# MIRI - BINTULU REGIONAL PLANNING STUDY

# PLANNING MANUAL REGIONAL DEVELOPMENT

DRAFT

PART I

CONFIDENTIAL

PUBLIC SERVICES

Chapter:
1. INTRODUCTION
2. EDUCATION
3. HEALTH
4. PUBLIC ADMINISTRATIVE OFFICES
5. POSTAL SERVICES
6. POLICE
7. FIRE BRIGADE

## 1. INTRODUCTION

This Manual is intended to be a practical tool for planning of integrated regional development. The Manual comprehends in one cover the standards, unit costs, staff and land requirements for housing and for different types of services and utilities. It emphasizes the relationships between the supply of different types and standards of services and underlines the importance of their coordination in time and space.

For each type of public and private service facility there should at any point in time be established standards which are designed to serve different sizes of populations. The standards established should express the relative importance, which at anytime is given to the different services. They should therefore be reviewed periodically and reestablished in the light of previous achievements and future desires and expectations. This basic principle of revision could imply in practice that the Manual should be made as a loose leaf system, so that pages with obsolete standards could be taken out and new ones put in as required.

In the Manual the size of population has been used as the criterion for deciding the number and standard of different services. Although for practical reasons the population has been used as the basic criterion, it must be emphasized that also other criteria should be taken into consideration, namely the level of social and economic activity, the character of the transport network, the density and distribution of the population, the security situation and political preferences to develop and upkeep certain areas. Moreover, the relative importance of these criteria would change over time.

The catchment areas for different service levels in the hierarchy normally cover each other. For instance, one Class A post office serves a population of about 20 000; each 10 000 of this population, however, are served at the same time by one Class B post office, and each 5 000 people of the 10 000 population are in turn served by a Class C post office, etc. Normally the service hierarchy is structured in such a way that the more advanced facilities, which seldom are sought by each individual or by all members of the population, are found in the upper levels, while the day to day needs are met by the lower units. Units in lower ranks of the hiarchy will also act as 'agent' for services which only can be carried out by superior units. In this way there is a division of work and an interaction between the different levels. It is important that this interaction is secured through a planned location of the service units within an area, and that the road network and the public transport system are designed to facilitate an effective operation of this service hiarchy.

In space the hierarchy of services could be visioned to form a Service District, in which the highest standards of each different service type are located in the central town of the District, the second highest level in service centres of a smaller size, etc. Such a Service District could appropriately be delineated to fit the future division of the State into Administrative Districts. In a Service District, where there is a coordination in the location of different types of amenities, people would only need to visit one place to make use of the highest standard of a number of services in the hiarchy; and one place to visit a number of services on the next level, etc.

For the various types of amenities there will be various numbers of service levels and population thresholds as it appears from Figure 1.1. Consequently, the envisaged Service District hiarchy can only be obtained if the population thresholds for some types of services are adjusted. In this connection it is important to find out which are the 'leading' or most rigid types of services, and how in general the population thresholds are derived.

The services mentioned in this Manual are designed to meet certain needs or requirements of the population in such fields as education, health, post, police, fire protection and public administration. Education, for instance, is offered to the population in many different ways. Formal education, for example, from Primary school to the Pre-University level is offered to the people through the formal educational system. This system contains a series of standards which are determined by such circumstances as the natural conditions of the country; the situation of the people like the age structure; the prevailing state of development in the country indicated, among other things, by the literacy rate and the number od dropouts, and the economies of teaching, which include the number of students in a classroom. The age structure could hardly be influenced in the short run; the general educational level of the population can gradually be improved; and the number of students per classroom could be changed rather quickly if this is found opportune. The age structure of the population imposes certain limits on the way in which education is conducted. Such limits seem to be less rigid for other types of public services because the supply unit for these are determined mainly by the 'convenience' and economies of supply.

Another factor that makes formal teaching rather rigid in terms of the size of each unit and its location is the high frequency with which the schools are visited by a part of the population. Such a frequent use of one facility is not the case with the medical services, for instance. However, in terms of life or death, the medical services are considered more important than the schools. Hence, the 'emergency' factor of the health service makes this sector also somewhat rigid in terms of unit size and location.

In our planning education and health therefore have been considered the 'leading' service facilities, also because the facilities require the highest amount of capital and manpower inputs. This implies that the unit sizes; the population thresholds; and the location of other services should be closely linked or adjusted to these services. Such an adjustment has not been undertaken in the present paper. However, if the idea is found sound, a gradual adjustment of the unit sizes and the population thresholds for the 'non-leading' services like post and police could be carried through.

Figure 1.1 shows the population thresholds for different levels of service facilities.

FIGURE 1.1: POPULATION THRESHOLDS FOR PUBLIC SERVICES

| POPULATION | EDUCATION | HEALTH | GOVERNMENT ADMINISTRATIVE OFFICES | LOCAL COUNCILS | POSTAL | POLICE |
|---|---|---|---|---|---|---|
| 75 000 | | DISTRICT HOSPITAL | | | | |
| 45 000 | PRE-UNIVERSITY LEVEL | | DISTRICT OFFICE | | | |
| 30 000 | | | | | | |
| 25 000 | | HEALTH CENTRE | | | | |
| 20 000 | | | | | CLASS A POST OFFICE | DISTRICT OFFICE STATION |
| 15 000 | UPPER SECONDARY SCHOOL | | SUB-DISTRICT OFFICE | DISTRICT COUNCIL | | |
| 10 000 | | | | | CLASS B POST OFFICE | MINOR POLICE STATION |
| 7 500 | LOWER SECONDARY SCHOOL | | | | | |
| 5 000 | | HEALTH SUB CENTRE | | | CLASS C POST OFFICE | POLICE POST |
| 1 500 | PRIMARY SCHOOL | COMMUNITY HEALTH CENTRE | | | CLASS C PHASE I POSTAL AGENT | VILLAGE POST |

The costs of the different service projects in the Manual have been worked out at the present price level. These cost figures can then be adjusted according to an expected rate of inflation. The derived standards and costs in the Manual refer to Sarawak conditions and not only to our Study Area. This implies that the Manual could be used for planning purposes all over the country: for regional planning like the present study and in planning that will be carried out by the various departments in their constant efforts to develop the country.

The standards should be regarded as 'average' figures which cannot be applied 'mechanically' on a planning task, but should be adjusted carefully to the local conditions. It is therefore important to regard the Manual as a Tool and not a final Answer to planning problems.

Appendix 1.I gives some of the Calculation Bases used in the Manual.

APPENDIX 1.I. CALCULATION BASES

1. AREA REQUIREMENT STANDARDS

a) Parking Lots

| | | |
|---|---|---|
| Lorry | 10' x 20' | = 200 sq. ft. |
| Car | 16' x 8' | = 128 " " |
| Bicycle | 6' x 1½' | = 9 " " |

b) Office Space User (Gross Area)

| | |
|---|---|
| Clerks and executive group | - 12' x 10' = 120 sq. ft. |
| Typist | 6' x 10' = 60 " " |
| Toilets, lobbies & Storeman, Stairways etc. | - 20% of gross floor area of office building |

c) Road Reserves and Open Space - 33% of the built over area

d) Housing - Government Quarters (gross floor area)

| | |
|---|---|
| Class II | - 2 800 sq. ft./unit |
| Class III | - 1 400 " " " |
| Class IV | - 1 300 " " " |

2. COSTS

a) Parking Lots

| | |
|---|---|
| 1 Car Parking Lot with Shed (Paved) | - $ 530 or $4.15/sq.ft. |
| 1 Car Parking Lot with no Shed (Unpaved) | - $ 190 or $1.50/sq.ft. |

b) Road access constructed to gravel road

| | |
|---|---|
| Standard for use of light vehicles | - $ 1.50/sq.ft. |

c) Government Buildings - Concrete - Ranging from $13 to $20/sq.ft. depending on location and type of building

d) Furniture - Office -

| | |
|---|---|
| 1 Table | - $80/unit |
| 1 Chair | - $20/unit |

e) Office Equipment

| | |
|---|---|
| Typewriter (18") | - $400/unit |
| Safe | - $600/unit |
| Table Calculator | - $200/unit |
| Duplicating Machine | - $1 200/unit |

| | |
|---|---|
| Filing Cabinet | - $ 600/unit |
| Air Conditioner | - $1 100/unit |
| Air Conditioning Plant | - $50 000/unit |

f) Vehicles

| | |
|---|---|
| Land Rover | - $15 000/unit |
| Land Rover (Firefly) Fire engine | - $36 000/unit |
| Heavy Motor Cycle | - $ 2 500/unit |

g) Quarters

| | |
|---|---|
| Class II | - $60 000/unit |
| Class III | - $30 000/unit |
| Class IV | - $20 000/unit |

h) Miscellaneous items

| | |
|---|---|
| Flag pole for Government Office | - $ 500/unit |
| Fencing | - $ 8/linear foot |
| Contingencies | - Calculated at 3% to 5% of total building cost |
| Maintenance of buildings | - Calculated at 2% of investment cost. |

## 2. EDUCATION

Education can be divided into formal education and what can be called education for work. Between these two forms of education there is, however, no sharp distinction as both can have a practical and a cultural effect:

- practical, meaning forming and improving productive skill;
- cultural, giving a general understanding of oneself and one's society.

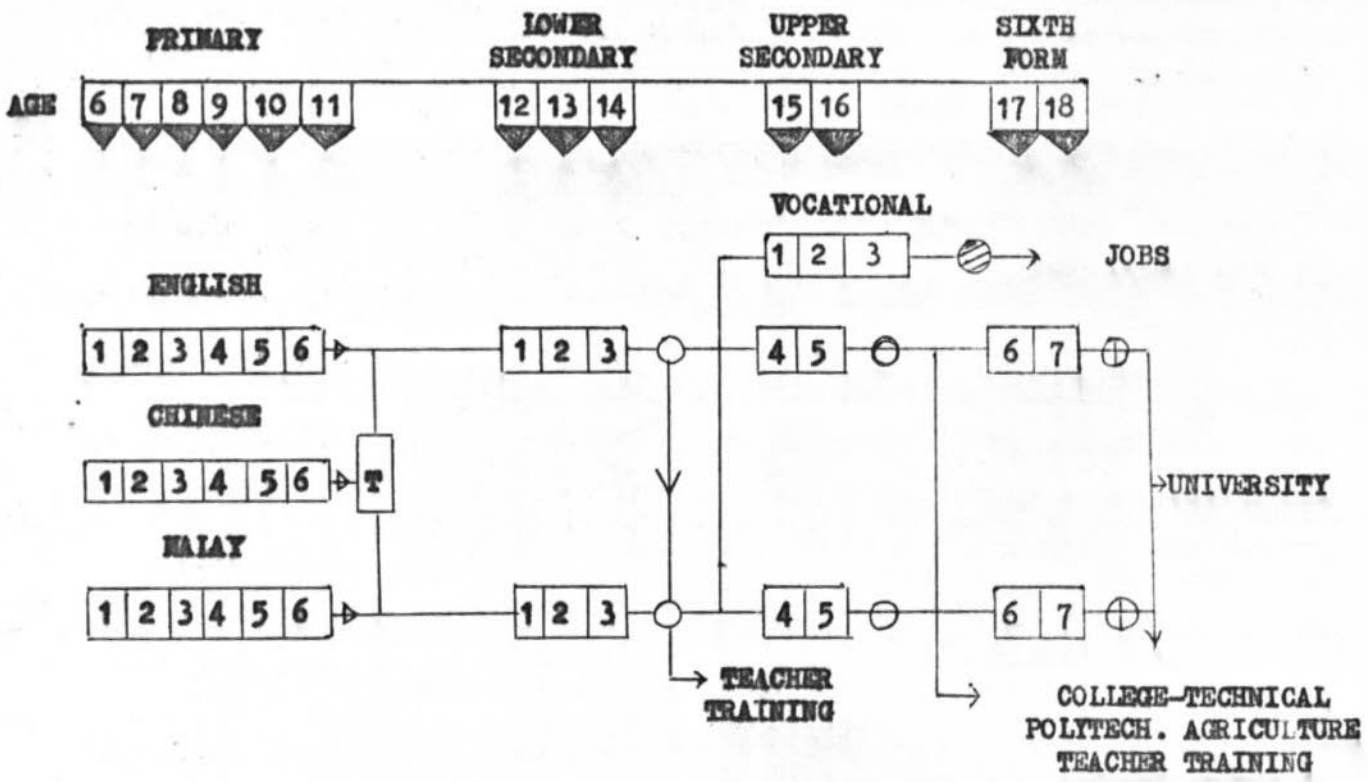
The present public educational system of Sarawak is shown in Figure 2.1 which gives the different types and levels of education corresponding to specific age groups.

### 2.1 Derivation of Standards

The number of people who will attend the different levels of education will depend both on the population 'available' in each relevant age group, on the entrance requirements and/or on the survival rates. The entrance requirements are constantly under review, and in particular the abolishment of the primary six entrance examination is envisaged in 1974.

The calculation of the number of people in the age groups 6-11, 12-14, 15-16 and 17-18 is based on the information contained in the 1970 Census and shown in Appendices 2.I, 2.II and 2.III. The Census figures reveal that the proportion of the total population in each age group does not vary much by geographical location, i.e. by Planning Unit. A comparison of the interpolated figures in the 1970 Census with the actual figures of the 1960 Census shows in general that there are more persons

FIGURE 2.1 PUBLIC EDUCATIONAL PATTERN, SARAWAK 1970




KEY

- ⊳ SECONDARY ENTRANCE EXAMINATION
- ○ LOWER CERTIFICATE OF EDUCATION (S.R.P./L.C.E.) SABAH/SARAWAK: JUNIOR CERTIFICATE
- ⊖ MALAYSIAN CERTIFICATE OF EDUCATION/ SCHOOL CERTIFICATE (S.P.M./M.C.E./S.C.)
- ⊕ HIGHER SCHOOL CERTIFICATE (S.T.P./H.S.C.)
- ⊜ MALAYSIAN VOCATIONAL CERTIFICATE (S.V.M./M.V.C.)

[3] CLASSES

T = TRANSITION CLASS

per 1 000 people in the young age groups in 1970 than in 1960. Such a trend is expected, but not likely to continue when family planning comes into effect. Hence, the following standards have been based on the assumption that the percentage composition of each age group will remain the same over the next decade or so.

2.1.1 Primary Level

One primary stream will consist of 6 classes at 35 pupils per class, which makes a total of 210 pupils per stream.

The following survival rates have been taken from the Mid-Term Review of the Second Malaysia Plan (Department of Education). The rates indicate the number of pupils expected to continue from one primary stage to the next, e.g. about 92 percent of the pupils in primary 1 continue to primary 2 (see below).

| | |
|---|---|
| Primary 1 - Primary 2 | 92% (92%) |
| Primary 2 - Primary 3 | 95% (87%) |
| Primary 3 - Primary 4 | 95% (83%) |
| Primary 4 - Primary 5 | 88% (73%) |
| Primary 5 - Primary 6 | 98% (72%) |

Assuming that 100 percent of the primary 1 age group is starting in school, the percentages in brackets then indicate the fraction of the population that actually would attend each level, e.g. 92 percent of the primary 2 age group would attend this level etc. The calculations indicate that about 72 percent of the primary six age group would attend this stage, and that an average of 85 percent of the age group 6–11 will be studying in primary school. However, if less than 100 percent of the primary 1 age group is starting in school, the figures in brackets would be correspondingly less.

A check on this average has been carried out by means of the 1970 Census. In that year it is estimated that about 17 percent of the population is in the age group 6–11. The actual number of pupils in primary school in 1970 was 144 000, which corresponds to 14.7 percent of the total population. From this can be concluded that the attendance rate was about 86 percent ($\frac{14.7}{17} \times 100$), which is the same percentage as obtained through the survival rates.

Appendix 2.I reveals that the average number of people falling within the age group of 6–11 (the primary school attending age) is 172 per thousand, with the range from 160 to 180. Applying the attendance rate of 85 percent to these figures the average number of primary pupils per thousand population would be 145, with a range from about 135 to 155. Consequently, in order to realise a primary stream of 210 pupils, there will be a need for a population size ranging from 1 350 to 1 550 with an average of 1 450. If the attendance rate in the future should increase to 100 percent, the average population required for one primary stream would go down to 1 200.

### 2.1.2 Lower Secondary Level

The smallest lower secondary unit normally built is one transition class and two streams, each stream consisting of 3 classes, forms 1 to 3, with 35 pupils in each class. The total number of students in the unit is 245.

The present attendance rate for lower secondary schools in Sarawak is about 30 percent of the age group 12-14 years. When the Common Entrance Examination is to be abolished in 1974, the Department of Education expects that about 90 percent of primary six pupils will continue to the lower secondary level. This high rate is further expected by the Department to fall again to 75 percent in the late 1970's. Hence, a rate of 75 percent will be used as a basis for the planning of new schools. With an attendance rate of 72 percent in primary six and a continuation of 75 percent of these people to the lower secondary level, the attendance rate for the age group 12-14 will be nearly 55 percent (72% x 75% = 54%). In the age group there are about 60 persons per 1 000 population, out of which an average of 33 persons would attend lower secondary school. Hence, to create one unit of two secondary streams and one transition class, a total population of more than 7 500 is required.

### 2.1.3 Upper Secondary Level

One unit of this level consists of 4 classes, i.e. form 4 and 5 (Arts and Science). Each class will have 35 students, which gives a total of 140 students.

In 1970 the number of students in forms 4 and 5 in Sarawak was 4 400, which corresponds to about 12 percent of the total population in this age group. The Department of Education intends to raise this attendance rate during the next years, and the aim is to allow nearly 60 percent of those leaving lower secondary school to continue to the next stage. With an attendance rate of 55 percent in lower secondary school this would imply that about 30 percent of the age group attends this level.

There are about 37 people per thousand population falling in the age group 15-16. Therefore, given the mentioned attendance rate, there will be about 10 persons per thousand population studying at this level, and in order to realise one unit of 140 students a population of 14-15 000 is required.

2.1.4 Pre-University Level

One unit of this level will consist of 4 classes, i.e. Lower Six Arts and Science and Upper Six Arts and Science. The number of students per class ranges from 25 to 30, which gives 100-120 students per unit.

Selection from the Upper Secondary level to this stage is envisaged by the Department of Education to be 22 percent. The attendance rate in this age group will then be about 6 percent corresponding to 2.2 persons per thousand population. Hence, in order to obtain one unit of 100 students there is a need of a population of about 45 000.

### 2.1.5 The Education Hierarchy

Figure 2.2 shows the Education Hierarchy based on the standards derived above. This hierarchy indicates that the Pre-University level will require a population of about 45 000 to support one unit, while one Upper Secondary unit will need about 15 000, etc. In other words, in order to obtain a sufficient number of students to support one unit of Pre-University level, three Upper Secondary units are required.

Similarly, students from 6 Lower Secondary units or 30 Primary Streams will support one unit of the highest level.

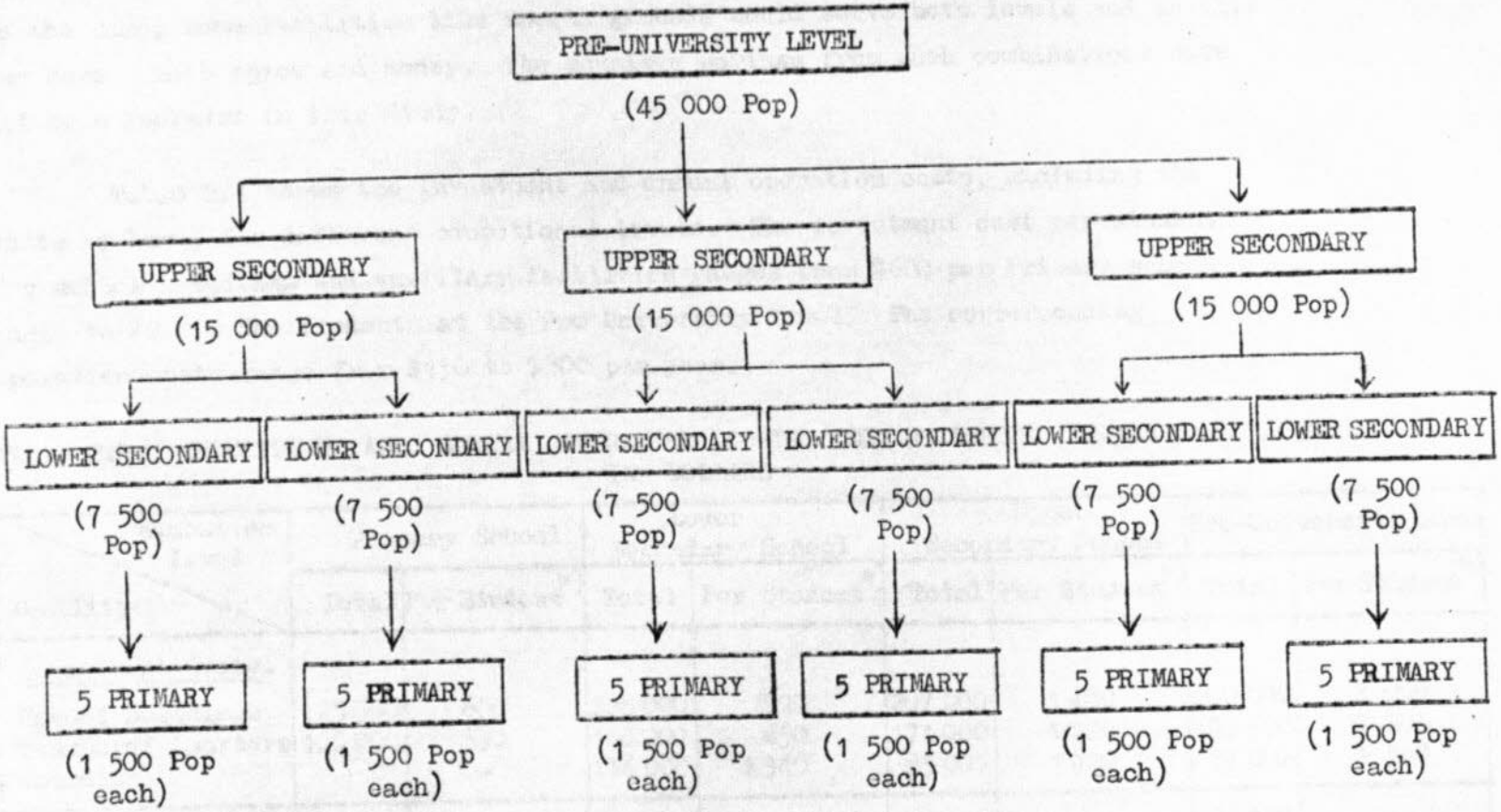
## 2.2 Physical Requirements and Investment Costs

The physical requirements and investment costs for primary and secondary streams are shown in the following sections. The standards and costs, which are derived from school projects presently implemented in Sarawak, should be regarded as 'average' figures.

As a basis for the calculations one stream has been found an appropriate unit for primary schools and two streams for the secondary level, but it should be borne in mind that some facilities require more than one stream to be viable in an economic sense, and that, in some cases, a functional secondary school could be less than two streams.

FIGURE 2.2

EDUCATION HIERARCHY



The physical requirements have been estimated separately for each education level. In some cases it could be found opportune to combine two successive levels together in one physical unit, e.g. Lower and Upper Secondary School. If this will be the case, some facilities like sports grounds could serve both levels and in this way save both space and money. The possible savings from such combinations have not been included in this Study.

Table 2.1 shows the investment and annual operation costs, excluding the costs of land, for different educational levels. The investment cost per student for school buildings and auxillary facilities ranges from $600 per Primary school pupil to $2 000 for students at the Pre University level. The corresponding operation costs range from $150 to $800 per year.

TABLE 2.1 INVESTMENT AND ANNUAL OPERATION COSTS PER DIFFERENT EDUCATIONAL LEVELS. IN DOLLARS

| Education Level / Facility | Primary School | | Lower Secondary School | | Upper Secondary School | | Pre-University Level | |
|---|---|---|---|---|---|---|---|---|
| | Total | Per Student*) | Total | Per Student*) | Total | Per Student*) | Total | Per Student*) |
| Investment Costs: | | | | | | | | |
| School Buildings | 125 000 | 600 | 225 000 | 920 | 207 000 | 1 480 | 200 000 | 2 000 |
| Teachers' Quarters | 128 000 | 530 | 160 000 | 650 | 171 000 | 1 220 | 199 500 | 1 995 |
| Boarding | - | - | 134 000 | 1 340 | 85 000 | 1 420 | 77 000 | 1 540 |
| Total | 253 000 | - | 519 000 | - | 463 000 | - | 476 500 | - |
| Operation Costs: | | | | | | | | |
| Teaching | 36 000 | 150 | 60 000 | 250 | 55 000 | 400 | 80 000 | 800 |
| Boarding | - | - | 10 000 | 100 | 10 000 | 170 | 10 000 | 200 |

*) The cost for boarding is estimated per boarder.

2.2.1 Primary School

The physical requirements for a primary stream, shown in Table 2.2, could be sub divided into two groups, namely the classrooms and facilities directly connected with the teaching and the teachers' quarters. Table 2.2 gives for each facility the floor space required, the number of units per stream, the costs per unit and the total for each item.

TABLE 2.2 ONE PRIMARY STREAM. PHYSICAL REQUIREMENTS AND INVESTMENT COSTS

| Facility | Size per unit in sq feet | Units per Stream | Unit Costs in Dollars | Total Costs in Dollars | Remarks |
|---|---|---|---|---|---|
| Classroom | 600-750 | 6 | 10 000 | 60 000 | |
| Office | " | 1 | 10 000 | 10 000 | |
| Assembly Hall | 3 000 | ½ | 30 000 | 15 000 | Optional |
| Toilet | 1 200 | 1 | 12 000 | 12 000 | |
| Electrical Installation | | | | 7 000 | |
| Water Supply | | | | 1 000 | |
| Furniture & Equipment | | | | 12 000 | |
| Fencing | 1 000 linear feet | | 8 per linear feet | 8 000 | |
| Total School | | | | 125 000 | |
| Teachers' Quarters | | | | | |
| Headmaster | 1 350 | 1 | 27 000 | 27 000 | |
| Teachers' flats/house | 1 200 | 6 | 15 000 | 90 000 | Optional |
| Furniture | | 7 | 1 500 | 10 500 | |
| Total Quarters | | | | 127 500 | |
| Grand Total | | | | 252 500 | |

The land requirements of one primary stream are estimated at 1.5 acres. This area allows for school buildings and playgrounds, but excludes teachers' quarters. The construction costs of the school buildings including auxiliary facilities like water supply, electricity and furniture amount to $125 000, which comes to about $20 000 per classroom or $600 per pupils place.

The provision of teachers' quarters costs about $128 000, of which $90 000 could be optional depending on whether the teachers manage to acquire accommodation on the 'normal' housing market or not. The high costs of quarters compared to the costs of the school itself should imply that the Government refrains from providing quarters whenever this is possible, i.e. in the larger urban areas.

The operating costs of primary schools are estimated to be $150 per pupil annually. This cost does not include boarding.

### 2.2.2 Lower Secondary School

The facilities needed and the corresponding investment costs of two junior secondary streams are shown in Table 2.3. As mentioned the unit of two streams plus a transition class, i.e. 245 pupils, has been chosen for this education level as this appears to be the smallest unit normally built.

TABLE 2.3 TWO **LOWER** SECONDARY STREAMS. PHYSICAL REQUIREMENTS AND BUILDING COSTS. IN DOLLARS

| Facility | Size per Unit in sq. feet | Units per 2 streams | Unit Costs in Dollars | Total Costs in Dollars | Remarks |
|---|---|---|---|---|---|
| Classroom | 600 - 750 | 7 | 10 000 | 70 000 | |
| Office | " | 1 | 10 000 | 10 000 | |
| Library | " | 1 | 10 000 | 10 000 | |
| Books | | | | 4 000 | |
| Assembly Hall | 3 000 | ½ | 30 000 | 15 000 | |
| Woodwork Shop | 750 | 1 | 30 000 | 30 000 | |
| Science Equipment | | | | 15 000 | |
| Office Equipment | | | | 2 400 | |
| Bicycle Shelter | | | | 1 500 | |
| Toilet | 1 200 | 1 | 12 000 | 12 000 | |
| Electrical Installation | | | | 3 500 | |
| Water Supply | | | | 1 000 | |
| Furniture | | | | 10 000 | |
| Sports Grounds: | | | | | |
| Basketball/Volley ball | 3 900 | 1 | ) | | Area given is |
| Football/Hockey | 86 400 | 1 | ) | 22 000 | net, gross |
| Badminton/Tennis | 2 800 | 1 | ) | | area 30% larger |
| Fencing | 2 400 linear feet | | | 19 200 | Optional |
| Total School | | | | 225 600 | |
| Teachers' Quarters | | | | | |
| Headmaster's house | 1 350 | 1 | 27 000 | 27 000 | |
| Teachers' flats/house | 1 200 | 8 | 15 000 | 120 000 | Optional |
| Furniture | | 9 | 1 500 | 13 500 | |
| Total Quarters | | | | 160 500 | |
| Boarding: | | | | | |
| Hostel (100 beds) | 7 000 | 1 | | 70 000 | |
| Dining Hall/Kitchen | 2 000 | | | 30 000 | |
| Equipment for dormitory | | 100 | 85 | 8 500 | |
| Equipment for Kitchen/ Dining Hall | | | | 20 000 | |
| Electrical Installation | | | | 4 000 | |
| Water Supply | | | | 1 500 | |
| | | | | 134 000 | |
| | | | | 520 100 | |

The additional facilities required for secondary education compared to primary are laboratory, library and sports grounds. The costs of these extra facilities amount to $100 000 and the gross area needed for school buildings and sports grounds are 6.5 acres.

The cost per unit of teachers' quarters has been assumed to be at the same level as for primary school teachers. However, 245 students on the secondary level require two more teachers than on the primary stage. Hence, two more furnished flats/houses for teachers have been included. The costs of quarters amount to $160 000.

In Sarawak about 30 percent of the 'secondary' students are boarders. It is the aim of the Government to step up the secondary school building programme, which among other things would imply a higher rate of boarding. It is expected that the percentage of boarders will increase by 2 percent annually to about 45 percent in 1980 (Second Malaysia Plan. Mid Term Review. Department of Education.)

If it is assumed that the percentage of boarders would be higher among the upper secondary students than among the lower secondary ones because of the larger catchment area of an upper secondary school, a rate of 40 percent boarders in a lower secondary school seems not unreasonable. For two streams this rate corresponds to about 100 boarders. The cost of a hostel of this size is estimated at about $135 000 or $1 350 per boarder.

The investment costs of two Lower Secondary streams including quarters and boarding total about $520 000 of which $225 000 refers to the school building. Per pupils place the school buildings and auxiliary facilities cost about $920.

The annual running costs of Lower Secondary education excluding boarding and teachers' quarters are calculated at $250 per pupil. The basis for the calculation are the salaries paid ($400-600 per month for teachers), the maintenance and the supply costs of water and electricity. In a similar way the annual costs per boarder have been worked out to be $100 excluding food.

2.2.3 Upper Secondary School

Table 2.4 shows the necessary facilities and the corresponding investment costs for two Upper Secondary Streams, i.e. 140 students. The investment costs of school buildings and auxiliary facilities per student's place amount to about $1 500, which is about 60 percent more than that of a pupil's place for Lower Secondary Schools. Including boarding and teachers' quarters the total cost would amount to about $460 000.

The land requirement for two streams of this level, excluding teachers' quarters, totals about 10 acres.

The annual operating cost of the teaching facilities has been estimated at $400 per student, or a total of $55 000 per year. The recurrent boarding costs, excluding food, amount to $10 000 per year, which corresponds to $170 per boarder.

TABLE 2.4 TWO UPPER SECONDARY STREAMS. PHYSICAL REQUIREMENTS AND INVESTMENT COSTS. IN DOLLARS

| Facility | Size per Unit sq. feet | Number of Units | Unit Cost in Dollars | Total Costs in Dollars | Remarks |
|---|---|---|---|---|---|
| Classroom | 600-750 | 6 | 10 000 | 60 000 | |
| Office | " | 1 | 10 000 | 10 000 | |
| Teachers' Room | " | 1 | 10 000 | 10 000 | |
| Library | " | 1 | 10 000 | 10 000 | |
| Books | | | | 10 000 | |
| Assembly Hall | 3 000 | 1 | 30 000 | 30 000 | |
| Toilet | 800 | 1 | | 8 000 | |
| Science Equipment | | | | 15 000 | |
| Office Equipment | | | | 2 400 | |
| Bicycle Shelter | | | | 1 500 | |
| Electrical Installation | | | | 3 000 | |
| Water Supply | | | | 1 000 | |
| Furniture | | | | 11 000 | |
| Sports Grounds | | | | | |
| Basketball/Volley ball | 3 900 | 1 | ) | | |
| Football/Hockey | 86 400 | 1 | ) | 22 000 | |
| Badminton/Tennis | 2 800 | 1 | ) | | |
| Fencing | 1 700 linear ft. | | $8 per foot | 13 600 | Optional |
| Total School | | | | 207 500 | |
| Teachers' Quarters: | | | | | |
| Headmaster's house | 1 350 | 1 | 27 000 | 27 000 | |
| Teachers' house | 1 350 | 5 | 27 000 | 135 000 | |
| Furniture | | 6 | 1 500 | 9 000 | |
| Total Quarters | | | | 171 000 | |
| Boarding: | | | | | |
| Hostel (60 beds) | 4 200 | 1 | 42 000 | 42 000 | |
| Kitchen/Dining Hall | 1 200 | 1 | 18 000 | 18 000 | |
| Dormitory Equipment | | 60 | 85 | 5 100 | |
| Kitchen/Dining Equip. | | | | 15 000 | |
| Electrical Installation | | | | 3 000 | |
| Water Supply | | | | 1 500 | |
| Total Boarding | | | | 84 600 | |
| Grand Total | | | | 463 100 | |

### 2.2.4 Pre-University Level

The facilities required for a Pre-University Unit of 100 students are roughly the same as for two Upper Secondary streams. Because the number of students is fewer, the size and costs of some of the facilities have been scaled down. The total costs of the unit including teachers' quarters and boarding amount to $475 000 as shown in Table 2.5. The school building and auxiliary facilities alone require an investment capital of about $200 000 or $2 000 per student's place.

The land needed for this unit is estimated at 10 acres.

The annual running cost of two Pre-University Streams totals about $80 000 or $800 per student. The recurrent boarding costs of about 50 students amount to $10 000 per year, which corresponds to about $200 per boarder. The provision of food is not included in the calculations.

## 2.3 Staff Requirements

The staff requirements for different educational levels and number of streams are shown in Table 2.6.

For secondary schools the following are the number of extra teachers for every additional stream above one stream, i.e. two Lower Secondary streams, for example, have 2 x staffing for one stream plus one extra teacher.

TABLE 2.5 PRE-UNIVERSITY EDUCATION. PHYSICAL REQUIREMENTS AND INVESTMENT COSTS. IN DOLLARS

| Facility | Size per unit in sq. feet | Unit per Stream | Unit Costs in Dollars | Total Costs in Dollars | Remarks |
|---|---|---|---|---|---|
| Classroom | 600-750 | 6 | 10 000 | 60 000 | |
| Office | " | 1 | 10 000 | 10 000 | |
| Teachers Room | " | 1 | 10 000 | 10 000 | |
| Library | " | 1 | 10 000 | 10 000 | |
| Books | | | | 10 000 | |
| Assembly Hall | 30 000 | 1 | 30 000 | 30 000 | |
| Toilet | 600 | 1 | 6 000 | 6 000 | |
| Science Equipment | | | | 15 000 | |
| Office Equipment | | | | 2 400 | |
| Bicycle Shelter | | | | 1 250 | Assume 50% |
| Electrical Installation | | | | 2 500 | using bicycle |
| Water Supply | | | | 1 000 | |
| Furniture | | | | 6 800 | |
| Sport Grounds | | | | 22 000 | |
| Fencing | 1 700 linear feet | | $8 per foot | 13 600 | |
| Total School | | | | 200 550 | |
| Principal's house | 1 350 | 1 | 27 000 | 27 000 | |
| Teachers Quarters | 1 350 | 6 | 27 000 | 162 000 | |
| " " | | | | | |
| Furniture | | 7 | 1 500 | 10 500 | |
| Total Quarters | | | | 199 500 | |
| Boarding: | | | | | |
| Hostel (50 beds) | 3 500 | 1 | 35 000 | 35 000 | |
| Kitchen/Dining Hall | 1 200 | 1 | 18 000 | 18 000 | |
| Equipment for dormitory | | 50 | 85 | 4 250 | |
| Equipment for Kitchen/ Dining Hall | | | | 15 000 | |
| Electrical Installation | | | | 3 000 | |
| Water Supply | | | | 1 500 | |
| Total Boarding | | | | 76 750 | |
| Grand Total | | | | 476 800 | |

TABLE 2.6 STAFF REQUIREMENTS

| Educational level and stream | | Teaching Staff | | | Teaching/Boarding | | Boarding Staff | | | Staff Total |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Principal | Teachers | Laboratory attendant | Clerk | Groundsman | Matron | Cook | Servants | |
| Primary School | 1 stream | 1 | 6 | | | 1 | | | | 8 |
| | 2 streams | 1 | 12 | | 1 | 1 | | | | 15 |
| Junior Secondary School | 1 stream | 1 | 3 | | | 1 | 1 | 1 | 1 | 8 |
| | 2 streams | 1 | 8 | 1 | 1 | 1 | 1 | 2 | 1 | 16 |
| Upper Secondary School | 1 stream | 1 | 3 | | | 1 | 1 | 1 | 1 | 8 |
| | 2 streams | 1 | 6 | 1 | 1 | 1 | 1 | 1 | 1 | 13 |
| Pre-University Level | 1 stream | 1 | 3 | | | 1 | 1 | 1 | 1 | 8 |
| | 2 streams | 1 | 6 | 1 | 1 | 1 | 1 | 1 | 1 | 13 |

Lower Secondary School: 1 extra teacher for each additional stream;

Upper Secondary School: 2 constants and 1 teacher extra for each 100 pupils in schools over 300 pupils.

APPENDIX 2.I PROPORTION OF 6-11 AGE GROUP PER THOUSAND. SOURCE: 1970 CENSUS

| Planning Unit | Sub Unit | Age group 6-11 | Total Pop. | Age group 6-11/1 000 pop. |
|---|---|---|---|---|
| Baram | Bakong | 1 065 | 5 923 | 180 |
| | Marudi | 1 848 | 9 912 | 186 |
| | Long Lama | 1 949 | 11 985 | 163 |
| Total | | 4 862 | 27 820 | 175 |
| Bintulu | Bintulu/ Similajau | 2 381 | 13 332 | 165 |
| | Kemena | 2 629 | 14 441 | 182 |
| Total | | 5 010 | 27 773 | 180 |
| Miri | Miri North | 5 902 | 35 707 | 165 |
| | Sibuti | 1 793 | 10 424 | 172 |
| | Niah Suai | 1 947 | 11 578 | 168 |
| Total | | 9 642 | 57 709 | 167 |
| Grand Total | | 19 514 | 113 302 | 172 |

APPENDIX 2.II. PROPORTION OF 12-14 AGE GROUP PER THOUSAND. SOURCE: 1970 CENSUS

| Planning Unit | Sub Unit | Age Group 12-14 | Total Pop. | Age Group 12-14/1 000 pop |
|---|---|---|---|---|
| Baram | Bakong | 328 | 5 923 | 55 |
| | Marudi | 813 | 9 912 | 82 |
| | Long Lama | 683 | 11 985 | 57 |
| Total | | 1 824 | 27 820 | 66 |
| Bintulu | Bintulu/ Similajau | 1 076 | 13 332 | 81 |
| | Kemena | 860 | 14 441 | 60 |
| Total | | 1 936 | 27 773 | 70 |
| Miri | Miri North | 2 934 | 35 707 | 82 |
| | Sibuti | 717 | 10 424 | 69 |
| | Niah Suai | 723 | 11 578 | 62 |
| Total | | 4 374 | 57 709 | 76 |
| Grand Total | | 8 134 | 113 302 | 72 |

APPENDIX 2.III. PROPORTION OF 15-16 AGE GROUP PER THOUSAND. SOURCE: 1970 CENSUS

| Planning Unit | Sub Unit | Age group 15-16 | Total Pop. | Age group 15-16/1 000 |
|---|---|---|---|---|
| Baram | Bakong | 218 | 5 923 | 37 |
| | Marudi | 489 | 9 912 | 49 |
| | Long Lama | 416 | 11 985 | 35 |
| | | 1 123 | 27 820 | 40 |
| Bintulu | Bintulu/ Similajau | 636 | 13 332 | 48 |
| | Kemena | 456 | 14 441 | 32 |
| | | 1 092 | 27 773 | 39 |
| Miri | Miri North | 1 811 | 35 707 | 51 |
| | Sibuti | 418 | 10 424 | 40 |
| | Niah Suai | 451 | 11 578 | 39 |
| | | 2 680 | 57 709 | 46 |
| | | 4 895 | 113 302 | 43 |

## 3. HEALTH

### 3.1 The Administrative Organisation of the Medical Service

Prior to 1971 a network of Dispensaries, Sub-dispensaries, Maternity Child Health Clinics and Rural Health Supervisors' posts were established to meet the need of the rural population. These units worked almost independently of each other, which was clearly felt as a disadvantage. Therefore during the Second Malaysia Plan a system of Main Health centres and Health Sub-centres based on a Malaysian Concept was introduced in Sarawak with the objective of integrating the curative and preventive services.

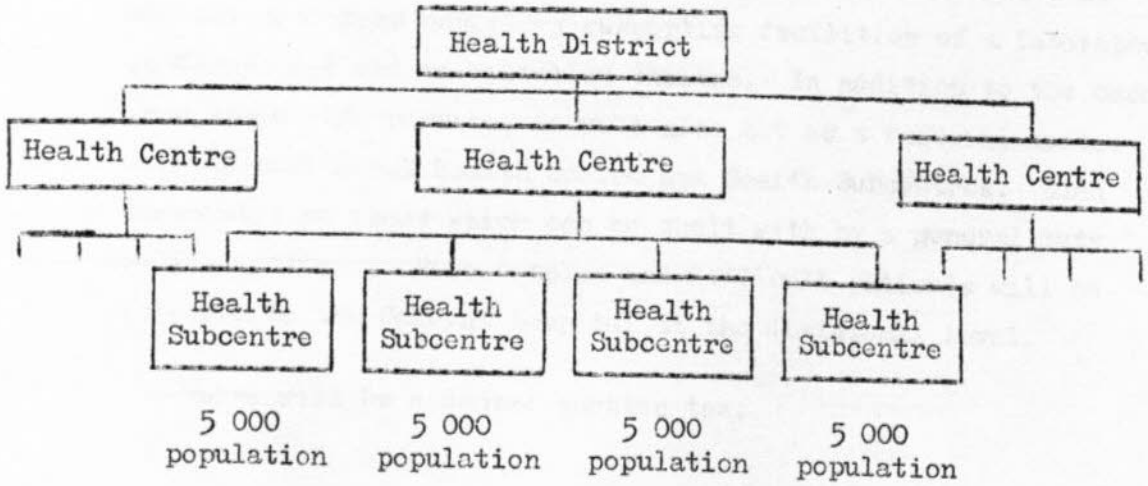
In a paper, "Regionalization of Patient Care Services in Malaysia," dated 22.7.72, the Ministry of Health has stated that the number of beds to population should be on a ratio of 2 beds per 1 000 population. On this criteria, the patient care service for this region by 1975 should have 742 beds as compared to what will probably be the actual figure - 496 or 1.3 beds per thousand population.

In the concept of regionalisation of patient care services, the State of Sarawak would have a Regional Hospital supported by General Hospitals and District Hospitals. It is envisaged that the Sarawak General Hospital at Kuching will be the Regional Hospital, and places like Sibu and Miri will have

General Hospitals. The intermediate hospitals in other divisions may have to be termed 'District Hospitals Level I' and the present District Hospitals, 'District Hospital Level II'.

The standards applied for estimating the future supply of medical services are based on the New Economic Policy in the Second Malaysia Plan in which Sarawak is divided into fifteen health districts each with an approximate population of 75 000. One health district is subdivided into health centres and sub-centres as shown in Figure 3.1.

FIGURE 3.1: ADMINISTRATIVE ORGANISATION OF THE HEALTH SERVICE




In each health district it is planned to build one district hospital attached to which are three health centres each with four subcentres.

A health centre with sub-centres constitutes one 'health unit' which covers a population of about 25 000, i.e. the health centre itself covers 5 000 people and 5 000 are covered by each sub centre.

From a memorandum on "Health Districts and Rural Health Service, Sarawak" (Medical Department) the following description of the administrative organisation of the medical service has been extracted:

"District Hospital

It is planned to build a district hospital in each Health District. It will have sufficient general and obstetric beds and the necessary ancillary supportive facilities of a laboratory, an X-ray unit and an operation theatre. In addition to the cases from its O.P.D. service, it will also act as a referral centre for the peripheral Health Centre and Health Subcentres. Such cases will be those which can be dealt with by a general duty medical officer. More complex and difficult patients will be referred to the General Hospital at the divisional level.

There will be a dental section too.

## Health Units

The operational organisation of a rural health unit is the Health Centre and Health Subcentres on which all the activities are based. Each unit consists of

1. One Health Centre
2. Four Health Subcentres

The centres would provide the following curative and preventive services:-

1. Medical care
2. Control of Major Diseases
3. Maternal and Child Health Service
4. Environmental Sanitation
5. Health Education
6. Data Collection
7. Dental care
8. Laboratory Service
9. Nutrition Programme
10. Mental Health
11. School Health

## Health Centre

In addition to providing the above services a Health Centre has another role. This is to give support and supervision to the staff of the Health Subcentres. The service component of the staff of a Health Centre is the basic staff of a Health Subcentre. These and the staff of the 4 Health Subcentres will be supervised and supported by a Medical Officer, a Dental Officer, a Public Health Nurse, a Health Inspector and a Laboratory Technician.

Each Health Centre will be located within easy reach of the 4 Health Subcentres and will serve an approximate population of 25 000.

## Health Subcentres

These are the lowest units in the organisation and their role will be mainly to provide those services listed above. Initially, the main component will be the curative and preventive Medical Services as provided by the Hospital Assistant; Maternal and Child Health Programme by the Midwives; and Environmental Sanitation Programme by the Rural Health Supervisors. Being provided with transport, the hospital assistant will be able to run a travelling dispensary service on land and by river, the midwives

an extended maternal and child health service to the kampongs and the Rural Health Supervisors a better coverage of the population for rural health improvement particularly environmental sanitation.

The population served by each Health Subcentre will average about 5 000. It is planned to develop 160 of these in the State over a period of 30 years. During the 2nd Malaysia Plan, the emphasis is mainly on expansion of the service but in the 3rd Malaysia Plan, some of the existing dispensaries will be converted into Health Subcentres. At the same time new centres will be established.

Existing Maternal and Child Health Clinics

The Divisional Medical Office will continue to provide the general support and supervision of the medical and health services in the Division. The Divisional Medical Officer will be assisted by Health Sister, Health Superintendent, Chief Hospital Assistant and Malaria Superintendent.

Besides supervision and support, these officers are also responsible for co-ordinating the activities of the health units.

Planning and development of the services in the Division is also the responsibilities of the divisional medical officer.

On the operational side, Divisional Medical Officer is also responsible for the administration and management of the staff, finance, etc."

However, with the progress of the State's development shown by the increasing demand on the side of the public for medical and health care, and the present security situation and staff shortage in the Medical Department, the above concept has to be modified, and the Mid-term Review of the Second Malaysia Plan 1971-75 of the Medical Department has already incorporated the modified concept, which is that of a Community Health Centre, to its estimates for their building and staffing programme in the last half of the Second Malaysia Plan.

Community Health Centre

A Community Health Centre has the following features:

a) it is a smaller and cheaper unit to operate than a Subcentre and can be established quickly;

b) it can provide most of the services that a Health Subcentre can provide;

c) and at a later stage it can be upgraded to a Health Subcentre; in other words, it can be called a Phase I Health Subcentre, depending on where it is located.

The Community Health Centre will cater for between 1 500 and 2 000 population, and as such, its location in Kampong and longhouse areas will be appropriate, especially in remote areas.

Organisationally, the Community Health Centre comes under the supervision of the Health Centre as part of a Health Subcentre. However, the technical supervision of the Medical Auxiliary may be easier handled by the Hospital Assistant in the Health Subcentre.

## 3.2 Physical Requirements and Costs

The following sections contain a description of the physical requirements and the investment and operational costs for different medical units. The standards and cost estimates are based on health projects, which are or will be implemented during the Second Malaysia Plan.

Table 3.1 shows 'average' investment and annual operation costs for different levels of the medical service.

TABLE 3.1: INVESTMENT AND ANNUAL OPERATION COSTS FOR DIFFERENT HEALTH UNITS. IN DOLLARS

| Health Unit / Cost Item | District Hospital | Main Health Centre | Health Sub Centre | Community Health Centre |
|---|---|---|---|---|
| | Costs in Dollars | Costs in Dollars | Costs in Dollars | Costs in Dollars |
| Investment Costs: | | | | |
| Clinic Buildings* | 858 000 | 186 500 | 69 800 | 40 000 |
| Equipment | 220 000 | 60 000 | 9 000 | 9 000 |
| Quarters | 432 000 | 341 000 | 86 000 | 26 000 |
| Total | 1 510 000 | 587 500 | 164 800 | 75 000 |
| Operation Costs: | | | | |
| Emoluments | 225 000 | 85 000 | 33 000 | 16 000 |
| Services and Supply | 100 000 | 11 000 | 10 000 | 4 000 |
| Maintenance** | 25 000 | 10 000 | 3 000 | 1 300 |
| Total | 350 000 | 106 000 | 46 000 | 21 300 |

* Including contingencies

** Maintenance of Clinic buildings and Quarters

In the annual operation cost is included maintenance of buildings, based on a rate of 2 percent of the investment cost in buildings. The costs of services and supply for a Main Health Centre appear to be in the lower range, as they are at the same level as for a Sub Centre.

From Table 3.1 it appears that the cost of quarters exceeds the cost of clinic buildings both in the case of a Main Health Centre and of a Sub Centre, and that housing generally covers a large part of the investment costs. In general this raises the questions (1) whether the standard of quarters is too high and (2) whether a more restricted number of the staff should be provided with houses on the public budget?

### 3.2.1 District Hospital

As a model for a District Hospital has been chosen the hospital in Serian. This unit will be finished in 1974-75, and will have 40 beds, which initially will serve a population of about 85 000. The hospital will require a 10 acre site with another 10 acres in reserve for future extensions.

The net floor space of the hospital buildings is estimated at nearly 24 000 square feet. The total costs of hospital buildings and equipment amount to $1 078 000 or $27 000 per bed. When staff quarters are included in

TABLE 3.2: DISTRICT HOSPITAL. PHYSICAL REQUIREMENTS AND INVESTMENT COSTS

| Facility | Floor Space in sq. ft. | Costs in Dollars | Remarks |
|---|---|---|---|
| Adm Block - Outpatients | 4 790 | 96 000 | |
| Operating Theatre, Dental Clinic X-ray & Lab Block | 4 670 | 117 000 | |
| Paediatric Ward Block | 2 130 | 43 000 | |
| Male Ward Block | 2 130 | 43 000 | |
| Female Ward Block | 2 130 | 43 000 | |
| Maternity Block | 2 670 | 54 000 | |
| Children's Ward Block | 1 780 | 38 000 | |
| Kitchen & Laundary Block | 1 600 | 32 000 | |
| Mortuary Tool Shed | 870 | 18 000 | |
| Garage | 870 | 18 000 | |
| Air-conditioning | | 50 000 | |
| Water Supply | | 35 000 | |
| Electricity Supply | | 10 000 | |
| Drainage | | 70 000 | |
| Roads | | 50 000 | |
| Furniture | | 73 000 | $2.5 per sq. ft. |
| Fencing | 1 500 linear ft. | 12 000 | |
| Contingencies | | 56 000 | |
| Hospital Buildings | 23 640 | 858 000 | |
| Hospital Equipment | | 220 000 | |
| Class II Houses | 2 800 per unit | 180 000 | 3 units |
| Class III House | 1 400 per unit | 30 000 | 1 unit |
| Class IV Houses | 1 300 per unit | 40 000 | 2 units |
| 1 Room Barrack Blocks | | 30 000 | 4 units |
| 2 Room Barracks | | 20 000 | 2 units |
| Nurses Accommodation | 5 500 | 110 000 | |
| Furniture | | 22 000 | |
| Total Quarters | | 432 000 | |
| Grand Total | | 1 510 000 | |

TABLE 3.3: MAIN HEALTH UNIT. PHYSICAL REQUIREMENTS AND INVESTMENT COSTS

| Facility | Floor Space in sq. feet | Costs in Dollars | Remarks |
|---|---|---|---|
| Clinic Buildings | 4 000 | 100 000 | |
| Land Preparation | | 7 000 | |
| Piling | | 2 000 | |
| Roads | | 2 000 | |
| Electricity | | 40 000 | |
| Drainage | | 1 000 | |
| Garage | | 15 000 | |
| Furniture | | 7 500 | |
| Equipment | | 60 000 | |
| Fencing | 520 linear feet | 4 000 | |
| Contingencies | | 8 000 | |
| Clinic Buildings & Equipment | 4 000 | 246 500 | |
| Class II Houses | | 120 000 | 2 units |
| Class III Houses | | 60 000 | 2 units |
| Class IV Houses | | 80 000 | 4 units |
| 2 room Barracks | | 60 000 | 6 units |
| Furniture | | 21 000 | |
| Total Quarters | | 341 000 | |
| Grand Total | | 587 500 | |

When in full operation the recurrent cost of a Main Health Centre is worked out to be annually a total of $106 000, of which $85 000 covers emoluments and $11 000 services and supply. The costs of services and supply seem to be somewhat out of proportion compared to the size of this item for other medical units. The maintenance of clinic buildings and quarters totals about $10 000 annually, of which only $3 700 refer to the clinic building.

3.2.3 Health Sub Centre

In the Mid Term Review of the Second Malaysia Plan the costs of three different projects have been worked out, namely for a Sub Centre located in (1) an accessible area, (2) a rural area and (3) a remote area. Table 3.4 gives the investment costs for (1), which corresponds to the Sub Centre in Tun Openg Bazaar. The investment costs of Sub Centres in rural and remote areas are estimated to be respectively 30 and 50 percent higher than for a centre located in an accessible area.

A Sub Centre will occupy about 2 acres of land, which would accommodate clinic building and quarters.

The total costs of clinic building, equipment and quarters amount to $165 000. The cost of water and electricity supply has not been included in the estimates from the Medical Department.

Excluding quarters the costs of a Sub Centre amount to $80 000 the annual operating cost is in total $46 000, of which $33 000 are emoluments $10 000 recurrent expenditures and $3 000 maintenance.

TABLE 3.4: HEALTH SUB CENTRE. PHYSICAL REQUIREMENTS AND INVESTMENT COSTS

| Facility | Floor Space in sq. feet | Costs in Dollars | Remarks |
|---|---|---|---|
| Clinic Building | 2 000 | 40 000 | |
| Garage | | 5 000 | |
| Boat Shed | | 10 000 | |
| Toilet | | 5 000 | |
| Electricity | | | |
| Water | | | |
| Furniture | | 5 000 | |
| Equipment | | 9 000 | |
| Fence | 600 linear feet | 4 800 | |
| Clinic Building & Equipment | | 78 800 | |
| 2 Room Barracks | | 40 000 | 5 units |
| Class IV Quarters | | 40 000 | 2 units |
| Furniture | | 6 000 | |
| Total Quarters | | 86 000 | |
| Grand Total | | 164 800 | |

### 3.2.4 Community Health Centre

The Community Health Centre is regarded as the first phase of a Health Sub Centre. Hence, some of the facilities, like the clinic building and land requirements will be the same as for a Sub Centre.

The costs of a Community Health Centre including quarters total $90 000.

Annual emoluments fo this unit turns out to be $16 000, the services and supply amounts to $4 000 and maintenance $1 300, in total $21 300.

## 3.3 Staff Requirements

The staff requiremen s for different medical units are shown n Table 3.6. The division of staff in groups is according to the syste indicated on page 5 in "Revision of Salaries and Terms and Conditions of Officers in the Public Services in East Malaysia (Sarawak), Kuching, November, 1971.

TABLE 3.5: COMMUNITY HEALTH CENTRE. PHYSICAL REQUIREMENTS AND INVESTMENT COSTS

| Facility | Floor Space in sq. feet | Costs in Dollars | Remarks |
|---|---|---|---|
| Clinic Building<br>Toilet<br>Boatshed<br>Equipment | 2 000 | 40 000<br>5 000<br>10 000<br>9 000 | |
| Clinic Building & Equipment | | 64 000 | |
| 2 Room Barracks<br>Furniture | | 24 000<br>2 250 | 3 units |
| Total Quarters | | 26 250 | |
| Grand Total | | 90 250 | |

ABLE 3.6: STAFF REQUIREMENTS

| Professional Classification / Medical Unit | Professional (i) | Sub Professional (ii) | Clerical & Technical (iii) | Manual (iv) | Total |
|---|---|---|---|---|---|
| District Hospital | 2 | 4 | 10 | 6 | 22 |
| Main Health Centre | 2 | 2 | 9 | 5 | 18 |
| Health Sub Centre | | 2 | 6 | 4 | 12 |
| Community Health Centre | | | 4 | 3 | 7 |

and Sub District. The population also varies much among the Districts, i.e. from about 17 000 in Lawas to about 215 000 in Kuching. However, most of the Districts' population are about 45 000 people, which has been chosen as an 'average' for this level. The minimum population for a Sub District has been found to lie between 15 and 20 000 people. The latter population threshold seems also to be the minimum before a Local Council is established.

## 4.1 Government Administrative Offices

It has been the practice in the past to concentrate all Government administration in one building block. There are obvious reasons for this deliberate concentration, namely security and the ease with which members of the public and the Government officers themselves can go from one department to the other. Today such practice is still continued as it can be seen in the building of a State Government Office complex in Long Lama and in the proposals for a Federal Government Office complex in Limbang. An additional advantage for concentrating departments in one coherent building compound is the savings in land, building costs and the costs of provision of essential public utilities. However, the building of such compounds could pose certain difficulties with regard to future extensions of the offices.

The following descriptions therefore assume that whatever State or Federal Government departments that can be grouped together will be housed under one building complex for the State offices and one for the Federal offices, unless specific departments have their policies to house their staff in separate buildings.

The "traditional" practice was to group the following departments together: the Court room, the Administrative Office, the Treasury, the Registration of Births and Deaths, the Post Office, Cooperative Department, Labour Office, Forest Department, Agricultural Department and the Immigration Office.

With the formation of Malaysia things have changed slightly with regard to control of Departments. Certain departments that were formerly under State are now directly under Federal control, and this new arrangement affects the grouping of Departments that were formerly found in association with the District Administrative Officer's Department. Departments that were formerly under State Government control but are now under Federal are Education, Immigration, Cooperative Department, Labour, Information.

4.1.1 Physical Requirements and Costs

The investment and operation costs for District and Sub District Offices are shown in Table 4.1. The State building complex house the D.O.'s office, the Courts, the National Registration of Births and Deaths, Probate Office, the Treasury, the Agricultural and the Forest Department of which the first four offices are located within the District Office.

TABLE 4.1 DISTRICT AND SUB DISTRICT OFFICES. INVESTMENT AND ANNUAL OPERATION COSTS. IN DOLLARS

| Administrative Level / Cost Item | District | | | | Sub District | |
|---|---|---|---|---|---|---|
| | State Offices | | Federal Offices | | | |
| | Size in sq.feet | Costs in Dollars | Size in sq.feet | Costs in Dollars | Size in sq.feet | Costs in Dollars |
| INVESTMENT COSTS | | | | | | |
| Buildings: | | | | | | |
| District/Sub District Office | 4 160 | 64 000 | | | 1 720 | 22 000 |
| Agriculture | 2 220 | 28 000 | | | 760 | 10 000 |
| Forestry | 645 | 8 500 | | | 660 | 8 500 |
| Treasury | 690 | 9 000 | | | 360 | 5 000 |
| Education | | | 1 005 | 16 000 | | |
| Immigration | | | 600 | 9 600 | | |
| Cooperative | | | 720 | 11 500 | | |
| Labour | | | 660 | 10 500 | | |
| Information | | | 2 445 | 39 000 | | |
| Toilet, lobbies, etc. | 1 500 | 24 000 | 1 300 | 20 000 | 400 | 5 000 |
| Ancillary Facilities: | | | | | | |
| Water supply | | 6 000 | | 4 000 | | 2 000 |
| Electricity | | 5 000 | | 4 000 | | 10 000 |
| Air conditioning | | 10 000 | | 50 000 | | - |
| Car Park | | 3 600 | | 2 500 | | - |
| Roads | | 4 100 | | 3 600 | | - |
| Flag Pole | | 500 | | 500 | | 500 |
| Furniture | | 10 000 | | 5 000 | | 2 000 |
| Equipment and Vehicles | | 110 000 | | 85 000 | | 15 000 |
| Contingencies | | 10 000 | | 10 000 | | 10 000 |
| Quarters: | 39 500 | 770 000 | | | 18 700 | 334 000 |
| TOTAL INVESTMENT | 48 715 | 1 062 700 | 6 730 | 271 200 | 22 600 | 424 000 |

con't.

TABLE 4.1 DISTRICT AND SUB DISTRICT OFFICES. INVESTMENT AND ANNUAL OPERATION COSTS. IN DOLLARS (Con't.)

| Administrative Level / Cost Item | District | | | | Sub District | |
|---|---|---|---|---|---|---|
| | State Offices | | Federal Offices | | | |
| | Size in sq.feet | Costs in Dollars | Size in sq.feet | Costs in Dollars | Size in sq.feet | Costs in Dollars |
| OPERATION COSTS | | | | | | |
| Emoluments | | 280 000 | | 300 000 | | 80 000 |
| Office Stationery | | 15 000 | | 10 000 | | 4 000 |
| Transport | | 70 000 | | 15 000 | | 15 000 |
| Water and Electricity | | 15 000 | | 30 000 | | 2 000 |
| Maintenance of Building | | 20 000 | | 2 000 | | 8 000 |
| TOTAL OPERATIONS | | 400 000 | | 357 000 | | 109 000 |

Based on a net floor space of about 9 000 square feet of State Government Offices excluding quarters and nearly 7 000 square feet for Federal Offices the total land requirements are estimated at a minimum of 1 acre for each building complex. The corresponding land requirements of a Sub District Office total about half an acre. However, the minimum area allocated to such an office should never be less than an acre in order to allow for future expansions. In general the mentioned area requirements should be regarded as absolute minimums, because land in Sarawak outside the large urban areas still can be purchased at a low cost.

The total investment cost for State Government offices at the District level is estimated at $1 060 000, of which as much as $770 000 is for Government quarters. It is assumed that 4 Class I/II, 9 Class III and 13 Class IV quarters are built. The investment costs for the Federal complex amount to $270 000. It is assumed that no quarters are supplied to the Federal Officers.

A 'complete' Sub District office is estimated to cost $420 000, of which again the quarters take the major part, namely $330 000. At the Sub District level 2 Class III and 12 Class IV quarters are built.

The annual operation cost for the State Government Offices at the District level is estimated at $400 000 and that for the Federal Offices at $357 000, while the recurrent expenditure for State Government offices at the Sub District level is about $110 000.

4.1.2 Staff Requirements

The staff requirements for the two levels are shown in Table 4.2. The grouping of the staff is according to the "Revision of Salaries and Terms and Conditions of Officers in Public Services in East Malaysia (Sarawak), Kuching, November, 1971."

TABLE 4.2. DISTRICT AND SUB DISTRICT STAFF REQUIREMENTS

| Professional Classification | District | | Sub District |
|---|---|---|---|
| | State Offices | Federal Offices | |
| Professional (i) | 5 | 4 | |
| Sub Professional (ii) | 11 | 10 | 2 |
| Clerical & Technical (iii) | 28 | 24 | 15 |
| Manual (iv) | 6 | 7 | 2 |
| Total | 50 | 45 | 19 |

## 4.2 Local Authorities

It is important that every large town or district has some form of Local Authority to administer some of the important public services. Such a Local Authority is normally known in Sarawak as the District Council, and in large towns as Kuching, the Municipal Status will be conferred.

The District Council is an elected body, which has a secretariate to administer the daily work. The size and functions of such a secretariate will depend on the population size and degree of urbanisation in the District.

The minimum population threshold for a District Council ranges from about 15 to 20 000 people. The investment and operation costs presented in Table 4.3 correspond to the minimum size of a District Council. A Council for a larger District would have additional facilities like a fire brigade and a public works section. The costs and physical requirements for a fire brigade is treated separately.

### 4.2.1 Physical Requirements and Costs

The physical requirements and costs of a District Council are shown in Table 4.3. The minimum land requirements for such an office are 0.5 acre. The total investment costs, excluding land, amount to $150 000, and the annual operational costs to $70 000.

TABLE 4.3 DISTRICT COUNCIL. INVESTMENT AND ANNUAL OPERATION COSTS. IN DOLLARS

| Cost Item | Size in sq. ft. | Costs in Dollars |
|---|---|---|
| INVESTMENT COSTS | | |
| Buildings | | |
| Office | 1 425 | |
| Store rooms and lobbies | 650 | |
| Council Chamber | 1 050 | 55 000 |
| Ancillary Facilities: | | |
| Air-conditioning | | 5 500 |
| Electrical Installations | | 4 000 |
| Water Connections | | 2 000 |
| Parking | | 5 000 |
| Road Access & Open Space | | 2 000 |
| Contingencies | | 5 000 |
| Equipment & Transport | | 73 000 |
| TOTAL INVESTMENT | 4 100 | 151 500 |
| OPERATION COSTS | | |
| Emoluments & Councillors fees | | 55 000 |
| Supply and Services | | 15 000 |
| Maintenance of Buildings | | 1 000 |
| TOTAL OPERATIONS | | 71 000 |

4.2.2 Staff Requirements

The staff requirements are shown in Table 4.4.

TABLE 4.4 DISTRICT COUNCIL STAFF REQUIREMENTS

| Group | Number of People |
|---|---|
| Sub Professional (ii) | 2 |
| Clerical & Technical (iii) | 5 |
| Manual (iv) | 10 |
| Total | 17 |

## 5. POSTAL SERVICES

In the Mid-Term Review of the Second Malaysia Plan the following introduction is given for the postal services:

> "Postal services will be expanded by constructing new post offices and introducing mobile and floating post offices. The programme provides for the construction of new post offices to replace inadequate ones, the building of branch offices in the larger towns and the introduction of mobile and floating postal facilities to serve people in the rural areas. The original programme for the construction of new post offices in Miri, Binatang, Kapit and Simunjan and for the expansion of the General Post Office in Kuching has now been revised to include provision for the establishment of additional post offices in Kenyalang Park, Lutong, Mukah and Lubok Antu as well as for the setting up of more mobile and floating postal facilities."

### 5.1 The Present Situation

The post offices in Sarawak are classified into three main categories, namely Class A, B and C. The volume of business, size of population and literacy rates appear to have been significant factors in determining the number and category of post offices in each Administrative

Division in Sarawak. Of the 6 Class A post offices in Sarawak today, one is located in each of First and Second Divisions, and two in each of Third and Fourth Divisions. Table 5.1 indicates the distribution of post offices by Class and Administrative Division. All the 48 post offices served a total population of 975 000. Owing to the uneven distribution of population it would be unrealistic to derive an average population threshold for, say, a Class A post office by dividing the total population by the number of Class A post offices, which in the present situation would give a standard of 1 Class A post office to 162 500 people. This would imply that the population sizes of the Second, Fourth and Fifth Divisions are still not large enough to support a Class A post office. This, however, is not the case. Again if the total population is divided by the number of post offices the ratio is 1 to about 20 000 which is a minimum population threshold adopted by the Department of Postal Services as sufficient to support a Class A post office. A close scrutiny of the postal business chart for the different Classes of post offices indicates that there are not only wide variations between the Classes but also among those of the same category. This tends to suggest that underutilization of the services provided for each centre, especially the smaller ones, may exist; while on the other hand, under-provision of services may exist in some of the larger ones.

TABLE 5.1 DISTRIBUTION OF POST OFFICES BY CLASS AND DIVISION

| Pop. 1970 | Administrative Division | Class A | Class B | Class C | Total |
|---|---|---|---|---|---|
| 347 000 | First Division | 1 | 7 | 1 | 9 |
| 137 000 | Second Division | 1 | 3 | 9 | 13 |
| 319 000 | Third Division | 2 | 8 | 3 | 13 |
| 135 000 | Fourth Division | 2 | 3 | 4 | 9 |
| 37 000 | Fifth Division | - | 2 | 2 | 4 |
| 975 000 | Total | 6 | 23 | 19 | 48 |

## 5.2 Derivation of Standards

The Department of Postal Services' population threshold for a Class A Post Office is between 20 000 and 30 000. This range coincides with thresholds for other services like Police, Medical Service and Education.

A hierarchy of postal establishments is proposed consequent to the existence of smaller centres and settlements that will have populations falling short of the threshold required for a Class A Post Office. This postal service hierarchy is made up of a series of five different types of units, each differentiated by its specific functions and population thresholds. These units, showed in Figure 5.1, are

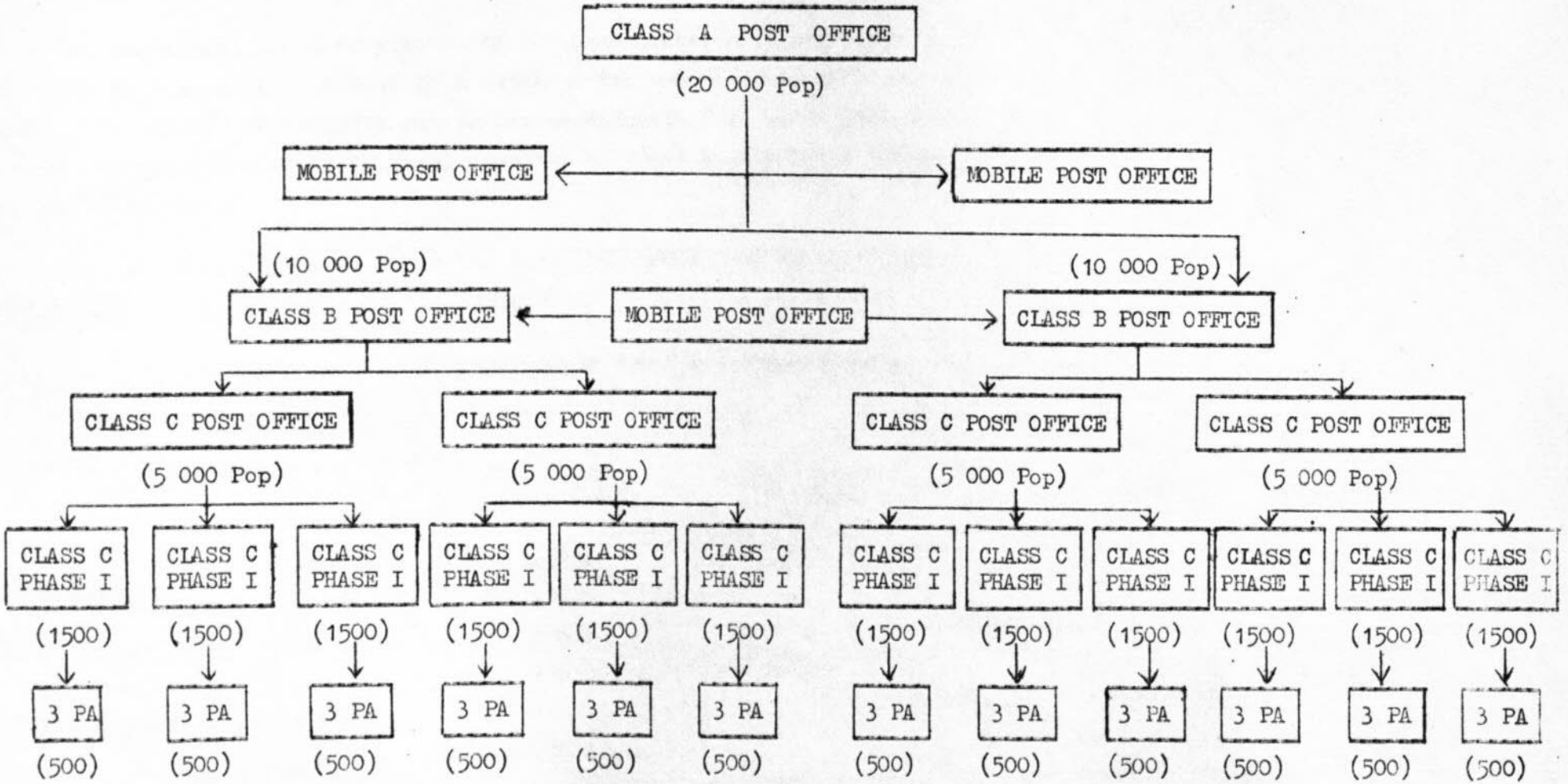
| Unit Type | Population Threshold |
|---|---|
| Class A Post Office | 20 000 |
| Class B " " | 10 000 |
| Class C " " | 5 000 |
| Class C Phase I Post Office | 1 500 |
| Postal Agency | 500 |

The hierarchy indicates that it is intended to create some sort of a Postal District, each with about 20 000 population and having the five different postal units. Figure 5.1 indicates that in a Postal District, the Class A Post Office will be supported by 2 Class B units, each of which is supported by 2 Class C units and each of which is supported by 3 Class C Phase I units; the smallest unit is the Postal Agency, three of which are sufficient to support a Class C Phase I Post Office.

The hierarchy system implies that units in the lower echelon are not able to provide all the services that those in the next higher rank are able to provide. This is only obvious for the following reasons: the population of Sarawak is widely scattered in centres of many different sizes and consequently these cannot justify the establishment of Post Offices of the same Class everywhere on economy, staffing and speed of establishment grounds. A hierarchy of postal units gives flexibility; thus the smallest unit, the Postal Agency will be located in the less accessible Kampong and longhouse areas where population is not only scattered but also small.

FIGURE 5.1

POSTAL SERVICES HIERARCHY




PA - POSTAL AGENCY

## 5.3 Physical Requirements and Costs

The investment and operation costs for each postal unit are given in Table 5.2. No cost estimates have been obtained for mobile or floating postal services. In the Mid-Term Review of the Second Malaysia Plan about $200 000 have been set aside for such services, compared to about $3.8 million for the total postal service.

Only $100 in investment costs for postal agencies have been indicated, as these will be located in existings shops.

The net floor space and land requirements for the different units are shown below.

| | Floor space in sq feet | Land area in acres |
|---|---|---|
| Class A | 3 500 | 0.5 |
| Class B | 2 500 | 0.4 |
| Class C | 1 000 | 0.3 |
| Class C I | 1 000 | 0.3 |

TABLE 5.2 POSTAL SERVICES. INVESTMENT AND ANNUAL OPERATION COSTS FOR DIFFERENT UNITS. IN DOLLARS

| Cost Item \ Postal Unit | Class A | Class B | Class C | Class C I | Postal Agencies |
|---|---|---|---|---|---|
| INVESTMENT COSTS | | | | | |
| **Buildings:** | 50 000 | 34 000 | 18 000 | 12 000 | - |
| Ancilliary Facilities: | | | | | |
| Air conditioning | 1 100 | 1 100 | - | - | - |
| Electrical & Water Connection | 3 000 | 2 500 | - | - | - |
| Road Access | 2 100 | 2 000 | 1 200 | 1 200 | - |
| Parking | 1 200 | 1 000 | 800 | - | - |
| Equipment & Transport | 45 800 | 24 200 | 19 800 | 2 300 | 100 |
| Contingencies | 10 000 | 4 300 | 2 400 | 1 100 | - |
| **Quarters:** | 220 000 | 80 000 | 40 000 | 20 000 | - |
| Total Investment | 333 200 | 149 100 | 82 200 | 36 600 | 100 |
| OPERATION COSTS | | | | | |
| Emoluments | 81 300 | 62 800 | 13 200 | 7 200 | - |
| Supply & Services | 9 600 | 4 900 | 2 000 | 700 | 200 |
| Maintenance of buildings | 1 000 | 700 | 500 | 200 | - |
| Total Operation Costs | 91 900 | 68 400 | 15 700 | 8 100 | 200 |

The total land requirements includes some open space, parking facilities and access roads.

## 5.4 Staff Requirements

The minimum staff requirements for different postal units are shown in Table 5.3.

TABLE 5.3. STAFF REQUIREMENTS

| Group \ Postal Unit | Class A | Class B | Class C | Class C Phase I |
|---|---|---|---|---|
| Managerial & Professional | - | | | |
| Executive & Sub professional | 2 | | | |
| Clerical & Technical | 8 | 3 | 2 | 1 |
| Subordinate & Manual | 6 | 8 | 2 | 1 |
| Total | 16 | 11 | 4 | 2 |

The staff requirements for a postal agency will normally be part-time and covered by a single person, usually a shopkeeper.

## 6. POLICE SERVICES

In this Chapter certain population thresholds for different police units relevent for planning purposes are set up. They should meet the demand for economic operation and the strategic requirements of a given police station in any specific locality. These population thresholds are designed to suit population centres of varying sizes.

### 6.1 The Present Situation

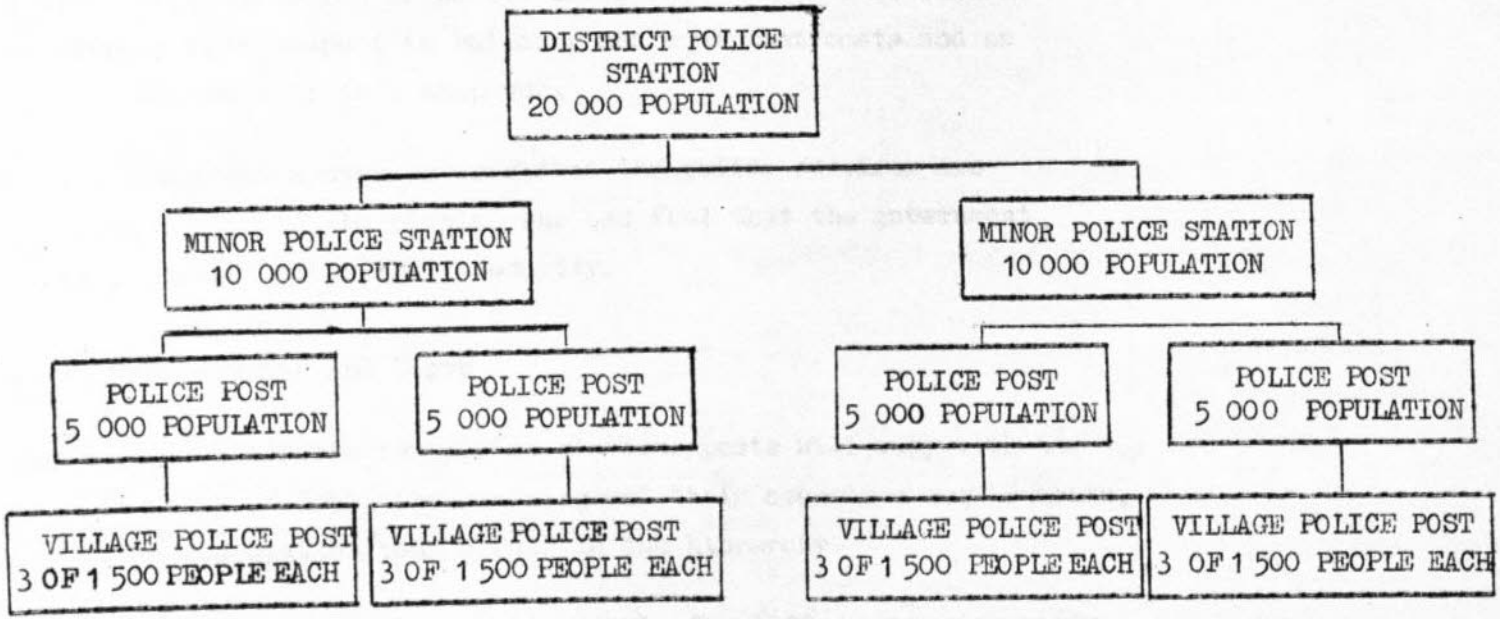
Generally, the location of police stations/posts is decided by the present settlement pattern and the local security situation. Although the present average for Sarawak is 1 policeman to every 239 population as compared to 1:317 in Malaya and 1:204 in Sabah, their distribution by geographical area is far from even. In 1970, for instance, the census returns showed that there were 332 policemen and detectives or 1 policeman to 178 persons in Miri District as compared to 1 to 1 437 in Baram District and 1 to 1 866 in Bintulu District.

In closed societies like longhouses and isolated remote Kampong areas one may not find any policeman even though the population of such settlements often exceed 500.

## 6.2 The Hierarchy of Police Stations

The chart below shows the hierarchy of police stations and posts in Sarawak and their related population thresholds.

FIGURE 6.1: HIERARCHY OF POLICE STATIONS



The existing hierarchial structure has several advantages namely:

i) The population thresholds for the four different levels of station/post corresponds roughly to those for other services like education, postal and medical services.

ii) The differentiation of police units into four levels ensures economy with respect to building and equipment costs and an optimal use of scarce manpower.

iii) The hierarchy system ensures that the police services are brought near to the people, who can feel that the government is concerned about their security.

## 6.3 Physical Requirements and Costs

Land area requirements for police stations/posts will vary with the locality, availability of land, the staffing and their operation requirements, i.e. it depends on the station/post's rank in the hierarchy.

The investment and annual operation costs for different police units are given in Table 6.1 with the detailed breakdown shown in the following tables.

District Police Station

A maximum of 5 acres is preferable for this unit, though 3 acres may be the basic minimum in urban centres where availability of land is limited and difficult to obtain.

This area will contain basically the administrative building, other ancillary buildings, parade ground etc. The detailed breakdown can be found in Table 6.2.

The total investment cost for this unit is $675 000 and the recurrent expenditure is $140 000 per annum. The detailed breakdown also appears from Table 6.2.

Minor Police Station

For this unit,a gross area from 2 to 3 acres is required. This area will be sufficient to accommodate an administration block of around 3 000 sq. ft., space for 2 quarters, 8 barrack type quarters, service area and parade ground.

Initial investment cost would be about $312 000. Recurrent expenditure is nearly $60 000.

TABLE 6.1. INVESTMENT AND ANNUAL OPERATION COSTS FOR DIFFERENT POLICE SERVICE UNITS (DOLLARS)

| Cost Item \ Police Unit | District Police Station | Minor Police Station | Police Post | Village Police Post |
|---|---|---|---|---|
| | Total | Total | Total | Total |
| Investment Costs: | | | | |
| Police Buildings | 204 500 | 133 500 | 77 600 | 10 700 |
| Equipment | 77 700 | 60 500 | 22 600 | 3 500 |
| Quarters | 360 000 | 103 000 | 25 800 | - |
| Contingencies | 33 000 | 15 000 | 6 300 | 700 |
| Total | 675 200 | 312 000 | 132 300 | 14 900 |
| Operation Costs: | | | | |
| Personal Emoluments | 114 000 | 44 000 | 15 460 | 3 340 |
| Services & Supply | 16 000 | 11 000 | 2 850 | - |
| Maintenance | 10 000 | 4 000 | 1 800 | 350 |
| Total | 140 000 | 59 000 | 20 110 | 3 690 |

Police Post

The land area required is around 1 acre and this includes an administrative block, a motor cycle shed, a service area and a 4 door barrack.

Investment cost is $132 300 and the recurrent expenditure is $20 000 per annum.

Village Police Post

For this unit an area of $\frac{1}{4}$ to $\frac{1}{2}$ acre will be sufficient. Total initial investment cost would be $14 900 and the recurrent expenditure would be $3 690 per annum.

## 6.4 Staff Requirements

Manpower requirement standards will have to be different between large urban centres and small semi-urban and rural settlements for very obvious reasons such as higher incidence of crime and other social disturbances in areas of large population concentration. The overall situation in Sarawak shows that between 1961 and 1970 the number of cases of crime reported to the police had increased 38.9 percent or an annual compounded rate of 3.4 percent growth. This situation therefore tends to suggest that more policemen would

be required to suppress the constantly rising rate of crime. With this view in mind it is suggested here that the urban standard be 1 policeman to 250 population and in semi urban/rural settlements, 1 policeman to 500 population. Some of which, for instance detectives, could be stationed in towns from where they can move out to places where they are needed. In this context therefore any police station/post of the Minor Police Station class and below is considered to have a location in semi urban/rural settlements. The staff requirements are shown in Table 6.2.

TABLE 6.2. STAFF REQUIREMENTS

| Police Unit / Classification | District Police Station | Minor Police Station | Police Post | Village Police Post |
|---|---|---|---|---|
| Managerial & Professional (i) | - | - | - | - |
| Executive & Sub professional (ii) | 2 | - | - | - |
| Clerical & Technical (iii) | 5 | 3 | - | - |
| Subordinate & Manual (iv) | 25 | 9 | 5 | 1 |
| | 32 | 12 | 5 | 1 |

TABLE 6.3. DISTRICT POLICE STATION: PHYSICAL REQUIREMENTS AND INVESTMENT COSTS

| Facility | Floor space (sq. ft.) | Total Cost ($) |
|---|---|---|
| Buildings: | | |
| Administration Building | 4 000 | 80 000 |
| Other ancillary buildings | 4 000 | 80 000 |
| 1 Generator house | 400 | 8 000 |
| 1 Toilet | 450 | 5 000 |
| 1 Garage with 4 parking space | 512 | 2 000 |
| Ancillary facilities: | | |
| Security fencing | 1 500 linear ft. | 12 000 |
| Electrical installation | | 3 000 |
| Water supply installation | | 2 000 |
| 1 Flag pole | | 500 |
| 1 Parade ground | | 12 000 |
| 1 Standby generator | | 10 000 |
| Communication equipment | | 31 000 |
| 2 Land Rovers | | 30 000 |
| 1 Heavy motor cycle | | 2 500 |
| Furniture for station | | 2 000 |
| 2 Air conditioners | | 2 200 |
| Total | | 282 200 |
| Quarters: | | |
| 6 unit quarters | 5 760 | 150 000 |
| 2 x 12 door barracks | 14 000 | 190 000 |
| Furniture | | 20 000 |
| Total | | 360 000 |
| Contingencies | | 33 000 |
| GRAND TOTAL | | 675 200 |

TABLE 6.4 DISTRICT POLICE STATION. RECURRENT EXPENDITURE PER ANNUM.
IN DOLLARS

| PERSONAL EMOLUMENTS | DOLLARS |
|---|---|
| 2 inspectors | 12 000 |
| 1 Sergeant | 5 300 |
| 3 Corporals | 17 500 |
| 20 Constables | 62 400 |
| 3 Constable/drivers | 9 720 |
| 1 Clerk Typist | 3 020 |
| 2 IMG | 4 200 |
| TOTAL | 114 140 |
| **OPERATING EXPENDITURE** | |
| Telephone rentals | 510 |
| Maintenance of radio equipment | 1 800 |
| Vehicle maintenance and petrol | 7 600 |
| Water | 150 |
| Electricity | 800 |
| Office Stationary | 5 000 |
| Maintenance of buildings | 10 000 |
| TOTAL | 25 860 |
| GRAND TOTAL | 140 000 |

TABLE 6.5. MINOR POLICE STATION: PHYSICAL REQUIREMENTS AND INVESTMENT COSTS.

| Facility | Floor space (sq. ft.) | Total cost in Dollars |
|---|---|---|
| Buildings | | |
| Administration Building | 3 000 | 60 000 |
| Other ancillary buildings | 2 000 | 40 000 |
| 1 Generator house | | 8 000 |
| 1 Toilet | | 2 500 |
| 1 Garage with 2 parking spaces | | 1 000 |
| Ancillary Facilities | | |
| Security fencing | 1 440 linear ft. | 11 500 |
| Electrical installation | | 2 000 |
| Water supply installation | | 2 000 |
| 1 Flag pole | | 500 |
| 1 Parade ground | | 6 000 |
| 1 Standby generator | | 10 000 |
| Communication equipment | | 31 000 |
| 1 Land Rover | | 15 000 |
| 1 Heavy motor cycle | | 2 500 |
| Furniture | | 2 000 |
| Total | | 194 000 |
| Quarters | | |
| 2 Quarters | | 50 000 |
| 1 barrack block (8 doors) | | 48 000 |
| Furniture | | 5 000 |
| Total | | 103 000 |
| Contingencies | | 15 000 |
| GRAND TOTAL | | 312 000 |

TABLE 6.6 MINOR POLICE STATION. RECURRENT EXPENDITURE PER ANNUM. IN DOLLARS

| | |
|---|---|
| Personal Emoluments | |
| 1 Sergeant | 6 300 |
| 1 Corporal | 5 500 |
| 8 Police Constables | 26 720 |
| 1 Clerk/Typist | 3 024 |
| 1 IMG | 2 100 |
| Total | 43 644 |
| OPERATING EXPENDITURE | |
| Telephone rental | 510 |
| Maintain charges for radio equipment at 10% of per annum | 1 800 |
| Vehicle maintenance | 3 500 |
| Motor cycle maintenance | 600 |
| Water consumption | 150 |
| Electricity consumption | 480 |
| Office stationary | 4 200 |
| General maintenance of buildings at 2% of capital cost | 4 000 |
| TOTAL | 15 240 |
| GRAND TOTAL | 58 884 |

TABLE 6.7 POLICE POST: PHYSICAL REQUIREMENTS AND INVESTMENT COSTS

| Facility | Floor space (sq. ft.) | Total cost in Dollars |
|---|---|---|
| Buildings: | | |
| Administration building | 3 500 | 70 000 |
| Toilet | | 700 |
| Ancillary Facilities: | | |
| Communication equipment | | 11 100 |
| 4 Heavy motor cycles | | 10 000 |
| Furniture | | 1 500 |
| 1 Flag pole | | 500 |
| Security fencing | 800 linear ft. | 6 400 |
| Quarters: | | |
| 4 door barrack | | 24 000 |
| Furniture | | 1 800 |
| Contingencies | | 6 300 |
| TOTAL | | 132 300 |

TABLE 6.8 POLICE POST. RECURRENT EXPENDITURE PER ANNUM. IN DOLLARS

| | |
|---|---|
| EMOLUMENTS | |
| 4 Police Constables | 13 360 |
| 1 IMG | 2 100 |
| Total | 15 460 |
| OTHER OPERATING EXPENDITURE | |
| Maintenance charges for radio equipment at 10% p.a. | 200 |
| Motor cycle maintenance for 4 vehicles | 2 400 |
| Electricity | 150 |
| Water consumption | 100 |
| General building maintenance | 1 800 |
| Total | 4 650 |
| GRAND TOTAL | 20 110 |

TABLE 6.9. VILLAGE POLICE POST. PHYSICAL REQUIREMENTS AND INVESTMENT COSTS

| Facility | Floor space (sq.ft.) | Total cost in Dollars |
|---|---|---|
| Buildings: | | |
| Administration building | | 7 000 |
| Toilet | | 500 |
| Ancillary Facilities: | | |
| Communication equipment | | 3 500 |
| Fencing | | 3 200 |
| Contingencies | | 700 |
| GRAND TOTAL | | 14 900 |

TABLE 6.10. VILLAGE POLICE POST. RECURRENT EXPENDITURE PER ANNUM. IN DOLLARS

| | |
|---|---|
| Personal Emolument | 3 340 |
| Other operational expenses | |
| Maintenance charges for radio equipment at 10% | 350 |
| GRAND TOTAL | 3 690 |

## 7. FIRE BRIGADE

The fire services in Sarawak, in general, are poorly developed, but when compared with other developing countries Sarawak may be more advanced. In Sarawak itself, the best developed fire services are in Kuching, Sibu and Miri.

In the Kuching urban area there were about 43 firemen of all grades serving a total of around 100 000 population in 1971, thus giving a fireman-population relationship of around 1 to 2 300.

Fire occurrences in Sarawak are generally infrequent, possibly due to frequent heavy rainfall, short dry spells, the use of not easily inflammable building materials, building density controls and observance of fire precaution rules. The frequency of genuine fire outbreaks in Kuching in 1971, for instance, was 0.9 calls per week.

The effectiveness of a fire service depends not so much on the number of firemen available as on the type of firefighting equipment used, the alertness and training of the firemen, on the organisation of operations, the location of the station, the type of fire and the availability of fire extinguishing agents.

The following is a brief description of the minimum size and staffing of fire brigades at the District and Subdistrict level located in urban centres of 10 000 and 5 000 people respectively.

## 7.1 Physical Requirements and Costs

The major fire fighting equipment comprises of the following: Fire engines and pumps, fire ladders, compressed air breathing apparatus, foam making equipment and fire hoses.

The physical requirements and costs for the two different types of fire stations are shown in Table 7.1, which shows an investment cost including quarters of $380 000 for a District Fire Brigade and $150 000 for a Sub District Brigade. The annual operation costs for the two levels are $34 000 and $16 000 respectively.

The total land requirements for a District Fire Brigade are estimated 1.5 acres, for a Sub District Fire Brigade 0.8 acres.

TABLE 7.1 DISTRICT AND SUB DISTRICT FIRE BRIGADE, PHYSICAL REQUIREMENTS AND COSTS. IN DOLLARS

| Cost Item | District Fire Brigade | | Sub District Fire Brigade | |
|---|---|---|---|---|
| | Size in sq.feet | Costs in Dollars | Size in sq.feet | Costs in Dollars |
| INVESTMENT COSTS | | | | |
| Buildings: | | | | |
| Buildings including parking space for engines | 1 800 | 40 000 | 1 000 | 25 000 |
| Ancillary facilities: | | | | |
| Water supply | | 2 000 | | 1 000 |
| Electricity | | 2 000 | | 1 000 |
| Car park | | 800 | | 500 |
| Roads | | 1 600 | | 1 000 |
| Fencing | | 8 000 | | 5 800 |
| 2 Fire engines | | 136 000 | | 36 000 |
| Equipment | | 2 000 | | 1 000 |
| Quarters: | 41 000 | 190 000 | 17 000 | 80 000 |
| TOTAL INVESTMENT | 42 800 | 382 400 | 18 000 | 151 300 |
| OPERATION COSTS | | | | |
| Emoluments | | 26 000 | | 12 000 |
| Services & supply | | 4 000 | | 2 000 |
| Maintenance of buildings | | 4 000 | | 2 000 |
| TOTAL OPERATIONS | | 34 000 | | 16 000 |

## 7.2 Staff Requirements

The staff requirements for the two Units are shown in Table 7.2.

TABLE 7.2 STAFF REQUIREMENTS

| Group | District Fire Brigade | Sub District Fire Brigade |
|---|---|---|
| Clerical & Technical (iii) | 1 | |
| Manual (iv) | 9 | 5 |
| | 10 | 5 |

# PART II

## TRANSPORT

Chapter: 1. ROAD COSTS

2. TRUCK TRANSPORT COSTS (See separate Working Paper)

## 1. ROAD COSTS

In this part is presented some estimates of road construction and maintenance costs for budgetary purposes. The estimates are based on information supplied by Public Works Department, Kuching and data from land development schemes and timber companies.

### 1.1 Construction of Main Public Roads

The function of main public roads is to connect the major centres of the country together and provide access to main development areas. There are four road standards, Trunk road, Secondary road, Improved Feeder road and Feeder road. The main design criteria for the road standards are set forth by PWD. In Table 1.1 is presented estimated cost of constructing main public roads according to the PWD design criteria.

### 1.2 Construction of Local Roads

Road access to villages, smaller centres and individual farms are to be provided by local roads of lesser standard. In Table 1.2 is presented cost estimates for four classes of local roads. The local roads are low-cost roads of low alignment standard with no built in features which allow for future improvement to main road standards.

TABLE 1.1 ESTIMATED COST OF CONSTRUCTING AND IMPROVING MAIN PUBLIC ROADS

A. Cost of New Construction[1)]

| Road standard | Design | | | Costs in 1 000 M$ per mile | | |
|---|---|---|---|---|---|---|
| | Surface type | Width in Formation | feet of Pavement | Construction | Surface | Total |
| Trunk Road | pre-mix | 36 | 24' | 260 | 260 | 520 |
| Secondary Road | pre-mix | 30 | 20' | 200 | 220 | 420 |
| Improved Feeder Road | bitum sealing | 30 | 18' | 150 | 150 | 300 |
| Feeder Road | gravel | 28 | 14' | 120 | 30 | 150 |

B. Cost of Improvement[1)]

| Standard | | Costs in 1 000 M$ per mile | | |
|---|---|---|---|---|
| From | To | Construction | Surface | Total |
| Improved Feeder Road | Modified Trunk-road | ? | ? | ? |
| Feeder Road | Modified Trunk-road | 180 | 260 | 440 |

con't.

TABLE 1.1 ESTIMATED COST OF CONSTRUCTING AND IMPROVING MAIN PUBLIC ROADS (Con't.)

C. Bridge Construction Costs (Permanent bridges over 40 feet)

| | | |
|---|---|---|
| Concrete and Steel bridges | Pavement width 24' | Cost per linear foot M$ 1 200 |

Note: 1) Exclusive major bridges and land aquisition.

TABLE 1.2 ESTIMATED COSTS OF LOCAL ROADS (Low Cost Roads)

Note: Stone Costs

| | |
|---|---|
| Cost of crushed stone ex quarry | M$ 6 |
| Transport (30 miles at $0.26 per cu. yd. mile): | M$ 8 |
| Total Cost at Work Site : | M$ 14 |

con't.

TABLE 1.2 ESTIMATED COSTS OF LOCAL ROADS (Low Cost Roads) (con't)

| | M$ per mile |
|---|---|
| 1. Local Primary Road: 18–20 feet wide Pavement | |
| Basic Construction Costs (Earthworks, drainages etc) | 24 000 |
| 8" Stone Pavement (2 600 cu. yd. per mile) | 36 000 |
| Total | 60 000 |
| 2. Local Secondary Road: 14 feet wide Pavement | |
| Basic Construction Costs (Earthworks, drainage etc) | 11 000 |
| 6" Stone Pavement: 1 370 cu. yd. per mile | 19 000 |
| Total | 30 000 |
| 3. Local Tertiary Road: 10 feet wide Pavement | |
| Basic Construction Costs (Earthworks, drainage etc) | 7 000 |
| 4" Stone Pavement: 650 cu. yd. per mile | 9 000 |
| Total | 16 000 |
| 4. Earth Road (Track): 10 feet wide | |
| Basic Construction Costs | 6 000 |

5. Bridges for Local Roads (Over 40 feet length)

Width 14 feet; Timber: M$ 400 per linear foot

Bailey: M$ 700 per linear foot

## 1.3 Road Maintenance Costs

The cost of maintaining main public roads, both paved roads, gravel and stone roads, are estimated to;

Routine Maintenance: M$ 5 000 per mile per year
Periodic " : M$12 000 per mile each 4th year

The cost of maintaining local roads are roughly estimated to be as follows;

Local Primary Road : M$ 3 500 per mile per year
Local Secondary Road: M$ 2 500 per mile per year
Local Tertiaty Road: M$ 1 500 per mile per year
Earth Road : M$ 1 500 per mile per year

## 1.4 Road Administration

The Public Works Department is at present responsible for the construction and maintenance of the main public road network and access roads to microwave stations and land development schemes. Local councils in Sarawak are in general responsible for the maintenance only of roads in the urban areas, while local rural roads are generally under the responsibility of the Civil Administration. The construction of local roads are usually carried out on a 'gotong royong' (communal work) basis with the people in the area supplying the labour. Maintenance of these roads is the responsibility of the people benefiting from the roads.

The present system of road administration has worked well up to now. The increasing modernization and specialization of the society indicates, however, that the system ought to be reviewed. A revised organizational setup might be;

1) Local Councils

It is considered that only the councils in the main urban areas are in a position to build up a rational and efficient road maintenance organisation. The construction of roads in these urban areas (e.g. Kuching, Sibu, Miri) can be undertaken by PWD or private contructors on request by the Council.

2) P.W.D.

P.W.D. should as now be responsible for all main public roads and for access roads (local roads) to estates, groups of individual farms and smaller centres and for roads within the smaller urbanized areas.

3) Private Roads

It is suggested that all roads within estates and farms except the public access road should be the responsibility of the estate and the individual farmer.

The essence of this proposal is that the responsibility of the PWD should be extended to include local access roads such as the local roads in Riam and Bakam and roads now maintained by the District Councils. This additional activity of PWD could e.g. be financed through a State Road Fund based on a local gasoline tax of say a few cents per gallon.

1.5 Road Network Density

Road access is a prerequisite for modern agricultural development, the farmer must have a suitable opportunity to bring in agricultural inputs such as fertilizers etc, to evacuate the farm produce and provide access to public and private services.

It can as an example be argued that any farm in a Development Area should in average not be more than $\frac{1}{2}$ mile from the nearest public road, constructed and maintained as a public service. The minimum local access road requirement in agricultural Development Areas with individual farms would then be about 0.4 chains (rubber) to 1.3 chains (oil palm) of access and harvesting roads per gross area. Of this about 0.13 chains per acre would be secondary access road.





SJ/CPC/VS
23.10.1973.

# PART III

## PUBLIC UTILITIES

1 WATER SUPPLY

2 SEWAGE AND EFFLUENT DISPOSAL

3 ELECTRICITY SUPPLY - in preparation

4 TELECOMMUNICATIONS - in preparation

5 CLEANSING AND REFUSE DISPOSAL - in preparation

# PUBLIC UTILITIES

## 1. WATER SUPPLY

### 1.1 General

#### 1.1.1 Introduction

The need for a sufficient supply of pure water to all members of the population may be taken as fundamental in any society, and no justification of this need is thought necessary. The meaning of the words "sufficient" and "pure" will be discussed in following sections. The practicability of providing water supplies to small scattered communities however requires examination, and in these circumstances a compromise may be needed both on the quality and quantity of the water.

Sarawak is fortunate in its climate and topography in that it possesses many rivers with dependable flows sufficient for large water supplies, and they are well distributed across the country. On the other hand natural gradients in the populated areas tend to be very flat, and hence water supply to larger towns by gravity is seldom possible. As a result of these two characteristics a pattern has been established for the engineering of the larger water supplies, which commonly makes use of a river intake without weir, treatment works beside the river, and pumping through a pipeline of appreciable length to supply the main service reservoir or reservoirs for the town or other

settlement. In the case of coastal towns the length of the pipeline is usually determined solely by the need to abstract water sufficiently far inland to avoid salinity due to intrusion of sea water at times of very low flow. Pollution of the rivers upstream of water intakes is thought to be negligible at present so far as the treated urban supplies are concerned, but a health risk exists in the very common use of untreated river water supplies by the rural communities inland.

1.1.2 Alternatives available

It is possible to provide water supplies by a number of means other than that outlined in the introduction, such as by use of rain water stored from run-off from the roofs of buildings (roof catchments), by abstraction from ground water, or by impounded storage at dams. In addition variations on the river abstraction method can be made if there is available a significant drop in elevation between the source and the settlement or along the path of the river or stream. Various approaches are more suited to settlements of one size rather than another, as is shown on the following table (Table 1). This table contains a number of generalisations and is included to give background information. Types of supply numbered 1 to 5 are all used in small supply schemes for longhouses and kampongs by the Rural Health Improvement Scheme, and no treatment is given in these circumstances. Types 2, 5 & 6 are suitable, with treatment, for towns of any size but, due to Sarawak conditions as explained above, only Type 5 is in common use. We consider that greater use should be made of roof catchments (Type 3) with individual house storage tanks in situations where there is no possibility to provide a piped water supply.

TABLE 1 WATER SUPPLY ALTERNATIVES

| Type No | Description | Order of Cost | Sensitivity to Dry Spells | Water Quality | Water Treatment Requirement | Level of Maintenance Needed | Suitable in principle for | Normally Used for |
|---|---|---|---|---|---|---|---|---|
| 1 | Shallow Wells | Cheap | Considerable | Variable | Variable | Slight | Very small settlements | Very small settlements |
| 2 | Gravity supply from river | Moderate | Considerable | Variable | Essential | Slight | All sizes | Small inland settlements |
| 3 | Roof Catchments | Moderate | Extreme | Good | Slight | High | Very small settlements | Very small settlements |
| 4 | Hydraulic ram supply from river | Moderate | Considerable | Variable | Desirable | Slight | Small settlements | Small settlements |
| 5 | Pumped river Abstraction | Expensive | Considerable | Variable | Essential | High | All sizes | Towns |
| 6 | Impounded gravity supply (dams) | Expensive | Slight | Good | Desirable | Medium | Towns | Not used |

These conditions will apply to scattered settlers houses and also to the water needed for any cattle owned by such settlers. (Details will be supplied later.)

For the purposes of this Manual, Type 5 only will be considered in detail. However there may well be particular cases in the Study Area where Type 6, impounded source, should be considered at the stage of detailed feasibility studies. The possible advantages are reliability of supply in dry spells, reduced length of pipeline, and the ability to maintain a small but sufficient catchment area as an unexploited and unpolluted reserve. This last reason may assume major importance in later stages of development of the Region.

While the use of untreated water supplies is unavoidable from practical considerations in small scattered communities, it cannot be recommended. The much greater availability of treated water in large communities, with elimination of many health risks as a result, is one reason among many why urbanisation of the rural areas is recommended by our Study.

### 1.1.3 Public Health Effects and Precautions

Many diseases can be transmitted by impure water supplies. The list is headed by cholera and typhoid, which are fortunately reasonably well under control in Sarawak at present, although their occasional development in epidemic form due to contaminated water supplies is an ever-present risk. Large numbers of cases of dysentery and gastro-enteritis occur in the State, and it can safely be assumed that much of this is conveyed by water. The reduction of these debilitating diseases, which can be fatal in infants, must be a high priority of policy. The virus diseasesof polio-myelitis and infectious hepatitis are also known to be water-borne, and the latter occurs in the State in significant numbers.

The experience in epidemics of water-borne disease in Europe and other more economically developed countries in the last 40 years, in circumstances where it has been possible to identify the source with some certainty, had led to the conclusion that more than one "line of defence" against infection should always be provided. That is to say one disinfecting process should be sure of remaining operative even when unforeseen events cause interruption of another. With heavily polluted water sources modern practice would provide at least three "lines of defence", the most usual sequence being:

a) storage for at least 2, and preferably 30 days;
b) clarification by coagulant-aided settlement, followed by filtration
c) chlorination.

In Sarawak conditions the use of (b), (c) above should be sufficient in the short-term, except in special cases, such as where a river intake is located downstream of an industrial plant which uses, but is not allowed to discharge, toxic materials.

It is virtually impossible to guarantee a disinfected water by chlorination unless it has first been clarified by removal of suspended solids and organic matter in solution, therefore the provision of process (b) above, the conventional water treatment process, is essential for supplies derived from rivers. Where chlorination is not available then the water should be boiled by the consumer.

## 1.2 Water Consumption and Quality

A brief study of existing conditions in Sarawak reveals an enormous variation in the quantity of water "consumed", that is to say, drawn from the sspply each day, per head of the population. Consumption is usually expressed in imperial gallons per head per day (ghd). The amounts range from 100 ghd, at the estate villages of SLDB at Lambir and of Sarawak Oil Palms Sdn. Bhd., to 12 ghd at Meradong (3rd Division), which is the lowest figure quoted by the PWD for their schemes in the Annual Report for 1971. 12 ghd is also the design figure used by the Rural Health Improvement Scheme. Most authorities agree that the most extravagant way to distribute water is by unattended public standpipes, and it is this system which produces high figures of 80 ghd and above at new agricultural estate villages. The way to reduce this extravagant consumption is, firstly, to provide individual piped supply to each house, so that one family becomes

responsible for its own tap, and secondly to meter the supply to each household and charge it for water consumed.

Experience has shown that the charge for water need not be high to secure a reduction to reasonable consumption figures. Reasonable consumption, sufficient for both personal hygiene and public sanitation, can be considered as being in the range of 25 to 50 ghd. This is still a wide range, and we propose to narrow it by analysing recorded figures in more detail.

Very large consumption is also reported for institutions such as schools and military camps. Wasting water is bad training in citizenship, and it is suggested that those in charge of these institutions should regard water as an accountable commodity like all other materials used.

The consumption figures given above are calculated as (total consumption ÷ estimated population served). This ratio only approximates to domestic consumption in the smallest of rural communities. As soon as schools, shops, offices etc; appear in the settlement then of course they consume water in addition to the domestic use. As the town grows larger so does the proportion of water taken for non-domestic functions, which include the needs of industry, street and market cleaning, government departments, vehicle cleaning, etc. etc. Non-domestic consumption in Kuching is half of the total, and in Singapore it has commonly been around 60 per cent of the total. Figures for Miri are being obtained from the 4th Division Office of the P.W.D. and will be available in a

later draft of this Manual.

It has become customary to quote consumption figures for planning new works which vary from a low figure in scattered rural areas to a high one in urban areas. This convention confuses the fact that true domestic consumption varies only slightly with increase in the standard of living; the larger part of the increased consumption is due to more extensive commercial and industrial use of water. It is suggested that the adoption of an overall consumption-per-head figure to calculate the water requirement of towns with variable commercial and industrial water needs should be avoided where possible. It can lead to serious under-estimating of future requirements through not assessing separately the growth of industrial demand. However there is an urgent need for improved statistics to enable the different categories of use to be distinguished. Until these are available, and for preliminary assessment purposes, we propose a simplified system as explained below.

Water tariffs in the larger towns of Sarawak make use of three main charging categories, based on the political or social decision that non-domestic users should pay more than domestic users. This decision is extended, in the case of Kuching, to include schools and similar institutions in the favoured domestic tariff, and a compromise tariff is offered to shopkeepers and other persons who live at their place of work, and for whom it is not practicable to separate the water used for domestic and commercial purposes. The use of this charging system

does not yield directly any statistics of true domestic consumption, and certain assumptions to obtain this have been made in the present study.* As a result it is found that the "true domestic consumption" of persons in Kuching supplied through meters is about 25 ghd (1971), and if the estimated population served by standpipes is included the overall true domestic consumption by Kuching Water Board users is about 18 ghd. Some uncertainty about these figures must remain because of the difficulty of accurately assessing the number of persons served by each water meter. In existing towns there are many people without piped water supplies to their dwellings, and this situation will remain even when all standpipes are abolished and all supplies are therefore in theory sold to individuals by meter. It will probably be impossible to separate the population served indirectly from the public supply through middlemen from those who exist by taking water from shallow wells, streams, etc.

In new settlements dwellings without individual piped water supply should not be permitted, and therefore it should be possible to assess actual

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* Viz: all Domestic and Domestic/Commercial tariff users taking more than 20 000 galls/month are assumed to be institutions, and two thirds of the remaining Domestic/Commercial tariff consumption is taken as true domestic use. Number of persons per domestic meter: 8.9, based on Kuching M.C. 1970 population & living quarters statistics.

domestic consumption provided demographic statistics are maintained. However it is important for public health as well as statistical purposes that, if and when subdivision of housing lots should occur in later years, new separate metered connections to the water main are made.

For purposes of new settlements in the Study Area we propose the following provisional method of calculating water consumption. All sizes of settlement are assumed to need 25 gallons per head per day (ghd) for basic domestic use. In addition to this a supplementary quantity for other purposes should be allowed as follows:

| | |
|---|---|
| Agricultural village:<br>(2,000 population or less) | 20% of basic domestic use |
| Small town<br>(4,000-8,000 population) | 40% of basic domestic use |
| Sub-Regional centre<br>(12,000 population) | 67% of basic domestic use |
| Regional centre | 100% of basic domestic use |

As and when more details of the types of industrial and commercial development become known, then more precise forecasts should be made.

Sarawak surface waters are generally of suitable quality for rendering into a supply of pure and non-corrosive water after fairly simple conventional treatment. The principal contents of the raw water which must be reduced or eliminated by treatment are the fine particles in suspension,

miscellaneous vegetable matter in solution and the dissolved iron. It is also necessary to correct the natural acidity by the addition of an alkaline solution or a suspension of lime. Settlement, after the addition of chemical coagulants, followed by filtration in sand-bed filters achieves a satisfactory reduction in the components mentioned above and in colour and turbidity which are associated with them, as well as reducing certain other constituents. After filtration a dose of chlorine should be added to the water to disinfect it of any bacteria or viruses which may remain and, after a suitable interval, the acidity is corrected to a value slightly on the alkaline side of neutral.

The resulting treated water should conform to accepted international standards of water purity such as those of the World Health Organisation published in 1963.

The use of chlorine gas in place of tropical chloride of lime is a more reliable means of securing the necessary residual chlorine content, and it is recommended that this be used in future water treatment plants. Existing 4th Division plants use chloride of lime.

## 1.3 Threshold Considerations

It is the policy of the Sarawak Government to make fully treated water supplies available to all communities so far as is practicable both economically and technically. However even the smallest water treatment plant requires

skilled operation and supervision, and this factor makes it impracticable to provide this service in many cases. We have estimated that an independent water supply system with treatment cannot cover even its day-by-day operating costs with a population served of fewer than 2 000 to 3 000, corresponding to an output of 65 000 gallons per day (gpd). This assumes every person paying for water at the highest domestic rate now charged by the PWD; there would inevitably be some who could not. Although there will without doubt be cases where an exception must be made we consider, generally speaking, that a settlement population of 4 000 is the smallest which can afford a fully treated water supply in circumstances where the source and treatment works cannot reasonably by combined with other settlements. It does not of course follow that, say, 3 villages of 1 500 could always justify a joint water supply on these criteria. The above conclusion assumes the minimum use of water for other than domestic purposes. Obviously where such use is paid for in significant amounts the population threshold can be reduced.

A check of the present settlements supplied by the PWD shows, using 1971 figures, that of 14 fully treated supplies, 5 came below the above threshold on a water production basis and 8 came below it on a population basis. The smallest community supplied with fully treated water was Panderuan with an estimated population of 550 and a supply of 19 000 gpd. There may well be special circumstances to justify this and other cases of very small supplies.

The existing two Water Boards, at Kuching and Sibu, are required to be self-financing for capital works (investment) as well as for operation and maintenance. In smaller towns and where the industrial/commercial sales of water become small it will not be possible to finance investment out of revenue, so that Government assistance will be needed. In the smallest towns and settlements, if they are to have a proper water supply, both the investment cost and a part of the maintenance cost will have to be borne by Government or, in the case of new communities, by the appropriate development authority.

## 1.4 Design Examples

### 1.4.1 Water Supply to Sub-Regional Centre

"Sub-Regional Centre" is the term used to describe new towns in the Study Area having a population range of 10 000 to 20 000, and current plans assume a value of 12 000 as typical. Such a town would require 25 ghd for domestic use and about two thirds as much for other uses. The supply would have to make allowance for the inevitable losses in any reticulation system, "unaccounted water", as well as the need for greater than usual supplies at times of peak demand due, for instance to excessively hot weather or the drying up of other sources for garden watering. Output for the peak 24 hours may be taken as 20 per cent above normal, but this should be realisable partly from service storage and partly by overloading the treatment works, so the design output of the treatment works would be set at intermediate figures.

In this instance the design population figure would only be reached over a period of 12 years and the waterworks would be built with minimum provision for enlargement beyond the needs of the design population; that is to say suitable space on the ground would be planned but no structures put up to cover needs in excess of those initially being met. The method of sizing the plant is summarised in the following table. For budgetting purposes we assume that the whole of the civil works and two thirds of the plant would be provided in the first stage, with the balance of the plant installed when demand reached half of the design figure.

TABLE 2 WATER SUPPLY FOR SUB REGIONAL CENTRES

| | Gallons per day |
|---|---|
| Design Population: 12 000 | |
| Domestic consumption: 25 ghd, equivalent to | 300 000 |
| Non-domestic consumption, provisional allowance (This figure should be derived in more detail if possible) | 200 000 |
| Total average metered sales | 500 000 |
| Unaccounted water lost in system | 75 000 |
| Design output of treatment works | 575 000 |
| Extra quantity delivered on peak day | 60 000 |
| Design capacity of pipeline | 635 000 |
| Extra quantity supplied on peak day from service storage | 60 000 |
| Peak outflow from service storage | 695 000 |

Peak instantaneous outflow from service storage: $2\frac{1}{2}$ times above rate

TABLE 2 WATER SUPPLY FOR SUB REGIONAL CENTRE (Con't)

| Storage Provided: | Gallons |
|---|---|
| Pure water tank at treatment works (12½ hrs*) | 300 000 |
| Service reservoir(s) in town area (25 hrs) | 600 000 |

Pipelines

Trunk mains: 8 ins. or 9 in. diameter: (asbestos cement)

- depending on length, cost of pumping, etc.

Distribution mains: 8 in., 6 in., 4 in., and 3 in. diameter

* The time in hours is that for which the reservoir could supply at the average rate without replenishment

It is not possible to generalise on the size of river or catchment area needed for a given supply, since river flow conditions are affected by many factors. As an instance of this it was found that streams having their source in the Lambir Hills sustained flows during the 1973 drought much better than a river like S. Sibuti with a larger catchment in a different locality. This was probably due to the gradual release of water from shallow ground water storage in the sandy formations at Lambir.

The system would consist of a river intake with pumping station delivering to the treatment works inlet. If the treatment works can be sited

on a convenient hill less than ½ mile from the intake so that the town is fed by gravity, this would be done. However ease of access to the treatment works site is essential, and the site must have an area at the same elevation for unforeseen future needs. If this cannot be arranged the use of hill sites is better avoided, and the criteria for treatment works siting are that it be near the intake but on ground not liable to flooding and with good access also not liable to flooding. For larger plants a natural slope of between 5 per cent and 10 per cent is desirable. In Sarawak conditions the alignment of main roads largely predetermines the points at which headworks can be sited, and the road route usually forms the best route for the trunk mains.

The trunk mains would deliver, either by pumping or by gravity, into an elevated service reservoir or reservoirs close to the town, from which the supplies would be distributed by a network of 6 in. and 4 in. diameter pipes. The use of 3 in. diameter pipes should be restricted to headers along short streets where there is no possibility whatever of later extension or of the development of any bulk supply demand. Each house or other living unit should have its own separate indoor supply, with separate meter at the property boundaries.

### 1.4.2 Water Supply to Group of Agricultural Villages and Palm Oil Factory

For this example three villages and one palm oil processing factory will be assumed to share one water supply. The villages will be taken as

and
having a design population of 2 000 each/the factory as rated at 72 tons/hour of fresh fruit bunches, working 20 hours a day maximum. The domestic consumption should be the same as in the previous example (25 ghd), but due to the greater relative lengths of distribution pipelines a larger allowance is made for unaccounted water. The sizes and capacities of the system are shown in Table 3.

The comments on the source, treatment works and delivery works in para.14.1 are equally applicable to this case. Security of the factory supplies, for which only a small storage is provided, should be assisted by avoiding pipeline routes to it which pass through villages or other areas where construction work may take place. As far as practicable each of the three villages should have its service reservoir at the same elevation above the houses, for equality of the service.

TABLE 3 WATER SUPPLY TO AGRICULTURAL GROUP

| | | Gallons per day |
|---|---|---|
| Design population: 3 at 2 000 = 6 000 | | |
| Domestic consumption: 25 ghd, equivalent to | | 150 000 |
| Non-domestic consumption, including estate use other than for factory | | 50 000 |
| | Sum | 200 000 |
| Unaccounted water lost in village systems | | 50 000 |
| Extra quantity delivered on peak day | | 25 000 |
| Total output for general purposes | | 275 000 |

TABLE 3 WATER SUPPLY TO AGRICULTURAL GROUP (Con't)

| | | Gallons |
|---|---|---|
| | Brought forward | 275 000 |
| Factory: 72 x 20 x 1.5 = 2 160 tons/day | = | 484 000 |
| Wastage on factory quantity | | 24 000 |
| Design capacity of treatment works | | 758 000 |
| Deisgn capacity of pipeline | | 783 000 |
| Extra quantity from service storage on peak day | | 25 000 |
| Peak outflow from service storage | | 808 000 |

Peak instantaneous outflow from service storage at villages: 2½ times peak daily rate

Storage Provided

| | |
|---|---|
| Pure water tank at treatment works (12½ hrs) | 400 000 |
| Service reservoir at village (24 hrs) | 80 000 |
| do | 80 000 |
| do | 80 000 |
| Service reservoir at factory (6 hours) | 150 000 |

Pipelines

Trunk mains: 9 in. or 10 in. diameter (asbestos cement)

Gravity main supplying one village: 4 in. diameter

Distribution mains: 4 in. and 3 in. diameter (6 in. may be needed where service reservoir has insufficient head)

## 1.6 Costs

### 1.6.1 Investment Costs

The capital cost of recent water supply schemes for small towns in Sarawak has approximated to one dollar for each gallon per day of rated output. Thus a scheme for 1.5 million gallons per day (mgd) has cost $1.5 million. This figure is understood to include river intake works, treatment works, pumping station, all trunk pipelines but not the distribution system. As the length of pipeline is obviously not a standard quantity for a particular size of scheme we are giving costs for pipelines separately.

The cost figures tabulated below are proposed for use in this Study; they are intended as current prices for work carried out by contract, excluding the cost of engineering design and supervision.

| Item | Details | Investment Cost |
|---|---|---|
| Headworks | River intake, treatment works, pure water storage and pumping station, including all plant | 80 cents per rated gallon per day |
| Pipelines | Asbestos cement class C pipes, including laying | $ per foot |
| | | 3 in. 5/17 |
| | | 4 in. 6/- |
| | | 6 in. 7/50 |
| | | 8 in. 9/53 |
| | | 9 in. 10/67 |
| | | 10 in. 12/13 |
| | | 12 in. 14/33 |
| | | 15 in. 18/33 |

| Item | Details | Investment Cost |
|---|---|---|
| Service Reservoirs | Reinforced concrete (at ground level) | 75 cents per gallon stored |
| Service Reservoirs | Steel or concrete (on elevated tower) | $1/= per gallon stored |
| Individual House Connections | Main tapping, meter and $\frac{3}{4}$ in. pipe in trench (including pipe within property) | $190/= each - 1 acre lots<br>$140/= each - $\frac{1}{4}$ acre lots<br>$110/= each - 1/6 acre lots |

It will be seen that the costs of Headworks and Service Reservoirs are given as directly proportional to size, that is, there are apparently no "economies of scale". This is not strictly true since studies elsewhere have shown that investment costs do not rise quite as steeply as the size of the utility; however this effect is small within the size range of about ten to one with which we are concerned, and the accuracy of the figures given is not such as would justify the refinement of a scale factor. For pipelines the situation is quite different, and there are large economies to be made by combining flows of water in one large pipeline as compared with several smaller ones. For example the water conveying capacity of an 8 inch pipe is about six times that of a 4 inch pipe, while the cost is only greater by a factor of 1.6.

The layout of the design examples is not yet sufficiently detailed to estimate total costs using the above figures, except for the following:

Agricultural village with 2 000 population: Cost of service reservoir, distribution pipelines and house connections only is $300 000 ($150 per head)

1.6.2 Operating Costs

to follow

# 2. SEWAGE AND EFFLUENT DISPOSAL

## 2.1 General

### 2.1.1 Introduction

The field of liquid waste disposal and sewerage can best be introduced by two quotations from a World Bank leaflet which serve to show both its importance and the fact that the slow development of this public utility in Sarawak is not exceptional.

> "Urban communities of any size without adequate piped water and sewerage are not viable and thus seriously compromise national development prospects".

> "Water supply contributes to a city's existence in another way: it provides the only satisfactory method of removal of human wastes. Inadequate central sewerage not only raises problems of public health and aesthetics, but usually leads to higher costs. As a practical matter, every city has to provide some waste disposal system. For example, a large East Asia city, which has no sewerage system, is forced to haul away most of its wastes by truck. This is an increasingly expensive and unsatisfactory solution, not only because the volume is growing with the city, but also because disposal is becoming more and more difficult and labour for this kind of work is scarce.

> Waterborne sewerage systems are normally the most effective means of urban waste disposal, and water and sewerage facilities should thus be considered as part of an integrated system carrying "new" and "used" water. Unfortunately, because sewerage systems may cost as much or more than the water systems and because the value of a sewerage system to an individual is often much less apparent to him than it is to society as a whole, sewerage is often given even lower priority than piped water in developing countries".*

In view of the relatively low population density and small size of towns in Sarawak there is a notable opportunity to avoid the mistakes and false economics made in many of the larger developing countries.

Sewerage is the term applied to the physical system of pipes (sewers), junction chambers and (usually) pumping stations which convey, by the addition of water, human waste products and industrial effluents from the premises where they are generated to a principal collecting point. The liquid conveyed which is termed sewage may, at the terminal point, either be treated before disposal or be discharged direct into a receiver, such as the sea, or a river or other watercourse.

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* "Water Supply and Sewerage" - Sector Working Paper World Bank, October 1971

Although no towns in Sarawak have extensive sewerage they all have arrangements of a sort for disposal of sewage. Before new sewerage schemes in existing towns are initiated, clear administrative and financial regulations should be established for the works which will become needed within private properties in order to connect them to the proposed sewers. Obviously it is much easier to plan for sewerage in a new town as yet unbuilt or in major new housing developments, than it is to create an effective system within an existing framework of buildings.

2.1.2 Sewage and Liquid Wastes

The only characteristics of domestic sewage which need to be mentioned here are those which, it is generally agreed, have the greatest effect in polluting a watercourse into which it may be discharged. These are (a) the content of solid material in suspension - "Suspended Solids", (b) the capacity to absorb oxygen from its surrounding water - "Biochemical Oxygen Demand" (B.O.D.) and (c) the content of bacteria and viruses. The first two are inter-related because the solids and the liquid each have an oxygen demand and therefore a reduction in Suspended Solids automatically reduces the B.O.D. It is the aim of sewage treatment and disposal to reduce these parameters to an acceptable value. If they are not so reduced the tendency is for solid matter to deposit in watercourses and for the dissolved oxygen in the receiving water to be absorbed. Both are highly undesirable on grounds of health, aesthetics and the maintenance of a clean environment. If the natural dissolved oxygen is eliminated septic conditions develop in the watercourse; the water changes to a black colour and offensive gases are generated. Fish and other forms

of natural life are unable to live in water which has a serious deficiency of oxygen.

Item (c) above, the content of bacteria and viruses, is only indirectly influenced by sewage treatment. Indeed bacteria are essential to the biological purification process which reduces B.O.D. It is not normal to attempt to disinfect or sterilise sewage effluent after treatment, since this would be expensive and would inhibit the further biological purification which can and does take place after discharge into the watercourse. It follows however that any watercourse downstream of a sewage treatment works is to some degree polluted as a source of drinking water. The water supply therefore requires disinfection. The above comments do not apply to the case of effluents deriving from hospitals containing cases of waterborne disease or of small communities afflicted with such disease, where special measures to sterilise all liquid waste must be taken by the medical services.

Typical values for raw (incoming) sewage and the effluent from a well operated treatment works are:

| | Suspended Solids mg/l* | B.O.D. mg/l |
|---|---|---|
| Raw sewage | 750 | 600 |
| Treated effluent | 30 | 20 |

* mg/l indicates milligrams per litre (approximately equal to parts per million)

The figures for raw sewage vary inversely as the quantity of water used domestically; the more water is used the more the sewage is diluted. The figures given above correspond to a water consumption of 30 gallons per head per day.

It is not possible to generalise on the qualities of liquid waste from industrial or agricultural operations. Processing of rubber and palm oil and the conversion of timber to pulp all give rise to organically polluted effluents with high B.O.D. Timber pulp mills are unlikely to develop in the Study Area within the short term, but the other processes mentioned will do so. The effluent from palm oil factories has particularly high B.O.D. and Suspended Solids contents. No factories are yet in production in Sarawak, but analyses for Peninsular Malaysia are quoted in the Johor Tenggara Report, which also lists effluent qualities from rubber processing factories as follows:

Palm Oil Factory Effluent

| Sample No. | Suspended Solids mg/l | B.O.D. mg/l |
|---|---|---|
| 1 | 29,200 | 20,000 |
| 2 | 99,400 | 18,000 |
| 3 | 49,600 | 15,500 |
| 4 | 54,400 | 13,000 |
| Mean | 58,150 | 16,625 |

Rubber Factory Effluent

| Sample No. | Process | Suspended Solids mg/l | B.O.D. mg/l |
|---|---|---|---|
| 1 | Crumb and crepe | 430 | 750 |
| 2 | Crumb and crepe | 90 | 1,100 |

For each ton of fresh fruit bunches between 90 and 100 gallons of effluent are produced. The above figures show that, for a palm oil factory rated at 60 tons/hr of fresh fruit bunches, the total weight of suspended solids and B.O.D. generated is the same as the sewage from a town of 150,000 people.

The consequences of these very high values of pollutant material are discussed later (section 2.3). It is sufficient to say here that these effluents cannot be treated in combination with domestic sewage, in the relative quantities which are met in an estate agricultural development, though mixing of domestic and industrial waste is advantageous for most industrial effluents in the context of a large town.

## 2.2 Means of Sewage Disposal

The methods of dealing with sewage vary greatly since what may be entirely acceptable for isolated and scattered communities will not work in an urban situation. In this section will be described the means which are recommended for these varying conditions. There is a clear range of sewerage alternatives of steadily increasing cost, and in some cases it may be that a less costly alternative can be used initially with provision later to change to a better one as development and population density grow.

### 2.2.1 Pit Latrines

Pit latrines from the simplest way for acceptable disposal of domestic sewage. Open pit latrines cause nuisance by smell; they are dangerous if children can fall in, and are a health risk in providing a breeding ground for insects. This can be avoided by the design now used by the Rural Health Improvement Service, (RHIS) which is termed the "pour-flush latrine". This design incorporates a bowl with trap (water-seal) discharging to a completely enclosed and covered pit. A limited supply of water in buckets is necessary for flushing. The RHIS recommend a minimum pit size of 3 ft. by 5 ft. by 7 ft. deep. The pit sides should be strengthened with timber to prevent collapse, and one latrine is required for each family dwelling or door of a longhouse.

In new settlements pit latrines are only acceptable where the density of dwellings or households does not exceed three per acre.

A pit latrine is the minimum facility and it requires careful siting to avoid polluting ground or water at lower elevations. To remain sanitary all latrines require effort by the user and regular inspection; a new latrine pit must be dug if the first becomes full. Latrines should always be separated from the dwelling by a reasonable distance, and a balance is needed in judging the distance which people will walk and that which they will carry water so that it is properly used. The use of piped water for flushing is not acceptable since the pit would in all probability fill up very quickly.

2.2.2 Individual Septic Tanks

Septic tanks have been in use in Sarawak over a considerable period. Unfortunately many existing septic tanks have not been designed or operated correctly, and they differ from the tanks which are described here. In the present section it should be understood that new Septic Tanks only are being considered, and this fact will be distinguished by the use for them of capital letters.

A Septic Tank forms a means of settling raw sewage and of achieving some reduction of the accumulating solids by anaerobic digestion after settlement. The solids do not however consolidate as fast as new solids enter, and therefore all Septic Tanks require emptying at regular intervals. In an efficient tank the effluent contains an acceptably low amount of suspended solids, but has undergone little or no reduction of its Biochemical Oxygen Demand (B.O.D.). That is, the sewage liquid may be as strong on leaving the tank as it was on entering. A

Septic Tank therefore must include a secondary stage of biological filtration, which is an aerobic process needing a drop in free air of several feet for percolation to take place. Where the ground and ground water levels do not permit this then either the Septic Tank must be raised well above ground or a pump must be installed to raise the tank effluent to the inlet of the biological filter.

The biological filter occasionally releases solid material known as humus which should be intercepted in a small settling tank through which the filter effluent flows. If the tank effluent is pumped up to the filter then it can be arranged that the humus tank is cleared by periodic draining back into the Septic Tank; otherwise the humus tank must be emptied separately. As an alternative to the tank the effluent may be spread evenly on grassland and then collected before discharge to a watercourse. Humus settles out on the grass by this method, which requires about 25 sq. yd. for 10 persons served.

As a guide the following sizes are proposed for small Septic Tank installations.

| No. of Persons served | Septic Tank size (galls) | Biological Filter (cu yd) | Humus Tank (galls) |
|---|---|---|---|
| 6 (minimum) | | | |
| 12 | | | |
| 25 | (figures to follow) | | |
| 50 | | | |

2.2.3 Larger Systems - General

It is not necessary or practicable to describe in detail the larger systems which are available for sewage disposal. These systems may, if concerned with populations of a few hundred only, take the form of larger Septic Tanks, or they may make use of the methods normally in use for sewerage of complete urban areas. Outside the regional centres of Miri and Bintulu it is not expected that joint sewerage for populations above 500 will be necessary, because all settlements will average a population density low enough to make separate individual disposal arrangements generally acceptable. However in even the smallest settlements there will be local zones of dense population which require different treatment. These zones would include bazaar, schools and public buildings, either taken separately or as a whole.

Two particular advantages of any larger system over the individual sewage disposal unit are worth stressing, since they are sufficient in many cases to justify the extra expense of the larger system. The first advantage is the obvious fact that, since the sewage is conducted away from the building where it originates, it is possible to avoid the risk of contaminating the areas close to the places where the population lives and works. The second advantage is related to this in that the living and working environment can be further improved when all domestic waste water used for washing and food preparation, termed sullage

water, is discharged into the sewers. This should always be done when a sewerage system is available, but it is not practicable when latrines or individual Septic Tanks are used due to the quantity of water involved.

2.2.4 Principles of Sewage Treatment

Conventional sewage treatment is generally effected by two main processes. The first process consists of sedimentation, after screening and/or disintegration of solids, which removes about 65% of the suspended solids and 35% of the easily oxidisable organic matter, (B.O.D.). This is normally carried out in specially designed sedimentation tanks (settlement tanks). The secondary process is biological, the sewage being brought into contact with aerobic micro-organisms either suspended in the liquid as activated sludge or forming a film on the media of percolating filters. The biological (percolating) filter is much simpler to operate than the activated sludge process, although more land area is required. Further sedimentation is necessary to remove the activated sludge or humus and other matter formed in the biological process. Where an effluent of exceptionally high quality is required it is necessary to use micro-strainers, sand filters or stabilization ponds in order to capture a higher proportion of the solids formed during the biological process. These additional measures can be described as effluent polishing methods.

As an alternative to the conventional processes mentioned above, primary treatment can be provided in raw sewage lagoons in which organic matter is

precipitated and partly stabilised by anaerobic digestion, and secondary treatment can be provided by aerobic action in oxidation ponds. The process in which the micro-organisms are sustained in oxidation ponds differs from that which occurs in the activated sludge process or with percolating filters, in that the ponds depend on the work of algae to help produce the oxygen required to maintain aerobic conditions.

After conventional methods of treatment have been employed to ensure that the sewage effluent is to the required standards, a residue of heavier matter, normally referred to as sludge, remains to be disposed of. Having regard to the volume of sludge produce from the primary and secondary sedimentation of sewage, dewatering of sludges to a forkable consistency is usually essential. Sewage sludge is a liquid with a water content of over 90 per cent, that is to say it is mainly water. In the case of individual septic tanks and large tanks in smaller settlements the sludge should be taken by road tanker to pits prepared for it in suitably isolated locations. In larger plants sludge drying beds should be provided, having underdrains for removing the water as far as possible. The liquid draining through the beds must be returned to the works inlet as it has a high polluting capacity. Dried sludge can be dug out by hand and removed to a disposal area. The sites for final disposal of sludge in any form should be covered with earth as soon as practicable. Sewage sludge can in principle be used as a fertiliser, though its value as such is usually low. The application entails a number of possible public health risks and it is not recommended.

2.2.5 Community Sewerage System

Septic Tanks may in theory be used to treat sewage from populations of any size. In practice large tanks have very many disadvantages and their use for large populations is not recommended. There will however be many cases in the Study Area where systems for a population of several hundred are required, as mentioned in Section 2.2.3; such units should be served by a community system. Community sewerage systems may utilise one of the following treatment methods:

Septic Tank, biological filter and humus tank

Septic Tank or raw sewage lagoons, followed by oxidation ponds

It must be made clear that all types require regular inspection and maintenance, though some need more than others. The larger the plant is the worse are the consequences of faulty operation or defective maintenance.

The larger Septic Tank system functions in the same way as the individual unit described in section 2.2.2. It would be supplied through a network of pipes or sewers and should be located further from the buildings served than is possible with individual house tanks. Because of the greater lengths of travel involved, leading to greater falls in the sewers, it is likely that, before treatment, pumping of sewage to a higher elevation would become necessary. If the septic tank inlet can be set reasonably high above ground then there is little difficulty in feeding by gravity through the biological filter and humus tank which follow.

In the case of this and other community systems it is essential that care is taken in the arrangements for final disposal of treated effluent. This liquid remains a highly polluted water which must not be allowed into roadside drains or to flow in accessible channels past other buildings or private gardens. Treated effluent should be discharged either into a major watercourse - one which normally contains natural run-off sufficient to dilute the effluent - or it may be spread at low density over levelled ground to be dispersed by infiltration and evaporation. In the latter case 2 acres should be allowed per 100 persons of population served. When it is intended to discharge into a watercourse or river this should only be decided with the agreement of the authority responsible for river pollution control.

## 2.3 Factory Effluent Disposal

The potential capacity of a palm oil processing factory for pollution is very much larger than that for any other type of industrial or agricultural development envisaged. This section therefore considers such a factory only, although it applies in a general way to other types of factory effluent.

The heavy polluting capacity of the effluent from a palm oil processing factory was referred to in section 2.1.2. The situation is however basically different from that of domestic sewage for two reasons: firstly a palm oil factory can and must be sited so that its effluent can discharge into unpopulated and unused land, and secondly the liquid does not of itself constitute a health risk for persons in contact with it.

There has been much consideration given to means of treating palm oil effluent. At present no effluents within Malaysia are treated to a degree comparable to that applied to sewage in modern municipal plants. It can be assumed that, if and when any such treatment is developed, cost considerations will affect its widespread implementation. At present there is a much greater need for a high level of treatment in Peninsular Malaysia than in Sarawak. The only process proposed at present for palm oil factories in the Study Area is the temporary storage of the effluent in lagoons which will act as oxidation ponds. In these ponds the suspended solids which float should be collected by a suitable surface barrier, and be removed to a waste tip where they will not be washed back into any watercourse by rainfall. The suspended solids which settle may be dug out at intervals or, which may be easier, a new pond constructed when the first becomes full.

The point of ultimate discharge of the effluent into a river must be downstream of waterworks intakes as far as practicable. The responsibility for ensuring that its effluent does not pollute any important watercourse or inhabited areas must remain with the owners of the processing plant. Provided this situation is accepted there is no need to require in advance the construction of effluent treatment plant which could turn out to be more elaborate than necessary. The present knowledge of the effects of oxidation ponds, of time and of climate on palm oil effluent does not permit quantitative calculations advance. However the following guidelines are suggested:

(a) construction initially of an oxidation pond of not more than 4 ft. average depth with a capacity of at least .....days production of effluent. (This implies about .....acres of pond for a ..... ton/hr factory).

(b) the reservation of sufficient land immediately adjacent to the first oxidation pond to permit later enlargement or replacement of the ponds. (Say 10 times the area of the first pond).

(c) siting so that no important watercourse is reached by the effluent for at least 2 miles downstream of the oxidation ponds.

Obviously the flatter the land available for ponds and the longer the time delay before discharge into an important watercourse the better will the treatment be.

The paper prepared by the Ministry of Health, Malaysia, "Water Policy Objectives - General Policy Guidelines" gives, for industrial effluents generally, the following permissable quantities in an effluent discharged to the waters of the State.

| | |
|---|---|
| Suspended Solids | 400 mg/l |
| Biochemical Oxygen Demand | 100 mg/l |

When compared with the typical palm oil effluents given in section 2.1.2 it will be seen that these values represent treatment to the point of eliminating more than 99 per cent of both constituents. This is certainly not feasible by the means outlined, but the paper referred to allows relaxation of its standards when it can be shown that the effect on the receiving waters will not contravene the general objective, which is to avoid "adversely and unreasonably impairing the quality of the waters of the State for beneficial use".

## 2.4 Design Examples

### 2.4.1 Individual Septic Tank

- to follow -

### 2.4.2 Sewerage for Small Bazaar

Small existing bazaars may consist of 4 or 6 shophouses in a terrace. The example shows 6 shophouses with space on the ground for later enlargement to 10 or 12. In this case the sewage plant and most of the sewers should be built initially for the ultimate design population, which is obtained as follows:

| | |
|---|---|
| 6 shops with 6 persons resident in each | 36 |
| Extra population due to use as hotels and/or eating houses: average 4 persons per shop | 24 |
| 4 future shops at (6 + 4) persons | 40 |
| Future government office or 2 shops, say | 20 |
| Total population served | 120 |

With existing shophouses which front on one street only, the shops are usually very deep and narrow, and they may have varied out-houses in the rear. The sewer should therefore be laid in the road in front of the shops; this will be easier for construction access and it will ensure that any blocking or malfunction of the system is quickly noticed. With new bazaar developments using a wider and less deep shape for each shop, then, provided the back lane is paved, the sewer can be laid in the back lane.

(illustration to follow)

## 2.5 Costs

Costs of sewage disposal vary greatly with the type of system used. A pour-flush latrine built by a longhouse under gotong royong may only cost $3 per unit (the price of the cement). Large scale sewerage with full treatment by conventional means may cost as much as $500 per head of the population at

1972 prices. It is difficult to correlate prices given for septic tanks, which vary in size and in whether they have a biological filter. It is claimed that a well designed communal sewerage system can cost no more per house served than does a septic tank.

The following costs (using 1973 prices) are proposed for use in this Study; they are based on the assumption that the individual unit is sized for 6 persons in the household.

| System | Investment Cost ($M) Per house | Per head |
|---|---|---|
| Pour-flush latrine | 100 | 17 |
| Septic Tank | 2 400 | 400 |
| (existing type septic tank without filter) | (1 200) | (200) |
| Small Community System | 1 500 | 250 |
| Main sewerage with treatment in oxidation ponds | 2 000 | 330 |

AKM/ml
24.10.1973.

# PART V

# HOUSING

1 INTRODUCTION

2 HOUSING NEED

3 HOUSING COSTS

4 HOUSING STANDARDS

# PART V HOUSING

## 1. INTRODUCTION

By 'housing' is meant the building of new residential houses of any kind, including the development and preparation of the site. Houses can be built by individuals for their own use, by contractors for scale or rent or by housing corporations. It could be relevant to think of house subsidy-schemes (in connection with housing), primarily in the shape of cheap building sites and preferential financing. Taking into consideration the overall need for development funds in Sarawak, however, we are inclined to think that apart from special projects for families with special needs, the major part of housing should be based on a cost-pay-principle', i.e. the user of the house pay the cost of building and maintaining the house. The essential point in such an approach is to keep the costs as low as possible in order to enable low income families to live in a reasonable house.

## 2 HOUSING NEED

The estimated need for houses must be based on certain standard assumptions. The population is increasing by approximately 2.8 per cent per year (in the whole of Sarawak) and the household size will gradually decrease as more people move from the rural sector into urban environments. At the same time a certain part of the existing houses will need renewal in the future.

Considering these factors:-

- growth of population: 2.8 per cent per annum
- urban household size: 5.2 persons
- rural household size: 5.6 persons
- gradual change in the urban/rural population ratio from 25/75 in 1970 to 40/60 in 1990
- urban housing renewal: 5 per cent per annum of houses constructed before 1970
- rural housing renewal: 2 per cent per annum of houses constructed before 1970,

the future housing need in the whole of Sarawak will be:-

| | 75-80 | 1980-85 | 1985-90 | 1990-95 |
|---|---|---|---|---|
| No. units | 7 000 | 55 000 | 64 000 | 75 000 |

In the Study Area the housing need will depend on the actual projects proposed and the general development of the urban and rural sectors.

## 3 HOUSING COSTS

If the aim is that all households should be supplied with proper dwellings within the limitations presented by the household income the following demands should be met: Annual housing costs (including land) should in general not exceed 15 per cent of the annual housing income.

The average annual housing cost at an interest level of 10 per cent would be:-

- 14 per cent of the total construction cost and land.

The 14 per cent are calculated as:

- 7 per cent discounted interest
- 2 per cent maintenance
- 5 per cent payback = depreciation over 20 years.

The personal income available for consumption and housing is supposed to increase by 3 per cent per annum in the years from 1970 to 1990 at the same time it is assumed that there will be 1.7 income earners per household. Actually the number of employed per household in rural areas will rather be two, but as an average income will probably be somewhat lower in rural than in urban areas; the 1.7 factor is used in both cases.

The income distribution in 1970 has been estimated at:-

| Income in $ per year | | Income distribution in per cent | |
|---|---|---|---|
| Range | Average | Urban | Rural |
| 0 - 3 500 | 2 000 | 40 | 70 |
| 3 500 - 7 000 | 5 500 | 35 | 30 |
| 7 000 - 12 000 | 9 000 | 20 | - |
| 12 000 - | 20 000 | 5 | - |

The 1990 income distribution is assumed to be:-

| Income in $ per year | | Income distribution in per cent | |
|---|---|---|---|
| Range | Average | Urban | Rural |
| 0 - 5 500 | 3 500 | 40 | 70 |
| 5 500 - 12 000 | 9 500 | 35 | 30 |
| 12 000 - 21 000 | 15 000 | 20 | - |
| 21 000 - | 30 000 | 5 | - |

In the period from 1970 to 1990 the average incomes and their distribution will be changed gradually (interpolation).

If it is considered that the average households should be able to pay for their own housing it would be relevant to calculate the average income in the different groups in the year 1980 and then let these figures represent the target figures for the housing costs and requirements. Thus the average incomes would be:

| | $ per year | |
|---|---|---|
| Average 1980 | Per person | Per household |
| Low income | 2 700 | 4 600 |
| Lower middle income | 7 300 | 12 400 |
| Higher middle income | 12 000 | 18 000 |
| High income | 27 000 | 32 000 |

As it should be acknowledged that the employment factor varies from lower groups to higher ones, the number of income earners per household has been reduced to 1.5 in the higher middle income group and 1.2 in the higher income group. The possible variation in the tendency to spend different relative amounts of the income for housing in different income group has not been considered in this context.

The amount available for each household for housing purposes and the corresponding construction and land costs are estimated as follows:

| | $ available for housing per year | Total cost of housing and land in $ |
|---|---|---|
| Low income | 700 | 5 000 |
| Lower middle income | 1 850 | 13 000 |
| Higher middle income | 2 700 | 19 000 |
| High income | 4 800 | 35 000 |

As mentioned above the calculated figures are average figures. The specific need for different housing classes within the Study Area will depend on proposed development of rural and urban activities and their implementation. However, the average figures have been calculated in accordance with the general planning guidelines of the project and the housing figures might thus be applied as general indicators where no specific information is available.

## 4 HOUSING STANDARDS

The maximum cost level for different houses in different standard categories indicate the economic limits within which future housing needs must be covered. It does, however, not describe the physical standard of the mentioned house types. This would require a thorough knowledge of construction cost and housing preferences which is not available in Sarawak today.

The main items which determine the house standard are:

- site (area and location)
- space (floor area)
- design
- materials
- facilities
- supply of public utilities
- length of life.

The extent to which these qualities can be supplied will depend on the economic limits for each house type, which in turn are determined by the income level and distribution.

The minimum requirements for a low cost house, the lowest standard, should be determined partly by traditional housing standards in Sarawak, partly by the budget which limits the number of facilities which can be made available.

To examplify how the standard requirements could be expressed the following short description of the mentioned items is carried out for a low cost house.

Site: The housing area should be cleared and reasonably even, not prone to flooding or swamp vegetation. Access from public road should be possible in a way that transport by motor car up to 150 ft from the house is possible. The size of the lot should correspond to the character of the house in a way that deficiencies in the house standard could be substituted by reasonable land qualities.

Space: The floor area should be sufficient to give satisfactory living floor space for all dwellers in the household. By international standards — (UNITED NATIONS) this would mean at least 70 sq. ft per person. Traditional Sarawak standards are, however, far above this minimum. Within all community groups an average of 150 sq. ft could probably be assumed. If an average household in urban areas is 5.2 persons and in rural areas 5.6 persons the minimum would be 365 and 390 sq. ft respectively while local traditional standards would allow for 780 and 840 sq. ft respectively.

Design: The design of the house should satisfy basic sociological demands from all community groups. Possibility for separation of women and men's living room, separate bedroom facilities, covered and yet ventilated kitchen, and a general layout which gives satisfactory climatic protection (rain and heat).

Materials: The materials used should be of a standard which maintains the obtained standard qualities throughout the life time of the house. No special finish in construction and use of materials will be required but possibilities for amendments should exist. The choice of materials should also satisfy basic requirements as to weather protection.

Facilities: It is supposed that water is available for the household either by metered individual connection from mains or from a roof catchment with tank. Electricity supply is not a basic requirement.

Washing facilities should be offered in the house or in a protected place close to the house. Toilet should either be in separate latrine (pit) or in the house where acceptable sewerage is available.

Length of life: The length of life of the house will naturally depend on materials and costs. For immediate schemes that aims at a solution of urgent housing problems an average life of 20 to 25 years is probably realistic. In urban areas with tendency towards more permanent housing, especially within storey building, a 40 to 50 year life is to be assumed.

The above description of standard items does not aim at giving an actual guideline as to the standards to be applied forSarawak low cost housing.

The future assessment of standard requirements, both for low cost and high income houses, will only be possible after a specific analysis:- an analysis which would include economic evaluation of different requirements and their realisation.

To analyse and possibly minimise the costs in low cost house construction a pilot study is now being carried out by the Consultants on a house type designed for SLDB settlers. This house should possibly include a series of the standard requirements mentioned above. By this intermediary investigation of the cost components it might be possible to give a rough picture of the cost of the standard items within this specific low-cost housing category - but it does not attempt to make a general guideline for the different standards and cost that must be applied to houses of different income groups.

That must follow a special study covering all means of production, traditional and modern implementation principles, which determine both standards and costs.

MI/ml
30.10.1973

# PART V

# HOUSING

1 INTRODUCTION

2 HOUSING NEED

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the future housing need in the whole of Sarawak will be:-

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MI/ml
30.10.1973

# PART 6

## PHYSICAL PLANNING PRINCIPLES

1. INTRODUCTION
2. THE CENTRE HIERARCHY
3. THE PRINCIPLES OF CENTRE AND SETTLEMENT LOCATION
4. THE REGIONAL CENTRES
5. SUB REGIONAL CENTRES
6. THE VILLAGE
7. THE NEIGHBOURHOOD UNIT AND THE ONE ACRE PLOT
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PART 6

# PHYSICAL PLANNING PRINCIPLES

## 6.1 INTRODUCTION

The purpose of this Part is to present a few town planning principles which have been derived from and used in the physical planning of the Miri-Bintulu Regional Planning Study. The focus of the physical planning in this study has been on the urbanisation of rural areas, i.e. how to locate and develop service centres and settlements so that the existing rural population and the new population connected to large scale agricultural development are provided with urban amenities. Comprehensive town planning has been outside our scope of work, and would in any case need to be treated in a much wider context than what is intended in this Manual.

Urban planning and town planning can no longer be seen as a "once-and-for-all" Master Plan which would cover a series of decisions for the next two decades. It should rather be seen as a tool for creating a development machinery whereby a full control and a positive encouragent of the development process can be exercised. In this planning philosophy, based on a set of 'open' planning principles, 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 necessary decisions, the stages of the planning and its translation into running pro-

grammes and projects, and the costs of providing the necessary facilities and services.

The open planning principles envisage an overall Structure Plan based on mechanical inputs but designed for expansion with an inbuilt flexibility. The further growth above the population targets in the Structure Plan should be seen as an organic process caused partly by the mechanical input estimated requirments of dwellings, public and private service, land use etc. as described in this Manual, and partly by a number of unforeseen factors coming up during the implementation and the growth of the settlement.

The Structure Plans for new towns and the expansion plans for existing towns and settlements cannot be seen as actual Town Plans, but should be understood as principle strategy plans which can be developed into action programmes when further information on the topography, land use and ownership is collected.

The function of the Structure Plan is to demonstrate in outline the practical consequences of certain basic ideas of and wishes to the future, so that the Government can formulate more specific policies and the Administration can work out the final action programmes, i.e. the detailed town plans ready for implementation.

In the planning of new towns and villages one of the first things to be considered after the detailed surveys have been undertaken should

be to identify the main qualities and characteristics of the landscape and to incorporate this in the overall planning of the area. In this way each different settlement could be given a specific image mainly based on the landscape.

## 6.2 THE CENTRE HIERARCHY

Sarawak and the Study Area have a low degree of urbanisation; in Sarawak: 25 percent and in the Fourth Division: 27 percent of the population are living in towns. The urbanisation of the Fourth Division is expected to reach about 40 percent in 1990. There are three major centres in Sarawak, namely Kuching, Sibu and Miri. It is the aim of the Government to establish a "four-centre growth pattern" in the state by appointing Bintulu a regional centre.

It is also the intention of the Government to restructure society and "to make life richer and more rewarding for those who live in rural areas" among others by providing free or subsidised social services. In order to achieve these aims the urbanisation of rural areas should take place through a differentiated settlement pattern with a reasonable distribution of all categories of service centres.

The Centre Hierarchy of the Region consists of four different types of service centres.

1. Regional Centres with a population target of 30 000 people
2. Sub Regional Centres with a population target of 10-15 000 people

3. Smaller Service Centres with a population target of 4-6 000 people
4. Villages with a population target of 2 000 people.

The Regional Centres would normally be Divisional Headquarters, which would have the majority of the trade and industries in the country. These towns would form the major growth poles which would have an important interaction with the Sub Regional Centres and their surrounding rural and semi rural areas. The level and variety of public and private services in the Regional Centres should be at the 'highest order' in the country.

The Sub Regional Centres would be the domicile for a District or a Sub District Office. Apart from the industries directly connected with the processing of agricultural produce and timber these centres are envisaged to have only a limited number of small-scale industries. The Sub Regional Centres would have an urban character with a fairly high standard of public and private services (see Figure 1.1 in the Introduction to the Manual). The Service Centres would normally have an urban image in its core, although the residential areas would be in a rural setting mainly based on the one acre homestead plot for each house. The Service Centres would have a bazaar area, would be supplied with water and electricity and would have such public services as a secondary school and a health sub centre.

The Villages would mainly have a rural image. There would be a few shophouses and a primary school in their centres. The population however, would mainly be working in agriculture with a one acre homestead plot for each family.

## 6.3 THE PRINCIPLES OF CENTRE AND SETTLEMENT LOCATION

The planning of the location of settlements and urban centres in agricultural development areas, like the Priority Area South, could be based on a grid of $1\frac{1}{4}$ miles (2 kilometer) between the lines.

The grid pattern identifies certain nodal or central points which could be the future locations of settlements. Each nodal point would be surrounded by a cultivated area of about 5 000 acres which support an agricultural population of approximately 2 000 people. The maximum distance from any nodal point to any plot within a developed area would be $1\frac{1}{2}$–2 miles (2–3 kilometers) which corresponds to about 30 minutes of walking. Each nodal point has the potential of being developed into a village of about 2 000 people. However, in order to obtain a differentiated settlement pattern the potential population of two or three villages should be concentrated into one town. Such a concentration of the agricultural population would require that cultivation should be under an estate type of management with organised transport of the workers to and from the fields.

Depending on the shape of the agricultural areas the distance between the Villages and the "higher order" Service Centres would then be 5-10 miles, which implies that the Village population could utilise the service facilities in the Service Centre rather frequently. The combination of a series of well-equiped Service Centres with smaller Villages attached to them could imply that the service level in the latter would be kept at a basic minimum. Although the Village people would not enjoy a wide range of amenities at their door step, they would not be excluded from a frequent use of the facilities in the nearest town.

This planning concept would give a differentiated settlement pattern with a reasonable distribution of different categories of urban centres. As shown in Figure 6.1, the distribution between the 'higher order' Service Centres and the Villages appears to be about five Villages per each major Service Centre.

## 6.4 THE REGIONAL CENTRES

The Regional Centres should be developed on planning standards and principles which apply to larger towns like administrative and industrial centres. The urbanity of these centres are based on a wide range of employment apportunities offered by public administration, industry and other services.

FIGURE 6.1


THE PRINCIPLES OF LOCATION OF CENTRES AND SETTLEMENT

1½ MILE GRID (2 KILOMETRES).....

AREA SUITABLE FOR AGRICULTURE.....

SERVICE CENTRE.....

VILLAGE.....

The industry could, from a town planning point of view, be devided into two categories:

1. heavy and polluting industries
2. light industries

Heavy and polluting industries should be separated from residential areas and be located in close connection to the main road system and port facilities. Light industries, and non polluting industries, workshops etc. could be integrated with other service facilities in service areas or even in residential areas. This would decrease the transport between the house and working place for the workers; it would prevent unnecessary pressure of traffic on the local road net work and would make the town more lively and attractive. Reserve areas for heavy and light industries should by laid out in The Structure Plan.

Services and administration activities within the towns should be located in one major centre and in maximum 2-3 sub centres depending on the size of the town, developed within walking distance from the residential areas. Some of the recreational areas should be developed in close connection to the central facilities and the residential areas and should be laid out with enough space to allow future expansion of the central facilities. Service facilities which are used by the majority of the population like the Bazaar, the Market Place, the Community Hall, and the Post Office should be given a nucleus 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 average height of buildings in central areas should be maximum 3 storeys.

The residential area in the Regional Centres should contain all different classes of housing based on the expected income distribution of the urban population. Below is indicated housing density that would apply to residential areas in the Regional Centres:

1. High income housing, 3-4 units per acre
2. Upper middle income housing 4-6 units per acre
3. Lower middle income housing 6 to 8 units per acre
4. Low income housing 6 to 10 units per acre

The average height of buildings in residential areas should not be more than two storeys.

The traffic system should be planned to avoid heavy traffic through residential and central areas. Moreover it should be attempted to achieve a segregation between pedestrians and bicycles on one side and motor vehicles on the other side to ensure safe routes between the residential areas, schools and central facilities.

## 6.5 SUB REGIONAL CENTRES

The Sub Regional Centres would be centres with a population of 10-15 000 people and be the main urban centre for a total population of about 25-40 000 people.

The town could have roughly the services indicated by Figure 1.1 in the Introduction to the Manual. The basic strategy of the town plan (see Figure 6.2) is built up on a location pattern with:

a. Industries located close to the main regional road with expansion possibilities parallel to the road.

b. The town centre and the main service facilities developed from the central part of the industrial area with expansion possibilities as shown on Figure 6.3.

c. The residential areas developed on both sides of the town centre with expansion possibilities in two directions as shown on Figure 6.3.

The industries in the Sub Regional Centre would mainly consist of service industries, workshops etc. situated in the central area facing the main road access to the town and the bazaar area. The agricultural

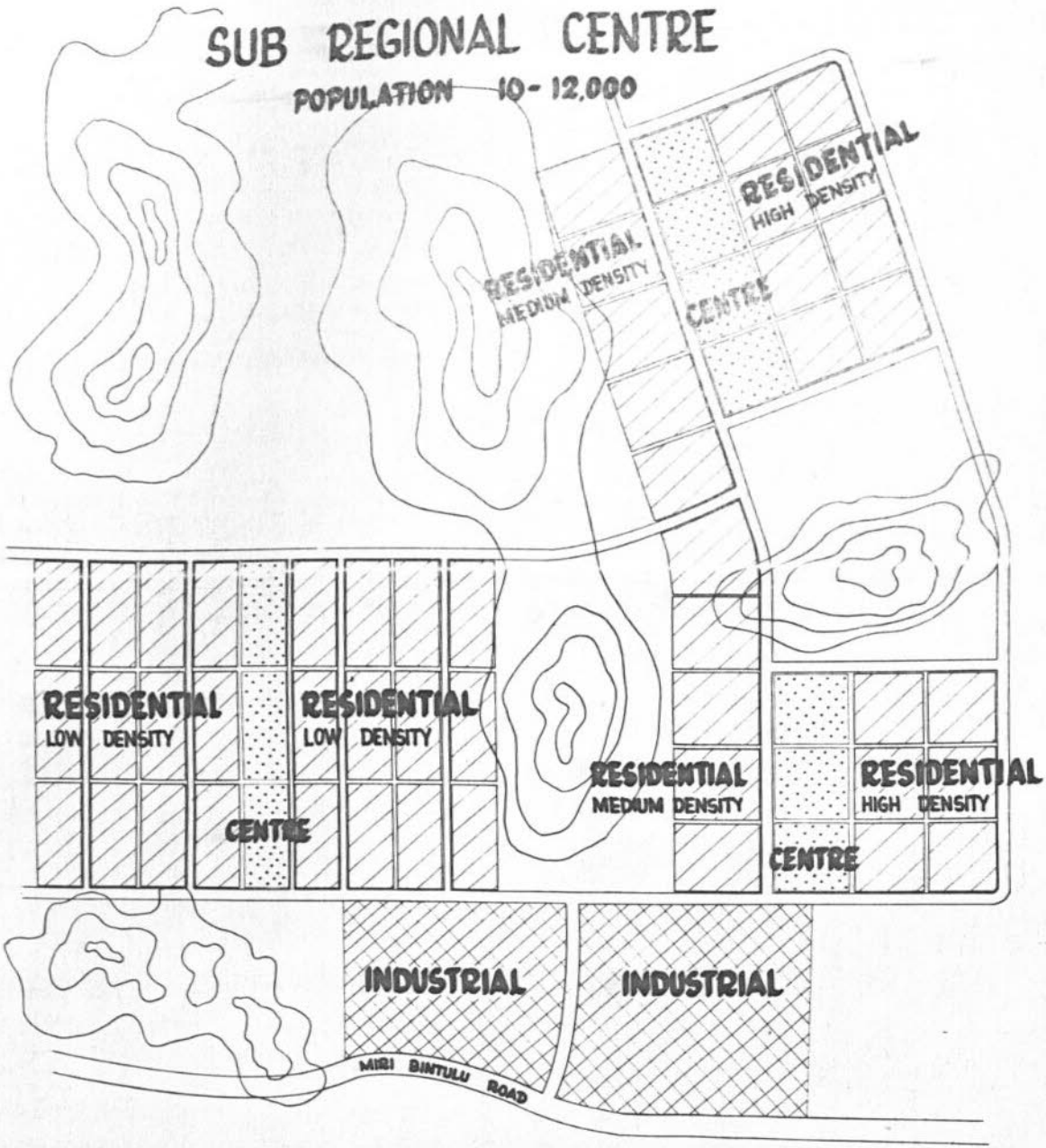

SUB REGIONAL CENTRE
POPULATION 10 - 12,000
RESIDENTIAL
HIGH DENSITY
RESIDENTIAL
MEDIUM DENSITY
CENTRE
RESIDENTIAL
LOW DENSITY
RESIDENTIAL
LOW DENSITY
CENTRE
RESIDENTIAL
MEDIUM DENSITY
RESIDENTIAL
HIGH DENSITY
CENTRE
INDUSTRIAL
INDUSTRIAL
MIRI BINTULU ROAD

FIGURE 6.2

and forestry processing facilities should be situated further out along the main road.

The town centre should be laid out with 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 and include higher educational facilities, some public offices and religious buildings.

The residential areas should be planned to accomodate a differentiated pattern of housing. However, it is important to point out that Sub Regional Centres mainly will be based on employment in agriculture and forestry which would give a minimum of 50 percent of the total households in the town to be living in low cost housing.

The plot-ratio of the residential areas should be worked out carefully to avoid creation of slum and working camp type of towns with a resulting early renewal. Planning for early large scale renewal cannot be seen as a desirable thing because this has a tendency to destroy the atmosphere of any developed town.

The principles of the residential areas based on a majority of low cost housing should, to avoid any future and overall renewal, be developed as low building density areas which enable the settlers to improve the standard of the dwellings as their incomes increase. The improvement and renewal of the town would then take place as a gradual process.

The plot ratio of residential areas in Sub Regional Centres would be as follows:

1. High income housing 3 units per acre
2. Upper middle income housing 4 units per acre
3. Lower middle income housing 6 units per acre
4. Low income housing:
   a. for agricultural households 1 unit per acre
   b. for other low income groups: 6 to 10 units per acre

Primary schools in sub service centres could be located within the residential areas.

## 6.6 THE VILLAGE

The Village should be planned to serve the future demand of independent farmers. The main reasons for the Village settlement type are to establish settlements which give a basic minimum of services and which at the same time give the farmers an easy access to their agricultural plots.

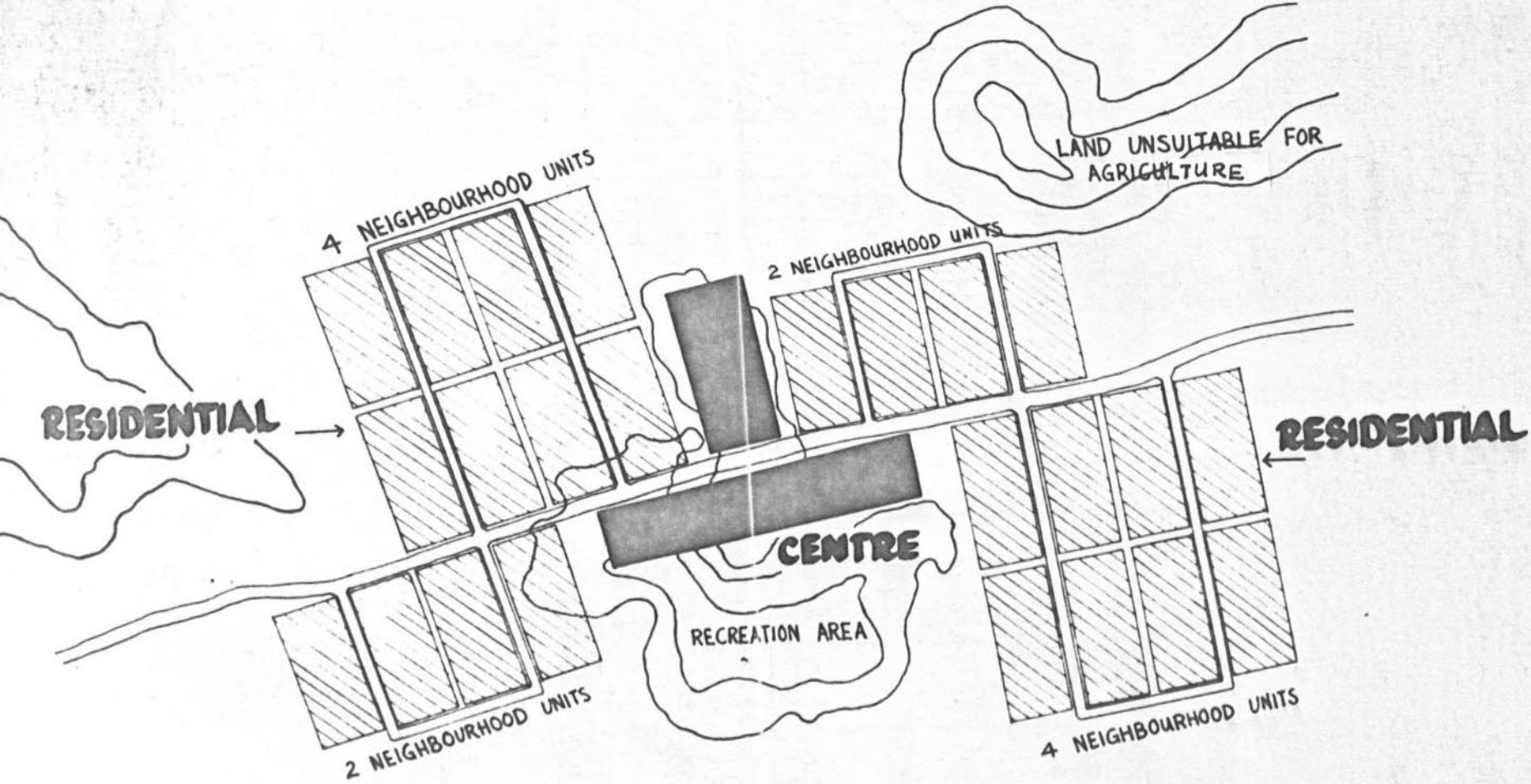
The Village is situated with approximate 5 000 acres of surrounding agricultural land which can be reached within a reasonable walking time. The Village is built up of two main elements as shown in Figure 6.4.

a. The residential area
b. The Village centre

The residential areas should be developed on the principles of neighbourhood units and the one-acre-plot (see chapter 7). One Village would consist of 12-14 neighbourhood units with about 20-25 households in each unit.

Certain service facilities such as religious buildings could be situated within the actual residential areas. The residential areas should be located with direct connection from their access road to the main road. The expansion possibilities of the Village would be along the main road as shown on Figure 6.5.

The central facilities should be situated within convenient walking distance of all neighbourhood units and with expansion possibilities as shown on Figure 6.5. The Village centre should be planned with service facilities such as one Primary School, a Bazaar with approximate 5-6 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. Such a Village could in addition be allocated




# A TYPICAL VILLAGE OF 2,000 POPULATION

FIGURE 6.4

a Health Sub Centre, a Post Office Class C and a minor Police Station. Open space and recreational areas should be located in connection with the town centre and allow for possible future expansion of the centre.

## 6.7 THE NEIGHBOURHOOD UNIT AND THE ONE ACRE PLOT

Settlements in rural areas, based on a majority of low cost housing should, in order to avoid any future slum and overall renewal, be developed mainly on low building density principles which enable the settler to improve the standard of the dwelling as the income increases.

A housing area based on low cost houses and low density principles (assumed to be 1 acre per housing unit) tends to provide the settler with a certain needed security. The family can provide a substantical part of their living by cultivating the one acre plot with fruits, vegetables, live-stock etc. The one acre plot would give sufficient space for expansion of farm houses and storage facilities. The dwellings and public utilities can in low density areas be kept on a basic minimum and still stand up to a reasonable health standard. Later improvements can take place with the increase of income or other improved situations, introduced either by the local authority or by the owner. The renewal of the residential areas could take place as a natural and gradual process based on the one acre plot. When the standard of living increases the one acre plot can be subdivided

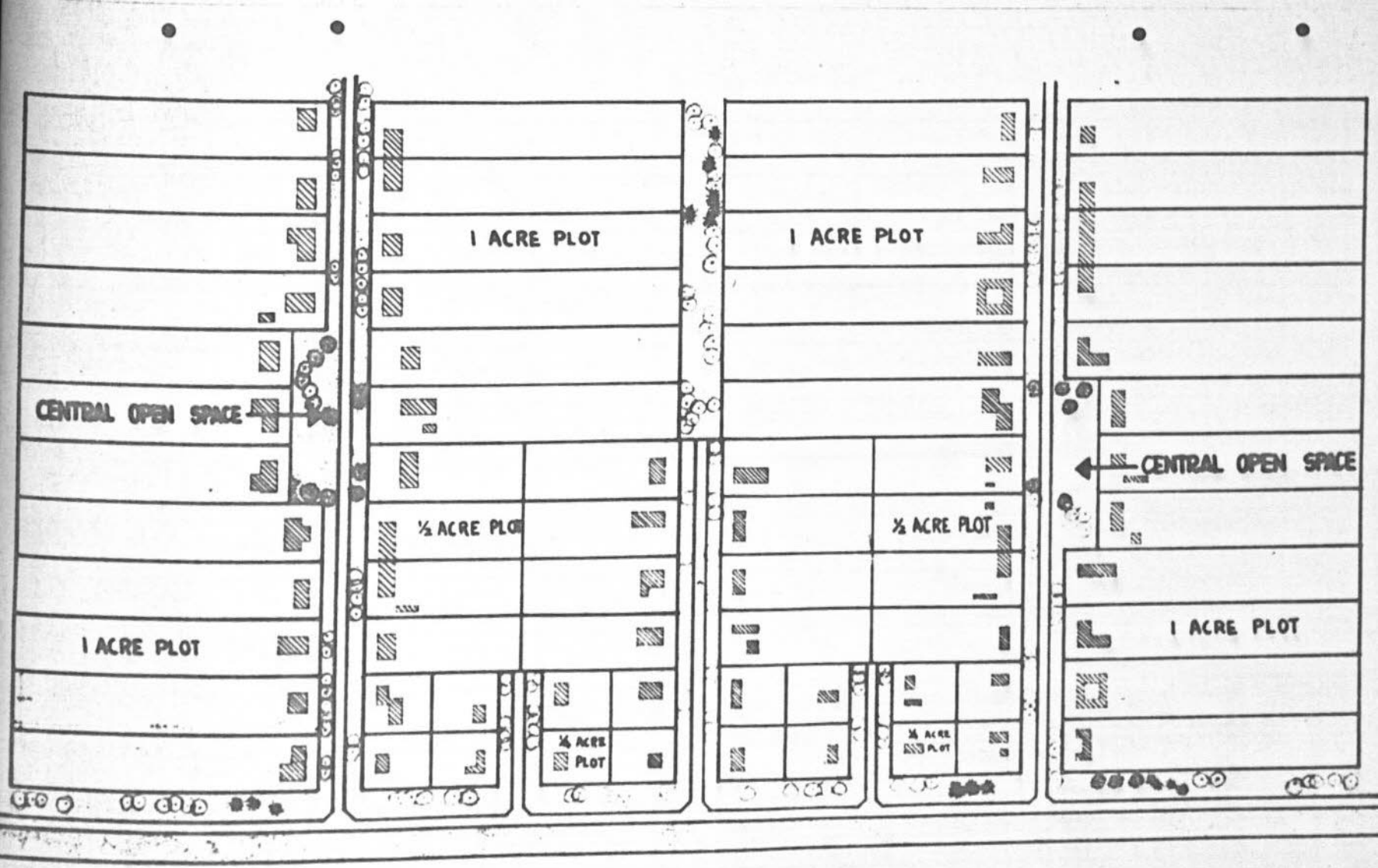
into half acre or quarter acre plots whereby the residential areas have got an inbuilt reserve for the accommodation of more people in the future, see Figure 6.6.

Residential rural areas developed on one acre plots for each household should be organised in neighbourhood units and it is believed that a creation of neighbourhood units with 20-25 households or 100-150 people in each unit should give a certain social security. This is important because the people who will form the new towns in development areas would come from different communities, and with different cultural backgrounds.

By the provision of neighbourhood units people with the same background could in the beginning settle close together in the same unit. A neighbourhood unit is in most societies seen as an important tool for the creation of a communal understanding with a natural communication and interaction.

Such a communal understanding could be seen in practice when the farmers, working in the fields, will need other members of the neighbourhood unit to look after their house and plot.

A small area within the neighbourhood unit should be reserved for a meeting place for children and adults as shown on Figure 6.6.




# 2 NEIGHBOURHOOD UNITS

EACH OF 24 ONE ACRE PLOTS

FIGURE 6.6

## 6.8 EXPANSION OF EXISTING SETTLEMENTS AND TOWNS

The expansion of existing centres in rural areas like Bekenu, Beluru, Batu Niah, Marudi and Labang in the Study Area, should be based on the same standards as other urbanised rural areas. The majority of Housing should take place on one acre 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.