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THE GOVERNMENT OF MALAYSIA
THE STATE OF SARAWAK

MIRI-BINTULU

REGIONAL PLANNING STUDY

SUPPORTING REPORT

No. 5

POPULATION SETTLEMENTS AND INFRASTRUCTURE

—1974—

HUNTING TECHNICAL SERVICES LTD. LONDON

HOFF AND OVERGAARD COPENHAGEN

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C O N V E R S I O N S

ENGLISH AND METRIC EQUIVALENTS

Linear Measures:

1 inch	=	25.4 millimetres
	=	2.54 centimetres
1 foot (12 inches)	=	0.3048 metre
1 yard (3 feet)	=	0.9144 metre
1 chain (22 yards)	=	20.117 metres
1 mile (1 760 yards)	=	1.609 kilometres

Square Measure:

1 square inch	=	6.452 square centimetres
1 square foot	=	9.290 square decimetres
1 square yard	=	0.836 square metre
1 acre (4 840 sq. yards)	=	0.405 hectare
1 square mile(640 acres)	=	259.00 hectares

Cubic Measure:

1 cubic inch	=	16.387 cubic centimetres
1 cubic foot	=	0.028 cubic metre
1 cubic yard	=	0.765 cubic metre

Weights:

1 ounce (16 drams)	=	28.350 grammes
1 pound (16 ounches)	=	0.454 kilogram

Measure of Capacity:

1 pint	=	0.568 litre
1 quart	=	1.137 litres
1 gallon	=	4.546 litres

Velocities:

1 cubic foot per second or 1 cusec	=	0.028 cubic metre per second or cumecs
	=	28.31 cubic decimetres per second
1 gallon per hour	=	4.54 cubic decimetres per day
1 gallon per second	=	4.54 cubic decimetres per second

Temperature:

Fahrengeight	=	9/5 ^{o}C + 32
Centigrade	=	5/9 (^{o}F - 32)

INDEX TO PLANNING MAPS IN THE MAP FOLDER

Scale	Map No.	Title
1: 50 000	20	Detailed Plan Area
1:250 000	21	The Action Programme
1:250 000	22	The Regional Plan

INTRODUCTION AND SUMMARY

This Report gives a picture of the planned future settlement pattern and the infrastructural requirements associated with the developments in the various sectors of production. First the present situation, is described in Chapter 1: Characteristics of the Study Area and Chapter 2: Present Population and Labour. Chapter 3: Regional Development describes the growth potentials and the planned or target development of the various Rural Development Areas (RDA). The RDA's, shown in Figure 3.1, (on Page 15) are geographical divisions of the Study Area delineated by the Consultants on the basis of existing development and future potential. The envisaged investment in the various sectors of production is transformed into Employment Creation and Population Growth in Chapter 4, which also shows the possible consequences of in-migration to the Region and internal migration within it. A discussion of settlement planning goals is given under the heading Urbanisation of the Rural Areas, then this principle is applied to the Study Area, and plans drawn up for the future the settlement pattern (Chapter 5) and Transport Infrastructure (Chapter 6) for the Study Area.

Town plans for various types of settlements are described and presented in Chapter 7: Town Planning, and the public utilities required in Chapter 8: Public Utilities. The Consultants considerations and recommendations with regard to education for work and labour recruitment are presented in Chapter 9: Manpower. The Report has two appendices, Appendix I: Population and Settlements in Malaysia and Appendix II: Sewerage Scheme for Bintulu.

Parts of Chapter 1 and 3 in this Report contain similar information to that given in Supporting Report 2: Agriculture. This repetition is considered necessary in order to make the present Report complete.

CHAPTER 1

CHARACTERISTICS OF THE STUDY AREA

The Study Area, also termed the Region, is situated in the Fourth Division, Sarawak and covers about 3.5 mn acres or roughly 37 per cent of the Division. The Region is about 130 miles long on a line drawn direct from the Brunei border near Kuala Baram to Bintulu and 60 miles wide at the widest point from Kuala Niah on the coast to Long Pila on the Baram river. In 1970 about 115 000 people lived in the Region; that is about 80 per cent of the population in the Fourth Division.

The climate of the Study Area is monsoonal with distinct shifts in the prevailing winds. The two winds and the seasons over which they persist are known as the north-east monsoon (locally called the "Landas") and the south monsoon. On the basis of this circulation pattern four seasons can be distinguished (see Supporting Report 2, Part I). Rainfall is predominantly of the shower type with a more persistant wet period normally occuring during the north east monsoon or "Landas". However heavy rains or longer dryer periods can occur at any time of the year.

In the past the opening up of land for settlement and for agriculture throughout the Fourth Division has been similar to the rest of Sarawak. The rivers have been the highways of the country and people have settled along their banks forming narrow bands of villages, longhouses and cleared land from the estuaries to far inland. The majority of the remaining land between the larger rivers has been left relatively undisturbed. This was particularly true in the Study Area and only recently have some roads been constructed, in particular the Miri-Bintulu road and roads in conjunction with the logging of hill forests, resulting in settlements spreading away from the rivers.

A type of agriculture, made possible by the new Miri-Bintulu road and at present unique to the Study Area, is developing in the Lambir-Subis Development Area. Here pure stands of oil palm are being established on a large scale under estate management.

The river estuaries were the gateways of the country and became important sites for villages of the Malays and Melanaus, relics of the Muslim arrival in the Fifteenth Century. These coastal settlements are generally in a swamp environment where the main occupations of the peoples are fishing, the cultivation of rice, coconuts and sometimes sago. The hilly, rugged and forested inland areas close to the rivers form the background for the shifting cultivation of hill rice by the longhouse people; Ibans and other indigeneous people. The areas where coastal and inland groups meet are also generally the sites of Chinese rural settlements. These settlements though often predominantly Chinese, who hold title to much of the

land they work, also contain farmers of the other main ethnic groups who, to a large extent, are adopting the Chinese pattern of settled agriculture.

At present road communications are poor. Many parts of the Study Area must be considered remote and are accessible only by longboat. In the past the lack of roads has been a constraint to development. Even now the majority of agricultural and forest exploitation inputs and marketable products are still transported by river despite the completion of the Miri-Bintulu road. But this is only a temporary situation. The construction of roads already planned as part of the overall State network together with those recommended in the Regional Plan will change the orientation of movement of goods.

Coastal traffic is overwhelmingly the most important for movement of goods in and out of the Study Area. Sand bars at the mouths of the rivers and the shallow continental shelf along the whole coast are features which hinder the easy development of sea borne transport.

Air communications are of fairly recent origin but are steadily being improved. There are daily scheduled flights by Fokker Friendship planes connecting Miri and Bintulu with Kuching, Sibu, Brunei and Sabah. There is also regular service to Marudi. The runway at Marudi is being improved.

Although there are some large peat swamp areas associated with the larger rivers, most of the land can be described as undulating to rough with average slopes in excess of 10 degrees.

Forest covers nearly 2.8 mn acres, while about 700 000 acres are, or have been, under cultivation of some sort. Settlements and non-agricultural lands total roughly 50 000 acres. A further approximate breakdown of these acreages is given in Table 1.1.

The areas identified at the broad transect soil survey level as having high proportions of land suitable for agriculture total roughly 590 000 acres. These areas are shown on the Regional Plan Map. The total is made up of:-

a) about 170 000 acres in existing Forest Reserves and Protected Forests, (all this land is in the mixed dipterocarp forests: no land in the peat swamps forests has been assumed as suitable for agriculture)

b) about 210 000 acres in land presently occupied, and about 210 000 acres in forest land outside existing forest reservation and protection areas.

TABLE 1.1 ACREAGE OF LAND CATEGORIES IN THE STUDY AREA

Land type	Approximate acreage
A) Forest Areas	
Reserved Forests(1)	
Mixed Dipterocarp Forest Reserves or Protected Forests	1 007 000
Swamp Forest Reserve	346 000
Communal Forests	500
Non-Reserved Forest(2)	
Mixed Dipterocarp Forests	1 149 000
and Swamp Forests	340 700
B) Cultivated Land(2)	
Shifting cultivation	521 000
Wet rice	15 000
Permanent crops	57 000
C) Settlement and Non Agricultural Land(2)	54 000

Note (1) Forestry Department Gazetted acreages.
(2) Areas obtained by planimeter measurement from 1:250 000 scale published land use maps (1968) and Zonation Plan (October 1972).

In addition some 160 000 acres were assessed at the Zonation Plan stage as being possibly suitable for agriculture. Most of this land is already occupied. The unoccupied exploited or currently licenced forest land outside reserved and protected forest is the land which has been selected for early agricultural development aimed at settling people from other parts of Sarawak.

Only little exploitation has yet been undertaken in the Reserved and Protected mixed dipterocarp forests; practically all of it is included in plans, drawn up by a UNDP/FAO Forest Development Team, for exploitation by large timber industry complexes.

CHAPTER 2

PRESENT POPULATION AND LABOUR

This chapter gives brief characteristics and the geographical distribution of the present population and labour force in the Study Area. Such characteristics are the sex, age and ethnic background of the people and their occupations.

2.1 POPULATION CHARACTERISTICS AND GEOGRAPHICAL DISTRIBUTION

In 1970 the Fourth Division had about 140 000 inhabitants or 14 per cent of the population in Sarawak. About 115 000 or 80 per cent of the population in the Fourth Division lived in the Study Area. Table 2.1 shows the composition and geographical distribution of these people within the Study Area. The boundaries of the three Districts are shown in Figure 2.1, together with existing roads and major settlements in the area.

TABLE 2.1 COMMUNITY COMPOSITION BY DISTRICTS IN THE STUDY AREA 1970

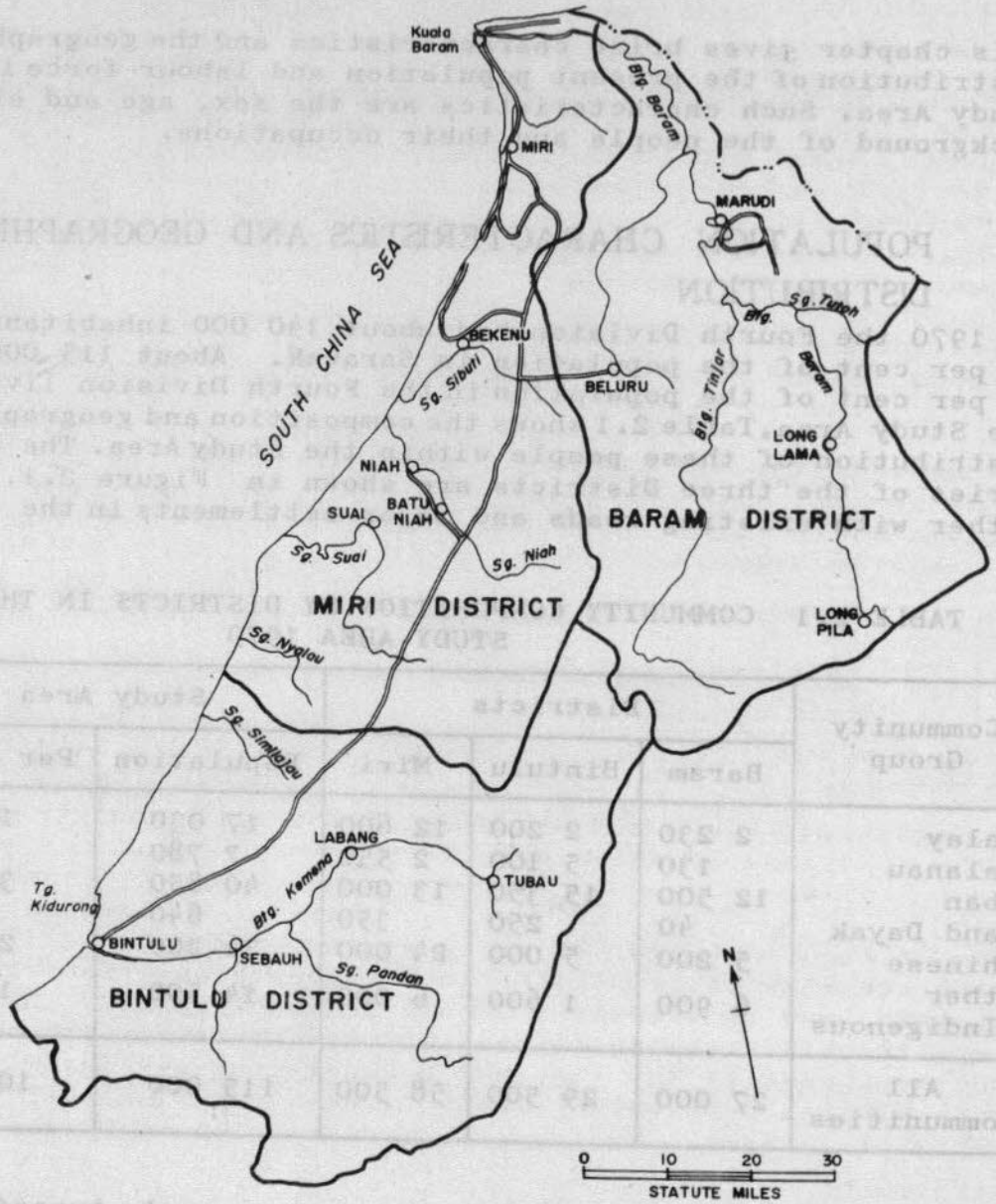
Community Group	Districts			Study Area	
	Baram	Bintulu	Miri	Population	Per cent
Malay	2 230	2 200	12 600	17 030	14.8
Melanau	130	5 100	2 550	7 780	6.8
Iban	12 500	15 350	13 000	40 850	35.5
Land Dayak	40	250	350	640	0.6
Chinese	5 200	5 000	24 000	34 200	29.7
Other Indigenous	6 900	1 600	6 000	14 500	12.6
All communities	27 000	29 500	58 500	115 000	100.0

The locational grouping of different races can be traced back to the effects of early settlement policy and the nature of occupation of the people. The Chinese and Malay population are mainly urban and semi-urban dwellers, the largest concentrations being in Miri and Bintulu towns. Melanaus are heavily concentrated in fishing areas, especially in Bintulu town. The major community group the Ibans, are evenly spread over the Districts and, together with "Other Indigenous" people, they are settled along all major rivers.

The population of the Study Area is predominantly rural, that is, about 40 000 or 35 per cent live in urban or semi-urban areas. The proportions of the urban population vary in the different Districts; about four-fifths of the population in

FIGURE 2.1

ADMINISTRATIVE DISTRICTS



the Baram and Bintulu Districts are classified as rural compared to only half of the population in Miri District.

Miri, Bintulu and Marudi are the only three recognisable fully urbanised centres in the Study Area. Together they have a total population of 37 000. Remaining settlements are small; only six are classified as semi-urban and over 200 as rural settlements.

The 1970 population census figures show that in the Study Area there is an excess of males over females of 60 per thousand people. This is much higher than the State average,

implying that a net migration of males from other parts of Sarawak to the Study Area has occurred. The imbalance is found in all three Districts.

The age group distribution of the population has changed little during the past ten years. The 1970 distribution per thousand people in the Study Area is shown below:

Age group:	0-14	15-64	65 and over
Number of people per thousand population:	441	522	37

In the Baram and Bintulu Districts the proportions of children below 15 years of age are greater than normal, while in Miri District the proportion is below average. These differences are probably due to an out-migration of the working age group (15-64 years) from Baram and Bintulu to the Miri District where most of the new employment opportunities have been created.

The average number of persons per household recorded in the 1970 Census were:-

Baram	Bintulu	Miri	Study Area
6.4	5.9	5.6	5.8

The registered birth and death rates for all community groups in the Study Area differ so much that they cannot be relied upon to estimate a natural population growth rate (number of births less the number of deaths). However, the general tendency is clear: better services and nutrition are leading to a lower death rate, resulting in a higher population growth rate. These trends are and should be counteracted in the future by active family planning. The natural growth of the Study Area appears to be around 2.8 per cent per annum. This may seem high compared to planned growth rates in other countries in this part of the world; for example, Thailand is aiming at 2.5 per cent by 1975, and Indonesia at 1.5 per cent over a somewhat longer period. The overall growth, including in migration, in Fourth Division during the past decade has been 3.4 per cent annually.

2.2 LABOUR

The supply of labour is determined by the following factors:-

- size of the population;
- age structure of the population;
- the lower and upper age limits of people that can be considered economically active.

The population and the age structure have already been quoted; there are about 52 per cent or 60 000 people in the age group

15 to 64 years, which are the chosen lower and upper age limits for what has been termed "the economically active group". The reasons for this choice are:-

- in Sarawak, as in most countries, people younger than 15 years are not considered old enough to undertake a full productive labour task;
- 65 years old is generally considered a suitable age for retirement.

The labour force has been taken as that part of the economically active age group who are willing and able to enter the labour market. In effect this is the people between the ages of 15 and 65 other than students, housewives, the sick, handicapped and pensioners. Information on the numbers in these groups has not been available. However, a reasoned assumption has been made that an appropriate labour participation rate (the proportion of the 15 to 64 age group which is job seeking) would be 90 per cent for males and 60 per cent females. On this assumption the present labour force in the Study Area amounts to 45 000 or 39 per cent of the total population.

Employment is here defined as people gainfully occupied, that is the labour force less unemployed. The Labour Force Survey, which was carried out by the Department of Statistics in 1972 gives information only for the larger towns in Sarawak. According to this Survey 7.2 per cent of males and 8.1 per cent of females in the labour force in Miri were classified as "actively unemployed", that is persons wanting and looking for work. The corresponding figure for "passively unemployed", that is persons wanting work but not looking for it, were 1.8 per cent for males and 15.1 per cent for females. If these figures are applied to the whole Study Area population, the number of actively and passively unemployed would be about 5 000 in each group. Most of passively unemployed people are, however, regarded as part of the under-employed or people engaged in low productivity activities, because it is believed that these groups overlap to a large extent. The number of partly or fully employed persons in the Study Area was estimated at 39 000 in 1970. This corresponds to an employment rate of 34 per cent, that is the number of employed as a percentage of total population. The present employment structure of the Study Area is shown in Table 4.2 in Chapter 4.

In a society such as that in the Study Area which has both a "modern" and a "traditional" sector the distinction between employed and unemployed is not as clear as in a modern western society. A large part of the population in the Study Area is living in a subsistence economy which is only little influenced by, and has little influence on, the rest of the economy. In this part of the society low productivity or under-employment particularly prevails. These are people who are not working full hours or those who are employed in activities which make relatively little contribution to the National Product. The people who mainly constitute this group in the Study Area are those who in the population census are termed "padi workers".

According to the 1970 Census such people total about 21 000 or nearly half the estimated labour force. 85 per cent of the farmers recorded that during the padi planting season they worked three hours or more per day. After padi planting, however, a significant proportion of the padi workers are underemployed, although they use some of their time in the building and maintenance of houses, tool construction and repair, hunting, fishing and gathering of forest produce.

In establishing the employment structure in the Study Area, a low productivity worker is assumed to equal two-thirds of a full time worker. The number of padi workers are evenly distributed throughout the three Districts in the Study Area.

The employment structure shown in Table 4.2 in Chapter 4 shows that the primary sector: agriculture, forestry, fishing and mining is the largest employer of labour having nearly 65 per cent of all occupied people. The importance of this sector varies over the three Districts. In the Miri District about 50 per cent of those employed were engaged in primary activities compared to as much as 85 per cent in each of the other Districts.

The non-primary occupations, that is manufacturing and construction and the various types of public and private services, accounted for about 35 per cent of the total occupied people. Most of this employment is concentrated in the Miri District, which has about 75 per cent of all non-primary occupied. In more detail, the Miri District has about 75 per cent of the manufacturing, 60 per cent of the trade, 70 per cent of the private services and 80 per cent of the employment in electricity, water, banking, insurance and public administration in the Study Area. Most of these work places are located in the Miri-Lutong area.

CHAPTER 3

REGIONAL DEVELOPMENT

This chapter deals with the geographical distribution of the planned development. It describes the location of agricultural development, the siting of towns, industries, transport lines and terminals, as well as the associated movement and growth of population. All which these in turn depend on:-

- the natural geography of the area: topography, rivers, soils, vegetation, mineral deposits and climate; and on
- the cultural geography, that is, man-made geography such as roads, ports, towns and cultivated areas.

The planned regional structure by 1990 is shown on the Regional Plan Maps. An intermediate stage, following implementation of the Action Programme by the end of 1980, is shown separately on the Action Programme Map. (Map Nos. 21 and 22 in the Map Folder)

The present chapter combines the development proposals from various sectors. Details of the proposed development in these sectors are given in the respective Supporting Reports, and in successive chapters in this report.

3.1 GROWTH POTENTIALS BY RURAL DEVELOPMENT AREAS

For planning purposes the Study Area has been divided into nine Rural Development Areas (RDA), which together contain more than 90 per cent of the population in the Region. The size, shape and location of the Areas have been determined mainly by physical, organisational, management, processing and investment factors within agriculture, but they have also been adjusted to fit into the general regional planning. Each area consists of land that can largely be developed independently as a viable development package based on agriculture and forestry, but development in one area could be mutually supporting or associated with previous or subsequent development in an adjacent area. The division of the Study Area into Rural Development Areas is shown in Figure 3.1.

The activities planned in each RDA follow a principle of concentrated development to form a nucleus from which further development can spread outwards. In four Areas the nuclei already exist, namely the towns of Miri, Bintulu and Marudi in their respective RDAs, and the oil palm estates of the Sarawak Oil Palm Berhad (SOP) and the Sarawak Land Development (SLDB) in the Lambir-Subis RDA. In the land around these nuclei only expansion of development has to be planned, while in the other RDAs the nuclei themselves have to be created. In all cases it is intended to combine and integrate forest exploitation and agricultural development with all the other activities necessary to create a modern society, namely improved

transport and communication facilities, urbanisation, establishment of industries and provision of services such as education, medical care, administration and the supply of public utilities such as water and electricity. The agricultural development is planned to be carried out largely by the SLDB and the Department of Agriculture but also by private organisations and individuals. New forest development will be mainly under the suspices of Sarawak Timber Industry Development Corporation (STIDC) and will be associated with large timber complexes based on the FAO Units 1, 2, 3 and 7. Industrial growth and private services will be based on private investment promoted and guided by Sarawak Economic Development Corporation (SEDC), and Government will provide the necessary infrastructure such as roads, public services and utilities. The urban infrastructure is planned to be phased and located according to town plans continuously reviewed by the Land and Survey Department.

The planned regional development is described in two phases:-

- 1970 to 1980 which includes the six year period of the Action Programme, from 1975 to 1980,
- 1981 to 1990, which completes the 20 year period covered by the Regional Plan.

3.1.1 The Miri RDA

The Present Situation

Population 1970:

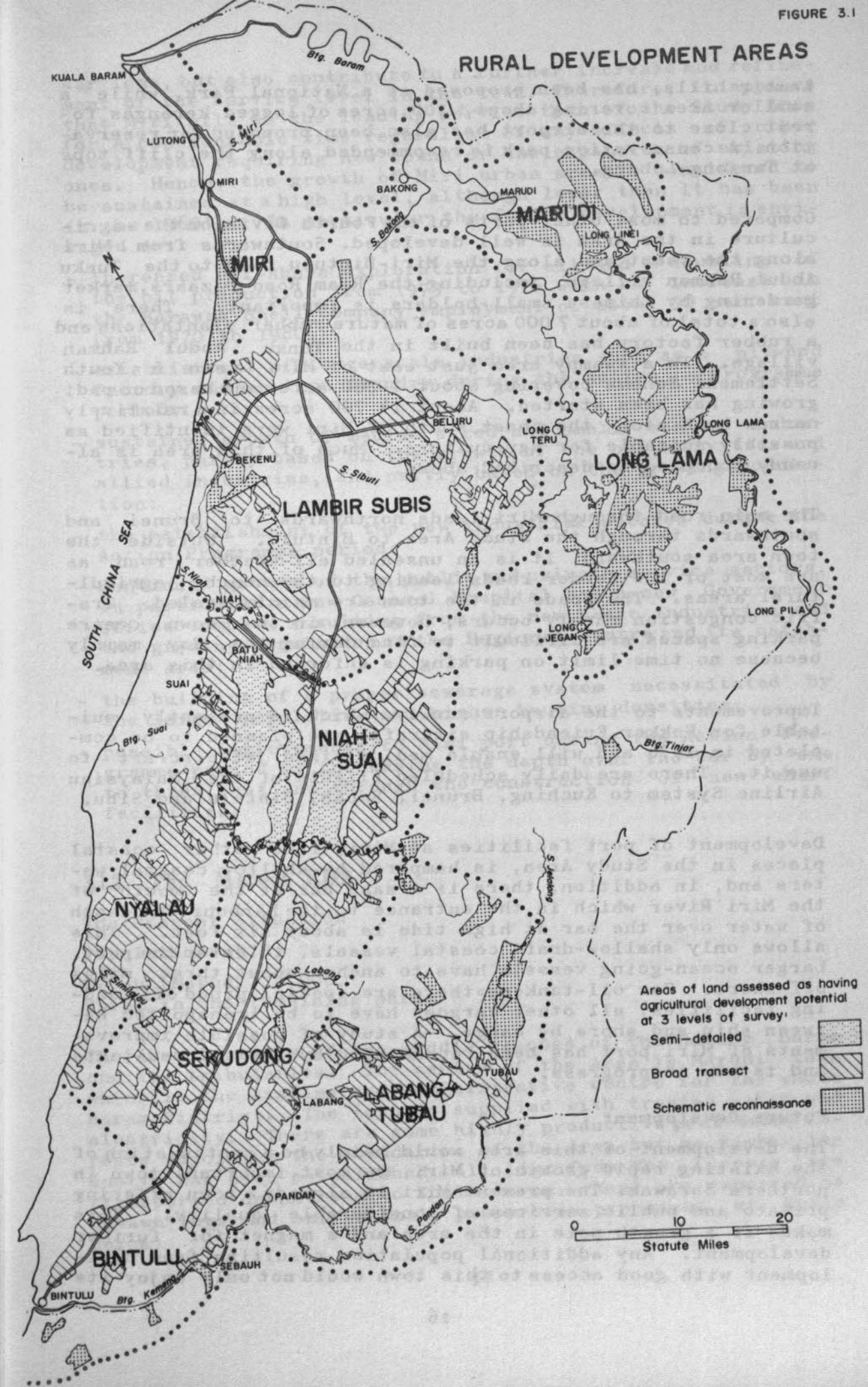
Urban (Miri, Lutong) 27 000,
Rural and semi-urban in the remaining parts 8 000.

The activities associated with the exploitation of oil and natural gas occurring in the vicinity of Miri and off-shore has been the reason for the relatively advanced development of Miri town and the land immediately around it. The Sarawak Shell Company oil refinery at Lutong and extensive off-shore drilling activities in total employs about 1 000 people. Miri town is a commercial bazaar and a Government Divisional administrative headquarters with service functions reaching all over the Fourth Division. The town has a modern supply of treated water, electricity is supplied by a new gas powered plant. In Miri town the population relies, with one exception, on individual septic tanks or some less satisfactory methods of sewage disposal.

The SLDB is constructing an palm oil storage terminal on the bank of the Miri River north of the town and there is a small ship building industry and some small and medium sized sawmills in the town.

All the forest in the Area has been exploited. About 17 000 acres of steep, rugged, forested terrain, which includes the

FIGURE 3.1


RURAL DEVELOPMENT AREAS
KUALA BARAM
Btg. Baram
LUTONG
S. Miri
MIRI
BAKONG
MARUDI
MARUDI
LONG LINEI
S. Bakong
MIRI
BELURU
LONG TERU
LONG LAMA
LONG LAMA
BEKENU
S. Sibuti
LAMBIR SUBIS
SOUTH CHINA SEA
S. Niah
NIAH
LONG PILA
LONG JEGAN
BATU NIAH
SUAI
Btg. Suai
NIAH-SUAI
Btg. Tinjar
S. Jelalong
NYALAU
S. Similigi
S. Labang
SEKUDONG
TUBAU
LABANG
LABANG-TUBAU
PANDAN
S. Pandan
BINTULU
SEBAUH
BINTULU
Btg. Kemena
Areas of land assessed as having agricultural development potential at 3 levels of survey¹
Semi-detailed
Broad transect
Schematic reconnaissance
0
10
20
Statute Miles

Lambir hills, has been proposed as a National Park, while a smaller area covering about 1 300 acres of logged kerangas forest close to the airport has also been proposed for reservation. A conservation park is recommended along the cliff tops at Tanjong Lobang.

Compared to most other parts of the Fourth Division the agriculture in the Area is well developed. Southwards from Miri along the coast and along the Miri-Bintulu road to the Tunku Abdul Rahman village, including the Riam Road Bazaars, market gardening by Chinese small-holders is important. There is also a total of about 7 000 acres of mature rubber plantations and a rubber factory has been built in the Tunku Abdul Rahman village. In a swampy area just east of Miri town a Youth Settlement Scheme covering about 1 200 acres and based on padi growing has been started. About 14 700 acres in a relatively narrow band along the coast south of Miri were identified as possibly suitable for agriculture. Much of this area is already occupied as described above.

The main road through Miri leads northwards to Brunei and southwards through the Study Area to Bintulu. Outside the town area southward, it is an unsealed all-weather road as are most of the feeder roads leading to the nearby agricultural areas. The roads in the town are mainly sealed. Traffic congestion rarely occurs, however, in the town centre parking spaces are difficult to find during the day mainly because no time limit on parking is enforced in this area.

Improvements to the airport runway, which is presently suitable for Fokker Friendship aircraft, are planned to be completed in 1976 and will enable medium sized jet-aircraft to use it. There are daily scheduled flights of the Malaysian Airline System to Kuching, Brunei, Sabah, Bintulu and Sibu.

Development of port facilities at Miri, like other coastal places in the Study Area, is hampered by shallow coastal waters and, in addition, there is a sand bar at the mouth of the Miri River which is the entrance to the harbour. The depth of water over the bar at high tide is about six feet. This allows only shallow-draft coastal vessels, to enter the port. Larger ocean-going vessels have to anchor about three miles off-shore. For oil-tankers there are special piped oil loading facilities; all other cargoes have to be transported between ship and shore by barge. A study of possible improvements of Miri port has been recommended by the Consultants and is now in progress.

Future Development

The development of this area would mainly be a continuation of the existing rapid growth of Miri, the most important town in northern Sarawak. The present Miri is already a town offering private and public services of considerable quality. This makes it a growth pole in the area and a magnet for further development. Any additional population resulting from development with good access to this town would not only enjoy its

services, but also contribute to a further increase and refinement of the service level in the town. Therefore, it appears that Miri will be the leading service town of the Study Area for a considerable time regardless of any effects of other development requiring new towns or the expansion of existing ones. Hence, the growth of Miri urban area is considered to be sustained at a high level, although lower than it has been in the 1960's. In particular the future development is envisaged as:

- increased off-shore exploration for oil and a doubling of the oil production from 1973 to 1976 with an increase in the Sarawak Shell Company employment of about 50 per cent from 1970 to 1980;
- establishment of large scale industries such as a plywood factory and an iron foundry during the Action Programme period;
- sustained growth of medium sized and small scale industries, partly based on the growth of the oil activities and allied industries, and partly based on the growing population;
- the establishment of two new industrial estates during the Action Programme period;
- continued growth of the public and private service sectors, in particular a new General Hospital and a new Government Office complex resulting from the new basic industries and the growing population in the Regional Centre and its catchment area;
- the building of a proper sewerage system necessitated by the larger population and higher housing densities;
- possible improvements to Miri port during the Action Programme period by increasing the depth over the bar by one to three feet and through the construction of new wharf facilities.

3.1.2 The Marudi RDA

The Present Situation

Population 1970:

Urban (Marudi) 4 000,
Rural in the remaining parts 7 500.

The Area consists of the middle reaches of the Batang Baram and its tributaries. The centre of the Area is Marudi town which is the trading and administrative centre for the whole Baram District. The town is supplied with treated water and electricity. There are some highly productive peat-swamp forests adjoining the boundaries of the Area but no timber industry has been established; all logs from the forests are transported downstream to Kuala Baram. Most are exported as unsawn logs and only a small proportion processed at Kuala Baram.

Apart from some 7 000 acres of rubber around Marudi town and roughly 2 000 acres at Kampong Karop the farming consists mainly of diversified crops along the river levees and shifting hill rice cultivation in the hills east of Marudi. Although much of the rubber comes from low yielding trees and from plantations which have been sadly neglected it still represents a large potential production which should be properly exploited.

There are scheduled daily flights by light aircraft of the Malaysian Airline System to Marudi from Miri and the airport runway is being improved which will facilitate the regularity of the flights. However, the Baram River and its tributaries will remain, for a long time, the main line of communications. It is navigable by large launches and tugs northwards to the coast and quite far southwards into the interior. Marudi is at present served by shipping services to Singapore and Peninsular Malaysia via transhipment at Labuan in Sabah, a weekly launch service to Kuching and a daily launch service to Miri via Kuala Baram. The existing circular road system is presently being extended to Long Linei.

Future Development

Marudi town is not anticipated to expand much in the future, partly because of a lack of unoccupied land in its nearby catchment area, partly because of the expected increased growth and importance of Long Lama and partly because of its lack of direct road connection to Miri.

Some 35 000 acres of land east and south east of Marudi were identified by schematic reconnaissance soil and terrain studies as possibly suitable for agriculture. Although much of this land is already occupied it represents the main areas for further agricultural development. This development, it is recommended, should be based largely on the production of rubber. Marudi town is already a rubber market and collection centre and this function should be strengthened. Attempts should be made to make it the rubber centre of the whole Baram river system which would then make the town an ideal site for a rubber processing factory. In order to increase future production of rubber and create a firm basis for future improved processing facilities it is proposed that a road based improvement scheme, be started along the new road to Long Linei. The road based improvement scheme is planned to start in 1976 and be undertaken by a team from the Agricultural Development Unit (ADU).

Although Long Lama will be connected to the Miri-Bintulu road in 1977 and thus be in a more favourable position as a trading centre for the upper Baram area, Marudi will continue to be the main trading centre for the whole Baram system for several years to come and will remain the centre for the middle reaches of the Baram and its tributaries. However, if Marudi is to keep its position as the main District centre for the whole of Baram, it is the Consultants' opinion that a direct road connection to Miri via Bakong will be needed. With this

road the distance to Miri will be 38 miles only, while the distance to Miri via Long Lama will be 130 miles, and to Bintulu 187 miles. The road via Bakong would shorten the distance between Marudi and a possible future deep water port in Bintulu by about 40 miles. Moreover, the town will then be less than an hours run by car from Miri airport which could obviate the need for an airport at Marudi. It is recommended that a study of a direct road link to Marudi is carried out as soon as possible.

Although the future growth and importance of Marudi will depend on whether such a road link is feasible, the town will in any case be affected by competition from Long Lama as the possible new District centre for the upper Baram.

Because of these constraints to the growth of Marudi it is expected that the population growth will be at a moderate level. The existing Marudi water works are already planned to be uprated in 1974; therefore no additional plant is included in the Action Programme. A main sewerage system is proposed for the high density residential areas in the town.

3.1.3 The Lambir-Subis RDA

The Present Situation

Population 1970:

Semi-urban (Bekenu) 700;
Rural and semi-urban in the remaining parts 18 300.

All forest in this Area, except that in the proposed Niah National Park, has been exploited but some valuable marketable timber still remains; this should be extracted from all areas destined for agricultural development by salvage logging operations.

The central part of this Area - the Lambir-Subis Development Area - was selected for intensive development and planned in 1966/67. Large-scale oil palm planting has since been undertaken by the SLDB and SOP. The Niah National Park, though not officially gazetted, was proposed as such in 1961. Much of the remaining land is already occupied, most of it for shifting cultivation of hill rice. Some of the occupation is illegal. The unoccupied land is available for development to agriculture should it be found suitable by soil survey.

Bekenu and Beluru are small established towns each with a bazaar. Bekenu has a Government office. The Beluru bazaar, which was burned down in 1972, is being rebuilt by Government. A Health Centre has been built close to the Miri-Bintulu Road between the SLDB Bukit Peninjau Scheme and the SOP estate.

The SOP and SLDB oil palm plantings are estate-type undertakings covering approximately 10 000 and 27 600 acres respectively. Planting started in 1969 and is still continuing. The earliest plantings, those of SOP, will come into bearing in early 1974 when the SOP oil palm mill is due for completion. Centred on the SOP estate is a village located close to the Miri-Bintulu road, and SLDB has established villages at Bukit Peninjau and Sungai Tangit. These villages have not yet been fully completed. The SOP village is supplied with water, but there is an urgent need for a supply of treated piped water in the Bukit Peninjau village.

The SLDB and SOP oil palm estates form nuclei on which future agricultural expansion in the area is planned. The SLDB estate consists of six different units, each with a centrally located village. In all units planting will be finished by the end of 1974. The SLDB units and corresponding acreages are shown below:-

Unit:	Acres:
Bukit Peninjau	4 787
Ladang Empat	3 500
Sungai Tangit	3 955
Ladang Tiga	5 497
Subis I and II	12 000 (in total)

The SLDB palm oil mill, currently being planned, will be located on the north-western boundary of the SLDB Subis Scheme. It is expected to have a capacity of 60 tons of fresh fruit bunches per hour and should be operational in 1975. Both mills in the area are expected to be able to process fruit from nearby oil palm plantings undertaken in Native Customary Land and on State Land proposed for allocation to private development.

Much of the agriculture in the occupied areas is shifting cultivation of hill rice but there are considerable areas of Mixed Zone land around Bekenu, along the road leading to it and along the Sibuti River. Also near Bekenu, at Paya Selanyau, there is a partially completed Government rice scheme where drainage and irrigation works are in hand. The works are planned to cover eventually about 3 350 acres.

The all-weather Miri-Bintulu trunk road passes right through the area with other all-weather feeder roads leading off it to Bekenu and Beluru. This latter road, which in 1973 was completed to a point six miles beyond Beluru is currently being improved to trunk road standard and extended towards Long Lama.

The Sungai Niah and Sungai Sibuti are navigable by trading launches as far inland as Batu Niah and Bekenu respectively. However, the mouths of both the rivers have sand bars which, together with the shallow coastal waters, severely restrict the size of vessels that can enter or leave the rivers.

Future Development

Recommended agricultural development in the area are:-

- establishment of a 5 000 acres cattle ranch in the Sungai Karabungan during the Action Programme period,
- start of a livestock Production and Animal Husbandry Training Centre on 1 000 acres adjacent to the ranch in 1975,
- in 1974/75 commence clearing of almost 4 400 acres of land in Mera-a close to Beluru for eventual establishment of a small-holder settlement scheme;
- in 1975/76 start road based improvement schemes managed from three ADU Centres situated in Bukit Peninjau, Beluru and Bekenu;
- the release for private agricultural development of nearly 34 000 gross acres of land in seven different areas. Most of this development is planned to occur in about 1980.

In the SLDB area four new villages will be established between 1974 and 1976. The recommended development pattern in the areas suggested for private enterprise depends on the location of the land. Small, medium and large-scale farming has been recommended. But the eventual settlement pattern will be influenced by the response that Government receives to the announcement that land for private development is available.

Three water supply schemes are planned for the villages in the Lambir-Subis area; these are:-

- the North Lambir-Subis Scheme which will supply Bekenu, Kabuloh, Bukit Peninjau and Ladang Empat,
- the South Lambir-Subis Scheme, which will supply the oil palm factory and four SLDB villages in the south of the area,
- the Beluru water supply, which also will serve the Mera-a village.

Expansion of public and private services in the Area is designed to meet the daily requirements of the population in the villages and surrounding areas during the Action Programme period. The service facilities will be situated in the village centres. Bukit Peninjau in the north and Ladang Tiga in the south are also planned to contain some higher level amenities. As a derived effect of long term agricultural activities in the area some small-scale and medium-sized industries are envisaged to be attracted to Ladang Tiga after 1980.

Improvements planned for the communication network in the area are the sealing of the Miri-Bintulu road to Miri by 1983, and by 1976 the upgrading of the Beluru road to Trunk Road standard and the construction of about four miles of feeder roads to the agricultural areas by 1976.

3.1.4 The Long Lama RDA

The Present Situation

Population 1970:

Semi-urban (Long Lama) 600;
Rural population in the remaining parts 7 400.

The township of Long Lama is a typical up-country small bazaar town having developed from one of the more flourishing longhouses. There is a small Agricultural Station close to the town; a new Sub District Office is being built and there is a Lower Secondary School which is supplied with piped water. The existing water works are currently being uprated to serve the bazaar area.

East, south-east and south of Long Lama are large areas of unexploited mixed dipterocarp forests. The forest east of the town (outside the Study Area) has been included in the Study undertaken by the UNDP/FAO Forest Industries Team who estimate that the area contains about 180 million cubic feet of valuable timber. They have recommended it for early logging and processing by a large timber industry complex. The area is referred to as FAO Unit 7. There is a large limestone deposit and a quarry at Batu Gading, just down river from Long Lama. Large areas of occupied land, totalling over 100 000 acres, are found to the north, west and south-west of Long Lama, practically all is under shifting cultivation of hill rice; but there are scattered patches of rubber.

The River Baram provides the only line of communication leading northwards to Marudi, some 50 miles away, and southwards to the interior.

Future Development

About 90 000 acres of the occupied land was assessed at the schematic reconnaissance survey level as being possibly suitable for agriculture. This represents a considerable area where development could occur, but the present lack of communications rules out any immediate start for intensive activities. However, the road currently being constructed from Beluru to Long Lama is expected to reach these areas in 1971. This road, which is planned to pass through occupied land, will provide the opportunity to undertake road based improvement in the area. This is planned to be started in 1977 when an ADU Centre would be formed in Long Lama. The road will also provide an easy outlet to the markets of Miri and Bintulu for the produce from around and upriver of Long Lama. This diversion of trade from the upper reaches of the Baram and Tinjar rivers will reduce the volume of goods handled by Marudi. Thus Long Lama is expected to grow at the expense of Marudi.

After 1980 further road based improvement could be undertaken along a new road expected to be constructed southwards from the Beluru-Long Lama road to Long Jegan eventually connecting

with a road planned to extend northwards from Tubau. The alignments of these roads are planned to go through occupied land assessed as having agricultural potential.

The establishment of a timber complex during the Action Programme period and some derived small-scale industries would be vital elements in the early year's of Long Lama's growth to a Sub Regional Centre around 1990.

The central location of Long Lama in the Baram area and with only about 50 miles of trunk road needed to connect it with the Miri-Bintulu road gives it a favourable position as a future District or Divisional Centre. This will undoubtedly lead to an important increase in public and private service activities in the town.

The uprated water works has been planned to be sufficient for new development at Long Lama up to the middle of the 1980's.

3.1.5 The Niah-Suai RDA

The Present Situation

Population 1970:

Semi-urban (Niah and Batu Niah) 2 000;
Rural in the remaining parts 2 500.

This Area lies between two rivers, the Niah in the north and the Suai in the south. The only two existing towns, Niah and Batu Niah, are situated on the Niah river. Both towns are typical small country settlements, each with a small bazaar area. In Batu Niah there is a water treatment plant servicing the Secondary school.

About half of the forest in the area has already been exploited. Logging is continuing in the central part and there are three sawmills in addition to a mill handling the valuable local hardwood, belian operating. In the south east there is virgin forest which forms part of the forest area planned for expoitation by a timber industry complex, FAO Unit 3. This Unit covers an area of 197 000 acres comprising the entire Sawai Forest Reserve and almost all of the Niah-Jelalong Protected Forest area . In the Niah Forest Reserve important forest regeneration experiments have recently been started by the Forest Department. The experimental plots are in three separate blocks.

Just east of Batu Niah there are two stone quarries; one Government and one privately owned. These are the only easily accessible large sources of stone between Miri and Bintulu. Around Niah and Batu Niah is a cluster of Chinese smallholdings. Practically all the rest of the occupied land is

under shifting cultivation of hill rice with small rubber plantings scattered throughout. During 1973 the Department of Agriculture started a block alienation settlement scheme at Sepupok. The scheme covers about 3 000 acres. The all-weather Miri-Bintulu trunk road runs right through the RDA. The branch road to Batu Niah and Niah is an all-weather feeder road.

The Suai river, is navigable by trading launches for a considerable distance inland, but no trading towns have developed along its banks. The Niah river, which is the main outlet for the log export from the areas is similarly navigable to a short distance upriver of Batu Niah.

Future Development

Investigations carried out by the Consultants revealed that this Area contains the majority of the already logged land suitable for agricultural development, and which is easily accessible from existing roads. The land assessed as suitable for agriculture at the semi-detailed survey level was subsequently selected and planned for major agricultural development in the Action Programme period. According to the Plan this land would consist of about 14 000 acres planted on a public estate to be managed by SLDB, and of roughly 20 000 acres planted for subsequent division into small-holdings. Immediately after the Action Programme period (1981 o 1983) about 21 500 gross acres in the eastern part of the RDA (land block Kabatu) is planned to be cleared for agricultural development. The planned settlement pattern for this area, shown on the Action Programme and Regional Plan Maps, and described in Chapter 5, comprises one sub regional centre (Igang) close to the Miri-Bintulu road with eight villages surrounding it. Four of these villages are planned to be built during the Action Programme period. The planned service level and layout of the settlements are given in Chapter 7.

Unoccupied agricultural land regarded to be outside easy walking distance from the villages, that is a radius of about 1.5 miles, has been allocated to private development. This totals about 2 175 acres. A further 4 430 acres have been assumed to be legally occupied in which road based improvement schemes are planned to be carried out.

The whole plan is based on initial development by SLDB which would retain management of the public estates for as long as needed. The estate would be the nucleus on which the rest of the farms would depend for processing and marketing of their main products palm-oil and rubber. Oil palm plantings are planned to reach an eventual 30 000 acres; sufficient to warrant the construction of a large central mill handling 60 tons of fresh fruit bunches per hour. The rubber plantings, in total 7 000 acres, which are generally on the steeper or less accessible lands, are designed to be sufficient to justify the establishment of a central processing factory which could also cater for rubber from a much wider area.

Cocoa fermentation and drying based on about 2 300 planted acres is expected to take place in conveniently located processing units.

Under the auspices of STIDC a timber complex based on the FAO Unit 3 is planned to be in operation from 1978. The location of this complex is recommended to be close to the sub regional centre so that the workers in the complex can live in and enjoy the facilities of this town. The complex is planned to process at a maximum capacity of 150 000 tons per annum.

During the first five years of its operation more than 70 miles of forest roads will be built within the Forest Unit. The alignment of some of these roads coincides with roads required for the agricultural development in the area. Such roads are recommended to be built as public roads, which in total would amount to about 40 miles to be constructed from 1974 to 1980.

The households and the processing facilities within agriculture and forestry are recommended to be supplied with water from the Niah-Suai Scheme, which is further described in Chapter 8.

3.1.6 The Sekudong RDA

The Present Situation

Population 1970:

Rural population in the whole area: 5 000.

Huge areas of this RDA are covered by virgin forest which forms a part of the forest areas reserved for timber industry complexes operating in FAO Units 1 and 2. There are also large areas of occupied land where the agriculture is predominantly shifting cultivation of hill rice with small, scattered plots of rubber throughout the occupied areas. In the north the occupation is associated with the Suai river and has extended along the Miri-Bintulu road. In the south occupation has spread along the Kemena river and its tributary the Sungai Labang as well as along the Miri-Bintulu road which passes right through the Area. The Sungai Labang is navigable by small river craft a long way upstream from its junction with the Kemena.

Future Development

Only broad transect soil surveys were carried out by the Consultants in this Area. The approximate acreages of different categories of land assessed as having high proportions suitable for agriculture are:-

- occupied land 52 700 acres;

- unoccupied forest land outside existing Forest Reserves 10 600 acres;
- virgin forest land within existing Forest Reserve 74 900 acres.

These lands represent a considerable potential for agricultural development. It is proposed that the SLDB should undertake the systematic development of all the suitable land in the existing Forest Reserves estimated about 52 000 acres. The unoccupied lands outside existing Forest Reserves are recommended for private development, while road based improvement operated by the ADU is planned for the occupied lands.

Forest exploitation and agricultural development are planned to start close to the Miri-Bintulu road and gradually work outwards. The first development should take place in land blocks Timong and Sigrak with the establishment of a public estate scheme and the initiation of a sub regional centre in Timong. Later developments should be northwards and southwards forming satellite small-holder villages. It is envisaged that large centralised processing and marketing facilities would be set up by SLDB for palm oil and rubber. Cocoa fermentation and drying plants would also be established located at strategic places close to the cocoa growing areas.

Private development is proposed in the Majam block of land which is adjacent to land similarly proposed for development in the southern part of the Niah-Suai Area. The plan for this block is to release an estimated 4 700 acres for private agricultural enterprise, as medium and large sized farms, soon after SLDB has started operations in the Igang sub-scheme in the Niah-Suai Area.

A road, linking the existing settlements of Labang and Tubau to the Miri-Bintulu road, is recommended to be commenced in 1975. The section of this road to Labang is expected to be completed by 1976. An ADU team is scheduled to be formed in Labang in 1977 to undertake road based improvement along this road section.

The timber industry complex based on FAO Unit 2, is expected to be in operation from 1977. It should be located close to the junction of the proposed road to Labang with the Miri-Bintulu road. The total area of the Unit is 257 000 acres and the maximum capacity of the complex would be 150 000 tons per year. About 65 miles of forest roads are planned to be built during the first five years of operation, of which some would also serve the agricultural development and therefore be built as public roads. It is recommended that the people working in the factory of this complex should live in the future Timong Sub Regional Centre, which would be situated about two miles from the Labang junction. Although this town would not be established on an agricultural basis until the early 1980's, the clearing and planning of it should take place in 1976 to accommodate the forestry people.

During the period 1980 to 1990 six new agricultural villages and one service centre (in Sigrak) are envisaged in addition to the Timong sub regional centre. Town plans and infrastructural requirements have not been planned because these urban settlements start after the Action Programme period. However, the layout of the agricultural villages and the towns should follow the pattern shown for the settlements in the Niah-Suai Area.

About 40 miles of public roads are planned to be built before 1980 in areas destined for agriculture. The early construction of these road in relation to the phasing of the agriculture is dictated by the early needs of forest exploitation.

3.1.7 The Labang - Tubau RDA

The Present Situation

Population 1970:

Rural and semi-urban in the whole Area: 8 500.

This Area consists of land associated with the middle and upper reaches of the Kemena river and its tributaries. Large blocks of land are occupied, especially along the rivers. The unoccupied forest in the north is unexploited and is included in FAO Unit 2. The unoccupied land in the centre is currently being exploited under Government licence.

The three settlements of any size, Labang, Tubau and Pandan, are typical small riverside bazaars with a mainly agricultural population totalling about 800. Agriculture is practically all cultivation of hill rice with a few small patches of rubber scattered throughout. The river system forms the only lines of communications. Trading launches are able to reach Tubau on the Kemena and a considerable distance up the Pandan tributary.

Future Development

Only schematic and broad transact investigations were carried out by the Consultants in this Area. Semi-detailed soil surveys will still be needed in selected areas to identify accurately the land suitable for agriculture. The estimated acreages of such land that will be found are:-

- occupied land 52 000 acres;
- unoccupied forest land outside existing Forest Reserves 16 000 acres;
- virgin forest land within existing Forest Reserves 3 600 acres.

Agricultural activities are planned to start when the proposed road from the Miri-Bintulu road through Labang to Tubau is

completed, expected to be in 1977. Early development in this RDA is important in order to create a nucleus for further development to assist the quite considerable existing population in the surrounding occupied areas. Because SLDB is expected to be fully occupied in the Sekudong RDA recommendations have been made that the necessary initial development in the Labang-Tubau RDA should be undertaken by large-scale private enterprise. This would be in the occupied land block Beseduan outside the existing Forest Reserves. The ADU would then undertake road based improvement in the occupied lands and small-scale private developers work in the Lebus land block. No plans are proposed for the blocks of potential agricultural land within the Forest Reserves because their possible development is too far in the future, and for a long time they are expected to be too inaccessible and isolated.

ADU Centres are planned to be formed at Labang in 1977 and at Tubau in 1978 to carry out the road based improvement work along the roads already mentioned. In addition further road based improvement schemes could be started between 1980 and 1990 along roads planned to be constructed through the occupied lands north of Tubau and towards Belaga along the Tubau river, also during and along feeder roads planned through the occupied lands south west of Labang.

The private agricultural development of about 13 000 acres in Beseduan should be used as a population and activity basis for creating a service centre. This town would be established around 1980 and could be supplied with a wide range of public and private services because it would be the only town of some size in the area. The location of the town is indicated close to the Labang-Tubau road. At this place the service centre would be centrally situated in relation to the whole population in the area and should therefore provide an important function. During the Action Programme period Sub-District Offices will be established in Labang and Tubau.

A water supply works system, drawing from the Kemena river is planned to supply piped water to Labang, Tubau, Beseduan and Lebus. In addition to the 17 miles of road from Labang to Tubau, 8.5 miles or roads are planned for construction during the Action Programme period.

3.1.8 The Nyalau RDA

The Present Situation

Population 1970:

Rural in the whole Area: 3 500.

The majority of the Area is virgin forest which has been included for exploitation by the timber industry complexes in FAO Units 1 and 2. Occupation of land only occurs in the

north along the Suai river and in the east around the Nyalau and Similajau rivers. There are no existing towns in the Area. In the occupied areas the agriculture is predominantly shifting cultivation of hill rice. There are no existing roads but the Suai river is navigable by trading launches probably for its whole length along the northern boundary of the Area. Small river craft are used on the Nyalau and Similajau rivers.

Future Development

All the lands in the Area were investigated at the broad transact level and the estimated acreages of land with high proportions suitable for agriculture are:-

- occupied land 12 400 acres;
- unoccupied exploited forest outside the existing Forest Reserves 4 400 acres;
- virgin forest within existing Forest Reserves 45 600 acres.

Development of all these lands is envisaged as a natural extension and continuation of development in the Sekudong Area during the late 1980's and early 1990's. Thus the forest land inside and outside the existing Forest Reserves should be developed by SLDB while the ADU carries out road based improvement in the occupied lands.

The pattern of development foreseen is the same as for the Niah-Suai and Sekudong Areas whereby SLDB creates a public estate to initiate a service centre at Nyalau with five mutually supporting small-holder villages around it. The cropping pattern is expected to follow and supplement, if necessary, that in Sekudong. Nearly 40 miles of public feeder roads to serve the agricultural and forest development are planned to be built before 1985.

3.1.9 The Bintulu RDA

The Present Situation

Population 1970:

- urban (Bintulu) 6 000;
- semi-urban (Sebauh) 700;
- rural in the remaining parts 5 300.

Bintulu town has become established as a natural result of the trading activities associated with timber and other products produced in the catchment areas of the Kemena river and its tributaries. The town is a Government District headquarters with a bazaar and several small industries including sawmills and a sago mill. Sebauh is a small riverside bazzar town.

phase it is planned to be an agricultural University, which among other things would utilise the 3 000 acres of unoccupied forest land (land block Sibiu) for its research and education. In support of the proposals already made for Bintulu to become a timber town it is suggested that Government should consider the possibility of early inclusion in the university's syllabus of timber and forestry subjects including perhaps research.

The integration of the university with the urban life of future Bintulu and the location of the campus are discussed in Chapter 7. It is expected that the university would influence the growth of Bintulu during the Action Programme period by creating employment, increasing investment in infrastructure, buildings and residential quarters as well as attracting groups of highly educated teachers and students to the town. In addition, a general hospital and a junior college are planned for the town. The hospital could perhaps later become a teaching hospital in association with the university.

This large-scale expansion and development of Bintulu town must be matched by a corresponding expansion of the Government administrative services . It is therefore proposed that Bintulu should become a Divisional Centre which would enhance the status of the town and increase employment.

The heavy investment in industries and public services will require a rapid and orderly planned town expansion. A skeleton plan, as a basis for more detailed planning, is given in Chapter 7. The road requirements would amount to about 20 miles of new trunk roads between existing Bintulu town and Tanjong Kidurong by 1977, a 13 miles secondary road along the coast in the early 1980's and about six miles of internal feeder roads before 1980. The plan also outlines the establishment of a new centre for private services and a residential area close to the new industrial area south of Tanjong Kidurong. The future public administrative centre for Bintulu is suggested to be at Tanjong Batu between the present and new town centre.

Estimates of future air traffic associated with this development show that a new airport would be required about 1985. It should be situated away from the town.

The agricultural development around Bintulu town is planned to take place mainly as improvements to existing farming in occupied land, excluding the 3 000 acres to be allocated to the university. An ADU centre is planned for 1976 at an Agriculture Department Station about 10 miles from Bintulu on the road to Miri. The activities of the ADU should be concerned mainly with increasing the acreage of rubber along the main road to support the future factory, and with market gardening, the raising of pigs and poultry and pond culture of fish.

All the enterprises are primarily aimed at supplying the market created by the expected rapid increase of population (14 000 by 1980 and 38 000 by 1990), and possibly in the future expanded to victualling the ships calling at the new port.

3.1.10 Other Areas

Areas outside the RDAs contain about 8 000 people. These areas are mostly in the much less accessible interior of the Study Area where no important agricultural potentials have been identified. Close to the coast these areas are mostly peat swamp. However, no new industries or settlements are envisaged in these areas.

CHAPTER 4

EMPLOYMENT CREATION AND POPULATION GROWTH

4.1 INTRODUCTION

A major development objective for the Study Area is to create new jobs, so that people from other parts of Sarawak could be settled within the Region. The future population growth of the Area including migration will be influenced by the number of new jobs that will be created. The number of people that can be accommodated in the Region is also influenced by the magnitude of the natural growth of the population and the labour force; and by the present and target employment/unemployment rate.

The employment and population growth shown in Table 4.4 for the period 1970 to 1980 is based on the proposals contained in the Action Programme described in the previous chapter and on the growth in employment from 1970 and up to the present time. The growth from 1981 to 1990 is estimated more roughly. Although the expected employment in agriculture and forestry are closely connected to the development proposals for these sectors, it is not possible to establish a similarly planned basis for the employment figures in manufacturing and services in the long term, particularly because the human imagination cannot cover all future technical, organisational and social possibilities over this time span. The 1990 figures for these sectors are therefore partly derived employment emerging as a result of the massive creation of new jobs in modern agriculture and forestry, and partly target figures which should be fulfilled if a reasonable share of people from outside the Study Area is to be absorbed.

Hence, the population and labour figures for 1990 should not be regarded as exact projections but as realistic and desirable targets within the potential of the Study Area and which would enable the Area to play its envisaged role in Sarawak. The target figures should be regularly checked and re-estimated as new information about the human, natural and man-made resources becomes available and as new priorities for the development of Sarawak and the Study Area are established.

4.2 EMPLOYMENT CREATION

In this section the new employment created in each RDA is discussed. Although considerable uncertainty is associated with such a geographical breakdown of the total regional figures, especially in the long term, it has been done in this way mainly because of the large numbers of jobs created by agricultural and forestry development within specific RDAs, as shown in Table 4.1.

The planned agricultural development envisages small-holder, medium sized and estate development on unoccupied land and

improvements in the cultivation on occupied land. In all areas included in the Plan a diversified cropping pattern is recommended. Small-holdings on State Land schemes are planned to consist of two plots of different permanent crops with a homestead and a rice plot each of one acre. The total size of small-holdings and the number of acres handled by each estate worker would depend largely on the type of crops concerned.

If only one crop were to be handled by an agricultural household, averaging 5.6 persons with two full time workers, the following acreages could be managed:

Oil palm	:	17 acres
Rubber	:	12 acres
Cocoa	:	20 acres

However with a diversified cropping pattern and settlement system such as is planned for the Niah-Suai RDA the average acreage handled per family has been calculated as roughly 16 acres. This figure has been used to estimate the employment created by development of unoccupied State Land. Little new employment creation from the road based improvement schemes is envisaged during the Action Programme period. After 1980 it has been assumed that the intensified cultivation of occupied land will lead to some reallocation of land resulting in the establishment of new farm units and new employment.

During the Action Programme period the growth of employment in manufacturing, which also includes building and construction workers, is based on the envisaged enterprises mentioned in Chapter 3 and described in more detail in Supporting Report 8. Employment increases in public and private services during the same period are similarly based; service employment outside Miri and Bintulu being based on employment figures for different service and utility units described in Supporting Report 6. Within the urban areas of Miri and Bintulu the new service employment is based partly on the growth of public services described in Chapter 3, partly on generated employment in private services resulting from the expansion in manufacturing industries, and on the growth of the population in the towns and their catchment areas.

For the period 1981 to 1990 the same estimation system is used for new employment in manufacturing and services outside the Regional Centres of Miri and Bintulu. However, the employment figures for manufacturing and services for the regional centres should be regarded purely as targets. The distribution of the manufacturing and service employment between the two towns should also be regarded as targets. The objective being mainly to develop Bintulu to an important growth pole in Sarawak. However, the calculations have taken into account that Miri, because of its present status as the most important manufacturing and service centre in the Area, will grow by its own momentum. The employment creation by sector and RDA is shown in Table 4.1.

TABLE 4.1 NUMBERS OF EMPLOYED PERSONS BY SECTOR AND RDA 1970-1980 AND 1981-1990

SECTOR / RDA	Agriculture		Forestry		Manufacturing		Services		Total	
	1970-80	1981-90	1970-80	1981-90	1970-80	1981-90	1970-80	1981-90	1970-80	1981-90
Miri	650	500	110		1 555	4 000	1 900	3 000	4 215	7 500
Marudi	50	100			115	100	155	100	320	300
Lambir-Subis	5 650	2 400			50	550	565	450	6 265	3 400
Long Lama	100	750	110		190	600	200	500	600	1 850
Niah-Suai	3 700	4 050	425	125	110	550	540	900	4 775	5 625
Sekudong	500	6 920	425	125	100	550	25	750	1 100	8 345
Labang-Tubau	50	2 530			40	100	115	250	205	2 880
Nyalau		500			40	50		50	40	600
Bintulu	250	250	330	250	1 800	6 000	1 000	3 000	3 480	9 500
Other Areas										
Study Area	1 100	1 800	1 500	500	4 000	12 500	4 500	9 000	21 000	40 000

Explanatory Comments to Table 4.1

Agriculture

The main growth of employment from 1970 to 1980 will be in Lambir-Subis and Niah-Suai RDAs with a total of 85 per cent of new employment, and from 1981 to 1990 in Sekudong, Niah-Suai, Labang-Tubau and Lambir-Subis with nearly 90 per cent of the net creation. Although development will be started in Nyalau before 1990, the bulk of the new employment will come after that year.

Forestry

Employment here covers both sawmills and logging activities including transport of logs. The modest growth in employment is because this sector is already well staffed.

Manufacturing

About 35 per cent of the new jobs during the first period will be in construction of roads, urban infrastructure, housing and in the clearing of land for agriculture. The distribution of these jobs in the various RDA's would be in accordance with the planned development rate explained in Chapter 3. About 20 per cent of new employment by 1981 would be in unspecified small-scale and medium-sized industries, mainly located in Miri and Bintulu as a result of the growth of other industries and the population. It is anticipated that only a minor portion of such industries would be established in Marudi, Long Lama and in the new Igang and Ladang Tiga towns during the Action Programme period. Apart from Long Lama, large-scale industries are planned only for Miri and Bintulu during this first period.

After 1980 it is believed that the main towns in the new agricultural areas and Long Lama could attract some small-scale and medium-sized industries, to serve both the agricultural and forest activities, and the population. However, 80 per cent of new employment in this sector is scheduled for Bintulu and Miri.

Services

The new jobs during the Action Programme period are expected to be divided equally between private services and public services and utilities.

About 60 per cent of the employment growth in private services from 1970 to 1980 is derived employment from the growth of Miri and Bintulu, and 30 per cent of the new employment in private services during this period would be associated with new agricultural development in other RDAs calculated on the basis of the standards contained in Supporting Report 6.

The new jobs created in public services and utilities outside Miri and Bintulu during the same period is based on the staff requirements specified in Supporting Report 6. The towns and villages in the RDAs will have about 25 per cent of all new occupations in the public service sector, while nearly 70 per cent of this category of new jobs will be in the regional centres and five per cent in association with existing small-bazaars.

Outside Miri and Bintulu towns the growth of services after 1980 has been worked out in a corresponding way although on a looser basis. It has been taken into account that the settlement pattern planned for the new agricultural areas, except for Lambir-Subis, will contain important sub regional centres or service centres, which in the long term will attract more services than the smaller villages in Lambir-Subis RDA.

The employment figures for Miri and Bintulu towns during 1981-1990 are considered partly as derived effects of the envisaged growth of these towns, and partly as targets which must be achieved if the area is to absorb a substantial number of persons from other parts of Sarawak.

Based on the detailed breakdown of employment figures in Table 4.1 the total employment by sector, unemployment/under employment and labour force for 1970, 1980 and 1990 have been worked out and shown in Table 4.2.

TABLE 4.2 OCCUPATIONAL STRUCTURE

Sector	1970		1980		Growth rate 1970/80	1990		Growth rate 1980/90	Growth rate 1970/90
	Persons	%	Persons	%		Persons	%		
Agriculture	21 000	54	32 000	53	4.4	50 000	50	4.6	4.4
Forestry	4 000	10	5 500	9	3.2	6 000	6	0.9	2.1
Manufacturing	4 500	12	8 500	14	6.5	21 000	21	9.5	8.0
Services	9 500	24	14 000	24	4.0	23 000	23	5.0	4.6
Total employed	39 000	100	60 000	100	4.4	100 000	100	5.2	4.8
unemployment/ under employment	6 000	-	6 000	-	-	7 000	-	-	-
Total labour force	45 000	-	66 000	-	4.0	107 000	-	5.0	4.5
Unemployment/ under employment as percentage of total labour force		13		9			7		

The target figures in the table show a certain unemployment/ under employment;this is intended to indicate that some of the population may not be willing to work full time and that full employment may not be attainable within the 20 year period. It could also indicate the need to reduce the population growth rate.

The table shows that the labour force is growing at rates corresponding to those applied to the total population, while total employment is growing at slightly higher rates (see Section 4.3). In the first 10 year period agriculture and manufacturing are growing above average; in the second 10 year period manufacturing and services are the fastest growing with the result that the urban occupations in 1990 account for 44 per cent of the total employment against 36 per cent in 1970 and 38 per cent in 1980.

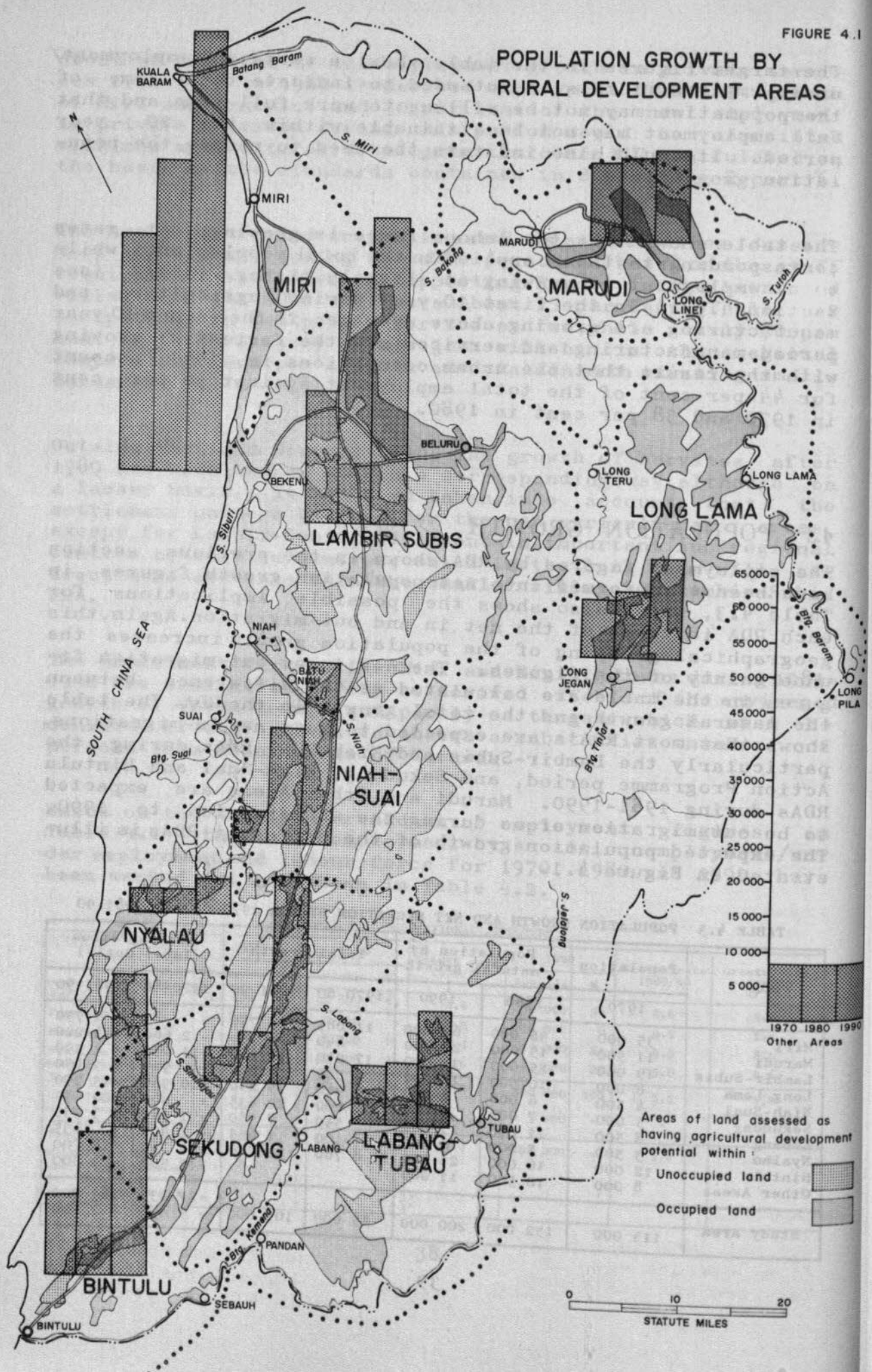
4.3 POPULATION GROWTH

The employment figures by RDA shown in the previous section have been transformed into net population growth figures in Table 4.3, which also shows the possible implications for each RDA in terms of the net in and out-migration. Again, this geographical grouping of the population growth increases the uncertainty of the figures. The net in-or out-migration figures in the table are calculated as the difference between the natural growth and the total growth in the RDA. The table shows that most RDA's are expected to have net in-migrations, particularly the Lambir-Subis and Niah-Suai RDAs during the Action Programme period, and Sekudong, Niah-Suai and Bintulu RDAs during 1981-1990. Marudi and Other Areas are expected to be out-migration areas during the whole period to 1990. The expected population growth of the different RDAs is illustrated in Figure 4.1.

TABLE 4.3 POPULATION GROWTH AND NET MIGRATION BY RDA 1970-80 AND 1981-90

RDA	Population	Population by natural growth		Total growth		Net migration In(+) Out(-)	
	1970	1980	1990	1970-80	1981-90	1970-80	1981-90
Miri	35 000	46 000	60 000	11 085	18 750	+ 85	+ 4 750
Marudi	11 500	15 000	20 000	840	780	- 2 660	- 4 220
Lambir-Subis	19 000	25 000	33 000	17 030	9 190	+11 030	+ 1 190
Long Lama	8 000	10 500	17 000	1 585	4 850	- 915	+ 1 350
Niah-Suai	4 500	6 000	8 000	12 460	15 290	+10 960	+13 290
Sekudong	5 000	7 000	9 000	2 600	22 835	+ 660	+20 835
Labang	8 500	11 000	15 000	540	7 950	- 1 960	+ 3 950
Nyalau	3 500	5 000	6 000	100	1 655	- 1 400	+ 655
Bintulu	12 000	16 000	21 000	8 760	23 700	+ 4 760	+18 700
Other Areas	8 000	10 500	11 000			- 2 500	- 3 500
Study Area	115 000	152 000	200 000	55 000	105 000	+27 435 - 9 435	+64 720 - 7 720

FIGURE 4.1


POPULATION GROWTH BY
RURAL DEVELOPMENT AREAS
KUALA BARAM
Batang Baram
S. Miri
MIRI
MARUDI
S. Bakelig
S. Tutoh
LONG LINE
BELURU
BEKENU
LONG TERU
LONG LAMA
S. Sibuti
LAMBIR SUBIS
LONG LAMA
NIAH
BATU NIAH
SOUTH CHINA SEA
SUAI
Btg. Sugi
S. Niah
NIAH-SUAI
LONG JEGAN
Btg Tinjar
Btg. Baram
LONG PILA
NYALAU
S. Bucking
S. Labong
S. Simbuai
SEKUDONG
LABANG
LABANG-TUBAU
TUBAU
Btg. Kemena
PANDAN
BINTULU
SEBAUH
BINTULU
65 000
60 000
55 000
50 000
45 000
40 000
35 000
30 000
25 000
20 000
15 000
10 000
5 000
1970 1980 1990
Other Areas
Areas of land assessed as having agricultural development potential within :
Unoccupied land
Occupied land
0 10 20
STATUTE MILES

The net in-migration to the Study Area that is, the difference between the total in- and out-migration, amounts to 18 000 and 57 000 for the two periods respectively.

Based on the information in Tables 4.1, 4.2 and 4.3 key population, labour force and employment figures for 1970, 1980 and are shown in Table 4.4.

TABLE 4.4 POPULATION - LABOUR FORCE - EMPLOYMENT

	1970		1980		1990	
	Persons	Per cent of total population	Persons	Per cent of total population	Persons	Per cent of total population
Population by natural growth			152 000	89	200 000	73
Total population	115 000	100	170 000	100	275 000	100
Age group 15-64	60 000	52	88 000	52	143 000	52
Labour Force	45 000	39	66 000	39	107 000	39
Employed	39 000	34	60 000	35	100 000	36
Unemployed/ Under employed	6 000	4	6 000	4	7 000	3

Explanatory comments to Table 4.4.

a) Population by natural growth is calculated as the existing population increased by 2.8 per cent per annum.

b) The growth rates for the total population are four per cent during the period 1970 to 1980 and five per cent during 1981 to 1990. These rates include net in-migration from outside the Study Area of 18 000 during 1970 to 1980 and 57 000 during 1980 to 1990 (totalling 75 000 from 1970 to 1990). This increase corresponds to 12 per cent of the growth of the population in Sarawak outside the Study Area during the same period. Consequently the areas outside the Study Area will have to cater for a total population corresponding to the present one plus 88 per cent of its natural growth; in all equivalent to about 1 420 000 people. The figures for in-migration to the Study Area include both the primary in-migrants and their natural growth as residents in the Study Area, and these figures are considered, by the Consultants, as minimum targets if the Study Area is to absorb sufficient people and thus help ease social problems and population pressure in other parts of the State.

c) The age group 15 to 64 is the main source of the labour force. The 1970 Population Census figures showed that this age group represented 52 per cent of the total population and that the age group 15 to 45 represented 40 per cent. This proportion has been assumed to remain constant up to 1990 though changes could perhaps occur. However, changes will not influence the Plan to any significant extent.

d) The labour participation rates for males and females are assumed to be constant during the planning period, that is, about 75 per cent of age group 15 to 64 years are

assumed to be able, willing and actually looking for, or participating in, gainful work.

e) With more jobs being created than can be filled by the natural growth of the labour force, the employment rate in the Study Area is envisaged to increase from 87 per cent of the labour force in 1970 to 91 and 93 per cent in 1980 and 1990 respectively. Whether the planned development will in fact lead to lower unemployed/under employment in the Study Area will depend, to some extent, on the conditions offered to new settlers, for instance in agriculture. If the present SLDB assumption of one settler per family is maintained, the overall employment rate is likely to go down because the employment rate on the new estates then will be less than 20 per cent. Such an employment policy is however, not recommended by the Consultants or made the basis for the above employment figures.

It is emphasised that the figures for population, employment and occupation structure are targets, which should be aimed at in order to achieve a number of other fundamental social and economic goals. These targets have been taken as the basis for the settlement plans described in the next chapter.

CHAPTER 5

SETTLEMENT PATTERN

5.1 INTRODUCTION

In this chapter the recommended settlement pattern for the Study Area is described. The 1980 and 1990 situations are illustrated in the Action Programme and Regional Plan Maps. The settlement planning process has passed through several stages, starting with an evaluation of the Johor and Pahang Tenggara reports which, in the Terms of Reference were referred to as models for the present study. In particular the type of settlement recommended for the agricultural areas in the Pahang Tenggara Plan was pointed out to the Consultants as favoured by the Government. Consequently, the Consultants undertook a planning exercise comparing the large-settlement system recommended by the Pahang Plan with the small village system being implemented by the SLDB on their oil palm schemes in the Study Area. The conclusion, after weighing the advantages and disadvantages of each system, was that on the whole a Pahang-type system would be the most appropriate for the oil palm schemes. Therefore, if the Pahang model were to be followed SLDB would have to concentrate into one town, all the workers on the oil palm estates in the Southern Lambir-Subis schemes. The town would be in addition to an existing village but would replace three planned villages. For various reasons, explained later, SLDB could not accept such a pattern in the Lambir-Subis RDA.

In the plans for development in the Niah-Suai RDA explained in the next section, the settlement proposals have been combined with the diversified cropping pattern recommended for the future agricultural development.

5.2 URBANISATION OF RURAL AREAS

There are different ways in which areas selected for agricultural development could be provided with urban amenities. Urbanisation is here used in its widest sense, it is not only the introduction of physical elements such as public and private service facilities, but it also includes non-physical elements, such as, the way of organising the daily routine of each person and household, the introduction and expansion of a cash economy, the acceptance by people of a different attitude towards change and innovation and realising the increasing importance of education. The physical and non-physical elements of urbanisation are important factors conditioning a restructuring of the Society to the benefit of the poor.

In the Plan importance has been given to the physical part of urbanisation of rural areas, i.e. the different ways in which public and private services could be offered to people living and working in rural areas. This is done through the presentation of three possible settlement patterns for the Niah-Suai

RDA. These models attempt to show the relationship between different ways of organising agriculture and the network of settlement and service centres.

The description of the models includes only what could be named "mechanical" inputs, such as the size of the areas for various purposes, the number and types of public and private services allocated to each town or village and locations of processing facilities. The actual growth of a town, however, is organic, which means that over time it will be influenced by a number of unforeseen factors. These would include the consequences of interaction with other towns and the political adjustments of the aims of development. Hence, the suggested settlement pattern in Section 5.2.1 should be regarded as an open system which in the course of time could and should be adjusted. Although there will be flexibility in the settlement system, there are certain decisions that have to be taken to initiate the implementation process. These decisions about cropping patterns, the ratio between the area developed for estates and for independent farmers, and the resulting settlements could have an impact reaching far into the future.

In order to appreciate the significance of the models it must be realised that any future settlement pattern for the area between Miri and Bintulu should be designed primarily to support and serve the development in agriculture and forestry. This area is at present without any significant town. The existing towns have populations of only 500 to 1 000 people and therefore, it will be important to create viable new towns - service centres - of a higher order than the present ones. Within the foreseable future, because the area is so sparsely populated and is in fact largely unoccupied jungle, this process can only be achieved by using the people employed in agriculture and forestry to create the towns and villages.

There is a connection between the type of agricultural development and the type of settlements which can be appropriately established. Preferably small-holders should live close to their farm land, thus they need to be accommodated in small villages spread throughout the area. The Agricultural Plan recommends that small-holdings should be built up on a system whereby each holding, in addition to a homestead and a rice plot, should consist of a plot or plots, of the major crops such as oil palm, rubber and cocoa growing in the vicinity of the village. The location of each crop would be dictated, to a large extent, by the land capability. Examples of actual holdings recommended are:-

Crop	Acreages in each holding		
	Example 1	Example 2	Example 3
Oil palm	9	10	9
Rubber	6	5	-
Cocoa	-	-	5
Rice	1	1	1
Homestead plot	1	1	1

The extent of the agricultural land attached to one village would be based on a maximum walking distance of 1.5 to 2 miles (2 to 3 kilometres) from the village to any plot. Thus the cultivated area associated with a village would be limited to a maximum acreage of 5 000 to 6 000 acres, and the village would at the most consist of 1 500 to 2 000 people.

In the case of estate-type agriculture it is considered possible to concentrate the workers and their families into larger towns which could provide fairly high standards of service facilities and thus act as service centres also for the population living in surrounding villages. Such large-settlement systems would necessitate an organised transportation of workers to and from their working places. Ideally a large-settlement should be based on a cultivated area of 10 000 to 20 000 acres which would require between 625 and 1 250 workers, equivalent to an agricultural population of 3 500 to 7 000 people who could be used as the creating force for the town. The alternative would be to create three or more settlements of the same size as the proposed villages for small-holders. This would be similar to the present SLDB pattern in the Lambir-Subis RDA. The Consultants, however, find that the concentrated estate settlement with a number of surrounding small-holder villages will meet stated economic and social goals in a much better way.

It is envisaged that the future agriculture in the Study Area will consist of independently managed farms as well as estates; furthermore, that the majority of the new development could initially take place under estate-type management with a gradual transfer of land from estates to independently managed farms, largely depending on the established success of such a change. However, it is believed for several reasons that there is a need to retain some areas permanently under estate management. Consequently, there would initially be two types of estate development; a permanent estate giving short and long term jobs to people who like to work in agriculture, but who do not want to or are not capable of being small-holders; and a temporary estate which at a later stage would be gradually transferred to small-holders under the supervision of an ADU.

The combination of permanent estates with larger towns surrounded by small-holder villages, offers the opportunity of

obtaining a differentiated settlement pattern with a hierarchy of service centres which would constitute a desirable urbanisation of the rural areas. In this system the selection and combination of areas for permanent estates and for smallholders will be of great importance.

5.2.1 Settlement Models

The settlement models are shown in Figures 5.1, 5.2 and 5.3. They each show a different way by which the land, could be developed and settled. The Miri-Bintulu road, and the connection to Batu Niah already exist.

5.2.2 Evaluation of the Models

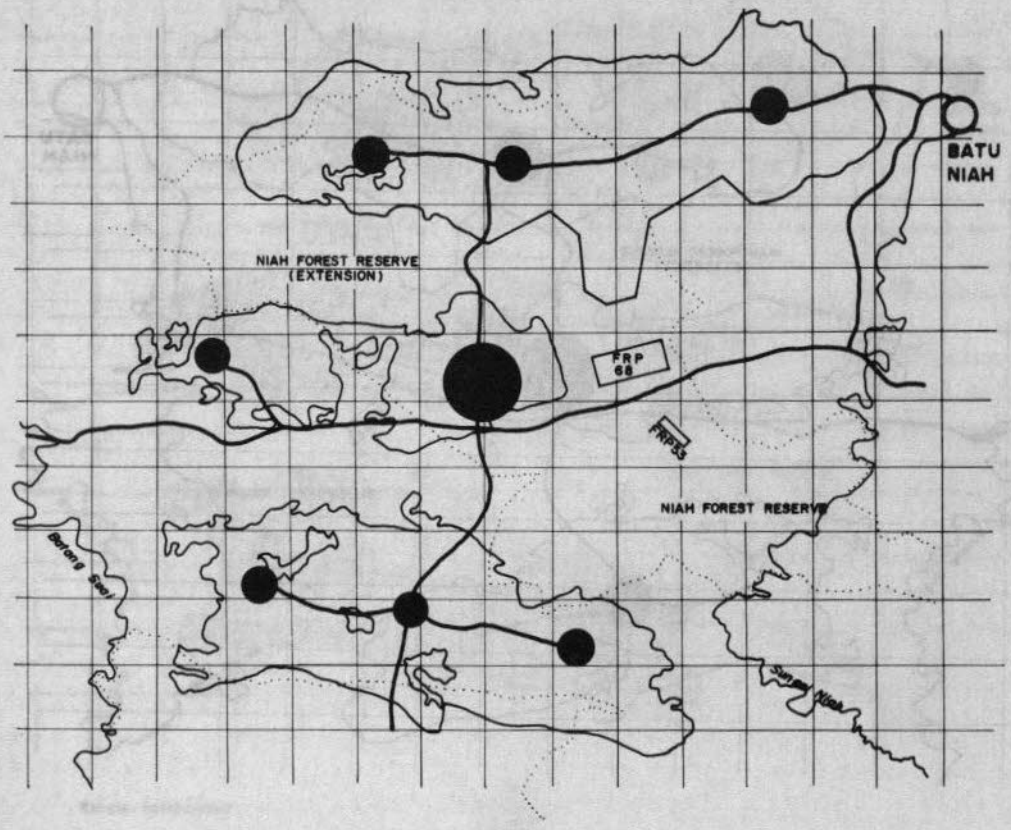
Model 1 has considerable built-in flexibility in terms of the way in which agriculture could be organised. This pattern represents the present SLDB system whereby management units of about 5 000 acres of crop land with a village of roughly 300 families are scattered throughout the area and attempts to build one of the villages into a larger service centre. However, the aim of creating a viable service centre would not be met by this model because the main town would be unlikely to grow to more than 3 000 to 4 000 people by 1990. There would be little derived effects from the initial small population to induce a further growth and a high level of services would not be justified. However, if the same standard of services should be provided in all three models, the costs for Model I would be considerably higher because there would be a repetition of the same type of services in each village.

The development of the Study Area according to this model would give a widely dispersed settlement pattern. Consequently, in the initial planning of the service centre network in the Study Area the growth of a few towns to sub regional centres would not have been catered for in this model. The level of public and private services directly accessible to the population would be lower than with the two other models. A dense network of public transport would be needed.

Model 2 would meet the requirements of supplying the population directly with a wide range of public and private services. It is similar to the estate-type development recommended in the Pahang Tenggara Study. The estate workers would always be dependent on some form of organised transport and would work fixed hours. They could never become smallholders in the true sense.

FIGURE 5.1

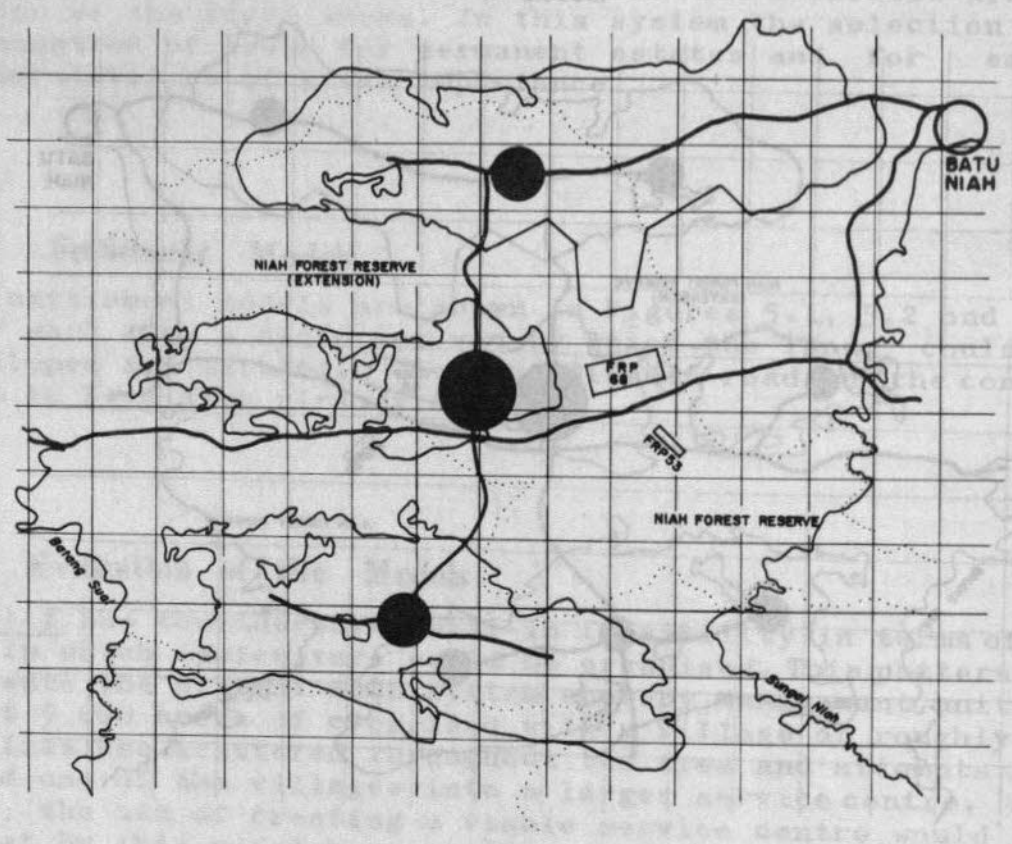
MODEL 1



MODEL 1: This settlement pattern is based on a planning grid of 1.5 miles. The nodal points in the grid identify the location of eight settlements, each with an adjoining cultivated area ranging from 2 500 to 6 500 acres. The maximum walking distance from any centre to any plot is 1.5 to 2 miles, which corresponds to about 30 minutes of walking. The settlement model is suitable for estates, for small-holders and for any combination of the two. The main town would have a population of about 3 000 people and each of the villages 1 000 to 2 000 people. The connection between the centres would be the main road system in the area.

FIGURE 5.2

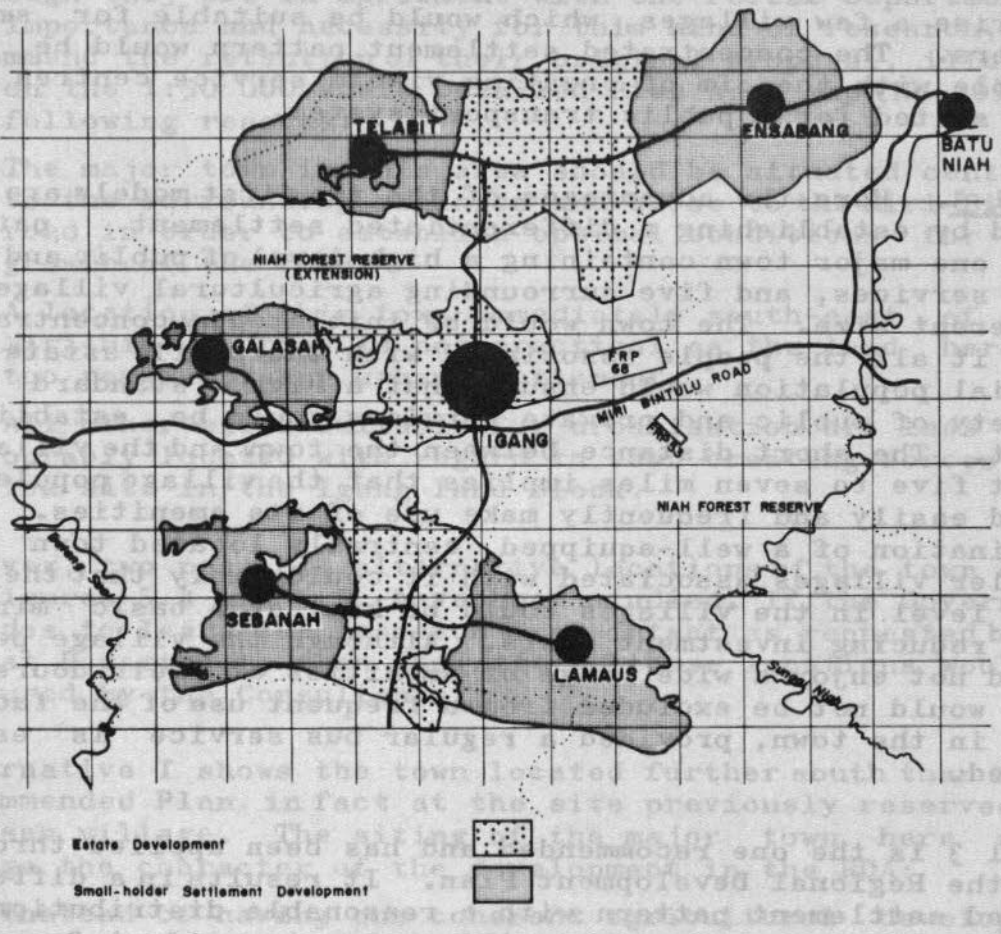
MODEL 2



MODEL 2: This settlement pattern consisting of three towns each with a population ranging from 3 000 to 7 000, is suitable for estates and for a limited number of small-holders. Each town would have an adjoining 7 000 to 15 000 acres of cultivated land, of which 4 000 to 5 000 acres nearest each town could be handed over to small-holders. The remaining 21 000 acres would be run on estate basis requiring organised transport of the workers.

FIGURE 5.3

MODEL 3



MODEL 3: The settlement pattern in this model is intended to suit both estates and small-holders. The area roughly indicated around the central town (14 000 acres) is suggested to be kept permanently as an estate. Organised transport for the field workers would be required in this area. The 2 500 to 5 000 acres around each of the five villages should eventually be worked by small-holders (21 000 acres). The main town - Igang - would have a population of 8 000 to 10 000 and each village would have about 1 000 to 2 000 people depending on the size of the surrounding planted area.

The per capita costs of service supply would be relatively cheap. Development of the Study Area to this model would comprise a few villages, which would be suitable for smallholders. The concentrated settlement pattern would be compatible with the aim of creating viable service centres and well suited for a public transport system.

Model 3. Here the advantages of the two first models are combined by establishing a differentiated settlement pattern with one major town containing a high level of public and private services, and five surrounding agricultural villages of different size. The town would be initiated by concentrating into it all the people associated with the public estate. This initial population would ensure that a high standard and variety of public and private services could be established in it. The short distance between the town and the villages, about five to seven miles implies that the village population could easily and frequently make use of its amenities. This combination of a well-equipped, centrally located town with smaller villages associated with it could imply that the service level in the villages could be kept at a basic minimum thus reducing investment costs. Although the village people would not enjoy a wide range of amenities at their doorstep, they would not be excluded from a frequent use of the facilities in the town, provided a regular bus service is established.

Model 3 is the one recommended and has been applied throughout the Regional Development Plan. It results in a differentiated settlement pattern with a reasonable distribution of all categories of towns and villages as is evident from the Regional Plan Map.

5.23 Conflict of Land Use for Urban or Forest Development

During the Consultants' planning a problem arose which was not resolved at the time of writing the present Report. The conflict concerns a clash of interests over the land block Igang. This block totalling roughly 6 400 acres contains part of an area of logged forest in which the Forest Department has started experimental work connected with the regeneration of mixed dipterocarp forests. In particular the block contains the smaller of three specific experimental plots. The purpose and significance of this research work is explained in Supporting Report 3. For development purposes following Model 3 the area containing about 4 600 acres of suitable agricultural land - is ideally located for the siting of the sub regional centre which would have five villages around it by 1990. The whole, as already explained, making up a mutually dependent rural and urban complex which would warrant a high level of services. But the siting of the town would eliminate or substantially reduce the value of the research. Therefore the Forest Department asked for a resiting of the town and a preservation of the present land use of the

area. The Consultants have considered these objections but, although they are in agreement with the Forest Department on the importance and necessity for this kind of research, they recommend the retention of their original proposal, illustrated on the 1:50 000 scale Detailed Plan Area Map (No.20), for the following reasons:

a) The major town in this area should be situated centrally to the surrounding villages and close to the Miri-Bintulu road in order to establish optimal conditions for the growth of the town.

b) A location of this town immediately south-east of the Miri-Bintulu road is not practical as the land here is too rough for any urban settlement.

c) All other sites suitable for urbanisation are less favourably located with regard to town creating forces than the site in the Igang land block.

However, two possible alternative locations of the town shown in Figures 5.4 and 5.5, have been studied. If the Government decides to leave the research area intact as requested by the Forest Department, then the latter of these locations would be favoured by the Consultants.

Alternative I shows the town located further south than in the recommended Plan, in fact at the site previously reserved for Galasah village. The siting of the major town here would change the character of the development in the RDA:

a) Instead of having one coherent agricultural development area there would be two separate areas; one orientated towards Batu Niah and one towards the new town. Thus the town creating forces would be split.

b) The major town could not be centrally located;

c) The concept of the SLDB estate and the town creating a nucleus surrounded by areas for small-holders could not be realised; the estate area would have to be moved to the southern end of the Priority Area;

d) 4 600 gross acres of agricultural land would be retained under permanent forest resulting in a lower agricultural population by about 1 700 people. This would reduce the development potentials of the town.

The conclusion therefore is that the growth of the town would be considerably slower and its possible future status as a sub regional centre would be most uncertain.

Alternative II shows the town located in the middle of the Sawai sub-scheme, which together with the Lamaus and Sebanah sub-schemes would create the estate area. The consequences of this alternative in terms of cropping pattern and management are described in Supporting Report 2, Part II. It is shown that the results of the change could be

- a reduction of the total crop area by 3 000 net acres.

FIGURE 5.4

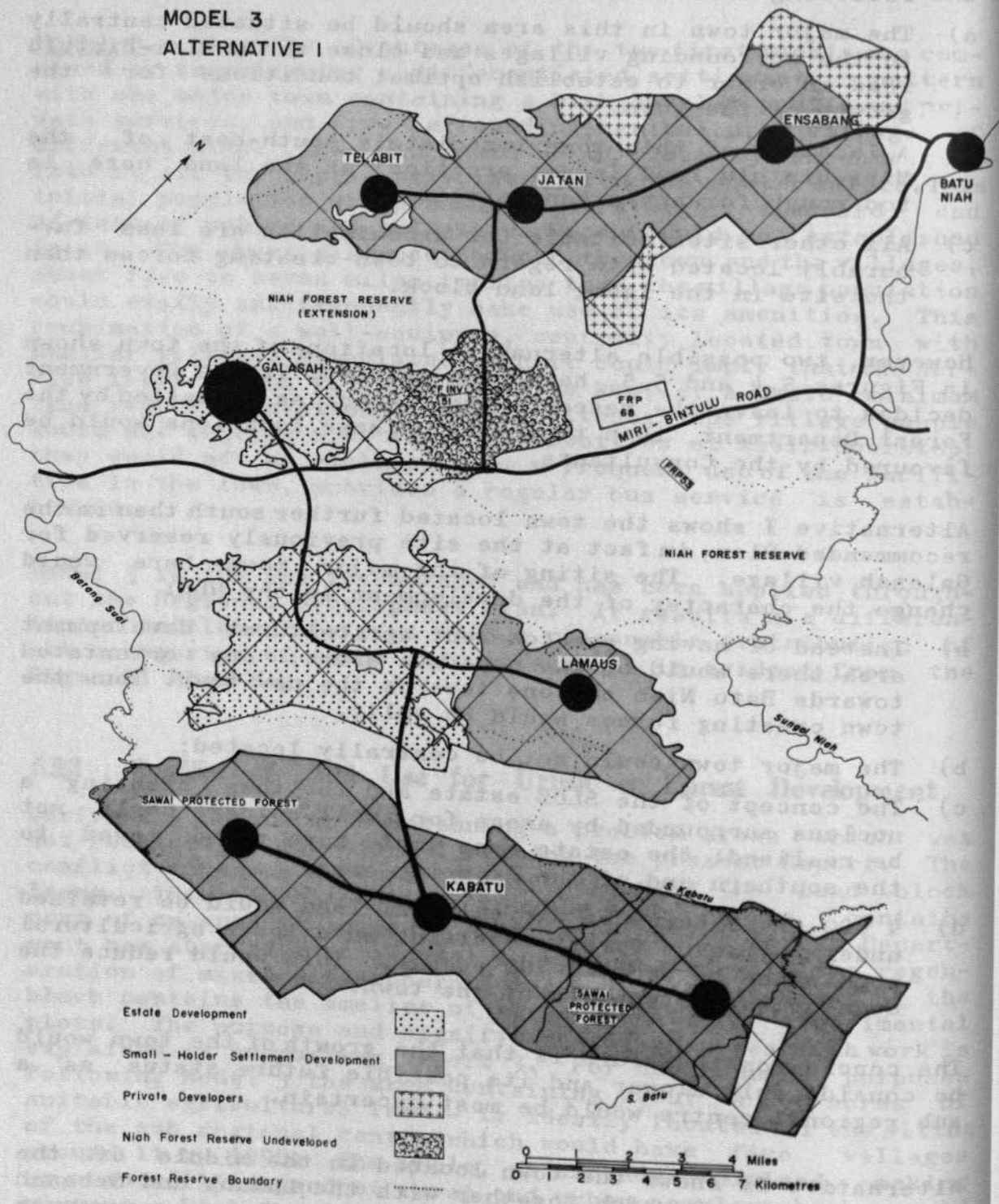
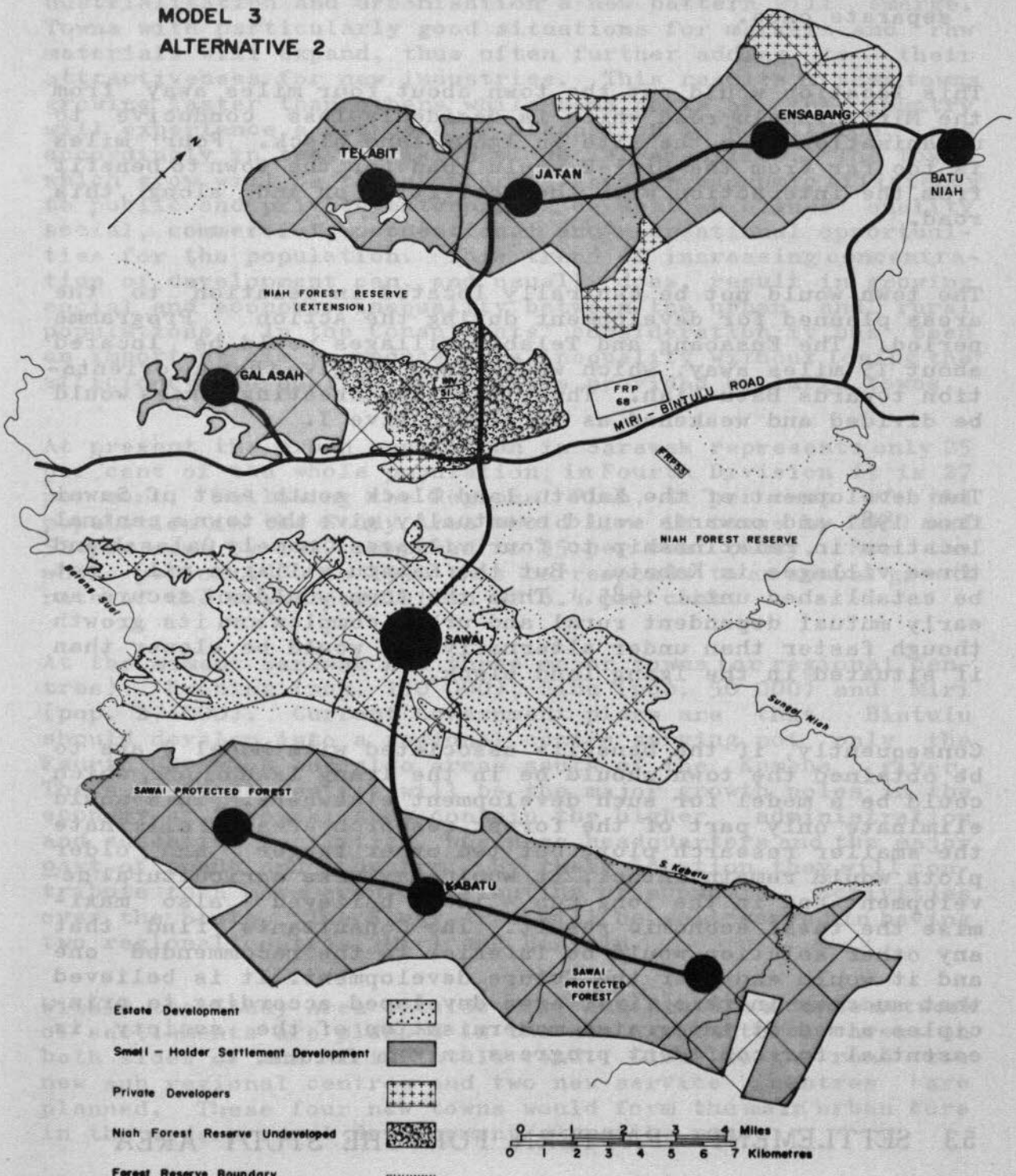

MODEL 3
ALTERNATIVE I
N
TELABIT
JATAN
ENSABANG
BATU NIAH
NIAH FOREST RESERVE (EXTENSION)
GALASAH
F.INV. 51
FRP 68
MIRI - BINTULU ROAD
FRP 53
NIAH FOREST RESERVE
Batang Suai
LAMAUS
Sungai Niah
SAWAI PROTECTED FOREST
KABATU
S. Kabatu
SAWAI PROTECTED FOREST
S. Batu
Estate Development
Small - Holder Settlement Development
Private Developers
Niah Forest Reserve Undeveloped
Forest Reserve Boundary
0 1 2 3 4 Miles
0 1 2 3 4 5 6 7 Kilometres

FIGURE 5.5


MODEL 3
ALTERNATIVE 2
N
TELABIT
JATAN
ENSABANG
BATU NIAH
NIAH FOREST RESERVE (EXTENSION)
GALASAH
FRP 68
MIRI - BINTULU ROAD
NIAH FOREST RESERVE
Batang Suai
SAWAI
Sungai Niah
SAWAI PROTECTED FOREST
S. Kabatu
KABATU
SAWAI PROTECTED FOREST
Estate Development
Small - Holder Settlement Development
Private Developers
Niah Forest Reserve Undeveloped
Forest Reserve Boundary
0 1 2 3 4 Miles
0 1 2 3 4 5 6 7 Kilometres

- a reduction of about 300 small-holder families or one small-holder sub scheme but an increase of about 50 families employed on the estate.
- an improved management situation for the estate, which would now consist of three contigious blocks instead of three separate ones.

This location would put the town about four miles away from the Miri-Bintulu road which is decidedly less conducive to urbanisation than the site in Igang land block. Four miles is too far from the Miri-Bintulu road for the town to benefit from the interaction with the activities on and along this road.

The town would not be centrally located in relation to the areas planned for development during the Action Programme period. The Ensabang and Telabit villages would be located about 15 miles away, which would tend to give them an orientation towards Batu Niah. Thus, the town creating forces would be divided and weakened as in alternative I.

The development of the Kabatu land block south east of Sawai from 1981 and onwards would eventually give the town a central location in relationship to four villages, namely Galasah and three villages in Kabatu. But the Kabatu villages will not be established until 1985. Thus the town would not secure an early mutual dependent rural and urban complex and its growth though faster than under alternative I, would be slower than if situated in the Igang land block.

Consequently, if the benefits associated with Model 3 are to be obtained the town should be in the Igang land block, which could be a model for such development elsewhere. This would eliminate only part of the forest research area and eliminate the smaller research plot, but two other larger and older plots would remain intact; it would maximise agricultural development and in the long run - it is believed - also maximise the total economic result. The Consultants find that any other solution would be inferior to the recommended one and it would endanger the future development. It is believed that success in this first area developed according to principles aimed at integrated modernisation of the society is essential for confident progress in the future.

5.3 SETTLEMENT PATTERN FOR THE STUDY AREA

The settlement plan for the Study Area is, as mentioned is based on the concept of urbanisation of rural areas and on a philosophy of concentrating development in a limited number of growth poles.

In typical agricultural societies the occupation and settlement of new territory results from the demands of an increasing population and is directed by the suitability of the land for the prevailing type of agriculture; usually the nearest suitable land is occupied first. With the appearance of industrialisation and urbanisation a new pattern will emerge. Towns with particularly good situations for markets and raw materials will expand, thus often further adding to their attractiveness for new industries. This results in some towns growing faster than others while some parts of the country will experience a decrease or stagnation in population, and accordingly in the provision of social amenities. The towns which grow will be those offering greater economic efficiency to public and private enterprises as well as higher quality social, commercial, occupational and recreational opportunities for the population. This trend of increasing concentration of development can, and usually does, result in growing social and economic inequality between the urban and rural populations. In the Consultants' consideration it has been an important aim to reduce this inequality without losing the efficiency and quality of services provided by large towns.

At present the urban population in Sarawak represents only 25 per cent of the whole population; in Fourth Division it is 27 per cent. Following the Regional Plan, 41 per cent of the population in the Study Area would live in towns by 1980 and 52 per cent by 1990 compared to 35 per cent today. For the whole period 1970 to 1990 this corresponds to an annual growth rate of the urban population of 6.4 per cent.

At the moment Sarawak has three major towns (or regional centres): Kuching (pop. 110 000), Sibu (pop. 50 000) and Miri (pop. 27 000). Current Government plans are that Bintulu should develop into a regional centre serving not only the Fourth Division but also areas south of the Kemena river. These regional centres will be the major growth poles in the economy of Sarawak; they contain the higher administration and education facilities, business headquarters and the major part of trade and industry. By their location they will contribute to a more even distribution of economic activities over the State. The Study Area will be well served in having two regional centres, Miri and Bintulu.

Within the Study Area outside Miri and Bintulu a dense network of settlements are planned in the new agricultural areas on both sides of the Miri-Bintulu road. Close to the road two new sub regional centres and two new service centres are planned. These four new towns would form the main urban core in the modern rural development along the road.

In addition to the urbanisation of the rural areas on both sides of the Miri-Bintulu road, it is important already within this Plan to extend development and urbanisation into the interior of the Study Area. The opportunity for such advances is offered in the Long Lama and Labang-Tubau areas.

Marudi, with an extensive bazaar area and a wide range of public services, has already a position as a sub regional centre, which it is expected to maintain in the future. The population growth of Marudi, however, will be slow and it is not envisaged to reach the usual minimum population threshold (7 000 people) for a sub regional centre by 1990.

The distribution of different types of settlements in the Study Area by 1990 is planned as follows:

- two regional centres; Miri with about 55 000 people and Bintulu with nearly 40 000;
- four sub regional centres, three of which, Long Lama, Igang and Timong, would each have a population of 7 000 to 8 000, and Marudi a somewhat lower population;
- five smaller service centres with populations of 4 000 to 5 000 people at Batu Niah, Sigrak, Nyalau, Ladang Tiga and Beseduan;
- 26 new villages with populations of 1 000 to 2 000 people, of which nine will be established by 1980.

The Sub Regional Centres are planned to be District or Sub District headquarters. In addition to the industries directly connected with the processing of agricultural produce and timber, these centres would have a limited number of small-scale industries. They would have an urban character with a fairly high standard of public and private services.

The Service Centres are planned to have an urban core, while the residential areas would consist mainly of medium density housing. There would be a bazaar area, supplies of water, electricity and such public services as a secondary school and a community health centre.

The Villages are planned to have a rural image with a few shophouses and a primary school in their centres around which the population, mainly farmers, would live on One-Acre Homestead Plots (see Section 7.1.1).

The target population growth and existing populations of regional centres, sub regional centres, service centres and existing main bazaars are given in Table 5.1. The settlements listed in the table are those classified as semi-urban and urban. The figures should be regarded targets not exact projections; they are indications of a possible future situation.

TABLE 5.1 POPULATIONS OF SEMI-URBAN AND URBAN SETTLEMENTS 1970, 1980 and 1990

Settlement	Population		
	1970	1980	1990
Miri	27 000	36 000	55 000
Bintulu	6 000	14 000	38 000
Marudi	4 000	5 000	6 000
Long Lama	600	2 500	7 500
Igang	0	3 600	8 000
Timong	0	900	7 000
Ladang Tiga	0	2 500	4 000
Beluru	500	1 000	1 500
Bekenu	700	1 000	1 500
Batu Niah	1 000	2 000	4 000
Niah	1 000	1 300	1 300
Sigrak	0	0	4 000
Beseduan	0	0	5 000
Sebauh	700	900	1 000
Total	41 500	70 700	143 800

CHAPTER 6

FUTURE TRANSPORT INFRASTRUCTURE

This chapter gives a summary of the future transport infrastructure, that is, new roads, ports and airports associated with the planned development. A more detailed description, which includes the present situation, is given in Supporting Report 7. Work on each of the following items has been planned to synchronise with other activities in the overall plan. The estimated costs of the road construction and improvements up to 1980 are given in Table 6.1 while the whole road network is shown in Figure 6.1. The standards and estimated costs for main public roads are given in Supporting Report 7. These are the bases for the figures given in Table 6.1 unless the particular item has already been included in the Public Works Department (PWD) programme, in which case their estimates are used.

The transport infrastructure in the Study Area should include the following main features:

- construction of 48 miles of new trunk roads during the Action Programme period;
- construction of 264 miles of other public roads outside the urban areas, of which 124 miles should be completed in the Action Programme period;
- construction of 76 miles of new urban roads during the Action Programme period;
- improvement and surfacing of 130 miles of trunk roads and secondary roads and improvements to 11 bridges during the Action Programme period;
- constructing, by 1980, a deep water port near Bintulu, modernising the ports at Miri and Marudi, and possibly the port facilities at Kuala Baram;
- building modern airports, able to serve medium-sized jet aircraft, at Miri and Bintulu.

In addition to the road works already mentioned, there would be an extensive network of forest roads in the FAO Units 1, 2 and 3. About 60 miles of these roads would also serve planned agricultural development and are proposed to be built as public roads. They would be built to PWD standards at an estimated cost of between $120 000 and $150 000 per mile. Normal Class I forest roads cost about $35 000 per mile. It is assumed in the overall costings for the regional plan that the costs of building these public roads would be shared between the Government and the timber firms exploiting the Units.

The high cost in Table 6.1 of construction and improvements of roads in 1976 is partly due to considerable work already planned by PWD for the improvement and strengthening of the Miri-Bintulu road ($6 mn). In order to avoid such a peak it

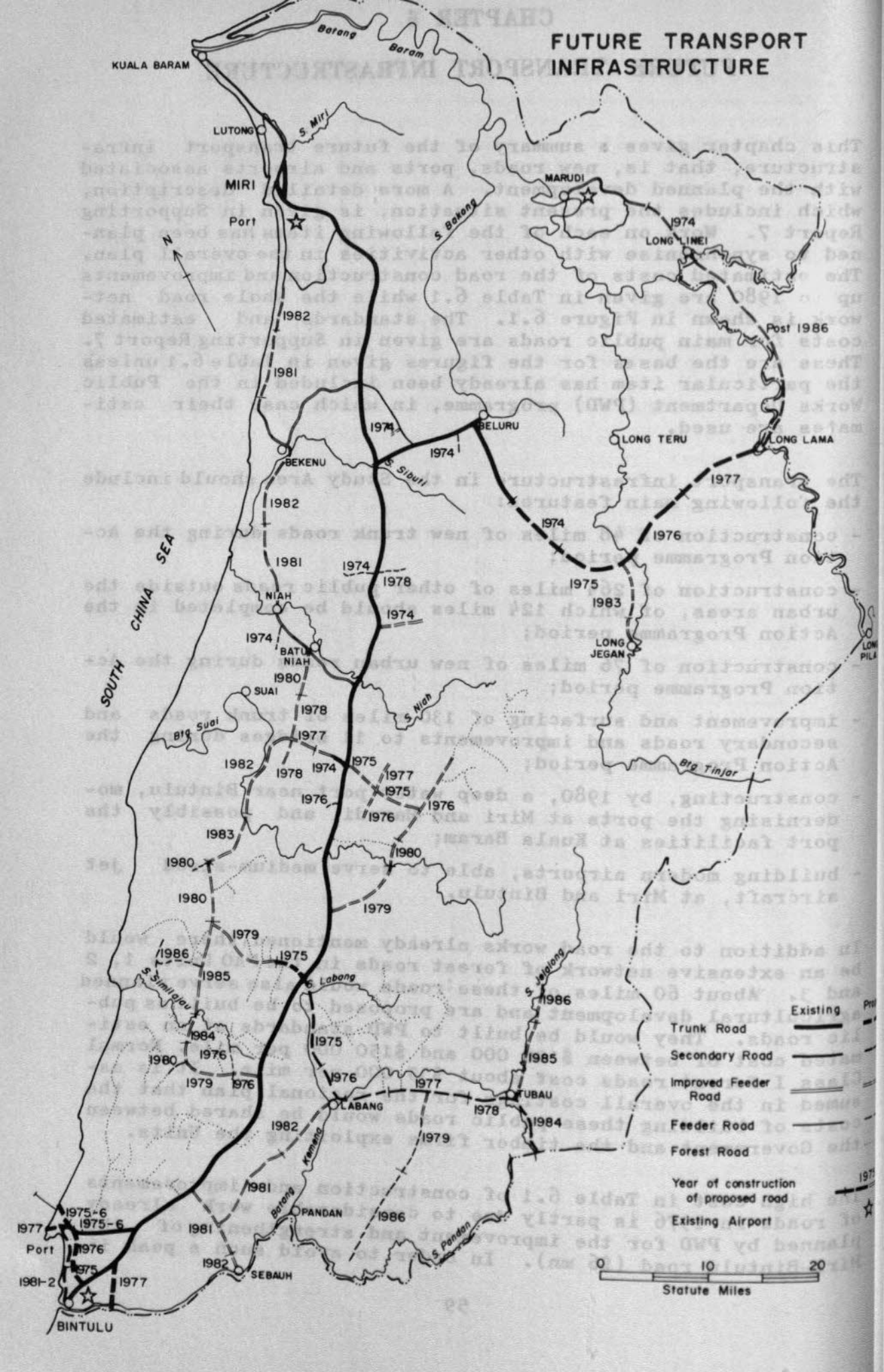

FUTURE TRANSPORT INFRASTRUCTURE
KUALA BARAM
Batang Baram
LUTONG
S. Miri
MIRI
Port
N
MARUDI
S. Bakong
1974
LONG LINEI
Post 1986
1982
1981
BELURU
1974
LONG TERU
LONG LAMA
BEKENU
S. Sibuti
1977
1982
1974
1976
SOUTH CHINA SEA
1981
1974
1978
1975
1983
NIAH
1974
1974
LONG JEGAN
BATU NIAH
1980
SUAI
S. Niah
1978
Btg Suai
1977
1982
1978
1974
1975
1977
1975
1976
1976
1976
Btg Tinjar
1983
1980
1980
1980
1979
1979
1986
1975
1985
S. Labang
S. Similajau
S. Jelalong
1986
1984
1975
1980
1976
1985
1979
1976
1976
1977
TUBAU
LABANG
1978
1984
1982
1979
Kemena
1981
Batang
PANDAN
1986
1975-6
1975-6
1977
Port
1976
1981
S. Pandan
1975
1982
SEBAUH
1981-2
1977
BINTULU
Existing
Trunk Road
Secondary Road
Improved Feeder Road
Feeder Road
Forest Road
Year of construction of proposed road
Existing Airport
0
10
20
Statute Miles

TABLE 6.1 ROAD CONSTRUCTION AND IMPROVEMENTS 1975-80

Construction	1975		1976		1977		1978		1979		1980		Totals 1975-1980	
	Miles	Costs $ 000	Miles	Costs $ 000	Miles	Costs $ 000	Miles	Costs $ 000	Miles	Costs $ 000	Miles	Costs $ 000	Miles	Costs $ 000
Trunk roads	20.0	5 755	15.1	4 577	12.5	3 240							47.6	13 572
Secondary roads	9.0	1 600	8.0	1 600	8.0	1 600	4.8	960					28.8	5 760
Improved feeder roads	20.6	2 710	11.3	1 695	5.5	830	6.1	910	20.4	3 060	14.0	2 100	77.9	11 305
Feeder roads			4.1	492			2.7	324	6.5	780	4.1	492	17.4	2 088
Urban roads	8.4	617	9.1	921	17.1	1 432	19.2	1 887	12.7	1 074	9.9	990	76.4	6 921
Sub Total		10 682		9 285		7 102		4 081		4 914		3 582		39 646
Improvements and surfacing														
Trunk roads	10.5	2 500	30.5	7 000	26.5	6 000	18.0	4 160	17.0	4 000	17.0	4 000	119.5	27 660
Secondary roads	2.3	500	2.3	500			3.0	1 500	3.0	1 500			10.6	4 000
Bridges		250		700		500		250		250			-	1 700
Sub Total	12.8	3 250	32.8	8 200	26.5	6 500	21.0	5 910	20.0	5 500	17.0	4 000	130.1	33 360
Total	69.8	13 932	80.4	17 485	69.6	13 602	53.8	9 991	59.6	10 414	45.0	7 582	378.2	73 006

TABLE 6.2 URBAN ROADS PLANNED FOR CONSTRUCTION BETWEEN 1974-1980

Town	1974	1975		1976		1977		1978		1979		1980	
	Miles	Miles	Standardise ($ 000)	Miles	Standardise ($ 000)	Miles	Standardise ($ 000)	Miles	Standardise ($ 000)	Miles	Standardise ($ 000)	Miles	Standardise ($ 000)
Ladang Tiga, Subis I and II	6.3												
Ladang Empat		2.0	40										
Meraa		2.2	44										
Igang				3.3	200	3.3	200	3.3	190				
Galasah						2.5	150						
Sebanah						3.6	254						
Lamaus								4.2	267				
Ensabang										4.2	267		
Telabit												1.4	188
Timong				0.4	8								
Miri*		3.3	500	3.3	500	3.3	500	3.3	500	3.3	500	3.3	500
Bintulu**				1.2	180	1.2	180	1.2	180	1.2	180	1.2	180
Long Lama								4.1	615	1.4	29	1.5	29
Batu Niah		0.9	33	0.9	33	0.9	33	1.0	33	1.0	33	1.0	33
Marudi						1.3	40	1.3	40	1.3	40	1.1	35
Beluru								0.3	25	0.3	25	0.4	25
Bekenu								0.5	37				
Labang						1.0	75						
Total	6.3	8.4	617	9.1	921	17.1	1 432	19.2	1 887	12.7	1 074	9.9	990

* Mileages estimated on basis of cost figures taken from the Mid Term Review of the Second Malaysia Plan.
** Excludes trunk roads in the Tanjong Kidurong Area.

is suggested that the work on the Miri-Bintulu road is phased in the light of the above figures.

The urban roads required in the Plan up to 1980 are shown in Table 6.2. The type of road planned for each settlement is described in the town packages in Chapter 7. Some of these roads are planned to be built to PWD standards. In addition low cost roads have been proposed to provide access to residential areas in villages and small towns. Estimated construction costs and standards for these roads are given in Supporting Report 7.

The phasing of urban roads is planned in accordance with the expected growth of the populations, consequently the construction, for example for Batu Niah, is assumed to occur throughout the whole Action Programme period. However, if from a road construction point of view, it is found more opportune to concentrate the road building in each town, this should be done.

CHAPTER 7

TOWN PLANNING AND URBAN INFRASTRUCTURE

The present chapter describes the Consultants' recommendation for a planned development of individual towns and settlements in the Study Area.

The basic ideas and general conclusions of the town planning are presented in Section 7.1, and plans for each settlement in successive sections. The town plans are accompanied by town development packages, which show in detail the physical requirements and investment costs for building-up the towns planned to be started during the period 1975 - 1980.

7.1 TOWN PLANNING

The town planning work in this Study has been an integral part of the concept of urbanisation of rural areas which is described in Chapter 5. More comprehensive town planning has been outside the scope of work. The present report covers structure plans for sub regional centres, service centres, villages, existing smaller settlements and towns and some outlines for the planning of the regional centres, Miri and Bintulu. The function and hierarchy of these towns are described in Chapter 5.

The section builds on the results from several other branches of the Study, such as:

- the surveys of topography and soils;
- the agricultural planning, which indicates the areas where agricultural development should take place and the number of people that could be accommodated;
- the population and occupation studies, which show the relation between population occupied in primary activities (agriculture, forestry, etc) and the derived population, serving the primary population;
- Supporting Report 6, which describes the character and quantity of public and private services to be established in urban settlements of various sizes, and the corresponding investment costs.

A basic view point has been that town planning can no longer be seen as a once and for all master plan covering a series of decisions for the next two decades. It should rather be seen as a part of the development machinery facilitating full control and positive encouragement of the development process. In this philosopy a plan is not considered as an end in itself, comprising ideal patterns of land use and design, population distribution and industrialisation, but rather as a

means of action, indicating the decisions to be taken, the stages of the planning and the translation of the plans into running programmes and projects for implementation.

This open planning principle leads to the preparation of overall structure plans based on the envisaged function of the town/village, mainly determined by the agricultural and forestry activities around it, and the standards contained in Supporting Report 6. The plans provide for expansion of the town or village and include a flexibility which would allow for a further growth beyond the foreseen population targets, functions and activities.

The structure plans for new towns and the expansion plans for existing towns should be regarded mainly as strategy plans which can be developed into action programmes when further information on the topography, land use and ownership is collected.

7.1.1 The Neighbourhood Unit and the One Acre Homestead - Plot

Settlements in rural areas should be based mainly on the principle of low building density. This would enable the house-holder to improve the standard of the dwelling in the future and would reduce the danger of creating slums. Also excessive renewal requirements would be avoided.

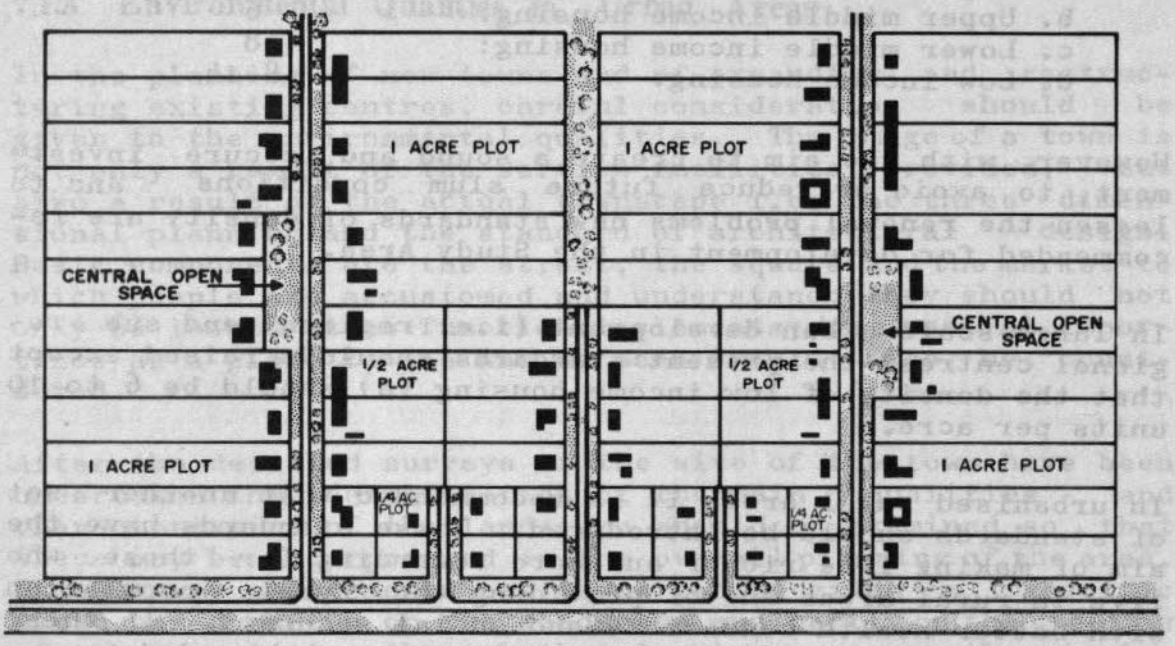
A residential area with low cost houses on one acre plots is recommended for rural settlements. This, it is believed, would provide the villagers with a certain needed economic and social security. A family could derive part of its living from cultivating the one acre plot. The production of fruit, vegetables, pepper, smallstock, etc, could be undertaken and there would be sufficient space for the expansion of farm land, the house and storage facilities. In low density areas the dwellings and public utilities could be kept to a basic minimum and still be of a reasonable health standard. Later improvements could take place as incomes increase. Those improvements could be introduced either by the authority or by the owner. The renewal of the residential areas could take place as a natural and gradual process. Also, should the occupational and functional structure of the settlement change, the one acre plot could be subdivided into half acre or quarter acre plots. In this respect the low density residential areas would have a built-in reserve for the accommodation of more people in the future. This possible subdivision is illustrated in Figure 7.1.

A further principle recommended for the rural settlements is that the houses should be organised in neighbourhood units with 20 to 25 households or 100 to 150 people in each unit. It is believed that this arrangement would contribute to the

FIGURE 7.1

2 NEIGHBOURHOOD UNITS

EACH OF 24 ONE ACRE PLOTS



creation of a new identity for the villagers, and would meet an explicit need for social security. This is important because the people who would live in the new towns, would come from different communities with different cultural backgrounds.

By creating neighbourhood units,people with the same background could be settled close together in the same unit. This would contribute to evolving a community spirit and encourage cooperation and mutual assistance. For instance, while some farmers are working in the fields, other members of the neighbourhood unit could be looking after their homes and smallstock on the homestead plot. A small area within each neighbourhood unit should be reserved for a meeting place for children and adults as shown in Figure 7.1.

7.1.2 The Standards of Density

The standards of density, i.e. the number of dwellings per acre of land, is an important factor in town planning. The various sizes and qualities of houses and the density at which they are built in urban areas are factors which usually depend on the income of the people concerned. The currently

applied standards of housing density in the Fourth Division and in Sarawak are:-

	Units per acre
a. High income housing:	3
b. Upper middle income housing:	6
c. Lower middle income housing:	8
d. Low income housing:	8-14

However, with the aim to create a sound and secure investment, to avoid or reduce future slum conditions and to lessen the renewal problems new standards of density are recommended for development in the Study Area.

In large-scale urban development (i.e. regional and sub regional centres) the present standards should be raised except that the density of low income housing (d) should be 6 to 10 units per acre.

In urbanised rural areas it is recommended that another set of standards should be introduced. These standards have the aim of making life richer and more rewarding for those who live in rural areas and of providing the rural population with better health conditions and social security. In these areas the following housing densities are recommended:-

	Houses per acre
a. High density areas:	6
b. Medium density areas:	3-4
c. Low density areas:	1

The percentage distribution of income groups in urbanised rural areas, that is, in urban areas outside the regional centres, in 1980 has been estimated at:-

	Percent
a. Low income:	50
b. Lower middle income:	30
c. Higher middle income:	15
d. High income:	5

The standards applied in the structure plans for settlements in the rural areas are as follows:-

	Units per acre
1. Low income:	
a) small-holders in low density areas	1
b) estate workers in agriculture in medium density areas	3-4
c) other groups in high density areas	6
2. Lower middle income in high density areas:	6
3. Higher middle income in medium density areas:	3-4
4. High income in medium density areas:	3-4

These standards have been applied to the structure plans for settlements in the rural areas in the Study Area.

7.1.3 Environmental Qualities in Urban Areas

In the planning of new towns and of expanding and restructuring existing centres, careful consideration should be given to the environmental qualities. The image of a town is not only a result of the service facilities provided, but also a result of the actual townscape i.e. the three dimensional planning and the standard of architectural design. Basic components are the street, the square and the market to which people are accustomed and understand; they should not only be looked at as functional elements; their social importance as a place to see and be seen should also be considered.

After the detailed surveys of the site of the town have been undertaken the identification of the main qualities and characteristics of the landscape should be examined so that these may be incorporated in the overall planning of the area. In this way settlements and towns can be given a specific image based partly on the landscape and partly on the creation of urban qualities through the planning process, the implementation, and the activities established by the future settlers.

Landscaping is an important factor in the planning of a town. Shade trees should be planted in streets, square, in front of and around public buildings and in pedestrian areas. By such efforts and by a general landscaping of each settlement the functional structure of the towns could be emphasised.

Another important environmental quality could be the integration of various urban functions; they must to some extent be seen in opposition to a simultaneous differentiation of activities as envisaged in the structure plans. Differentiation could be obtained by keeping for instance heavy industries, and industries which pollute the environment, and heavy road traffic out of the town centres and residential areas. However, light industries, workshops, handicraft and other similar activities could be kept in the town centre and even in some of the residential areas thus being integrated with all the other facilities located there. Likewise the town centres could have limited residential functions especially for shopkeepers and other people directly attached to the activities in the centre. This would tend to decrease transport needs between the house and working place; it would prevent unnecessary pressure of traffic on the local road network and would make the towns more lively and attractive and offer a wide range of opportunities and attractions. Reserve areas

for heavy and light industries should be laid out in the structure plans.

7.2 THE REGIONAL CENTRES

The regional centres should be developed according to planning standards and principles which apply to larger towns like administrative and industrial centres. The urban image of these centres is based on a wide range of employment opportunities offered by public administration, industry and other services.

The residential area in the regional centres should contain all different classes of housing based on the expected income distribution of the urban population. The housing density recommended for residential areas in the regional centres was indicated in Section 7.1.2.

The height of buildings in residential areas should not be of more than two storeys. Services and administration activities within the towns should be located in one major centre or in a maximum of two to three sub centres depending on the size of the town, developed within walking distance of the residential areas. Some of the recreational areas should be developed in close connection to the central facilities and the residential areas should be laid out with enough space to allow future expansion of the central facilities. Services facilities like the bazaar, the market place and the community hall, which are used by the majority of the population should be given a central location in the town. Other services such as higher education and hospitals could be located in close connection to the housing and recreational areas. The height of buildings in central areas should be of maximum three storeys.

7.2.1 Outline Plan for Miri

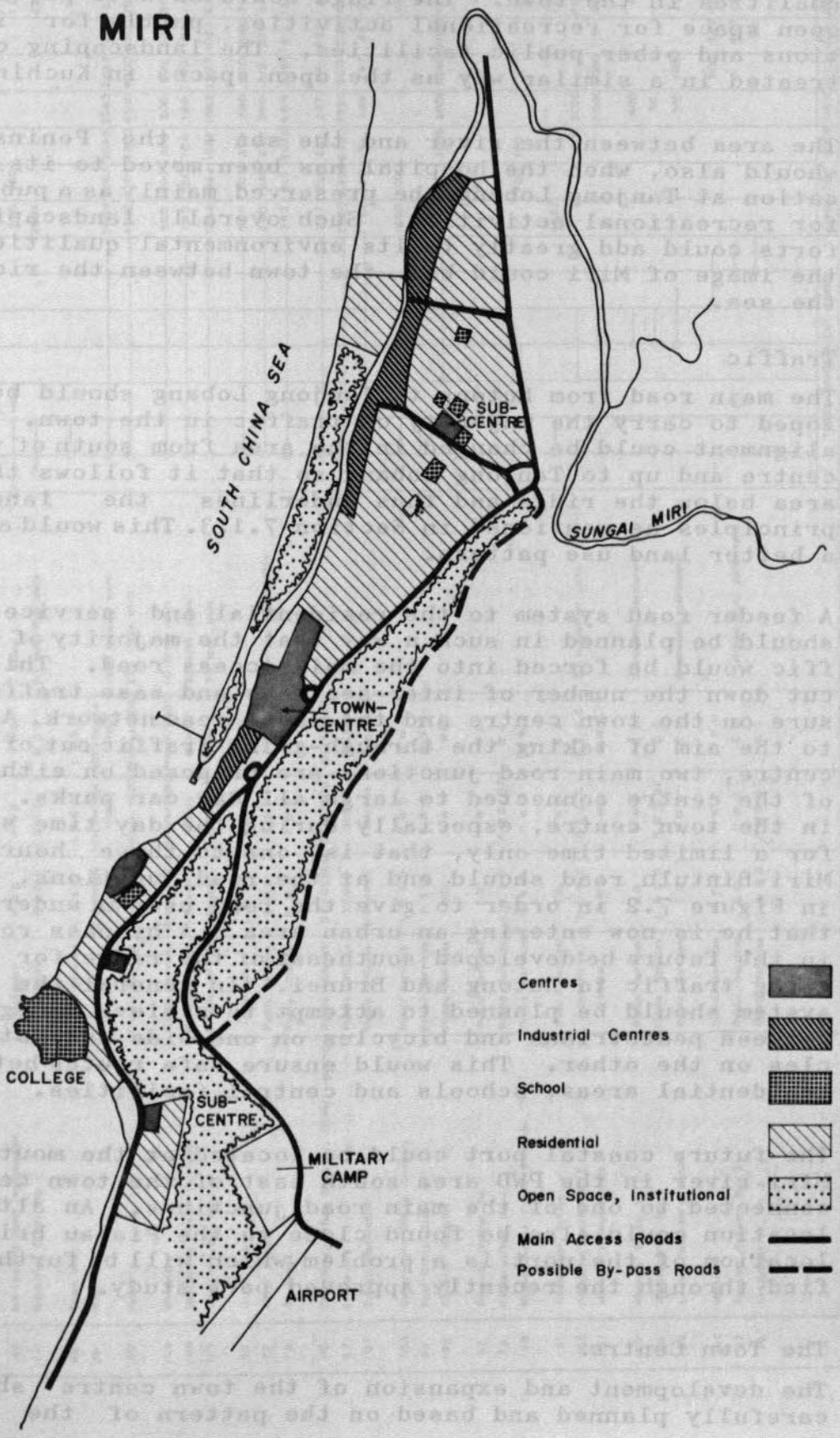
It is envisaged that Miri and Lutong would grow from an approximate population of 30 000 in 1970 to 55 000 in 1990. As mentioned in the introduction to this Chapter, comprehensive town planning has been outside the scope of the present work. Therefore, the outlines given in the section are presented primarily as an inspiration to those who will continue the detailed town planning of Miri.

Landscaping

The location of Miri along the river and coastline with a distinct ridge behind it, has forced Miri into a long narrow development from Tanjong Lobang to Piasau. This is shown in Figure 7.2. This situation, however, although it has created

FIGURE 7.2

DRAFT OUTLINE PLAN
MIRI



considerable difficulties in road planning, should be taken as a positive opportunity to develop special environmental qualities in the town. The ridge could be used partly as an open space for recreational activities, partly for institutions and other public facilities. The landscaping could be treated in a similar way as the open spaces in Kuching.

The area between the river and the sea - the Peninsular - should also, when the hospital has been moved to its new location at Tanjong Lobang, be preserved mainly as a public area for recreational activities. Such overall landscaping efforts could add greatly to its environmental qualities, and the image of Miri could be: the town between the ridge and the sea.

Traffic

The main road from Lutong to Tanjong Lobang should be developed to carry the majority of traffic in the town. The road alignment could be changed in the area from south of the town centre and up to Tanjong Lobang so that it follows the green area below the ridge and thus underlines the landscaping principles as mentioned in Section 7.1.3. This would also give a better land use pattern.

A feeder road system to the residential and services areas should be planned in such a way that the majority of the traffic would be forced into the main access road. This would cut down the number of inter-sections and ease traffic pressure on the town centre and the local road network. According to the aim of taking the through-going traffic out of the town centre, two main road junctions are proposed on either side of the centre connected to large all day car parks. Parking in the town centre, especially during the day time should be for a limited time only, that is, one to three hours. The Miri-Bintulu road should end at the road junctions, as shown in Figure 7.2 in order to give the road user an understanding that he is now entering an urban area. A by-pass road could in the future be developed southeast of the ridge for through-going traffic to Lutong and Brunei. In general the traffic system should be planned to attempt to achieve a segregation between pedestrians and bicycles on one side and motor vehicles on the other. This would ensure safe routes between the residential areas, schools and central facilities.

The future coastal port could be located at the mouth of the Miri river in the PWD area south east of the town centre and connected to one of the main road junctions. An alternative location could also be found close to the Piasau bridge. The location of the port is a problem which will be further clarified through the recently approved port study.

The Town Centre

The development and expansion of the town centre should be carefully planned and based on the pattern of the existing

Table 7.1

TOWN DEVELOPMENT PACKAGE NUMBER : 1 : MIRI

PROJECT NUMBER	PROJECT NAME	SECTOR	DEPARTMENT			SPECIFICATIONS	IMPLEMENTATION							INVESTMENT COSTS THOUSAND DOLLARS						
			PLANNING	IMPLEMENTING	BUDGET		1974	1975	1976	1977	1978	1979	1980	1975	1976	1977	1978	1979	1980	TOTAL
51	Extension Miri Airport	Transport	P W D	P W D	P W D									4000	2000					6000
49	Miri- Lutong Road Improvement	Transport	P W D	P W D	P W D	7 miles								500	500					1000
111	Industrial Estate No. 1	Industries	B D C	B D C	B D C	50 industrial units								2500						2500
66	Town Plan	Public Services	L & S D	L & S D	L & S D															
29	Housing	Housing	HDC/Private /PWD	HDC/Private /PWD	HDC/Private /PWD	1395 housing units								2063	2063	2063	2063	2063	2063	12378
107	Retail	Private Services	Private/SEDC	Private/SEDC	Private/SEDC	225 trade units								4300	4300	4300	4300	4300	4300	25800
108	Wholesale	Private Services	Private/SEDC	Private/SEDC	Private/SEDC	15 trade units								500	500	500	500	500	500	3000
109	Specialised Private Services	Private Services	Private	Private	Private	25 spec. units								180	180	180	180	180	180	1080
110	Other Private Services	Private Services	Private	Private	Private	75 spec. units								1062	1062	1062	1062	1062	1062	6372
50	Urban Roads	Transport	L & S D	P W D	P W D									500	500	500	500	500	500	3000
77	Water Supply	Public Utilities	P W D	P W D	P W D	Pipelines, distribution								240	1640	240	940	512	276	3848
78	Sewerage	Public Utilities	P W D	P W D	P W D									383	313	2033	4414	3562	1612	12317
90	Cleansing, Refuse Disposal, Street Lighting	Public Utilities	DC/SESCO	DC/SESCO	DC/SESCO									227	212	227	227	299	299	1491
97	Electricity	Public Utilities	SESCO	SESCO	SESCO									2250	2350	2350	2350	500	500	10300
101	Telecommunication	Public Utilities	Telecoms	Telecoms	Telecoms									1780	100	51	139	797	49	2916
70A	Government Office Complex	Public Services	L & S D	P W D	P W D									1000	1000					2000
65	Post Office Class A	Public Services	P S D	P W D	P S D									450						450
192	General Hospital	Public Services	M D	P W D	M D											3000	3000	3000	3000	12000
57	Primary School No. 1	Public Services	E D	P W D	E D										427					427
72	Kindergarten No. 1	Public Services	L & S D	P W D/DC	D C										50					50
156	Miscellaneous Public Buildings	Public Services	P W D	P W D	P W D										100	100				200
191	Vocational School	Public Services	E D	P W D	E D									1527						1527
203	Industrial Estate No. 2	Industries	S E D C	S E D C	S E D C	50 Industrial units										2000	2000			4000
221	Miri Port Improvement	Transport	P W D	P W D	P W D												2000	2000		4000
57	Primary School No. 2	Public Services	E D	P W D	E D	2 streams, permanent											400			400
72	Kindergarten No. 2	Public Services	L & S D	P W D/DC	D C												50			50
154	Lower Secondary School	Public Services	E D	P W D	E D	2 streams, permanent											565	500		1065
252	Mosque	Public Services	S P U	P W D	S P U													500	500	1000
57	Primary School, No. 3	Public Services	E D	P W D	E D	1 stream unit, permanent													400	400
72	Kindergarten, No. 3	Public Services	L & S D	P W D/DC	D C														50	50
						TOTAL INVESTMENT COSTS								23462	17297	18606	24690	20275	15291	119621

bazaar area. For the edification of environmental qualities and atmosphere of a town, time is a very important factor, therefore considerations should be given to preservation and evaluation of existing historical public or private buildings. The re-development and expansion programmes should be treated in layout and phasing in a more sensible way than those which have caused the decline of environmental qualities of many towns and cities all over the world at the present time. In Miri there are several buildings of quality and interest, although it is not obvious that everybody is as yet fully aware of it. If these buildings are destroyed, the population would within a few years deplore the lack of environmental qualities and relations with the past.

The town development package for Miri is shown in Table 7.1. The specific recommendations with regard to public utilities are described in Chapter 8.

7.22 Outline Plan for Bintulu

It is envisaged that Bintulu might grow from an approximate population of 6 000 in 1970 to nearly 40 000 in 1990 thus being established as the fourth regional centre in the State. A precondition for this growth, which cannot be expected to come by itself, would be a deliberate effort by Government to promote and support such a development. The public and private enterprises proposed for Bintulu are mentioned in Chapter 3. Of the possible industries proposed for the Action Programme period only the Liquidfied Natural Gas plant and the glass and bottling factories are included in the town development package, Table 7.2.

The Outline Plans shown in Figures 7.3 and 7.4 demonstrate a possible layout for the future Bintulu Regional Centre. The existing centre and bazaar area at the mouth of the Batang Kemena should in 1976 be connected by a road to the area close to Tanjong Kidurong, where the LNG plant is going to be built.

The alignment of this road would be important for the structuring of the future regional centre. A detailed survey of this alignment should be undertaken by PWD in co-operation with a town planning team, and it should be based on a broad understanding of all planning factors involved. It is believed that this road could be the main spine of the road network in the future Bintulu, with all major town developments attached to it.

The Outline Plan for 1990, as shown in Figure 7.4, illustrates that a linear development principle has been chosen for this growth of Bintulu. The town would be located in the coastal area, covering an area from the existing bazaar and service centre to the future deep water port and industrial areas at Tanjong Kidurong.

Table 7.2

TOWN DEVELOPMENT PACKAGE NUMBER : 2 : BINTULU

PROJECT NUMBER	PROJECT NAME	SECTOR	DEPARTMENT			SPECIFICATIONS	IMPLEMENTATION							INVESTMENT COSTS THOUSAND DOLLARS						
			PLANNING	IMPLEMENTING	BUDGET		1974	1975	1976	1977	1978	1979	1980	1975	1976	1977	1978	1979	1980	TOTAL
44	Bintulu - Tg. Kidurong Road	Transport	PWD	PWD	PWD	10 miles trunk road								1800	2000	200				4000
66	Town Plan, Bintulu	Public Services	L&SD	L&SD	L&SD															
30	Housing, Bintulu	Housing	HDC/Private	HDC/Private	HDC/Private	1314 housing units								1940	1940	1940	1940	1940	1940	11 640
79	Water Supply, Bintulu	Public Utilities	PWD	PWD	PWD	Head work, pipelines distribution								370	130	130	280	726	130	1766
80	Sewerage, Bintulu	Public Utilities	PWD	PWD	PWD									305	1910	1575	672	1791	1141	7394
91	Cleansing, Refuse Disposal, Street lighting Bintulu	Public Utilities	DC/SESCO	DC/SESCO	DC/SESCO									97	177	172	127	161	181	915
98	Electricity, Bintulu	Public Utilities	SESCO	SESCO	SESCO									670	670	670	670	670	670	4 020
102	Telecommunication, Bintulu	Public Utilities	TELECOMS	TELECOMS	TELECOMS									35	11	1391	74	202	774	2 487
107	Retail, Bintulu	Private Services	SEDC/Private	SEDC/Private	SEDC/Private	120 trade units								2300	2300	2300	2300	2300	2300	13 800
108	Wholesale, Bintulu	Private Services	SEDC/Private	SEDC/Private	SEDC/Private	20 trade units								670	670	670	670	670	670	4 020
109	Specialised Private Services, Bintulu	Private Services	Private	Private	Private	30 spec. units								225	225	225	225	225	225	1 350
110	Other Private Services, Bintulu	Private Services	Private	Private	Private	50 spec. units								708	708	708	708	708	708	4248
52	LNG Road	Transport	Private	Private	Private	0.9 mile trunk road								135	135					270
45	Miri-Bintulu Road to Bintulu-Tg. Kidurong Road	Transport	PWD	PWD	PWD	4.7 miles trunk road								780	442					1 222
57	Primary School No. 1, Bintulu	Public Services	ED	PWD	ED	2 streams Permanent								400						400
72	Kindergarten No. 1, Bintulu	Public Services	L&SD	PWD/DC	DC									50						50
70B	Government Office Complex, Bintulu	Public Services	L&SD/PWD	PWD	PWD									400	400					800
150	Urban roads, Bintulu	Transport	L&SD	PWD	PWD	6.0 miles improved feeder road									180	180	180	180	180	900
154	Lower Secondary School, Bintulu	Public Services	ED	PWD	ED	2 streams Permanent									565	500				1 065
157	Miscellaneous Public Buildings, Bintulu	Public Services	PWD	PWD	PWD										100					100
164	Glass Factory, Bintulu	Industries	SEDC/Private	SEDC/Private	SEDC/Private										4 750					4 750
165	Bottling Plant, Bintulu	Industries	SEDC/Private	SEDC/Private	SEDC/Private										600	600				1200
188	Deep Water Port, Tg. Kidurong	Transport	PWD	PWD	PWD											20000	20000	20000	15000	75000
57	Primary School No. 2, Bintulu	Public Services	ED	PWD	ED	1 stream unit Permanent										400				400
72	Kindergarten No. 2, Bintulu	Public Services	L&SD	PWD/DC	DC											50				50
190	Junior College, Bintulu	Public Services	ED	PWD	ED											3000	2300			5300
193	District Police Station, Bintulu	Public Services	RMP	PWD	RMP											382	300			682
204	Industrial Estate, Bintulu	Industries	SEDC	SEDC	SEDC	50 industrial units										1000	3000			4000
223	General Hospital, Bintulu	Public Services	MD	PWD	MD												2000	2000	2000	6000
57	Primary School No. 3, Bintulu	Public Services	ED	PWD	ED	2 streams Permanent												400		400
72	Kindergarten No. 3, Bintulu	Public Services	L&SD	PWD/DC	DC													50		50
253	Vocational School, Bintulu	Public Services	ED	PWD	ED													750	777	1527
						TOTAL INVESTMENT COSTS								10885	17913	36093	35446	32773	26696	159806

FIGURE 7.3

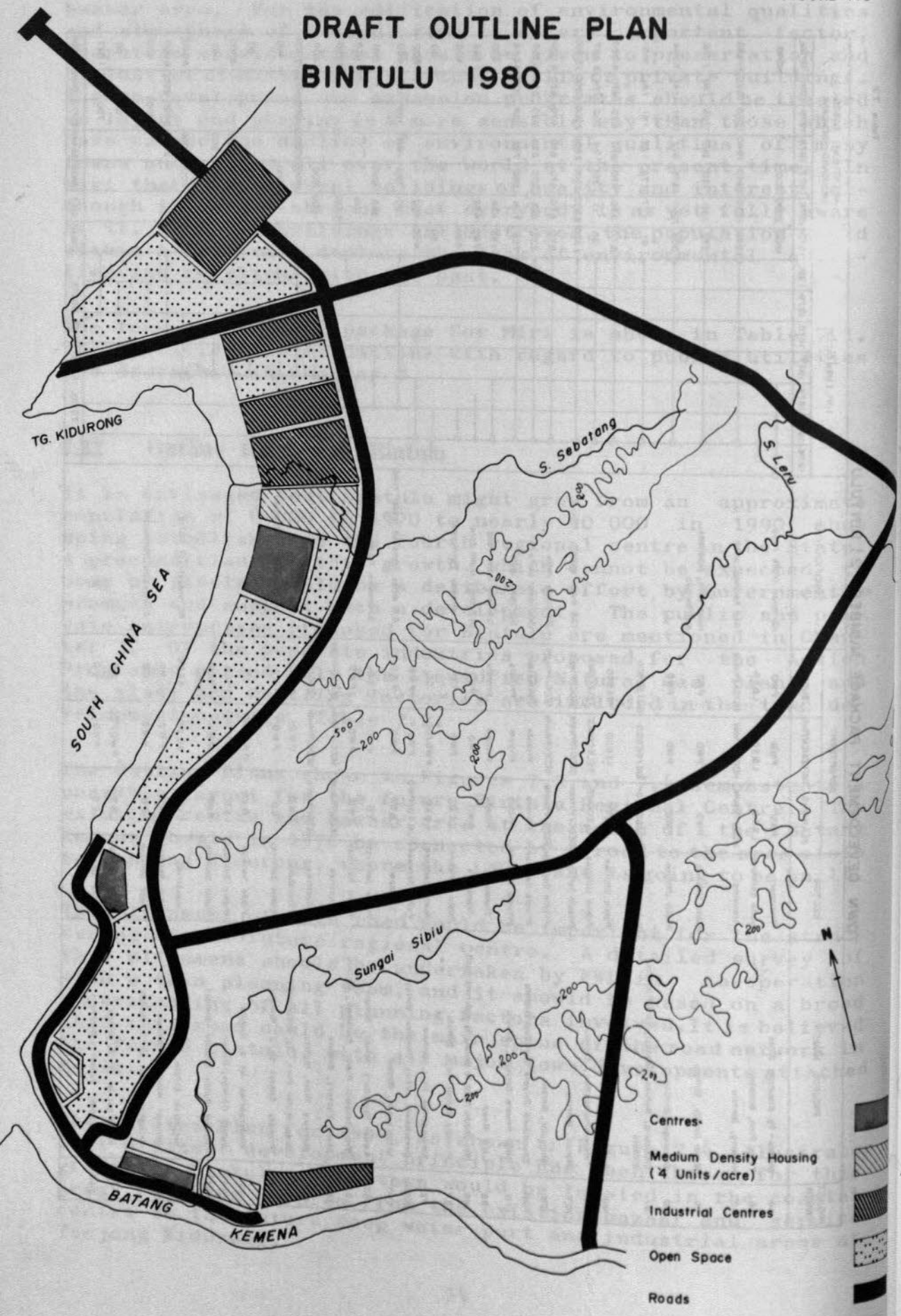
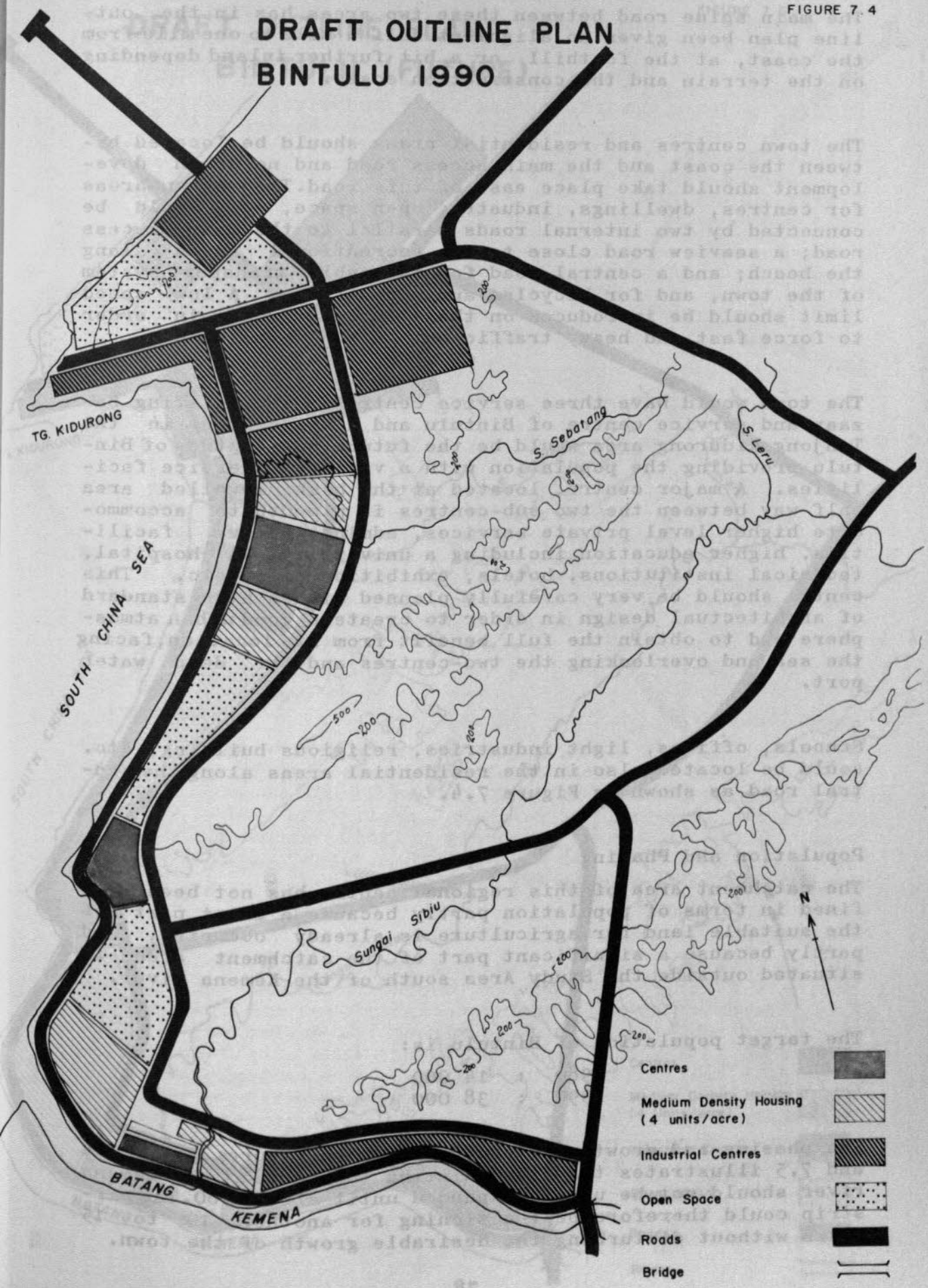

DRAFT OUTLINE PLAN
BINTULU 1980
TG. KIDURONG
SOUTH CHINA SEA
S. Sebatang
S. Leru
Sungai Sibiu
BATANG KEMENA
N
Centres
Medium Density Housing (4 Units/acre)
Industrial Centres
Open Space
Roads

FIGURE 7.4


DRAFT OUTLINE PLAN
BINTULU 1990
TG. KIDURONG
SOUTH CHINA SEA
S. Sebatang
S. Leru
Sungai Sibiu
BATANG KEMENA
N
Centres
Medium Density Housing (4 units/acre)
Industrial Centres
Open Space
Roads
Bridge

The main spine road between these two areas has in the outline plan been given an alignment half a mile to one mile from the coast, at the foothill or a bit further inland depending on the terrain and the construction costs.

The town centres and residential areas should be located between the coast and the main access road and no urban development should take place east of this road. The various areas for centres, dwellings, industry, open space, etc. would be connected by two internal roads parallel to the main access road; a seaview road close to the recreational areas along the beach; and a central road for the public transport system of the town, and for bicycles and pedestrians. A low speed limit should be introduced on these internal roads in order to force fast and heavy traffic out on the spine road.

The town would have three service centres. The existing bazaar and service centre of Bintulu and a new centre in the Tanjong Kidurong area would be the future sub-centres of Bintulu providing the population with a variety of service facilities. A major centre, located at the high levelled area half way between the two sub-centres is planned to accommodate higher level private services, administrative facilities, higher education including a university, a hospital, technical institutions, hotels, exhibition hall, etc. This centre should be very carefully planned with a high standard of architectual design in order to create a good urban atmosphere and to obtain the full benefit from its location, facing the sea and overlooking the two-centres and the deep water port.

Schools, offices, light industries, religious building, etc. could be located also in the residential areas along the central road as shown in Figure 7.4.

Population and Phasing

The catchment area of this regional centre has not been defined in terms of population partly because a great part of the suitable land for agriculture is already occupied, and partly because a significant part of the catchment area is situated outside the Study Area south of the Kemena river.

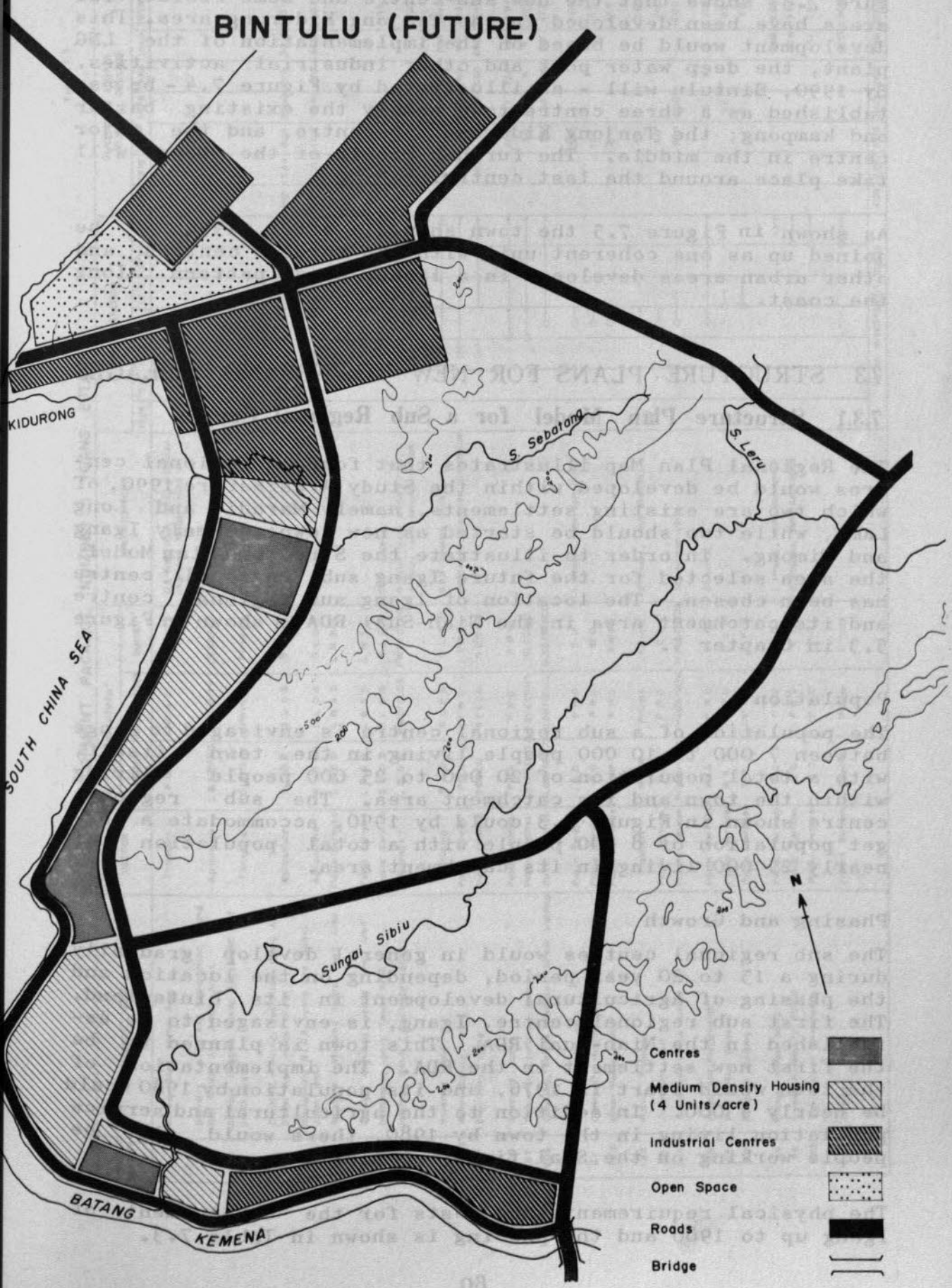
The target population of Bintulu is:

1980	:	14 000
1990	:	38 000

The phasing and growth pattern as shown in Figures 7.3, 7.4 and 7.5 illustrates that the existing town area at the Kemena river should not be unduly expanded until after 1980. The airstrip could therefore be functioning for another 10 to 15 years without disturbing the desirable growth of the town.

FIGURE 7.5

DRAFT OUTLINE PLAN BINTULU (FUTURE)



The first development phase 1975 to 1980, illustrated by Figure 7.3, shows that the new sub-centre and some residential areas have been developed in the Tanjong Kidurong area. This development would be based on the implementation of the LNG plant, the deep water port and other industrial activities. By 1990, Bintulu will - as illustrated by Figure 7.4 - be established as a three centre town namely the existing bazaar and kampong; the Tanjong Kidurong sub-centre, and the major centre in the middle. The further growth of the town will take place around the last centre.

As shown in Figure 7.5 the town should - after 1990 - be joined up as one coherent unit with the three centres and other urban areas developed in a linear town pattern along the coast.

7.3 STRUCTURE PLANS FOR NEW TOWNS AND VILLAGES

7.3.1 Structure Plan Model for a Sub Regional Centre

The Regional Plan Map illustrates that four sub regional centres would be developed within the Study Area before 1990, of which two are existing settlements, namely Marudi and Long Lama, while two should be started as new towns, namely Igang and Timong. In order to illustrate the Structure Plan Model, the area selected for the future Igang sub regional centre has been chosen. The location of Igang sub regional centre and its catchment area in the Niah-Suai RDA is shown in Figure 5.3 in Chapter 5.

Population

The population of a sub regional centre is envisaged to range between 7 000 to 10 000 people living in the town itself, with a total population of 20 000 to 25 000 people living within the town and its catchment area. The sub regional centre shown in Figure 5.3 could by 1990, accommodate a target population of 8 000 people with a total population of nearly 25 000 living in its catchment area.

Phasing and Growth

The sub regional centres would in general develop gradually during a 15 to 20 year period, depending on the location and the phasing of agricultural development in its hinterland. The first sub regional centre, Igang, is envisaged to be established in the Niah-Suai RDA. This town is planned to be the first new settlement in the RDA. The implementation of the town would start in 1976, and its population by 1980 would be nearly 4 000. In addition to the agricultural and service population living in the town by 1980, there would also be people working on the Suai timber complex.

The physical requirements and costs for the development of Igang up to 1980 and the phasing is shown in Table 7.3.

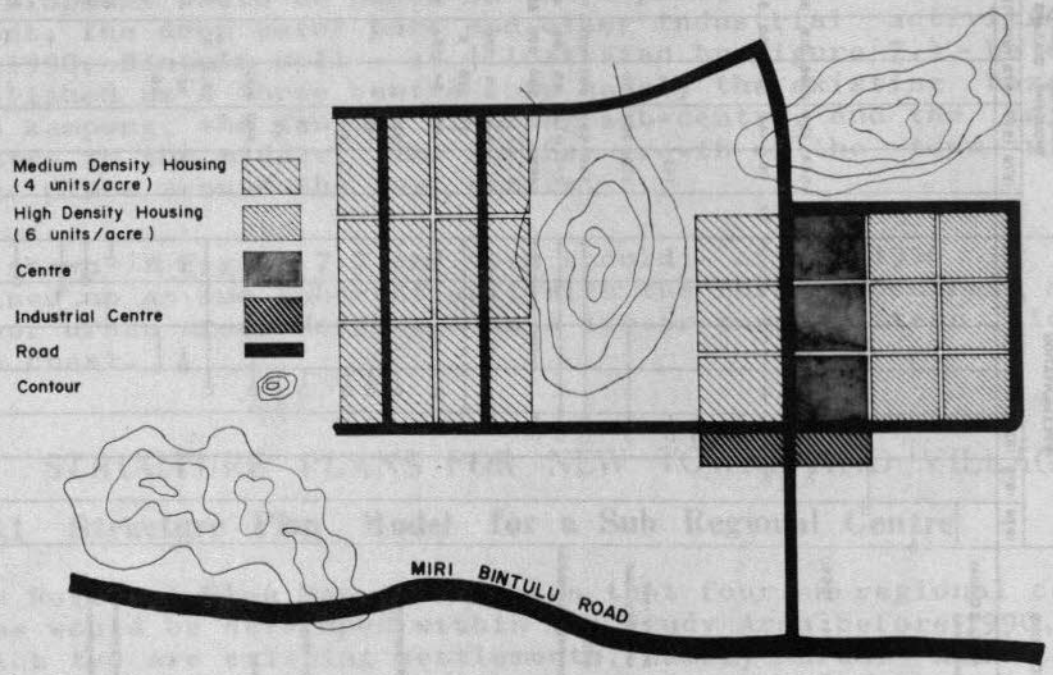
Table 7.3

RURAL DEVELOPMENT PACKAGE NUMBER : 5: IGANG ESTATE

PROJECT NUMBER	PROJECT NAME	SECTOR	DEPARTMENT			SPECIFICATIONS	IMPLEMENTATION							INVESTMENT COSTS THOUSAND DOLLARS						
			PLANNING	IMPLEMENTING	BUDGET		1974	1975	1976	1977	1978	1979	1980	1975	1976	1977	1978	1979	1980	TOTAL
	Access Road, Igang Area	Transport	P W D	P W D	P W D	0.8 mile trunk road, 2.0 miles improved feeder road														
2	Boundary Survey And Demarcation, Igang And Sawai And Jatan Areas	Agriculture	L&S D/F D	L&S D/F D	L&S D/F D	10 miles														
21	Salvage Logging Igang And Sawai And Jatan Areas	Forestry	F D/ Private	Private	Private	15790 acres														
8	Clearing, Planting, Operating Igang And Sawai And Jatan Areas	Agriculture	S L D B	S L D B	S L D B	15790 acres gross, 13690 acres net								352	1544	864	2566	1219	3825	10370
9	Management SLDB Igang And Sawai And Jatan Areas	Agriculture	S L D B	S L D B	S L D B									57	70	144	286	100	310	967
67	Airphoto / Mapping Igang Town Area	Public Services	L&S D	L&S D	L&S D															
68	Detailed Planning Igang Town Area	Public Services	L&S D	L&S D	L&S D															
59	Destumping Igang Town Area	Public Services	S L D B	S L D B	S L D B	580 acres									145					145
37	Internal Roads / Drainage Igang	Transport	L&S D	PWD/SLDB	PWD/SLDB	6 miles local primary road, 4 miles local secondary road									200	200	190			590
28	Housing, Igang	Housing	S L D B	S L D B	S L D B	628 housing units									349	697	697	697	700	3140
159	Water Supply, Igang	Public Utilities	P W D	P W D	P W D	Headworks, Pipelines, Distribution									779	1112	85	85	85	2146
162	Electricity, Igang	Public Utilities	SESCO	SESCO	SESCO										180		380	530	650	1740
200	Sewerage, Igang	Public Utilities	P W D	P W D	P W D											446	811	130	10	1397
197	Telecommunications, Igang	Public Utilities	TELECOMS	TELECOMS	TELECOMS											30	529	6	5	570
202	Cleansing, Refuse Disposal, Street Lighting	Public Utilities	SLDB/SESCO	SLDB/SESCO	SLDB/SESCO											80	134	101	96	411
54	Primary School No. 1	Public Services	E D	P W D	E D	1 stream, semi-permanent										288				288
61	Community Health Centre	Public Services	M D	P W D	M D											137				137
153	Minor Police Station	Public Services	R M P	P W D	R M P											314				314
189	Public Transport	Transport	M C W	Private	Private	2 buses, 1 bus station										75				75
58	Community Hall	Public Services	D C	P W D	D C											30				30
106	Shops And Coffee Houses	Private Services	Private/SEDC	Private/SEDC	Private/SEDC	30 service units										900	900			1800
56	Parks And Playgrounds	Public Services	D C	P W D	D C	5 acres										1	3	3	3	10
63	Post Office Class C	Public Services	P S D	P W D	P S D												82			82
60	Religious Building	Public Services	S P U	P W D	S P U												50			50
54	Primary School No. 2	Public Services	E D	P W D	E D	1 stream, semi-permanent													288	288
55	Lower Secondary School	Public Services	E D	P W D	E D	2 streams, semi-permanent													776	776
222	Sub-District Firebrigade	Public Services	D C	P W D	D C														151	151
266	Cinema	Private Services	Private	Private	Private														300	300
						TOTAL INVESTMENT COSTS								409	3267	5318	6713	2871	7199	25777

FIGURE 7.6

SUB REGIONAL CENTRE
PHASE I POPULATION 4 000



Layout of the Structure Plan

The layout of the structure Plan is shown in Figures 7.6 and 7.7. The town is located close to the Miri-Bintulu road. Some hilly country covered with forest, which is unsuitable for agriculture, has been integrated in the town area as open space for recreational purposes.

The first phase of the town development, as shown in Figure 7.6 is mainly based on agricultural households (estate workers) in medium density housing areas.

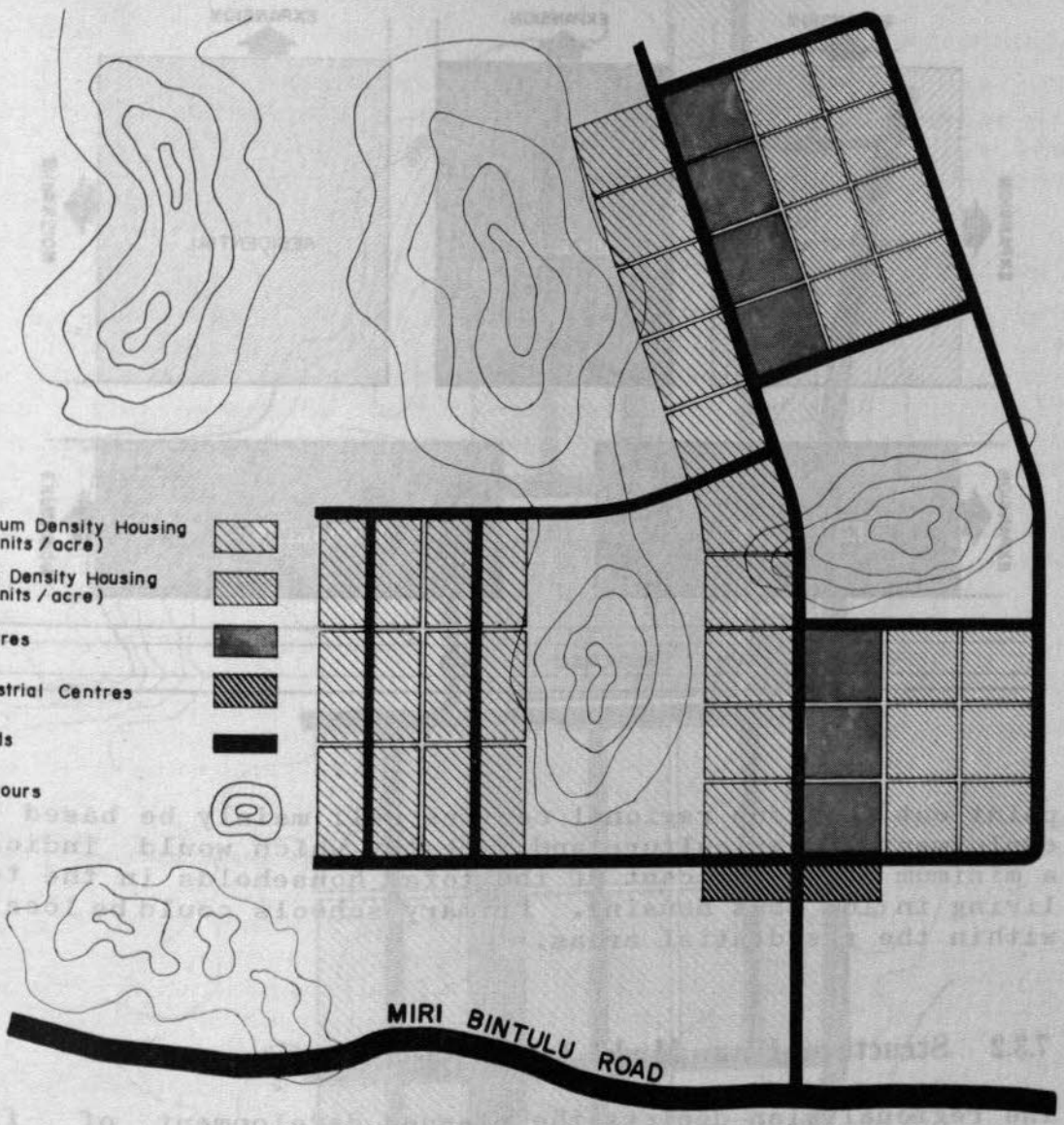
The basic strategy of the town plan is built up on a location pattern with:-

- industries located close to the Miri-Bintulu road with expansion possibilities parallel to the road;
- the town centre and the main service facilities developed from the central part of the industrial area with expansion possibilities as shown in Figure 7.8;
- the residential areas developed on both sides of the town centre with expansion possibilities in two directions as shown in Figure 7.8.

The industries in the sub regional centre would consists mainly of service industries, workshops, etc. situated in the

FIGURE 7.7

SUB REGIONAL CENTRE
POPULATION 8 000



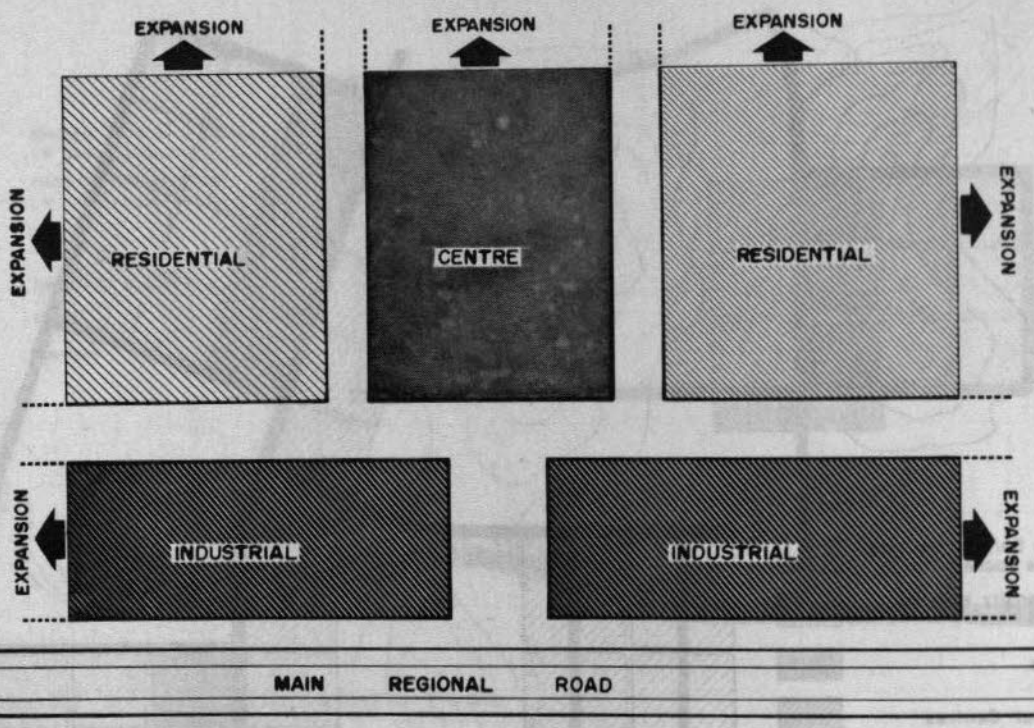
central area facing the main road to the town and the bazaar area. The agricultural and forestry processing facilities should be situated further out along the main road.

The town centre should be laid out with the intention of locating the bazaar, the market place, the post office, the cinemas, the banks, the restaurants and the community hall as the major nucleus of the centre. In close connection to this nucleus, parks and recreational areas should be developed to include higher educational facilities, some public offices and religious buildings.

The residential areas should be planned to accommodate a differentiated pattern of housing. However, it is important to

FIGURE 7.8

DIAGRAMMATIC ZONATION & EXPANSION PLAN OF A SUB REGIONAL CENTRE



point out that sub regional centres will mainly be based on employment in agriculture and forestry which would indicate a minimum of 50 per cent of the total households in the town living in low cost housing. Primary schools could be located within the residential areas.

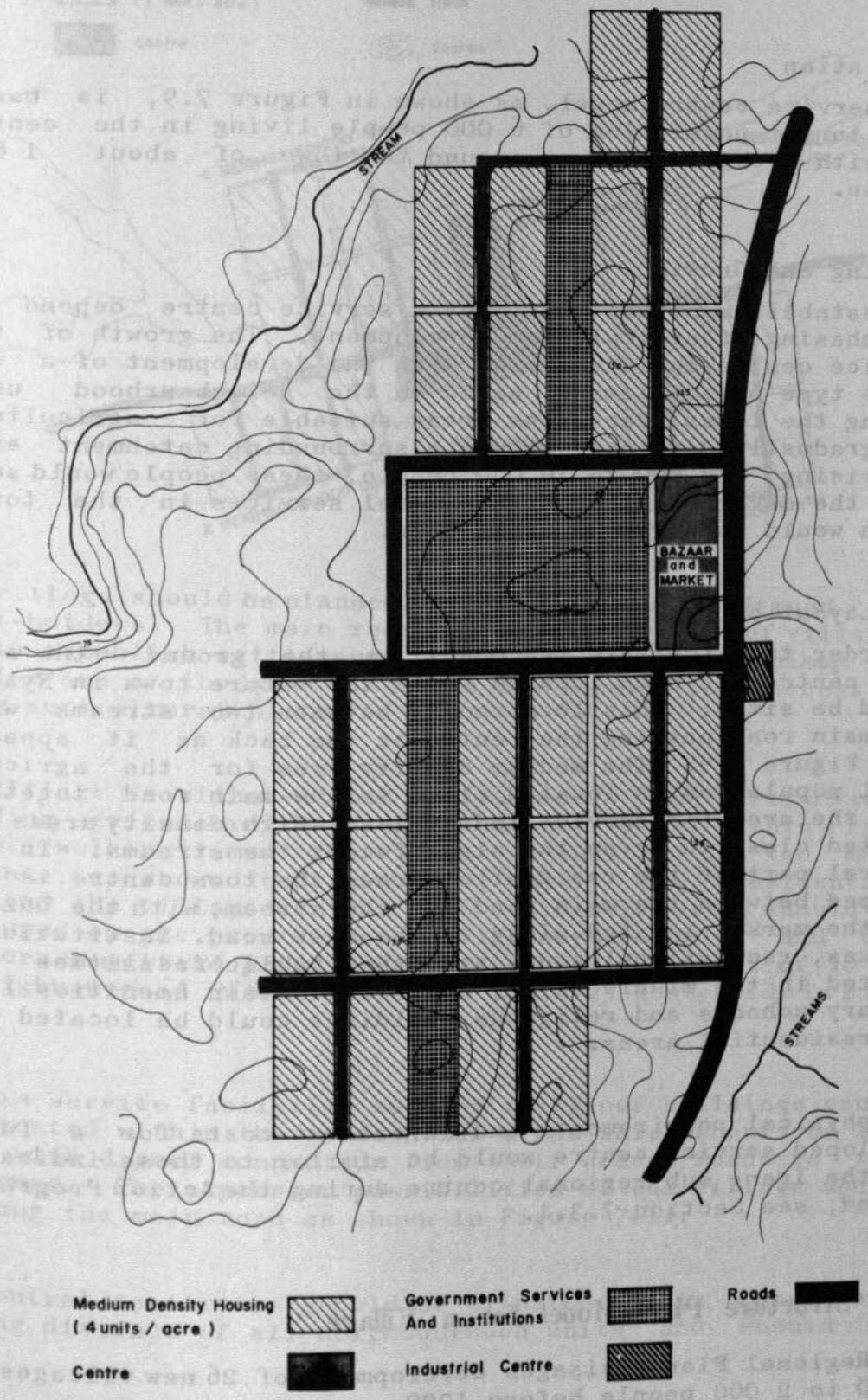
7.3.2 Structure Plan Model for a Service Centre

The regional plan depicts the planned development of five service centres in the Study Area before 1990.

The service centre has been built up on the same principles as the sub regional centre with a concentration of a potential population corresponding to one to two villages in the town, and with three to five villages attached to it. The location of service centres and the size of their catchment area would not permit the same growth as for the sub regional centres, and in general the population of these centres is estimated to be 4 000 to 6 000 people when the agricultural areas are fully developed.

FIGURE 7.9

SERVICE CENTRE



The service centre would have an urban image in its core like the bazaar area in Marudi or Batu Niah, while the residential areas would have a rural character mainly based on medium density housing and the neighbourhood unit principle.

Population

The service centre model, as shown in Figure 7.9, is based on a target population of 6 000 people living in the centre and with a catchment area around the town of about 1 000 people.

Phasing and Growth

The establishment and growth of a service centre depend on the phasing of agricultural development. The growth of the service centre could commence with the development of a village type of settlement, based on the neighbourhood unit during the first years. As areas suitable for agriculture are gradually developed within a surrounding catchment area comprising 8 000 to 10 000 people, these people would support the development of higher level services in the town, which would then get an urban core.

The Layout of the Structure Plan

In order to illustrate the model on the ground the service centre has been located where the future town in Nyalau could be sited. This location is between two streams with the main road passing the centre at the back as it appears from Figure 7.9. The medium density area for the agricultural population is located close to the main road together with the area for service industries. High density areas are located close to or on the slope facing the streams. In the central part of the residential areas the town centre is developed between the main road and the stream, with the bazaar and the market located close to the main road. Institutions, offices, recreational areas and other public facilities are located in the middle of the centre. Certain amenities like primary schools and religious buildings could be located in the residential areas.

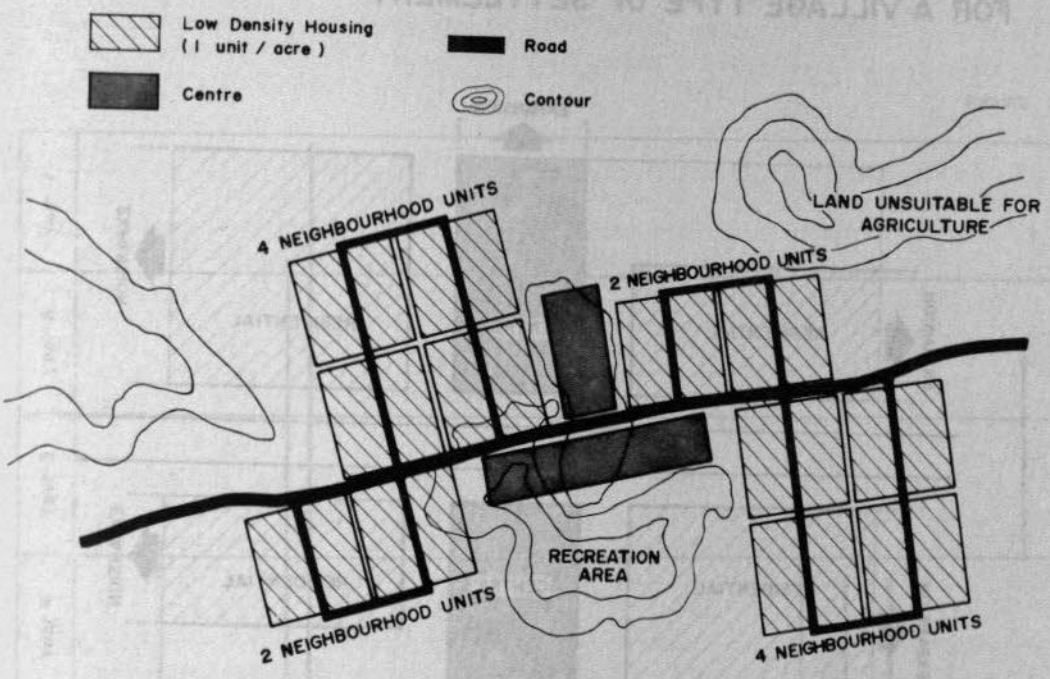
The physical requirements and investment costs for a fully developed service centre would be similar to those indicated for the Igang sub regional centre during the Action Programme period, see Section 7.3.1.

7.3.3 Structure Plan Model for a Village

The Regional Plan envisages development of 26 new villages of 1 000 to 2 000 people before 1990.

FIGURE 7.10

VILLAGE



The village should be planned to serve the future demand of small-holders. The main reasons for the creation of villages are to establish settlements which give a basic minimum of service and at the same time give the farmers easy access to their agricultural plots.

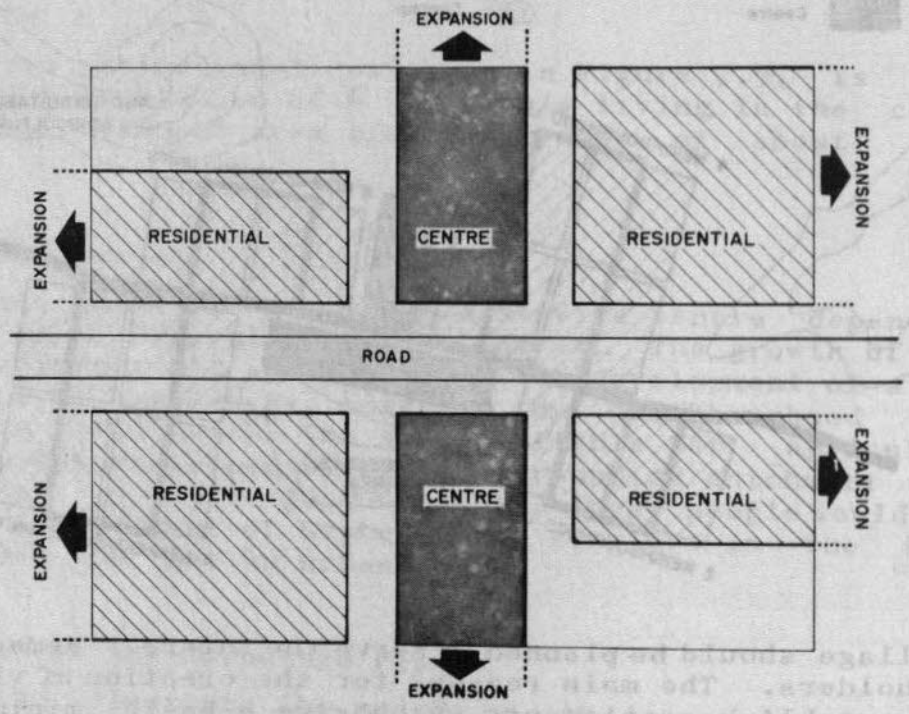
The village is situated with approximately 5 000 acres of surrounding agricultural land which can be reached within a reasonable walking time. The village is built up of two main elements, as shown in Figure 7.10, namely the residential area and the village centre. The residential areas should be developed on the principles of neighbourhood units and the one acre homestead plot. One village would consist of 10 to 14 neighbourhood units with about 20 to 25 households in each unit.

Certain service facilities such as religious buildings could be situated within the residential areas which should be located with direct connection from their access roads to the main road. The expansion possibilities of the village would be along the main road as shown in Figure 7.11.

The central facilities should be situated within convenient walking distance of all neighbourhood units and should be

FIGURE 7.11

DIAGRAMMATIC ZONATION & EXPANSION PLAN FOR A VILLAGE TYPE OF SETTLEMENT



planned with service facilities such as one primary school, a bazaar with approximately five to six shops, a coffee house, a market place and a community hall. In certain cases a lower secondary school could be located in a village which then in terms of its service facility would range above the other villages. A community health centre, a post office class C and a police post could in addition be located in such a village. Open space and recreational areas should be located connection with the town centre and allow for possible future expansion of the centre.

Population

The population in the village is envisaged to 1 000 to 2 000 people, mainly working in agriculture.

Phasing and Growth

The development of villages is dependent on the phasing of agricultural development. However, the implementation of a village, based on 5 000 acres of surrounding agricultural land, would take place mainly within a four year period; electricity and telecommunications would be introduced in years six and seven as shown in Figure 7.12. As an example, the development package for the Sebanah village established during the Action Programme period in the Niah-Suai RDA is shown in Table 7.4.

PHASING OF DEVELOPMENT PROGRAMME —— AGRICULTURAL VILLAGE

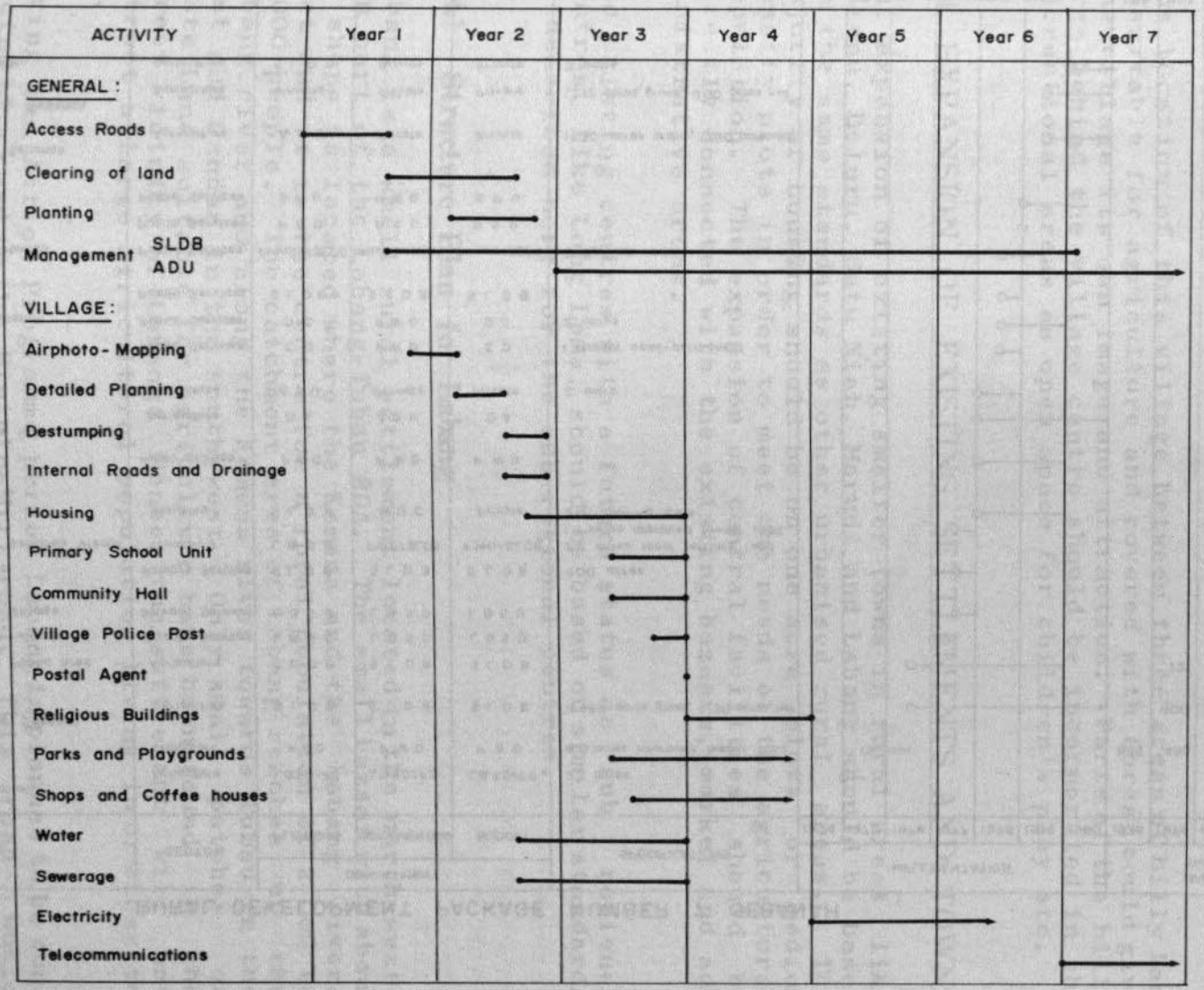


FIGURE 7.12

Table 7.4

RURAL DEVELOPMENT PACKAGE NUMBER: 7 : SEBANAH

PROJECT NUMBER	PROJECT NAME	SECTOR	DEPARTMENT			SPECIFICATIONS	IMPLEMENTATION							INVESTMENT COSTS THOUSAND DOLLARS						
			PLANNING	IMPLEMENTING	BUDGET		1974	1975	1976	1977	1978	1979	1980	1975	1976	1977	1978	1979	1980	TOTAL
2	Boundary Survey & Demarcation, Sebanah Public Area	Agriculture	L&SD/FD	L&SD/FD	L&SD/FD	22 miles														
39	Igang - Sebanah road	Transport	PWD	PWD	PWD	6.9 miles improved feeder road								585	450					1035
118	Clearing, Planting, Operating Sebanah Public Area	Agriculture	SLDB	SLDB	SLDB	4990 acres gross, 4130 acres net									400	1774	729	1081	101	4086
119	Management SLDB Sebanah Public Area	Agriculture	SLDB	SLDB	SLDB										72	154	67	131		424
67	Airphoto / Mapping Sebanah Village	Private Services	L&SD	L&SD	L&SD															
68	Detailed Planning Sebanah Village	Private Services	L&SD	L&SD	L&SD															
59	Destumping, Sebanah Village	Private Services	SLDB	SLDB	SLDB	400 acres										100				100
37	Internal Roads / Drainage, Sebanah Village	Transport	L&SD	PWD/SLDB	PWD/SLDB	2.2 miles local tertiary road 1.4 miles improved feeder road										254				254
28	Housing, Sebanah Village	Housing	SLDB	HDC	Private	265 housing units											662	663		1325
232	Sewerage, Sebanah	Public Utilities	PWD	PWD	PWD												15	29		44
209	Management ADU Sebanah Public And RBD Areas	Agriculture	DA	ADU	DA												397	60		457
215	Rice mills, Sebanah	Agriculture	ADU	Private	Private	2 units											4			4
54	Primary School, Sebanah	Public Services	ED	PWD	ED	1 stream semi-permanent											288			288
56	Parks And Playgrounds, Sebanah	Public Services	DC	PWD	DC	2 acres											2	2		4
58	Community Hall, Sebanah	Public Services	SLDB	SLDB	SLDB												30			30
106	Shops And Coffeehouses, Sebanah	Public Services	Private/SEDC	Private/SEDC	Private/SEDC	6 Service units											180	180		360
64	Postal Agent, Sebanah	Public Services	PSD	PSD	PSD													50		50
60	Religious Building, Sebanah	Public Services	SPU	PWD	SPU															
243	Clearing, Planting, Operating Sebanah RBD Areas	Agriculture	ADU	Private	Private	1530 acres gross, 1380 acres net												60	317	377
244	Clearing, Planting, Operating Sebanah Private Area	Agriculture	Private	Private	Private	1222 acres gross, 1100 acres net												36	192	228
214	Cocoa Drying Units, Sebanah	Agriculture	SLDB	Private	Private	3 units													9	9
						TOTAL INVESTMENT COSTS								585	922	2283	2374	2292	619	9075

The Layout of the Structure Plan

In order to illustrate the model the Structure Plan has been worked out for the Sebanah village in the Niah-Suai RDA. The village is developed around the main road in the agricultural area and built up of six neighbourhood units on either side of the village centre.

The location of this village between three areas of hilly land unsuitable for agriculture and covered with forest could give the village its own image and attraction. Parts of the hilly area behind the village centre should be incorporated in the recreational areas as open space for children's play etc.

7.4 EXPANSION OF EXISTING SETTLEMENTS AND TOWNS

The expansion of existing smaller towns in rural areas like Bekenu, Beluru, Batu Niah, Marudi and Labang should be based on the same standards as other urbanised rural areas. The majority of housing should be on one acre plots or medium density plots in order to meet the needs of the agricultural population. The expansion of central facilities should be directly connected with the existing bazaars, market and administrative areas.

The existing centres with a future status as sub regional centres, like Long Lama, should be based on similar standards as described here for the sub regional centres.

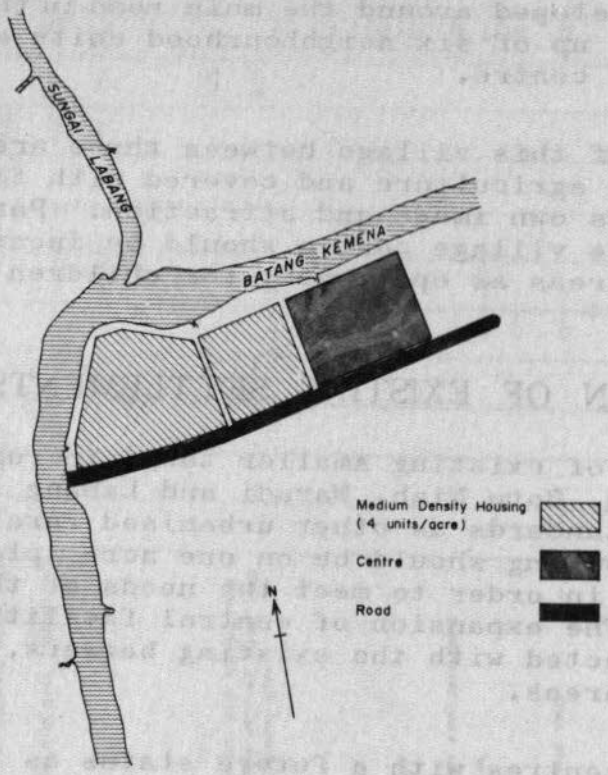
7.4.1 Structure Plan for Labang

Labang is a small rural settlement located in the north-western part of the Labang-Tubau RDA. The small bazaar with about 10 shops is located where the Kemena and the Labang rivers meet and it is the centre for a rural population of 2 000 to 3 000 people. The catchment area of Labang reaches up the Labang river and along the Kemena river towards Tubau in the east and Pandan in the south-west. Only small patches of State Land suitable for agriculture have been found in the direct vicinity of Labang. Hence, the settlement will not attract a large agricultural population living in or close to it.

During the Action Programme period Labang is planned to be connected by a road to the Bintulu-Miri road. This road would mean an important change in the transport situation for Labang; it will strengthen its position as a trading centre for a wider area than today. The boundaries of its catchment area however, are expected to shrink when the road is continued through the suitable agricultural areas east of Labang (Beseduan) and when these areas are developed. It is envisaged that a new service centre would be established in Beseduan.

FIGURE 7.13

DRAFT STRUCTURE PLAN LABANG 1990



Population

The 1970 population of Labang was 500 people living in the bazaar and the kampong areas along the Kemena river. The target population for 1990 is 1 000 people.

Phasing and Growth

A majority of the agricultural land within the catchment area of Labang is already occupied. Hence, most agricultural development would be improvements to existing cultivation, while new developments would be undertaken on small areas of State Land. An ADU centre is planned to be established in 1977 and one lower secondary school in 1978. The growth of Labang will depend to some extent on the success of the road-based improvement scheme.

Layout of the Structure Plan

The Structure Plan for Labang outlines that new development should take place in connection with the existing settlement, where a total of about 1 000 people could be accommodated (see Figure 7.13). The road connection to the Miri-Bintulu road will cross the Kemena river east of the town. A branch road from this road, located between the river and the swampy areas behind the town, has been proposed. The development could then take place between the river and the road.

The town development package for Labang during the Action Programme period is shown in Table 7.5.

Table 7.5

TOWN DEVELOPMENT PACKAGE NUMBER : 10 : LABANG

PROJECT NUMBER	PROJECT NAME	SECTOR	DEPARTMENTS			SPECIFICATIONS	IMPLEMENTATION							INVESTMENT COSTS THOUSAND DOLLARS						
			PLANNING	IMPLEMENTING	BUDGET		1974	1975	1976	1977	1978	1979	1980	1975	1976	1977	1978	1979	1980	TOTAL
144	Housing	Housing	PRIVATE	PRIVATE	PRIVATE	41 housing units			○				→		33	66	66	66	70	301
152	Village Police Post	Public Services	RMP	PWD	RMP				○						15					15
71	Sub District Office	Public Services	R&DO	PWD	PWD				○						224	200				424
37	Internal Road	Transport	L&SD	PWD	PWD	1 mile local primary road				○						75				75
64	Postal Agent	Public Services	PSD	PWD	PSD															
106	Shops & Coffee houses	Private Services	PRIVATE	PRIVATE	PRIVATE	4 service units				○			→			60	60	60	60	240
55	Lower Secondary School	Public Services	ED	PWD	ED	2 streams, semi-permanent					○						776			776
56	Parks & Playgrounds	Public Services	DC	PWD	DC	2 acres					○						4			4
262	Sewerage	Public Utilities	PWD	PWD	PWD								→						51	51
264	Electricity	Public Utilities	SESCO	SESCO	SESCO								→						120	120
60	Religious Building	Public Services	SPU	PWD	SPU								○						50	50
						TOTAL INVESTMENT COSTS									272	401	906	126	351	2 056

7.4.2 Structure Plan for Batu Niah

Batu Niah is one of the existing settlements between Miri and Bintulu which has the greatest potential for future growth. Batu Niah, located at the Niah river, is envisaged to have obtained the status of a service centre within the Study Area in 1990. The existing bazaar area has a very distinguished atmosphere which together with the attraction of the nearby Niah caves, carry an opportunity for Batu Niah to be a small but interesting and attractive tourist place in the Fourth Division.

Population

In 1970 Batu Niah had a population of 1 000 people. By 1990 the population of Batu Niah service centre could be 4 000 people living in and close to the town and 5 000 to 10 000 people living within its catchment area, the size of which will depend on the strength and influence of Igang sub regional centre.

Phasing and Growth

The attractions of Batu Niah and the fact that major agriculture development will take place close to the town, indicate that the town could grow fast. The growth of Batu Niah from 1970 to 1980 is estimated to be from 1 000 to 2 000 people.

The development of the town should then be seen in two phases:-

1980 : a population of 2 000 people;
1990 : a population of 4 000 people.

Layout of the Structure Plan

The structure plan for Batu Niah, as shown in Figure 7.14 illustrates that the town could be developed within the loop of the main access road. The environmental qualities of the existing bazaar and market area at the river bank should be preserved in the future development of the town centre. A recreational area or public park should be located up the river from the bazaar and in front of an area of public facilities. Residential and educational areas should be located between the main road and the town centre. Industrial areas are located close to the river.

The town development package for Batu Niah during the Action Programme period is shown in Table 7.6.

7.4.3 Structure Plan for Bekenu

The bazaar area in Bekenu is one of the finest examples of an attractive local building tradition well suited for the conditions of the area. It has a layout similar to Marudi with

FIGURE 7.14

DRAFT STRUCTURE PLAN
BATU NIAH 1990

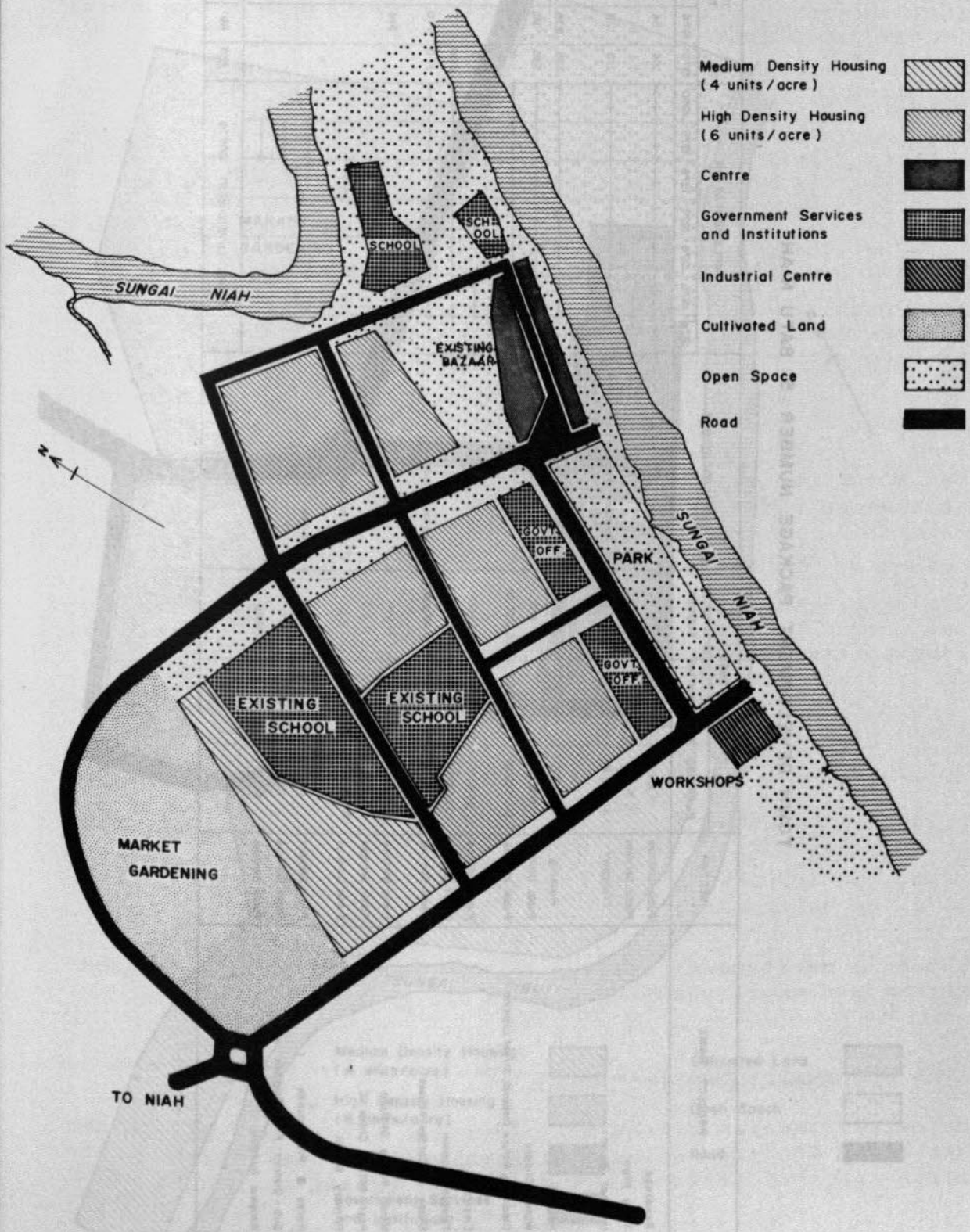


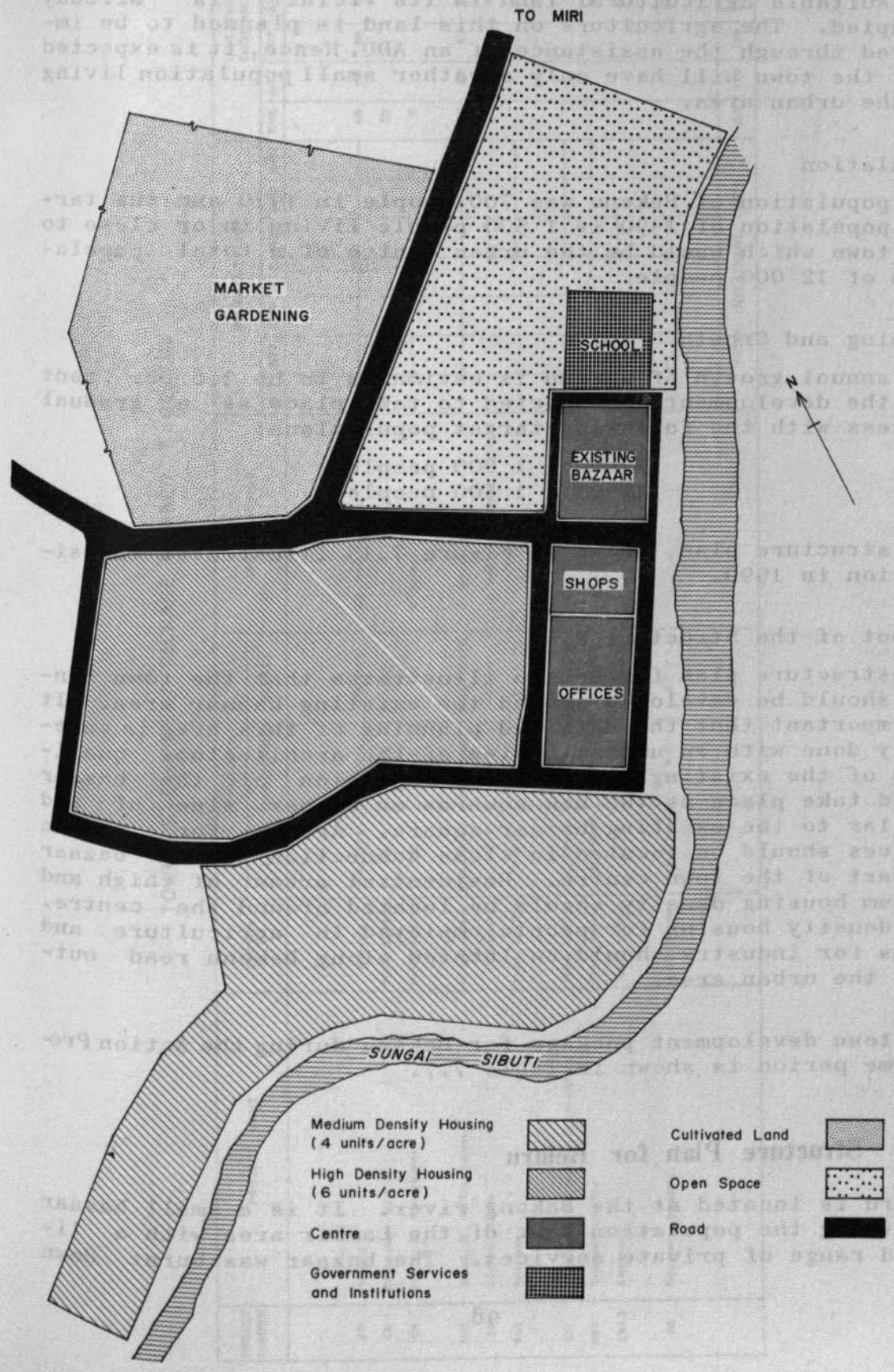
Table 7.6

TOWN DEVELOPMENT PACKAGE NUMBER : 5 : BATU NIAH

PROJECT NUMBER	PROJECT NAME	SECTOR	DEPARTMENTS			SPECIFICATIONS	IMPLEMENTATION							INVESTMENT COSTS THOUSAND DOLLARS						
			PLANNING	IMPLEMENTING	BUDGET		1974	1975	1976	1977	1978	1979	1980	1975	1976	1977	1978	1979	1980	TOTAL
86	Sewerage	Public Utilities	P W D	P W D	P W D									64	54	54	54	80	86	392
66	Town Plan	Public Services	L & S D	L & S D	L & S D															
37	Internal Roads	Transport	L & S D	P W D	P W D	4.2 miles local tertiary roads, 1.5 miles local primary roads								33	33	33	33	33	33	198
33	Housing	Housing	PRIVATE	PRIVATE	PRIVATE	155 housing units								235	235	235	235	235	238	1 413
85	Water Supply	Public Utilities	P W D	P W D	P W D	Head works, pipelines, distribution								336	95	15	65	10	10	561
94	Cleansing, Refuse Disposal, Street Lighting	Public Utilities	DC/SESCO	DC/SESCO	DC/SESCO									9	39	15	15	17	17	112
100	Electricity	Public Utilities	SESCO	SESCO	SESCO									115		180		180		475
104	Telecomunication	Public Utilities	TELECOMS	TELECOMS	TELECOMS									306	1	1	1	1	1	311
106	Shops & Coffee houses	Private Services	SEDC/PRIVATE	SEDC/PRIVATE	SEDC/PRIVATE	11 service units								110	110	110	110	110	110	660
153	Minor Police Station	Public Services	R M P	P W D	R M P										314					314
63	Post Office Class C	Public Services	P S D	P W D	P S D											82				82
54	Primary School	Public Services	ED	P W D	ED	1 stream, semi - permanent											288			288
56	Parks & Playgrounds	Public Services	DC	P W D	DC	2 acres											2	2		4
222	Sub - District Fire Brigade	Public Services	DC	P W D	DC													151		151
60	Religious Building	Public Services	SPU	P W D	SPU													50		50
						TOTAL INVESTMENT COSTS								1238	881	725	803	869	495	5 011

FIGURE 7.15

DRAFT STRUCTURE PLAN BEKENU 1990



high environmental qualities. Bekenu is a river based settlement located at the Sibuti river; it now also has a road access as shown in Figure 7.15.

All suitable agricultural land in its vicinity is already occupied. The agriculture on this land is planned to be improved through the assistance of an ADU. Hence, it is expected that the town will have only a rather small population living in the urban area.

Population

The population of Bekenu was 700 people in 1970 and the target population of 1990 is 1 500 people living in or close to the town which would be the urban centre of a total population of 12 000 people.

Phasing and Growth

The annual growth of Bekenu is estimated to be 3.8 per cent and the development is expected to take place as a gradual process with the following target populations:

1980 : 1 000 people
1990 : 1 500 people

The structure plan, shown in Figure 7.15 illustrates the situation in 1990.

Layout of the Structure Plan

The structure plan for Bekenu illustrates that the town centre should be developed around the existing bazaar area. It is important that the detailed planning of this area is carefully done with an understanding of the architectual qualities of the existing bazaar. The expansion of the bazaar could take place as two new squares on either side of and similar to the existing bazaar square. Areas for public offices should be located in close connection to the bazaar as part of the town centre. Residential areas of high and medium housing density should be located around the centre. Low density housing for people employed in agriculture and areas for industry should be located along Bekenu road outside the urban area.

The town development package for Bekenu during the Action Programme period is shown in Table 7.7.

7.4.4 Structure Plan for Beluru

Beluru is located at the Bakong river. It is a small bazaar providing the population east of the Lambir area with a limited range of private services. The bazaar was burnt down

Table 7.7

TOWN DEVELOPMENT PACKAGE NUMBER : 7 : BEKENU

PROJECT NUMBER	PROJECT NAME	SECTOR	DEPARTMENTS			SPECIFICATIONS	IMPLEMENTATION							INVESTMENT COSTS THOUSAND DOLLARS						
			PLANNING	IMPLEMENTING	BUDGET		1974	1975	1976	1977	1978	1979	1980	1975	1976	1977	1978	1979	1980	TOTAL
35	Housing	Housing	PRIVATE	PRIVATE	PRIVATE	48 housing units		○	→	→	→	→	→	69	69	69	69	69	71	416
58	Community Hall	Public Services	DC	PWD	DC			○	→					30						30
56	Parks & Playgrounds	Public Services	DC	PWD	DC	2 acres		○	→					4						4
106	Shops & Coffee houses	Private Services	SEDC/PRIVATE	SEDC/PRIVATE	SEDC/PRIVATE	6 service units		○	→	→	→	→	→	60	60	60	60	60	60	360
37	Internal Roads	Transport	L & S D	PWD	PWD	0.5 mile local primary road					○	→					37			37
235	Sewerage	Public Utilities	PWD	PWD	PWD						○	→	→				51	46	47	144
237	Cleansing, Refuse Disposal, Street Lighting	Public Utilities	DC/SESCO	DC/SESCO	DC/SESCO						○	→	→				8	13	8	29
227	Telecommunication	Public Utilities	TELECOMS	TELECOMS	TELECOMS						○	→	→				141		1	142
230 B	Electricity	Public Utilities	SESCO	SESCO	SESCO						○	→					115			115
60	Religious Building	Public Services	S P U	PWD	S P U						○	→					50			50
						TOTAL INVESTMENT COSTS								163	129	129	531	188	187	1 338

FIGURE 7.16

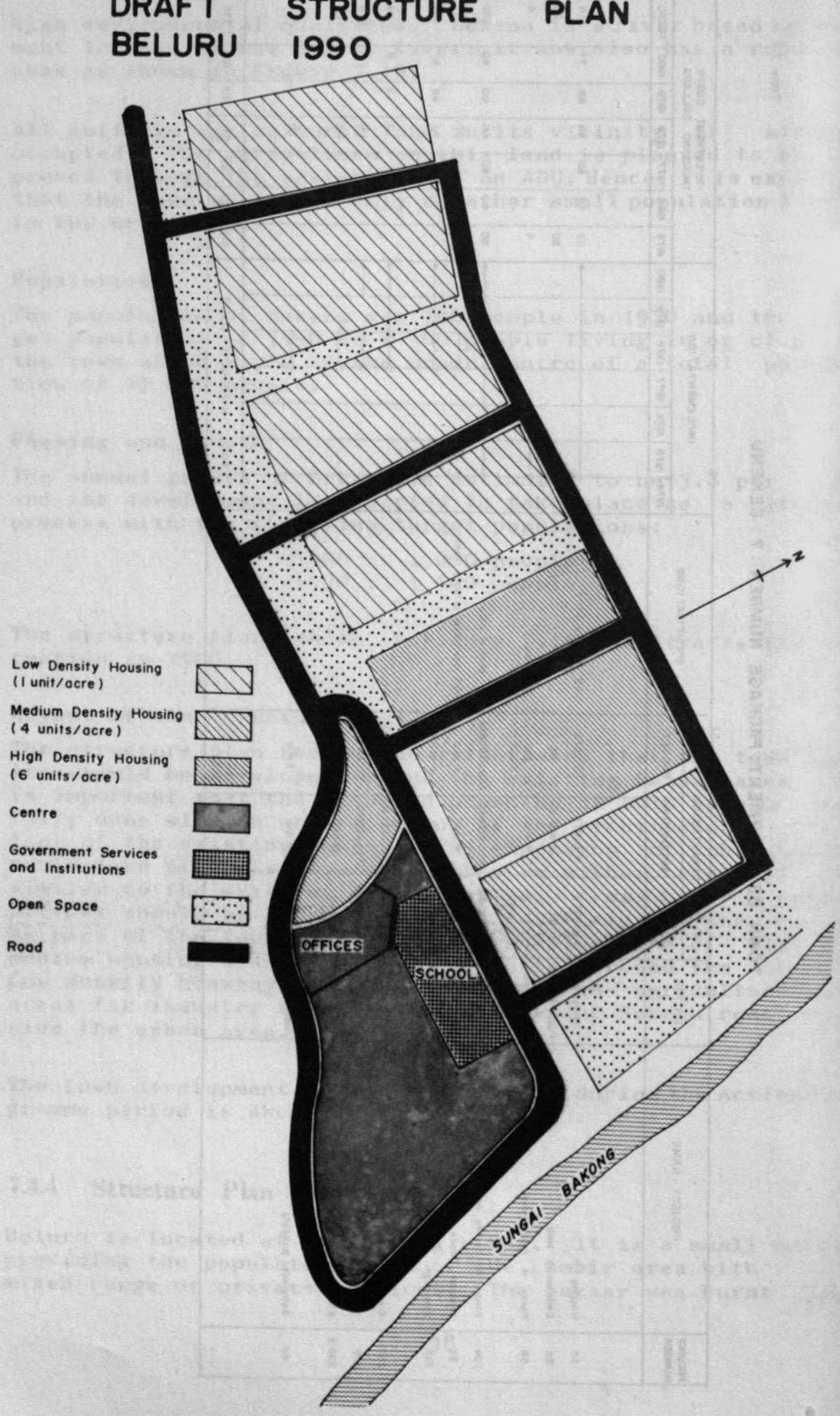

DRAFT STRUCTURE PLAN
BELURU 1990
N
Low Density Housing (1 unit/acre)
Medium Density Housing (4 units/acre)
High Density Housing (6 units/acre)
Centre
Government Services and Institutions
Open Space
Road
OFFICES
SCHOOL
SUNGAI BAKONG

Table 7.8

TOWN DEVELOPMENT PACKAGE NUMBER : 6 : BELURU

PROJECT NUMBER	PROJECT NAME	SECTOR	DEPARTMENTS			SPECIFICATIONS	IMPLEMENTATION							INVESTMENT COSTS THOUSAND DOLLARS						
			PLANNING	IMPLEMENTING	BUDGET		1974	1975	1976	1977	1978	1979	1980	1975	1976	1977	1978	1979	1980	TOTAL
34	Housing	Housing	PRIVATE	PRIVATE	PRIVATE	77 housing units		○	→	→	→	→	→	119	119	119	119	119	119	714
62	Police Post	Public Services	R M P	P W D	R M P			○	→					125						125
71	Sub-District Office	Public Services	R & D O	P W D	P W D			○	→					424						424
58	Community Hall Beluru	Public Services	DC	P W D	DC			○	→					30						30
106	Shops & Coffee houses	Private Services	SEDC/PRIVATE	SEDC/PRIVATE	SEDC/PRIVATE	6 service units		○	→	→	→	→	→	60	60	60	60	60	60	360
37	Internal Roads	Transport	L & S D	P W D	P W D	1 mile local primary road					○	→	→				25	25	25	75
234	Sewerage	Public Utilities	P W D	P W D	P W D						○	→	→				51	46	47	144
236	Cleansing, Refuse Disposal, Street Lighting	Public Utilities	DC/SESCO	DC/SESCO	DC/SESCO						○	→	→				8	13	8	29
226	Telecommunication	Public Utilities	TELECOMS	TELECOMS	TELECOMS						○	→	○				141		1	142
61	Community Health Centre	Public Services	M D	P W D	M D						○	→					137			137
230 A	Electricity	Public Utilities	SESCO	SESCO	SESCO						○	→					120			120
63	Post Office Class C	Public Services	P S D	P W D	P S D							○	→					82		82
56	Parks & Playgrounds	Public Services	DC	P W D	DC	2 acres							○						4	4
						TOTAL INVESTMENT COSTS								758	179	179	661	345	264	2 386

recently, and it has been rebuilt intermediately, close to the river. The area of the present bazaar is flooded frequently and the Land and Survey Department has recently provided a re-development plan, which has been used as the basis for the structure plan for Beluru. Although the town is located close to Mera-a development area, it is not expected that there would be any major agriculturally based population living in the town itself because suitable agricultural land is located too far away.

Population

The 1970 population of Beluru was 500 people. The target population for 1980 is 1 000 people and for 1990 1 500 people. It is estimated that about 10 000 people will live in the catchment area of the town by 1990.

Layout of the Structure Plan

The structure plan, as shown in Figure 7.16 is based on the Land and Survey Department's proposal for the re-development of the town centre. Residential areas are located close to the main road with high and medium density areas around the town centre and low density areas for the agricultural households further down the road connecting with the potential agricultural land. The town development package for Beluru for the Action Programme period is shown in Table 7.8.

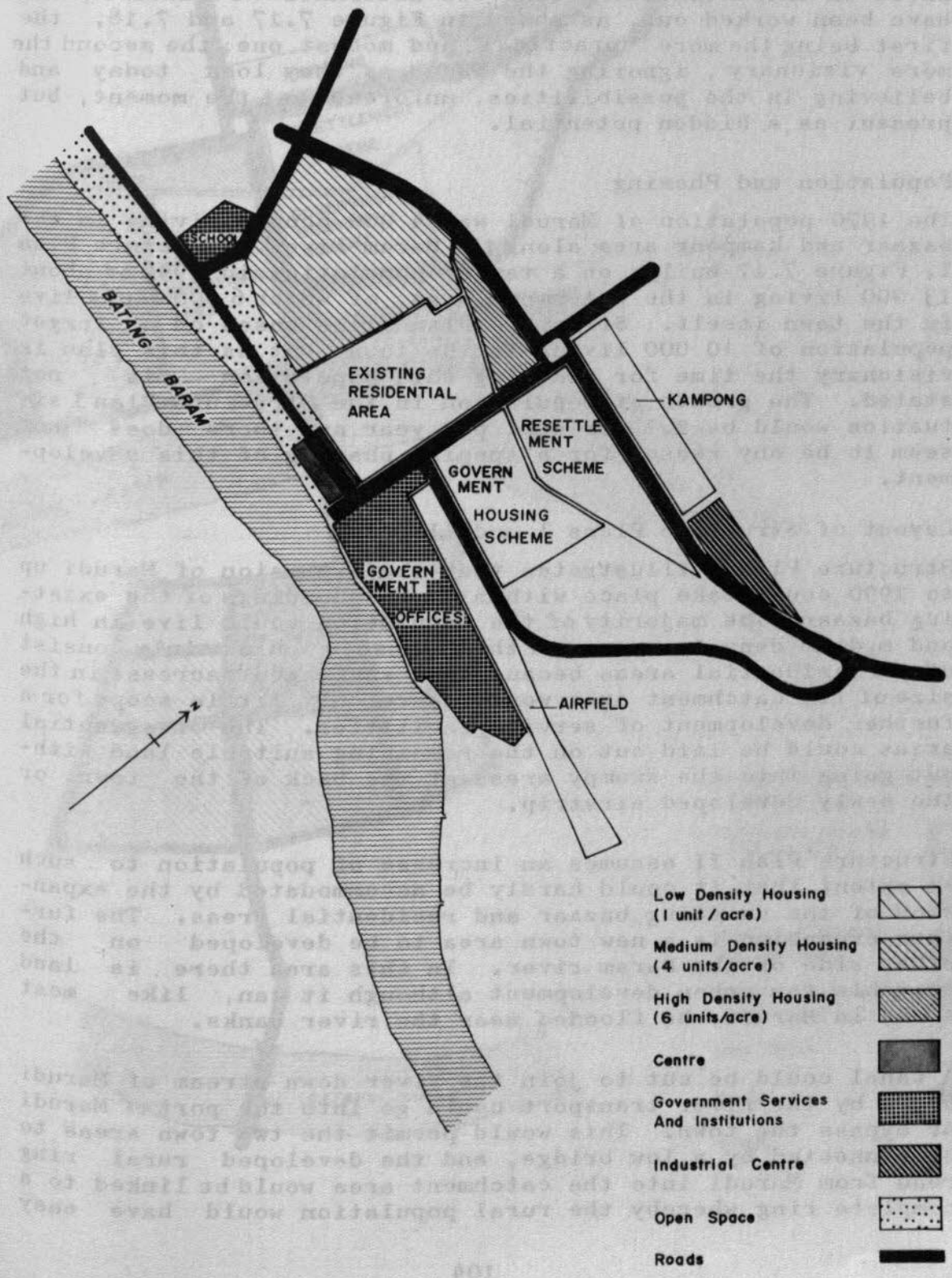
7.4.5 Structure Plan for Marudi

Marudi has functioned as the main bazaar and administrative centre for the Baram District for many years. The location of the town at the Baram river half way between Long Lama and Miri ensures that Marudi would keep its status as an important town in the Study Area. The large catchment area of Marudi, which reaches as far as the hinterland of Long Lama, will in the future be reduced by the envisaged development of Long Lama to a sub regional centre, which is supported by the road connection of this town to Miri.

The Consultants are aware of the austere perspectives for Marudi by a shifting of economic, traffic and administrative emphasis to Long Lama, but would hesitate to accept a decline and deterioration of the town as an inevitable consequence. The atmosphere of the town, its historical interest and last but not least the concern for the people living and working there, makes it imperative to find ways for a continued meaningful function of the town. A careful study of the possibility of connecting Marudi and Miri by a road via Bakong has been recommended in Supporting Report 7. This road, it is believed, would give the town a better chance to participate in the expected industrial development in and around Miri.

FIGURE 7.17

DRAFT STRUCTURE PLAN I
MARUDI 1990



The land suitable for agriculture in the catchment area of Marudi is all occupied land, which makes it difficult to predict the future development. However, to strengthen Marudi it is proposed to establish an ADU which should make particular and concentrated attempts in this area to promote settled farming and increasing the economic activity and the population in the catchment area.

Based on these considerations two alternative structure plans have been worked out, as shown in Figure 7.17 and 7.18, the first being the more practical and modest one; the second the more visionary, ignoring the facts as they look today and believing in the possibilities, unforeseen at the moment, but present as a hidden potential.

Population and Phasing

The 1970 population of Marudi was 4 000 people living in the bazaar and kampong area along the Baram river. Structure Plan I, Figure 7.17 builds on a target population in 1990 of about 13 000 living in the catchment area, of which 6 000 would live in the town itself. Structure Plan II is based on a target population of 10 000 living in the town, but as this plan is visionary the time for reaching this population is not stated. The growth of population in the Structure Plan I situation would be 2.1 per cent per year and there does not seem to be any reason for a special phasing of this development.

Layout of Structure Plans I and II

Structure Plan I illustrates that the expansion of Marudi up to 1990 could take place within the surroundings of the existing bazaar. The majority of the population would live in high and medium density areas and the expansion would mainly consist of new residential areas because the envisaged decrease in the size of its catchment area would leave only little scope for a further development of service facilities. The residential areas could be laid out on the remaining suitable land without going into the swampy areas at the back of the town or the newly developed airstrip.

Structure Plan II assumes an increase of population to such an extent that it could hardly be accommodated by the expansion of the existing bazaar and residential areas. The further expansion is a new town area to be developed on the other side of the Baram river. In this area there is land suitable for urban development although it can, like most areas in Marudi, be flooded near the river banks.

A canal could be cut to join the river down stream of Marudi where by the river transport could go into the port of Marudi or bypass the town. This would permit the two town areas to be connected by a low bridge, and the developed rural ring road from Marudi into the catchment area would be linked to a complete ring whereby the rural population would have easy

FIGURE 7.18

DRAFT STRUCTURE PLAN II
MARUDI (FUTURE)

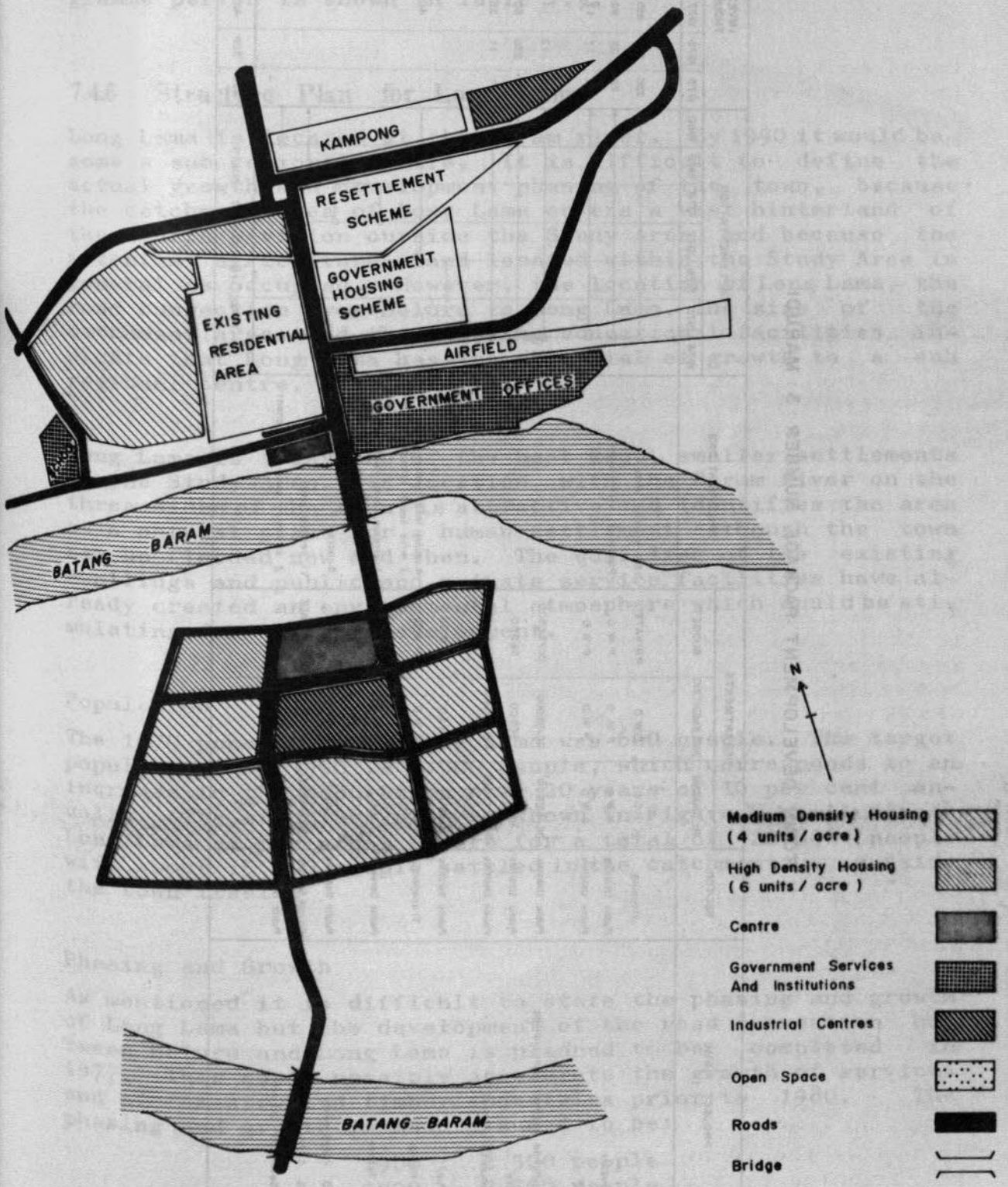


Table 7.9

TOWN DEVELOPMENT PACKAGE NUMBER : 3 : MARUDI

PROJECT NUMBER	PROJECT NAME	SECTOR	DEPARTMENTS			SPECIFICATIONS	IMPLEMENTATION							INVESTMENT COSTS THOUSAND DOLLARS						
			PLANNING	IMPLEMENTING	BUDGET		1974	1975	1976	1977	1978	1979	1980	1975	1976	1977	1978	1979	1980	TOTAL
31	Housing	Housing	HDC	PWD	PRIVATE	155 housing units		○	→	→	→	→	→	235	235	235	235	235	238	1 413
81	Water Supply	Public Utilities	PWD	PWD	PWD	Pipelines, distribution		○	→	→	→	→	→	72	22	22	83	33	33	265
82	Sewerage	Public Utilities	PWD	PWD	PWD			○	→	→	→	→	→	52	17	17	317	558	119	1 080
92	Cleansing, Refuse Disposal, Street Lighting	Public Utilities	DC/SESCO	DC/SESCO	DC/SESCO			○	→	→	→	→	→	44	13	14	43	14	24	152
99	Electricity	Public Utilities	SESCO	SESCO	SESCO			○	→	→	→	→	→	230	230	50	50	50	50	660
103	Telecommunication	Public Utilities	TELECOMS	TELECOMS	TELECOMS			○	→	→	→	→	→	1	11	32	332	152	12	540
66	Town Plan	Public Services	L&SD	L&SD	L&SD				○	⊣										
37	Internal Roads	Transport	L&SD	PWD	PWD	4 miles local tertiary road 1 mile local primary road				○	→	→	→			40	40	40	35	155
54	Primary School	Public Services	ED	PWD	ED	1 stream, semi – permanent					○	⊣					288			288
56	Parks & Playgrounds	Public Services	DC	PWD	DC	5 acres					○	⊣					10			10
106	Shops & Coffee houses	Private Services	SEDC/PRIVATE	SEDC/PRIVATE	SEDC/PRIVATE	11 service units						○	→					320	320	640
55	Lower Secondary School	Public Services	ED	PWD	ED	2 streams, semi – permanent							○						776	776
						TOTAL INVESTMENT COSTS								634	528	410	1398	1402	1607	5 979

access to the town. However, the Consultants have not looked into the economy of such a development, which has been presented primarily as an inspiration or starter for future planners.

The town development package for Marudi for the Action Programme period is shown in Table 7.9.

7.4.6 Structure Plan for Long Lama

Long Lama is located at the Baram river. By 1990 it would become a sub regional centre. It is difficult to define the actual growth and development phasing of the town, because the catchment area of Long Lama covers a vast hinterland of the Fourth Division outside the Study Area, and because the potential agricultural land located within the Study Area in general is occupied. However, the location of Long Lama, the road connection from Beluru to Long Lama, the size of the catchment area, and the existing educational facilities indicate that Long Lama has the potential of growth to a sub regional centre.

Long Lama is today one of the best kept, smaller settlements in the Study Area. Its location, with the Baram river on the three sides of the town, is attractive and identifies the area as a natural place for a human settlement although the town can be flooded now and then. The qualities of the existing dwellings and public and private service facilities have already created an environmental atmosphere which could be stimulating for any new development.

Population

The 1970 population of Long Lama was 600 people. The target population for 1990 is 7 500 people, which corresponds to an increase in the population over 20 years of 16 per cent anually. The structure plan as shown in Figure 7.19 illustrates Long Lama as the urban centre for a total of 22 000 people with about 15 000 people settled in the catchment area outside the town itself.

Phasing and Growth

As mentioned it is difficult to state the phasing and growth of Long Lama but the development of the road connection between Beluru and Long Lama is planned to be completed in 1977. This could possibly accelerate the growth of services and of forestry and timber industries prior to 1980. The phasing and growth is then assumed to be:

1980 : 2 500 people
1990 : 7 500 people

DRAFT STRUCTURE PLAN LONG LAMA 1980

FIGURE 7.19

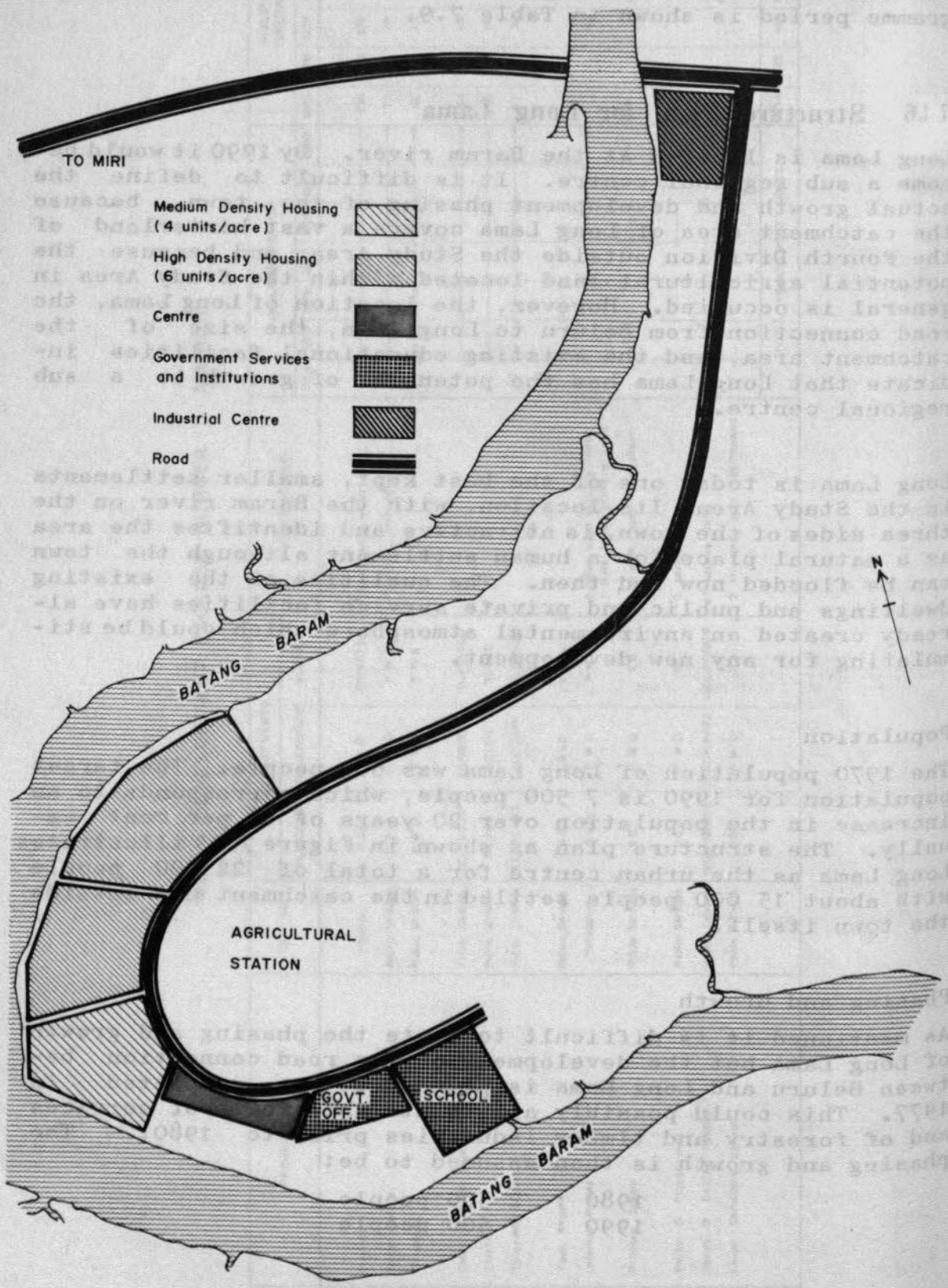


FIGURE 7.20

DRAFT STRUCTURE PLAN LONG LAMA 1990

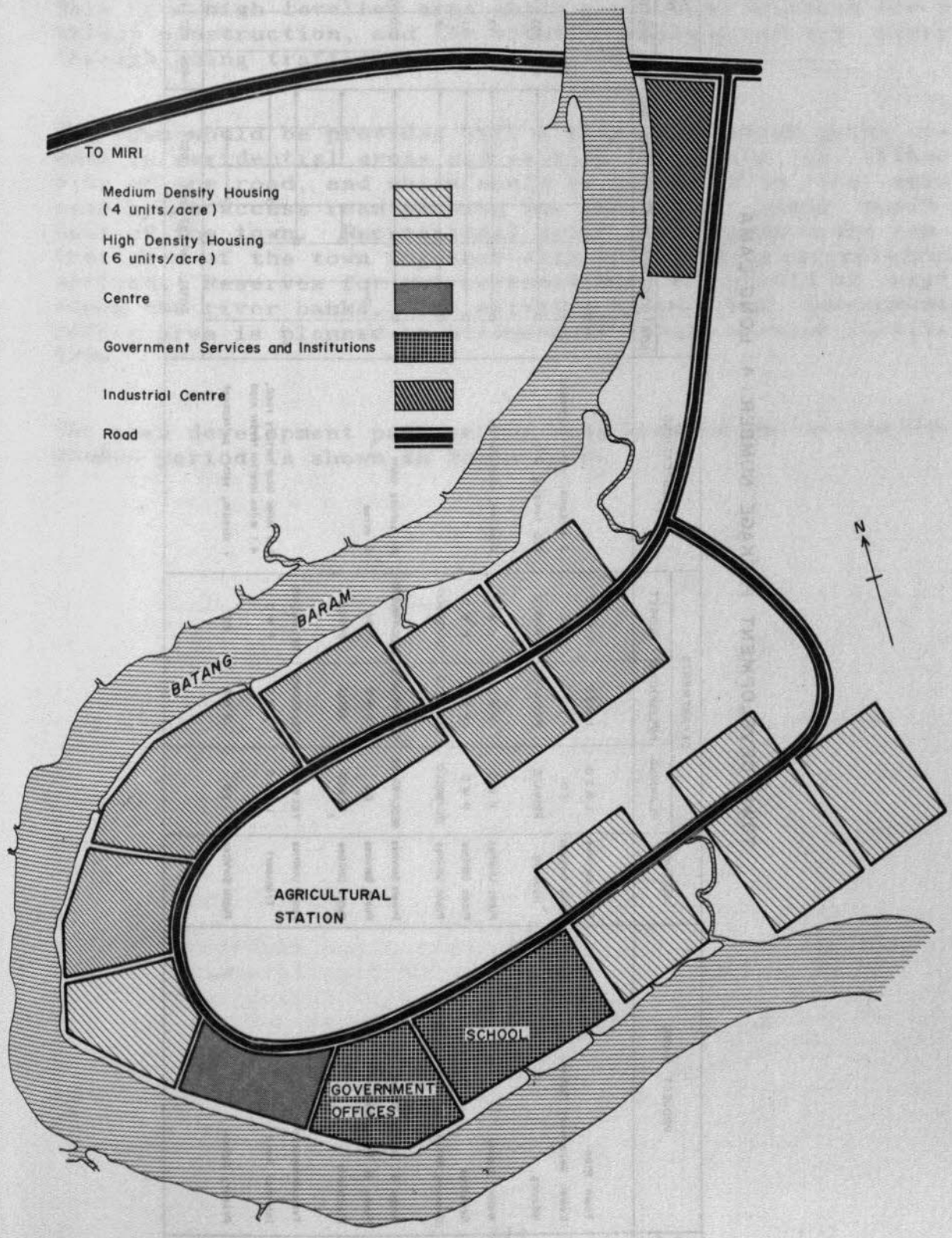


Table 7.10

TOWN DEVELOPMENT PACKAGE NUMBER : 4 : LONG LAMA

PROJECT NUMBER	PROJECT NAME	SECTOR	DEPARTMENTS			SPECIFICATIONS	IMPLEMENTATION							INVESTMENT COSTS THOUSAND DOLLARS						
			PLANNING	IMPLEMENTING	BUDGET		1974	1975	1976	1977	1978	1979	1980	1975	1976	1977	1978	1979	1980	TOTAL
66	Town Plan	Public Services	L&SD	L&SD	L&SD															
55	Lower Secondary School	Public Services	ED	ED	ED	2 streams, semi-permanent								776						776
32	Housing	Housing	PRIVATE	PRIVATE	PRIVATE	310 housing units								455	455	455	455	455	455	2 730
83	Water Supply	Public Utilities	P W D	P W D	P W D	Pipeline, distribution								27	13	13	40	97	93	283
84	Sewerage	Public Utilities	P W D	P W D	P W D									10	11	156	191	166	32	566
93	Cleansing, Refuse Disposal, Street Lighting	Public Utilities	DC/SESCO	DC/SESCO	DC/SESCO									8	8	48	28	30	57	179
106	Shops & Coffee houses	Private Services	SEDC/PRIVATE	SEDC/PRIVATE	SEDC/PRIVATE	21 service units								210	210	210	210	210	210	1 260
56	Parks & Playgrounds	Public Services	DC	P W D	DC	5 acres								10						10
195	Electricity	Public Utilities	SESCO	SESCO	SESCO											120		180	180	480
198	Telecommunication	Public Utilities	TELECOMS	TELECOMS	TELECOMS											369	732	3	6	1 110
37	Internal Road	Transport	L&SD	P W D	P W D	2.9 miles local tertiary road, 4.1 miles internal feeder road											615	29	29	673
54	Primary School	Public Services	ED	P W D	ED	1 stream, semi - permanent											288			288
							TOTAL INVESTMENT COSTS							1496	697	1371	2559	1140	1062	8 305

Layout of the Structure Plan

As shown in Figures 7.19 and 7.20 the structure plan recommends to develop the town as a direct expansion of the existing Long Lama although high lying and cheaper land could be found further down the river. The road alignment is proposed to bypass the town and cross the river in the northern area. This is a high levelled area which possibly is suitable for a bridge construction, and the solution would avoid any heavy through-going traffic in the town itself.

The town would be provided with a ring road, which gives access to residential areas and service facilities on either side of the road, and which would be connected to the main road by an access road passing the industrial areas northeast of the town. Recreational areas are located in the central area of the town together with the existing agricultural station. Reserves for recreational purposes should be kept along the river banks. The existing bazaar and Government office area is planned to accommodate future service facilities.

The town development package for Long Lama in the Action Programme period is shown in Table 7.10.

CHAPTER 8

PUBLIC UTILITIES

This chapter deals with public utilities, that is, water supply, sewerage and sewage disposal, cleansing, drainage, street lighting, electricity supply and telecommunications. The recommendations are based on the standards presented in Supporting Report 6.

8.1 WATER SUPPLY SCHEMES

8.1.1 Introduction

Water supplies in general are discussed in Supporting Report 6, Part III which also deals with the criteria for water consumption and treatment. The outline schemes included in this Report are, as far as possible, in conformity with the designs and preliminary plans of the PWD for the places concerned. A number of the smaller settlements have as yet no specific PWD schemes for their supply, or none that have been brought to notice. In these cases water supply systems are proposed which should be suitable as regards quantity and quality. However at two small settlements there is a need for studies at the site before making even preliminary recommendations. These settlements are Beluru and Sebauh, of which further details are given later in this section.

8.1.2 Details of Water Supply Schemes

Twelve separate water supply schemes will be required including existing ones, to feed 14 towns or bazaars and four distinct groups of agricultural villages. The details are summarised in Table 8.1. More complete information of the works envisaged for each scheme will be found in the Development Packages (Chapter 7) and Supporting Report 10. The location of the places listed are shown in Figure 8.1.

8.1.3 Lambir Works

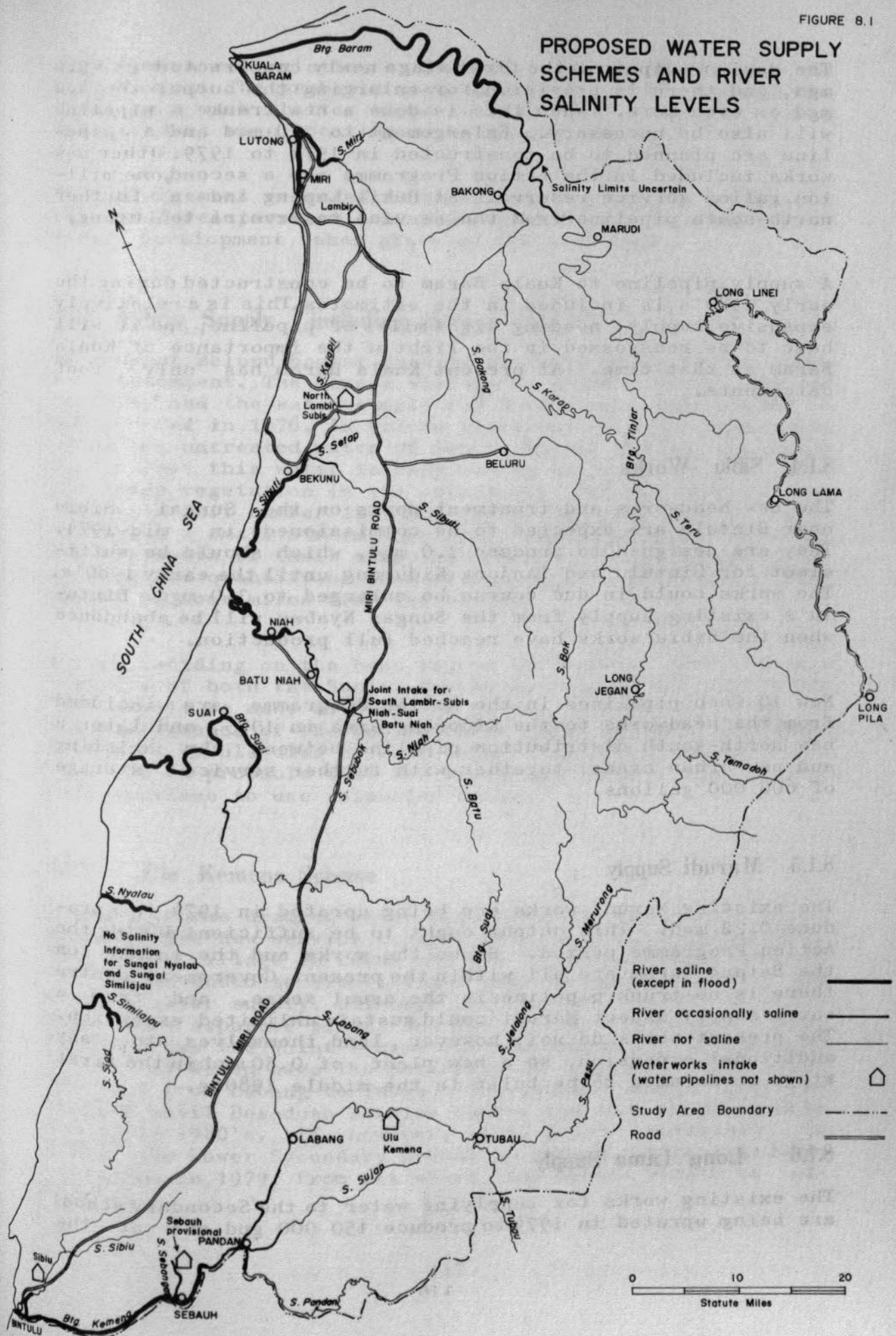
The PWD headworks and treatment works for Miri on the Sungai Liku were commissioned early in 1972 and reached the necessary rate of output to supply Miri in July 1972. The supply previously taken from Sarawak Shell Berhad's water supply, decreased steadily until mid-1973 when it averaged only about 60 000 gallons per day (gpd). At that date the new Lambir works were supplying at a rate of 1.3 mn gallons per day (mgd). This included about 65 000 gpd delivered to Tunku Abdul Rahman Village in the Lambir Rubber Planting Scheme.

TABLE 8.1 WATER SCHEMES

Scheme Name	Source	Places served	Total output in m.g.d.		State (see key)	Remarks
			1980	1990		
Lambir	Sungai Liku near Lambir Village (SLDB)	Miri, Lutong, Kuala Baram, Lambir Village	2.50	3.70	I.O.	Sarawak Shell Berhad intake at downstream site on Sungai Liku also supplies Miri and Lutong.
Sibiu	Sungai Sibiu at 6½ mile, Miri-Bintulu Road	Bintulu, Tanjong Kidurong	0.80	2.20	U.C.	Commissioning expected mid-1974.
Marudi	Batang Baram right bank	Marudi	0.21	0.25	I.O.	
Long Lama	Batang Baram Right bank	Long Lama	0.10	0.30	I.O. MBS	Existing plant enlarged could serve until 1985 approximately. New works needed thereafter.
Beluru	Sungai Bakong	Beluru and adjacent agricultural land	0.08	0.10	Prov.	Quality of the Sungai Bakong uncertain. Better quality may be available in smaller stream.
Ulu Kemena	Batang Kemena near Beseduan	Labang, Tubau, Beseduan and Lebus		0.26	MBS	A joint scheme for the four settlements is not strictly essential, but is preferable for convenience of operation.
Sebauh	Sungai Sebangat	Sebauh	0.03	0.04	Prov.	Source said to be the nearest for acceptable non-saline water. A relatively expensive scheme.
South Lambir Subis	Sungai Niah at site of MRCU camp	Sungai Tangit Village, Ladang Tiga, Subis I, Subis II, Palm Oil Factory	0.82	0.90	P.P.	Headworks near Gunong Subis
North Lambir Subis	Sungai Kejapil at Bekenu road bridge	Bekenu, Bukit Peninjau, Ladang Empat, Kabuloh	0.19	0.26	D.P.	Preliminary work at intake site commenced 1973.
Batu Niah	Sungai Niah at site of MRCU camp	Batu Niah, Niah and settlements in between	0.14	0.27	MBS	
Niah-Suai	As above	Sub-Regional Centre and five Villages in Niah-Suai	0.67	1.40	MBS	
South Sawai	As above	South Sawai agricultural area	-	0.40	MBS	Work on the headworks and pipelines of Niah-Suai scheme to take account of Sungai Sawai needs after 1980.

Key
I.O. First stage in operation 1974.
U.C. First stage under construction.
D.P. In detailed planning stage by PWD.
P.P. In preliminary planning stage by PWD.
MBS Proposed by Miri-Bintulu Study.
Prov. Provisional scheme used by MBS for cost purposes.

FIGURE 8.1


PROPOSED WATER SUPPLY SCHEMES AND RIVER SALINITY LEVELS
Btg. Baram
KUALA BARAM
LUTONG
S. Miri
MIRI
Lambir
BAKONG
Salinity Limits Uncertain
MARUDI
LONG LINEI
S. Kelapi
North Lambir Subis
S. Setap
BEKUNU
S. Sibiu
S. Bakong
S. Korap
Btg. Tinjar
BELURU
LONG LAMA
S. Teru
S. Sibuti
MIRI BINTULU ROAD
SOUTH CHINA SEA
NIAH
S. Bok
BATU NIAH
Joint Intake for South Lambir-Subis Niah-Suai Batu Niah
LONG JEGAN
LONG PILA
SUAI
Btg. Suai
S. Sebuyak
S. Niah
S. Batu
S. Temadoh
S. Nyalau
No Salinity Information for Sungai Nyalau and Sungai Similajau
S. Similajau
BINTULU MIRI ROAD
S. Labang
S. Merurong
S. Lelalong
S. Pasu
S. Siut
LABANG
Ulu Kemena
TUBAU
S. Sujau
S. Tubau
Sebauh provisional PANDAN
S. Sibiu
S. Sebauh
S. Pandan
Sibiu
SEBAUH
BINTULU
Btg. Kemena
River saline (except in flood)
River occasionally saline
River not saline
Waterworks intake (water pipelines not shown)
Study Area Boundary
Road
0
10
20
Statute Miles

The design output of the first stage newly constructed is 2.0 mgd, and there is provision for enlarging the output to 4.0 mgd or even more. When this is done a new trunk pipeline will also be necessary. Enlargement to 3.0 mgd and a pipeline are planned to be constructed in 1978 to 1979. Other new works included in the Action Programme are a second, one million gallon service reservoir at Bukit Lopeng and a further north-south pipeline from the service reservoirs to Lutong.

A supply pipeline to Kuala Baram to be constructed during the early 1980's, is included in the estimates. This is a relatively expensive supply, needing eight miles of pipeline, and it will have to be reassessed in the light of the importance of Kuala Baram at that time. At present Kuala Baram has only roof catchments.

8.1.4 Sibiu Works

The new headworks and treatment works on the Sungai Sibiu near Bintulu are expected to be commissioned in mid-1974. They are designed to produce 1.0 mgd, which should be sufficient for Bintulu and Tanjong Kidurong until the early 1980's. The works could in due course be enlarged to 3.0 mgd. Bintulu's existing supply from the Sungai Nyabau will be abandoned when the Sibiu works have reached full production.

New 10 inch pipelines in the Action Programme are included from the headworks to the Kidurong area in 1975, and later a new north-south distribution pipeline between the existing and new urban areas, together with further service storage of 600 000 gallons.

8.1.5 Marudi Supply

The existing Marudi works are being uprated in 1974 to produce 0.22 mgd. This output ought to be sufficient during the Action Programme period. Since the works and the intake on the Batang Baram are all within the present Government centre there is no trunk pipeline in the usual sense, and from a water supply aspect Marudi could sustain unlimited expansion. The present works do not, however, lend themselves to any additional expansion, so a new plant of 0.30 mgd in the first stage is assumed to be built in the middle 1980's.

8.1.6 Long Lama Supply

The existing works for supplying water to the Secondary school are being uprated in 1974 to produce 150 000 gpd and at the

same time a reticulation system will be installed in the bazaar area. The probable need to trim the east bank of the Baram to a much flatter slope to stabilise it must be taken into account when locating water supply works.

The enlargement referred to above is believed to be sufficient for new development at Long Lama up to the middle 1980's provided, development takes place on the east bank.

8.1.7 Beluru Supply (including Mera-a Village)

At present Beluru bazaar depends entirely on rainwater from roof catchment. The Mera-a village is planned to be started in 1975, and the water supply for Mera-a and Beluru should be implemented in 1976. In Beluru there may be a few households using the untreated water of Sungai Bakong but local opinion has it that this water is very bad in quality, due to peat and swamp vegetation in the catchment. PWD mechanical construction unit number 12 (MRCU 12) is establishing a water intake on a small stream, probably Sungai Mapok or Sungai Benuang, south of their camp, and records should be made of the quality and quantity of this stream in the dry season. This intake is four miles from the bazaar.

Before deciding on the best source for Beluru, and Mera-a analysis of both the Sungai Bakong and the stream used by the MRCU should be made at very low flows. Laboratory tests on the performance of the Bakong water under normal treatment processes should also be made before deciding which source to use. It is probable that the bazaar population will in any case continue to use rainwater tanks.

8.1.8 Ulu Kemena Scheme

A joint scheme drawing water from Batang Kemena is proposed to serve the new service centre, Beseduan, in the Labang-Tubau RDA, a new village in Lebus and the Labang and Tubau bazaars. This is intended to simplify and improve operation of the present water supply, although both bazaars could in principle have separate plants and thus reduce pipeline costs. Nevertheless the joint scheme for Ulu Kemena is recommended because it would have the potential to supply settlers along the road from Labang to Tubau. The scheme should not be started until Beseduan service centre has been established in the early 1980's. If, however, it is found necessary to supply the Lower Secondary School in Labang, which will be in operation in 1979, from its start the scheme should be advanced.

8.1.9 Sebauh Supply

At present Sebauh has no piped water supplies and its obvious source, Batang Kemena, is saline every year at times of low flow. Preliminary suggestions have been made by others for a water supply from either Sungai Selezu or Sungai Sebangat some six or seven miles north of Sebauh. These or other possibilities have not been investigated by the Consultants and a careful comparison of alternatives, including that of constructing a large roof (or impervious) catchment, is necessary. A reliable supply is needed by 1976 for a new Secondary School, but the total demand of Sebauh up to 1990 appears to remain below 0.1 mgd and hence well below the desirable minimum size for an independent treated water supply system.

8.1.10 South Lambir-Subis Scheme

The four SLDB villages in the southern part of Lambir-Subis Development area, and a new SLDB palm oil factory there, are to be supplied from a new intake and treatment works on Sungai Niah. The same works are recommended for supplies to the Niah-Suai area and to the Batu Niah and Niah bazaars. The defined South Lambir-Subis Scheme, however, is limited to the settlements and factory north of the Sungai Niah. It is understood that the PWD is already engaged in design of this scheme since supplies to their factory are required by the SLDB in January 1976. Enlargement of the headworks to serve Niah-Suai and the two bazaars could take place later if necessary, though it would be more convenient to do the work in one stage under one contract. The allocations of headworks capacity recommended in the first stage are as follows:-

South Lambir-Subis	1.0 mgd
Batu Niah and Niah	0.2 mgd
Niah-Suai area	0.8 mgd
	2.0 mgd

This is expected to be followed in the 1980's by enlargements to bring the South Lambir-Subis allocation to 1.1 mgd out of a total capacity of 3.0 mgd for the whole supply system.

8.1.11 North Lambir-Subis Scheme

This scheme is already well in hand with the PWD, and construction would have started in 1973 but for certain contractual difficulties. The intake and treatment works are on the Sungai Kejapil where the road to Bekenu crosses it. The scheme is intended to supply Bekenu, Kabuloh and the SLDB estates of Bukit Peninjau and Ladang Empat. Bukit Peninjau, with 300 settlers houses occupied, is already in urgent need of a competent water supply. The Sungai Kejapil is a small stream, and its tributary upstream, Sungai Luak Besar, is already used

for water supply to the SOP estate and to the small plant at Kabuloh which is to be abandoned. The yield of the Sungai Kejapil may need to be reassessed before any enlargement is made to the 0.3 mgd plant currently planned. On the information available this capacity should be sufficient to after 1990.

8.1.12 Batu Niah Supply

At present there is an intake and treatment plant at Batu Niah serving the Secondary School. The PWD plan to extend this works to feed Batu Niah bazaar during 1974. The Sungai Niah at the intake was brackish, however, during the early 1973 drought and therefore the plant should eventually be abandoned. An additional reason is that heavy pollution from the bazaar could probably advance upstream to the intake as a result of tidal reversal of flow during low river discharge periods.

It is proposed that Batu Niah and Niah are both supplied from the new Sungai Niah plant which will be upstream of the limit of saline intrusion during 1973; this plant was discussed in Section 8.1.10.

8.1.13 Niah-Suai Scheme

The Niah-Suai RDA is expected to contain 17 000 people by 1980 and 30 000 by 1990 including existing and dispersed settlements. A palm oil mill is planned for production starting in 1978. Supply of this area from the new Sungai Niah plant discussed in Section 8.1.10 is recommended. The only alternative source of adequate size in Batang Suai is to the south of the area. Use of the Sungai Niah intake has the advantage of increasing in size an existing plant rather than incur the difficulties of operating a separate smaller plant at a more remote site on Batang Suai. It is also considered better to develop more fully the available yield of Sungai Niah so as to reserve the whole of the Suai yield for other future development to the south of the river.

8.1.14 South Sawai Supply

A small supply will be needed for the proposed settlements in South Sawai in the early 1980's. Since this area lies south of Niah-Suai, and its demand is small (about 0.4 mgd in 1990) it can most economically be fed from the same pipelines. The Niah-Suai pipelines from the treatment works as far the road junction between the villages of Sebanah and Lamaus should be sized to allow for the extra flow later required by South Sawai.

8.2 SEWERAGE AND SEWAGE DISPOSAL

8.2.1 Existing Situation

The sanitary disposal of human waste is a basic requirement for the maintenance of good public health. The present arrangements for providing sanitary facilities are inadequate throughout much of the Study Area. In the towns reliance is placed on the use of septic tanks from which highly polluting liquors flow into surface drains and water courses. Because of the high water table in the plains, it is not possible for effluent from the tanks to percolate into the ground and filter beds, which although provided to treat the effluent generally serve little or no purpose because of bad design or lack of maintenance. Consequently, the ground may become saturated with effluent and some surface water drains become foul and evil smelling.

Although septic tanks serve a useful purpose in less densely populated areas where sufficient land is available for the effluent to be disposed of without danger or nuisance, in urban areas the only satisfactory method for removing excreta and waste water is by the provision of sewers to carry the wastes away for treatment and safe disposal.

8.2.2 Criteria for Future Construction and Operation

In Chapter 7 it is proposed that development should be divided into four categories of density;

Housing density	Housing units per net acre	Average persons per net acre
Low	1	6
Medium	3 - 4	15 - 20
High	6	31
High	6 - 10	30 - 55

It should be the object of the sewerage authority to provide sewerage facilities to all high density residential areas and bazaars as early as possible. The financial projections for this programme have allowed for this to be completed by 1980. Where the density is four houses to the acre or less, allowance has been made in the projections for new houses to be provided with septic tanks. Facilities are also urgently needed for desludging both the existing and the new septic tanks, a process which should be carried out every one to two years and for this purpose allowance has been made for the provision of mechanical septic tank emptying vehicles.

In very low density agricultural villages it is anticipated that it will not be possible to provide many of the houses with septic tanks because of shortage of resources and difficulties with tanker access for desludging.

It is therefore proposed that pit latrines of the pour flush type should be used and allowance has been made in the estimates for a latrine at each new house. Community sewerage

systems are included in the Plan for each village to serve the school, community hall, and bazaar. Typical layouts of treatment works sized to cater for populations of up to 300 using either the septic tank or stabilisation pond methods of treatment are illustrated in Supporting Report 6 Part III.

8.2.3 Bintulu

The Plan for the Study Area includes the construction of a new town at Bintulu, with a population rising to a total of nearly 40 000 in 1990. The development will include residential, commercial institutional and industrial areas with a deep water port and a LNG plant. Planning is not inhibited by existing development, the present population is only about 6 000. The opportunity should be taken to develop the area in planned stages with amenities and public utilities including sewerage as integral parts of the plan. At the same time random development in areas which cannot economically be provided with these services should be prohibited.

In Appendix II a sewerage scheme for Bintulu is discussed. In the Appendix it is proposed that the future town should be divided into three sewerage zones with separate disposal facilities in each.

The southern zone would cover the existing town and all development up to the watershed on Tanjong Batu. Sewage would be pumped to stabilisation ponds sited beside Sungai Sibiu about 1.5 miles inland. The central zone would include the area between Tanjong Batu and the southern side of Tanjong Kidurong, including the proposed new port. Sewage from this zone would be pumped to stabilisation ponds sited on the banks of Sungai Sebatang in the area scheduled for industrial development. In both zones the effluent from the ponds would be discharged to the adjacent rivers. The northern zone forms the area north of Tanjong Kidurong in which the LNG plant is sited. No information is yet available of the sewerage requirements in this zone.

8.2.4 Miri

It has not been possible to discuss in any detail the sewerage requirements of Miri which are complex and for which a number of alternative arrangements must be carefully evaluated. A feasibility study is required and proposals for carrying out this work have been included in considerations of the Second Malaysia Plan - Mid-term Review. The study should consider the sewerage and sewage disposal needs of the whole Miri development area and evaluate all feasible arrangements by which these needs could be met. The optimum arrangement should be selected in the light of all public health,

economic, and financial considerations and a staged development plan drawn up to define the main elements of the proposed system.

The development plan should cover not only the engineering requirements, but also give full financial projections with alternative methods of funding where necessary, and details of organisation, management and staffing together with all other matters which relate to the efficient implementation and operation of the utility.

The plan should be prepared in sufficient detail to enable the Government to approve a sewerage development programme and for the design and construction work to proceed without delay. The study cannot, however, be successfully carried out until the Miri urban development plan has been completed by the Land and Survey Department, who will no doubt liaise with the sewerage authority.

In conjunction with the Miri feasibility study, similar plans should be prepared for the other main towns in the Study Area, insofar as this is possible. If the work is carried out by consulting engineers, the additional cost of preparing plans for the other towns may be relatively low. It must however be emphasised that, where future development is expected, sewerage development plans cannot be prepared until the urban development plans have reached a certain stage of completion.

8.2.5 Marudi

At present the population of Marudi is divided equally between high and medium density housing, and it is expected that most future housing will be at medium density. The financial projections for main sewerage have been included for the high density areas only. By 1980, these areas will house about 2 300 persons. The rest of the population will be served by septic tanks unless their houses are sited conveniently for new sewers.

The effluent from the sewage treatment works could be discharged into the Batang Baram at a point downstream of the town.

8.2.6 Batu Niah

A sewerage system is planned to serve the existing bazaar and all future high density housing. The system will cater for about 1 300 persons by 1980 rising to 2 600 by 1990. The

population figures for Batu Niah include a substantial number in the surrounding rural areas where it will be possible to provide only pour-flush latrines. A septic tank emptying vehicle is included for the new sub regional centre (Igang) in the Niah-Suai RDA and emptyings from the septic tanks in this area can be taken for treatment and disposal at a convenient treatment works.

Care will be necessary in siting the outfall of the sewage treatment plant to prevent the effluent being carried up the Sungai Niah as far as the bazaar during high tides in conditions of low river flow.

8.2.7 Long Lama

According to the plan Long Lama will be expanded; its population will rise to three or four times the present by 1980 and to ten times the present by 1990. This situation is therefore similar to Bintulu and the opportunity must be taken to follow a staged and integrated development plan in which amenities and public utilities are included. So far as possible random urban development which cannot be provided with necessary utilities, including sewerage, should not be permitted.

8.2.8 Smaller Towns

In the small settlements at Bekenu, Beluru, Labang, Sebauh and Niah, the bazaar areas are made up of high density housing, and community sewerage facilities should be provided to these as soon as is practicable. However, this work cannot be carried out until improved water supplies have been provided and an adequate number of private connections have been installed. At Bekenu, Sebauh and Niah a water source off the main river is essential because of saline intrusion. At the other two places there is a considerable risk of recirculating untreated sewage.

Many of the smaller communities are built on the banks of large rivers. Where the quantity of sewage is small and the dilution afforded by the river flow is large, the sewage may require little treatment and the cost may fall below the budget figure of $250 per head.

8.2.9 Sub Regional Centre in Niah-Suai

The sewerage requirements of the sub regional centre should be planned as part of the initial town planning designs, and as large a proportion as possible of medium density housing

should be connected into the sewerage system in addition to all the high density housing. The estimates have allowed for 95 per cent of the population to be served by sewerage systems, but to achieve this without duplication of temporary facilities will require detailed planning to start not later than 1975.

Plans for the structural layout of the centre have not been worked out to a point where sites for disposal works and types of treatment can be considered.

8.2.10 Organisation, Management and Finance

The basic responsibility for sewerage and drainage services rests with the various District Councils under the general oversight of the Ministry of Local Government. Approval of sewerage proposals for new development is the responsibility of the Land and Survey Department. Detailed design and execution of sewerage works, other than for private development, is the function of the Public Works Department. The Medical and Health Department has an overall responsibility to establish and maintain sewerage standards acceptable for public health needs. The boundaries of responsibility of these four departments or ministries in a field where little or no construction has yet taken place may not be entirely clear. One point, however, which is fairly clear is that, in the Study Area, no District Council is in a position to take the initiative with major sewerage works.

It is therefore recommended that the terms of reference for the Miri sewerage feasibility study should include a study of alternative ways in which the construction and management of sewerage services could be organised. This aspect should also be considered in the context of the needs of the whole State.

As already mentioned the provision of water supplies and the removal and treatment of waste water are two parts of a continuous process and cannot be dealt with in isolation. It is becoming increasingly common throughout the world for these two interrelated activities to be undertaken by a single authority, and consideration should be given to setting up one organisation with responsibility for the provision of water supply and sewerage services.

The organisation(s) must be capable of efficiently implementing and managing the utility, attracting the necessary investment funds, accounting for the funds and monitoring the necessary staff, and creating and enforcing by-laws to ensure that the full benefit is received from the installations.

The organisation must have the power to raise revenue to meet loan service charges and operating costs. If, for social

reasons, it is not possible to charge the user the true cost of the utility, then subsidies from the Government or from local rates will be necessary. Such subsidies should be clearly accounted for to ensure that there is no waste of public funds.

There are four ways of charging for sewerage services which are commonly used throughout the world; combination of these methods may be used:-

a) Where water supplies are metered a direct sewerage surcharge can be made on the rate for water to those consumers who benefit from the sewerage service. While this method has the advantage that the cost of the service is related directly to the quantity of sewage passed into the system, it has the drawback that the apparent high unit rate for water may discourage the poorer section of the community from using water sufficiently to maintain good health;

b) charges can be based on the general rate (or local house tax). This is generally a fair system provided a satisfactory arrangement exists for assessing and collecting the rates;

c) charges can be based on the frontage length of the property; or

d) charges can be made for each water closet and each unit length of urinal. This method may have the undesirable effect of discouraging people from installating adequate facilities in their houses.

It may be necessary for the sewerage authority to provide loans to assist those householders who cannot themselves afford to install sanitary facilities and make connections into the public sewers. Appropriate provisions for this should be included in the financial projections.

Industrial effluents are usually metered and charged for at a rate which depends upon the strength of the effluent and its amenability to treatment. Charges should reflect the true cost to the authority of providing the service.

8.3 DRAINAGE CLEANSING AND STREET LIGHTING

8.3.1 General

The services included in this chapter are described in Supporting Report 6. They consist of:-

a) construction and maintenance of surface channels for conveying water from all sources: main channels and road side drains;

b) operation and maintenance of refuse collection service;

c) cleansing and scavenging of streets, drains and public paved areas; including markets;

d) street lighting (maintained by SESCO through a tariff charge to local authority).

These services should, to the appropriate extent, be supplied in all towns in the Study Area. The larger the town the higher should be the level of service. Their performance imposes considerable responsibilities upon District Councils, and these councils require to have powers to raise sufficient revenue to provide an adequate service.

Expenditure on these services has not been allowed for under District Council control in agricultural villages or in bazaars with populations less than 800. However items a) and b) above and to a small extent item c) require to be organised in villages by a responsible committee. Likewise in very small bazaars some form of voluntary or co-operative effort is needed to keep drains operating effectively and to ensure that refuse is disposed of and the public areas kept clean.

It is considered that the cost of these services in all larger communities should be met from annual assessments of tax on property (rates). For estimating purposes an allocation from this source has been allowed for in the utilities under consideration of $4.00 average per head per year in bazaars of 1 000 to 2 000 population, rising to $9.50 average per head in towns like Miri.

8.3.2 Miri

The topography of Miri lying on a flat coastal plain only a few feet above sea level makes it a very difficult place to drain, even though flood levels cannot build up very high due to the closeness of the sea. Minor flooding however is very frequent, and conditions are made worse by the heavy erosion of sand and silt from Canadian Hill, the greater part of which is redeposited in and around the Miri surface drainage system. Protective measures to minimise this erosion should receive urgent attention; it is not possible to convey a large proportion of this coarse sediment into the sea or the Miri river by the natural flow of water, however well the drainage channels are constructed. If sedimentation was kept under control by creating and maintaining sediment basins (see Supporting Report 6) flooding would be reduced, although it could never be eliminated without expensive measures to raise the roads and building thresholds above the level of the general flood plains. If the disruption by flooding is considered to have serious financial consequences then a feasibility study of drainage improvements should be made.

Miri's refuse collection and general cleansing services are barely adequate and measures should be taken to improve them. A considerable labour force is employed but is not fully

effective. Funds are required to purchase new plant, and trained men are required to fill additional inspector and overseer posts.

8.3.3 Bintulu

The sites for new development in Bintulu have some similarity topographically with Miri, in being areas of coastal plain with steep adjoining hillsides discharging their runoff on to them. However, the transitions of slope are more gradual at Bintulu and much of the coastal strip retains appreciable gradient. Problems of sediment deposition ought to be less than in Miri on this account, but the probability of an intensive phase of construction on the lower hill slopes will produce risks of very serious erosion and sediment deposition unless precautions are taken. An example of this has already occurred with the construction of the access road to Bukit Nyabau micro-wave station. Eroded material from this road caused serious problems at the Nyabau waterworks.

One agency should have overall responsibility for erosion protection, with powers to enforce such precautions as are necessary.

The existing cleansing and refuse disposal services in Bintulu or other smaller towns in the Study Area have not been observed, though it seems likely that improvements similar to those suggested for Miri would be beneficial.

8.4 ELECTRICITY SUPPLIES

8.4.1 General

The present electricity supply situation in Sarawak, and the criteria to be applied to the provision of electrical supply systems within the Study Area, are treated in Supporting Report 6 Part III; where particular references are made to existing systems within the Study Area for the purpose of extending the information available to towns and settlements not served at present by the Sarawak Electricity Supply Corporation (SESCO). In this section the individual settlements and their electricity requirements as recommended by the Study will be discussed briefy.

At present only the three larger towns, Miri, Bintulu and Marudi are supplied by SESCO with electricity 24 hours a day. It is considered that all the settlements, including agricultural villages, having a population in excess of 1 000 should have the benefit in due course of an electricity supply by SESCO. Many small bazaars below this population already have supplies from private licensees, and where possible these supplies could with advantage be taken over by SESCO even

though the population remains below 1 000. The general conclusions about future supplies, as summarised in Supporting Report 6, after discussions with SESCO engineers, are as follows:

a) it will not be economic to provide inter-connecting transmission lines between settlements, since all are small and widely separated, within the next 15 to 20 years at the least.

b) each town and settlement should have a separate power station with generators driven by diesel engines. Possible exceptions to this are Miri, Bintulu and Long Lama;

c) all new electricity systems should, in accordance with Government policy, be installed and operated by SESCO, who should take over private systems as and when licences expire.

8.4.2 Miri

Miri has a new SESCO power station at Pujut Road which was commissioned at the end of 1971. In 1973 the plant consisted of three 1 000 kilowatt (kW) sets and one 1 320 kW set. Two larger sets, of 2 400 kW and 3 000 kW, are due to be installed in 1973-74, giving an installed capacity of 9.7 Megawatts (mW) before the start of the Action Programme period. Two further sets of 5.0 mW each are planned for installation in 1975-1980. Miri demand in 1972 showed exceptional growth (34 per cent in peak demand and 40 per cent in units generated).

In 1972 the existing diesel generators were converted to dual fuel operation and sets number five and six will use reciprocating engines designed for this. Sets number seven and eight (5.0 mW) will be driven by gas turbines, using natural gas as fuel.

Sarawak Shell Berhad has its own power station at Lutong, feeding the refinery, company housing, and certain installations within the Miri central area. It would appear desirable for SESCO to take over the supply to isolated Shell users within the Miri town area.

8.4.3 Bintulu

The SESCO power station at Bintulu contained installed capacity in 1973 of 1 155 kW, and two new 600 kW sets are scheduled for installation in 1974. There is a heavy but intermittent demand from sawmills, with the result that the load factor is low. Indications have been received of new sawmill demands of 1 000 kW or more before the end of 1975. Excluding these rather uncertain new requirements it is estimated that the peak demand may rise to 3 000 kW by 1980. This would

require the addition of three sets of 1 000 kW each during the Action Programme period. Possibly the last of these should be a larger unit but in the cost estimates they have been taken to be of equal size.

When the LNG plant at Tanjong Kidurong is well advanced there is the possibility of using natural gas as fuel for Bintulu generators.

Bintulu is the nearest load centre to a site for possible hydro-electric generation on Batang Belaga in the Seventh Division. However this site is some 90 miles away, and it is not at present possible to foresee a demand sufficient to justify a scheme to exploit the river potential, which is of the order of 250 mW. Further investigation of this matter is required as soon as the rate of growth of Bintulu demand becomes clearer.

8.4.4 Marudi

Marudi has a SESCO power station of 410 kW installed capacity in four sets. The peak demand is increasing very slowly but, at the time of the regatta, it has exceeded the capacity of the station (with one set out of use). It is proposed that two new sets of 250 kW each are installed in the period to 1980.

Due to the absence of road access to Marudi diesel fuel is taken up river in 40 gallon drums. This adds greatly to the operating cost which is double that of the Miri station.

8.4.5 Batu Niah

There is at present an electricity supply to Batu Niah by a private licensee which is due to be taken over by SESCO in 1974. The existing system is only energised six hours a day, and is limited to the bazaar area and immediate surroundings. SESCO expects to complete renovations and some extensions to the distribution system in 1975.

The installation of 260 kW of new plant is included in the Action Programme; this assumes that the 60 kW of plant taken over will remain in service.

8.4.6 Long Lama

Supplies at Long Lama are limited to one or more very small privately owned generators. A completely new system will be

required in 1977 when the bazaar is expected to expand considerably with completion of the road link. Even with road access the haulage of diesel fuel to Long Lama will be expensive. There is a possibility of developing a small hydro-electric scheme using the waters of Sungai Temala or one of its tributaries. The site would be about five miles east of the bazaar, and investigation of this prospect should proceed without delay.

Peak demand is estimated to reach 150 kW by 1980 and 900 kW by 1990; the cost estimates have allowed for 260 kW of installed diesel plant by 1980, since the prospects and costs of hydro-electric power are uncertain at present.

8.4.7 Bekenu

There is at present a private supply system to Bekenu which is due to be taken over by SESCO in 1975. This system feeds over 30 shophouses and two schools. For its population Bekenu has an unusually high level of business activity, and a growth in power demand to 90 kW is assumed by 1980. This will require between 60 and 120 kW of new plant, depending on the size and condition of the sets taken over.

8.4.8 Other Settlements

There are no existing systems of note, and no special geographical factors affecting electrical requirements of the other settlements, both new and proposed, in the Study Area. They have been allocated electricity systems in accordance with the criteria given in Supporting Report 6. Apart from the sub regional centre in Niah-Suai, the timing of the installation of these systems is open to wide variation, depending on the resources available, and the town development packages show merely those which could with benefit have electrical systems of the size given. In the case of the Niah-Suai sub regional centre an adequate power supply is essential from the outset if it is to grow as envisaged in the Plan and meet the needs of its surrounding agricultural area.

8.5 TELECOMMUNICATIONS

8.5.1 Introduction

The general criteria for this subject are set out in Supporting Report 6 Part III. In this part matters specifically affecting the Fourth Division and the Study Area are discussed. Individual telephone lines form the largest and most important part of the service provided by the Telecommunications Department, and in this text and the cost studies they

are the quantity which determines the size of the system. However it must be remembered that other services have to be provided. These services are listed below; those at the top of the list being principally associated with the larger towns:-

- telex
- inland and overseas telegrams
- public telephone call boxes
- radio telephone
- radio call service for remote settlements
- special radio services for police, civil aviation and the civil administration.

Costs of new works proposed are given in the Development Packages (Chapter 7) and in Supporting Report 10.

A micro-wave link system is already in use between Kuching and Sibu, and is being extended through the Third, Fourth and Fifth Divisions to Sabah.

Micro-wave relay stations in the Study Area are listed below, reading from west to east:

From Third Division (Balingian) to -

Bukit Nyabau (drop-off to Bintulu)
Mile 34 from Bintulu
Bukit Ancharang (south of Batu Niah)
Bukit Lambir (drop-off to Miri)
Bukit Dabei (east of Marudi) leading to Fifth Division.

Most of the new settlements to be recommended by the Study will lie within a 20 to 25 mile radius of Mile 34 or Bukit Ancharang stations, and it may be necessary to consider whether drop-off facilities will be needed in future at one or both of these stations. At present these stations are planned as repeater stations only.

8.5.2 Existing Services

The present telephone service in Fourth Division of Sarawak is summarised in Table 8.2.

Sites for new telephone exchanges at Bintulu (in bazaar) and at Miri (Merbau Estate) have been earmarked. Construction at Bintulu is expected to start shortly. A new main underground duct for cables has recently been laid between Miri and Piasau. Overhead lines have been laid to Miri Airport and, for one subscriber, as far as Tunku Abdul Rahman Village seven miles from Miri.

TABLE 8.2 EXISTING TELEPHONE SYSTEMS

Place	1970 population	Telephone exchange			Lines used per 1 000 population	Remarks
		Type	No. of lines used	No. of lines (capacity)		
Miri)	27 000	Automatic	1 200	2 000)	45	(Two exchanges (connected by (physical (junctions (cable)
Lutong)		Automatic	21	50)		
Bintulu	6 200	Automatic	210	300	34	
Marudi	3 900	Automatic	126	150	32	
Bekenu	700	Automatic	33	50	47	
Niah	1 000	Automatic	10	20	10	
Batu Niah	1 000	Automatic	21	30	21	
Sebauh	700	Manual	9		13	
Kuala Baram	500	Manual	5	10	10	
Tatau	-	Automatic	19	50	-	Outside Study Area

8.5.3 New Development

Accelerated economic growth is expected to continue between 1975 and 1980 at four locations already provided with telephone exchanges namely Miri/Lutong, Bintulu/Kidurong, Bekenu and Batu Niah.

Growth is also expected at the small settlements, Long Lama and Beluru which have at present no telephone service.

In addition the planned new sub regional centre in the Niah-Suai RDA and the surrounding villages should be supplied with telephone service.

Of the above places Long Lama is the most remote from existing telephone links and the micro-wave system. It is expected to require one or more relay stations to connect with Miri. Development of Long Lama will be slight until such time as the road connection with Beluru is open, which is expected to be in 1977.

The recommended sub regional centre near Bukit Igang is between the micro-wave stations at Mile 34 and Bukit Ancharang, and is about 55 miles in a direct line from Bintulu.

Locations of all the above settlements are shown on Figure 8.2 together with the existing telecommunication network. Their populations and telephone demands are set out in Table 8.3. The standard telephone densities given in Supporting Report 6 have been adjusted in Table 8.3 where this has been found necessary, for instance a bazaar centre like Bekenu is expected to continue to require a higher density than a new village of the same population.

FIGURE 8.2

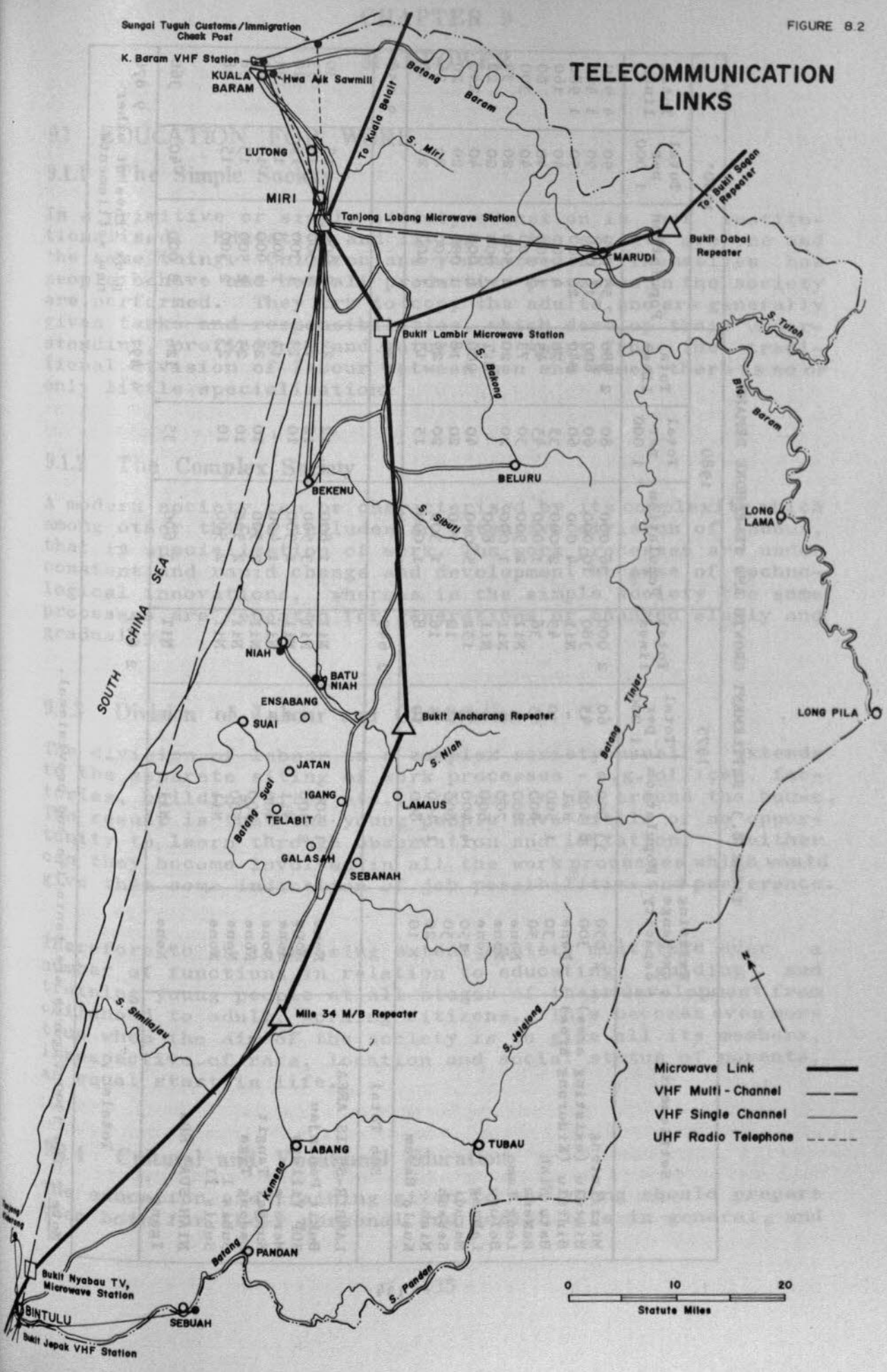

TELECOMMUNICATION LINKS
Sungai Tuguh Customs/Immigration Check Post
K. Baram VHF Station
KUALA BARAM
Hwa Aik Sawmill
Batang Baram
To Kuala Belait
S. Miri
LUTONG
MIRI
Tanjong Lobang Microwave Station
To Bukit Sagan Repeater
Bukit Dabai Repeater
MARUDI
Bukit Lambir Microwave Station
S. Tutoh
Big. Baram
S. Batang
BELURU
BEKENU
S. Sibuti
LONG LAMA
SOUTH CHINA SEA
NIAH
BATU NIAH
ENSABANG
SUAI
Bukit Ancharang Repeater
Batang Tinjar
LONG PILA
S. Niah
JATAN
IGANG
LAMAUS
Batang Suai
TELABIT
GALASAH
SEBANAH
S. Similajau
Mile 34 M/B Repeater
S. Jelalong
LABANG
TUBAU
Kemena
Batang
PANDAN
S. Pandan
Bukit Nyabau TV, Microwave Station
BINTULU
SEBUAH
Bukit Jepak VHF Station
Microwave Link
VHF Multi-Channel
VHF Single Channel
UHF Radio Telephone
0
10
20
Statute Miles

TABLE 8.3 SETTLEMENT GROWTH AND TELEPHONE DEMAND

Settlement	Existing exchange capacity	1975			1980			1990*		
		Population	Total per 1 000	Total lines	Population	Total per 1 000	Total lines	Population	Total per 1 000	Total lines
Miri/Lutong	2 050	33 000	60	2 000	36 000	80	2 880	55 000	90	4 950
Bintulu (existing area)	300	8 500	45	380	10 000	60	600	16 000	90	1 440
Bintulu (Kidurong area)	None	Nil	-	Nil	4 000	60	240	22 000	90	1 980
Batu Niah	30	1 500	30	45	2 000	35	70	4 000	40	160
Bekenu	50	800	45	36	1 000	45	45	1 500	40	60
Long Lama	None	800	-	Nil	2 500	30	75	7 500	40	300
Beluru	None	700	-	Nil	1 000	20	20	1 500	20	30
Labang	None	600	-	Nil	800	-	Nil	1 000	20	20
Marudi	150	4 400	35	152	5 000	40	200	6 000	40	240
Sebauh	30	800	15	12	900	20	18	1 000	20	20
Niah	20	1 100	15	16	1 300	20	26	1 300	20	26
Kuala Baram	10	800	10	8	1 000	15	15	1 500	20	30
Sub Total				2 649			4 189			9 256
LAMBIR-SUBIS AREA:										
Bukit Peninjau	None	1 500	-	Nil	1 800	12	22	2 000	15	30
SOP Village	None	2 500	-	Nil	3 500	12	42	3 500	15	53
Mera-a	None	Nil	-	Nil	1 300	10	13	1 300	15	20
Sungai Tangit	None	1 000	-	Nil	1 400	-	14	1 400	15	21
Ladang Tiga	None	500	-	Nil	2 500	10	25	4 000	15	60
Subis I	None	500	-	Nil	2 500	10	25	2 500	15	38
Subis II	None	Nil	-	Nil	2 500	10	25	2 500	15	38
NIAH-SUAI RDA										
Igang	None	Nil	-	Nil	3 600	35	126	8 000	40	360
Totals				2 649			4 491			9 876 plus lines at other new settlements

Note * The 1990 figures are tentative and provisional.

CHAPTER 9

MANPOWER

9.1 EDUCATION FOR WORK

9.1.1 The Simple Society

In a primitive or simple society education is not institutionalised. Education, and living in the society are one and the same thing. Children and youths see for themselves how people behave and how all productive processes in the society are performed. They try to copy the adults, and are generally given tasks and responsibilities, which develop their understanding, proficiency and maturity. Apart from the traditional division of labour between men and women there is no or only little specialisation.

9.1.2 The Complex Society

A modern society can be characterised by its complexity which among other things includes an extensive division of labour, that is specialisation of work. The work processes are under constant and rapid change and development because of technological innovations, whereas in the simple society the same processes are repeated for generations or changed slowly and gradually.

9.1.3 Division of Labour and Observation

The division of labour in a complex society usually extends to the separate siting of work processes - e.g. offices, factories, building sites etc., and not in and around the house. The result is that the young people have little or no opportunity to learn through observation and imitation, neither can they become involved in all the work processes which would give them some indication of job possibilities and preference.

Therefore to an increasing extent society must take over a number of functions in relation to educating, guiding and training young people at all stages of their development from childhood to adult, working citizens. This becomes even more true when the aim of the society is to give all its members, irrespective of race, location and social status of parents, an equal start in life.

9.1.4 Cultural and Vocational Education

The education and training given to the young should prepare them both for their personal and social life in general, and

for their productive work. Because working processes and working relations are part of society's culture, there is little distinction between cultural and vocational education. This attitude seems to be increasingly accepted throughout the world, leading to educational systems which permit students to pursue various lines of education and to switch from one line to another with a minimum of loss and trouble. Formal education and at least a preparation for working life are united until the stage where more specialised education for work is necessary.

9.1.5 The INEM Example

An example of this approach is described in the World Bank's magazine (1972). It describes a World Bank financed education programme in Colombia, called INEM (Instituto Nacionales de Education Media), as follows:

> "Briefly, INEMs are six year secondary schools with a diversified curriculum, operating under a new educational concept. INEMs prepare students for employment or for further technical training at preuniversity and university levels. At the same time, they offer sufficient academic education to enable students to enter post-secondary institutions or universities.
>
> At each INEM, the first two years of the six year course are for general exploratory studies in prevocational subjects. At the end of the period, students, assisted by guidance counselors, choose more specialised courses to which they devote the next two years. In the last two years, the options become final. The student, again with assistance from guidance counselors, takes the subjects which will determine his future activities: humanities, science, metal mechanics, electricity, construction, industrial chemistry, farming and/or animal husbandry, secretarial, book keeping, social work, community development, or home economics. The INEMs' aim is to offer a combination of options consistent with the needs of manpower in the area where they are located."

9.1.6 The Malaysian Approach

As anywhere else in the world there is in Malaysia a lively discussion and activity in educational development. In Sarawak it has been stated recently that increasing emphasis should be placed on primary education in order to give all children equal opportunity of education. In addition the primary six selection examination will be abolished in 1974. It is realised that many youths born and brought up in longhouses and villages must face an adult life in towns with specialised work in offices and factories; or as modern cash

crop farmers. It is therefore necessary to prepare them for this in the primary school.

The secondary school system in Malaysia is described in the Official Yearbook (1972)

"Comprehensive Lower Secondary Education

At the end of primary school education when the pupils are at the age of 12 plus they are promoted automatically to follow Comprehensive Lower Secondary education for three years, either in Bahasa Malaysia or in English." "... at this stage the pupils must take one of the following subjects: Commercial Studies, Domestic Science, Agricultural Science and Industrial Arts as an addition to the academic subjects. At the end of the third year all pupils will either sit for the Lower Certificate of Education (LCE) or Sijil Rendah Pelajaran (SRP) Examination.

Upper Secondary

Pupils who pass their SRP/LCE examination are promoted to Form IV and to Form V the next year. They are divided into two groups namely academic or vocational stream. Those in the academic stream are taught subjects which qualify them to sit the Malaysian Certificate of Education or Sijil Pelajaran Malaysia examination at the end of Form V and those in the vocational stream are being prepared to sit Malaysia Vocational Certificate of Education examination.

Sixth Form

Education in Form VI is given to pupils who have achieved a good standard in the Sijil Pelajaran Malaysian examination or Malaysia Certificate of Education. Form VI is divided into three streams, namely Science, Art or Technical streams. Pupils learning at this stage will sit the Sijil Pelajaran Tinggi or Higher School Certificate at the end of their second year which is also an examination which qualify students for entrance into the University."

In preparing the student for his or her working life it seems to be a primary object of secondary education to give the youths a good picture of the variety of jobs available and to develop within each student a realistic sense of personal preference; moreover to explain the ways to achieve preferred jobs and to give some understanding of working life as such, especially the necessary discipline and the problems of personal communications. The more specialised education for work will often take place outside the secondary school system are described further in Supporting Report 6.

9.2 SOCIAL AND ECONOMIC ASPECTS OF EDUCATION

9.2.1 Benefits from Education

Expenditure on education can be considered a mix of consumption and investment; consumption when education adds to a person's general knowledge and understanding and to his cultural status; investment when it makes him a better producer, that is increasing his personal productivity. It is difficult in practice to distinguish between the two, and it is extremely difficult to estimate the benefits accruing from education.

Economists' have attempted to analyse the Gross National Product and to determine the relative importance of the various inputs: labour, capital and others, the latter also being termed the residual factor. This residual factor includes organisation, management, technological innovations and the like - elements which all more or less can be traced back to education. The results of these investigations, although uncertain, are interesting:

- Solow (1957) found "that only 10 per cent of the growth of American output between 1900 and 1960 could be explained by the increase in inputs of physical and human resources, leaving 90 per cent to be explained by the residual factor."
- Aukrust (1959) found "that about two-thirds of the growth in Norway between 1900 and 1955 could be attributed to the residual factor."

9.2.2 Setting Education Targets

There is no doubt that the importance of education has been realised not only by Governments all over the world, but also by the people. The political pressure for improved education is evident in many countries, developing as well as developed. It may lead to an over emphasis on education. Education must compete with other desirable activities, such as health and transport, for a share of scarce funds. This competition should as far as possible be based on national considerations, supported by economic calculations.

The distribution of funds between education and other purposes must be based on pragmatic considerations, as there apparently could not be pointed out any general rules. Higgins (1968) (op. cit.) refers the following:

"In the course of series of UNESCO conferences a figure of four to five per cent of GNP has somehow come to be accepted as an appropriate target for expenditure on education". According to figures available to the consultants it seems as if Malaysia is slightly above this level. It also appears that Malaysia is developing its educated resources rapidly as shown by the following:

Sarawak, Annual Growth Rates Based on 1961/1970 Figures

	Annual growth rate Per cent
Number of pupils in Primary and Secondary schools	5.1
Number of schools	3.2
Number of teachers	4.9
Number of trainee teachers	8.2
Enrolment in trade schools (1964-1970)	
a) full time	17
b) part time	10

Peninsular Malaysia, Annual Growth Rates Based on 1963/1970 Figures

Number of students in:	Annual growth rate Per cent
vocational schools	9.2
technical colleges	8.4
colleges of agriculture	34
universities	25

There does not seem to be any general key to the distribution of funds between education and other activities, but neither is there any key to the relative importance of general education; primary and secondary schooling, and special education for work. It is important to match the latter as closely as possible to the demand for specialised labour, including technical and professional trades. For economic as well as social and human reasons it seems inappropriate to develop skills which could not be utilised. A high degree of flexibility in education and training should therefore be maintained.

9.3 SPECIAL EDUCATION FOR WORK

9.3.1 General

Special education for work includes all types of training and education; from short term courses to several years of university studies. There is no need here to embark on a discussion on higher education, such as universities, technical colleges and teachers' training institutions. Although of utmost importance to regional development, these matters will be treated and decided at national level. From a regional development point of view it can be of importance that advanced education and training institutions are located in the area in due time. Two Vocational Schools are recommended for the Study Area during the Action Programme period 1975 - 80; one in Miri to be in operation in 1976 and one in Bintulu in 1980. Details of the proposed Miri Vocational School are given in Table 9.1. These schools could give Miri and Bintulu a bias and initiate a desirable interaction between institute and local enterprises, whether private or public.

9.3.2 Manpower Demand for Specific Projects

The need for specially trained manpower and staff for specific projects prepared and analysed by this Study will be indicated in Supporting Report 10, and in the Action Programme in the Main Report. This chapter therefore contains a general discussion of manpower training, relevant to the Study Area.

9.3.3 Types of Manpower Training

Development of productive skill could be undertaken in various ways:

- all necessary skills, know-how and proficiency could be obtained at work; new workers being instructed by their foremen and fellowworkers; or
- before commencing a job all necessary skill could be acquired by institutionalized training, so that the worker would be ready for his job when instruction was finished; or
- a combination of the two approaches.

The systematic organisation of vocational training is the responsibility of the Federal Ministry of Labour and Manpower, under whose responsibility is the National Industrial Training and Trade Certification Board (NITTCB). "The objective of the Board is to develop skilled manpower resources in order to fulfil the New Economic Policy objectives, particularly in respect of rectifying the nation's economic imbalance, and its functions are:-

a) to initiate and establish industrial training programmes which include preparatory trade training, in-plant and accelerated training, upgrading training, instructor and supervisory training;

b) to establish national training standards and develop training syllabi; and

c) to organise and implement a national programme of trade skill testing and award certificates to those who qualify".

The training programme consists of:

The National Apprenticeship Scheme, which aims at producing fully qualified tradesmen at the end of a four year training period. The main trades taught are mechanical, electrical building and printing. The training is a combined on-the-job and institution approach. Each apprentice must have a contract with an employer, who must provide adequate on the job training. The apprentice will attend an Industrial Training Institute for a 22 week period during the first year and 11 weeks during each of the following three years.

In Plant and Specialised Training Services offer training in the factory for special purposes. The Training Service can

supply training programmes, instructors and training of instructors. The service also includes up-grading courses, so that workers can gradually improve their skills and abilities.

From this it is apparent that Malaysia already has a framework for developing an up-to-date industrial labour force. The number of Industrial Training Institutes will be expanded. One is under consideration for Sarawak, depending on the results of the Manpower Survey which was commenced in August 1973. At the same time it is the intention to establish a Vocational School in Miri with a capacity of 300 students, to be in operation in 1976.

Modular Training Courses will be expanded. Through a number of short term courses from one to a few weeks, this type of training builds up increasing skills. The worker - and may be his employer - can either aim at obtaining a narrow and specialised skill, corresponding to his actual work situation; or he can aim at acquiring a broader skill so that he can master a wider range of operations. There seems to be good reasons for Sarawak to pay special attention to these possibilities, which are flexible and inexpensive. In a Brazilian survey from the city of Sao Paulo, Higgins (1968): "A combination of on-the-job training and vocational schools, ..., sufficed to meet all skill requirements within three months to a year, even when the intake consisted in large measure of illiterate peasants".

There is reason to adopt an optimistic attitude towards the development of a satisfactory and capable labour force over the years.

In the short run there may be difficulties in attracting people to the industrial labour force. The reasons may be shyness and lack of knowledge; uncertainty with respect to living and working conditions or discontent with these conditions.

The remedies to overcome these difficulties could be:

- better information in schools, through radio and television;
- giving higher prestige to manual and technical labour, through public speeches, awarding of prizes for good work, acknowledgement of Trade Unions as important social factors;
- a change in the wage/salary structure (income distribution) to the benefit of trained farmers, workers etc.
- a well developed labour recruitment system.

As long as white-collar jobs are better paid, more convenient and higher esteemed, it will be difficult to convince a considerable part of the intelligent youth to go for a career as skilled or trained labour.

It appears from this that the authorities in Sarawak should follow closely the development of training facilities and incentives offered by the Federal manpower authorities in order that a fair share may be applied to Sarawak. In the planning stage of new enterprises a careful examination should be made of how the maximum local people could be employed. If training is necessary, schemes for such training should be worked out by the manpower training authorities in Kuching and in Kuala Lumpur.

9.4 RECOMMENDATIONS

Based on the foregoing the following recommendations are put forward:

a) Primary and Secondary Education should give the students a fair idea of the working life in a modern society, including job varieties, training possibilities and working conditions. In addition to or instead of books, magazines could be used, describing relevant subjects in text, pictures and other illustrations. The magazines should be the private property of the students. Secondary schools should continue giving a pre-vocational education in optimal disciplines.

b) Industrial Training Centres and Vocational Schools should be established after a very thorough study of the kind of skills needed in Sarawak. This approach has already been provided for through the newly commenced Manpower Survey. Particular attention should be given to the endeavours of the Federal Training Service to initiate a programme for studying the specific actual skills requirements of Malaysian industry, and to investigate the optimum length of training for various trade skills to ensure that training time is reduced to the absolute minimum compatible with the requirements of the various industries.

c) Modular Courses should be introduced as soon as possible using existing facilities where possible, such as schools, public and private workshops, depots and building sites for instruction.

d) New investors whether domestic or foreign should be induced to cooperate in training programmes.

e) Wood and timber processing Courses should be established in Bintulu parallel to the development of new timber complexes.

f) Recognition should be given to people qualifying in carrying out skilled work in agriculture, industry and commerce. This could be done by improving work conditions whenever possible, by public acknowledgements and through further education.

g) Adult Vocational Training should be available for self-educated workers who wish to further qualify themselves. Correspondence courses should be developed in all suitable fields.

Generally it is recommended that the Sarawak authorities should:

- prepare for the necessary sites in and around towns for training facilities whether in buildings or in the open air
- keep a close watch on all major projects coming up with a view to organising training in due time and ahead of commencement of operations
- cooperate closely with the Training Service of the Federal manpower authorities to ensure their assistance and co-operation.

9.5 LABOUR RECRUITMENT

This is a vital aspect which must be an integral part of the whole organisation for development. In recruiting people for new jobs, whether in agriculture, forestry, industries or services there are two different aims to be pursued:-

- to select persons who are, or can be made suitable for the available jobs through appropriate training;
- to give people, who are facing special difficulties in their present location or occupation a chance to improve their economic and social situation.

The proper relationship of people to jobs can be obtained by bringing jobs to areas where unemployed and under-employed people live, or by bringing people to the jobs. Both approaches have been included in the development recommendations, but it is inevitable that the greater part of the Plan will require migration of people to jobs. In order to organise this migration and to follow the human, social and production problems arising from this transition, it is recommended that the State Manpower Section, already established in Kuching as a branch of the Federal Ministry of Labour and Manpower, should be strengthened to take up the following tasks:-

a) to establish a State-wide network of labour registry offices where potential workers could be matched with available jobs. Final screening and selection of workers would remain with the receiving employer or agency. For example, in the case of potential agricultural migrants to SLDB initiated schemes, it would be the Settler Development Division of SLDB which would undertaken the screening.

b) to conduct research into all social and psychological problems arising from people's migration and settling under new and often unknown conditions. This kind of research is necessary to obtain a more firm basis for decisions on settler selection and the conditions offered to migrant settlers. The knowledge is also necessary to ensure the welfare of the people and a smooth implementation and operation of new development schemes.

Such research, it is proposed, should be carried out by a special Sociology Research Section established within the

State Manpower Office. The Section need not be large but should consist of one or two sociologically trained staff who would be available to undertake investigations wherever needed. This aspect in discussed in greater detail in Supporting Report 4.

TABLE 9.1 MIRI VOCATIONAL SCHOOL PHYSICAL REQUIREMENTS AND COSTS (THOUSAND DOLLARS)

Accommodation Unit	No. of Units	Net Area in square feet		Building Cost		Furniture Cost	Equipment Cost
		Per Unit	Total	Per square foot	Total		
Section I - Teaching and Communal							
Classroom	6	750	4 500				-
Laboratory	1	1 250	1 250				18
Commerce Room I	1	600	600				14
Drafting Room II	1	1 250	1 250				6
Mechanical Shop	1	3 800	3 800				270
Electrical Shop	1	3 200	3 200				120
Auto Mechanical Shop	1	5 200	5 200				102
Welding/Sheet Metal	1	3 200	3 200				102
Library	1	1 750	1 750				23
Administration Area I	-	-	3 500				12
Multipurpose Hall/Kitchen Area I	-	-	5 000				17
Ablution Area	-	-	450				-
Roof Covered Area I	-	-	3 500				
Total net Area			37 200				
Walling/Circulation (30 per cent of 37 200)			11 200				
Total gross Area and Cost			48 400	10.5	508		681
Area per place			161				
Section II - Boarding Facilities							
180 Boarders at 70 square feet			12 600				
Walling/Circulation (30 per cent of 12 600)			3 800				
Total gross Area and Cost			16 400	13	213	32	-
Area per Boarder			91				
Section III - Staff Houses							
Principal House	1	1 900	1 900				
Labour House	1	1 800	1 800				
Total gross Area and Cost			3 700	14	52	-	-
Grand Total					773	73	681

Miri Vocational School

The proposed vocational school in Miri would be based on the following:

1. Enrolment

Total enrolment will be 300 students(180 boarders) distributed as follows:

60 Mechanical Engineering Craft Practice
60 Electrical Installation Technology
60 Automotive Engineering Craft Practice
60 Welding/Sheet Metal
60 Commerce (shorthand/typist, copy-typist)

2. Annual Output

Output starting from 1978 will be about 140 annually, consisting of:

20 Mechanical
20 Electrical
20 Automotive
20 Welding/Sheet Metal
60 Commerce

3. Entry Qualification and Final Examination

The entry qualification for the trade and copy-typist courses is the Sarawak Junior Certificate, and for the Shorthand-typist course the Overseas School Certificate/M.C.E.

Trade students are prepared for the City and Guilds of London Institute Examination, and Commerce students (shorthand and copy-typist) for the London Chamber of Commerce Examinations.

4. Length of Course

Trade courses = 3 years

Commerce = 1 year

5. Number of teachers/instructors: 25

APPENDIX I

APPENDIX I

POPULATION AND SETTLEMENTS IN MALAYSIA

I.1 POPULATION

The total population of Malaysia, according to the 1970 census, was 10.45 mn. Of this figure 8.82 mn were in Peninsular Malaysia, 653 000 in Sabah and 976 000 in Sarawak. The majority of the population is rural. The term rural has different connotations for the different states within Malaysia. Similarly the term urban also has different meanings for different parts of the Federation. In Peninsular Malaysia, the term urban has been used to describe all gazetted administrative areas with a population of 10 000 or over, and all other areas have been classified as rural. In Sabah and Sarawak, however, owing to the scarcity of towns with a population threshold of 10 000, it would be unrealistic to apply the threshold from Peninsular Malaysia, and instead a rather arbitrary set of factors, namely population size and function have been applied to identify urban, and semi-urban areas from purely rural areas.

In Malaysia as a whole the urban and rural population distribution shows not only differences in terms of geographical distribution but also of ethnic groups. In Peninsular Malaysia the large cities and dense population are on the West Coast; in the Borneo States the coastal towns are usually the largest urban centres, while the interior areas are less densely inhabited. In terms of urban community distribution in Sarawak and Sabah 60 per cent is Chinese, 25 per cent is Malays and 10 per cent is Indian. Urbanisation of other indigeneous groups than the Malays is insignificant (see Table I.1).

TABLE I.1 RURAL/URBAN POPULATION DISTRIBUTION 1970 IN SABAH AND SARAWAK

Community Group	Urban Per cent	Rural Per cent
Malays	15	85
Chinese	46	54
Indian	35	65
Dayak	2	98
Kadazan	3	97
Other Natives	5	95

Malaysia as a whole is a multi-racial society; the predominant ethnic groups are the Malays and the Chinese (see Table I.2) while the minority groups like the Dayaks and other natives of Sarawak and Sabah consist of a multitude of smaller tribal groups.

TABLE I.2 POPULATION COMPOSITION OF MALAYSIA 1970

Race	Number	Percentage
Malays	4 886 912	46.8
Chinese	3 555 879	34.1
Indians	932 629	8.9
Dayaks	386 260	3.7
Other Natives	337 395	3.2
Kadazans	184 512	1.8
Others	155 943	1.5
	10 439 530	100.0

The population of the State of Sarawak is predominantly Dayak. However, they are not of one homogeneous group, being made up of two major groups known as the Land Dayaks and the Ibans. Table I.3 gives the composition of the individual communities in Sarawak.

TABLE I.3 COMPOSITION OF SARAWAK POPULATION 1970

Community Group	Population	
	Number	Percentage
Dayaks	386 260	39.6
Chinese	294 020	30.1
Malays	182 709	18.7
Other Natives	103 194	10.6
Others	9 735	1.0
	975 918	100.0

The existence of a multiplicity of ethnic groups with different levels of economic, social and political status causes definite problems to the development of the Nation, which is reflected in regional imbalances in terms of occupations and income. It is the stated policy of the Malaysian Government to restructure the society to even out such imbalances and to achieve National Unity.

Improvements in medical and health services have increased at a rapid pace during the last decade, resulting in a significant decline in death and infant mortality rates. In Peninsular Malaysia the infant mortality rate dropped from 68.9 per thousand live births in 1960 to 42.2 per thousand in 1968, while the corresponding decline in Sarawak was from 55 in 1960 to 32 in 1971. The crude death rate for Peninsular Malaysia was 7.6 per thousand population in 1968 as against the corresponding rate of 9.5 in 1960; while that of Sarawak has 4.9 per thousand in 1971 as against a rate of 5.8 in 1960. Sarawak's birth rate per thousand population has increased from 27.7 in 1960 to 28.9 in 1971. These factors have important implications, especially with regard to the decline in the death rate which

has not been matched by a comparable decline in the birth rate. The National Family Planning Programme envisages that by 1985 the annual rate of population growth will be reduced from the current rate of about three per cent to two per cent. At an annual growth rate of 2.8 per cent, Sarawak will reach a population of 1.7 mn in 1990.

I2 OCCUPATION STRUCTURE

The employment composition in Malaysia is predominantly one of primary activity which accounts for not less than half of the total employment. Peninsular Malaysia has about 55 per cent of her total employment in primary industries (Table I.4) as compared to about 75 per cent in Sarawak.

TABLE I.4 EMPLOYMENT BY SECTOR, PENINSULAR MALAYSIA 1970

Sector	Share of Total Per cent
Agriculture	49.5
Mining	2.2
Manufacturing	9.2
Construction	3.5
Electricity, water and sanitary services	0.6
Transport, storage and communications	3.7
Commerce	11.6
Services	19.7
	100.0

In Sarawak the percentage of workers employed in primary production has shown a decline since 1960 when about 82 per cent of the employed labour force was engaged in primary activities like agriculture, forestry, fishing, mining and quarrying. Secondary industries account for 28 per cent of total employment in Peninsular Malaysia as compared to about 15 per cent in Sarawak. Service employment accounted for 17 per cent of total employed in Peninsular Malaysia and 10 per cent in Sarawak.

Normally rural and semi-urban settlements have a high proportion of primary activities and a low level of secondary activities like manufacturing, commerce, transport, construction, utilities and services. Table I.6 illustrates this point.

No comparable figures are available for Sarawak as a whole but within the Study Area a rather similar employment structure prevails, which clearly indicate the urbanisation is a necessary although not sufficient condition for changes in occupation structure to occur.

TABLE I.5 EMPLOYMENT COMPOSITION FOR DIFFERENT SIZED SETTLEMENTS IN PENINSULAR MALAYSIA

Employment sector	Percentage of employed			
	Rural	Urban	Metropolitan	Total
Primary	72.8	25.2	5.7	54.6
Non-Primary	27.3	74.8	94.3	45.4
	100	100	100	100

Note: Rural - refers to settlements of less than 5 000 population.
Urban - refers to settlements of from 5 000 to 75 000 population.
Metropolitan - refers to settlements of more than 75 000 population.

The annual rate of population growth in Malaysia and Sarawak is estimated to be about 2.8 per cent and the rate of increase of the labour force at 3.2 per cent (or 3.1 per cent for Sarawak). The unemployment rate was estimated at around eight per cent of the labour force in Malaysia in 1970, a figure not very high among developing countries, though the overall employment target during the Second Malaysia Plan period is to hold the unemployment rate at no more than 7.3 per cent of the total Malaysian labour force. A sample survey of Sarawak's seven major towns over a period of one year from December 1967 - November 1980 shows that in the age group 15 to 60 years nine per cent were unemployed, though only five per cent were actively unemployed, the balance, four per cent, not seeking employment.

Generally in Malaysia, even though the proportion of males and females in the total population is roughly equal, a point worthy of note is that female employment in urban activities is usually not more than one in five of the employed labour force and in smaller towns the ratio can be 1 in 15 as the sample survey on the labour force in Sarawak's seven major towns has revealed.

Female participation in the employed labour force is comparatively not so significant. In Sarawak it is also noteworthy that between 50 to 60 per cent of those not seeking employment are females who also constitute about 75 per cent of those seeking employment but are not employed. It is presumed that those unemployed, both males and females, are in the younger working age group, a possible indication also of migration from rural to urban areas of able bodied young males and females. This therefore suggests that female employment in Sarawak in particular, and Malaysia in general, has an important effect on the employment structure of towns of various sizes and that greater employment opportunities for females exist when the towns are larger.

Malaysian experience in general and Sarawak's in particular confirms that rural and semi-urban settlements normally result in a high proportion of primary occupations and a low level of employment in secondary industries and services. As towns increase in size there will be a decrease in primary employment and a gradual increase in non-primary occupations; such a change is not only gradual but could take a long time because migrants from rural areas to towns find it difficult to divorce themselves from primary occupation such as market gardening which is a form of guarantee for their subsistence.

L3 SETTLEMENT PATTERN

From a nationwide point of view "Malaysia manages to achieve a fairly high level of per capita income with less urbanisation than other countries seem to need", and "the pace of urbanisation is somewhat slow in relation to the overall rate of growth of the economy" (Foundation of Canada Engineering Corporation et alia 1972).

The Pahang Tenggara Report findings conclude that in the urban hierarchy in Peninsular Malaysia all the major cities, with the exception of Johore Bahru which is more closely linked to Singapore, might be regarded as satellites of Kuala Lumpur, the national capital. The geographical distribution of cities and city sizes clearly reflects the regional imbalances within Malaysia and within individual states in the Federation. Peninsular Malaysia, which is economically more advanced than either Sabah or Sarawak, has 22 out of a total of 28 cities with populations exceeding 18 000. Sabah and Sarawak each have three cities of such size, but the top ranking cities in the Malaysian urban hierarchy are all located in Peninsular Malaysia, for example Kuala Lumpur (708 000), Georgetown (332 000) and Ipoh (275 000). In Sarawak greater Kuching, which has an estimated urban population of 110 000, ranks fifth in the Malaysian urban hierarchy as compared to Sabah's largest town, Sandakan, which ranks fifteenth.

In Sarawak the regional structure has been characterised by the rapid growth of the state capital, Kuching, and the Divisional Centres of Sibu and Miri. These first three ranking cities at Sarawak State level have been dominating the economy for a long time and will continue to do so at the expense of other centres if new regional growth centres are not created.

In 1970 Sarawak had 20 towns and townships with population sizes ranging from 600 to 110 000. Although the rate of urbanisation in Sarawak is not easily discernible, existing statistical data show that some towns, especially those below 5 000 population, do show remarkable changes, with population increases of between 100 per cent and 200 per cent between 1960 and 1970. Out of those towns and townships identified eight are showing relative growth. Apart from Limbang, Miri-

Lutong, Sibu and Kuching, these are below 5 000 people; each thus indicating that urbanisation in Sarawak, like in many developing countries in Latin America, is possibly a stage by stage process whereby rural migrants go from farms to small towns, and from there, after a stopover for a certain number of years, to the bigger towns. This process has important implications for planning, especially of the service centre network, and if the rural - urban migration is to be arrested, the smaller towns should be developed to the extent that the facilities that rural migrants are seeking can be made available to them in conveniently located towns.

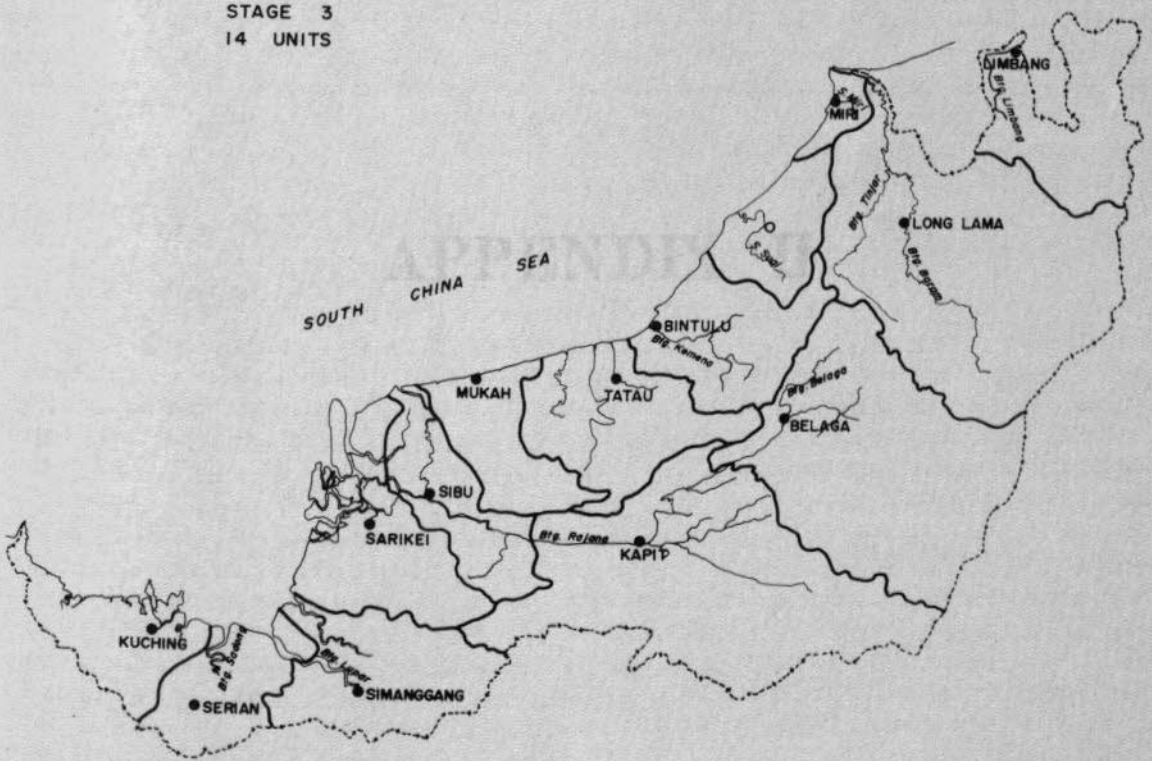
Although some small towns have shown a phenomenal increase in population, those with populations below 5 000 taken as a whole have shown a relative decline in the share of the total urban population of Sarawak i.e. a decline from 16.8 per cent in 1960 to 12.4 per cent in 1970. Towns of between 5 000 and 10 000 population have increased their share from 7.5 per cent to 10.9 per cent over the same period; for the three largest urban centres their total relative share has increased from 76 per cent to 77 per cent over the 10 year period. A rather similar situation also prevails in Sabah where the corresponding figures for the growth of towns of various sizes are comparable with those of Sarawak although the latter has larger towns and a slightly larger percentage of its population living in towns.

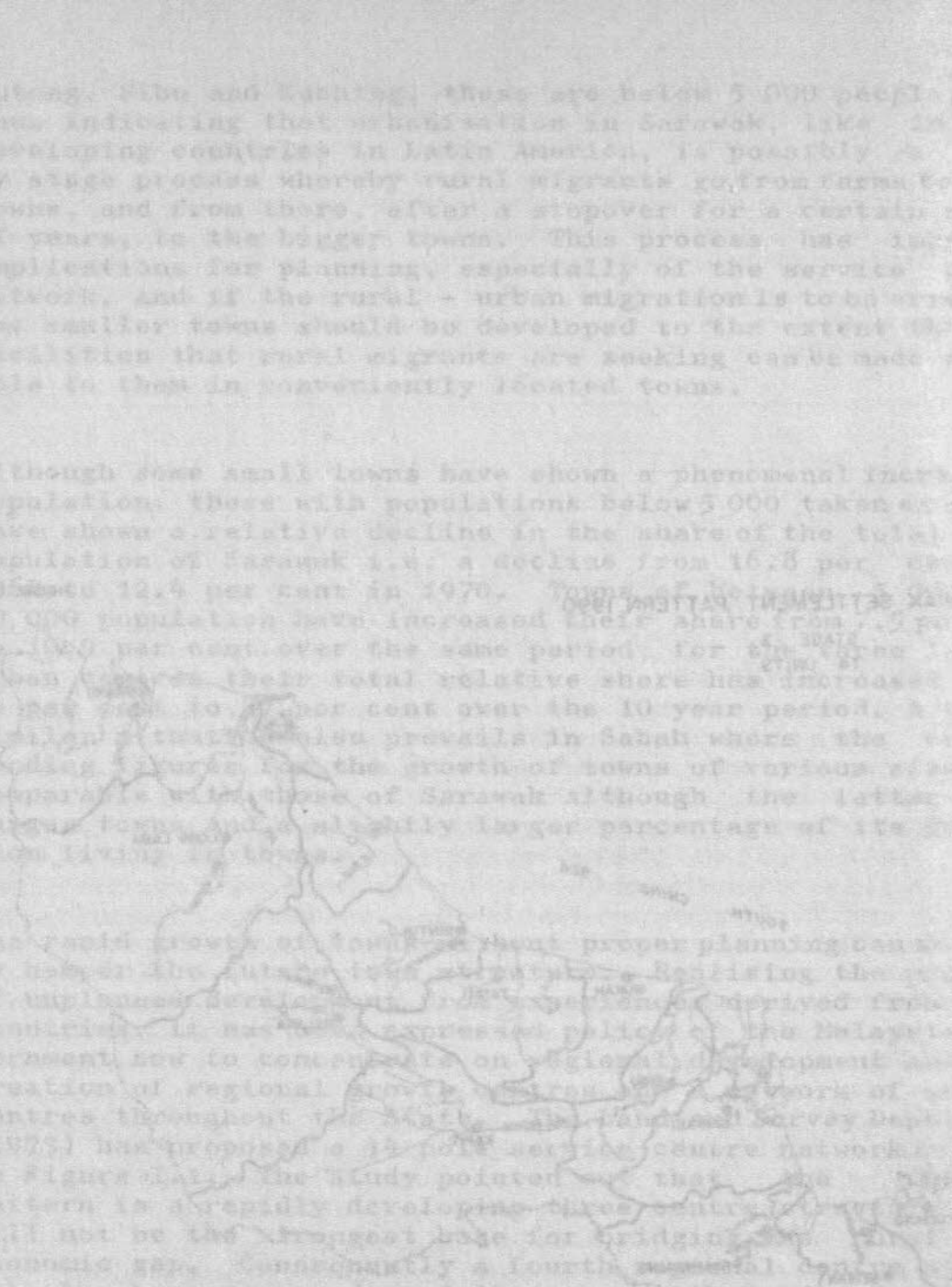
The rapid growth of towns without proper planning can seriously hamper the future town structure. Realising the problems of unplanned development from experiences derived from other countries, it has been expressed policy of the Malaysian Government now to concentrate on regional development and the creation of regional growth centres and a network of service centres throughout the State. The Land and Survey Department (1973) has proposed a 14 pole service centre network as shown in Figure I.1. The study pointed out that the existing pattern is a rapidly developing three centre structure which will not be the strongest base for bridging the rural-urban economic gap. Consequently a fourth regional centre at Bintulu has been proposed, and it appears likely that Government is making an all out effort to make that proposal a reality. In the Study Area the Consultants, in their thinking of urbanising rural areas, have also arrived at the conclusion that a hierarchy of service centres is essential not only for keeping a check on rural-urban migration, but also on the best use of land, location of public services and other infrastructure.

SARAWAK SETTLEMENT PATTERN 1990

STAGE 3
14 UNITS

FIGURE I.1





APPENDIX II

APPENDIX II

SEWERAGE SCHEME FOR BINTULU

II.1 INTRODUCTION

Proposals have been made for extensive urban development of the existing town at Bintulu, extending north to Tanjong Kidurong. It is proposed that what will, in effect, be an entirely new town should, from the outset, be provided with an efficient and hygienic means of disposing of its sewage and other effluents. This Appendix has been prepared to indicate a means by which the town can be provided with main sewerage.

The development area, shown in Figure II.1, is a stretch of land up to 1.5 miles in width extending along nine miles of coast and four miles of estuary. There are three flat areas of ground at approximately 20 feet above mean sea level, divided by two ridges, one extending from Bukit Nyabau to Tanjong Batu and rising to a height of about 300 feet, and the other at Tanjong Kidurong rising to about 250 feet. These ridges form natural boundaries for three sewerage zones into which the development area would be divided.

II.2 SEWERAGE ZONES

II.2.1 Southern Zone

The southern zone would extend from Sungai Sibiu to the Tanjong Batu ridge and include the existing airport, bazaar and development along Jalan Kidurong. In the town plan, proposals have been made for domestic, industrial, commercial and institutional development within the zone, which will provide for a maximum population of up to 26 500, with maximum 180 acres laid out for industrial development and 390 acres for commercial and institutional development. Populations used were calculated as the maximum which should be accommodated on the areas (zones) which would be available for development by the given date, and they exceed quite considerably the target populations for those dates which have derived subsequently. The respective population figures are as follows:

	Target population	Maximum population
1975	8 500	29 100
1980	14 000	58 600
1990	38 000	77 000

Except for the northern part which rises towards the ridge, the zone is generally flat, and the topography does not in any way dictate the required arrangements for the sewerage layout.

II.2.2 Central Zone

There is no existing development in the central sewerage zone, which would extend from the Tanjong Batu ridge to the high

ground at Tanjong Kidurong. Proposals have been made for domestic, industrial, commercial and institutional development with a deep water port to the north. The indicated areas will provide for a population of maximum 50 600, with 850 acres laid out for industrial and port development and 620 acres for commercial and institutional development. The zone is at present drained by three natural water courses, the Sungai Terus, Sungai Sebatang and Sungai Plan Besar. Except for an area of flat swampy ground between the Sebatang and Plan Besar the ground slopes are generally towards the coast, and sewers will be laid to take advantage of these natural gradients. This zone contains glass sand deposits, and detailed planning of sewerage should be coordinated with planning of the glass sand exploitation.

II.2.3 Northern Zone

The northern zone, to the north of Tanjong Kidurong, would consist of the flat coastal strip 1.25 miles long and 0.5 mile wide behind which the ground rises to a height of 250 feet. There is at present no development in the zone, the whole of which is designated as the site for a LNG plant; this will cover an area of about 400 acres.

II.3 POPULATION AND SEWERAGE FLOWS

There are about 7 000 people at present living within the development area, mostly around the bazaar and the airport in the southern zone. Future increases in population will be due principally to migration resulting from commercial and industrial development. In the town plan (see Chapter 7) provision has been made for a maximum population of 77 000. In addition to this there will be a total of 1 480 acres of industrial and port development (excluding timber mills) and 1 000 acres of commercial and institutional development.

In view of the flat nature of the terrain and the amount of pumping that will be necessary, it would be uneconomical to provide anything but an entirely separate sewerage system; this means excluding storm water from the system as far as possible and providing separate arrangements for surface water drainage. Nevertheless, a small amount of storm water will find its way into the sewerage system during and after periods of rainfall. The average daily flows of sewage would normally be calculated from water consumption projections, and it has been assumed for the purposes of these preliminary estimates that the average daily sewage flows will be as follows: 50 gallons per head from domestic and commercial premises and 1 500 gallons per acre from commercial, institutional, industrial and port development areas. These figures are based on experience of similar developments elsewhere.

TABLE II.1 PROJECTED SEWAGE FLOWS
AVERAGE DRY WEATHER FLOW

Zone	Sub-zone	1975				1980				1990			
		Domestic MGD	Commercial MGD	Industrial MGD	Total MGD	Domestic MGD	Commercial MGD	Industrial MGD	Total MGD	Domestic MGD	Commercial MGD	Industrial MGD	Total MGD
Southern	S1	0.135	-	0.068	0.253	0.185	-	0.135	0.320	0.185	-	0.270	0.455
	S2	0.500	0.270	-	0.770	0.865	0.285	-	1.150	1.050	0.315	-	1.365
	S3	-	0.150	-	0.150	-	0.255	-	0.255	0.090	0.270	-	0.360
Sub Total		0.685	0.420	0.068	1.173	1.050	0.540	0.135	1.725	1.325	0.585	0.270	2.180
Central	C1	-	-	-	-	-	-.195	-	0.195	0.650	0.390	-	1.040
	C2	0.350	0.225	-	0.575	1.265	0.450	-	1.715	1.265	0.495	-	1.760
	C3	0.420	0.015	0.473	0.908	0.615	0.030	0.510	1.155	0.615	0.045	0.825	1.485
	C4	-	-	0.240	0.240	-	-	0.450	0.450	-	-	0.450	0.450
Sub Total		0.770	0.240	0.713	1.723	1.880	0.675	0.960	3.515	2.530	0.930	1.275	4.735
Northern	N1	-	-	n.a	n.a	-	-	n.a	n.a	-	-	n.a	n.a
Total		1.455	0.660	0.731	2.896	2.930	1.215	1.095	5.240	3.855	1.515	1.545	6.915

Note n.a - Not available

When developed to a population of 77 000 it is estimated that there will be an average flow of 2.2 mgd in the southern zone and 4.7 mgd in the central zone. At present no information is available of the quantity of sewage that will be generated in the northern zone. The total average flow for the development area excluding the LNG plant will be 6.9 mgd, equal to 90 gallons per head.

There will be variations in the rates of flow in the sewerage system throughout the day and even in a separate system these variations will be accentuated by storm water unavoidably entering the sewers. In general the number of times that the peak flow in the sewers exceeds the average dry weather flow (known as peak flow factor) will be related to the size of population served; fluctuation will be less for large populations than for small. For the purposes of this preliminary study it is proposed that the principal sewers and pumping stations should be designed for flows equal to four times the average dry weather flow, and minor sewers for six times average dry weather flow. Peak flow factors of this magnitude have, in practice been found to give satisfactory operational results when used to design sewerage systems serving populations of similar size.

The average dry weather flows for the populations and areas are shown in Table II.1, and the corresponding peak flows at the pumping stations are shown in Table II.2.

TABLE II.2 PUMPING STATION PEAK FLOWS

Pumping Station	Discharge Point	Peak Flows		
		1975 mgd	1980 mgd	1990 mgd
1S	Sub-zone S2	1.012	1.280	1.820
2S	Sibiu sewage treatment works	4.692	6.900	8.720
3S	Sub-zone S2	0.600	1.020	1.440
1C	Sub-zone C2	-	0.780	4.160
2C	Sub-zone C3	2.300	7.640	11.200
3C	Sebatang sewage treatment works	6.892	14.060	18.940
4C	Sub-zone C3	0.960	1.800	1.800

II.4 SEWAGE TREATMENT AND DISPOSAL

II.4.1 General

The degree of sewage treatment required depends on the effect the effluent will have on the receiving waters and the uses made of them. At Bintulu, the effluent would be disposed of to the sea, either directly by submarine outfall or indirectly into a river estuary.

The alternative methods of sewage disposal in this situation are as follows:

a) primary and secondary treatment to reduce the pollution

load(measured as biochemical oxygen demand)by 95 per cent and the suspended solids by 90 per cent, and to destroy between 80 per cent and 95 per cent of the pathogenic organisms; effluent treated to this degree would be suitable for discharge to an estuary or to the sea at low water level;

b) primary treatment only to reduce the pollution load by (say) 50 per cent, and the suspended solids by (say) 80 per cent, followed by discharge to shallow water through a short submarine outfall; or

c) disintegration and screening to remove gross solids followed by discharge by long submarine outfalls; in this case discharge should be made at a depth of not less than six fathoms (36 feet).

Primary and secondary treatment could be given by:

a) conventional treatment works using either biological filters or an activated sludge process;

b) stabilisation pond systems; or

c) mechanically aerated stabilisation pond systems.

The use of conventional sewage treatment at Bintulu is not recommended in view of the higher cost, lack of local operational experience and difficulties in disposing of sludge. Stabilisation ponds provide a more suitable method of treatment as they require less operational skill, and reduce the problems of handling sludge which digests in the ponds and can be removed at about two-yearly intervals. Ponds require large areas of flat ground and if possible should be located adjacent to a water course with sufficient natural flow to dilute the stabilisation pond effluent; a total area of about 44 acres would be required to treat the total flow anticipated in 1990. In the present paper proposals are based upon treatment in stabilisation ponds, for reasons which are given later in this section.

The total length of the development area is some 13 miles, and since it is proposed that initially the development should take place at the extremities of the area, around the bazaar in the south, and near the port area in the north, it is clearly advantageous to provide separate sewage disposal facilities to serve the two parts. They correspond conveniently to the Southern and Central zones described above.

II4.2 Southern Zone

There is a suitable site for a stabilisation pond on land not scheduled for development adjacent to Sungai Sibiu (shown on Figure II.1). The location is more than half a mile from any proposed development and treatment could be provided to a suitable standard; an area of about 14 acres would be required.

II.4.3 Central Zone

The only suitable areas of flat ground on which a system of stabilisation ponds could be constructed in the central zone have been shown in town plan as scheduled for industrial development. It may therefore be necessary to redesignate part of the industrial area for use as a sewage treatment works site. If no land can be made available there for a sewage treatment works, the alternatives would be either to transfer the flow from the central zone for treatment with the flow from the southern zone at a combined works at Sungai Sibiu, or to discharge the sewage, after disintegration and screening, to deep water through a submarine outfall off Tanjong Kidurong. Neither of these alternativesis attractive. To transfer the flow to the southern zone, a distance of up to eight miles, would be uneconomic, and it would be impossible to prevent the sewage from becoming septic. At present there is no suitable site at Tanjong Kidurong from which an outfall could be constructed.

The most satisfactory solution is considered to be to treat the flow from the central zone at stabilisation ponds adjacent to Sungai Sebatang as shown in Figure II.1. This area of land required to treat the 1990 flow would be about 30 acres. This could be reduced to 18 acres by using mechanically aerated ponds but would involve higher operating costs. Comparison of these two alternative methods of treatment should be carried out at the design stage. When locating a suitable site in detail, consideration must be given to the value of its glass sand deposits, and the possibility of quarrying and stock-piling glass sand as part of the process of pond excavation.

Should future development be such as to produce a shortage of flat industrial land, then the possibility of constructing a submarine outfall at Tanjong Kidurong and disposing of the sewage flow to deep water could be further investigated with a view to dispensing with the stabilisation pond site at a later date.

II.4.4 Northern Zone

No provision has been made in this preliminary study for the disposal of sewage from the LNG plant in the northern zone as the quantities of sewage involved are not known. Small quantities of domestic sewage could be treated by means of septic tanks and/or sea outfall; large quantities of industrial effluent would require special consideration. If at a future stage a submarine outfall were to be constructed at Tanjong Kidurong then the flow from the LNG plant could be pumped through a pipeline laid along the coast to a common headworks.

II.4.5 Summary of Disposal Recommendations

Preliminary recommendations are that two systems of stabilisation ponds discharging to Sungai Sibiu and Sungai Sebatang should be constructed to provide treatment and disposal facilities for the southern and central sewerage zones respectively. Consideration should be given to the construction of a submarine outfall at Tanjong Kidurong at a later stage to release development land in the central zone; at that time the flow from the northern zone could be pumped to Tanjong Kidurong for disposal through a common outfall.

The preliminary recommendations are based on the proposals set out in the Structure Plan shown in Chapter 7. Should the extent or timing of the development be fundamentally altered, then the recommendations may have to be revised.

II.5 LAYOUT OF SEWERAGE

II.5.1 Principal Sewers

The arrangements of the principal elements of the proposed sewerage system are shown in Figure II.1. A relatively large number of sewage pumping stations will be required because of the flat terrain and the elongated nature of the development area. Every advantage should be taken of the natural gradients, to ensure that the minimum number of pumping stations are provided compatible with adequate sewer gradients and reasonable excavation depths. The maximum depth of excavation required for the sewers shown in Figure II.1 would be 16 feet. The optimum sewerage layout will be dependent on the road and the ground levels adopted by the developers and, to ensure the most economical arrangement, close liaison should be maintained between the designers of the sewerage system and the development planners, architects and road engineers.

It is proposed that the sewerage zones should be divided into a number of sub-zones, each sub-zone being drained to a pumping station. The sub-zones are shown in Figure II.1 and the projected sewage flows for each sub-zones are shown in Tables II.1 and II.2.

The proposed arrangements of principal sewers are described in the following.

II.5.2 Southern Zone

A principal sewer would be laid in sub-zone S1 along the northern bank of Batang Kemena from pumping station (PS) 1S to the extremity of the development area. The pumping main from PS 1S would discharge to the head of a sewer in sub-zone S2.

Principal sewers would be laid from PS 2S in both directions along the road to the north of the airport. The pumping main from PS 2S would discharge to the inlet of the Sibiu sewage treatment works.

II.5.3 Central Zone

Principal sewers would be laid in sub-zone C1 from PS 1C along the coast road in both directions. The pumping main from PS 1C would discharge to the head of a sewer in sub-zone C2.

Principal sewers would be laid in sub-zone C2 from PS 2C in both directions along the coast road. A principal sewer would also be laid in an easterly direction following approximately along the line of Sungai Terus. The pumping main from PS 2S would discharge to the head of a sewer in sub-zone C3.

Principal sewers would be laid in sub-zone C3 from PS 3C along the coast road to the north and to the south. A principal sewer would also be laid along the bank of Sungai Sebatang; this sewer is shown in the figure along the south bank but detailed survey may indicate a more favourable line along the north bank, or it may be necessary to have sewers along each bank. The pumping main from PS 3C would discharge to the inlet of the Sebatang sewage treatment works.

Principal sewers would be laid in sub-zone C4 from PS 4C to the east and to the west along the road below the Tanjong Kidurong ridge. The pumping main from PS 4C would discharge to the head of a sewer in sub-zone C3.

II.5.4 Northern Zone

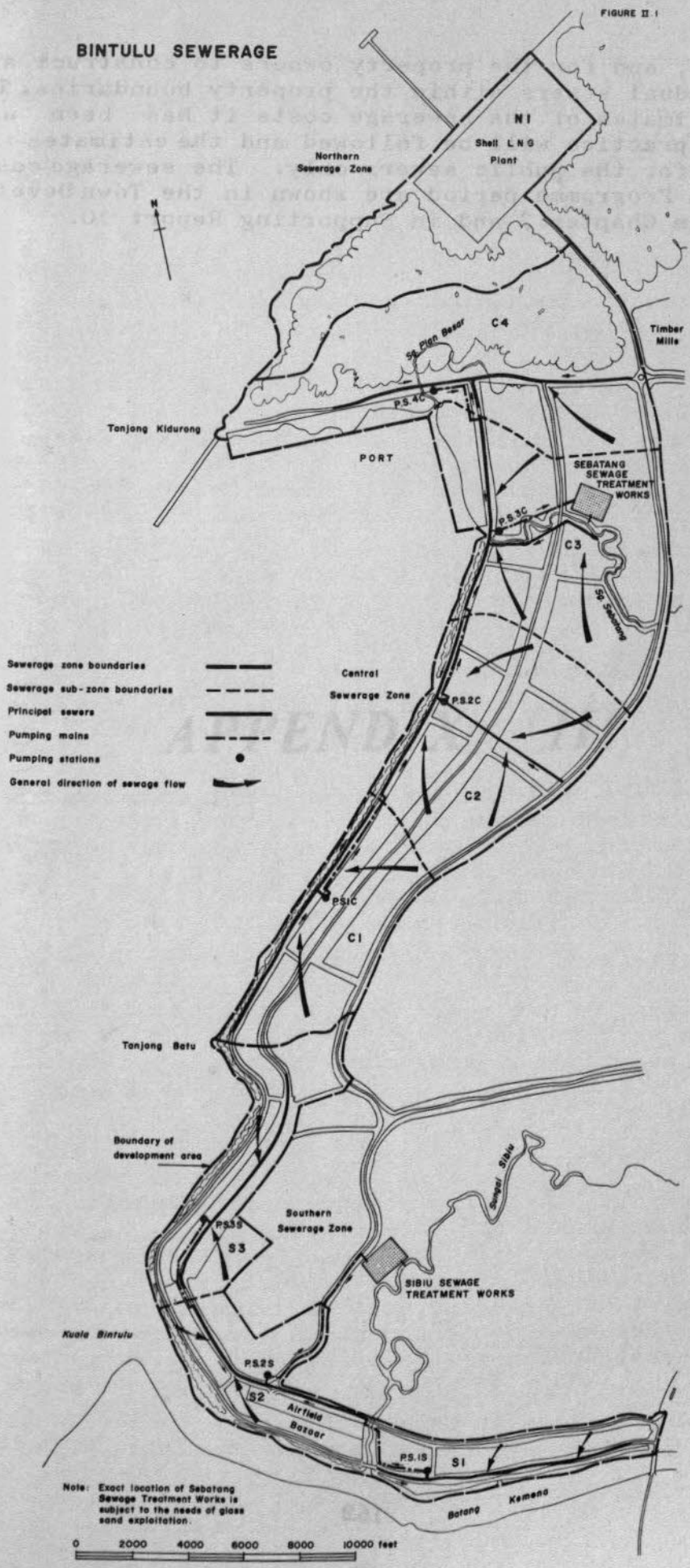
The arrangement of the sewers in the northern zone will be laid out to suit the LNG plant. No provision for these sewers has been made in the estimates.

II.5.5 Other Sewers

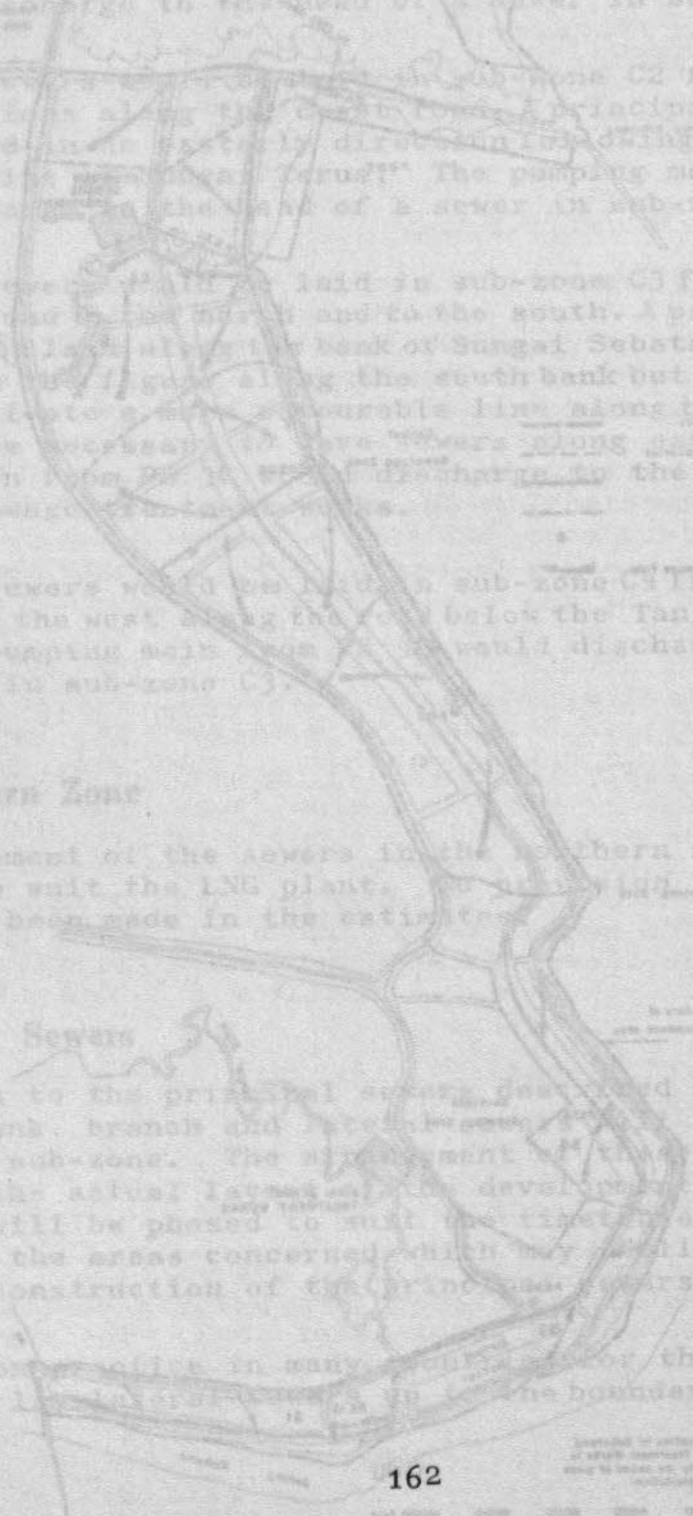
In addition to the principal sewers described above, a network of trunk, branch and lateral sewers will be provided to serve each sub-zone. The arrangement of these sewers will depend on the actual layout of the development; their construction will be phased to suit the timetable for full development of the areas concerned which may follow some time after the construction of the principal sewers.

It is common practice in many countries for the sewerage authority to lay lateral sewers up to the boundary of individual

FIGURE II 1


BINTULU SEWERAGE
N1
Shell L N G
Plant
Northern
Sewerage Zone
N
C4
Sg Plan Besar
Timber
Mills
P.S.4C
Tanjong Kidurong
PORT
SEBATANG
SEWAGE
TREATMENT
WORKS
P.S.3C
C3
Sg Sebatang
Sewerage zone boundaries
Sewerage sub-zone boundaries
Principal sewers
Pumping mains
Pumping stations
General direction of sewage flow
Central
Sewerage Zone
P.S.2C
C2
P.S.1C
C1
Tanjong Batu
Boundary of
development area
Sungai Sibiu
Southern
Sewerage Zone
P.S.3S
S3
SIBIU SEWAGE
TREATMENT WORKS
Kuala Bintulu
P.S.2S
S2
Airfield
Bazaar
P.S.1S
S1
Batang Kemena
Note: Exact location of Sebatang
Sewage Treatment Works is
subject to the needs of glass
sand exploitation.
0 2000 4000 6000 8000 10000 feet

properties, and for the property owners to construct and own the individual sewers within the property boundaries. In preparing estimates of the sewerage costs it has been assumed that this practice will be followed and the estimates include provision for the public sewers only. The sewerage costs for the Action Programme period are shown in the Town Development Packages in Chapter 7 and in Supporting Report 10.



APPENDIX III

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PRINTED AT THE GOVERNMENT PRINTING OFFICE, KUCHING, SARAWAK,
VINCENT KIEW FAH SAN, K.M.N., P.B.S., A.B.S., GOVERNMENT PRINTER.