau	T. Tangsi	P. Udang	P. Tiga Lapis	P. Jaring	P. Dubh	P. Kikia	Lengkong/Anchau	Jumlah Kecil	Jermal	Kilong	Ngian	Lentong	Belat (Dlm. Air Lebih Dari 1 depa)	Jumlah Kecil	Pancing	Rawai/Undan	Gorek/Gorit	Taut	Jumlah Kecil	Bintoh	Bubu	Jumlah Kecil Kecil	Pengeran	Paka	Julok	Jumlah Kecil	Sungkor	Panau	Sadak	Selodok	P. Jasa	Jumlah Kecil	P. Tarik Pantai	Pukat Jenis Rantaiq (Embang/Tugu/Belat Kecil)	Rambin (Miscellaneous)	Jumlah Besar
Sematan	11		112	65			17			6	295												31		31	11			11							3	14		272
Santubong	70		188	226			182		9		525			36			36		8			8	36		36		4		4	14					14		38	13	736
Bandar Kuching	121	12	366	5			7				378																										26		537
Kuala Sadong	6		254	54			64		14		418			9			9			3		3	21		21		55		55	22					22		53		592
Satang Lusar	4		398	53							449	5		15			20			47		47				79	312		391							3	56		966
Saribas	93		355	128						11	494					3	3		26	19		38	19		19	18	49		67								37		752
Sibu	158		163	64							247								7			7																	418
Mukah	44	6	104	203						2	315							24													28				28	1			415
Matu/Daro	161		278	78				32			388								17			17	14		14	9	365		373								119		1,082
Belawai	135		165	32				20			217			9			9		15			15	2		2		12		12								13		403
Sarikei/B'gor	78		113	14							155								1			1															13		248
Bintulu	36	5	88	89						12	161							37				37									23				23				282
Miri	83		114	193						6	313							67				67	1		1									17	17	1			482
Limbang			1	4	2	162				1	171					6	6		2			2															2		198
Lawas			13	47	3	475		3		41	582					3	3	5				5	8	2	10											3			603
JUMLAH BESAR	1,010	23	2,754	1,279	5	637	199	64	23	91	5,832	5		69		12	86	133	76	69		269	132	2	134	116	797		913	36	51			17	124	11	368	13	7,965

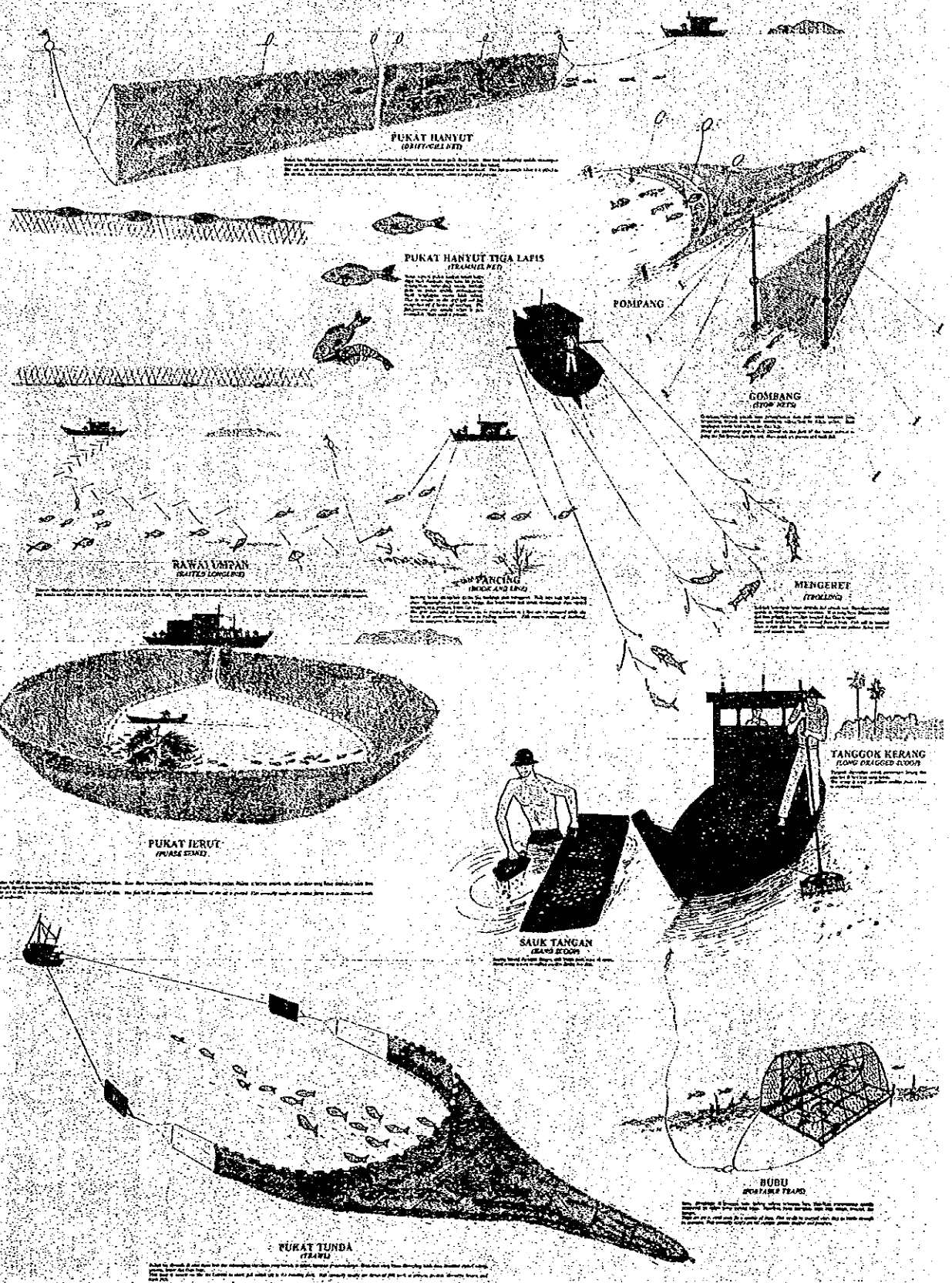
In Malaysia, there are a variety fishing methods; some are modernized, using trawlers, others are traditional. Major and minor fishing methods in Malaysia are shown in **Fig-1.3.5.6 - 1.3.5.7.**

Additionally, blessed with favourable geographical condition, there are many kinds of fish in Malaysia. **Fig-1.3.5.8 - 1.3.5.11** shows commercial fish in Malaysia.

Table-1.3.5.9 shows fish landing volume by each species and **Table-1.3.5.10** shows the landing of fishing operations of Sarawak.

PERALATAN MENANGKAP IKAN YANG UTAMA DI MALAYSIA

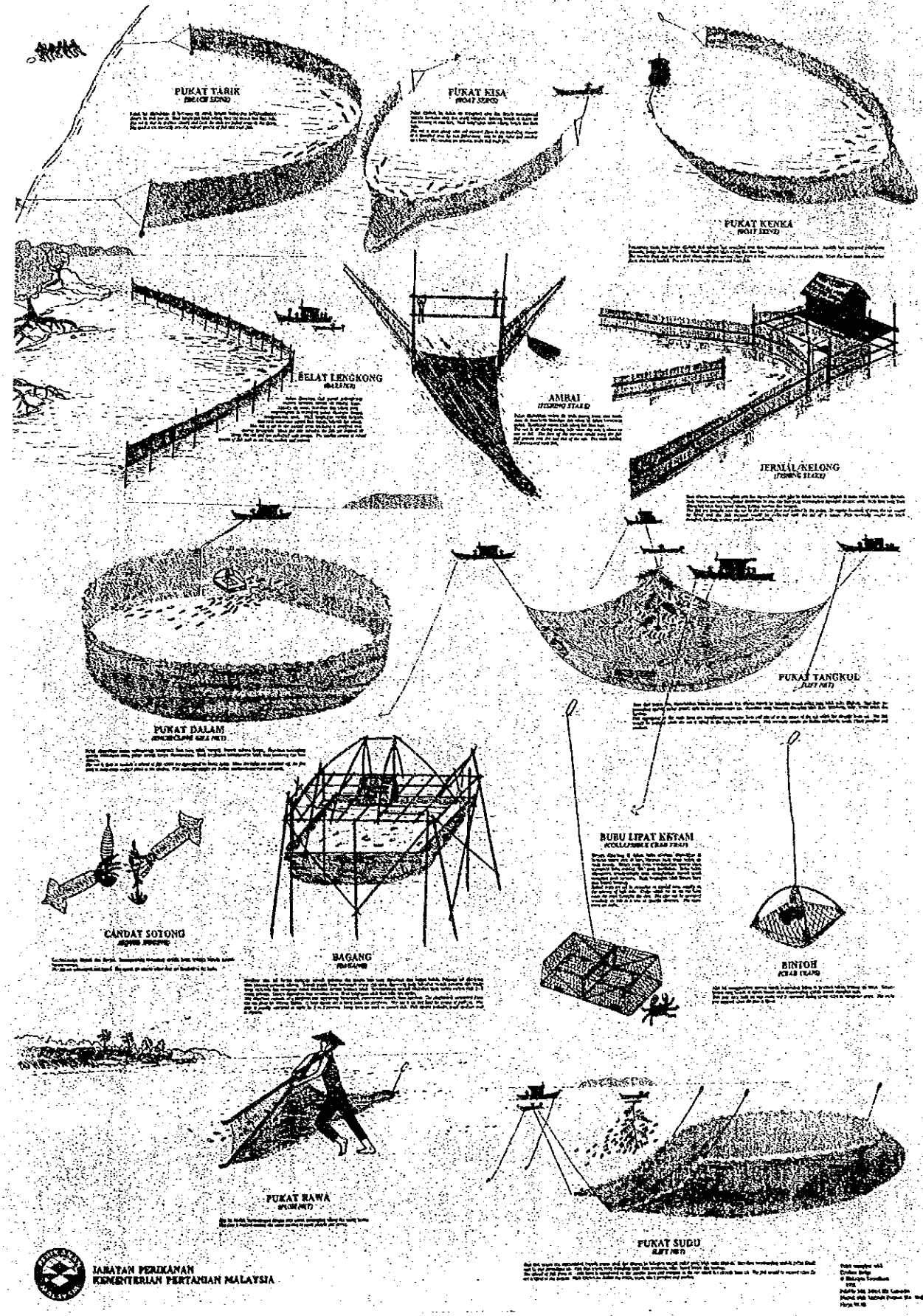
Figure-1.3.5.6 *MAJOR FISHING GEARS OF MALAYSIA*



JABATAN PERIKANAN
KEMENTERIAN PERTANIAN MALAYSIA

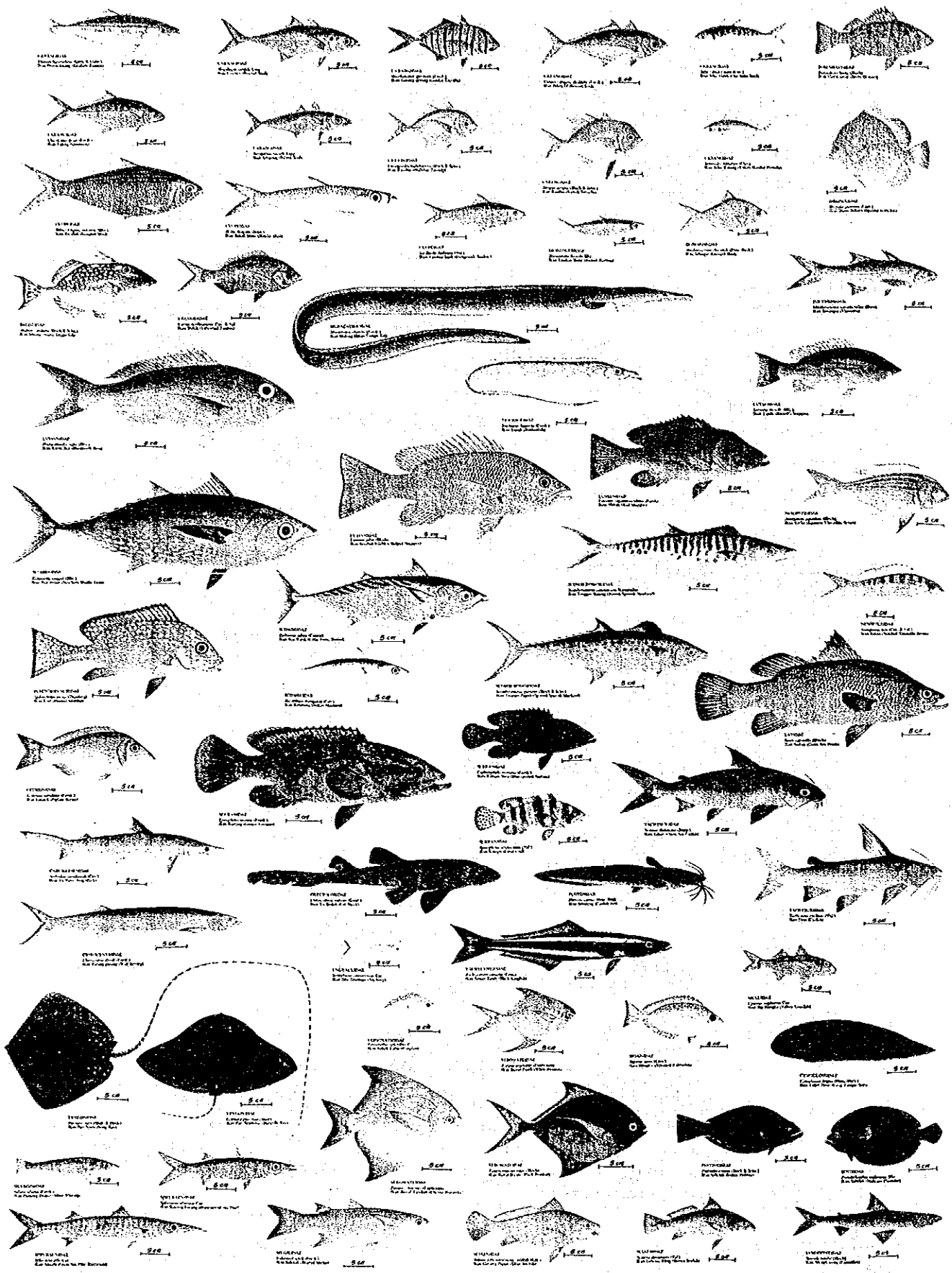
PERALATAN MENANGKAP IKAN YANG DIUSAHAKAN SECARA KECIL-KECILAN DI MALAYSIA

Figure-1.3.5.7 *MINOR FISHING GEARS OF MALAYSIA*



IKAN-IKAN LAUT DAGANGAN MALAYSIA

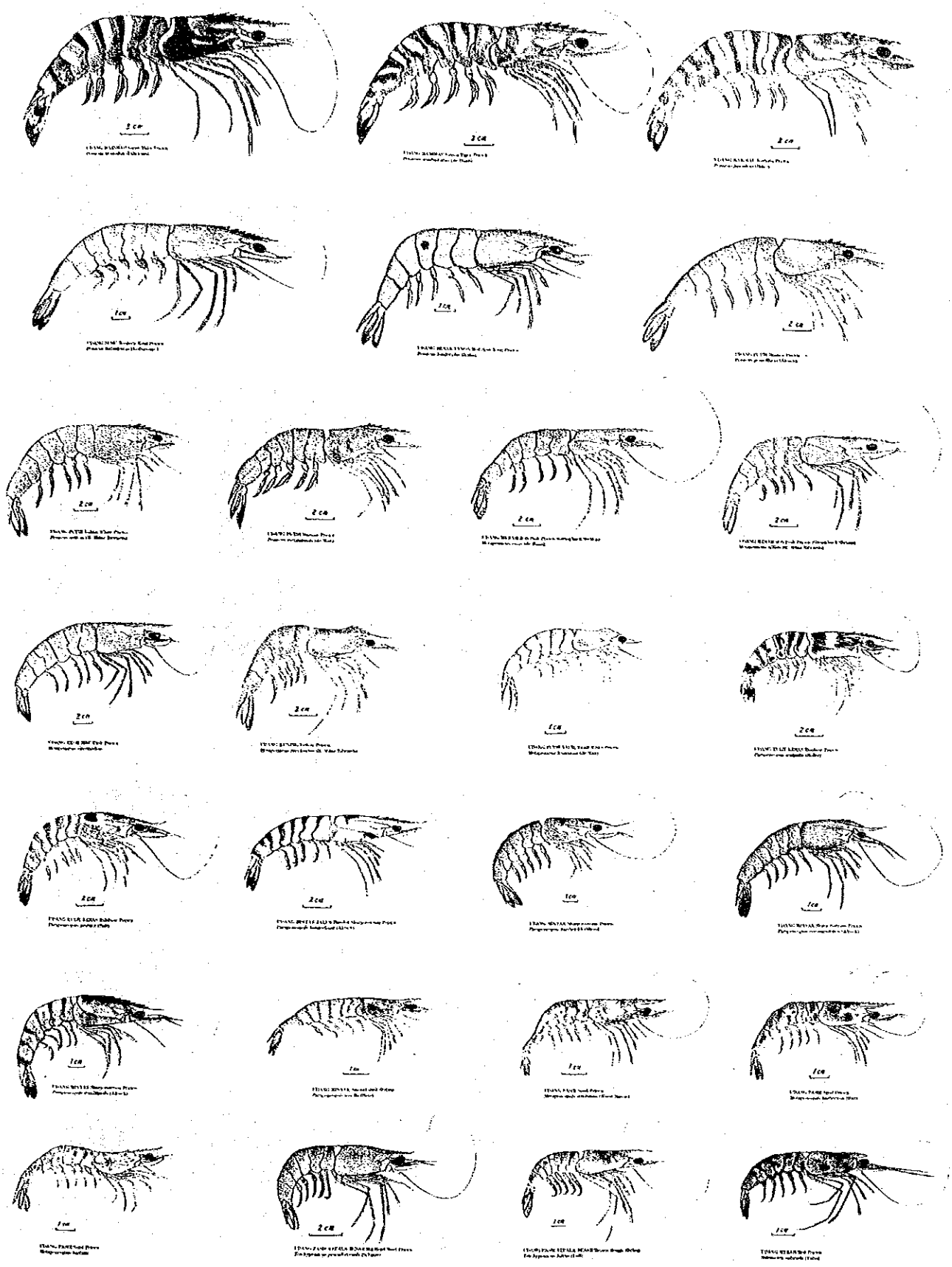
Figure-1.3.5.8 **Commercial Sea Fishes of Malaysia**



KELAB SUKAN & REKREASI
JABATAN PERIKANAN LAUT SARAWAK

UDANG-UDANG LAUT DAGANGAN DI MALAYSIA

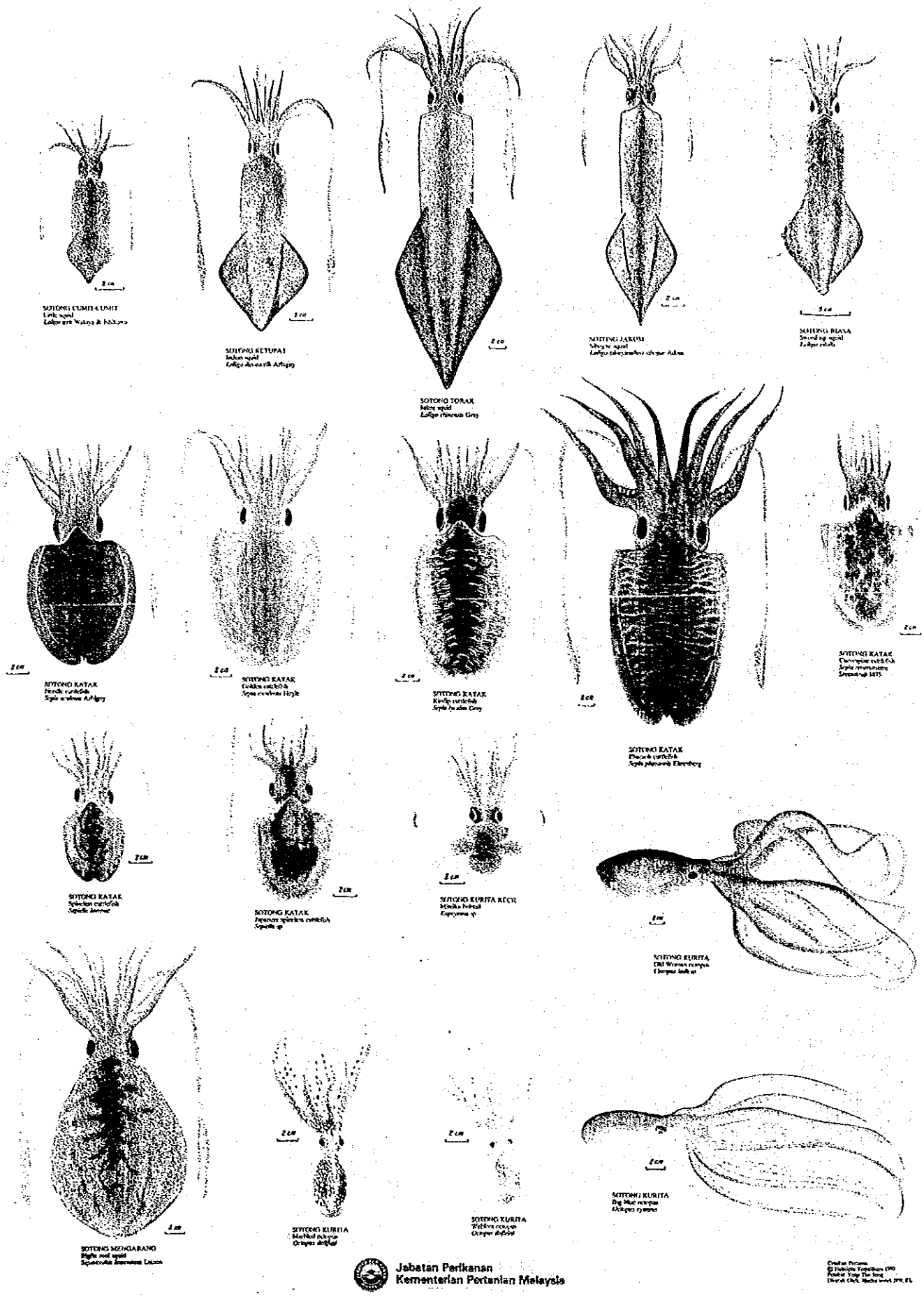
Figure-1.3.5.9 **Commercial Marine Prawns in Malaysia**



KELAB SUKAN & REKREASI
JABATAN PERIKANAN LAUT SARAWAK

SOTONG DAGANGAN DI MALAYSIA

Figure-1.3.5.10 CEPHALOPODS IN MALAYSIA



Jabatan Perikanan
Kementerian Pertanian Malaysia

MOLUSKA MALAYSIA

Figure-1.3.5.11 **Molluscs of Malaysia**

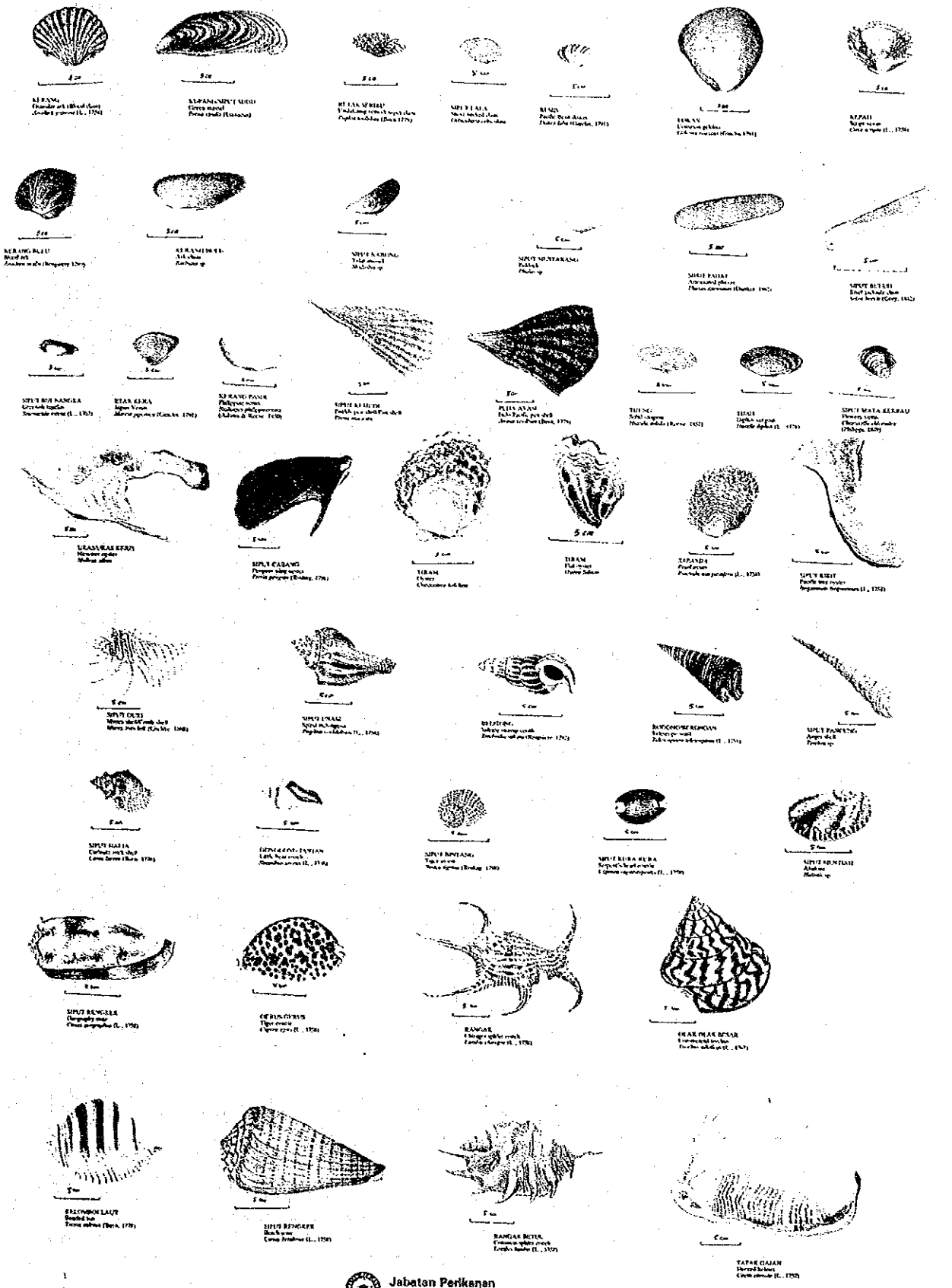


Table-1.3.5.9(1) Fish Landing Volume by Each Species

SPECIES	SIBU	BELAWAI	SARIKEI	OTHERS	JUMLAH BESAR
MKHAHI/SELANGAT	0.00	0.00	0.00	149.02	149.02
PUPUT	205.91	24.25	96.08	612.46	938.70
DIET. IAK MATA	1.27	0.00	4.25	584.8	590.32
TKRUBUK/T. TOLI	11.21	0.00	5.62	296.03	312.86
TRRUBUK/T. MACRURA	30.67	0.00	0.62	114.17	145.46
HLAKAP	0.00	79.35	0.00	4.33	83.68
I. IDAH.	0.00	19.51	0.00	21.52	41.03
MEBELAH	0.00	0.00	0.00	12.86	12.86
MIJI NANGKA	0.00	27.37	0.00	0	27.37
UBI. AH	0.00	0.00	0.00	0.63	0.63
UAUN BATHARU	0.60	0.00	0.66	22.02	23.28
DUHI/PULUTAN/UTEK	11.41	0.05	19.16	1,577.66	1,608.28
DKI. AMA/TENCKERONG	712.50	212.35	23.86	2,836.94	3,785.65
UKRUT-CERUT/SELUKUT	0.00	42.10	0.00	18.08	60.18
JAHAN/GOH	0.00	114.57	0.00	430.13	544.70
PRDUKANG	0.00	13.71	0.00	117.94	131.65
JBNAHAK	0.15	0.00	1.02	41.97	43.14
KACI	0.00	0.00	0.00	13.67	13.67
KBRAPU	0.00	0.00	0.00	104.32	104.32
KERISI	0.00	0.00	0.00	126.00	126.00
KERISI BALI	0.00	0.00	0.00	5.91	5.91
KIKEN	0.00	0.00	0.00	48.50	48.50
LUMI-LUMI	0.44	385.12	3.50	1,128.81	1,517.87
MALONG	204.87	0.00	5.16	946.3	1,156.33
MERAH	0.00	0.00	3.46	477.38	480.84
PELANDUK	0.00	0.00	0.00	43.58	43.58
BEMILANG	0.00	12.92	0.00	48.63	61.55
SHRUMBU/LEMAH	0.00	5.60	0.64	482.26	494.10
SENOLONG/KAPAS	4.20	0.00	7.99	211.94	224.13
ALU/KACANG	0.00	0.00	0.00	16.86	16.80
HAWAL HITAM	120.30	0.00	62.07	1,244.58	1,426.95
BAWAH PUTEH	195.85	0.00	15.21	482.82	693.88
BAWAL/BUJANG	10.81	0.00	12.43	177.82	201.06
BELANAK/KEDERA	0.00	13.53	0.00	63.52	77.05
CERMIN/SAGAI/CUPAK	0.10	0.00	0.10	16.63	16.83
GERONGGONG	28.36	0.00	28.22	159.93	273.73
CINCARU	28.86	0.00	28.60	1,023.33	1,080.79
DEMUDUK/RAMBAI	0.20	0.00	0.00	86.17	86.37
KURAU/SENOHONG	1.40	62.36	46.20	109.96	381.75
SENANGIM	15.37	40.48	17.84	401.96	475.65
SELAR	0.67	0.00	0.67	533.21	534.55
PELATA	0.00	0.00	0.00	42.38	42.38
SELAR KUNING	0.00	0.00	0.00	229.89	229.89
TALANG	13.88	88.38	16.25	246.65	365.16
TODAK/BANANG	0.00	0.00	0.00	0.98	0.98
TAMBAN SISEK	0.00	0.00	0.00	900.65	900.65
TAMBAN BULOH/BULAT	0.00	0.00	0.00	400.30	400.30
TAMBAN/CINCANG REBONG	0.00	0.00	0.00	423.58	423.58
TAMBAN BELURU	0.00	0.00	0.00	67.99	67.99
BILIS/BUNGA AIR	0.00	0.00	0.00	627.26	627.26
PARANG-PARANG	3.46	0.00	4.45	430.54	438.45

Table-1.3.5.9(2) Fish Landing Volume by Each Species

SPECIES	SIBU	BELAWAI	SARIKEI	OTHERS	JUMLAH BESAR
BULAN-BULAN	0.00	0.00	0.00	0.14	0.14
TONGKOL E. AFFINIS	0.00	0.00	0.00	407.00	407.00
TONGKOL K. PELAMIS	0.00	0.00	0.00	45.48	45.48
TONGKOL T. TONGGOL	6.08	0.00	6.08	946.44	958.60
TONGKOL A. THAZARD	0.00	0.00	0.00	98.22	98.22
TENGGIRI	370.03	0.00	240.99	1,889.09	2,500.11
KEMBONG	4.66	0.00	3.50	1,327.27	1,335.43
PELALING/TEMENONG	0.00	0.00	0.00	44.33	44.33
TIMAH/LAYOR/S'YOR	0.00	29.30	0.00	277.56	306.86
YU	34.47	55.41	29.70	1,273.02	1,392.60
PARI	433.35	111.79	33.89	1,468.67	2,057.70
IKAN BAJA	6,784.69	0.00	0.45	2,091.14	8,876.28
IKAN CAMPUR	3,058.78	372.15	195.11	4,471.11	8,097.15
KETAM LAUT/SURI	0.03	0.00	0.00	205.71	205.71
KETAM REJONG/BAKAU	0.00	0.00	0.00	44.54	44.54
KETAM BATU	0.00	0.00	0.00	11.16	11.16
UDANG KARANG	4.24	0.00	0.48	4.10	8.52
UDANG HARIMAU	6.74	0.00	0.66	7.33	14.73
UDANG PUTEH BESAR	378.04	135.32	202.85	924.64	1,640.85
UDANG PUTEH SEDANG	293.20	254.31	140.52	525.52	1,213.55
U PUTEH KECIL/KERTAS	24.58	0.00	1.16	121.53	147.27
UDANG SUA LOR (b)	227.26	0.00	11.98	187.11	426.35
UDANG SUA LOR (s)	0.00	0.00	0.00	114.17	114.17
UDANG MERAH ROS	0.00	0.00	0.04	2.76	2.50
UDANG KULIT KERAS	583.47	415.78	316.38	534.46	1,850.09
UDANG KUNING	0.00	0.00	56.19	66.56	122.75
UDANG MERAH/PAYAK	3,740.59	559.39	1,336.11	6,401.89	12,037.98
UDANG PASIR K. BESAR	0.00	26.36	0.00	0	26.86
UDANG PASIR KECIL	0.00	0.05	0.00	0	0.05
UDANG MINYAK	145.34	532.13	3.66	187.43	868.56
UDANG BARING	0.00	0.00	0.00	677.19	677.19
UDANG GALAH	0.00	0.00	0.00	0.42	0.42
SIPUT	0.00	0.00	0.00	2.12	2.12
KEPAH	0.00	0.00	0.00	0.00	0.00
SOTONG BIASA/CUMIT	322.62	5.40	25.27	1,009.18	1,362.47
SOTONG KATAK	193.53	0.00	0.30	25.07	218.90
SOTONG KERETA	0.00	0.00	0.00	1.4	1.4
UBUR-UBUR PUTEH	0.00	6,163.32	0.00	3,571.93	9,735.75
UBUR-UBUR MERAH	0.00	0.00	0.00	1,455.52	1,455.52
JAMAH	0.20	0.00	0.85	1,012.37	1,013.42
PERENCONG	0.00	39.53	0.00	107.53	147.06
PANJANG	0.00	56.02	0.00	948.91	1,004.93
PELAYAK	1.81	6.27	2.80	209.10	219.98
IMPIRANG	1.17	7.39	1.36	658.37	668.29
BULU AYAM	0.00	0.72	0.00	419.73	420.45
KILAT	284.56	53.86	6.48	245.16	590.06
BULU	4.85	59.81	0.61	34.22	99.49
EMPIRIT	11.77	1.62	11.77	221.11	246.27
JUMLAH BESAR	18,528.55	10,027.58	3,033.25	52,667.62	84,257.0

Table-1.3.5.10 Landing volume of fishing operations in Sarawak

Case IKAN (GRADE OF FISH)	I		II		III		LEOR-BUOR (JELLY FISH)		IKAN MAJA (TRASH FISH)		SIPUT (SHELLFISH)		JUMLAH (TOTAL)	
JENIS PERALATAN PERIKANAN (CZAR GROUP)	KUANTITI TAN METRIK (QUANTITY IN METRIC TONS)	Share (%)	KUANTITI TAN METRIK (QUANTITY IN METRIC TONS)	Share (%)	KUANTITI TAN METRIK (QUANTITY IN METRIC TONS)	Share (%)	KUANTITI TAN METRIK (QUANTITY IN METRIC TONS)	Share (%)	KUANTITI TAN METRIK (QUANTITY IN METRIC TONS)	Share (%)	KUANTITI TAN METRIK (QUANTITY IN METRIC TONS)	Share (%)	KUANTITI TAN METRIK (QUANTITY IN METRIC TONS)	Share (%)
PUKAT TUNDA (TRAWL NETS)	2,893.78	3.4	1,718.91	2.0	32,982.08	38.8	6,019.19	7.1	8,386.61	9.9	-		51,917.57	61.3
PUKAT TARIK (SZINE NETS)	595.36	0.7	4.03	0.0	2,767.07	3.3	-		-		-		3,366.45	3.9
PUKAT HANYUT (DRIFT/GILL NETS)	2,359.03	2.8	2,735.32	3.2	10,356.09	12.2	35.66	0.0	16.66	0.0	-		15,502.78	18.3
BELAT (FISHING STAKES)	58.44	0.1	28.27	0.0	1,257.51	1.5	1.56	0.0	35.08	0.0	-		1,380.87	0.2
Tali Kail (Hooks And Lines)	0.59	0.0	78.42	0.0	1,059.71	1.3	147.12	0.2	-	0.0	-		1,285.84	1.5
Perangkap (Traps)	39.29	0.0	-		-		-		-		-		39.29	0.0
Pukat Jenis Berpundi (Bag Nets)	13.04	0.0	-		3,210.88	3.8	638.41	0.8	437.90	0.5	-		4,300.23	5.1
Pukat Surung (Push/Scoop/Lift Nets)	245.61	0.3	-		241.79	0.2	3,797.92	4.5	-		-		4,285.31	5.1
Pukat Rentang (Barrier Nets)	24.90	0.0	3.80	0.0	1,589.92	1.9	547.53	0.6	-		-		2,165.15	2.6
Memungut Siput (Shellfish Collection)	-	-	-		-		-		-		2.12	0.0	2.12	0.0
Rampaian (Miscellaneous)	4.45	0.0	-		0.14	0.0	6.88	0.0	-		-		11.47	0.0
JUMLAH (TOTAL)	6,234.48	7.4	4,568.75	5.4	53,384.18	63.0	11,191.27	13.2	8,876.23	10.5	2.12	0.0	84,257.03	100%

NOTE: GRADE I : TERUBOK BAWAL HITAM, BAWAL PUTEH, BAWAL BUJANG, KURAU/SENOHONG, KETAM RENJONG/BAKAU, KETAM BATU, UDANG HARIMAU, UDANG HARIMAU, UNDANG PUTIH BESAR, UDANG PUTIH SEDANG, UDANG PUTIH KECIL, UDANG GALAH (Average Price @ 6,398.00 - Per Metric Ton)

GRADE II : PUPUT, DELAH, KERAPU, SENANGIN, TENGGIRI,UDANG KRIANG, UDANG KAKA MERAH/SUA LOR (B), UDANG KAKI MERAH/SUA LOR ($) (Average Price @ 53,610.00 - Per Metric Ton)

GRADE III : KEBASI/SEKANGAT, BELIAK MATA, LLIDAH, SEBELAH, BIJI NANGKA, DUAN BAHARU, DURI, GELAMA, GERUT-GERUT, JAHAN/GOH, PEDUKANG, JENAHAK, KACL, KERIS, KERISI BALI, KIKEK, LUMI/LUMI, MALONG, MERAH, PELANDOK SEMILANG, SHRUMBU, SENGLONG/KAPAS, ALU/ALU, BELANAK/KEDERA, CERMIN, GERONGGONG, CINCARU, DEMUDOK, SELAR, PELATA, SELAR KUNING, TALANG, TODAK/BANANG, TAMBAN SISEK, TAMBAN BULOH/BULAT, TAMBAN/CINCANG REBONG, BILIS, PARANG-PARANG, BULAN-BULAN, TONGKOL, KEMBONG, TIMAH, YU, PARI, IKAN CAMPUR, KETAM SURI, UDANG LOBOK, UDANG KULIT KERAS, UDANG KUNING, UDANG MERAH/PAYAK, UDANG MINYAK, SOTONG BIASA/CUMIT-CUMIT, SOTONG KATAK, SOTNG KERETA, JAMAH, PERENCONG, PANJANG, PELAYAK, IMPIRANG, BULU AYAMA, KILAT, BULU, EMPIRIT (Average Price @ 1,9800.00 Per Metric Ton)

SHELLFISH is estimated at $2,340.00 per metric ton
TRASH FISH is estimated at $528.00 per metric ton
JELLY FISH is estimated at $500.00 per metric ton

1.3.6 Habitats and Communities

(1) Habitats and Communities of birds

A joint survey of coastal wetlands in Western Sarawak was conducted from September to November 1985 by the NPWO (the National Parks & Wildlife Office of Sarawak Forest Dept.) and INTERWADER (the East Asia/Pacific Shorebird Study Programme). A total of 38,000 waterfowl were sited, including substantial numbers of rare and endangered species. One site, Pulau Bruit, is of international significance for waterfowl conservation as well as being of prime economic interest to the fishery industry.

i) Wading birds

A total of 28,688 waders were recorded during the ground survey, while the subsequent aerial survey revealed nearly 23,000 (**Table-1.3.6.1** and **Figure-1.3.6.1**).

Table-1.3.6.1 Distribution of Waders by Sector along the Sarawak coast, recorded during ground and aerial Surveys from September to November 1985

Sector No:	Region	Ground Survey	Aerial Survey	Max Count	% Max Cnt
1.	S. Buntal - S. Bako	1161	270	1161	3.73
2.	West coast Bako NP	149	NS	149	0.48
3.	East coast Bako NP	98	211	211	0.68
4.	M. Tebas - K. Samarahan	34	46	46	0.15
5.	K. Samarahan - K. Sadong	4054P	5372	5372	17.27
6.	K. Sadong - K. Lupar	154	151	154	0.50
7.	K. Lupar - K. Saribas	622	473	622	2.00
8.	K. Saribas - K. Kabong	1263	145	1263	4.06
9.	K. Kabong - K. Rajang	600	913	913	2.94
10.	K. Rajang - K. Belawai	746	94	746	2.40
11.	K. Belawai - K. Paloh	368P	940	940	3.02
12.	Pulau Bruit	18597	14300	18597	59.77
13.	Pulau Patok	256	NS	256	0.82
14.	Maura Lassa - K. Igan	317	NS	317	1.02
	Sub-total	28331	22943	30757	98.81
15.	Tekajong marsh and rice paddies	134	NS	134	0.43
16.	Kuching Airport	223	NS	223	0.75
	T O T A L	28688	22943	311114	

NS - Not surveyed
P - Partial count
S - Sungai
K - Kuala
M - Muara

Note: The maximum count column contains the number of birds recorded on either the ground or aerial surveys - whichever is the highest.

The % maximum count is the percentage of birds recorded in each sector - based on totals in maximum count column.

Source: Evaluation of Sarawak wetlands and their importance to waterbirds -- INTERWADER/NPWO

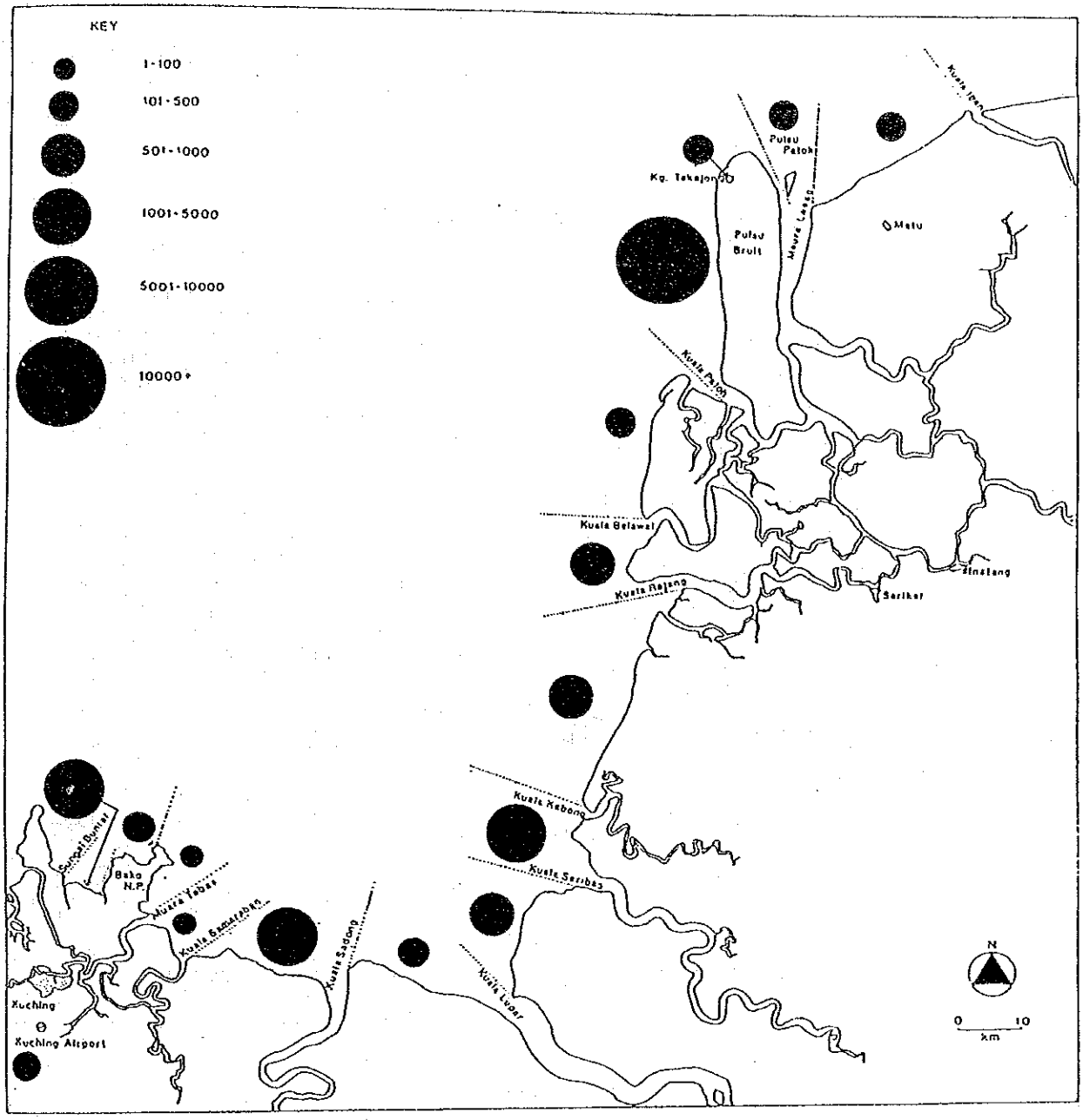


Figure-1.3.6.1 Map showing distribution of wader by sector along the Sarawak Coast recorded during ground and aerial survey from September to November 1985

ii) Terns

The ground survey found a total of 6,088 terns, all but 8 of which were on the coast, while the aerial survey recorded 4,325 (**Table-1.3.6.2** and **Figure-1.3.6.2**).

Table-1.3.6.2 Distribution of Terns by sector along the Sarawak coast from September to November 1985

Sector No:	Region	Ground Survey	Aerial Survey	Max Count	% Max Count
1.	S. Buntal - S. Bako	162	0	162	1.96
2.	West coast Bako NP	10	NS	10	0.12
3.	East coast Bako NP	0	0	0	0
4.	M. Tebas - K. Samarahan	0	0	0	0
5.	K. Samarahan - K. Sadong	388	404	404	4.90
6.	K. Sadong - K. Lupar	7	10	10	0.12
7.	K. Lupar - K. Saribas	35	200	200	2.43
8.	K. Saribas - K. Kabong	13	0	13	0.16
9.	K. Kabong - K. Rajang	2329	0	2329	28.26
10.	K. Rajang - K. Belawai	902	5	902	10.95
11.	K. Belawai - K. Paloh	643	160	643	7.80
12.	Pulau Bruit	1579	3541	3541	42.97
13.	Pulau Patok	4	NS	4	0.05
14.	Maura Lassa - K. Igan	15	NS	15	0.18
	Sub-total	6087	4325	8233	99.90
15.	Tekajong marsh and rice paddies	8	NS	8	0.10
16.	Kuching Airport	0	NS	0	0
	T O T A L	6095	4325	8241	100.00

Source: Evaluation of Sarawak wetlands and their importance to waterbirds -- INTERWADER/NPWO

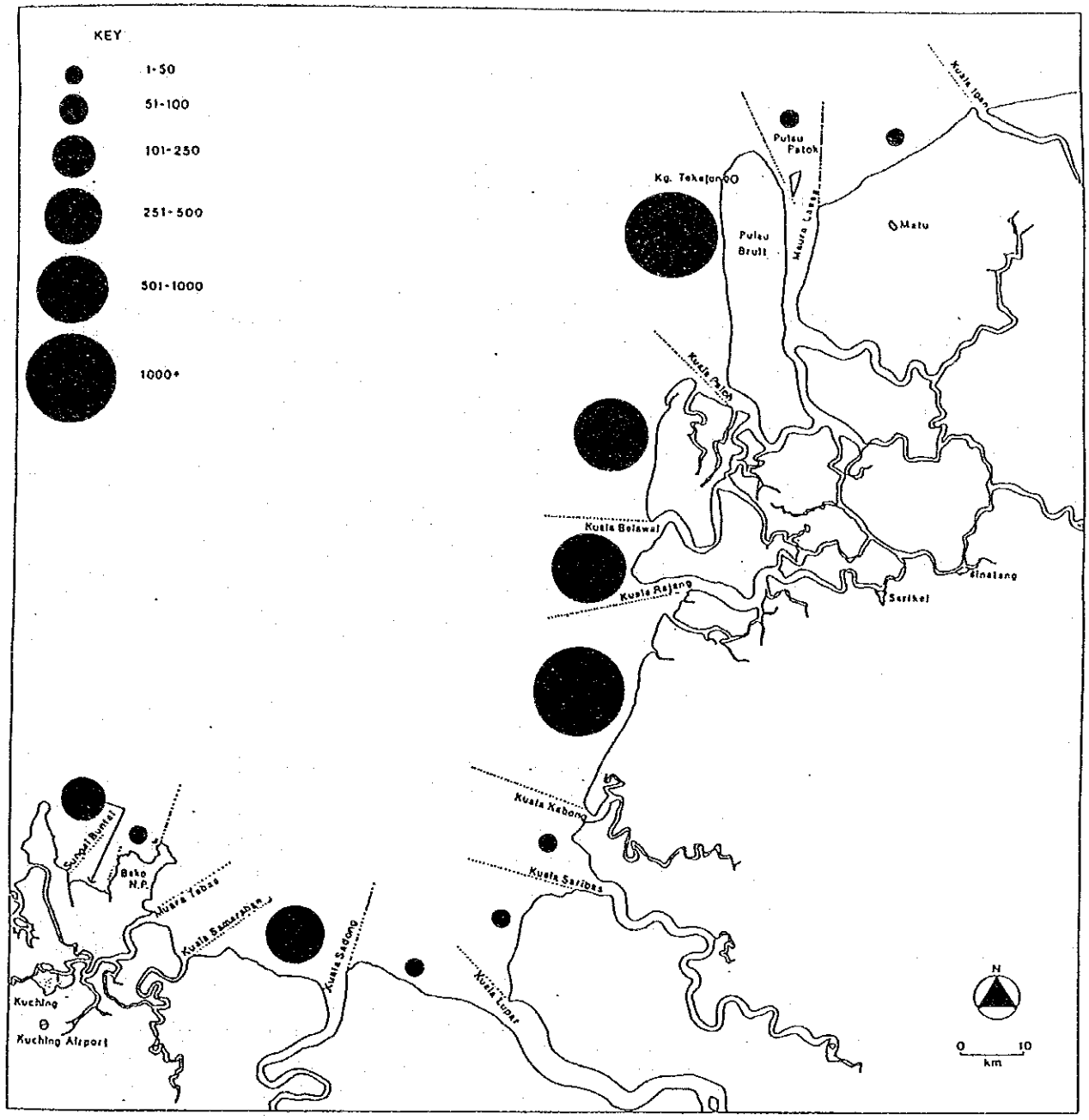


Figure-1.3.6.2 Map showing distribution of terns by sector along the Sarawak Coast recorded during ground and aerial survey from September to November 1995

iii) Egrets

Lastly, the ground survey recorded a total of 534 egrets using this stretch of coast (**Table-1.3.6.3** and **Figure-1.3.6.3**).

Table-1.3.6.3 Distribution of egrets by sector along the western coast of Sarawak, recorded during ground surveys from September to November, 1985

Sector No:	Region	Ground Survey
1.	S. Buntal - S. Bako	12
2.	West coast Bako NP	0
3.	East coast Bako NP	0
4.	M. Tebas - K. Samarahan	1
5.	K. Samarahan - K. Sadong	228
6.	K. Sadong - K. Lupar	0
7.	K. Lupar - K. Saribas	36
8.	K. Saribas - K. Kabong	1
9.	K. Kabong - K. Rajang	0
10.	K. Rajang - K. Belawai	6
11.	K. Belawai - K. Paloh	4
12.	Pulau Bruit	234
13.	Pulau Patok	6
14.	Muara Lassa - K. Igan	6
15.	Tekajong marsh and rice paddies	0
16.	Kuching Airport	0
	T O T A L	534

S - Sungai
K - Kuala
M - Muara

Source: Evaluation of Sarawak wetlands and their importance to waterbirds -- INTERWADER/NPWO

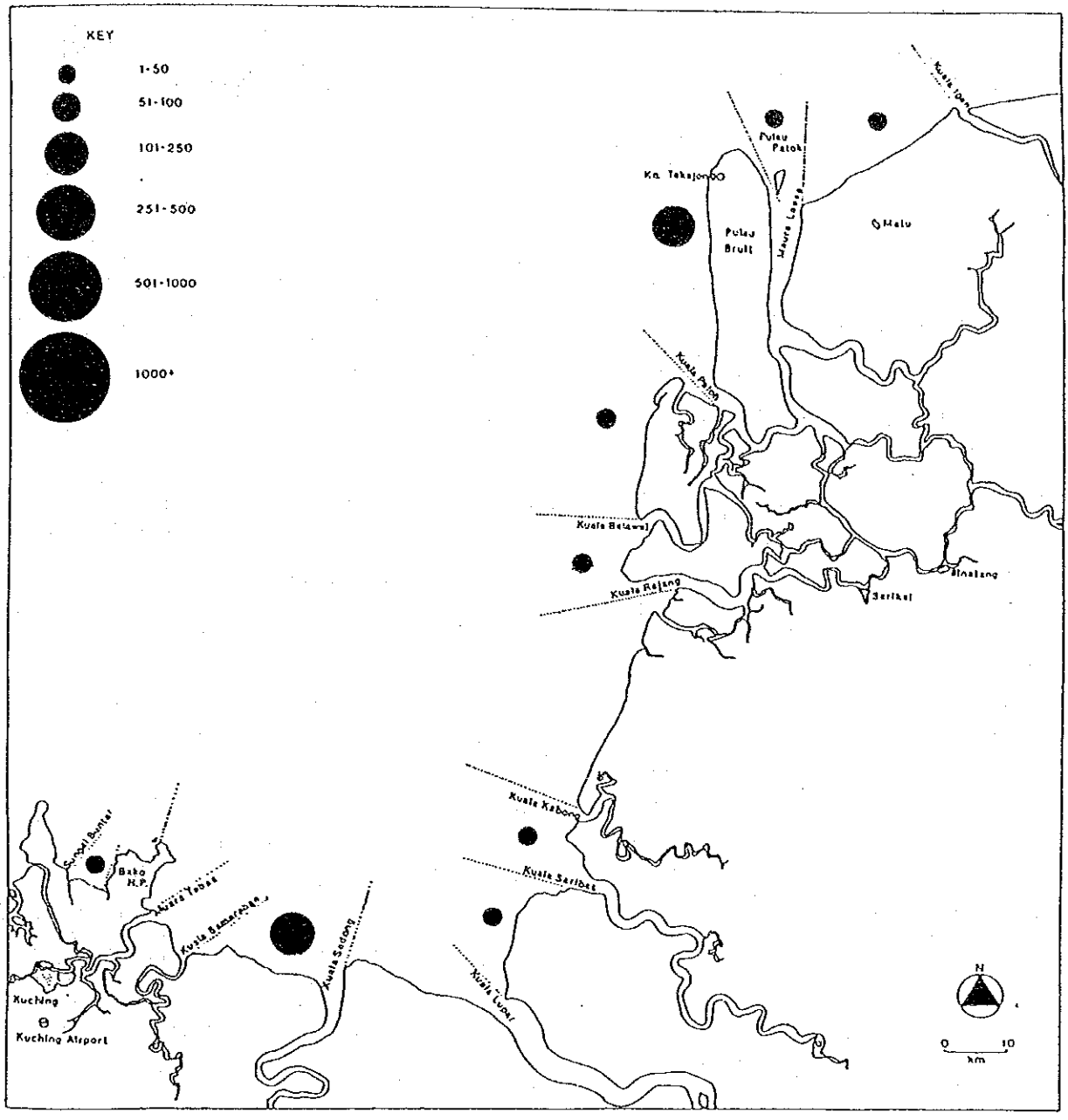


Figure-1.3.6.3 Map showing distribution of egrets by sector along the Sarawak Coast recorded during ground and aerial survey from September to November 1995

1.3.7 HEALTH AND SAFETY

The present situation of Illness in Sarawak is shown in the following table. According to the data, the most common illnesses are Organic diseases.

Table-1.3.7.1 Number of In-Patients by Type of Illness - Sarawak, 1988*

Jenis Penyakit Type of Illness	Dewasa Adult				Kanak-Kanak(Kurang 12 tahun) Children (below 12 years)				Jumlah Total
	Keluar Dari Hospital Discharged		Kematian Deaths		Keluar Dari Hospital Disharged		Kematian Deaths		
	Lelaki Male	Perempuan Female	Lelaki Male	Perempuan Female	Lelaki Male	Perempuan Female	Lelaki Male	Perempuan Female	
Intestinal Infectious Diseases	956	828		1	2,290	1,475	4		5,552
Tuberculosis	1,415	833	33	14	40	18	-		2,306
Viral Diseases	722	411	2	2	274	190	1		1,597
Malignant Neoplasm of Digestive Organs and Peritoneum	417	311	49	21	3	2	-	-	733
Benign Neoplasm	152	565	-	1	18	24	-	-	759
Endocrine and Metabolic Diseases, Immunity Disorders	530	1,095	14	11	36	31	2	-	1,692
Diseases of Blood and Blood Forming Organs	338	485	9	2	454	319	5	3	1,596
Mental Disorders	1,019	1,073	-	3	8	6	-		2,106
Diseases of the Nervous System	470	396	16	9	355	192	14	8	1,413
Disorders of the Eye and Adnexa	752	660			180	126	-		1,718
Hypertensive Disease	741	868	9	4	3	3			1,615
Ischaemic Heart Disease	537	276	70	33		1			814
Diseases of Pumonary Circulation and Other Forms of Hear Disease	826	686	110	95	67	49	18	10	1,628
Cerebro-Vascular Disease	398	264	120	79	7	5	3	3	674
Diseases of the Upper Respiratory Tract	497	434	2	1	789	571			2,291
Other Diseases of the Respiratory System	2,240	1,772	99	56	2,587	1,824	36	24	8,423
Diseases of Other Parts of the Digestive System	4,314	2,818	65	38	665	289	6	11	8,086
Diseases of Vrinary System	1,303	1,302	39	31	397	276	-	2	3,278
Diseases of Male Genital Organs	486		1	-	184				670
Diseases of Female Genital Organs	1	2,304	-	-	1	26	-		2,332
Abortion	-	3,122	-	2	-	-	-	-	3,122
Direct Obstetric Causes	-	6,985	-	5	-	-	-	-	6,985
Indirect Obstetric Caauses	-	824	-	-	-	-	-	-	824
Normal Delivery	-	27,840	-	-	-	-	-	-	27,840
Diseases of Skin and Subcutaneous Tissue	1,541	1,004	-	-	964	758	-	-	4,267
Diseases of the Musculoskeletal System and Connective Tissue	781	683	-	3	118	61	-	-	1,643
Certain Conditions Originating in the Perinatal period	-	-	-	-	3,598	2,861	139	90	6,459
Signs, Symptoms and Ill-Defined Conditions	1,710	1,591	19	19	829	575	3	2	4,705
Fractures	1,601	398	28	4	481	243	-	2	2,723
Intracranial and Internal Injuries, Including Nerves	1,336	338	47	12	209	101	3	-	2,034
Open Wounds and Injury to Blood Veessels	1,821	496	4	-	394	201	-	-	2,912
Other Injuries, Early Complications of Trauma	906	322	7	1	208	136	2	-	1,572
Lain-Lain/Others	3,806	4,339	179	115	1,764	1,220	66	38	11,129
Jumlah Total	31,619	65,373	922	562	16,923	11,583	302	193	125,498

* Di hospital dan klinik Kerajaan sahaja.
At Government hospitals and clinics.
Punca: Jabatan Perkhidmatan, Sarawak.

* Bilangan pesakit dikeluarkan dari hospital termasuk Kematian.
Number of in-patients discharged includes deaths.
Soure: Department of Medical & Health Services, Sarwak.

1.3.8 SOCIAL AND ECONOMIC

(1) Employment

The present situation of the employment in each industry in Sarawak is shown in Table-1.3.8.1. Of these industries, the number of employees in Agriculture, Forestry, Hunting & Fishing is the largest.

However, the share of employees in that sector is changing each year, depending on socio-economic conditions.

Table below shows the percentage distribution of the Labour force.

Table-1.3.8.1 Percentage Distribution of the Labour Force by Major Industry - Sarawak

Perusahaan Industry	1960 Jualah Total	Lekaki Male	Peremapuan Female	1970 Jualah Total	Lekaki Male	Peremapuan Female	1980 Jualah Total	Lekaki Male	Peremapuan Female	1986 Jumlah Total
Pertanian, Perhutanan, Pemburuan & Perikanan Agriculture, Forestry, Hunting & Fishing	81.4	74.0	93.8	68.0	62.7	76.4	60.6	53.3	73.6	51.5
Meloabong & Menggali Mining & Quarrying	0.8	1.4	0.1	0.3	0.5	0.1	0.4	0.6	0.1	0.4
Perkilangan Manufacturing	3.9	5.5	1.2	5.0	6.6	2.6	6.1	6.9	4.6	8.6
Elektrik, Gas, Air & Perkhidmatan Kebersihan Electricity, Gas, Water & Sanitary Services	0.2	0.3	-	0.4	0.6	0.1	0.3	0.4	0.1	0.6
Pembinaan Construction	1.6	2.4	0.1	1.5	2.4	0.1	3.4	5.1	0.4	5.8
Perdagangan Commerce	4.7	6.8	1.2	5.0	6.6	2.3	8.5	9.2	7.2	14.4
Pengangkutan, Penyimpanan & Perhubungan Transport, Storage & Communication	1.9	2.9	0.2	1.8	2.8	0.2	2.2	3.1	0.5	2.7
Perkhidmatan Services	5.5	6.7	3.4	11.0	13.9	6.4	17.5	20.4	12.4	16.0
Tidak Diterangkan atau Diketahui Inadequately Described or Unknown	-	-	-	7.0	3.9	11.8	1.0	1.0	1.1	
Jumlah Total	100.0 (294.285)	100.0 (184.214)	100.0 (110.071)	100.0 (364,100)	100.0 (222,798)	100.0 (141.302)	100.0 (457.192)	100.0 (291.303)	100.0 (165.889)	100.0 (614.300)

(1) Perangkann bagi 1960, 1970 dan 1980 merujuk Kepada angka-angka banci:
1960, 1970 and 1980 data refer to census figures:-

(a) Angka – angka bagi 1960 merujuk kepada penduduk yang aktif secara ekonomi berumur 15 tahun dan lebih.
1960 figures refer to economically active population aged 15 years and above.

(b) Angka - angka bagi 1970 dan 1980 merujuk kepada buruh berpengalaman berumur 10 tahun dan lebih.
1970 and 1980 figures refer to experienced labour force aged 10 years and above.

(2) Angka – angeka bagi 1986 merujuk kepada keputusan dari sempel Penyiasatan Tenaga Buruh yang meliputi penduduk yang bekerja dari isirumah persendirian beruaur 15 hingga 64 sahaja.
1986 data refers to results from the sample Labour Force Survey covering only employed persons in private households aged 15 to 64.

Table-1.3.8.2 Percentage Distribtuion of Labour Force by Major Occupation - Sarawak

Perusahaan Industry	1960 Jualah Total	Lekaki Male	Peremapuan Female	1970 Jualah Total	Lekaki Male	Peremapuan Female	1980 Jualah Total	Lekaki Male	Peremapuan Female	1986 Jumlah Total
Pertanian, Ikhtisas, Teknix & Yang Berkaitan Professional, Technical & Related Workers	2.1	2.5	1.5	3.0	3.5	2.3	5.1	5.3	4.7	6.7
Pekerja Pentadbiran & Pengurusan Adainistrative & Managerial Workers	0.3	0.5	-	0.5	0.8	-	0.7	1.0	0.1	1.0
Pekerja Jualan & Yang Berkaitan Clerical & Pelated Workers	1.5	2.1	0.4	3.1	3.8	2.0	5.2	4.8	5.8	6.1
Pekerja Jualan & Yang Berkaitan Sales Workers & Related Workers	4.0	5.8	1.0	3.9	5.2	1.9	5.3	6.2	3.9	8.4
Pekerja Perkhidmatan Service Workers	2.3	2.6	1.7	5.0	6.1	3.1	7.4	8.0	6.4	8.4
Pekerja Pertanian, Ternakan & Perhutanan, Melayan & Pemburu Agriculture, Animals Husbandry & Forestry Workers, Fishermen & Hunters	81.5	74.0	94.1	67.7	62.4	76.1	56.5	50.4	67.3	50.9
Pekerja Pengeluaran & Yang Berkaitan, Operator Alat Pengangkutan & Buruh Production & Rerated Workers, Transport Equipment Operators & Labourers	8.3	12.5	1.3	9.8	14.3	2.8	14.6	20.3	4.5	18.5
Tidak Diterangkan atau Diketahui Inadequately Described or Unknown	-	-	-	7.0	3.9	11.8	5.2	4.0	7.3	-
Jumlah Total	100.0 (294.285)	100.0 (184.214)	100.0 (110.071)	100.0 (364,100)	100.0 (222,798)	100.0 (141.302)	100.0 (457.192)	100.0 (291.303)	100.0 (165.889)	100.0 (614.300)

(1) Perangkann bagi 1960, 1970 dan 1980 merujuk Kepada angka-angka banci:
1960, 1970 and 1980 data refer to census figures:-
(a) Angka - angka bagi 1960 merujuk kepada penduduk yang aktif secara ekonomi berumur 15 tahun dan lebih.
1960 figures refer to economically active population aged 15 years and above.
(b) Angka - angka bagi 1970 dan 1980 merujuk kepada buruh berpengalaman berumur 10 tahun dan lebih.
1970 and 1980 figures refer to experienced labour force aged 10 years and above.

(2) Angka - angeka bagi 1986 merujuk kepada keputusan dari sempel Penyiasatan Tenaga Buruh yang meliputi penduduk yang bekerja dari isirumah persendirian beruaur 15 hingga 64 sahaja.
1986 data refers to results from the sample Labour Force Survey covering only employed persons in private households aged 15 to 64.

(2) Education

Table below shows the Number of pupils / students in primary and Secondary school.

Table-1.3.8.3 Number of Pupils/Students* in Primary and Secondary Schools - Sarawak

Year	Primary School			Secondary School			Total		
	Aided	Unaided	Total	Aided	Unaided	Total	Aided	Unaided	Total
1979	201,908	146	202,054	83,268	6,528	89,796	285,176	6,674	291,850
1980	206,923	218	207,141	90,982	6,070	97,052	297,905	6,288	304,193
1981	210,183	240	210,423	95,255	4,567	99,822	305,438	4,807	310,245
1982	213,614	253	213,867	100,276	5,014	105,290	313,890	5,267	319,157
1983	216,397	263	216,660	103,452	5,416	108,868	319,849	5,679	325,528
1984	216,621	380	217,001	108,398	6,003	114,401	325,019	6,383	331,402
1985	216,917	395	217,312	111,206	6,610	117,816	328,123	7,005	335,128
1984	217,718	381	218,099	115,724	6,099	121,823	333,442	6,480	339,922
1987	218,501	527	219,028	120,321	6,331	126,652	338,822	6,858	345,680
1988	218,541	562	219,109	121,933	6,320	128,253	340,480	6,882	347,362

* Pada 31 Januari.
As at 31st January.

Punca: Jabatan Pendidikan, Sarawak.
Source: Department of Education, Sarawak.

Other data regarding socio-economic condition of Sarawak, please refer to **Volume II.**

1.3.9 AESTHETIC AND CULTURAL

There are no special aesthetic or cultural features around the project site.

1.4 Potential Impact

1.4.1 Construction Phase

(1) Summary of construction work and related activities

i) Wharves and revetment

The figure below shows the cross sections of the Timber Wharf at depths of 10m & 5m and coal wharf.

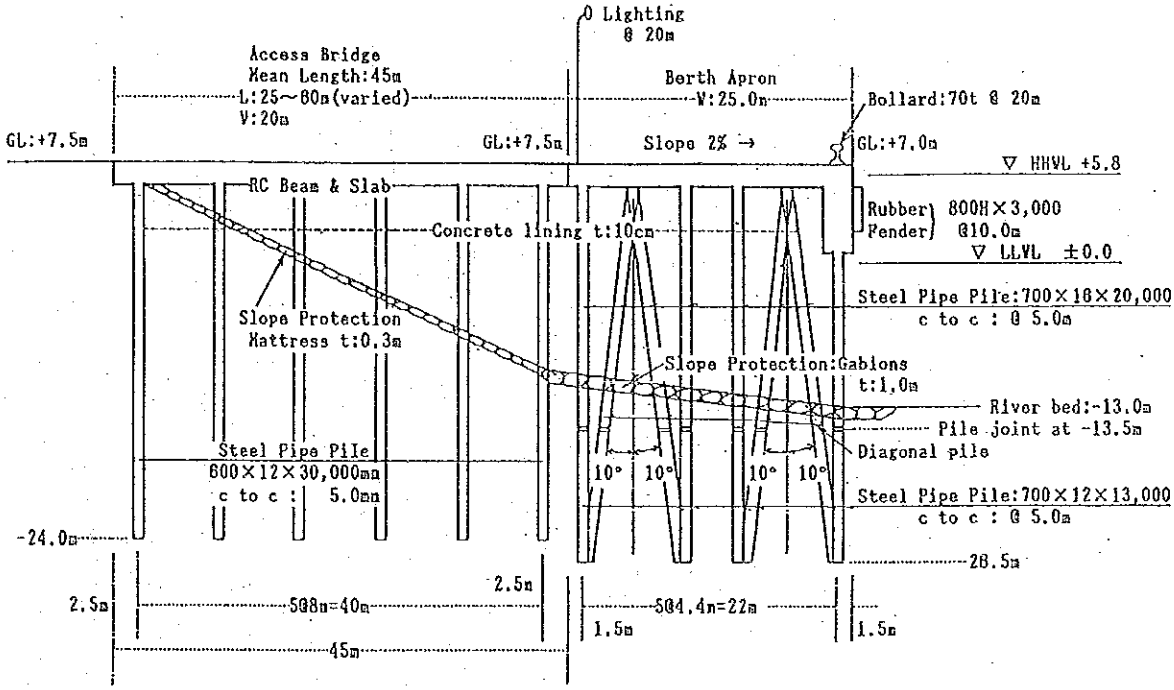


Figure-1.4.1.1 Typical Cross-Section of -10.0m Timber Wharf with diagonal piles at Tg.Sebubal

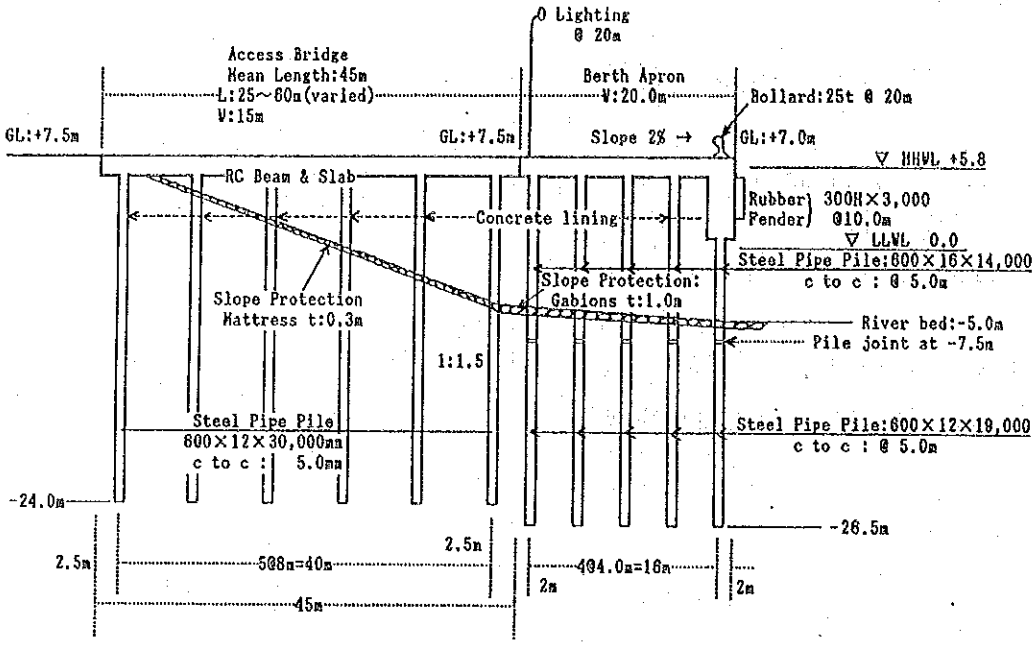


Figure-1.4.1.2 Typical Cross-Section of -5.0m Timber Whar

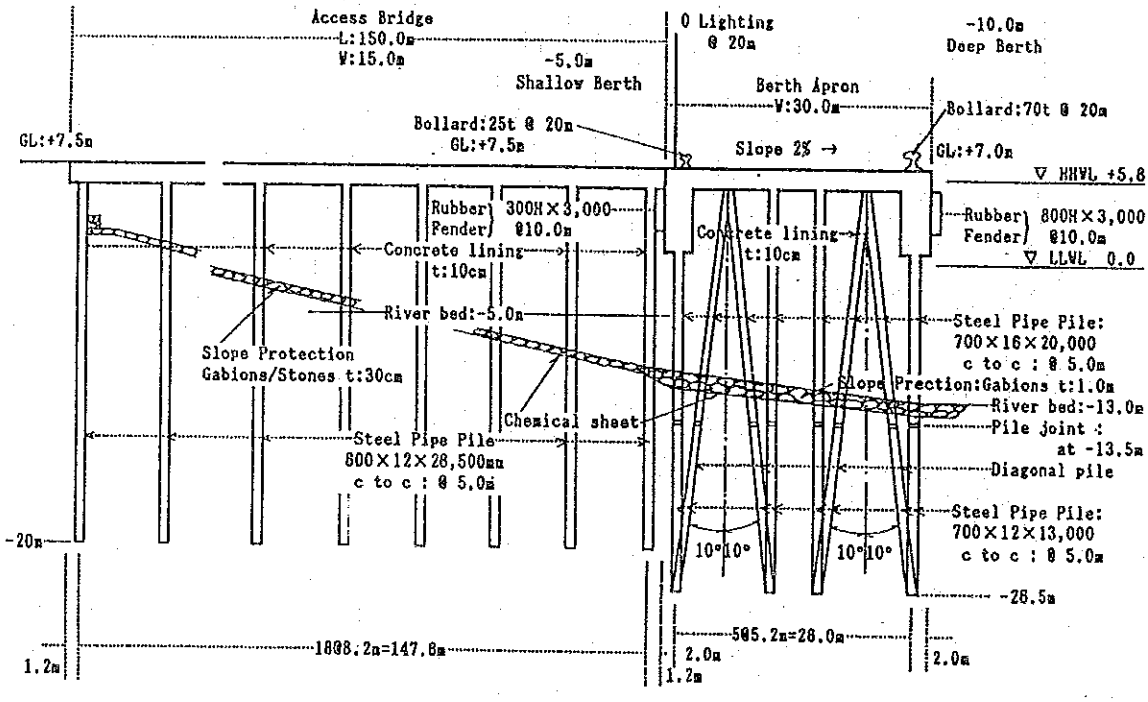


Figure-1.4.1.3 Typical Gross Section of Combined Coal Wharf (Depth of -10 & -5m) for Short-Term Plan at the opposite side of Tg. Sebubal

The relationship between those facilities and activities which will affect the environment are shown in the Tables listed below.

Table-1.4.1.1 The relationship between mooring facilities and activities

Facilities	Quantity	Site Clearing	Burning	Demolish	Earth Works				Piling	Pavement	Revege -tation	Waste Disposal	Erosion Control	Drainage Alternation	Dredging
					Excavation	Backfill	Dynamite	Leveling							
-10m Timber Wharf	350m								O	O			O		
- 5m Timber Wharf	180m								O	O			O		
-10m Coal Wharf	165m								O	O			O		
- 5m Coal Wharf	150m												O		
Revetment	700m	O											O		

To clear the site, trees, including those left as a buffer zone along the shoreline, need to be removed.

With regard to the piling, steel piles should be the base of the access bridge and berth apron.

Pavement refers to the Access Bridge and Berth apron by concrete.

As for Erosion control, the shore should be protected by stone.

Moreover, the line of the wharves is designed to minimize the effect of the river flow.

(Structural type selection of Timber -10m wharf)

- Type of wharf -

Where the water depth is -10.0m in the river a detached pier (see **Figure-1.4.1.4**) is recommended for a structural type of wharf. Because the detached pier will reduce the influence of the structure on the river flow. Furthermore, a detached pier is appropriate under such a ground condition as N value being less than 10.

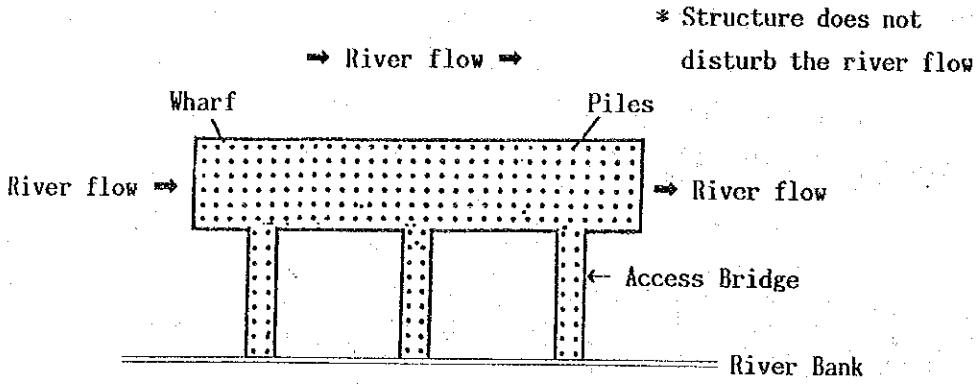


Figure-1.4.1.4 Plane View of Detached Pier

The gravity type (such as Concrete Block, Caisson, Cellar Steel Pile, Monolith Concrete, etc.) and the Sheet Pile type (such as Steel Sheet Pile, Steel Sheet Pipe Pile, etc.) are not recommended as a wharf structure because of disturbance to river flow and relative instability under bad soil condition.

- Comparative study on steel pile foundation with vertical or diagonal piles -

Two types as shown here below will be considered for pile foundation.

1 Vertical pile group with replacement by sand due to soft soil condition

2 Vertical piles with diagonal piles without replacement of soft soil

Item 2 is recommended for timber products wharf at east coast shore site of Tg.Sebubal due to following reasons.

a) Dredging work at the river bed for replacement by sand will induce the environmental impacts.

b) Construction cost of both types is almost same.

Concerning other reasons for the type selection, please refer to **Volume III.2.3.1.**

ii) Turning basin

Although a turning basin will be needed in front of the timber wharves and the coal wharf, the natural depth of the harbour is sufficient for planned use. Indeed, the wharves are designed to utilize natural conditions.

Consequently, only the turning basin will not require dredging.

As for the location of the turning basin, please refer to **Volume II.**

iii) Land reclamation and dredging for landfill

In this project, the land level of the Timber Wharf and the Coal Wharf should be elevated, according to the wharf level. Therefore, some dredging for the acquistion of sand will be required in front of the wharves.

Fig-1.4.1.5 shows the dredging area and **Fig-1.4.1.6-7** shows the reclaimed area in the short-term plan.

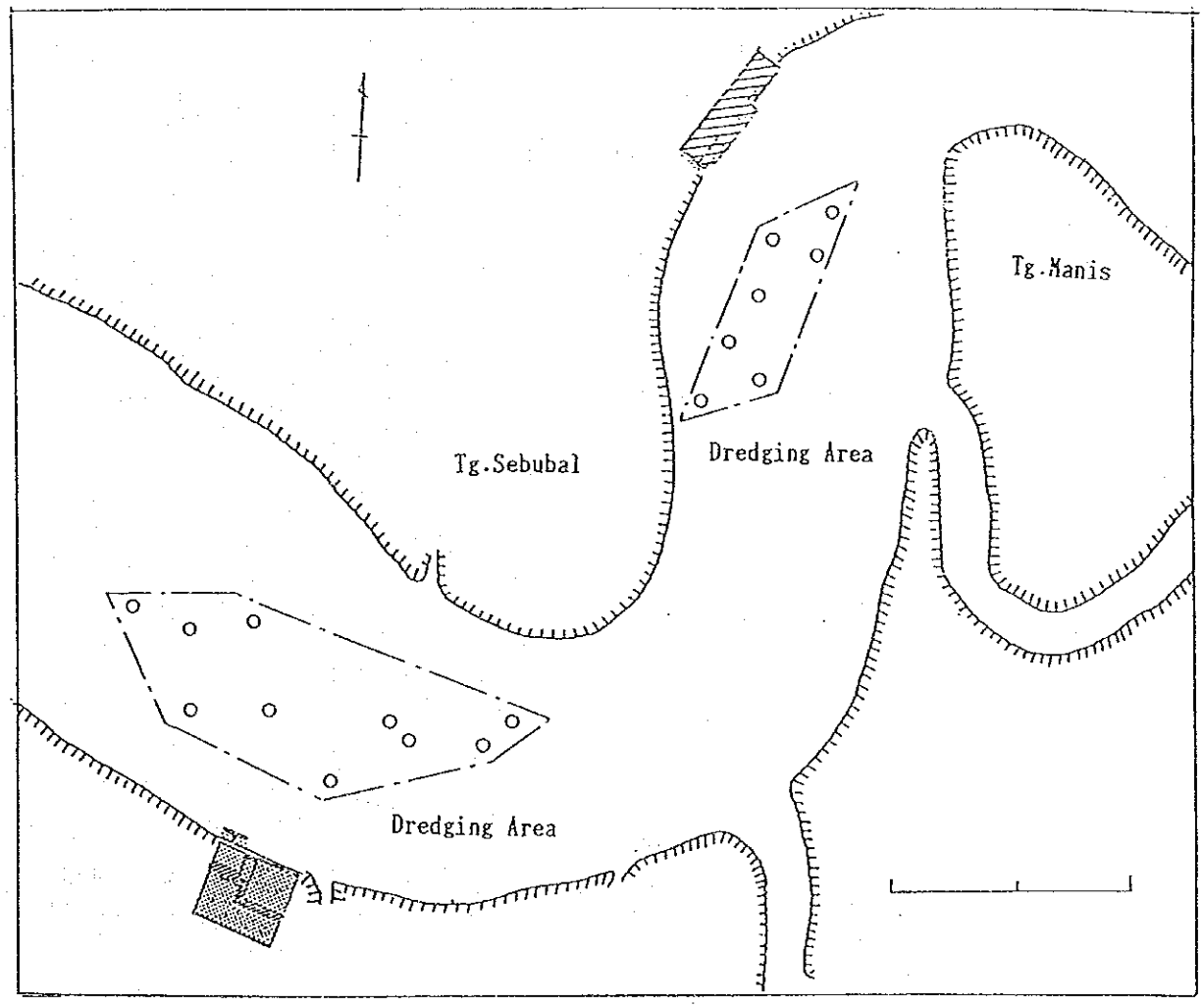


Figure-1.4.1.5 Dredging area

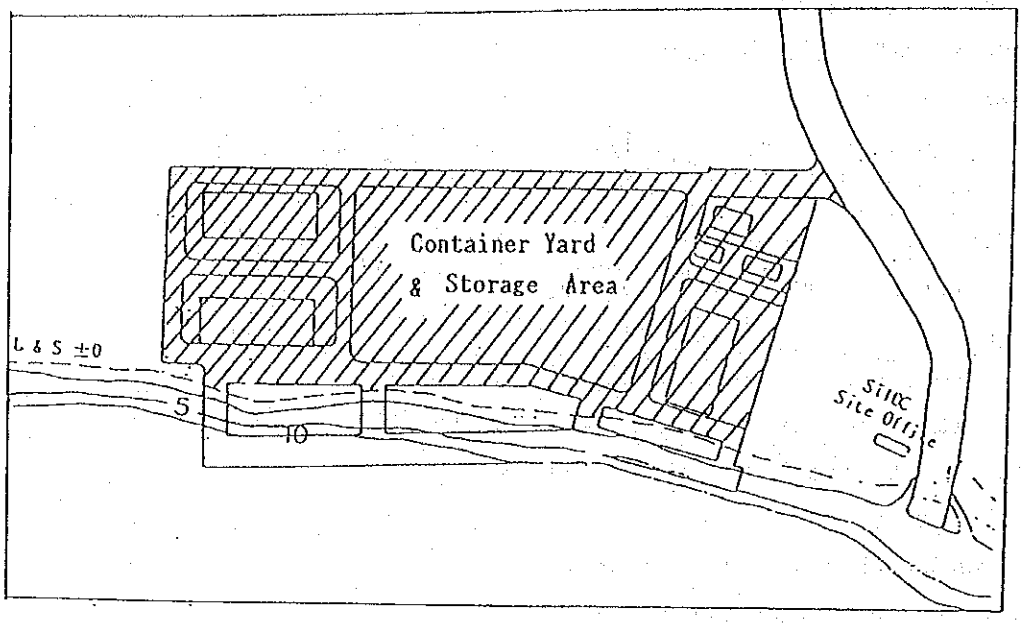


Figure-1.4.1.6 Reclamation area(Timber)

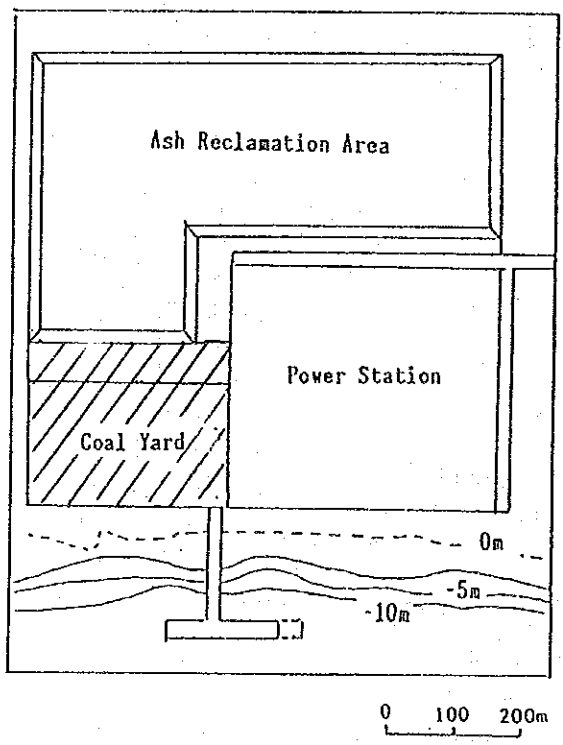


Figure-1.4.1.7 Reclamation area(Coal)

The total volume of dredging will be 449,000m3, which will be divided into 340,000 and 109,000. The former is for Timber port and the latter is for coal port.

Moreover, the surface of reclaimed land should be covered by earth and sand, but those materials will be diverted from excavation and leveling of each site.

iv) Access road

In this project, as vessels are the principal form of cargo transportation, there will be very little demand for a land access road.

However, an access road will be required for port related vehicles from Sarikei to Tg. Manis. **Fig-1.4.1.8** shows the proposed access road. However, the road will be implemented by other public sectors by 1994.

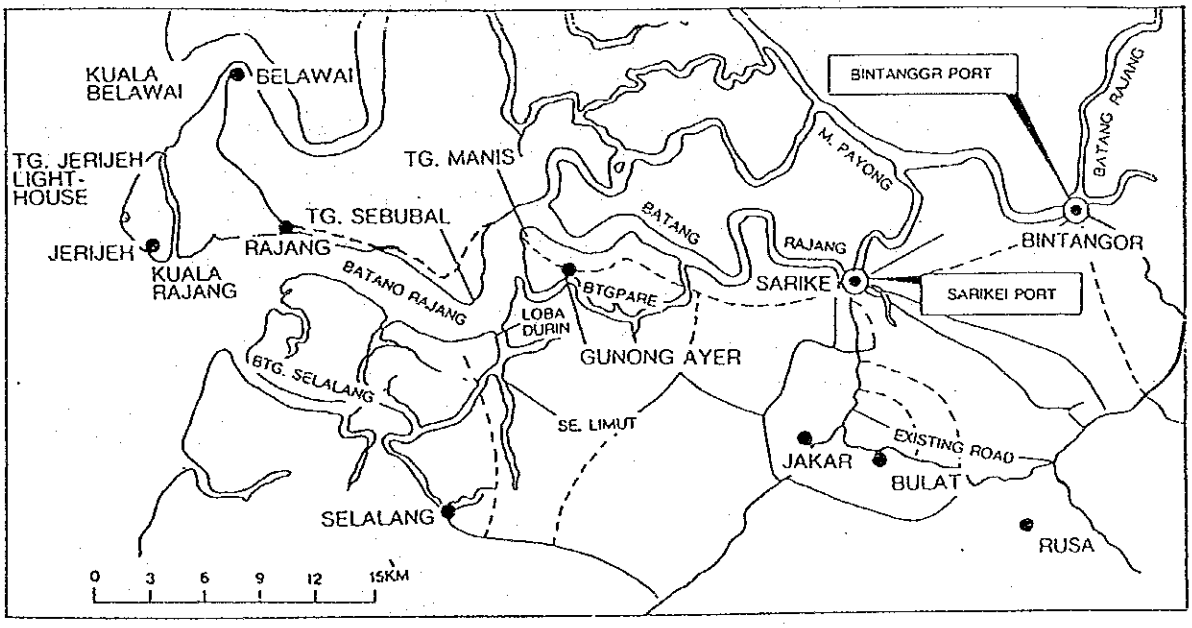


Figure-1.4.1.8 Location of Access Road

If the plan is not carried out, a temporary road will have to be established.

In that case, activities listed on **Table-1.4.1.2** will take place by 1994.

But, as explained above, as the implementation of the road is not included in this project, the environmental impact caused by road work is omitted from the report.

Table-1.4.1.2 The relationship between access road and activities

Facilities	Quantity	Site Clearing	Burning	Demolish	Earth Works				Piling	Pavement	Revege -tation	Waste Disposal	Erosion Control	Drainage Alternation
					Excavation	Backfill	Dynamite	Leveling						
Access Road		O	O					O		O				O

v) Port road

The Figure below shows the port road and others in the port area.

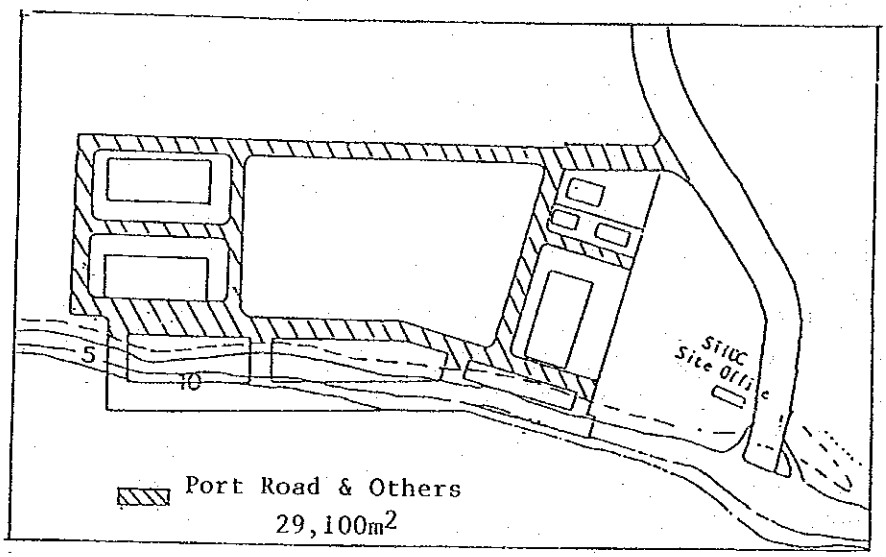


Figure-1.4.1.9 Port Road

A typical cross section of the road is shown in the following sketch.

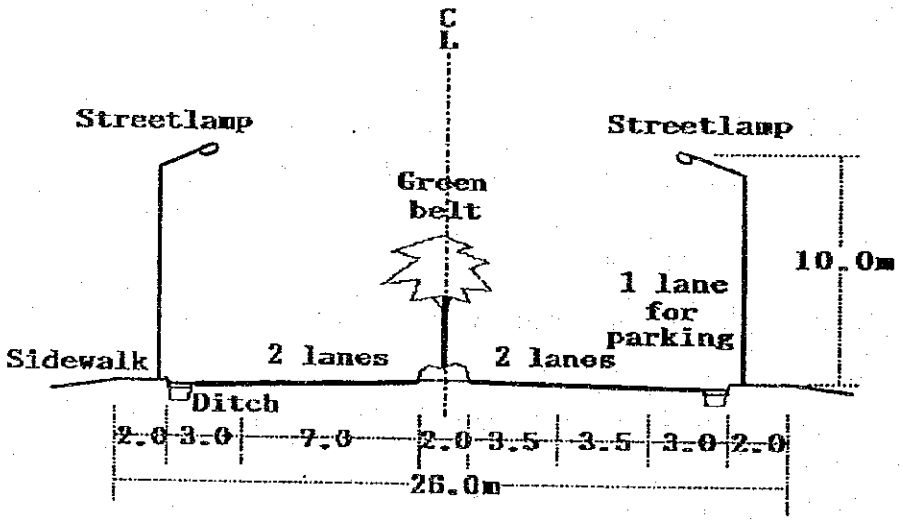


Figure-1.4.1.10 Typical Cross-Section of Road

Activities related to the road construction are listed in **Table-1.4.1.3.**

Table-1.4.1.3 The relationship between port road and activities

Work Item	Quantity	Site Clearing	Burning	Demolish	Earth Works				Piling	Pavement	Revege -tation	Waste Disposal	Erosion Control	Drainage
					Excavation	Backfill	Dycamite	Leveling						
Port Road	29,100m^2							○		○				○

vi) Stock Yard and Open Storage

The proposed stock yard, open storage area and coal yard are shown in the **Fig-1.4.1.11～12** below. A pavement structure of the container yards are shown in **Figure-1.4.1.13.**

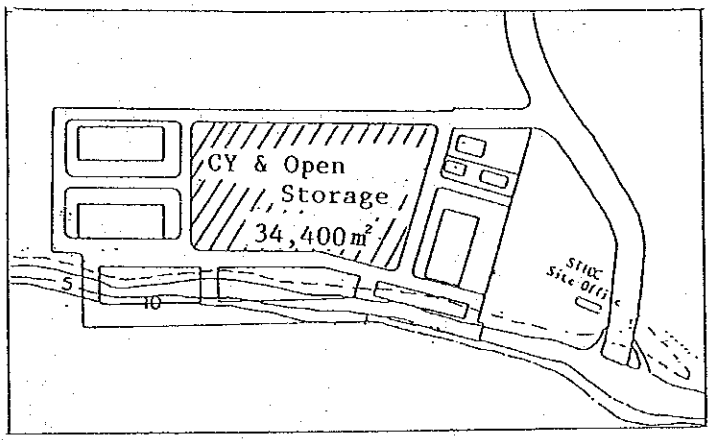


Figure-1.4.1.11 CY & Open Storage

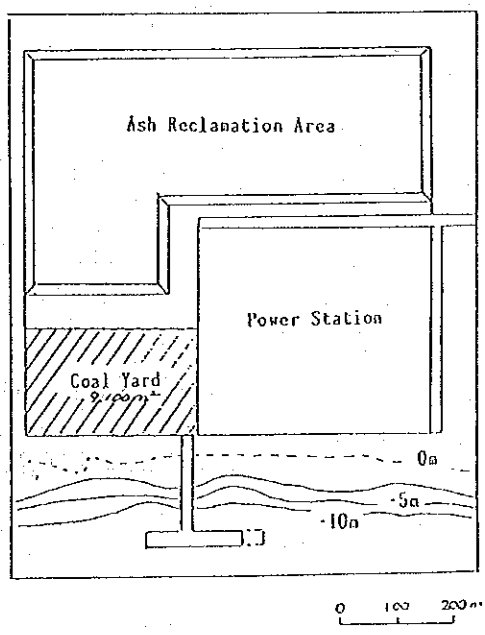
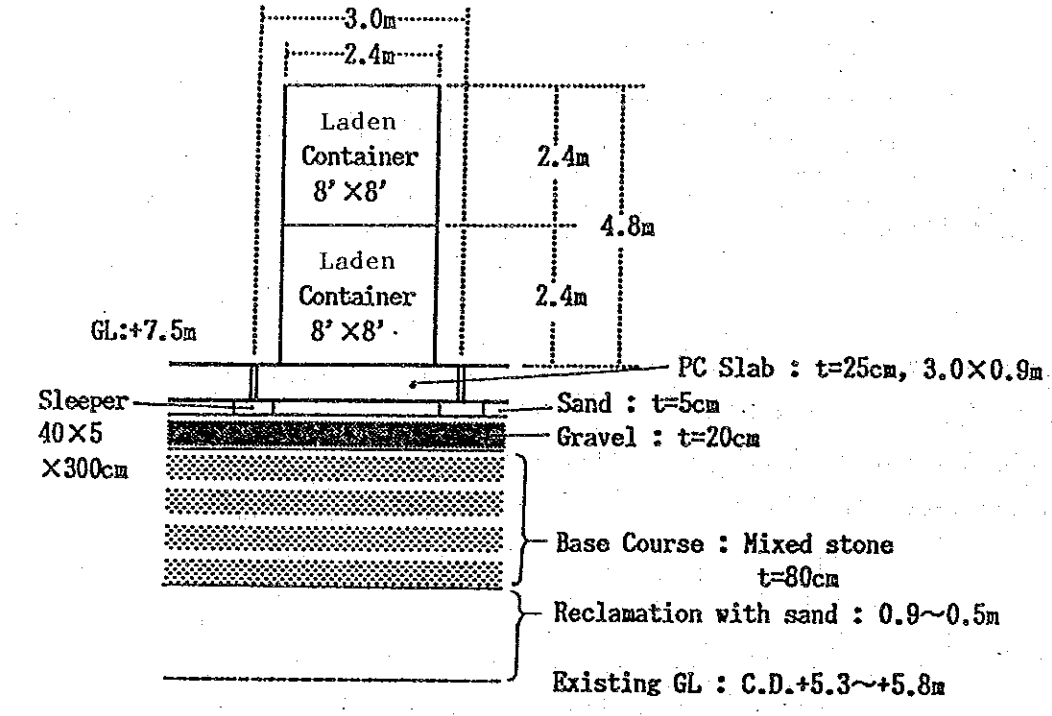


Figure-1.4.1.12 Coal Yard

— For Laden Container Yard —



— For Empty Container Yard and Open Storage Yard —

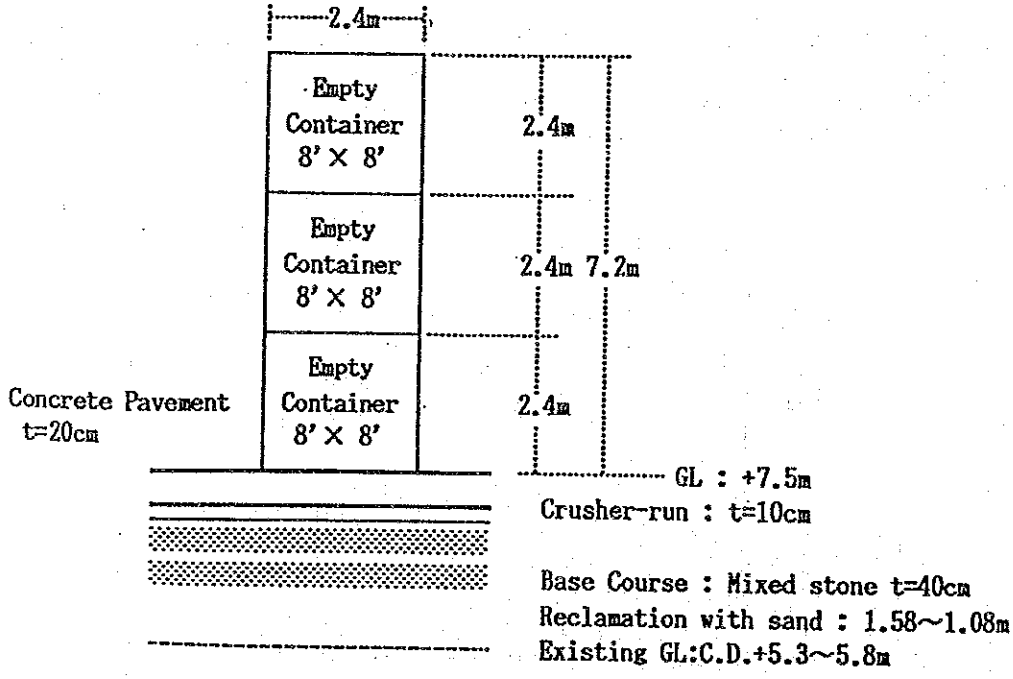


Figure-1.4.1.13 Pavement Structure of Containers Yard

Activities related to the stock yard, open storage area and coal yard are listed below.

Table-1.4.1.4 The relationship between yards and activities

Work Item	Quantity	Site Clearing	Burning	Demolish	Earth Works				Piling	Pavement	Revege -tation	Waste Disposal	Erosion Control	Drainage
					Excavation	Backfill	Dynamite	Leveling						
Stock Yard	48,300							O		O				
Open Storage	9,100							O		O				

vii) Administration Area and Others

In this project, the Administration area will be established as marked below. The land provides for administration buildings of 4,000m^2, a maintenance shop of 1,600m^2 and washing facilities of 900m^2. A total area, thus, of 6,400m^2 is designated as administration land.

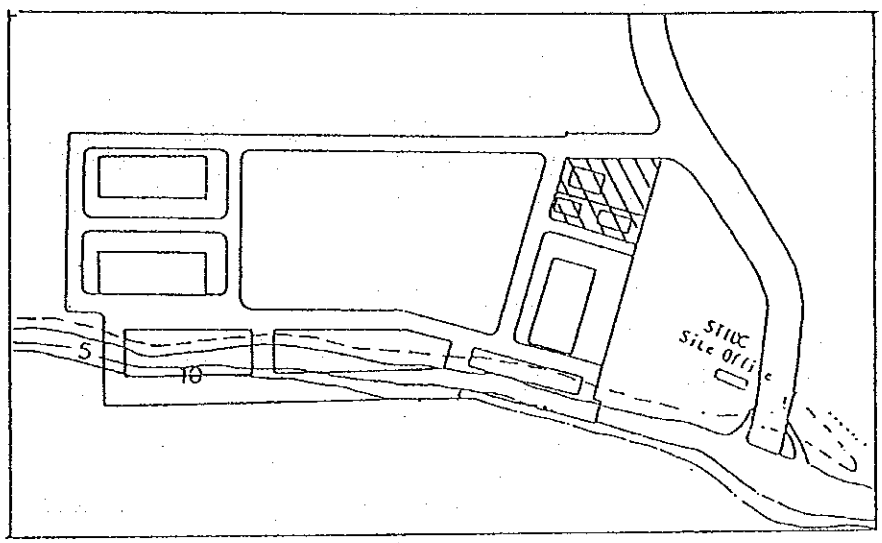


Figure-1.4.1.14 Administration area

Activities related to the administration area are listed in Table-1.4.1.5.

Table-1.4.1.5 Related Activities of Administration Area

Work Item	Quantity	Site Clearing	Burning	Demolish	Earth Works				Piling	Pavement	Revege -tation	Waste Disposal	Erosion Control	Drainage
					Excavation	Backfill	Dynamite	Leveling						
Administration Area	6,400m^2							O		O				

viii) Building Construction

a. Transit shed

In this project, a transit shed will be constructed at the back of the Timber wharf. The structure of the shed is shown in **Fig-1.4.1.15.**

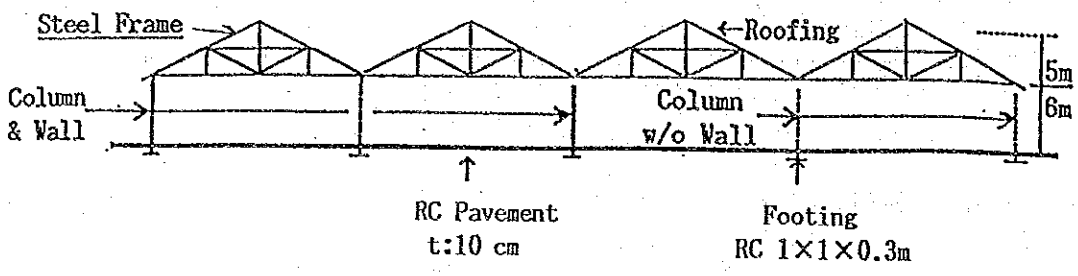


Figure-1.4.1.15 Transit Shed

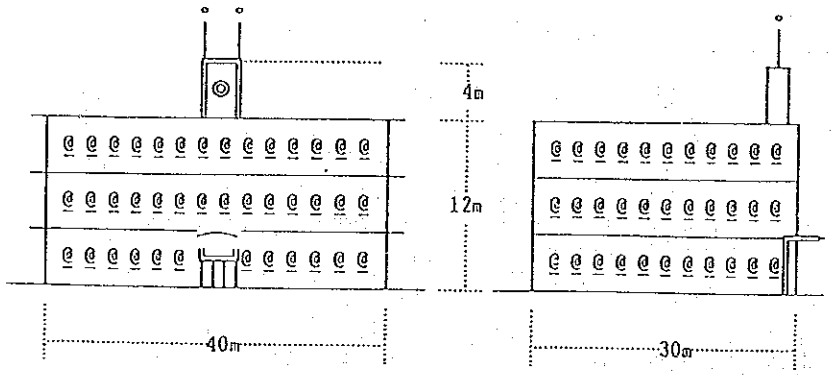
Related activities of the shed are shown in **Table-1.4.1.6.**

Table-1.4.1.6 Related Activities of the Shed

Work Item	Quantity	Site Clearing	Burning	Demolish	Earth Works				Piling	Pavement	Revege -tation	Waste Disposal	Erosion Control	Drainage
					Excavation	Backfill	Dynamite	Leveling						
Transit Shed	11,700m²				○	○				○		○		

b. Administration Building

Administration buildings are proposed at the Timber port and Coal port. Fig. listed below shows rough sketches of these buildings.

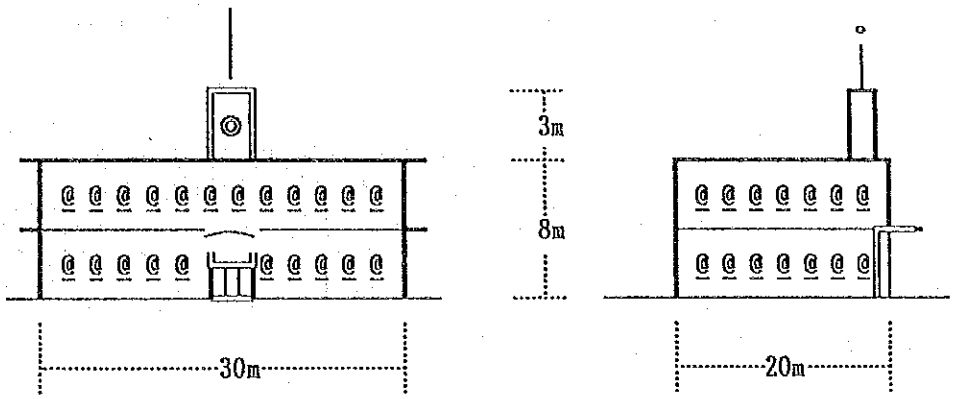


Floor area: 40×30×3F=3,600m²

Structure : RC with A/C, Elec. Gas Water etc.

Foundation: RC pile □ 250×12,000mm c to c : 2.0m

Figure-1.4.1.16 Administration Building at Timber Products Wharf Area



Floor area: 30 × 20 × 2F = 1,200 m²

Structure : RC
with A/C, Elec. Gas
Water etc.

Figure-1.4.1.17 Administration Building at Coal Terminal Wharf Area

Activities related to the building construction are shown in **Table-1.4.1.7.**

Table-1.4.1.7 Related Activities of Administration Building

Work Item	Quantity	Site Clearing	Burning	Demolish	Earth Works				Piling	Pavement	Revege-tation	Waste Disposal	Erosion Control	Drainage
					Excavation	Backfill	Dynamite	Leveling						
Administration					○	○			○	○		○		
Building														

c. Work shop

Fig-1.4.1.18 shows a cross section of the work shop.

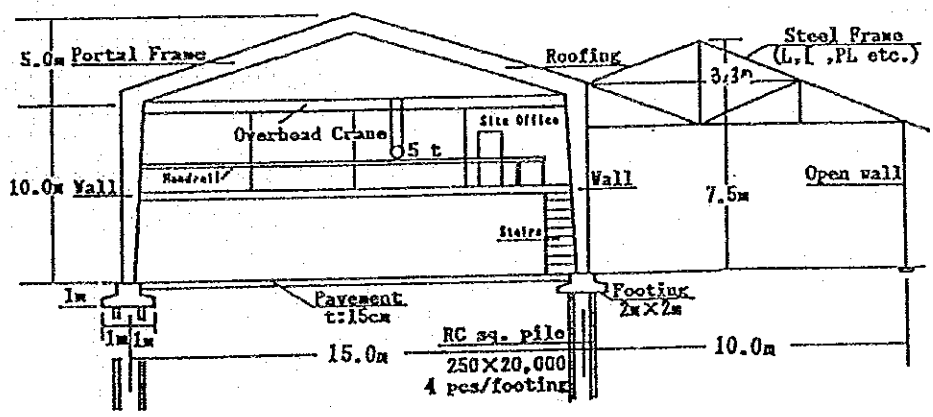


Figure-1.4.1.18 Structural section of Workshop

Related activities for work shop construction are listed in **Table-1.4.1.8.**

Table-1.4.1.8 Related Activities of the Work Shop

Work Item	Quantity	Site Clearing	Burning	Demolish	Earth Works				Piling	Pavement	Ravage -tation	Waste Disposed	Erosion Control	Drainage
					Excavation	Backfill	Dynamite	Leveling						
Maintain Shop	1				O	O			O	O		O		

(2) Construction Schedule and related machines

The table below shows the construction schedule of the Short-Term Plan.

Table-1.4.1.9 Construction Schedule (Short-Term Plan)

Description	Year / Q'ty Month	1991	1992	1993	1994	1995	1996
		6	6	6	6	6	6
1. F/S by JICA	L.S.						
2. E/S (D/D & Survey)	L.S.						
3. Tender for Construction	L.S.						
4. Sungei Merah Oil Jetty	L.S.						
5. Timber Products Terminal							
1) Deep Wharf (-10m)	300 m						
2) Shallow Wharf (-5m)	180 m						
3) Container Stock Yard	23,300 m²						
4) Transit Shed /C.F.S.	12,800 m²						
5) Admi. Building	1,000 m²						
6) Maintenance Shop	700 m²						
7) Washing Facilities	400 m²						
8) Open Storage Yard	8,300 m²						
9) Port Road	26,900 m²						
10) Parking & Paved Area	23,600 m²						
11) Green Area	3,000 m²						
12) Reclamation	340,000 m³						
6. Coal Terminal							
1) Deep Wharf (-10m)	165 m						
2) Shallow Wharf (-5m)	150 m						
3) Coal Stock Yard	25,000 m²						
4) Port Road	2,000 m²						
5) Reclamation	103,000 m³						
7. Cargo Handling Equipment	L.S.						
8. Coal Handling Equipment	L.S.						
9. Navigation System	L.S.						
10. Miscellaneous Works	L.S.						
11. Mobilization	L.S.						

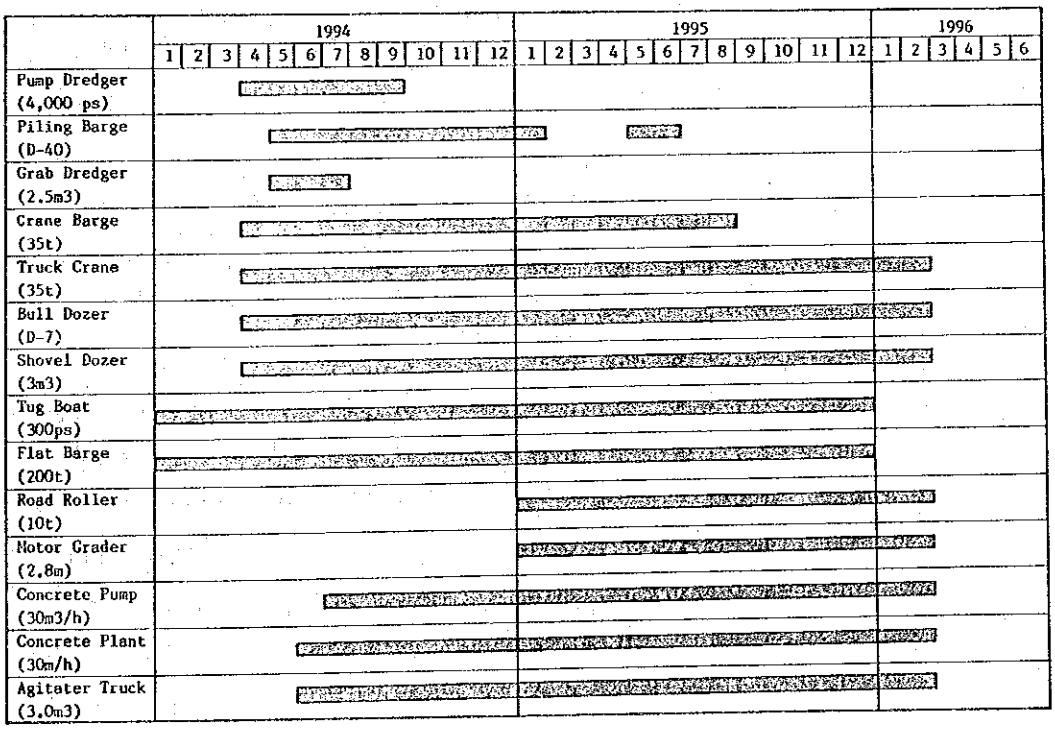
To construct the respective facilities, the construction machines listed below will be required.

Table-1.4.1.10 Construction Machines

Equipment	Timber Wharf	Coal Wharf	Stock Yard	Transit Shed	Adimini Building	Maintenance Shop	Port Road	Open Storage	Nevi System	Dredging Reclamation	Backfill
Pump Dredger (4,000ps)	O	O								O	
Piling Barge (D-40)	O	O									
Diesel Pile Hammer (D-180)				O	O	O					O
Crane Barge (35t)	O	O							O		
Truck Crane (35t)	O	O		O	O	O					
Bull Dozer (D-7)	O	O	O	O	O	O	O	O		O	O
Shovel Dozer ($3m^3$)	O	O	O	O	O	O	O	O		O	O
Tug Boat (800ps)	O	O							O		
Flat Barge (200t)	O	O							O		
Road Roller (10t)			O	O	O	O	O	O			
Motor Grader (2.8m)			O	O	O	O	O	O			
Concrete Pump ($30m^3/h$)	O	O		O	O	O					
Concrete Plant ($30m^3/h$)	O	O	O	O	O	O	O	O	O		
Agitater Truck ($3.0m^3$)	O	O	O	O	O	O	O	O	O		

Taking these tables into consideration, a working schedule for each machine can be summarized as follows.

Table-1.4.1.10



(3) Potential Impact and Examination of Construction Phase.

i) Determination of Causal factors

According to the result of (2), the causal factors (Activities) can be counted as follows.

Table-1.4.1.11 Total Number of Each Activity

Activities	Site Clearing	Burning	Demolish	Earth Works				Piling	Pavement	Revege -tation	Waste Disposal	Erosion Control	Drainage Alternation	Dredging and Reclamation
				Excavation	Backfill	Dynamite	Leveling							
Number	2	1	0	3	3	0	4	5	10		3	5	2	5

ii) Land

Causal factors affecting Landforms are excavation, backfill and leveling. These activities will be carried out at 3 to 4 facilities. However, the basic characteristics of landforms in and around the project site will not be changed as result of these activities.

Regarding soil profile and soil composition, the same factors may be regarded as a cause of change in soil profile and composition.

However the scale of these activities are limited in the building area (In total 14,900m^2), the change in soil composition and the soil profile can be considered to be small.

As for slope stability, the shore will be protected by stones to prevent erosion. The calculation for checking the slope stability against the circle failure was conducted. Moreover, the line of wharves are designed so that the effect on river flow will be as minimal as possible.

Concerning land use, construction work during this time will not interfere with the existing land use listed in **Figure-1.3.1.31** because the location of the port and construction site was determined taking into account the existing land use.

With respect to the coal terminal, though the port facilities will be established in the forest reserve area, the width of the coal yard is only 2.5ha, owned by the State Government. Therefore, the effect on the land use can be regarded as small.

Other items included in the "Land" section are not affected by the activities listed above.