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SOUTH EAST SULAWESI
TRANSMIGRATION AREA DEVELOPMENT
PROJECT. VOLUME 4

VOLUME 4

SOUTH EAST SULAWESI

TRANSMIGRATION AREA DEVELOPMENT PROJECT

SETTLEMENT PLANNING

HUNTING TECHNICAL SERVICES LIMITED AND HUSZAR BRAMMAH AND ASSOCIATES
in association with Sir M MacDonald and Partners
FOR THE ASIAN DEVELOPMENT BANK AS EXECUTING AGENCY FOR U N D P AND THE DIRECTORATE GENERAL OF TRANSMIGRATION GOVERNMENT OF INDONESIA

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Introduction

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1.1 Approach to settlement planning

The present volume, concerned with settlement planning, is an integral part of a comprehensive study. It should be read in the context of the developmental proposals made in the agricultural and irrigation sector studies, and in the light of the overall economic and social objectives underlying the whole project. Not-withstanding such determining factors as soils and topography; size and distribution of individual holdings; cropping pattern and agricultural technology; proposed irrigation system and anticipated family income, the settlement planner still has his own field of independent contribution. The settlement planner's brief implicit in the previous two volumes (Volumes 2 and 3), is open to any number of physical solutions. Those proposed in this volume are informed by the belief that any proposed new community should be endowed with a physical infrastructure which, as far as possible, can be maintained and improved by the community's own economic resources.

As part of the overall philosophy of the project, attempt has therefore been made to reduce physical investment costs, while emphasis has been given to investment in the productive sectors of the economy and to agricultural services. In addition, we have tried to use locally available materials for construction. The designs of the recommended housetypes are based on traditional building technology, with which many of the settlers are familiar.

In general, with physical development, we favour a policy of encouraging self-reliance after initial establishment, and would like to see investment so managed that as much as possible of its direct and indirect benefits should accrue to the new community. Equally, the construction programme should be so organised as to bring new opportunities and employment to the benefit of the transmigrant community and those indigenous people living around them.

1.2 Guide to the report

In Chapter 2 we describe briefly the distribution and characteristics of the population in the Province and the Study Area, and the standard and provision of the basic services of the physical and social infrastructure. We also discuss prevailing regional priorities, and their relationship to the proposed outline plan, which sets the long term context of our specific proposals for the loan project.

Chapter 3 presents the alternative area plans for the proposed new developments in the Wawotobi and Makaleo areas, including the provision and distribution of services and the ranking of service centres. In Chapter 4 and 5 we describe in detail the proposed layout of villages in the Wawotobi and Makaleo areas respectively, and present alternative prototype layouts for the two different cropping patterns proposed in this study: one for dryland and the other for irrigated agriculture.

Chapter 6 deals with housing, the buildings accomodating supporting community services and the layout of local and village centres. Two alternative housetypes are proposed and discussed in detail. In Chapter 7 we examine the existing settlements and comment on the lessons they offer for improvements in layout.

Chapter 8 discusses the problems related to infrastructure: standards and existing conditions of roads, bridges and fords, and the technical criteria of their improvement; and it also deals with the provision of essential services, such as water supply. In Chapter 9 cost estimates are provided for all physical development proposed in this volume, while Chapter 10 discusses the availability of construction materials, the problems of implementation, tendering procedures and contract management.

Technical details concerning demography, social services, housing, infrastructure and costings are given in the appendices.

The regional context 2

In Volume 1 we have outlined the parameters characterising the South East Sulawesi economy, while Volume 2 contains descriptions of the geology, climate and soils of the region. These together provide the economic and physical context in which development can take place. In this chapter we intend to describe briefly the distribution and characteristics of the population of the province, and more particularly that the Study Area; we shall also describe the standard and provision of basic infrastructure and social services in mainland South East Sulawesi and the priorities of the Provincial Government for future development. We shall also discuss the constraints and opportunities for future growth and its likely effect on the settlement pattern which is to form the basic of the outline plan proposed by this study for long term development.

2.1 Population

The population of South East Sulawesi was 816,045 at the latest count in mid 1976, of which 43.3 per cent live in the two kabupatens, Kendari and Kolaka which contain the Study Area. Transmigration settlements have only been located in these two kabupatens. Figure 2.1 shows the boundaries of the kabupatens and their subdivisions into kecamatans.

2.1.1 Population growth and migration

According the figures published by the Statistical Office, the population of the Province has growth between 1961 and 1976 by 256,400 people. This growth, representing a rate of 2.6 per cent per annum, however, has not been uniformly distributed between the four kabupatens, as Table 2.1 illustrates.

Table 2.1 Population totals by kabupaten, 1961–1976

thousand persons

Year	Kabupaten				Total	Total
	Kendari	Kolaka	Muna	Buton		
1961	159.5	35.1	111.8	252.3	559.6	
1963	165.9	36.5	124.9	263.9	590.8	
1965	172.6	38.0	129.9	274.1	614.7	
1967	180.7	39.4	136.0	286.9	643.0	
1969	190.6	67.3	137.2	295.0	690.1	
1971	190.0	69.7	154.0	300.4	714.1	
1973	203.9	92.5	156.6	291.7	744.7	
1976	244.2	108.9	163.5	299.5	816.0	
1961–1976 growth (per cent)	53	210	46	19	46	
Annual growth rate (per cent)	2.9	12.7	2.6	1.2	2.6	

Source: Biro Pusat Statistik

2.1 Administrative boundaries

Table 2.1 indicates rather low population growth for kabupatens Buton and Muna, both of which have experienced growth well below the rate of natural increase, while an exceptionally high growth rate was experienced by Kabupaten Kolaka. The growth rate for Kabupaten Kendari was also rather low up to about 1971. These figures point to substantial outward migration from three kabupatens, and to large scale migration into Kabupaten Kolaka.

No specific migration statistics are available regarding net movement of population at kabupaten level. We have estimated the net movement of population from and into kabupatens Kendari and Kolaka for the period between 1961 and 1971 by comparing actual 1971 population with what this population would have been if rates of natural increase were applied to the 1961 base population data.

The same procedure was adopted for calculating net migration between 1971–1976, but with revised rates for natural increase. The method used is desenibed in detail in Appendix A.1.

Table 2.2 shows the net migration figures for both periods, and also indicates the volume of net migration exclusive of the counterbalancing effects of transmigration.

Table 2.2 Estimated net migration, 1961–1971 and 1971–1976

thousand persons

Area	Net migration		Net migration without the effect of transmigration	
	1961–71	1971–76	1961–71	1971–76
Province	– 16.3	– 5.5	– 18.8	– 29.6
Kabupaten Kendari	– 18.2	+ 25.7	– 20.7	+ 9.6
Kabupaten Kolaka	+ 23.9	+ 28.7	+ 23.9	+ 20.7

Source: SESP.

Table 2.2 illustrates clearly, that despite transmigration, which has considerably accelerated in the last five years, the Province still had, during the same period, a net population loss of 5,500 people. In fact, without the counterbalancing effect of transmigration, the actual volume of outward migration, a total of 29,600 people, was greater during the last five years than the previous ten years. Nevertheless, during 1971–76 Kendari and Kolaka have experienced a net inflow of population. For Kolaka this represented a continuing pattern from the previous decade, but for Kendari it is a reversal of the previous trend. The population of Buton and Muna islands, on the other hand, remained virtually static over the last five years — a period during which well over 10 per cent natural increase of the population was experienced.

This indicates, if statistical figures are to be believed, a 10 per cent outflow of population. If this is in fact the case, the provincial authorities are fully justified in being increasingly anxious to resettle the local population. In fact, the magnitude of the problem appears to be such as to justify the intervention of Central Government in helping to find a solutiop. This may well lie in extending the benefits of transmigration to the inhabitants of the islands of Buton and Muna.

Just as population growth has not been distributed evenly between kabupatens, they have not been evenly distributed within them, between the various kecamatans. Table 2.3 below shows that during the period 1971–76 in kabupatens Kendari and Kolaka the annual growth rate of the individual kecamatans have ranged from 1.7 to 23.3.

The expanation of the very low rate of growth in Kecamatan Wawotobi probably lies in the relatively high physical investment costs required to extend cultivable areas, whereas the low growth rate of Kendari can be explained by the overspill of the population into the neighbouring kecamatans of Mandonga and Poasia around Kendari bay. The very high growth rates of Moramo and Ranômeeto in Kabupaten Kendari and Tirawuta in Kolaka are all due to transmigration schemes, while Wundulaho's rapid growth is, at least partly, related to nickel mining in the area. Kecamatan Kolaka's expansion is mainly due to spontaneous settlement, and also to the expanding service centre functions of Kolaka town.

Table 2.3 Population growth in the Kendari and Kolaka kabupatens, 1971–76

Population (000's)

Kecamatans		1971	1976	Per cent growth 1971–76	Annual growth rate
Kabupaten	**Kendari**	191.2	244.2	27.7	5.0
	Kendari	29.2	32.4	10.9	2.1
	Mandonga	10.0	17.2	73.0	11.6
	Soropia	5.4	6.2	15.3	2.9
	Poasia	6.6	11.8	78.9	12.3
	Moramo	8.2	12.7	55.4	9.2
	Wawotobi	21.0	22.8	8.7	1.7
	Lasolo	10.9	12.9	18.2	3.4
	Lainea	14.0	17.0	21.1	3.9
	Tinanggea	15.7	18.6	18.5	3.5
	Ranomeeto	13.8	23.0	67.2	10.8
	Sampara	12.6	15.0	19.0	3.6
	Wawonii	11.4	15.1	32.5	5.8
	Lambuya	13.1	16.9	29.0	5.2
	Unaaha	12.8	15.2	18.0	3.4
	Asera	6.6	7.5	13.7	2.6
Kabupaten	**Kolaka**	69.7	108.9	56.2	9.3
	Kolaka	19.0	27.0	42.2	7.3
	Wundulaho	20.6	34.2	65.8	10.6
	Mowewe	4.3	5.7	30.7	5.5
	Tirawuta	4.8	13.6	185.2	23.3
	Lasusua	11.0	14.7	33.7	6.0
	Pakue	10.0	13.7	37.6	6.6

Source: Biro Pusat Statistik

2.1.2 The age-sex structure of the population

It is typical of the age-structure of the population of Indonesia that over 60 per cent of the population is under the age of 25. In the case of South East Sulawesi this figure is even higher, 64.6 per cent, and in the case of Kabupaten Kendari it is still higher standing at 66.4 per cent; this is largely due to the high percentage of population in the under 5 years age group. Table 2.4 represents the age-sex structure of the population in kabupatens Kendari and Kolaka in 1971.

Table 2.4 Age-sex structure in kabupatens Kendari and Kolaka, 1971

per cent of population

Age group	Kendari Males	Kendari Females	Kendari Total	Kolaka Males	Kolaka Females	Kolaka Total
0–4	9.4	10.5	19.0	10.2	10.1	20.3
5–14	14.7	13.0	27.7	14.0	11.8	25.8
15–24	9.5	9.3	18.8	9.1	8.7	17.8
25+	17.1	16.5	33.6	18.3	17.8	36.1
Total	50.7	49.3	100.0	51.6	48.4	100.0

Source: Biro Pusat Statistik

An analysis of this overall picture, however, reveals substantial differences between rural and urban areas, particularly in the age-distributions of the population. Table 2.5 illustrates that among the urban population a much lower percentage is under the age of 5, whereas much higher percentage of the population is in the 15–24 age group than in rural areas. This is a clear indication of lower birth rates in urban areas, and also of substantial migration to towns by young people for either obtaining education or employment.

Table 2.5 Age structure of urban and rural population in kabupatens Kendari and Kolaka, 1971

per cent of population

Age	Kendari			Kolaka		
	Urban	Rural	Total	Urban	Rural	Total
0–4	15.8	19.9	19.9	17.4	20.6	20.3
5–14	24.5	28.0	27.7	26.3	25.7	25.8
15–24	29.5	17.7	18.8	21.4	17.1	17.8
25+	30.2	34.4	33.6	34.9	36.6	36.1
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: Biro Pusat Statistik

2.1.3 Economic activity rates

The most recent and reliable statistics relating to economic activity levels were published in the 1971 Population Census. Estimates have since been produced for later dates, but they are neither as reliable nor as exhaustive as the census figures.

54.3 per cent of the population over the age of 10 years in South East Sulawesi was classified as economically active in 1971. Economically active population is defined as the population actually working or seeking work at the time of the census. Activity rates are not uniform in the various kabupaten areas. For instance 57.2 per cent of the population over the age of 10 in Kabupaten Kendari was classed as economically active, while the corresponding figure for Kabupaten Kolaka was 42.8 per cent.

Although unemployment rates vary in the province, a general figure of approximately 10 per cent is typical. Urban unemployment seemed to be marginally above that of rural areas in kabupaten Kendari, while in Kolaka urban unemployment was substantially lower. But figures relating to unemployment in a primarily rural economy not experiencing land shortage must be treated with caution.

The employment structure of the province reflects its predominantly rural character, with over 85 per cent of the working population engaged in agriculture, forestry, fishing and hunting. This figure is substantially lower in Kabupaten Kolaka, only 67.6 per cent, as mining offers alternative employment.

2.2 The settlement pattern

The level of urbanisation in the province is unusually low. According to the 1971 Census information only 6.3 per cent of the population lives in urban areas. In the Kendari and Kolaka kabupatens 8.5 per cent of the economically active population live in areas classified by the Census as urban, but over one third of this urban labour force is engaged in primary activities, mainly agriculture, fishing and mining. The Census recognises only two urban areas in the mainland part of the province, Kendari and Kolaka, with a total population of about 25,000.

This undeveloped settlement pattern, shown in Figure 2.2, is a reflection of the provincial economy. Agriculture, the dominant sector, is almost totally composed of small scale farming, much of which is barely above subsistance level. Shifting cultivation is widespread, although most of the people live in well established villages. The cropped areas are limited by the availability of family labour. Cattle and buffalo are kept in parts of the Study Area, but are not normally used for land cultivation. Since much of the farming is essentially for subsistance, there is generally no cash available for hire of labour, or for the purchase of goods, services and agricultural inputs. Hence service centres are widely scattered, and the marketing chain is weak. The state of the communication network in the Study Area is rudimentary. There are two state roads with a total length of 197 kilometres; one from Kendari to Kolaka, the other from Kendari to the airport, both of which are all season, single lane roads, mostly surfaced. Of the 72 kilometres of provincial road running from Lepo-Lepo through Punggaluku to Lainea, 57 are in poor or very poor condition, sometimes not passable during the wet season. Of the 257 kilometres of district roads within the Study Area 234 are in poor or very poor condition, at times hardly more than dry season tracks. Traffic on these roads is minimal – again a reflection of economic activity. A count made on the state roads at two locations in 1974 indicated 85 vehicles per day. Very little traffic proceeds beyond the state and provincial roads – such vehicles as do are mainly motor cycles, light commercial vehicles and animal carts.

About two thirds of the population lives within easy access to the state and provincial roads, many of them in typical, linear shaped, road-side settlements, the truck road functioning as the high street, indeed often as the only street of the village. This form of settlement is understandable at the present state of development – but when the economy takes an upward swing and traffic volums increase it is likely to be the source of considerable difficulties and extra costs both in economic and social terms.

2.2 The existing settlement pattern

Those communities which live further away from the state and provincial road network are either served by district roads providing dry-season access or are isolated coastal fishing communities, to which access is by the sea alone.

It has been noted in other studies that in remote areas development of service centres is often sparked off by the location of administrative and other centrally funded services, such as communication and schools and health facilities. This is certainly appears to be the case in the Study Area. Therefore, to discover the incipient pattern of urban centres, one has to look for the developing administrative centres at kecamatan level. Perhaps Pomalaa is the only town in the Study Area which as it is independent of administration, has an economic base in the nearby nickel mining activity.

About half of the 21 kecamatan centres are located alongside the state and provincial roads. Both the educational and health facilities are distributed mainly on the basis of the administrative hierachy. Thus, hospitals and senior secondary schools are typically kabupaten level services, while health centres (puskesmas) and junior secondary schools are typically kecamatan level services, although not all the kecamatan centres have them at present. The structure of the health and educational services and their distribution in the Study Area is described in Appendix B.

A major influx of population and higher levels of income will result in a substantial increase in the demand for goods and services. But even before the influx of new settlers, the accelerated construction and land preparation activity is bound to generate a similar situation. These will lead, in a relatively short period of time, to a rapid expansion of secondary and tertiary activities resulting both in the strengthening and upgrading of existing service centres, and in the creation of new ones, particularly in the areas of new settlement schemes.

The existing transmigration and social welfare settlements did not have as great an impact as we generally anticipate from new schemes, partly because they are widely scattered in the province and often located on low fertility land, and partly because relatively small investment was made into improving the productive capacity of the settlers themselves. Even so, the more successful they were the greater impact they had. For example Ladongi I and II had a marked effect on the economy of Rate Rate, and reinforced its role as a service centre.

2.3 Regional priorities

In the course of last year there has been a major shift in the thinking of provincial planners concerning the spatial aspects of development priorities. In previous thinking emphasis was laid on the development of growth poles in the southern coastal areas of mainland South East Sulawesi, concentrating on the upgrading of Punggaluku and Tinanggea, the two kecamatan centres of the area. Priority was also given to the western coastal areas of Towari, south of Kolaka. These ideas have been reflected in the location of a number of transmigration settlements on the Rumbia and Roraya plains, some of which have already been developed. Also several irrigation projects have gone ahead to serve both the indigenous population and the new settlers.

The original terms of reference of the Consultants, prepared in 1975, also reflect the Provincial Government's earlier thinking on priorities — hence the choice of the Project Area, consisting of the four plains of the Lahumbuti–Konaweha rivers, the Opa Swamps, the south and the west coastal areas, as shown on Figure 1.3 in Volume 2.

In the early stages of this study, during consultations with officials of BAPPEDA and the Department of Public Works in Kendari, it became apparent that the Provincial Government had formulated revised guidelines for the spatial distribution of development, primarily on the basis of accessibility. Accordingly, top priority was given to the development along the Kendari–Kolaka highway, and South Kendari was relegated to second place. The Provincial Government was also giving active consideration, indeed tentative approval, to individual applications for concessions totaling some 40,000 hectares of land in the west coastal area around Towari for livestock development. This effectively meant that the west coastal areas were withdrown from consideration for large scale, intensive agricultural development.

These changes were reflected in the plans of the major implementing departments. On Bina Marga's programme the highest priority is given to the completion of the surfacing of the Kendari–Kolaka highway, to be followed by the widening of the same road. Vehicular traffic on this road is assumed to increase substancially as a result of the introduction of a car ferry from South Sulawesi to Kolaka. The partial rehabilitation of the Kendari – Punggaluku – Tinanggea road was given second priority. There are no plans at the provincial level for the improvement of access to the Towari area.

The priorities of the Provincial Irrigation Department were also redefined to conform to regional development policy. Irrigation development in South Kendari was given less emphasis, medium term plans for simple schemes in the Towari area were abandoned, while a number of small irrigation schemes, mostly less than 1,000 hectares, were identified along the Kendari–Kolaka axis, for early implementation.

It was more difficult for the transmigration programme to adapt to the new locational priorities at short notice. Land had been allocated, planned and prepared for a number of new schemes well in advance, particularly in the Roraya plains, and once contracts have been signed and construction commenced, it is not easy to abandon schemes without causing delay to the whole programme. Furthermore, there had been a strong feeling in the Province that South Kendari, which is still a priority area and has very low population densities, is a particularly good location for transmigration projects.

This feeling has been sustained in spite of clear evidence that the areas allocated for transmigration had, on the hole, sub-marginal soils unsuitable for intensive cultivation. The evidence first came from the reconnaissance survey carried out by the Soil Research Institute, Bogor, and published in 1975, and was later confirmed by the semidetailed soil surveys carried out by Hasanuddin University, and also by the Consultants' findings.

Consequently, during discussions with the Provincial Office of the Directorate General of Transmigration, it was agreed that once ongoing construction is completed in the Roraya area, emphasis on new settlements will shift to areas easily accessible from the main development axis of the Province. Such a shift is entirely consistent with the Provincial Government's regional policies. Furthermore, it is also supported by technical considerations in that known and potential land resources, suitable for intensive cultivation, are more readily available, and at lower infrastructure costs, along the Kendari–Kolaka development belt.

It is also contemplated by the Provincial Government to move the capital of Kabupaten Kendari from Kendari to Unaaha. We fully support these plans, which are consistent with the priority given to the development of the Kendari–Kolaka axis. Unaaha is situated about midway between Kendari and Kolaka, and is centrally located in an area which already has about the highest population density in mainland South East Sulawesi, outside Kendari, Kolaka and their immediate hinterlands.

2.4 The outline plan

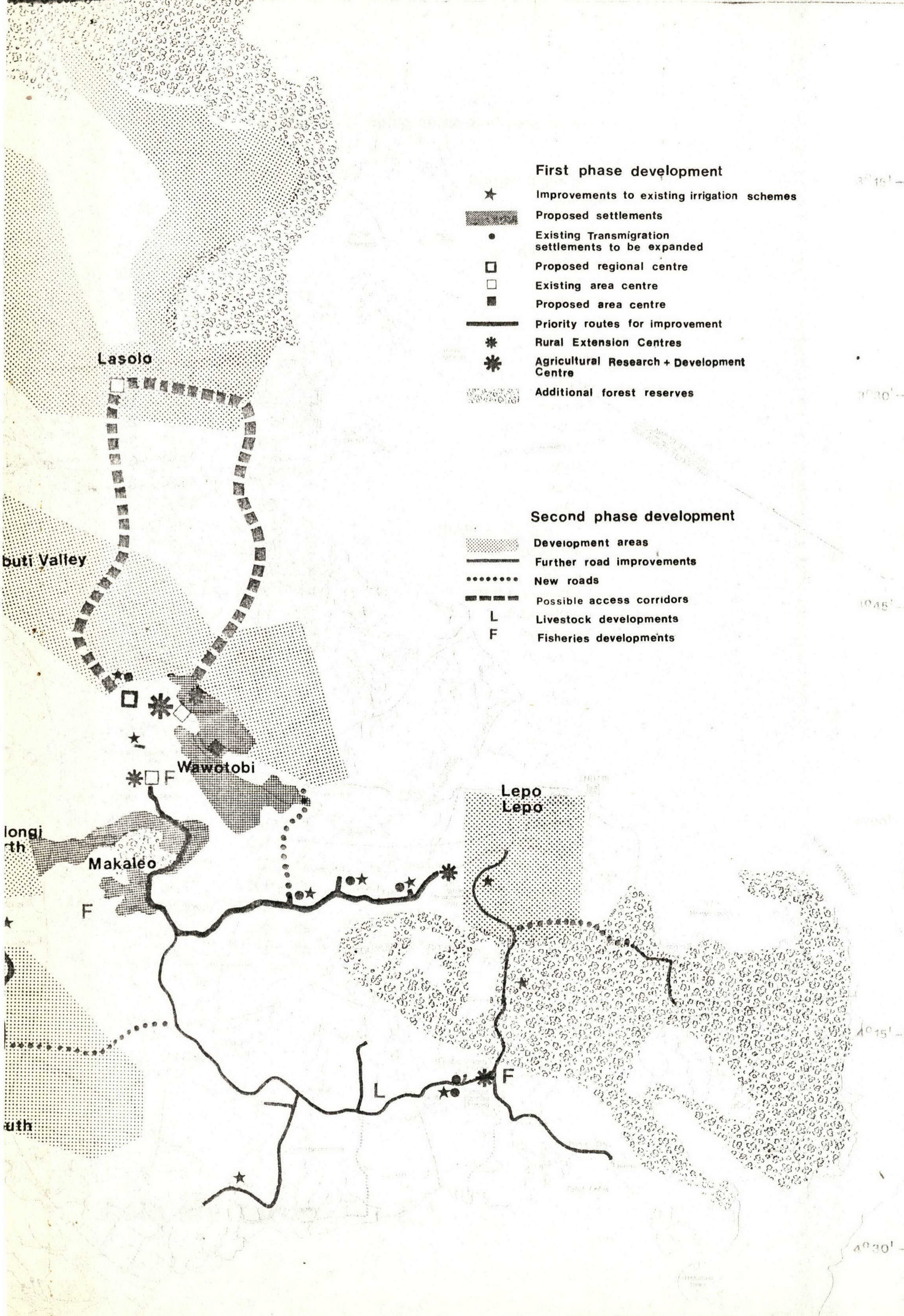
The outline plan is primarily intended to set the long term context of our proposals for the loan project and to indicate the effect of these proposals on the settlement pattern and spatial distribution o development in the Study Area. In doing so, we were guided by the Provincial Government's locationa priorities on the one hand, and by our assessment of resource potential on the other.

2.4.1 New settlement areas

Our choice for the development of new transmigration areas was largely predetermined by the fact tha either there was sufficient information available about them for us know that they are suitable for th project, or at least they could be assumed to be suitable. These are the Wawotobi and Makaleo projec areas, as shown in the outline plan on Figure 2.3. Their location, soil and physiographic characteristic are described in Chapter 2 of Volume 2. Both areas are situated along the Kendari–Kolaka axis, so the development is consistent with the locational priorities of the Provincial Government.

Outline plan — location guide	Latitude (south)		Longitude (east)	
Provincial capital : Kendari	3°	57′	122°	35′
Kabupaten centres :				
Kolaka	4°	3′	121°	35′
Kendari	3°	57	122°	35′
Villages :				
Abuki	3°	40′	121°	50′
Alangga	4°	20′	122°	15′
Ambaipuan	4°	4′	122°	25′
Ambesia	4°	20′	122°	28′
Benua	4°	13′	122°	6′
Benua	3°	47′	122°	8′
Hailu	3°	26′	122°	5′
Kumapo (Onembute)	4°	2′	122°	00′
Lahumbuti	3°	47′	122°	7′
Lainea	4°	20′	122°	35′
Lalonggasomate	4°	24′	122°	7′
Lambandia	4°	15′	122°	50′
Lambuya	3°	55′	122°	3′
Lamooso	4°	7′	122°	8′
Lapulo	4°	10′	122°	40′
Lasolo	3°	27′	122°	4′
Meraka	3°	57′	122°	3′
Mokaleleo	4°	8′	122°	3′
Motaha	4°	10′	122°	5′
Pohara	3°	57′	122°	23′
Poli Polia	4°	10′	122°	47′
Pomalaa	4°	10′	121°	35′
Puao	4°	10′	122°	7′
Puday	3°	52′	122°	7′
Punggaluku	4°	17′	122°	25′
Puriala	4°	4′	122°	6′
Rate Rate	4°	3′	121°	47′
Sauni (Sunai)	4°	1′	122°	6′

2.3 The outline plan


First phase development
Improvements to existing irrigation schemes
Proposed settlements
Existing Transmigration settlements to be expanded
Proposed regional centre
Existing area centre
Proposed area centre
Priority routes for improvement
Rural Extension Centres
Agricultural Research + Development Centre
Additional forest reserves
Second phase development
Development areas
Further road improvements
New roads
Possible access corridors
L Livestock developments
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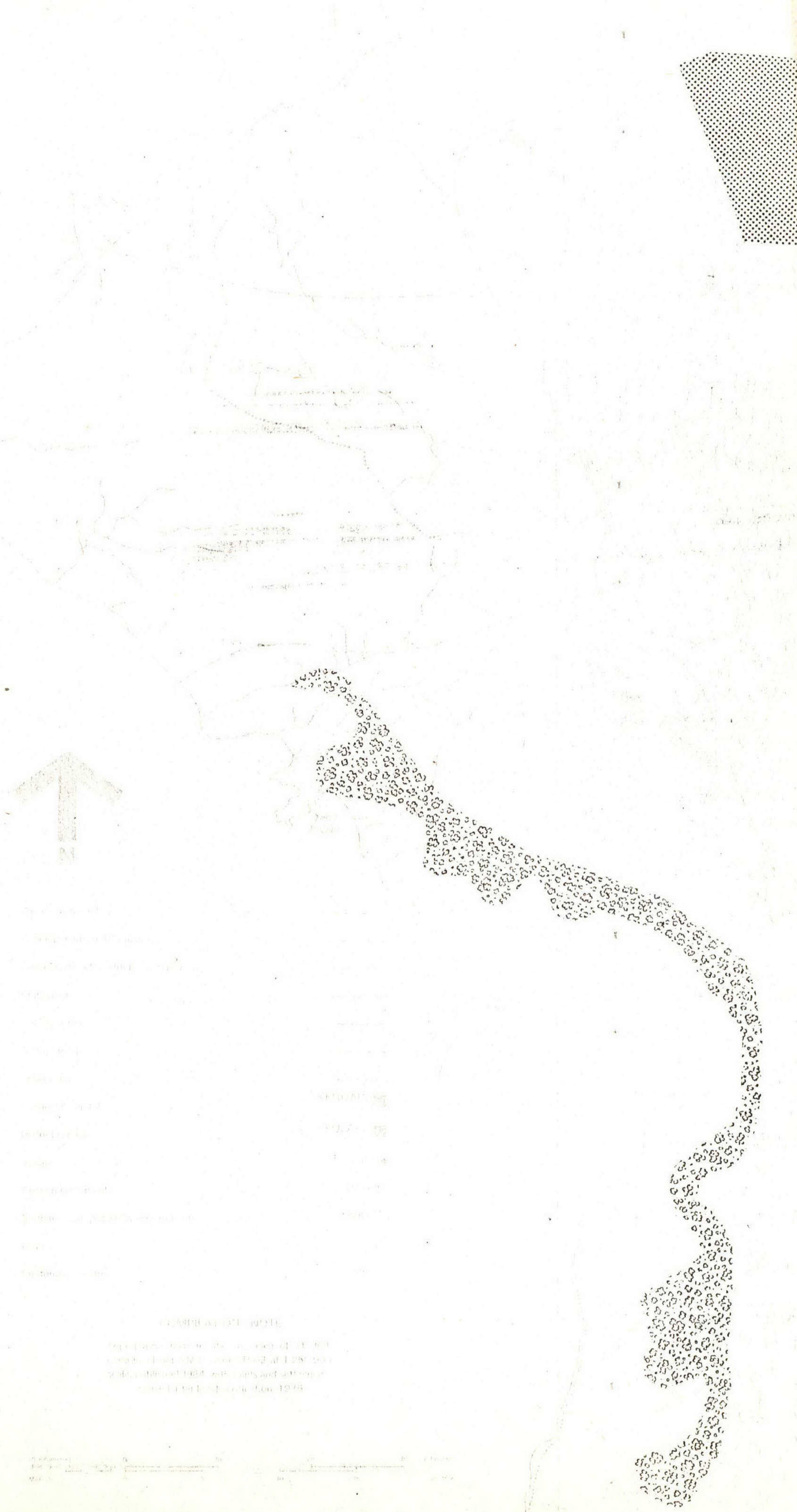


The agricultural proposals – irrigated and dryland alternatives for the Wawotobi area and a dryland cropping pattern for the Makaleo area – are described in Chapters 7 and 8 of Volume 2. The corresponding physical plans are presented in Chapters 4 and 5 in this volume. The alternative area plans, including the hierarchy of service centres are described in the next chapter. Our main concern here is to discuss the effect of the proposed development on the existing settlement pattern.

The area most directly affected falls within the boundaries of three kecamatans: Unaaha, Wawotobi and Lambuya, while the two proposed projects fall wholly within the Wawotobi and Lambuya kecamatans, and are roughly equidistant from Unaaha town itself. Assuming 3.5 per cent growth of the existing population from natural growth and net migration, and adding the anticipated population of the new developments and their increase over time as calculated for a typical settlement in Appendix A.2, the population of the area of the three kecamatans will change from 1976 to 2001 as shown in Table 2.6. The population changes in the three kecamatans, assuming that our proposals are implemented, are shown in Table 2.7.

Table 2.6 Population forecast for the areas affected by the proposed new settlements with project and without project

Area	Population ('000s)				
	1976	1981	1986	1991	2001
Unaaha Kec.	15.2	18.0	21.4	25.4	35.8
Wawotobi Kec.	22.8	27.1	32.1	38.2	53.9
Lambuya Kec.	16.9	20.1	23.8	28.3	40.0
Total without project	54.9	65.2	77.3	91.9	129.7
Wawotobi project					
irrigation alternative	–	24.7	28.4	33.1	44.0
dryland alternative	–	13.1	15.1	17.6	23.4
Makaleo project	–	8.1	9.3	10.9	14.4
Total with project					
With irrigation alternative	54.9	98.0	115.0	135.9	188.1
With dryland alternative	54.9	86.4	101.7	120.4	167.5

Source: SESP

Table 2.7 Population forecast for the affected kecamatans, with project

Kecamatan	Population ('000)				
	1976	1981	1986	1991	2001
Unaaha	15.2	18.0	21.4	25.4	35.8
Wawotobi					
with irrigation pr.	22.8	51.8	60.5	71.3	97.9
with rainfed pr.	22.8	40.2	47.2	55.8	77.3
Lambuya	16.9	28.2	33.1	39.2	54.4

Source: SESP

Table 2.6 clearly shows that even with the rainfed alternative for the Wawotobi project, the present population of the area will more than double by 1991, and increase over three fold by 2,001. Of the three kecamatan towns Unaaha is the most centrally located. Therefore our proposals give further impetus for the upgrading of Unaaha as an important urban centre at the level of a kabupaten town. It will not only have a population of about 160,000–170,000 within its catchment area, but it will be a population with substantially higher average cash income than it has today. Thus, within a 20 year period, the spending power of the population living in the sphere of influence of Unaaha could easily increase fivefold of what it is today, with obvious implications for the town itself.

The proposed project can assist to some degree in preparing Unaaha for its future role as the major urban centre of the central areas of mainland South East Sulawesi. It is particularly suitable for the location of some of the central services required by both of the proposed new schemes, such as the Project Management Unit. It is also a logical location for higher level services which will be required to cater for the increased population, such as marketing, wholesale and additional retail outlets, processing, small scale industries, and improved social services, particularly senior secondary schools and a hospital. We assume that the private sector will respond quickly to some of the opportunities offered by large scale development in the area.

2.4.2 Existing settlements

Development of existing settlements recommended in this report consist mainly of improved cropping patterns and cultural practices, more agricultural inputs, better supporting and extension services and generally improved organisation. Physical changes are recommended mainly to accommodate cattle – one additional hectare of grazing land per family, where possible. Location of existing settlements and their physical layout was considered as generally irreversible even if the original locational decision was open to question. Only in one instance, that of Moramo I, did we feel that in spite of the investment already made, at least the partial abandonment of the settlement should be given serious consideration (see Chapter 9 of Volume 2). On the other hand, opportunities exist for extending several of the existing settlements, some of them (Landono and Mowila Jaya) on a fairly large scale. In other instances the possibilities of extension are limited and opportunities dispersed, therefore more suitable for the purposes of spontaneous migrants. In Figure 2.3 we indicate the approximate location of land where more migrants, perhaps also those from Moramo, can be settled to form part of existing settlements.

The total transmigrant population in all existing schemes in South East Sulawesi was 28,123 at the end of 1976. According to our projections this existing population will increase to 32,970 by 1981, to 38,648 by 1986 and to 49,980 by 1996. Though this is a substantial number, the villages are so dispersed that the transmigrants are not likely to leave a major impact on the settlement pattern. If, however, the proposed improvements are implemented, the substantially increased spending power of these communities will attract trade and services. Also we recommend the settlement of an additional 663 transmigrant families in these villages.

Only along the Ambaipuah–Motaha and the Rate Rate–Poli Polia road sections is there a substantial concentration of transmigrant villages, notably Amoito, Landono I and II and Mowila Jaya along the first and Ladongi I and II along the second road section, together representing some 45 per cent of the total transmigrant population living in existing settlements. As these settlements also include the most successful ones, the expense of improving access to them has economic as well as social justification. Furthermore, both roads lead to areas of considerable potential for future settlements during the second phase period. Therefore our short term (first phase) recommendations include proposals for upgrading these two sections, together with the Lambuya–Motaha section which will serve the Makaleo project area and at the same time will provide direct access to settlers in Amoito, Landono and Mowila Jaya to the port at Kolaka. The long term recommendations include proposals for upgrading access to all the other settlements; the cost of doing so, at current prices, has been estimated. But the decision as to the priority of improving these roads, which include much of the provincial road network, goes beyond the scope of the present study. It is not possible to provide economic justification in terms of improving a few scattered transmigrant settlements. The final decision will have to depend on regional priorities, and will have to be an essentially political decision when plans are drawn up for the whole province. Our estimates and evaluation of possibilities in Chapter 8 and in Chapter 10 of Volume 5 are ment as a contribution to the process of regional policy formulation.

2.4.3 Prospective areas for future settlements

The outline plan also indicates an area of some 360,000 hectares within which, it is anticipated, land suitable for intensive agriculture, often with irrigation potential, can be found. To identify these areas, we consulted geological information and reconnaissance survey materials and carried out field and aerial observations. Chapter 10 of Volume 2 provides further information on these areas and the kind of additional studies required before the type and extent of future development can be determined.

Of the areas shown on the outline plan, Ladongi North and Ladongi South are of first priority for development. They cover a gross area of 50,000 hectares, largely unoccupied. They are easily accessible and are adjacent to both existing and proposed transmigration settlements. The development of these areas is recommended for the second phase of the proposed programme. However, if the programme requires acceleration, there is no reason why the second phase should not commence before the completion of the first phase, provided the preparatory studies are completed, permitting detailed designs to take place.

Other priority areas, also recommended for implementation in the second phase, are the Lahumbuti valley, the Lepo Lepo area and, finally, the valley of the Solo river and its main tributaries. The Lahumbuti valley is a north-westerly extension of the proposed Wawotobi project, and covers some 100,000 hectares, of which the south eastern end, about 35,000 hectares, largely covered by primary forest, and practically uninhabited, offers the best potential for transmigration settlement.

The Lepo Lepo area, covering some 30,000 hectares, is located south east of Kendari town. Though the soils have very low levels of fertility, the indications are that it might be a suitable area for irrigated rice growing. It is also easily accessible from Kendari. But before detailed investigations are commenced, the present levels of occupancy and land tenure situation requires close examination. The proposed aerial photo coverage (see Figure 10.1 of Volume 2) should give a good indication of current land uses and levels of occupancy in this area.

The valley of the Solo river and its main tributaries cover a gross area of about 180,000 hectares. Subject to the results of the recommended in Chapter 10 of Volume 2, this may well be one of the most suitable areas for large scale, intensive agricultural development, with irrigation potentials.

The main problem in developing this area relates to access. Some 50 km of road would have to be constructed over difficult terrain to reach Lasolo village and to open up the area for development. But agricultural potential in that area may be so great as to make the project economically feasible. Furthermore, prior development of the Lahumbuti valley may considerably shorten the additional road lenth required to connect the Solo Valley to Unaaha, and the main development belt. Figure 2.3 indicates two alternative approach routes to the Lasolo area, one across the Abuki hills, the other alongside the Lasolo bay.

Even on the basis of the conservative assumption that, say, only 30 per cent of all the potential areas are found suitable for settlement, some 110,000 hectares of land would become available for development, capable of accomodating 30–35,000 families, or an additional population of 120–140,000. Half of these areas could be settled under the second phase of the proposed programme, while the other half could either form a reserve area for later transmigration schemes, or could be utilised for the purposes of the Provincial Government's resettlement programme.

With the exception of Lasolo, all the potential settlement areas discussed above are within easy access to the main Kendari–Kolaka exist, and all except Lepo Lepo would fall within the sphere of influence of Unaaha, if its service facilities were sufficiently strengthened to fulfil its anticipated function as a central place.

We have also identified potentially suitable land for development in the narrow strip of alluvial coastal plains in the Towari area. But only small scale development would be possible there, and the relatively high infrastructure costs could be difficult to justify. We do not, therefore, recommend this area for transmigration settlements within the plan period.

It can be seen from Figure 2.1 that our strategies are consistent with the locational priorities of the Provincial Government in that main emphasis is placed on the Kendari–Kolaka development belt. But the previous emphasis on South Kendari as a potential reception area of second priority has been shifted in our proposals to North Kendari. In doing so, we responded to the physical constraints on development in the South, and to the opportunities that exist for intensive agriculture in the North.

In our judgement South Kendari offers opportunities for extensive uses, such as sugar cane cultivation and we have indicated areas which might offer good locations for cattle ranching. But such uses are ill suited for transmigrant settlements of the type recommended in this study.

In Volume 2 recommendations are made for the organisation of agricultural research, development and extension (Chapter 3); for the improvement of fishery in the Opa Swamp (Chapter 5); and for the need for additional forest reserves for the protection of river catchments (Chapter 6). The outline plan in Figure 2.3 shows the locational implications of these recommendations.

The area plan for new development 3

Both the Wawotobi and Makaleo areas proposed for new transmigration settlements under the loan project are located within Kabupaten Kendari. The Wawotobi project area falls within Kecamatan Wawotobi, while the Makaleo area is part of Kecamatan Lambuya. The two areas are capable of accomodating some 4,850 families in ten villages (four in Makaleo and six in Wawotobi) under the preferred alternative, which is based on dryland agriculture in both areas.

The Wawotobi Project Area is, however, technically suitable for the development of an irrigation scheme, which would permit the settlement of a substantially larger number fo transmigrant families. The details of such a scheme are given in Chapter 3 of Volume 3. The economic analysis in Volume 5 shows that this scheme would have a lower Internal Role of Return and would involve higher risks because of its dependence on a more complex technology. Yet, if high priority is given to the settlement of larger numbers of families, the irrigation alternative may have to be considered. Therefore, just as in Chapter 3 and 8 of Volume 2 in which the agronomic conditions and cropping patterns of an irrigation alternative are examined, in this volume corresponding settlement plans are proposed, and costed.

Under the irrigation alternative the two areas could accommodate a total of 7,500 transmigrant families in fifteen villages (four in Makaleo, which would remain under dryland cultivation, and eleven in Wawotobi).

3.1 Location of villages

In locating the individual villages, the following planning considerations were observed:

a Optimum utilization of all economically significant land within the project area.

b Demarcation of village boundaries in a manner that ensures that the extent and distribution of the various land capability categories are consistent with the recommended farming pattern.

c Accessibility to all-weather roads by each individual village.

d Maximisation of the number of households served by a unit length of all-weather road.

e Rational distribution of social and economic services and easy access from lower level centres to higher level ones, including the existing kecamatan towns.

f Minimization of future investment costs when public utilities, such as water supply and electricity, could be introduced to individual households.

g The possibility of phasing development in such a manner as to enable the full utilisation of infrastructure investment at any given time.

In locating villages in the Wawotobi area under the irrigation alternative, the following additional considerations were observed:

h The location of household plots, whenever possible, on out of command areas or on highest grounds practicable.

i The utilisation of engineering structures, such as primary and secondary canal inspection roads and flood protection bunds for all-weather village access roads.

j Keeping each village or clearly defined community unit within the same command area for ease of maintenance and management.

The size and shape of villages and the extent of individual holdings in all instances are a reflection of the cropping pattern and supporting technology devised on the basis of agronomic and economic considerations.

3.2 Population of a typical settlement

Subject to the availability of suitable land, we have attempted to group 500 transmigrant families in one village unit. To build villages of this size has become standard transmigration practice – convenient for administrative purposes and well suited for the initial services provided in the settlements, such as schools and extension facilities.

The actual number of families in the proposed villages are either 500 or very close to it with only two significant exceptions; in the Makaleo area one village has only 387 families, and in Wawotobi, under the irrigation alternative, one has 635 families.

Therefore the population projections for a typical village has been based on a model settlement of 500 families, with an approximate initial population of 2,200. For the two exceptional villages, future population can be easily calculated by proportionate upward or downward adjustments of that of a typical settlement.

For a typical village we assumed that all the transmigrant families will arrive within one calendar year, and projections for year 5, 10 and 20 are calculated from the year of arrival.

The technical assumptions made for the following projections are described in Appendix A.2.

3.2.1 Age-sex structure of a typical settlement

For the base year (year of arrival) we assumed an overall sex ratio of 1.085 (number of males divided by number of females). As implied by Table 3.1, 16.1 per cent of the population will be under five years of age, 31.2 per cent between five and fourteen years of age, 18.1 per cent between fifteen and twenty four years and 34.6 per cent over twenty five years of age.

Assuming that no inward or outward migration takes place, the population of a typical settlement will increase by about 1,700 persons over a 20 year period, representing approximately 2.9 per cent natural increase per annum. We predict that after 20 years the percentage distribution of the various age groups will be similar to that in the base year, except that the percentage of the population under twenty five years of age will increase from 65.4 per cent to 69 per cent, largely due to an increased proportion of the population in the fifteen to twenty five years age group. Table 3.2 indicates the age-sex structure of a typical settlement over a 20 year period.

Table 3.1 Base year age-sex structure of a typical settlement

number of persons

Age group	Males	Females	Total
0–4	183	168	351
5–9	194	212	406
10–14	149	133	282
15–19	129	111	240
20–24	74	81	155
25–29	65	78	143
30–34	70	103	173
35–39	111	70	181
40–44	74	46	120
45–49	39	26	65
50–54	35	15	50
55–59	11	2	13
60–64	2	3	5
65–69	1	0	1
70 +	0	0	0
Total	1137	1048	2185

Source: SESP

Table 3.2 Projected age-sex structure of a typical settlement

number of persons

Age grown	After 5 years Male	Female	Total	After 10 year Male	Female	Total	After 20 year Male	Female	Total
0–4	245	227	472	259	251	510	318	308	626
5–9	146	137	283	230	213	443	269	262	531
10–14	186	207	393	143	134	277	242	235	477
15–19	146	130	276	183	204	387	224	207	431
20–24	126	108	234	143	128	271	139	131	270
25–29	71	78	149	122	105	227	176	197	373
30–34	62	75	137	69	76	145	136	122	258
35–39	67	99	166	60	72	132	116	100	216
40–44	105	67	172	64	95	159	65	71	136
45–49	69	43	112	100	64	164	55	68	123
50–54	36	24	60	65	41	106	58	87	145
55–59	31	13	44	33	22	55	87	57	144
60–64	9	1	10	27	12	39	55	36	91
65–69	1	2	3	8	1	9	24	18	42
70 +	0	0	0	1	2	3	20	9	29
Total	1300	1211	2511	1507	1420	2927	1984	1908	3892

Source: SESP

3.2.2 Population characteristics of a typical settlement

Applying assumption detailed in Appendix A.2 concerning changing family sizes, economic activity rates and school population, Table 3.3 summarises our projections of the number of families, size of labour force and size of school population by level of education in a typical settlement.

Table 3.3 Projected number of families, size of labour force and school population in a typical settlement

Item	Base year	After 5 years	After 10 years	After 20 years
Population	2,185	2,511	2,927	3,892
No. of families	500	544	601	760
Labour force	682	807	950	1,233
School population:				
Primary	321	347	402	671
Junior sec.	72	110	100	165
Senior sec.	47	60	90	100
Total	440	517	592	936

Source: SESP

It can be seen from Table 3.3 that in 20 years the number of families in a typical settlement will increase by some 50 per cent, while the labour force will increase by approximately 85 per cent over the initial numbers. The school population will more than double, the majority of increase taking place during the second ten year period. This is mainly the result of the high birthrate during the first five years of the settlement's existence. There will be a demand for 500 additional school places, 75 per cent of which will be for places in primary schools. However, during the period of the loan project demand for additional school places will be marginal.

Most additional labour force on the settlement areas up to about the tenth year after arrival will be required by the intensification of agriculture. Beyond that time surplus labour will partly be absorbed by the expansion of the settlement areas as indicated in Chapters 4 and 5, and partly by the growing service sector.

3.3 Standard of services

The recommendations for educational and health facilities have been derived from available information on these services in the Province, and from proposed national standards. The distribution of agricultural supporting services and facilities are based on the recommendations of this study, as described in Chapter 3 of Volume 2.

3.3.1 Education

a Primary schools
Average class sizes of between 25 and 35 pupils, with a maximum of 45 pupils in any class.
One teacher for every 30 pupils.
Assuming six classrooms per school, with two streams of teaching, one school is required for every 300–400 pupils, or one school in each village.

b Junior secondary schools
Average class sizes of between 25 and 30 pupils, with a maximum of 35 pupils in any class.
One teacher for every 15 pupils.
Assuming six classrooms per school with one stream of teaching or three classrooms with two streams, one school is required for every 150–200 pupils, or one school for every two villages.

c Senior secondary schools

Average class sizes of 25 pupils, with a maximum of 30 in any class.

One teacher for every 13 pupils.

Assuming six classrooms per school with two streams of teaching, one school is required for every 250–350 pupils, or one school for every four to six villages.

3.3.2 Health

a First aid centres

One in each village with visiting nurse, also attending to mother and child health care and family planning. Voluntary health worker for every 20 families.

b Clinics

One clinic for every two villages, with two resident nurses or one nurse and one health inspector and small dispensary.

c Health centres/sub-puskesmas

One centre for four to six villages, with a total population of 8,000 or over, depending on distances.

Each centre to have two nurses, health inspector, midwife, family planning guidance and dispensary.

d Major health centres/puskesmas

One centre for population of 15,000 and over.

In addition to facilities in sub-puskesmas it has resident or visiting doctor, facilities for in-patient treatment and a motor vehicle to serve surrounding area. Recommended for kecamatan centres.

e Hospital

One hospital bed for every 1,500 person. For the whole Project Area, with about 90,000 population by 1981, including local population, one hospital of 60 beds is recommended in central location.

3.3.3 Agricultural supporting services

a Extension and research

One extension officer (PPL) per 250 families for first three years at village level.

Rural Extension Centres with four officers (PPS and PPM) one for each area.

Agricultural Development Centre with a technical staff of nine and Agricultural Research Centre with a staff of six to serve the whole region.

b Co-operatives

Village unit co-operatives in each settlement with co-operative store and rice store for 500 families and drying centres for every 250 families.

Co-operative headquarters at regional centre.

c BRI units

One unit to serve three to five villages, depending on distance. BRI headquarters at regional centre.

d Machinery service unit

To be located at regional centre

3.3.4 Other services

a Washing areas, including pumped wells. One for every 15 families.

b Community centres and playing fields. One for each community of 100–500 families. Initially one built for each settlement.

c Places of workship
One for each community of 100–500 families. One mosque to be built for each settlement.

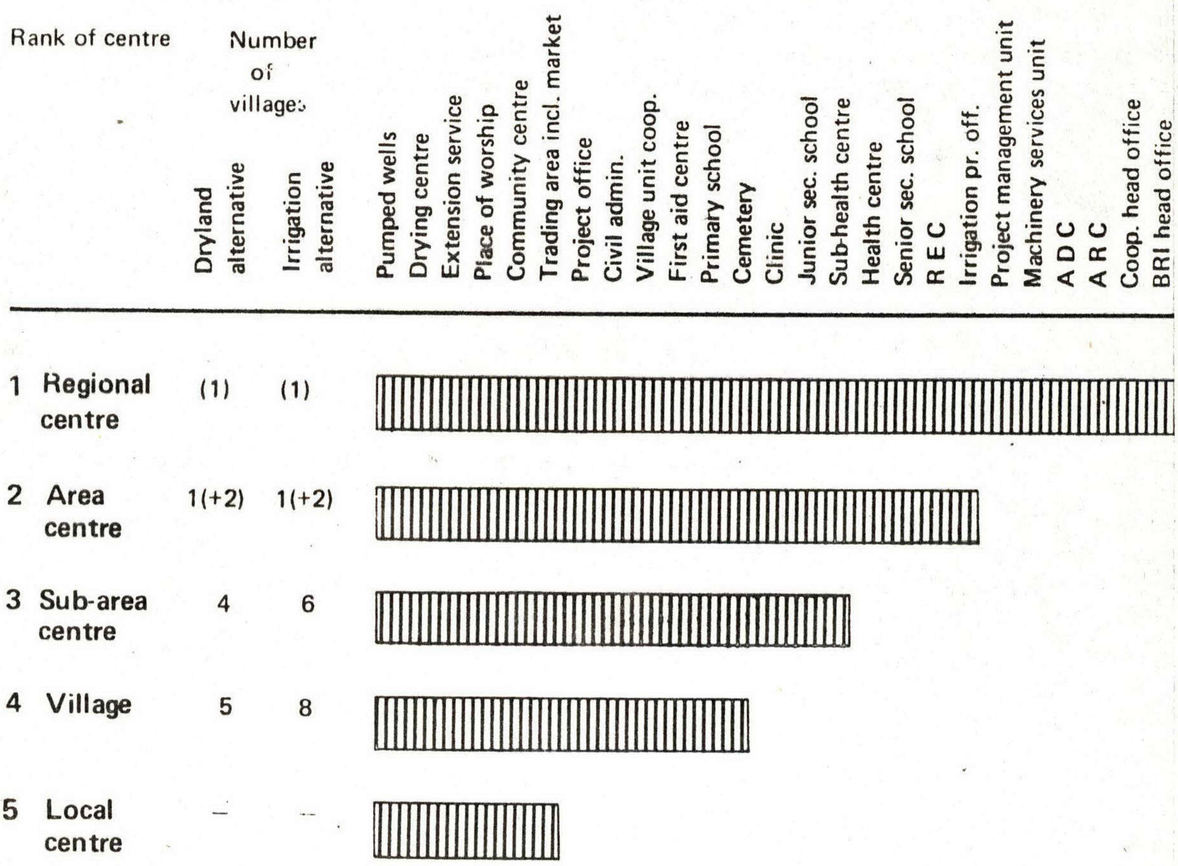
d Trading areas including market
One for each community of 100–500 families.

e Project offices
One for each settlement. Project Management Unit to be located at regional centre. Irrigation headquarters at Wawotobi area centre.

f Cemeteries
One for each setlement.

3.1 Hierarchy of settlements

Distribution of services according to rank of centre



Notes: Numbers in brackets indicate the one Rank 1 centre and two of the three Rank 2 centres which are existing kecamatan towns. Location of the listed services applies to them only in so far as it directly relates to the proposed project.

Source: SESP

3.4 Distribution of services among centres — the area plan

In order to achieve a rational distribution of services among the settlements, we grouped those services which require a comparable number of families for their maintenance, on the basis of standards described in the previous section. Thus, there will be local facilities serving a community within a settlement, a whole settlement, several settlements, an area or the whole project. Table 3.4 ranks the facilities according to the number of families they are serving. Higher level centres are those in which higher ranking services are grouped. As Table 3.4 implies, a centre which receives higher ranking services also receives the lower ones. Thus, a settlement with Rank 1 services has all the services of Rank 2, 3 and 4 centres, while one with Rank 2 services will also receive those in Rank 3 and 4, and so on, as represented in Figure 3.1. From this ranking a hierarchy of service centres arises.

Table 3.4 Ranking of services

Service required	Number of families served per unit	Number of units required		Rank of services
		Dryland alt.	Irrigation alt.	
Pumped wells	15	324	499	
Drying centre	250	20	30	
Extension service	250	20	30	Community
Place of worship	100–500	10+	15+	services
Community centre	100–500	10+	15+	(Rank 5)
Trading area incl. market	100–500	10+	15+	
Project office	500	10	15	
Civil admin.	500	10	15	Village
Village unit coop	500	10	15	services
First aid centre	500	10	15	(Rank 4)
Primary school	500	10	15	
Cemetery	500	10	15	
Junior sec. school	1,000	5	6	Sub-area
Sub-health centre	2,000	2	2	centre services (Rank 3)
Health centre	*	2	2	
Senior sec. school	*	2	3	Area centre
R E C	All	2	2	services
Irrigation pr. off.	5,500	–	1	(Rank 2)
Project management unit	All	1	1	
Machinery services unit	All	1	1	Regional
A D C	All	1	1	services
A R C	All	1	1	(Rank 1)
Coop head office	*	1	1	
BRI head office	*	1	1	
Hospital	*	1	1	

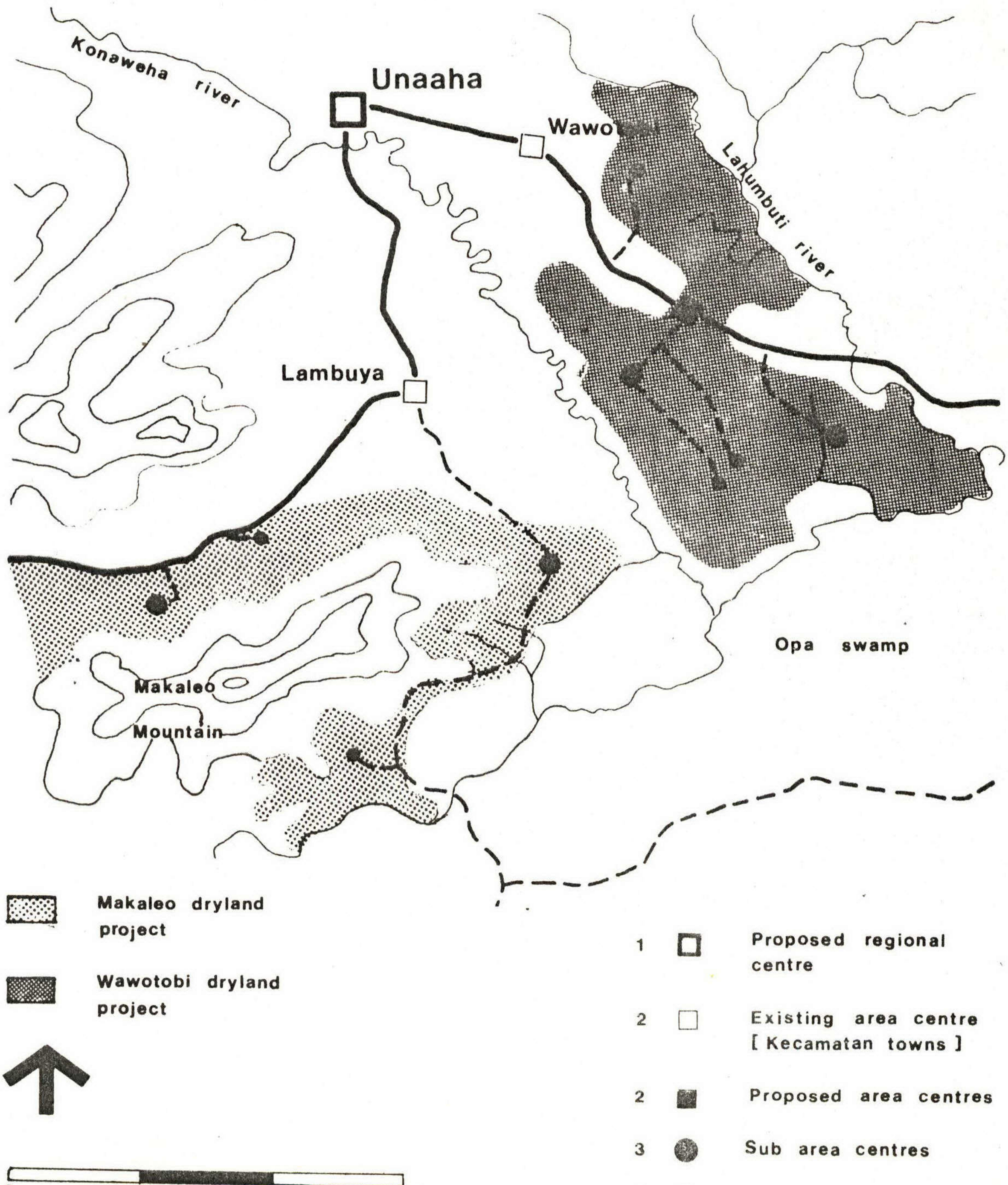
* These facilities would serve the surrounding local population as well as transmigrants, and are not included in our cost estimates.

Source: SESP

Rank 1 facilities serving the whole project will be located at the future regional centre (kabupaten town) at Unaaha, from where both project areas are easily accessible.

Rank 2 facilities, serving a larger area, whenever possible will be located at existing kecamatan centres, in Wawotobi and in Lambuya. An additional area centre will be required with Rank 2 facilities to serve part of the Wawotobi area. We propose to locate this centre about 3 km east of Pudai. In view of the large number of people within the sphere of influence of this proposed area centre, and in view of the very substantial projected population increase within Wawotobi kecamatan – 50–60,000 people will be living there by 1986 – consideration should be given to creating a new kecamatan from the catchment area of the proposed area centre.

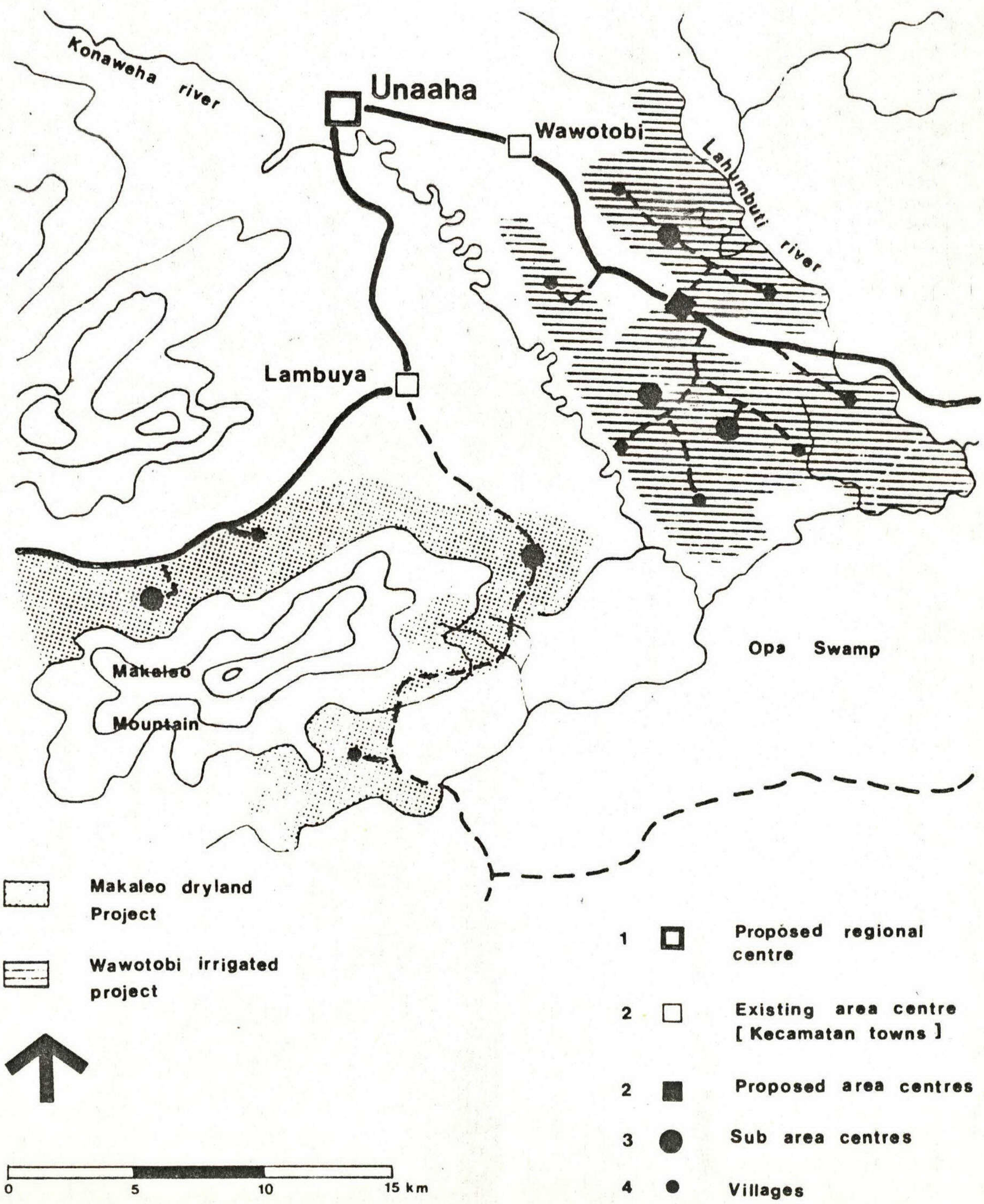
3.2 Area plan, dryland alternative



Rank 3 facilities catering for a couple of settlements will be located in new sub-centres, while Rank 4 and 5 facilities will be available in each village and community respectively. The whole network is so designed as to ensure the easiest access from lower ranking centres to the next higher ranking centre.

This relationship between settlements is expressed in the area plan, prepared for two agricultural planning options: the area plan for dryland cultivation both in Makaleo and in Wawotobi is shown on Figure 3.2; and the area plan for dryland cultivation in Makaleo and irrigated agriculture in Wawotobi is shown on Figure 3.3.

3.3 Area plan, irrigated alternative



Context

The character of the Wawotobi and Makaleo settlement areas

The Wawotobi area 4

The intention of this chapter is to describe in detail one of the project areas outlined in Chapter 3. Two possible forms of agriculture have been developed [1], an irrigated scheme and a dryland alternative, which would imply different numbers of settlers and quire radically different settlement planning solutions. The two alternatives are described in Sections 4.2 and 4.3 respectively.

4.1 The context for development

The Wawotobi project area is bounded on the west by the Konaweha river and on the east by the Lahumbuti river. The limits to the south are formed by the Opa swamp and to the north by the Wawotobi kecamatan boundary. The area is essentially a meander flood plain with a gentle slope from the northwest to southeast.

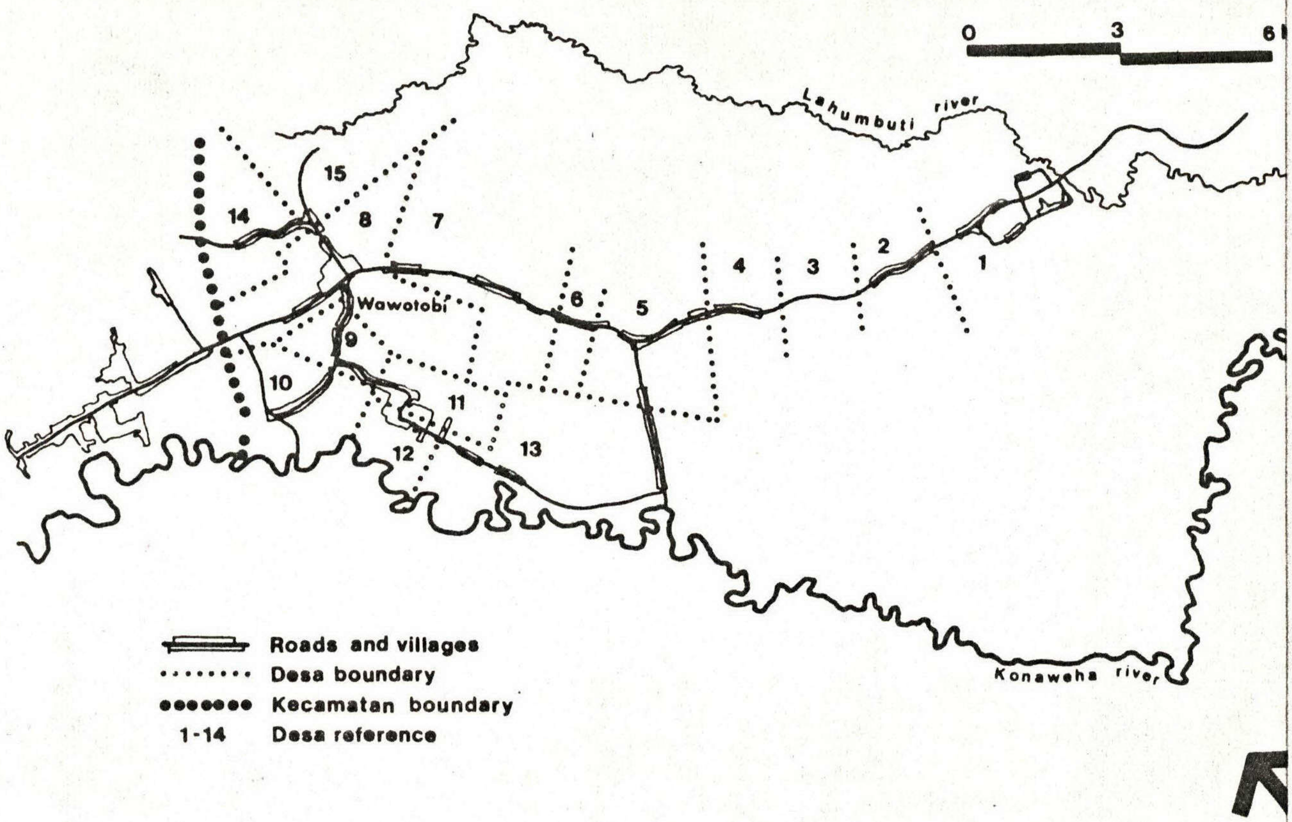
The existing settlements in the area are all villages, of which only Wawotobi itself has commercial facilities of any importance. Development is mainly concentrated along the Kendari-Kolaka road which cuts diagonally across the area.

4.1.1 The existing population

The existing 1976 population of the Wawotobi kecamatan is 22,835 persons, of which in the area for development, defined by the Konaweha and Lahumbuti rivers, there is around 18,430 persons. Assuming an average family size of 5.15 persons, which is consistent with that for the rural population of the province, the estimated total number of families in the area is 3578. Of these approximately 89 per cent would be engaged in agriculture, giving a total of 3192 farming families. The detailed breakdown for each rural district (desa) within the kecamatan is given in Table 4.1 and the desa locations on Figure 4.1.

The annual growth rate for Kecamatan Wawotobi for the 1971–76 period was 1.7 per cent per annum which was the lowest in the whole kabupaten, for which the annual average growth rate was 5 per cent. This is an indication that the area has reached its population limit unless a radical change in agricultural technology occurs.

[1] Chapter 7, Volume 2



4.1 Existing settlements – Wawotobi

Table 4.1 Existing population, by desa, of the Wawotobi settlement area[1] (1976)

	Desa [2]	Population 1971	Population 1976	Estimated number of families (1976)	Estimated number of families engaged in agriculture (1976)
1	Pondidiha	1732	1895	368	328
2	Wawoone	927	542	105	94
3	Lalohao	685	1243	241	215
4	Lambangi	893	788	153	136
5	Pudai	950	1593	309	276
6	Wonggeduku	1296	1127	219	195
7	Kasipute	1701	1687	328	292
8	Wawotobi	2324	2719	528	471
9	Bungguosu	968	888	172	154
10	Tudaone (Teteone)	1226	1331	258	230
11	Tawanga	999	954	185	165
12	Sanggona	703	835	162	145
13	Melawu	728	916	178	159
14	Kulahi	1067	1033	201	179
15	Paralahi	814	881	171	153
	Total	17013	18432	3578	3192

1 includes only those desas within kecamatan Wawotobi which fall within the development.
2 location of desas, by reference number, is shown in Figure 4.1

Sources: SESP and Biro Pusat Statistik.

4.1.2 Land use and physical features

The present land use of the Wawotobi area is summarised in Table 4.2 and shown on Figure 4.2. Some 21.7 per cent of the land is currently being cultivated, of which less than half is permanent cultivation. The majority of this development is concentrated along the main Kendari-Kolaka road. Of the total of 22,370 hectares some 10,500 – 10,700 hectares is available for new transmigrants in either an irrigated or a dryland development. The details of the land availability and potential use is discussed in Sections 4.2.3 and 4.3.1.

4.2 Existing land use – Wawotobi

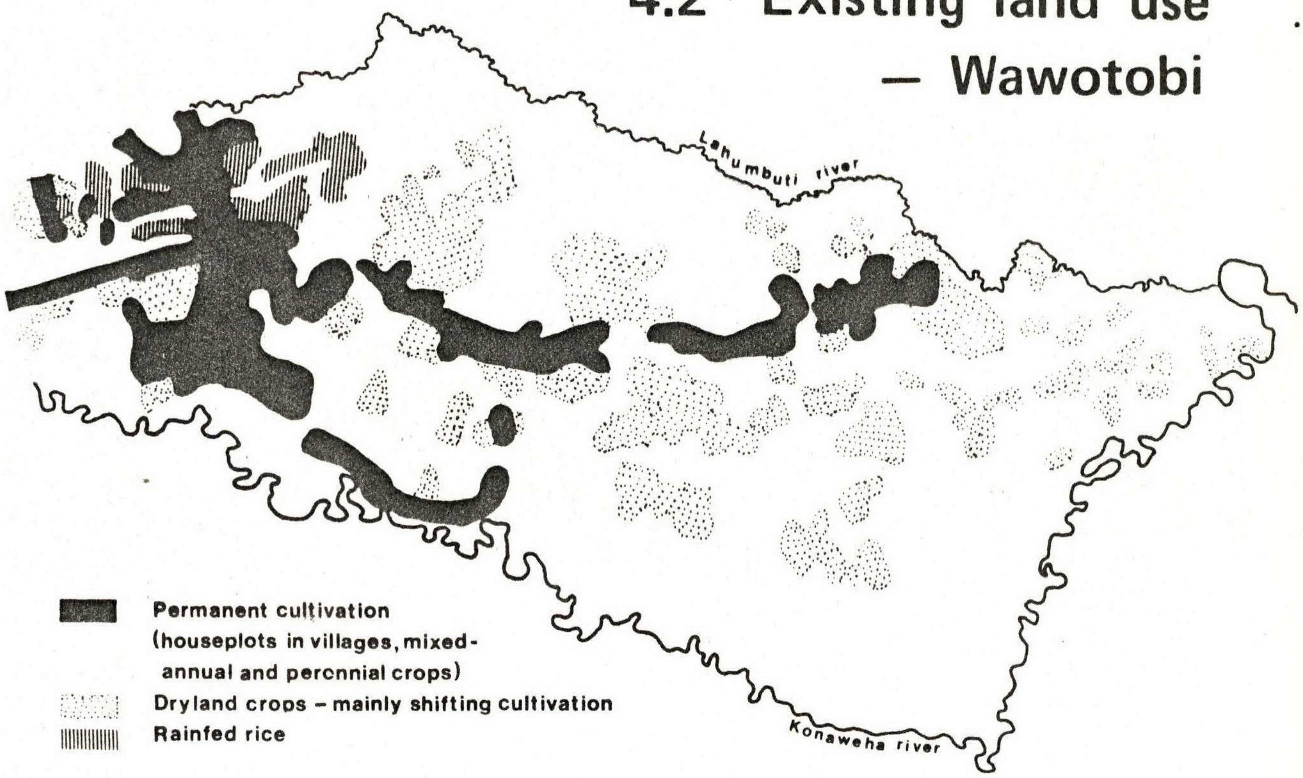


Table 4.2 Generalised land use in the Wawotobi area [1]

hectares

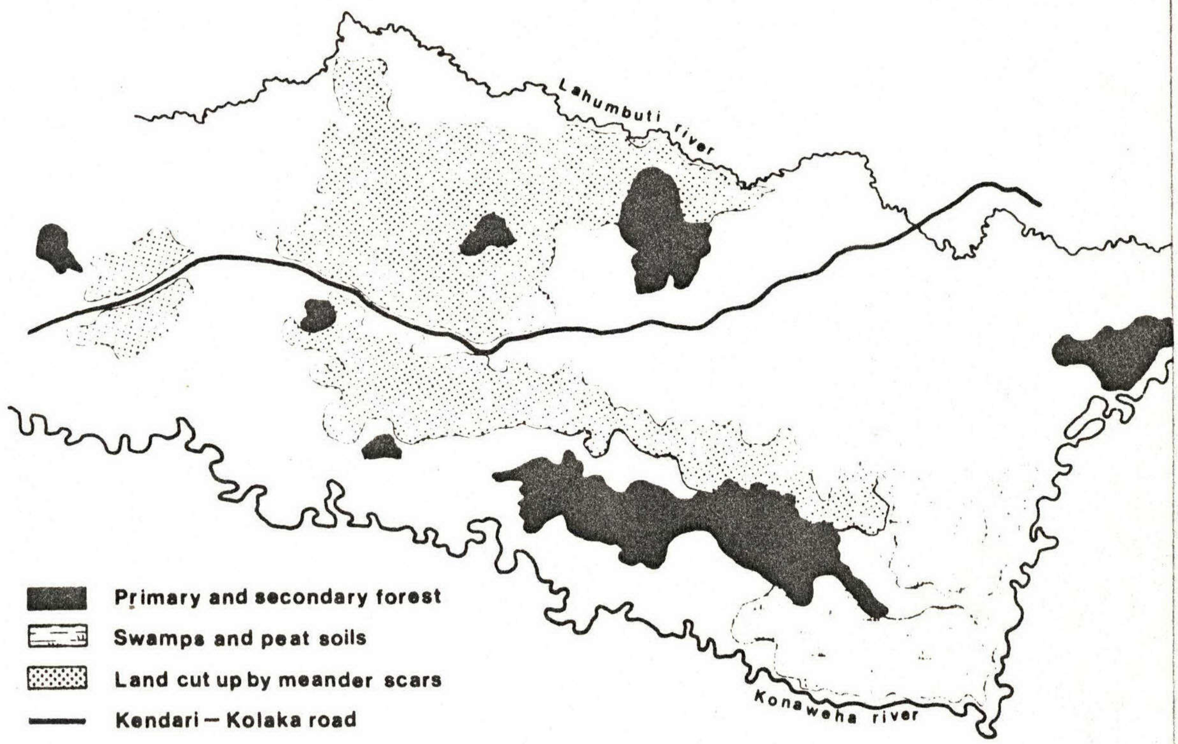
Land use category	Area	Per cent of total
Primary and secondary forest	1910	8.6
Secondary growth (shrubs and bushes)	5240	23.4
Permanent cultivation (houseplots, mixed annual and perennial crops)	2240	10.0
Mixed dryland crops (mainly shifting cultivation)	2150	9.6
Rainfed rice	470	2.1
Uncultivated land (mostly grasslands)	6980	31.2
Swamp vegetation	3380	15.1
Total	22370	100.0

1 A full classification of the land use in the Wawotobi area is given in Table 7.1, Volume 2.

Source: SESP

The other characteristics of the area are shown in Figure 4.3. The area cut up by meander scars overlaps other land uses, although predominantly forms zones of uncultivated land, with some areas of shifting cultivation.

4.3 Area characteristics – Wawotobi



4.2 The irrigated alternative

The planning of new settlements in an irrigated area is not something that can be based on a simple model relationship of service provision, housing and agricultural land. Rather, it must, of necessity, use as its starting point the layout of the irrigation system. Onto this structure the settlement planner must attempt to impose a pattern in which the competing and often conflicting demands for land can be balanced. Ideally there should be no waste of irrigable land within the command area. It is inevitable, however, that if walking distances from the houseplot to farmplots and community services are not to be excessive that some loss of irrigated land must occur.

4.2.1 Design methology

The main design criteria that we have adopted in preparing the settlement plan for the irrigated alternative in the Wawotobi area are as follows :

a to achieve a balanced village population, with an average of around 500 families.

b to ensure that any individual village is ideally served by a single secondary canal, so that the village can be built-up from a series of related tertiary command areas. This is consistent with our observations of the existing settlements contained in Chapter 7, identifying the need to obtain proprietary control of water sources and to create multi-nuclear ethnically homogenous communities c to maximise the use of out-of-command areas for purposes such as houseplots and dryland cropping.

d to obtain a compact village form which minimises walking distances to irrigated land.

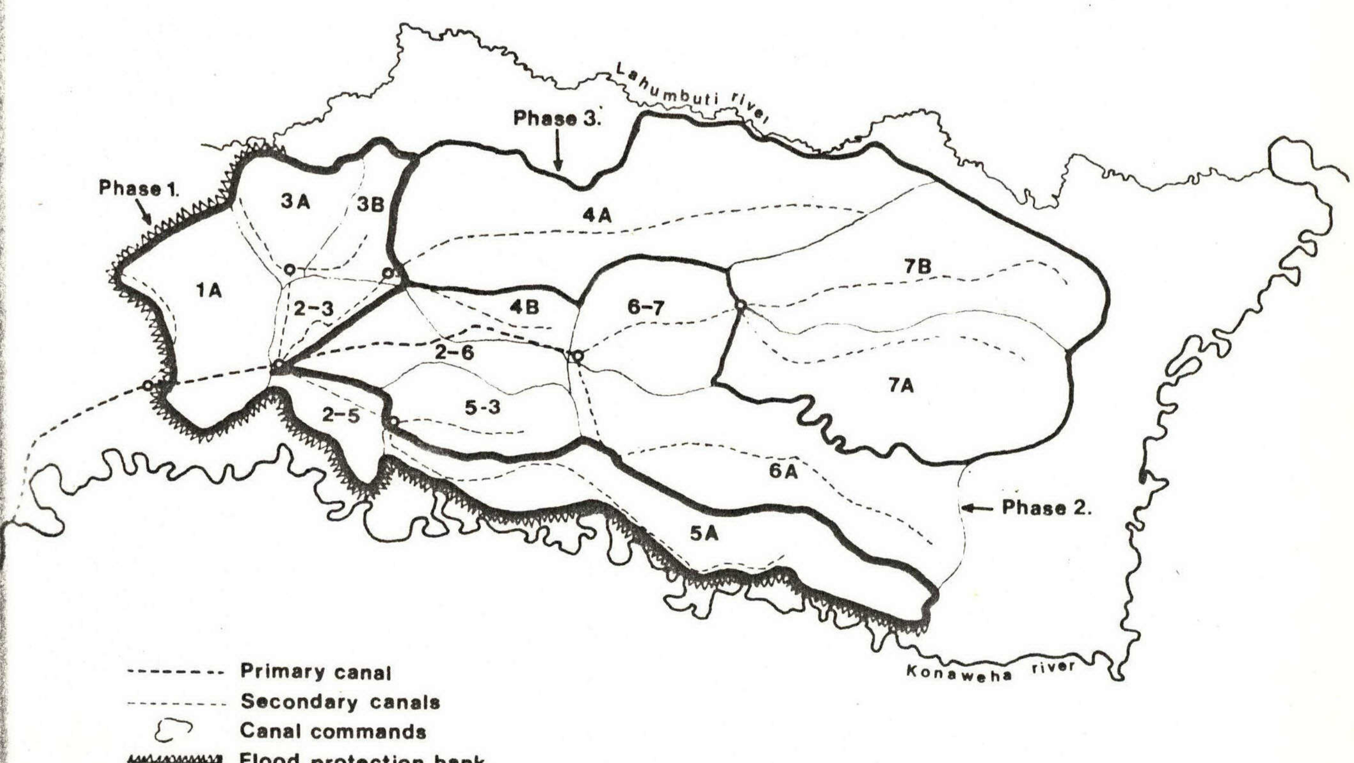
e to avoid duplication of roads by maximising the use of canal inspection roads to form the main road structure of the villages. This will fully capitalise on the initial construction (albeit to a higher standard than would have been required if they were solely to act as inspection roads), make full use of the potential bridging positions available at regulators and ensure that overall road maintenance costs are minimised.

The application of these criteria was essentially by means of a sieve mapping process, which analysed the constraints and opportunities that the area presented. These arise from a series of factors: the existing context, in terms of both its physical features and of the indigenous population and their husbandry; the proposed irrigation layout; estimates of the likely availability of land, together with feasible agricultural proposals; and from the application of a prototype settlement layout.

4.2.2 The irrigation system

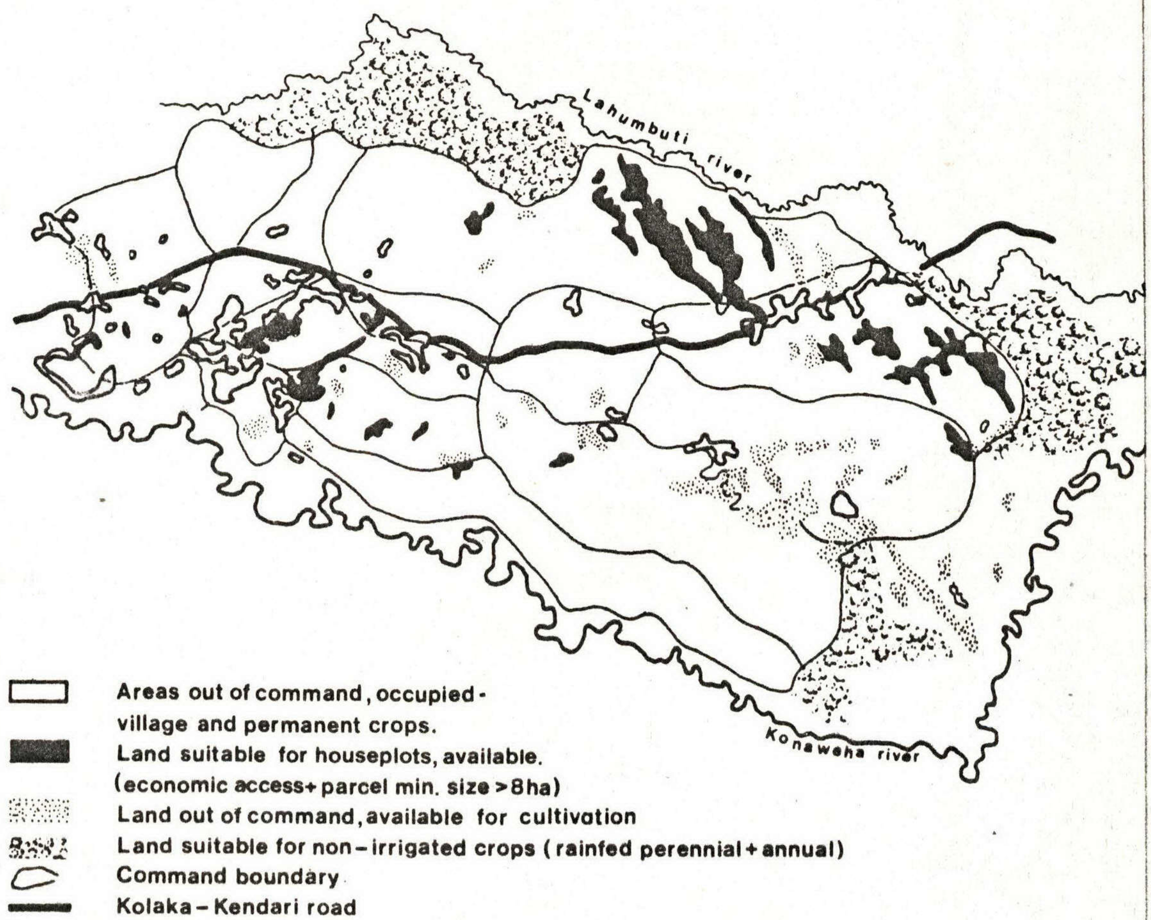
The preliminary layout of the primary and secondary canal system is shown in Figure 4.4, which also indicates the areas commanded by each canal unit, the extent of flood protection works and the general construction phasing. The full details of these proposals are described in Chapter 3, Volume 3.

4.4 Proposed irrigation scheme – Wawotobi



4.2.3 Land availability

The gross area that the canal system commands is 14,010 hectare of which 9,210 hectares would b available as irrigable land. Part of the gross area lost constitutes out-of-command land which may b available for new houseplots or dryland cropping. The approximate location of such land is shown i Figure 4.5 and a detailed description of each area is provided in Table 4.3, using the canal comman boundaries as convenient units of area. Of the total out-of-command land 36 per cent is alread occupied and a further 23 per cent would be relatively difficult to develop economically, especially fo houseplots.



4.5 Land availability – Wawotobi

The total non-irrigable land available is some 2013 ha, of which 625.7 ha is not contiguous with the areas for new development and should therefore be retained as expansion land for the existing villages. These pockets of land primarily fall within canal commands 1A, 2-3, 3A and 2-5 which are the areas presently most highly populated.

Table 4.4 analyses the land available within the canal commands and this together with a further 2,500 hectares of adjacent land with potential for dryland cropping, forms the total land suitable for agricultural development.

Table 4.3 **Wawotobi settlement, irrigated alternative. Analysis of out of command land**

hectares

Canal command		Out of command land				Reserved for dryland cropping and grazing	Total non-irrigable land available for development
Number	Gross area	Gross	Occupied with or without topographic constraints	Available for village site or dryland crops, no topographic constraints	Available for village site or dryland crops, serious topographic constraints		
1 A	990	60	10	50	–	98	148
2-3	260	30	30	–	–	28	28
3 A	500	–	–	–	–	56	56
3 B	330	10	–	10	–	28	38
4 A	2610	260	–	140	120	271	531
4 B	350	20	–	20	–	28	48
2-5	350	150	150	–	–	28	28
5 A	1340	10	–	–	10	140	150
5 B	620	60	–	–	60	56	116
2-6	630	130	60	–	70	56	126
6 A	1840	90	70	–	20	116	136
6-7	800	20	–	20	–	84	104
7 A	1750	130	50	80	–	72	152
7 B	1640	250	70	180	–	172	352
	14010	1220	440	500	280	1233	2013

Source : SESP

Table 4.4 Wawotobi settlement, irrigated alternative. Land available for agricultural development [1]

hectares

Canal command Number	Canal command Gross area	Occupied land, villages, houseplots & permanently cropped land (includes areas above command level)	Meander scarred areas, not available for development	Non-irrigable land theoritically available for new development [2]	Deduction for canals & roads, at 5% of gross canal command area	Net irrigable land available for transmigrants and existing population
1 A	990	330	19	148	50	443
2 - 3	260	170	8	28	13	41
3 A	500	110	–	56	25	309
3 B	330	20	3	38	17	252
4 A	2610	20	97	531	131	1831
4 B	350	120	9	48	18	155
2 - 5	350	230	15	28	18	59
5 A	1340	70	12	150	67	1041
5 B	620	10	30	116	31	433
2 - 6	630	160	21	126	32	291
6 A	1840	90	41	136	92	1481
6 - 7	800	130	8	104	40	518
7 A	1750	100	10	152	88	1400
7 B	1640	250	–	352	82	956
	14010	1810	273	2013	704	9210

[1] Excluding three zones of land totalling 2,500 ha to be used for perennial cropping, located outside the gross canal command area.
[2] Of this total some 625.7 ha would not be usable for new development.

Source : SESP

Wawotobi
1
2
3
4
5
6
7
8
9
10
11
Primary and secondary canals
Canal command boundaries
Existing permanent cultivation
Proposed allocation of irrigated land to indigenous population (0·75 ha. per family)
Boundaries of new villages
1·0 ha irrigated holding, 0·8 ha perennial, 0·2 ha houseplot (per family)
1·5 ha irrigated holding, 0·2 ha houseplot (per family)
Perennial cropping land for new villages
1 Village reference number
1 0·5 0 1 2 3 Km

4.2.4 Agricultural planning[1]

Any realistic proposal for developing the area for irrigation must take account of the indigenous population, which with such a scheme, must lose most of the land over which they presently practice shifting cultivation. Thus in addition to their existing houseplots and areas of permanent cultivation, averaging 0.55 hectares per family, we are proposing that they receive 0.75 hectares of irrigated land, totalling some 2395 hectares. Details of this are shown in Table 4.5, which also indicates the balance that is available for new transmigrants.

Table 4.5 Wawotobi settlement, irrigated alternative. Allocation of irrigated land

Canal construction phase	Estimated indigenous population (farming families)			Allocation of irrigated land (hectares)	
	Canal command	Number of families	Total	To indigenous families	To new transmigrants[1]
1 – 1980	1 A	831			
	2 - 3	212			
	3 A	126			
	3 B	80			
	2 - 5	368			
	5 A	119	1736	1302	843
2 – 1981	2 - 6	71			
	5 B	20			
	6 A	70			
	6 - 7	308			
	4 B	402	871	654	2145.5
3 – 1982	4 A	20			
	7 A	0			
	7 B	565	585	439	3675
Total			3192	2395	6663.5

[1] Excluding 151.5 ha of irrigated land which will need to be used for houseplots, where out of command areas are not available.

Source : SESP

The allocation of land to these new settlers is complicated because of the uneven distribution of out of command land suitable for perennial cropping and thus two different farm holdings are proposed: farms with 1.5 hectares of irrigated land and 0.2 hectare houseplot: and farms with 1.0 hectare of irrigated land, 0.2 hectare houseplot and 0.8 hectare of dryland perennial crops, the latter being predominantly located outside the canal command area. The first farm type would be given to 36 per cent of the families and the balance would receive the second farm type. In both cases the houseplot is of a minimal size (0.2 hectare) so that the demand on irrigable land for such purposes is reduced.

By combining these development strategies with the irrigation layout, in particular the command boundaries, it was possible to delineate areas suitable for eleven new villages, the overall zoning of which is shown in Figure 4.6. The distribution of farm holdings is given in Table 4.6.

[1] See Chapter 7, Volume 2

Table 4.6 Wawotobi settlement, irrigated alternative. Distribution of holdings to new transmigrants

number of families

Canal construction phase	Village reference number	Type of holding: 1.5 ha irrigated land, 0.2 ha houseplot	Type of holding: 1.0 ha irrigated land, 0.2 ha houseplot, 0.8 ha perennial crop[1]
1 – 1980	1	500	–
	2	62	–
2 – 1981	2	457	–
	3	500	–
	4	–	500
	5	140	–
3 – 1982	5	360	–
	6	–	500
	7	–	500
	8	–	635
	9	–	500
	10	–	500
	11	–	500
Total		2019	3635

[1] The required area for perennial cropping will be partly obtained from three adjacent zones, (totallin 2500 hectares), not within the gross command boundary.

Source : SESP

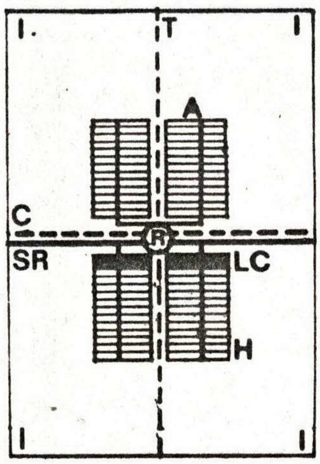
The land requirements for new development would be made up as follows :

Non-irrigable land used for houseplots and perennial cropping	1387.3 ha	
Irrigable land needed for houseplots	151.5 ha	
Land outside canal command suitable for perennial cropping	2500.0 ha	
Total land needed for houseplots and perennial cropping		4038.8 ha
Irrigated land in 1.0 hectare holdings	3635.0 ha	
Irrigated land in 1.5 hectares holdings	3028.5 ha	
Total irrigated land		6663.5 ha
Total land requirements		1,0702.3 ha

For the purposes of economic evaluation (Chapter 8, Volume 5) two different forms of draught powe have been investigated-tractors or buffaloes – either of which could be used with the proposed holdin patterns.

4.2.5 Prototype irrigated village layouts

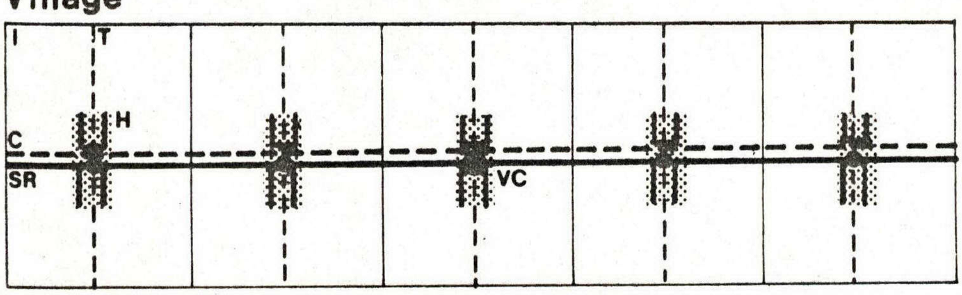
In addition to the design criteria stated in section 4.2.1 we have also developed a series of prototype village layouts which will be applicable to the types of situations that will arise at the detailed design stage, when the layout of the canal system has been finalised. The prototypes start from a simple case where the canal system is running in a flat area in which no land out of command is available for non-irrigated purposes. In this case, as shown in Figure 4.7, the tertiary canal units would have an orthogonal relationship with the main canal and a regular compact layout would result.



4.7 Prototype layout – Wawotobi irrigated alternative

H	houseplots
I	1.5 hectare irrigated holdings
C	main canal
R	regulator
T	tertiary canal
SR	spine road
A	access track
LC	local centre
VC	village centre

Village



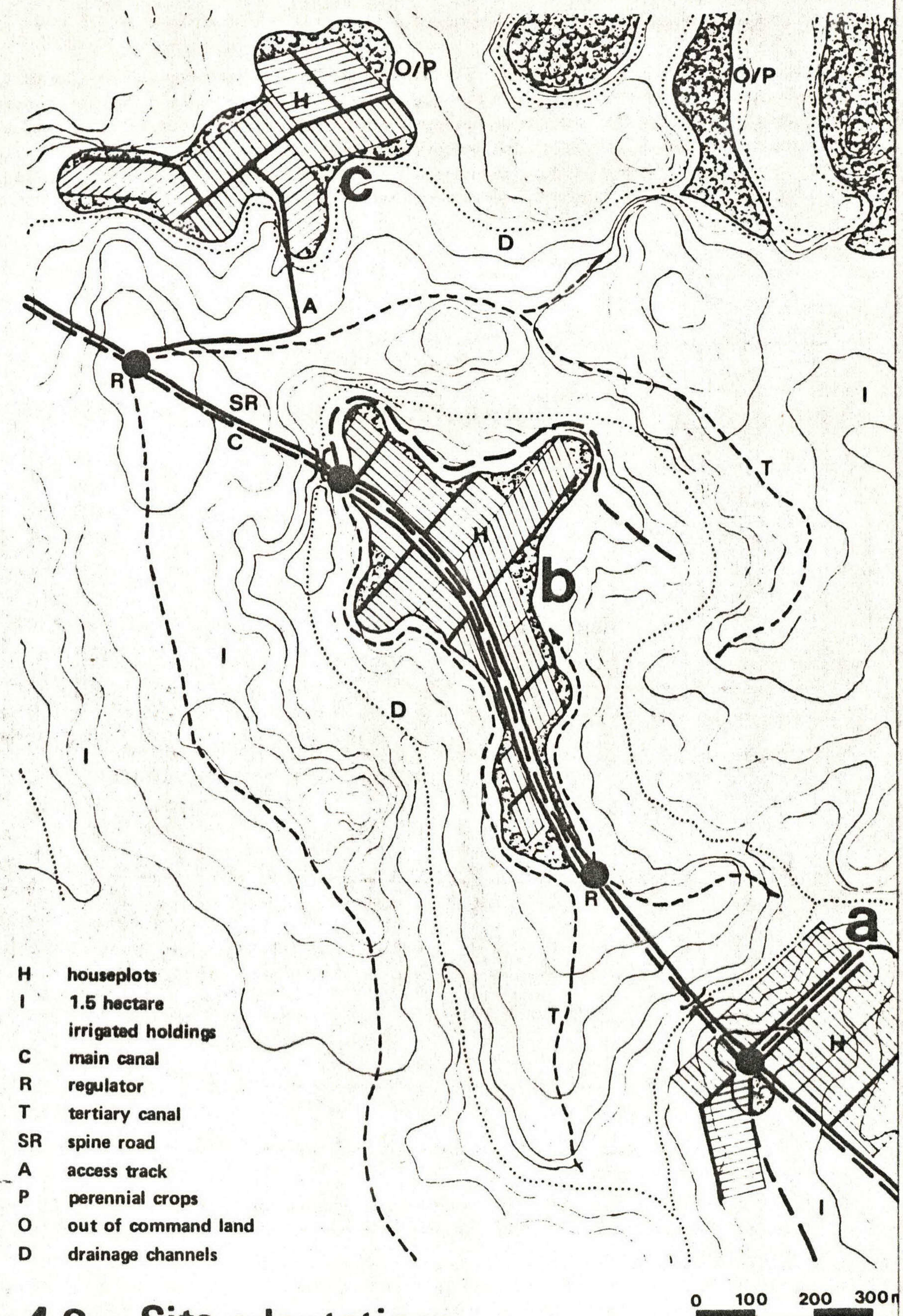
In the Wawotobi area this condition will essentially never be met and adaptions will be necessary to meet the following circumstances :

a tertiary units having an irregular geometrical relationship with the main canal, requiring twisting of the houseplot layout.

b the canal passing through an out-of-command area that can conveniently be used for houseplots (or for dryland cropping). In this case the layout should allow the fullest utilization of the available area.

c a similar situation to b above, but with the out-of-command areas remote from the main canal. In this case, if the area is to be used for houseplots, an additional road link will be required, which should ideally make use of embankments in the tertiary units.

Typical examples of such adaptions are given in Figure 4.8.

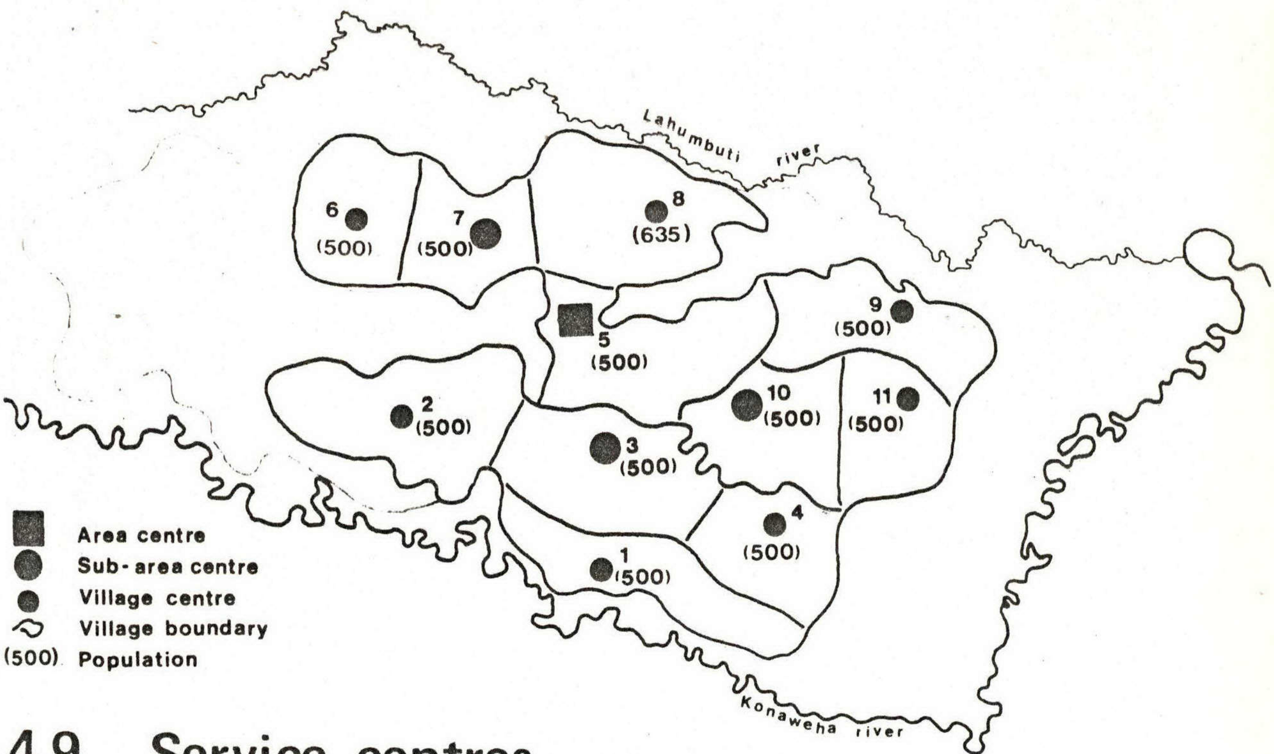


4.8 Site adaptations – Wawotobi, irrigated alternative

4.2.6 The irrigated area structure plan

The eleven proposed villages would all have an intake population of 500 families, except village number 8 which would be 635 families. The type of agricultural holding would be constant within any one village. Thus, five of them would have 1.5 hectare of irrigated land for each family, whilst the remainder – those adjacent to the three areas with potential for perennial cropping – would have 1.0 hectare irrigated holdings.

It is envisaged that each of the villages would have a service center, as shown in Figure 4.9, three of which (villages 3, 7 and 10) would form sub-area centres and one (village 5) a new area centre. The latter, would in time, have an equivalent status to Wawotobi and is the only new centre to be located on the Kendari-Kolaka road. We believe that sufficient land is available in the vicinity of of Lambangi to accomodate it. All the other centres would be located on the secondary canal system. The provision of services in the villages, including those in local centres corresponds to that shown in Table 3.4, in Chapter 3.



4.9 Service centres – Wawotobi, irrigated alternative

The structure plan, Figure 4.10, shows the hierarchy of roads in relation to the villages. Access to any village centre would be by a class II road and to any local centre by a class III road. The irrigated areas would be served by footpaths on the field enbankments. The houseplot areas would have the lowest grade of road, class IV, which would connect them to the village spine road system. The road system for the class II and III roads would be created by three different methods: by building completely new sections of road; by upgrading existing tracks; and, primarily, by constructing canal inspection roads to a higher standard. The details of the road classification and the construction method for each class is given in Chapter 8.

Bridging of the canal system would be at regulator/off-take positions, which would also form the ideal location for local and village centres. It is around these foci that we envisage the creation of neighbourhoods of around 100 families, which would form a multi-nuclear pattern in each village. Such a pattern cannot be determined until the details of the irrigation system have been finalised, the structure plan indicating only the possible location of the village centres.

4.2.7 Phasing

The phasing of construction in the Wawotobi area has been designed to fit in with that of the construction of the irrigation works. General construction work would start in 1980, at the same time as the irrigation development. Priority should be given to building the transmigrants houses, so that settlers can also come in 1980 and be employed for a year on general construction works and subsequently, in their second year, with on-farm works, field channels and final levelling. Prior to construction of the villages, a substantial amount of land clearance would be required which may also start in 1980 and proceed in parallel with other construction. Details of this clearance programme is given in Table 4.7, which excludes general clearance in grasslands, starting in 1979, forming part of the irrigation development (Figure 3.13, Volume 3).

Table 4.7 Land clearance in the Wawotobi area

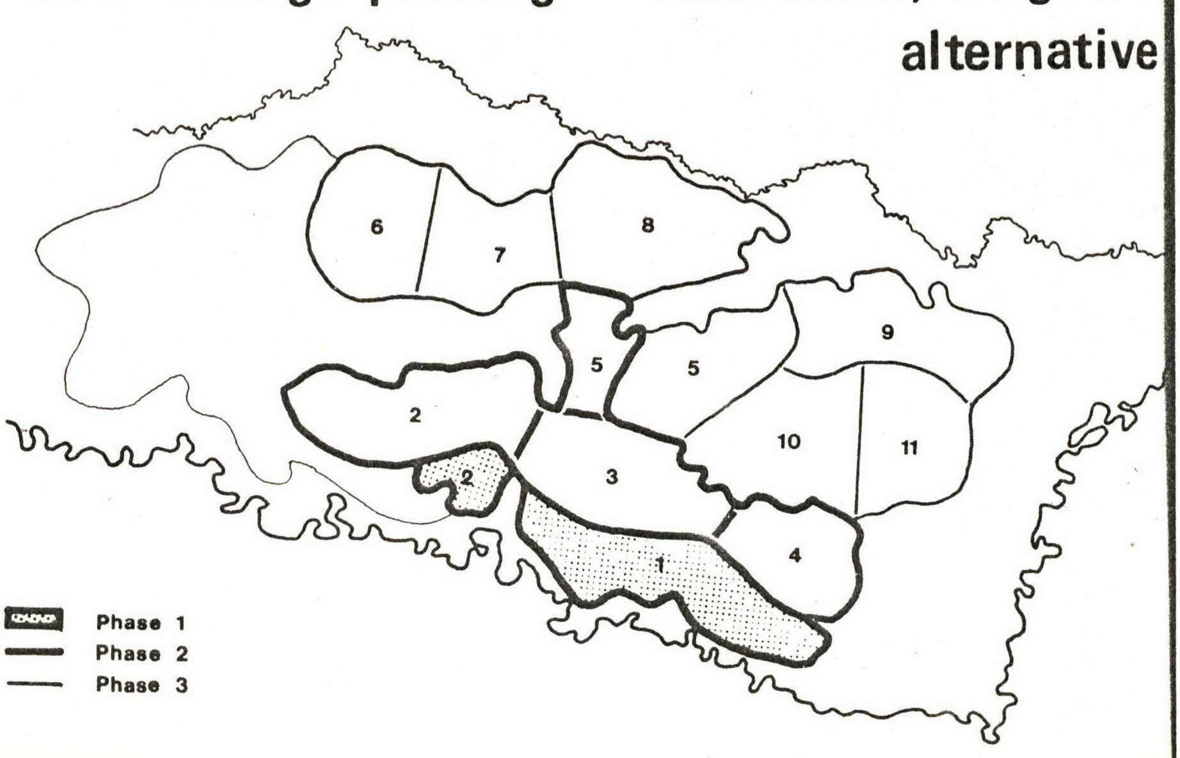
hectares

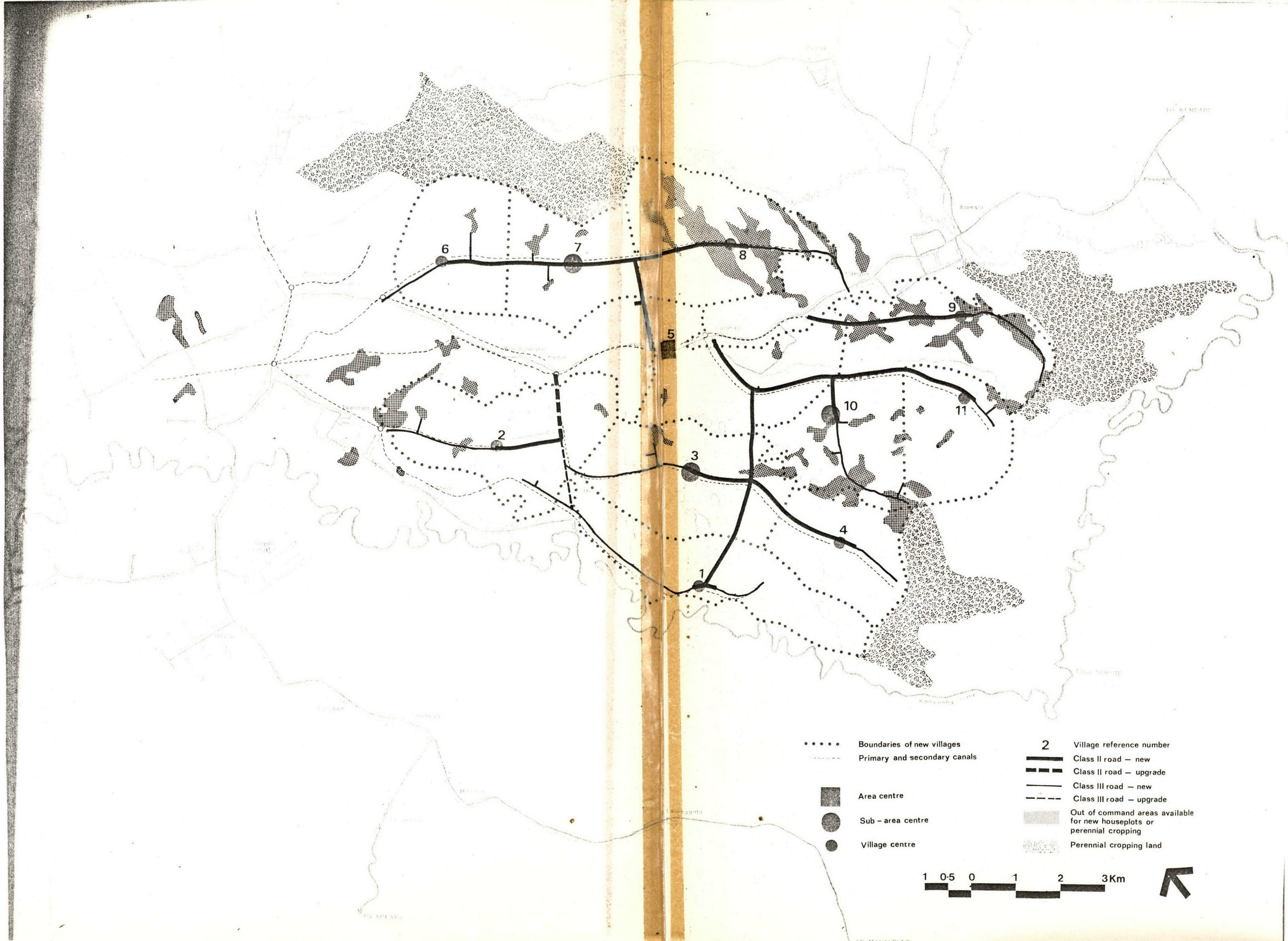
Phase	Year	Forest primary	Forest secondary	Bush
1 [1]	1980	397	272	767.5
2	1981	658	560	865.0
3	1982	–	498.5	3,397.5
Total		1,055	1,330.5	5,030

[1] Excludes 300 ha of land presently cultivated as rainfed rice.

Source : SESP

4.11 Village phasing – Wawotobi, irrigated alternative





6
7
8
9
5
10
11
2
3
4
1
Boundaries of new villages
Primary and secondary canals
Area centre
Sub - area centre
Village centre
2
Village reference number
Class II road – new
Class II road – upgrade
Class III road – new
Class III road – upgrade
Out of command areas available for new houseplots or perennial cropping
Perennial cropping land
1 0·5 0 1 2 3Km

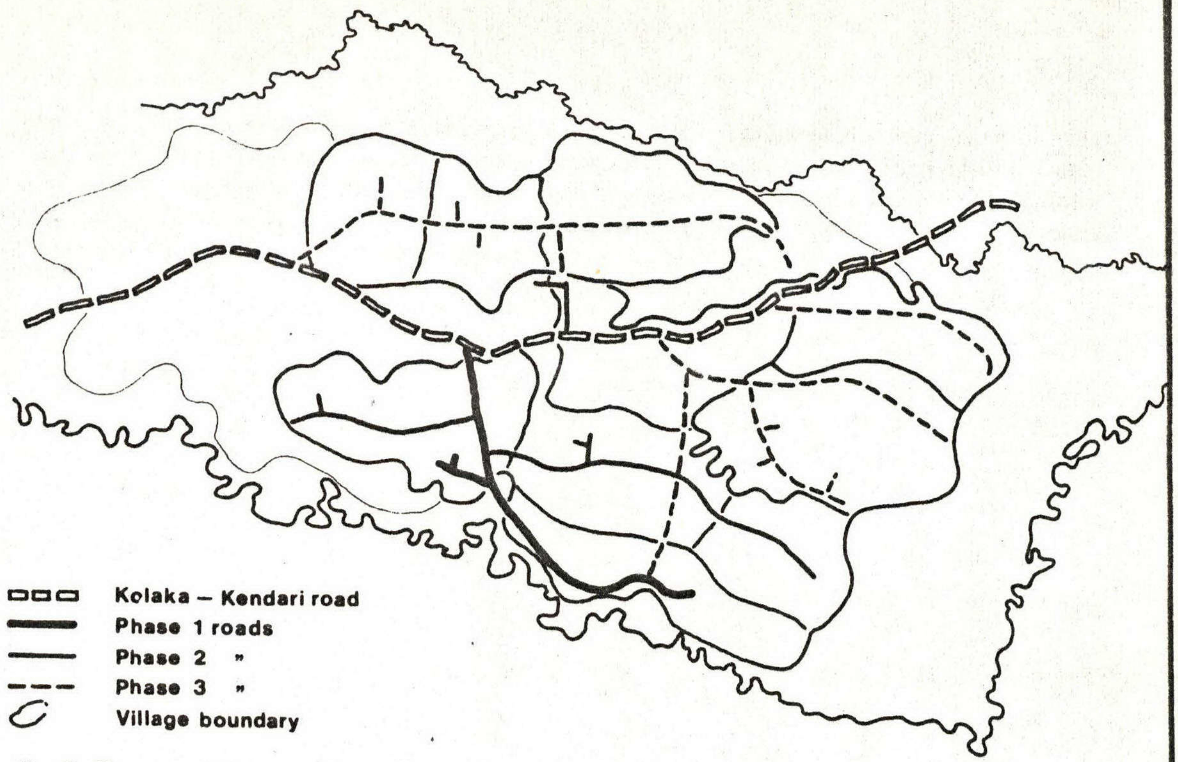
The need to match village building with the three main phases of the irrigation works will mean that some overlapping of villages into two construction years will be necessary. Thus village 2 will be started in 1980 and completed in 1981, and village 5 which contains the area centre will be started in 1981 and completed in 1982. The sequence of village construction is shown in Figure 4.11. The related road programme, which, especially in the second and third phases, must follow on after the construction of the secondary canal system, is shown in Figure 4.12.

Details of the phasing of the agricultural and social infrastructure are given in Table 4.8, and of the physical infrastructure in Table 4.9.

Table 4.8 Wawotobi settlement — irrigated alternative. Phasing of agricultural and social infrastructure

Component	1980 Village 1 and part of 2 (562 families)	1981 Villages 3 and 4, parts of 2 and 5 (1597 families)	1982 Villages 6, 7 8, 9, 10, 11 and part of 5 (3495 families)	Total (5654 families)
Agricultural infrastructure:				
Project offices	2	8	12	22
Co-operative stores	1	4	6	11
Rice stores	1	4	6	11
Drying centres	2	8	12	22
Staff housing: type D	4	10	24	44
type E	—	4	4	8
type T1	1	4	6	11
type T2	2	8	12	22
Social infrastructure:				
Transmigrants houses	562	1597	3495	5654
Primary schools	1	4	6	11
Junior high schools	—	2	2	4
Mosques	1	4	6	11
Village halls	1	4	6	11
Health sub-centres	—	1	2	3
Health centres	—	1	—	1
Washing areas	37	106	233	376
Latrines	562	1597	3495	5654
Market areas	1	4	6	11
Village centre land clearance	3.6 Ha	18 Ha	21.6 Ha	43.2 Ha

Source: SESP



4.12 Road phasing – Wawotobi, irrigated

Table 4.9 Wawotobi settlement – irrigated alternative. Phasing of physical infrastructure

Component	1980	1981	1982	Total
Class II roads	–	3.24 Km	12.96 Km	16.2 Km
Class III roads	0.18 Km	1.68 Km	8.38 Km	10.24 Km
Class IV roads	8.43 Km	22.62 Km	52.43 Km	83.48 Km
Bridges in class II roads	–	6.5 M	25.9 M	32.4 M
Bridges in class III and IV roads	0.32 M	2.5 M	14.4 M	17.22 M
Culverts	4.35 No	14.51 No	45.92 No	65 No
Extra for canal roads to class II	–	5.04 Km	21 Km	26.04 Km
Extra for canal roads to class III	7.8 Km	7.44 Km	7.86 Km	23.1 Km
Extra for regulators to class II bridges	1 No	5 No	7 No	13 No
Extra for regulators to class III bridges [1]	4 No (2))	7 No (4)	25 No (12)	36 No (18)
Extra enbankments in field roads [1]	843 Ha (0)	2146 Ha (0)	3675 Ha (0)	6664 Ha (0)
Extra culverts in field roads [1]	843 Ha (0)	2146 Ha (0)	3675 Ha (0)	6664 Ha (0)
Class II road, upgrade, fair condition	1.86 Km	–	–	1.86 Km
Class III road, upgrade, fair condition	1.92 Km	–	–	1.92 Km

1 Figures in brackets represent alternatives to the physical infrastructure requirements if the buffaloes alternative is adopted. All other components remain constant.

Source : SESP

4.3 The dryland alternative

The planning of the Wawotobi area for a dryland settlement scheme is similar in most respects to that of the Makaleo area. This is discussed in detail in Chapter 5, the only marked difference being in the criteria for the location of the farm holdings, which is outlined in section 4.3.3 below.

4.3.1 Land availability

The gross area of land considered for this scheme was some 16,510 hectares of which 3902 hectares is presently occupied by the indigenous people. It was considered essential with a dryland scheme that, as far as possible, this occupied land should be excluded from the new development. However, in some areas, boundary adjustments affecting the zones of non-permanent cultivation will be necessary. In Chapter 7 we discuss the particular probelms of "hak epe" rights to sago palms and we would recommended that the current practice of allowing continued access to indigenous people to these palms is followed.

Table 4.10 analyses the distribution of available land, using as a basis the canal command boundaries. These form convenient geographical units, based on drainage lines, and allow comparisons to be made with the analysis of land availability for the irrigated scheme, outlined in section 4.2.3.

Table 4.10 Wawotobi settlement, dryland alternative. Land available for agricultural development

hectares

Zone [1]		Total occupied and cultivated land [2]	Unusable meander scarced areas	Deduction for roads reserves etc. for new settlements	Land available	
Reference	Gross area				for expansion of existing communities	for new trans-migrants
1 A	990	579	19	–	392	–
2 - 3	260	170	8	–	82	–
3 A	500	239	–	–	261	–
3 B	330	128	3	–	199	–
4 A	2610	408	97	26	85	1994
4 B	350	133	9	–	208	–
2 - 5	350	230	15	–	105	–
5 A	1340	83	12	15	51	1178
5 B	620	60	30	7	22	501
2 - 6	630	214	21	5	16	374
6 A	1840	257	41	19	63	1460
6 - 7	800	435	8	4	15	338
7 A	1750	357	10	17	56	1310
7 B	1640	441	–	15	48	1136
Other [3]	2500	168	–	29	94	2209
Total	16510	3902	273	137	1697	10500

1 Corresponding to canal command boundaries, see Figure 4.4.
2 Includes all houseplots, permanently cropped areas, rainfed rice areas and other cultivation.
3 Three parcels of land outside of the area considered for irrigation.

Source : SESP

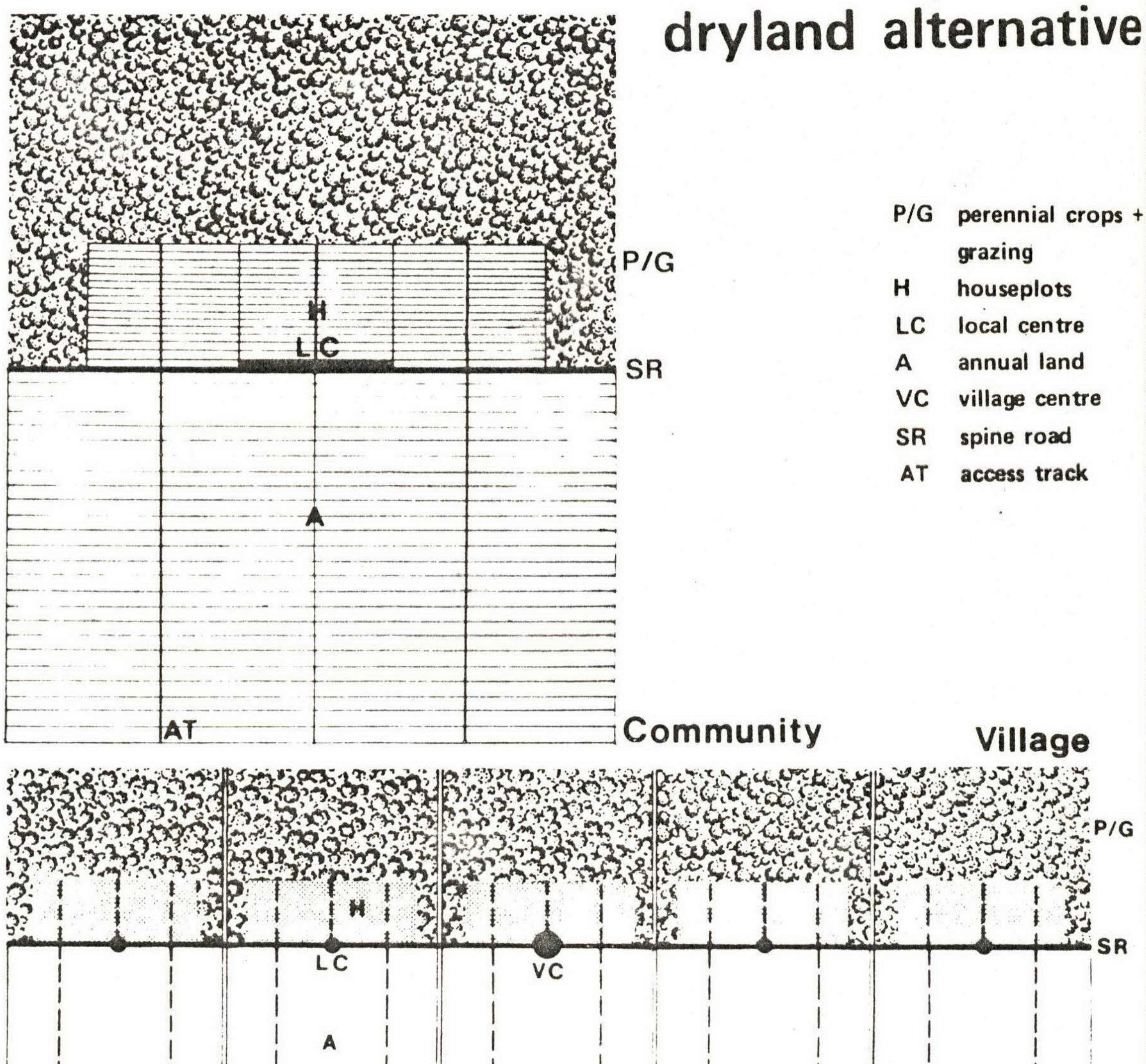
The average holding size of the indigenous population is approximately 1.1 - 1.2 hectares, of which the houseplot/permanently cropped area is around 0.55 hectare. Table 4.10 envisages that an area of land should be left for the indigenous population of at least an additional 0.4 hectares, giving a total minimum holding size of 1.5 hectares. Because of the pattern and density of existing development, the land left in some areas will, however, be equal to approximately an additional 0.53 hectare per farming family.

4.3.2 Agricultural planning

The envisaged farm holding for new settlers is the same as that proposed for Makaleo, comprising: 1.8 hectare arable land; 1.0 hectare pasture; 0.25 hectare perennial crops; and 0.45 hectare houseplot, vegetables and additional perennial crops. In the Wawotobi area, however, it will be possible, in many instances, to combine the components of the holding to obtain a farm with only three parcels – 1.8 hectare arable land, a combined 0.7 hectare of perennial land and houseplot and 1.0 hectare pasture. The latter will be predominantly located adjacent to the houseplots on the meander scarred areas, which account for approximately 50 per cent of the total net area available, as shown in Figure 4.3.

The total net land area available for new transmigrants is some 10,500 hectares and, given a farm holding size of 3.5 hectares; this represents adequate land for 3,000 families in six new settlements of 500 families each.

4.13 Prototype layout – Wawotobi dryland alternative

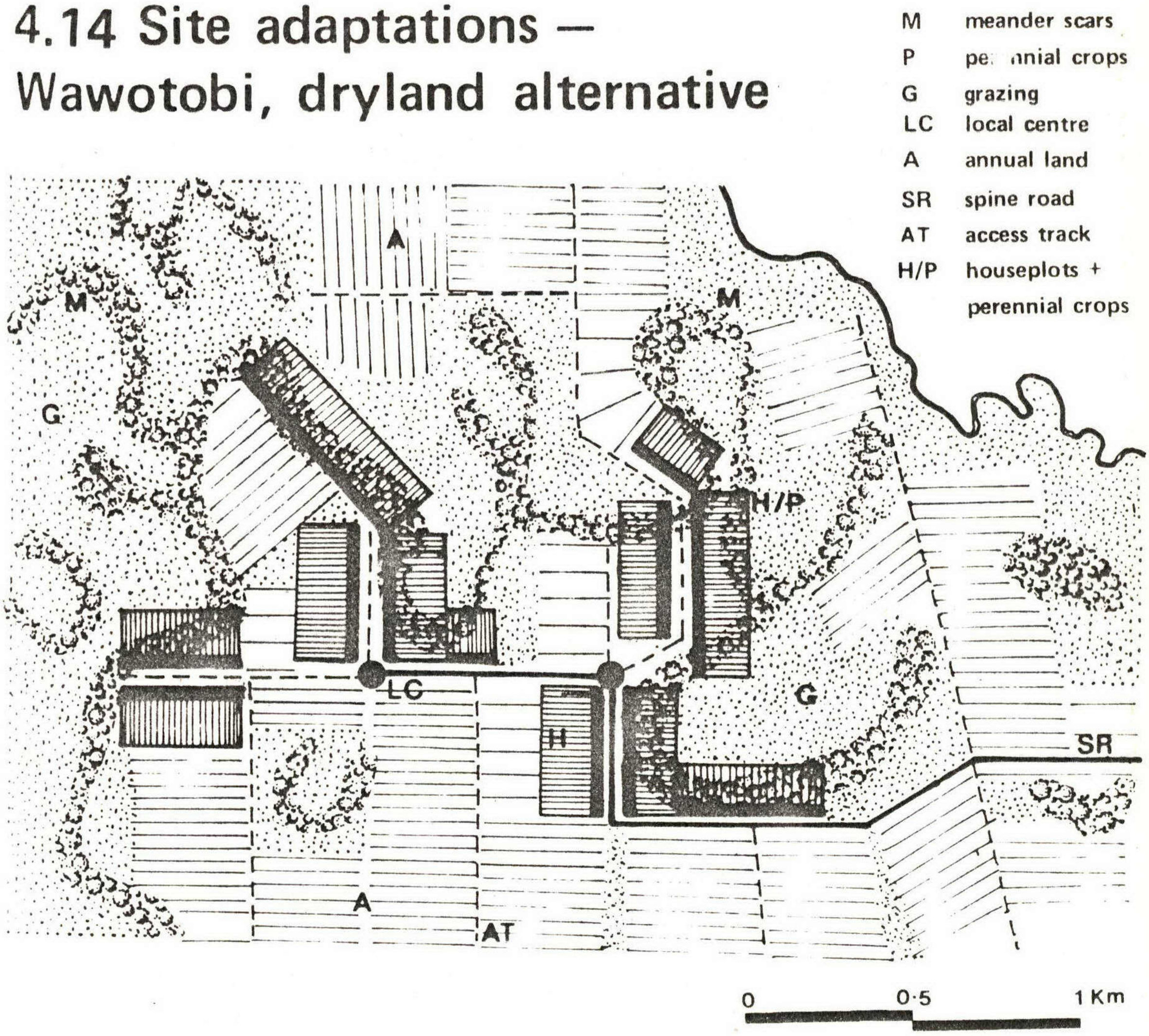


G
H
I
J
E
F
Boundaries of new villages
Area centre
Sub-area centre
Village centre
Local centre
Village reference
Class II road
Class III road
Class IV roads
Houseplot zone
Grazing and perennial cropping
Existing permanent cultivation
Flood protection bank
1 0·5 0 1 2 3Km

4.3.3 Prototype village layouts

A prototype layout for villages in the Wawotobi area is given in Figure 4.13. The major feature of this pattern is the use of the meander scarred areas for all development other than arable farming. In some situations the adaption of this prototype on the ground could follow the type of arrangement shown in Figure 4.14, in which the house is located on top of the oxbow levees together with perennial crops, the slopes of the levees being used for vegetables and the bottom of the depression for fishponds.

4.14 Site adaptations – Wawotobi, dryland alternative



4.3.4 The dryland structure plan

The plan for the six villages, shown in Figure 4.15, is based on the criterion of using a clear hierarchy of roads, which, together with the basis for the location of communal facilities, is discussed in detail in Chapter 5. The provision of facilities corresponds to that shown in Table 3.4 in Chapter 3. As with the irrigated alternative the plan envisages an area centre (village H) located on the main Kendari-Kolaka road. There would also be two sub-area centres, located in villages E and I.

4.3.5 Phasing

The construction of the six villages could occur over a three year period of equal phases. The first villages to be constructed in 1980 would be E and F, which are in an area where there is comparatively little existing shifting cultivation, thus necessitating only a minimum of boundary adjustments with the local people. This would be followed in the next year by villages G and H, the latter being the are centre. In the final year villages I and J would be constructed.

The phasing of all the components is shown in Table 4.11. Without detailed topographic informatio it has been assumed that equal programmes are possible for the physical infrastructure for eac project year.

Table 4.11 Wawotobi settlement – dryland alternative. Phasing of village buildin and infrastructure

Component	1980 Villages E and F (1000 families)	1981 Villages G and H (1000 families)	1982 Villages I and J (1000 families)	Total (3000 families)
Agricultural infrastructure :				
Project offices	4			12
Cooperative stores	2			6
Rice stores	2			6
Drying centres	4	as	as	12
Staff houses : type D	8	1980	1980	24
type E	2			6
type T_1	2			6
type T_2	4			12
Social infrastructure :				
Transmigrant houses	1000	1000		3000
Primary schools	2	2		6
Junior high schools	1	1		3
Mosques	2	2		6
Village halls	2	2		6
Health sub-centres	1	–	as	2
Health centres	–	1	1980	1
Washing areas	67	67		201
Latrines	1000	1000		3000
Market areas	2	2		6
Village centre land clearance	7.2 Ha	7.2 Ha		21.6 Ha
Physical infrastructure :				
Class II roads	8.62 Km			25.86 Km
Class III roads	10.39 Km			31.17 Km
Class IV roads	70.06 Km			210.18 Km
Bridges in class II roads	17.24 M	as	as	51.72 M
Bridges in class III + IV roads	73 M	1980	1980	219 M
Fords	5.5 No			16.5 No
Culverts	52 No			156 No
Bunding	117700 M^3			353100 M^3

Source : SESP

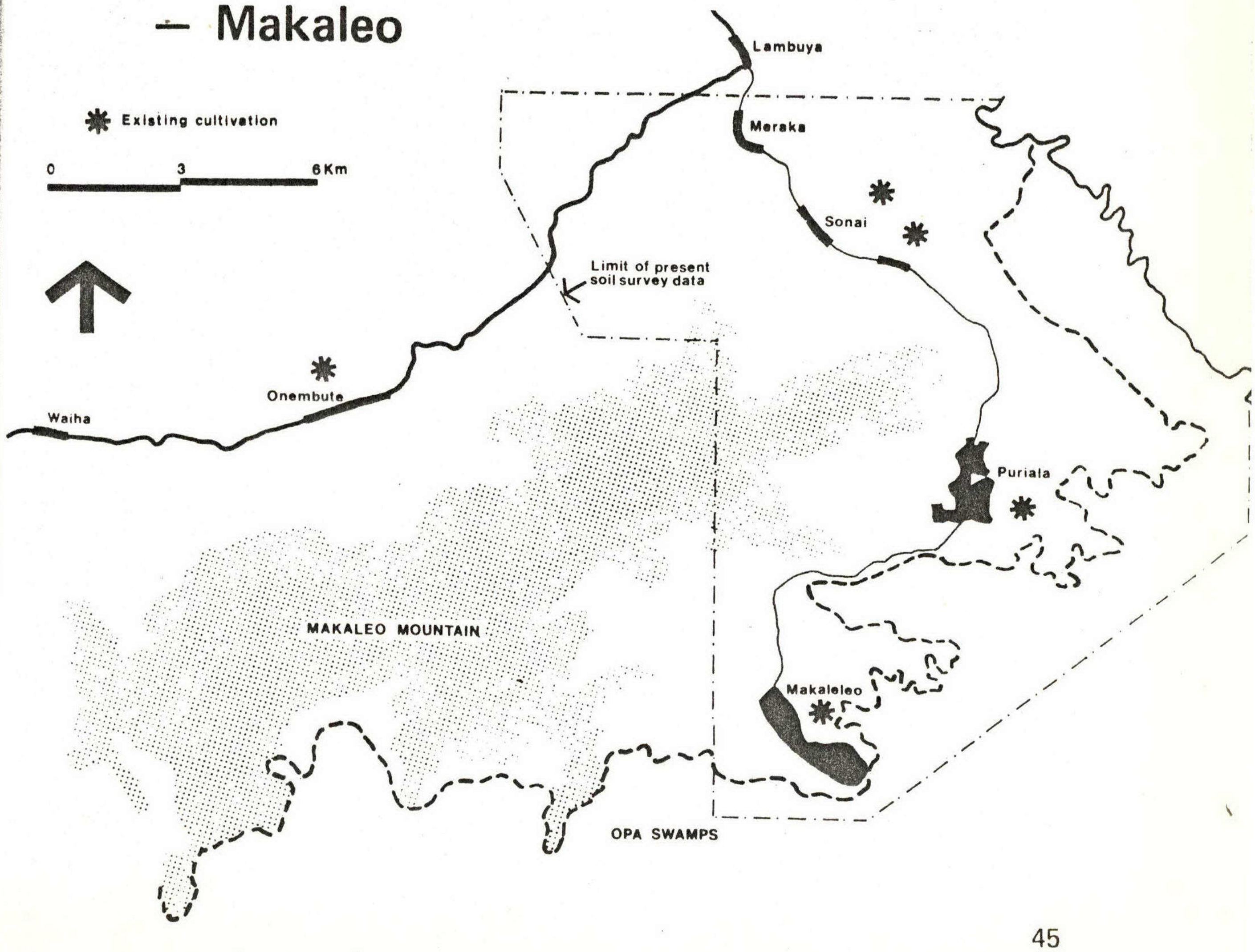
An important aspect of the development of the area is the provision of flood protection works For the purposes of costing we have assumed that this will be undertaken in three equal phases. It is possible, however, that a full survey of flooding in the area – for which, at the present time, there is little data available – would indicate the need for the completion of these works prior to the arrival of the transmigrants.

The Makaleo area 5

5.1 The context for development

The Makaleo project area is located to the north and east of the Makaleo hills, the highest point of which is 790 metres above sea level. To the south the area is defined by the Opa swamp, to the east by the river Konaweha and to the north by the main Kendari–Kolaka road. Figure 5.1 indicates the extent of the area and its general characteristics.

5.1 Area characteristics – Makaleo



5.1.1 The existing population

There are only four existing villages within, or on the edge of the Makaleo project area, the populations of which are given in Table 5.1. The majority of the people are subsistence farmers of the Tolaki ethnic group cultivating a very limited area of land.

Table 5.1 Indigenous population in 1976 of the Makaleo area

Village	Population	Estimated number of families
Puriala	1214	236
Mokaleleo	1042	202
Saoni	663[1]	129
Onembute (Kumapo)	450[2]	87
Total	3369	654

1 Projected from 1970 figure of 489 persons using average annual growth rate of 5.2 per cent foı Kecamatan Lambuya.

2 Exact dates of population estimate unknown.

Source: SESP

Larger centres of population, which act as service centres, are located just outside the project area, a Lambuya and Rate Rate.

5.1.2 Land use and physical features

The majority of the project areas is gently undulating open grassland, formerly used for shiftin cultivation. Of the areas analysed by photo-interpretation,[1] 4,130 hectares is in this physiographic class whilst another 1,250 hectares is of similar topography but covered in dense lowland forest. A furthe 910 hectares is hill land with steep to very steep slopes, predominantly open grassland. The Makaleo hill are still mostly forested, although further protection of the area is required to avoid soil erosion anc flood damage to any future settlement areas.

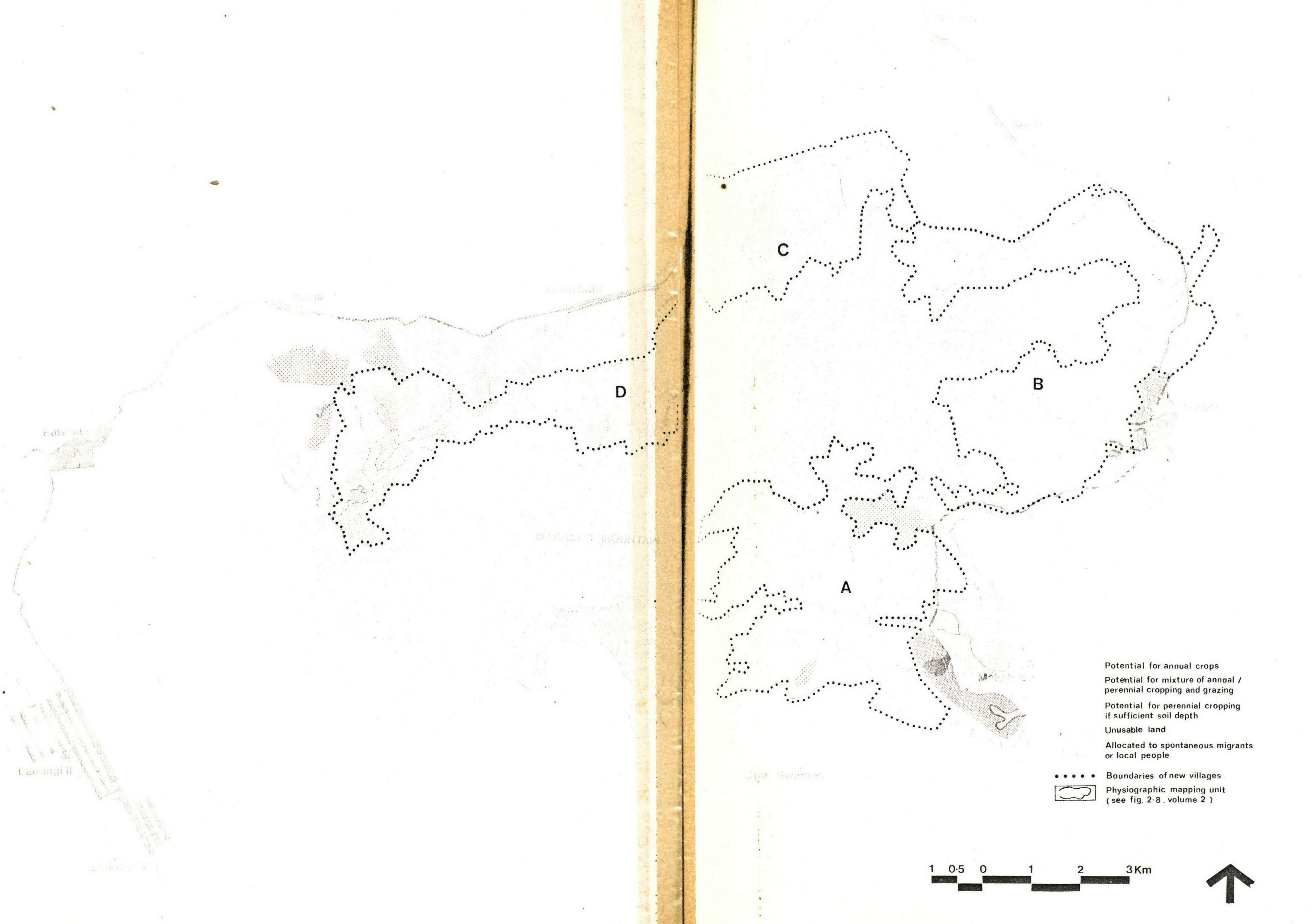
The roads in the area consist of the main Kendari—Kolaka state road, which is constructed to all-weathe standard, and of a track connecting Lambuya, via a ferry at Makaleo, to Motaha and other villages in th south of the province. We propose that the latter road, which is classified as a district road, should b up-graded to Class II standard as part of the first phase development[2]. There are, in addition, a numbe of tracks which provide access to stone and gravel quarries and for the extraction of rattan from th forested western part of the area.

5.1.3 Agricultural development

The average farm holding for each family would consist of four components: a house plot of 0.4 hectare including a garden plot of 0.1 hectare; an arable plot of 1.80 hectares; a perennial crop plot o 0.25 hectare; and a pasture plot of 1.0 hectare. This form of holding has been developed in response t the variation in soils and topography that the area presents. The implications of such a fragmente holding are discussed in Section 5.2 below.

1 Described in Chapter 2, Volume 2

2 Road section 2 – see Chapter 8.


C
D
B
A
Potential for annual crops
Potential for mixture of annual / perennial cropping and grazing
Potential for perennial cropping if sufficient soil depth
Unusable land
Allocated to spontaneous migrants or local people
Boundaries of new villages
Physiographic mapping unit (see fig. 2·8 , volume 2)
1 0·5 0 1 2 3Km

5.1.4 Land availability

The total land on latosols in the area is some 6,292 hectares of which we estimate 5,400 hectares will be available for development. An additional 1,060 hectares would be available for pasture land on the marginal podzolic soils to the north and east of the settlement area. Together, this 6,460 hectares would accommodate 1,845 families, each with 3.5 hectares holdings, in four new villages. A further 756 hectares has been retained as possible expansion areas for the existing villages, these areas partly forming a green belt around these villages, separating them from the new settlements. Details of the land availability are given in Table 5.2.

Table 5.2 Makaleo settlement. Land available for agricultural development[1]

hectare

Village	Development land on latosols in physiographic class[2]				Additional land needed for grazing[3]	Land left for expansion of local communities[4]	Number of transmigrant families that can be accommodated
	B	B/F	D	Total			
A	1436 (1436)	205 (256)	27 (53)	1668 (1745)	44	234	489 families
B	1243 (1243)	35 (44)	120 (614)	1398 (1901)	290	80	482 families
C	531 (531)	486 (607)	– –	1017 (1138)	338	n/a	387 families
D	917 (917)	277 (346)	123 (245)	1317 (1508)	388	442	487 families
Total	4127 (4127)	1003 (1253)	270 (912)	5400 (6292)	1060	756	1845 families

1 Excluding 1/1.5% of land lost for road reservations, local centres and village centres.
2 See Table 2.8, Volume 2 for details of physiographic units. Gross areas given in brackets.
3 On land other than latosols.
4 Assumed to be on latosols.

Source: SESP

The manner in which the total area would be subdivided is shown in Figure 5.2[1] which indicates the following potential land use zones:

a Those in physigraphic class B, on flatter land, with potential for annual crops and houseplots.

b Those in physigraphic class B/F, on gently undulating land with the potential for a mixture of annual and perennial crops and for grazing in residual areas.

c Those in physiographic class D on the lower hill slopes, with the potential, if sufficient soil depth is found, for perennial cropping. Small additions to this zone will be found in the sides of gullies.

d Small pockets of un-usable land, existing as isolated steep hills or swampland.

1 This should be read with Figure 2.8, Volume 2, which shows the physiographic units in the project area.

5.2 Alternative settlement layouts

The type of agricultural holding pattern envisaged in 5.1.3 above can lead to a large variety of physical planning solutions, all of which may possess suitable characteristics. It is unlikely, however, that any one solution will fulfill all possible design criteria. For this reason, we have in this study examined a wide range of solutions in detail before arriving at a prototype form which would be applicable to the whole settlement.

The mapping of the agricultural potential of the Makaleo area discussed in 5.1.4 above, creates a number of fixed parameters which would be applicable to any workeable settlement layout. These parameters are as follows:

a The land suitable for perennial cropping is fixed in both location and extent, being on hill slopes with suitable soil depths. Any viable solution must make maximum use of such land.

b The flatter areas with better quality soils should be used exclusively for arable cropping.

c Consequently the location of parture will be on more marginal land. Although some of this will be found in residual pockets, such as areas adjacent to streams, the majority of it will be in relatively large zones located well away from the perennial land.

Using these parameters and the general criteria for village location discussed in Section 3.1 it was possible to develop a series of alternative settlement layouts, the more important of which are shown in Figure 5.3 and discussed in detail below. All the solutions are based on the use of a grid pattern which is essential for ease of site setting out.

5.2.1 Dispersed pattern – A

Traditional farming practice in many coutries, including parts of Indonesia such as South East Sulawesi tends to produce a dispersed settlement pattern, especially when reliance is made, in part or fully, on shifting methods of cultivation. The constraints of land suitability do not allow a fully dispersed pattern to be applied in the Makaleo area, although a more adhoc pattern could be devised which allowed some holdings to be combined with the perennial land, but this would require a complicated setting out procedure and thus was not further examined.

The essential features of the dispersed pattern that was considered are:

a Houseplot combined with annual land, thus ensuring the farmers proprietory control of the majority of his land and reducing transporting/walking distance.

b Long distances between dwellings and to the local and village centres.

c Adequate maintenance of the road system is very important as the majority of dwellings are not close to the village spine road.

d Provision in the future of service networks would be very costly.

e House construction costs may be relatively high as the choice of house sites is limited by the dispersed pattern and a proportion of the development area is either suceptible to occasional flooding or has undulating topography.

5.2.2 Nucleated pattern – B

This form of settlement corresponds generally with current transmigration practice (see Chapter 7) and has the following features:

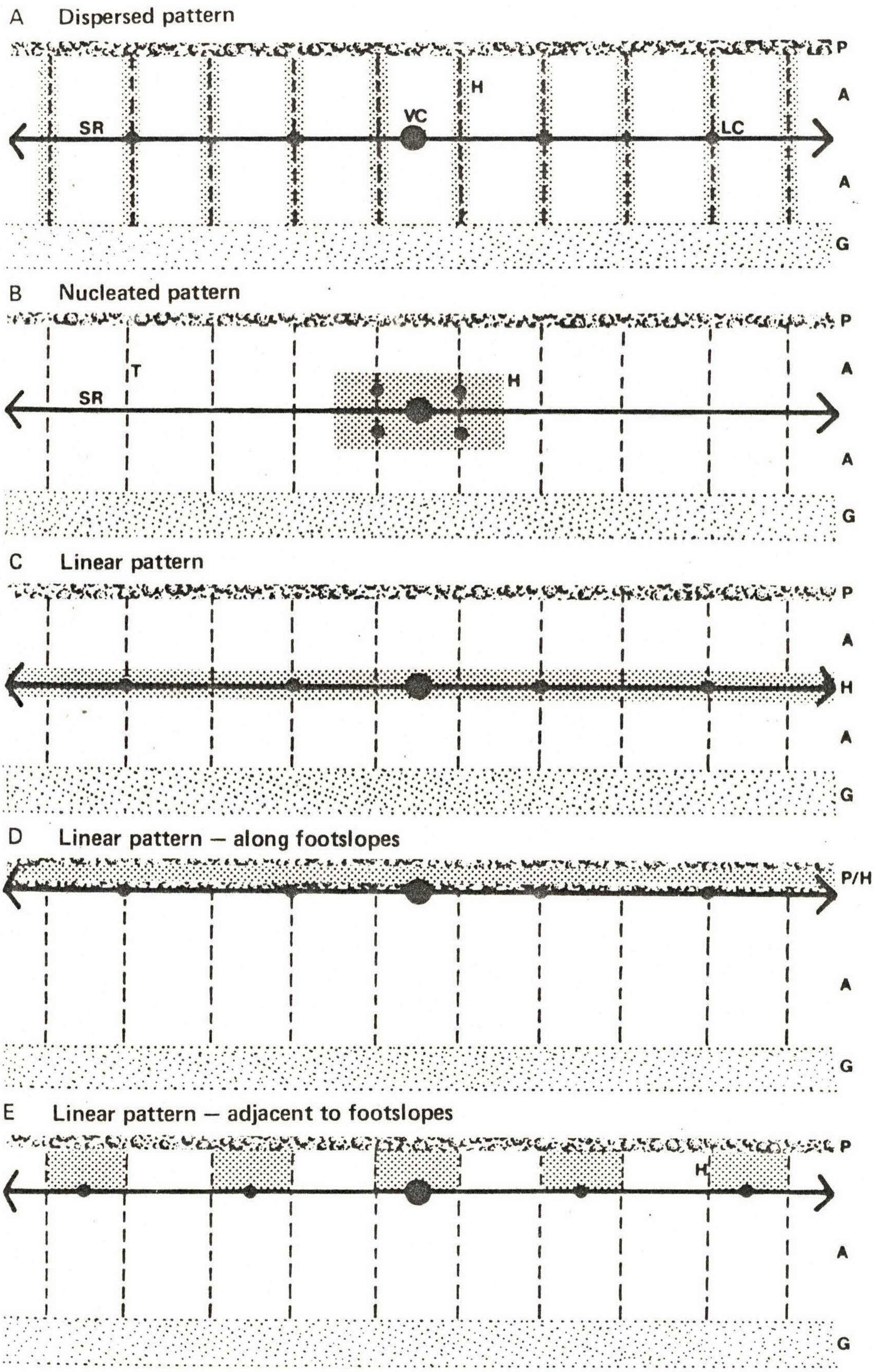
a All houseplots combined into one large settlement providing convenient support and access to all village facilities.

b Large distances to all components of the farm holding with consequent time wasting in travelling to the plots and more importantly in transporting crops.

c A single settlement of 500 families would be more difficult to sub-divide into multi-nucleated, ethnically homogenous communities.

d Inflexible in layout, requiring ideally a substantial area of flat land to be available in a single large parcel.

e Service networks could be provided in the future at a minimum cost.



5.3 Alternative settlement layouts for dryland areas

SR spine road
T access track
H houseplots
LC local centre
A annual land
VC village centre
P perennial crops
G grazing

5.2.3 Linear pattern – C

This form of settlement has many characteristics in common with that of traditional communities in Java and Bali, although with the refinement of not fronting the dwellings directly into a main road. Other features would be as follows:

a Houseplots separated, in the majority of cases, from all the other components of the farm holdings, but equi-distant between perennial land and pasture.

b Easy to form into clearly identifiable multi-nucleated communities, although still retaining flexibility in setting out.

c Local centre facilities would be very close and village centre facilities closer than in alternative A.

d Assuming that primary service networks would run with the village spine road, the provision of future services would be relatively inexpensive.

5.2.4 Linear pattern, along footslopes – D

This settlement form, a variant of C, is one which directly responds to the physical characteristics of the Makaleo area.

The features of it are:

a The houseplots are located on the footslopes with their perennial cropping land, and subsequently with a larger annual plot on the flatter areas.

b It makes maximum use of the potential perennial land and also leaves the maximum area available as annual land.

c More inflexible in setting out and expensive in house and road construction than C because of building on difficult topography.

d Similar characteristics to C in the houseplots relationship to the local and village centres but with extended walking distances to the pasture and annual land.

5.2.5 Linear pattern, adjacent to footslopes – E

This settlement form combines the better features of C and D; as follows:

a The houseplot is located close and in many cases adjacent to its perennial cropping land.

b The access to local and village facilities is similar to C and D, but the walking distance to pasture and annual land is marginally better than D.

c It would have the same simplicity and flexibility as C, but with the added characteristic that the location of the houseplots at the bottom of the footslope and surrounded by perennial crops would give a strong sense of visual identity to the individual communities.

5.2.6 The preferred alternative

The comparative characteristics of the alternative settlement layouts result in the rankings shown in Table 5.3. This analysis uses the following evaluation criteria:

a Maximum convenience: minimum walking distances to annual land, grazing land, perennial crops, local centre and village centre; maximise security and minimise possible crop damage.

b Minimum cost: least expensive system of roads, bridges and fords, and lowest in maintenance costs; allows the possibility of optimising the alignment of the village spine road; minimises the cost of future service networks; minimum setting out costs; and reduces abnormal site conditions for house construction.

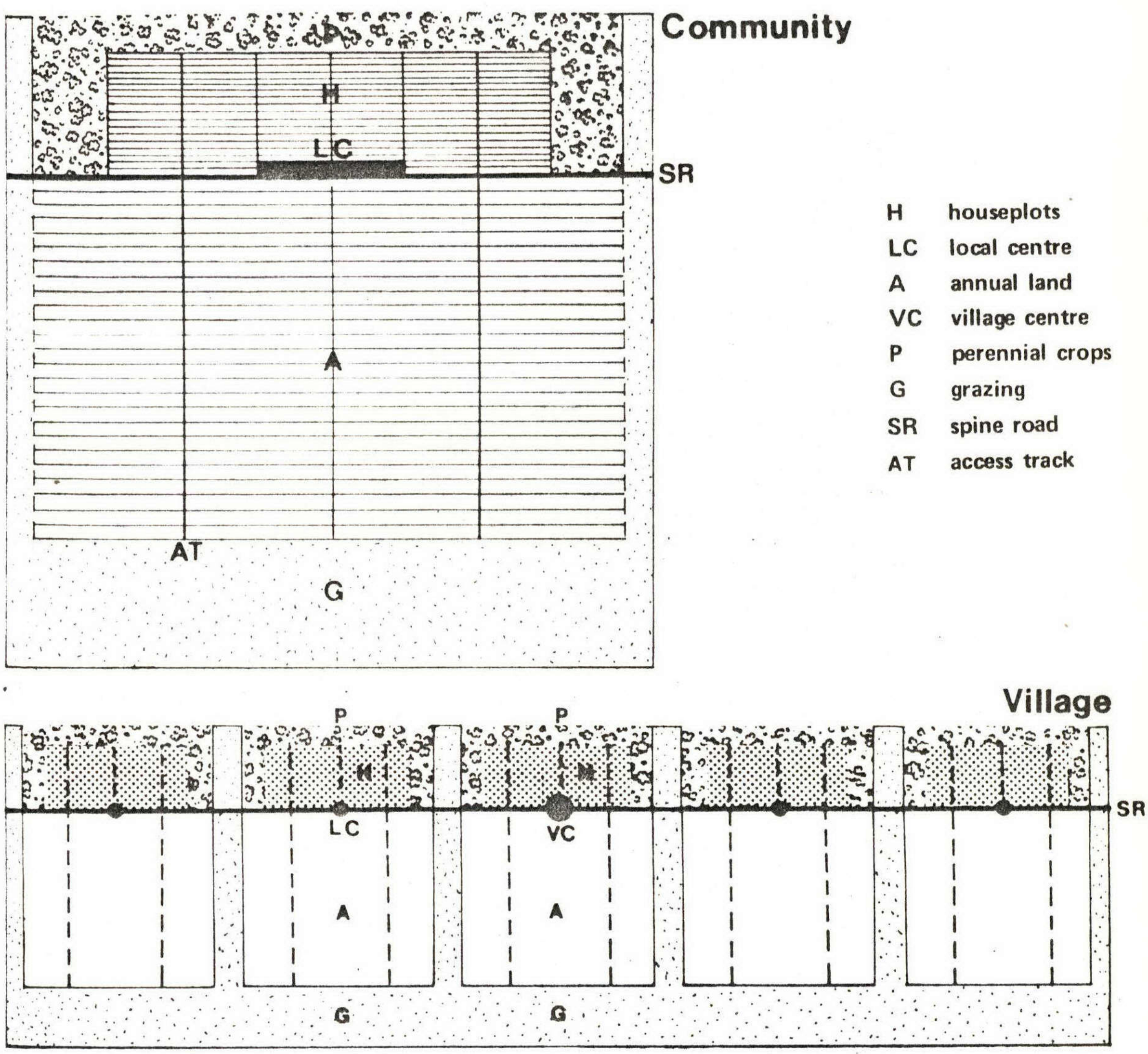
Table 5.3 Ranked comparison of alternative village forms

Criteria	Village form				
	A	B	C	D	E
Maximising convenience	4	5	2	3	1
Minimising cost	4	3	1	5	1

Source: SESP

Option C, which with Option E, minimises cost, is similar to settlement forms that have been suggested in other transmigration studies[1]. However, in view of the need for proprietory control over perennial crops, option E — which is essentially a variant of C, is more approprate to the site conditions and provides marginally more convenience — is the preferred alternative. We have used this pattern in the development of a prototype settlement layout (see below).

5.4 Prototype layout — Makaleo

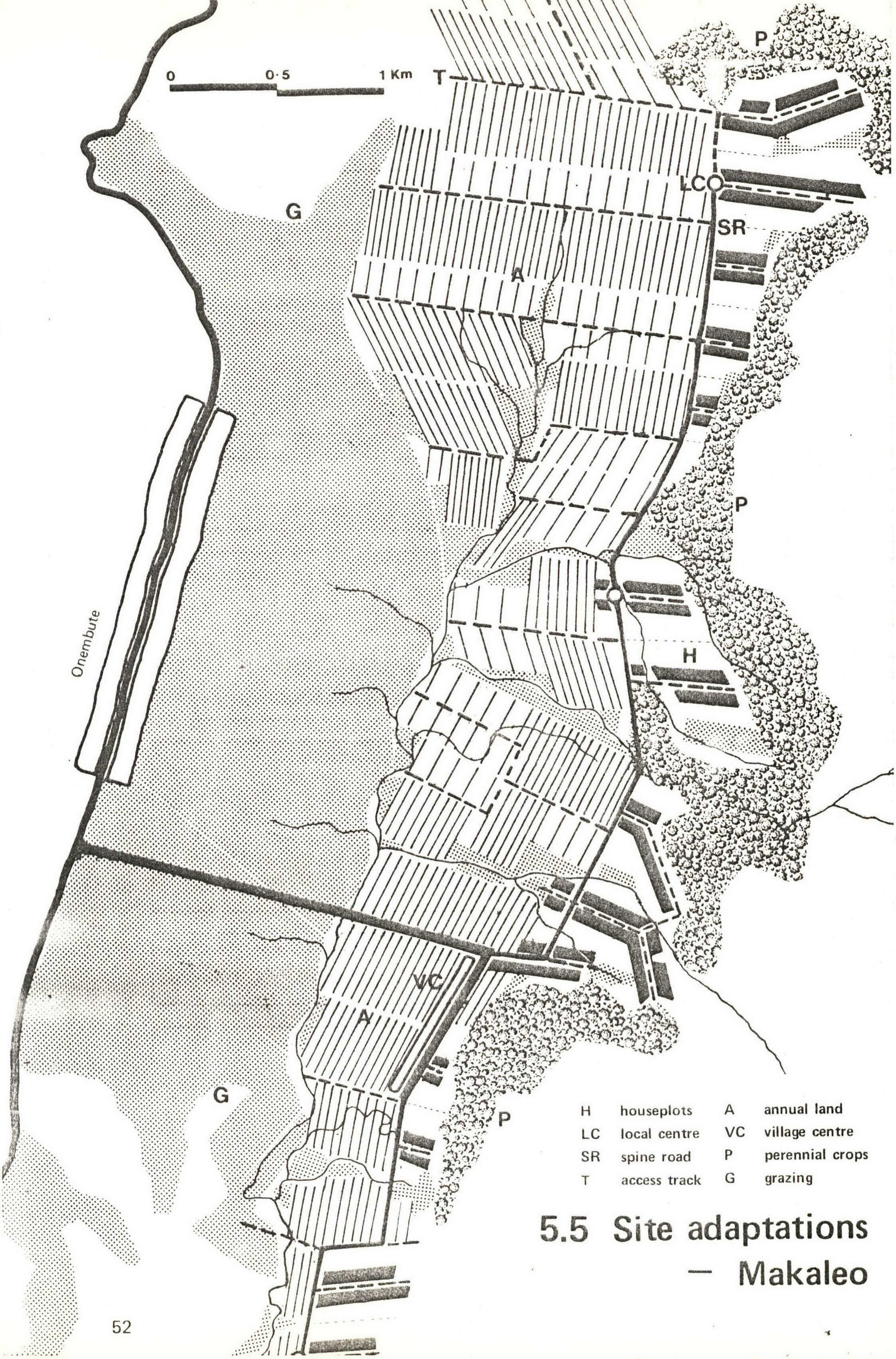


5.3 The prototype layout and its site adjustment

The essential features of the selected prototype are shown in Figure 5.4. The village would be built up from five communities of 100 families[2] with their own centre and connected to each other by a spine road of class III standard (see Chapter 8). One of the communities would contain the village centre, from which a connection would be made with a class II road to the main provincial road system.

1 Pematang Panggang Transmigration Study. Huszar Brammah and Associates, UNDP Project Report, INS/72/005, November 1974.

2 This level of population, apart from its potential ethnic homogenity, could also constitute a viable political unit-an RK (rukun kampung), as described in Chapter 7. The whole village would form a lembaga sosial desa unit



H	houseplots	A	annual land
LC	local centre	VC	village centre
SR	spine road	P	perennial crops
T	access track	G	grazing

5.5 Site adaptations — Makaleo

The community itself would comprise of a tight grouping of houseplots, 25 metres by 180 metres for each plot and usually grouped into three short class IV streets, one of which would contain a local centre of the same size as two houseplots. Adjacent to the housing, on the footslopes of the Makaleo hills, would be the perennial land of 0.25 hectare plots forming a tree belt around the community. The annual land, consisting of 1.80 hectare plots, 50 metre by 360 metre, would be located on the other side of the village spine road and would be reached by class IV farm tracks. Around the whole community would be a zone of grazing land of 1.0 hectare per family, although in most instances the majority of this land would be on the opposite side of the community away from the houseplots. The relatively large size of the houseplots, at 0.45 hectare, should allow the possibility of animals being grazed on the plot for a short time, particularly at peak labour demand periods.

It is inevitable that substantial site modifications will be necessary to this prototype at the implimentation stage. The design of the settlements was undertaken on the basis of only aerial survey data, no adequate mapping existing for the area at a scale larger than the 1:50,000 maps prepared by the Soil Research Institute, Bogor. Site verification of soil types will in any case be necessary for the majority of the settlement area. Figure 5.5 shows a detailed section of part of village D, demonstrating the site adaptions, the essential features of which are as follows:

- a Multi-nuclear houseplot pattern, with associated local centres
- b Linear form of village centre
- c Close relationship of houseplots to potential perennial land
- d Green belt of undeveloped land left around existing village of Onembute (Kumapo)
- e Twisting of the road grid and the annual plots to allow different boundary conditions to be followed, thus economizing on land
- f Use as pasture of residual parcels of land remaining between annual plots and streams
- g Balance of pasture made up to 1 hectare per family by using land, assumed to be more marginal, located on the other side of a major stream away from the settlement.

Further details of the geometry of plots and guidance on in setting-out settlements in dryland areas is given in Appendix C.

5.4 The structure plan

The Makaleo area subdivides into four villages their boundaries being formed by natural features such as hills or swamp. Each of the four villages would have a main service centre and four local centres. The main area centre would be located in the existing settlement of Lambuya, together with a new rural extension centre. The structure plan, shown in Figure 5.6, would form the basis for the development of the area, features of which are described below.

5.4.1 Village A

The transmigrant population of this village would be approximately 409 families. The village centre would be located on a spur, constructed to class II standard[1], coming off the Lambuya–Motaha district road. The existing village of Makaleo would be surrounded by a narrow green belt of undeveloped land.

Because of the constraints presented by the Makaleo hills and the Opa swamp, most of the pasture land for the village would need to be found within the village itself and in some cases it will be possible to combine this with the individual annual holdings. The swamp margins on the southern boundary of the village will also provide areas suitable for pasture. Not all the houseplots can be located to the footslopes

1 Details of road construction methods are given in Chapter 8.

without resulting in excessive walking distances to annual land and thus it will be necessary in the case of at least one community to use gully sides for perennial cropping.

5.4.2 Village B

The transmigrant population of this village would be approximately 482 families. The topography of the area essentially demands a village broken into two parts, but connected together by the Lambuya–Motaha district road. It is on this road that the focus of the village would be located, forming a sub-area centre for both the new and existing villages in the area. The village of Puriala which is adjacent to the new village would be surrounded by a narrow green belt of uncultivated land – their limited existing cultivated area, which lies to the east of the existing village, would not need to be included in the new development area.

Grazing land for the southern part of the new village would be predominantly found on the podsolic soils to the north and east of Puriala and for the northern section of the village on the podsols and regosols to the south of Sonai. Adequate land is available for perennial cropping on the footslopes of the Makaleo hills. Soil conservation measures will be especially important on these footslopes in this village.

5.4.3 Village C

The minimum population of this village would be 387 families, although site investigations of soils and topography, especially of the area to the north of the village, may reveal a further capacity of approximately 100–150 families. The village centre would be located on a short class II spur off the main Kendari–Kolaka state road.

A substantial part of the development area is at present under forest and it is therefore difficult to define the precise location of annual land and related settlements. However, it is probable that some of the grazing land for the village will need to be found in an area to the north, outside the natural village boundary.

5.4.4 Village D

The approximate population of this village would be 487 families. It would form a sub-area centre which would also serve village C and the existing villages of Waiha and Onembute. The location of this centre would be on the village spine road and connected to the Kendari–Kolaka road by a class II spur.

This area with its linear zone, suitable for perennial crops, is in a sense nearest to that envisaged by the prototype layout and once land clearance has been completed should be relatively easy to set out. The majority of the grazing land would be found in an area presently open grassland to the south of the village of Onembute and would form a green belt around that village.

5.4.5 Road hierarchy

The four villages all possess a clear hierarchy of roads, such that: main centres are located on, or connected by a class II road to higher categories of road; all local centres are connected to main centres by an all-weather road of class III standard; and the houseplots and annual plots are served by low-cost tracks, to class IV standard, which could be maintained by the local community on a gotong-royong (communal self help) basis. Such tracks would also connect together villages, D, C and part of B and could be upgraded to a class III standard in the future, as a by-pass around Lambuya. Villages A and B are linked together by the upgraded Lambuya–Motaha district road.

The unit lengths per transmigrant family of different categories of physical infrastructure are summarised in Table 5.4, the essential feature of which is the short average length of higher grade roads needed. Adequate all-weather access is, however, still maintained to all the centres of population and at least track access to each part of the agricultural holding.

D = 487 FAMILIES
C = 387 FAMILIES
B = 482 FAMILIES
A 489 FAMILIES
G
Boundaries of new villages
A-D Village reference
Class II road - new
Class II road - upgraded
Class III road - new
Class IV road
Houseplots
Perennial cropping
Grazing land
Sub - area centre
Village centre
Local centre
1 0·5 0 1 2 3 Km

Table 5.4 **Physical infrastructure per family**

Item	Unit	Village A	Village B	Village C	Village D	Average
Class II roads	metre run	6.42	0	1.86	6.69	3.74
Class III roads	metre run	16.0	20.04	21.0	19.73	19.19
Class IV roads	metre run	64.4	73.09	72.45	70.31	70.07
Bridges in class II road	metre span	0.0128	0	0.0037	0.0133	0.0075
Bridges in class III and IV roads	metre span	0.0653	0.077	0.078	0.073	0.073
Fords	number	0.005	0.0057	0.0056	0.0055	0.0055
Culverts	number	0.05	0.05	0.053	0.055	0.052
Average cost per family (000 Rp)		111	86	101	127	106

Source: SESP

5.5 Phasing

A substantial programme of land clearance is necessary for the establishment of the new settlements, the extent of which is shown in Table 5.5. The clearance of primary and secondary forest areas would necessitate the use of heavy machinery and the grassland, if to be used for arable cropping, would require initial preparation by tractor, equipped with heavy disc harrows.

The phasing of the construction programme is indicated in Figure 5.7 and summarised for each component in Table 5.6. The aim of the programme is to allow the arrival in late 1978 of 971 families, followed in late 1979 by the arrival of a further 874 families, bringing the total for the four settlements up to 1845 families.

The essential features of the programme are as follows:

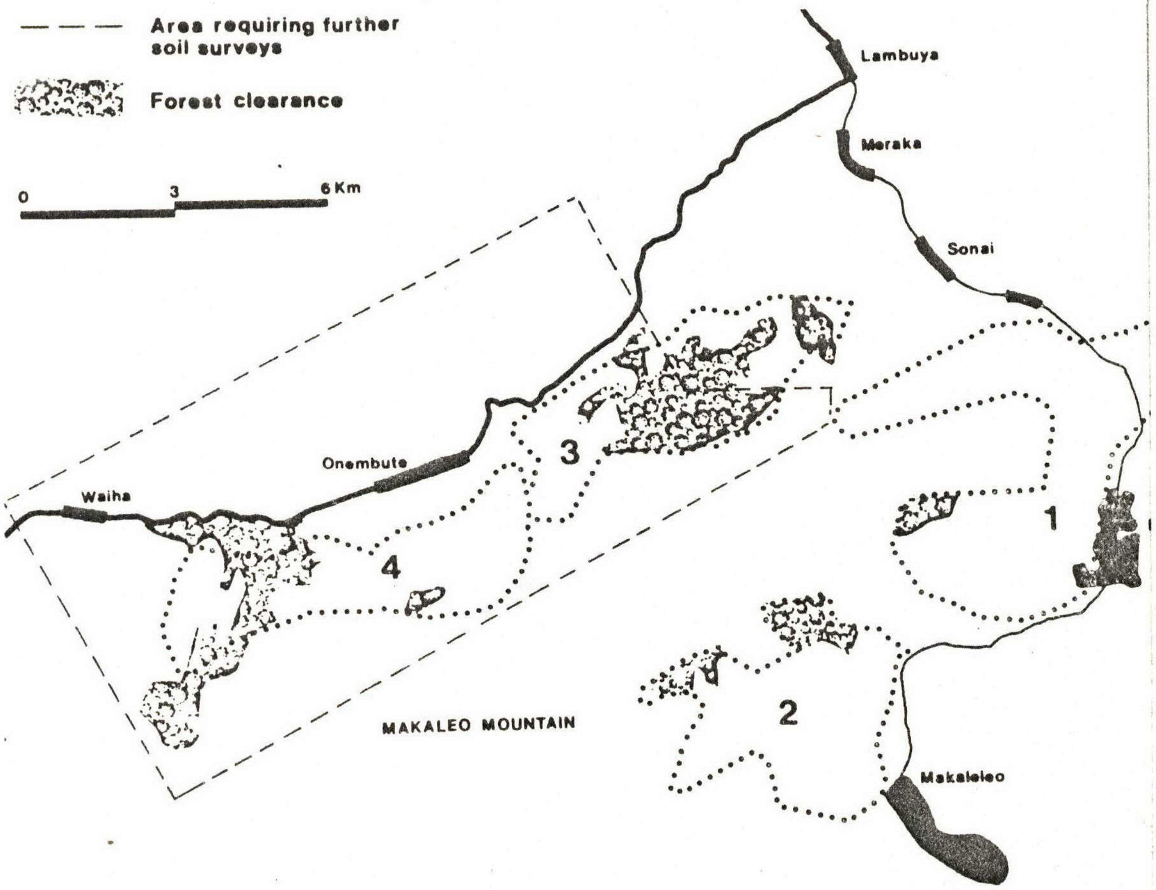
a Construction would start in 1978 with village B as this will be the easiest to develop first, although not necessarily the simplest to set out. Its centre is located on the main district road and thus would gain an initial impetus for its establishment by the proximity of the existing settlements.

Soils data exists for the area[1] and will only require brief on-site checking. A minimal area of forest clearance is required for the construction of the village. The improvement of the Lambuya–Motaha road would also start at this time, the section from Puriala to Lambuya being given priority.

b Village A would be started in the same year as B, having similar characteristics in regard to access and soils data, and needing less forest clearance than villages C and D.

c In the same year (1978) the detailed soil surveys for villages C and D should be started so that the areas available for development in 1979 are defined.

1 Figure 2.7, Volume 2



5.7 Phasing – Makaleo

Table 5.5 Makaleo settlement, Land clearance[1]

(hectare

Village	Grassland (alang alang) clearance				Forest clearance[2]			
	Annual land	Perennial land	Additional grazing	Total	Mixed annual perennial + grazing land	Perennial land	Total	Total (all clearar
A	1436	22	44	1502	205	5	210	171
B	1243	96	290	1629	35	24	59	168
C	531	–	338	869	486	–	486	135
D	917	98	388	1403	277	25	302	170
Total	4127	216	1060	5403	1003	54	1057	646

1 Including houseplot, but excluding roads, local centres and village centres.
2 Mixed forest and bush, predominantly secondary.

Source: SESP

d Villages C and D would be constructed in 1979, starting with village C because of its proximity to the main Kendari–Kolaka state road and so that a maximum time is left for negotiation with local people about the future extraction of rattan and quarrying of stone, both activities essentially taking place in village D.

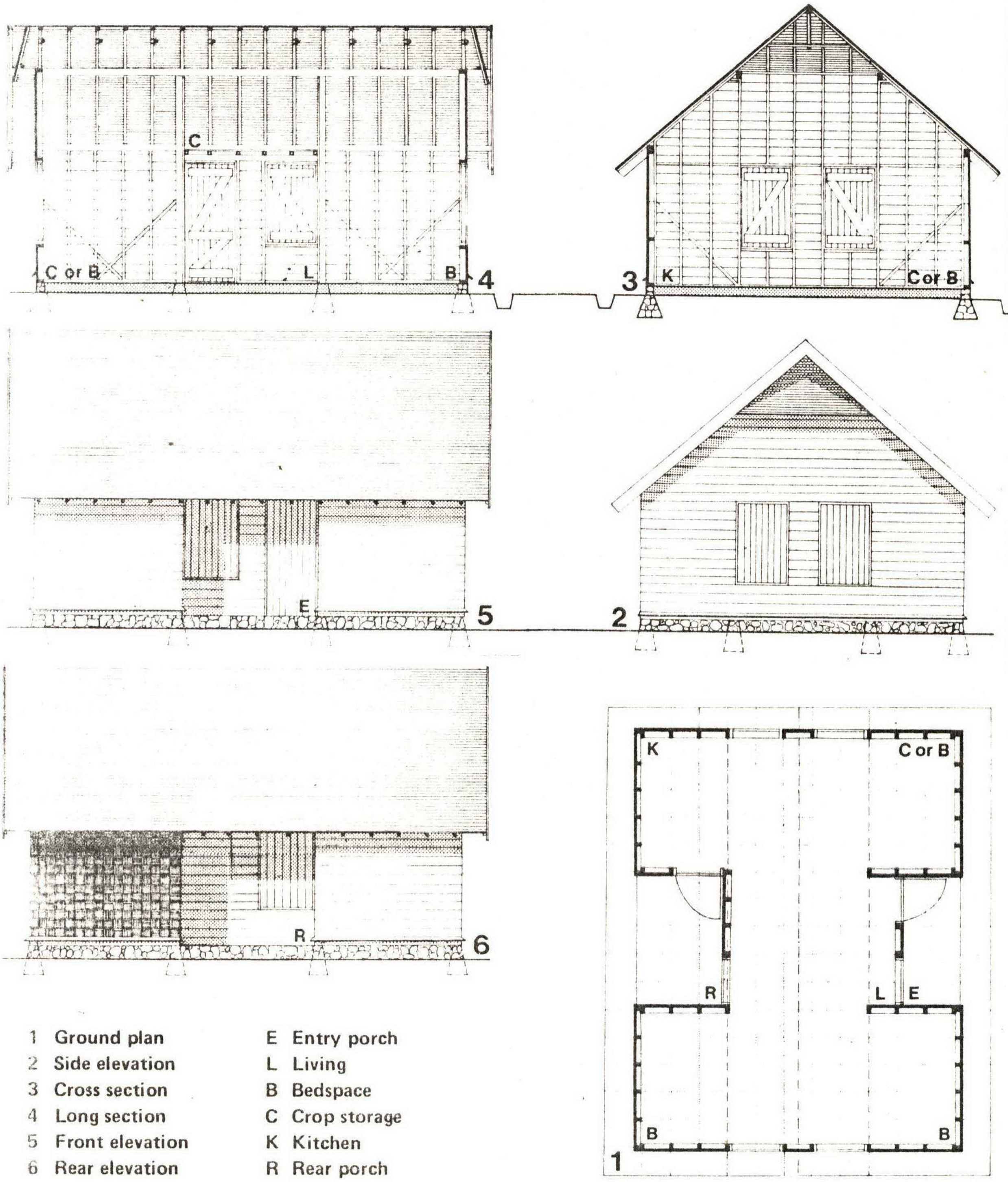
In all villages first priority should be given to the construction of the transmigrants houses and to the demarcation of the components of the farm holdings.

Table 5.6 Makaleo settlement Phasing of village buildings and infrastructure

Units required

Component		1978 Village A (489 families)	Village B (482 families)	1979 Village C (387 families)	Village D (487 families)	Total (1845 families)
Agricultural infrastructure:						
Project offices		2	2	2	2	8
Cooperative stores		1	1	1	1	4
Rice stores		1	1	1	1	4
Drying centres		2	2	2	2	8
Staff houses:	type D	4	4	4	4	16
	type E	–	2	–	2	4
	type T_1	1	1	1	1	4
	type T_2	2	2	2	2	8
Social infrastructure:						
Transmigrant housing		489	482	387	487	1845
Primary schools		1	1	1	1	4
Junior high schools		–	1	–	1	2
Mosques		1	1	1	1	4
Village halls		1	1	1	1	4
Health sub-centres		–	–	–	1	1
Health centres		–	1	–	–	1
Washing area incl. pump		33	32	26	32	123
Latrines		489	482	387	487	1845
Market area		1	1	1	1	4
Village centre land clearance (ha)		3.6	3.6	3.6	3.6	14.8
Physical infrastructure:						
Class II roads (kilometre)		3.14	–	0.72	3.26	7.12
Class III roads (kilometre)		7.8	9.66	8.13	9.61	35.2
Class IV roads (kilometre)		31.5	35.23	28.04	34.24	129.01
Bridges in cl. II roads (metre)		6.28	–	1.44	6.52	14.24
Bridges in cl. III-IV roads (metre)		31.95	37.14	30.23	35.76	135.08
Fords (number)		2.44	2.73	2.18	2.66	10.01
Culverts (number)		24.35	24.38	20.42	26.66	95.81

Source: SESP



1 Ground plan
2 Side elevation
3 Cross section
4 Long section
5 Front elevation
6 Rear elevation

E Entry porch
L Living
B Bedspace
C Crop storage
K Kitchen
R Rear porch

6.1 The first stage house – balloon frame

Housing and community buildings 6

6.1 Housing policy

Housing is an important element in both cost and social terms of any new settlement scheme. In our investigation of the existing settlements discussed in Chapter 7, we concluded that transmigrants appear to have a preference for the provision of a standard house, even though they are likely to substantially modify it at a later date. The demands on the transmigrants time in the early years of establishment of his holding are substantial, such that little time is available for any non-agriculturally productive activity.

Balanced against this need are the inevitable difficulties of creating a viable settlement scheme at a reasonable cost, where emphasis must be given to he provision of public infrastructure and agricultural inputs. Our sympathies lie with the philosophy of the Directorat Perumahan[1] which have as a social objective for rural housing, the need:

"To create an independent rural community able to plan, program and implement their own rural housing and community improvement programme, with guidance, assistance and stimulation from the Government."

This policy is essentially applicable to existing communities and the aim of any new settlement programme must be to create conditions under which this form of social development may proceed. Thus our recommendations with regard to the local communities are for the construction of simple basic houses, well sited, but with only a minimum provision of facilities. The house must provide, however, more than just the basic requirements of sleeping and living and be capable of being used as 'farmhouse' in which the drying and storage of crops can be easily accommodated. The prototype communities envisaged in Chapters 4 and 5 assume a tight clustering of houseplots, where the area over which the individual farmer and the community itself have proprietory control is demarcated, such that responsibilities for the development and maintenance of the infrastructure can be clearly established.

6.2 The transmigrants house

In the design of the basic house we have been guided by the need to use forms which are simple to build, use a minimum of materials and are possible, to a limited extent, to prefabricate. These aims are not, as it would first appear, necessarily compatable. Traditional construction methods, with an abundance of available materials and time produces different solutions to that which would arise with modern methods.

The limitations imposed by the general construction phasing of both the Makaleo and Wawotobi areas and of their agricultural development requires highly organised construction programmes in which some rationalisation of traditional methods will be necessary. It is inevitable that the more skilled and experienced contractors will be involved with road construction and with irrigation works. Thus any modification to traditional practice must recognise the relatively low level of construction skills that will be available.

1 Activities of the Directorate of Housing, Direktorat Perumahan, Jakarta, 1976.

6.2.1 Design criteria

In the development of prototypes a series of criteria were considered:

a The house should provide comfortable living conditions, with a maximum of cross ventilation.

b It should make the maximum use of materials and components available within the Study Area and provide opportunities for the employment of local sub-contractors and suppliers.

c It should use timber in available lengths and section, reducing cutting and wastage and aiding prefabrication.

d The inevitable changes, and possibly rebuilding of the house, that will occur should be recognised. However, it should also be possible to still maintain an adequate house after, say, five years by the replacement of cladding materials – which should be of a low-cost traditional type with which the farmer is familiar.

e The house should be of a simple modular form, allowing maximum flexibility in its subdivision to suit the farmers cultural and family requirements.

Two alternative forms were developed which meet these criteria, the essential difference between them being one of contractual convenience. Both use a consolidated earth floor of 33.4 square metres in area with a sand topping and a stone edging/fender wall. The main structure would be of lime-washed timber,[1] as would the door and window joinery and the wall cladding, except around the kitchen area where the wall would be clad in woven bamboo (gedek) sheets. The roof structure would consist of bamboo rafters, collars, struts and ridge – the limited spans involved making this the most suitable construction material. The roof itself and ridge ventilators would be clad in sago palm thatch (atap rumbia), which is the only easily obtainable local material. Roof drainage would be effected by a ditch around the house.

6.2.2 Balloon frame house type

This housetype is based on the use of low-grade light timber members nailed together to form panels. The construction of the panel is always made horizontally, either on-site or in a workshop. The pre-clad panels are then simply raised into position by a gang of 2–3 men and fixed through the sole plate. Temporary propping for the first few panels is necessary, before the structure obtains any rigidity; final structural strength is obtained when horizontal beams (purlins) are located, prior to the fixing of the roof members. With a bamboo roof structure it is also possible to pre-fix the elements – rafters, collars, struts – to form trusses which may be lifted into position.

The balloon frame method of construction essentially requires limited spans and this is reflected in the cellular nature of the ground plan of the house. Figure 6.1 indicates the general construction of the house and shows a possible arrangement of the internal spaces. Partitioning, which could give up to five seperate spaces, would be constructed by the transmigrant to his own requirements. Limited crop storage is possible on decks over the entry and kitchen porches but larger quantities of produce would need to be stored at floor level. A rice surplus of say 4 tons, presumably being stored only on a short term basis, could be accommodated in one of the corner cells of the house – which at other times could be used for crop drying or as an additional bed space.

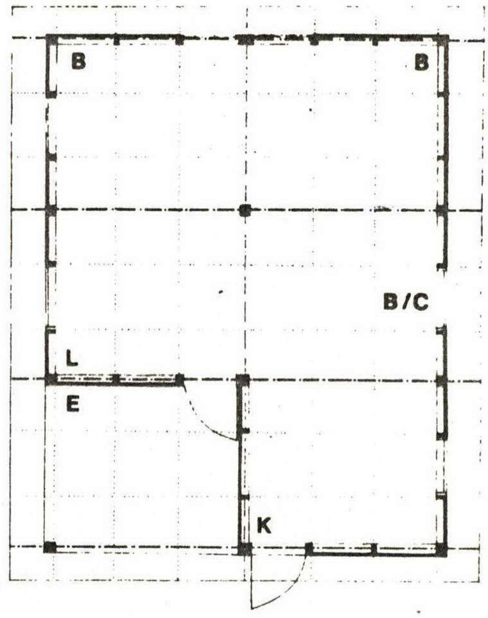
Further details of this house type are given in Appendix C.

6.2.3 Traditional frame house type

This house type uses a traditional post and truss system in three bays and with substantial structural members so that the frame is self supporting. The overall size of 33.4 square metres is identical to that of the balloon framed house, the difference being in the manner in which the structure is enclosed. The same possibility of internal subdivision into five spaces exists, but with a single porch (and overhead crop storage) which, if necessary, could be enclosed to form an additional room. The mode of ridge ventilation and number of door and window openings is also identical to the other house type. Figure 6.2 indicates the general arrangement of the house.

1 Details on suitable construction timbers are given in Appendix F.

6.2
The first stage house – traditional frame



Ground plan

E Entry porch
L Living
B Bedspace
C Crop storage
K Kitchen

6.2.4 Cost comparisons

Details of the costs of the two alternative house types together with that of the standard house type used by the Directorate General of Transmigration are given in Appendix E and summarised in Table 6.1.

Table 6.1 Comparative housing costs

rupiahs

House type	Unit cost[4] Square metre		Unit cost[4] Total
Directorate General Transmigration standard house type[1]	8,296		273,790
SESP traditional frame house type[2]	5,832		194,790
SESP balloon frame house type[3]	5,836		194,940
Variations:			
Omit wall boarding and substitute gedek	–	minus	30,800
Omit stone fender wall and substitute addition earth fill	–	minus	4,600
Omit bamboo rafters and substitute class 3 timber, 5 cm x 5 cm	–	plus	3,100

1 See Appendix E 4
2 See Appendix E 3
3 See Appendix E 2
4 Including profit and PPN tax.

Source: SESP

Assuming a standard profit margin and equal overheads for all contracts – an issue which is discussed in detail in Chapter 10 – the two alternatives are almost identical in price and from a purely functional point of view there is essentially very little difference in the two alternatives. However, the advantage of using one over the other would occur if a contractor could take advantage of the time-saving the balloon frame system offers.

Table 6.1 shows some possible variations, applicable to both types. The substitution of woven bamboo for timber cladding demonstrates a substantial saving, but is one which would probably be unacceptable as woven bamboo, except in circumstances where ventilation is essential, is generally regarded as an inferior material. The omission of the store fender wall is a saving that is not worth making, given the substantial advantages of water-proofness and termite resistance that the fender wall provides. The bamboo rafters could also be substituted, but our observations in the existing settlements would lead us to believe that the alternative would be no better and probably structurally inferior. Bamboo has been under-rated as a material, although a great deal of research, including in Indonesia[1], has indicated its great potential for low-cost high strength construction.

The substitution of the thatch roofing with tiles or galvernised iron sheeting was not considered in detail, the former being unfortunately extremely expensive in South East Sulawesi because of limited supplies of suitable clays and the latter, as it would give a markedly inferior roof in terms of solar heat gain, at a substantially greater cost.

6.3 The houseplot

The houseplot for both the irrigated and dryland alternatives has been based on the use of a standard frontage of 25 metres, but with a variable plot depth:

a Makaleo, dryland scheme – a plot of 25 m x 180 m (0.45 ha)

b Wawotobi, dryland alternative – as Makaleo, but in meander scarred areas where the houseplot can be combined with the perennial crops the plot would be 25 m x 280 (0.7 ha)

c Wawotobi, irrigated alternative – a plot of 25 m x 80 m (0.2 ha). With the holdings which have 0.8 ha of perennial land some of this, in out-of-command situations, may be found in areas adjacent to the houseplot.

The use of the houseplot will not be simply limited to domestic purposes: all will support fruit trees and vegetables and those for the dryland options will also need to allow, because of the comparatively long distance to the main pasture land, short term grazing for cattle.

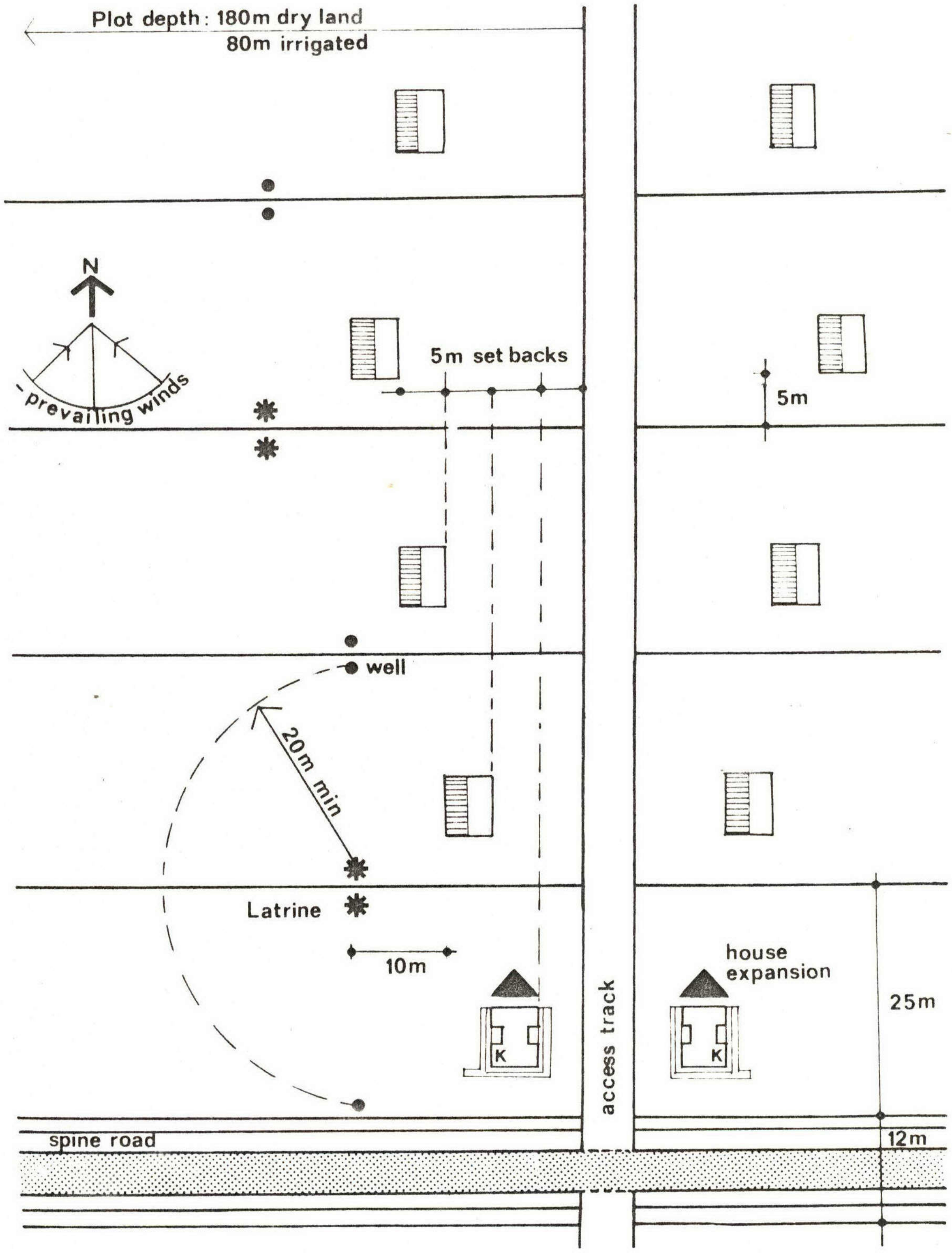
6.3.1 Infrastructure

All houseplots will be fronted by narrow track[2] of class IV standard, which will exclusively serve a single community, and thus may suitably be maintained on a gotong royong basis. Any ditching that may be required could also be constructed by this method.

The provision of drinking water, which would be on the basis of a shallow bore hand pump shared between about fifteen families, is discussed in detail in Chapter 8. In the costing of this element we have assumed that a small concrete slab will also be provided, which will form an effective washing area.

1 The use of bamboo and reeds in building construction, United Nations Publication ST/SOA/113, New York, 1972.

2 See Chapter 8.



6.3 The houseplot

We would recommend that a pit latrine is provided for each family. This should be carefully located, preferably near the plot boundary and at least 20 metres and preferably up-hill from any well that may be dug by the transmigrant. The pit latrine should be 1 metre in diameter and 2½ metres deep, which should be adequate for 8–10 years[1] after which a new hole will need to be dug and the shelter moved.

1 H.T. Mann and D. Williamson. Water Treatment and Sanitation, Intermediate Technology, London, 1973.

6.3.2 Micro-climate

The relationship of the house to the plot and to adjacent houses should be such that maximum benefit is obtained from the prevailing breeze thus ensuring effective cross ventilation. This can be achieved by the following means:

a The ridge of the house should run in an approximately north-south direction, thus exposing the majority of the window openings and the ridge ventilators to the prevailing breeze. This will effectively pull warm air from the roof zone of the house and act as a substitute for direct forms of ventilation which are likely to be disliked by the occupants.

b The wall area of the west facade of the house (front or back elevation, depending on the relationship to the access track) has been kept to a minimum to reduce heat gain from the severe westerly afternoon sun. Any expansion of the house on the north-south axis will increase this area and additional protection, by means of shade trees or a porch, will become necessary.

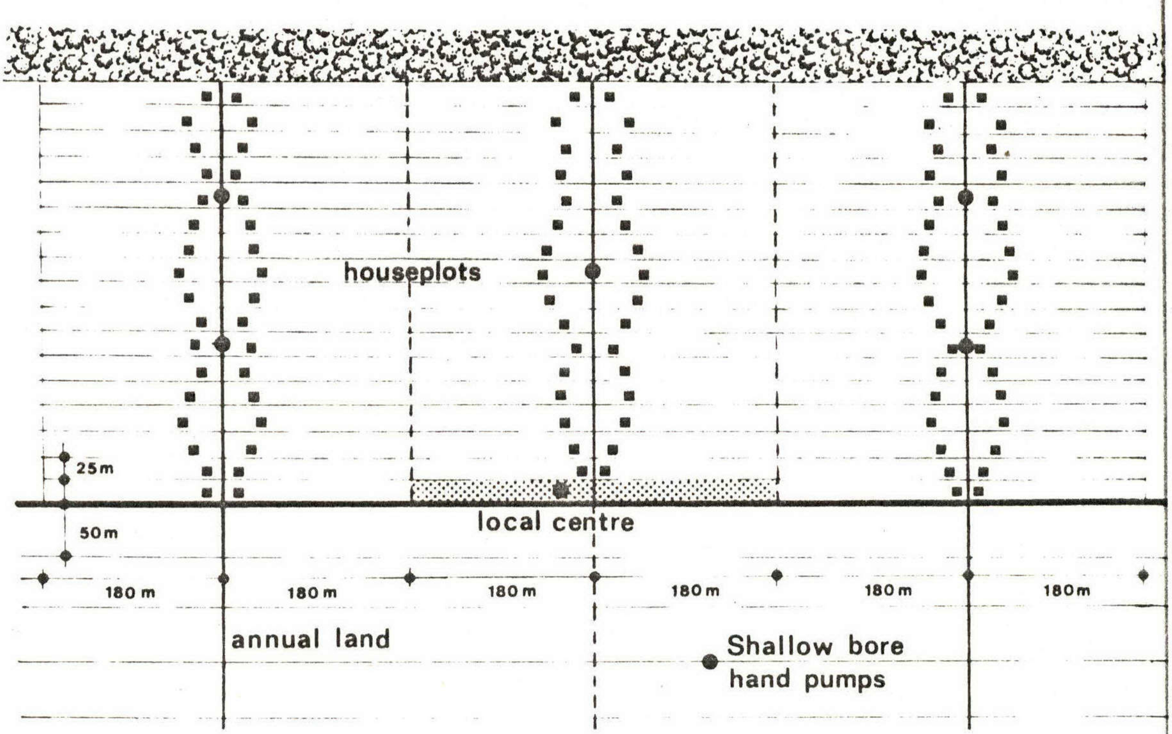
c The houses should be laid out on a staggered pattern, using say four standard set-backs, to avoid the occurrence of stagnant airzones.[2]

6.3.3 The prototype houseplot

The ideal form which the houseplot could take is shown in Figure 6.3. This arrangment should allow adequate space for the ultimate growth of the house, whilst also providing a fire check and reasonable acoustical privacy between the dwellings.

6.4 The local community

The focus of a local community[1] of around 100 families would be the local centre. This would be located adjacent to the spine road and cover an area equivalent to two houseplots (in dryland options) or four houseplots in the irrigated alternative for Wawotobi.



6.4 The local centre

1 See Chapter 7.

2 Koningsberger, Ingersoll, Mayhew and Szokalay. Manual of Tropical Housing and Building, Part 1, Climatic Design, Longman, London, 1973.

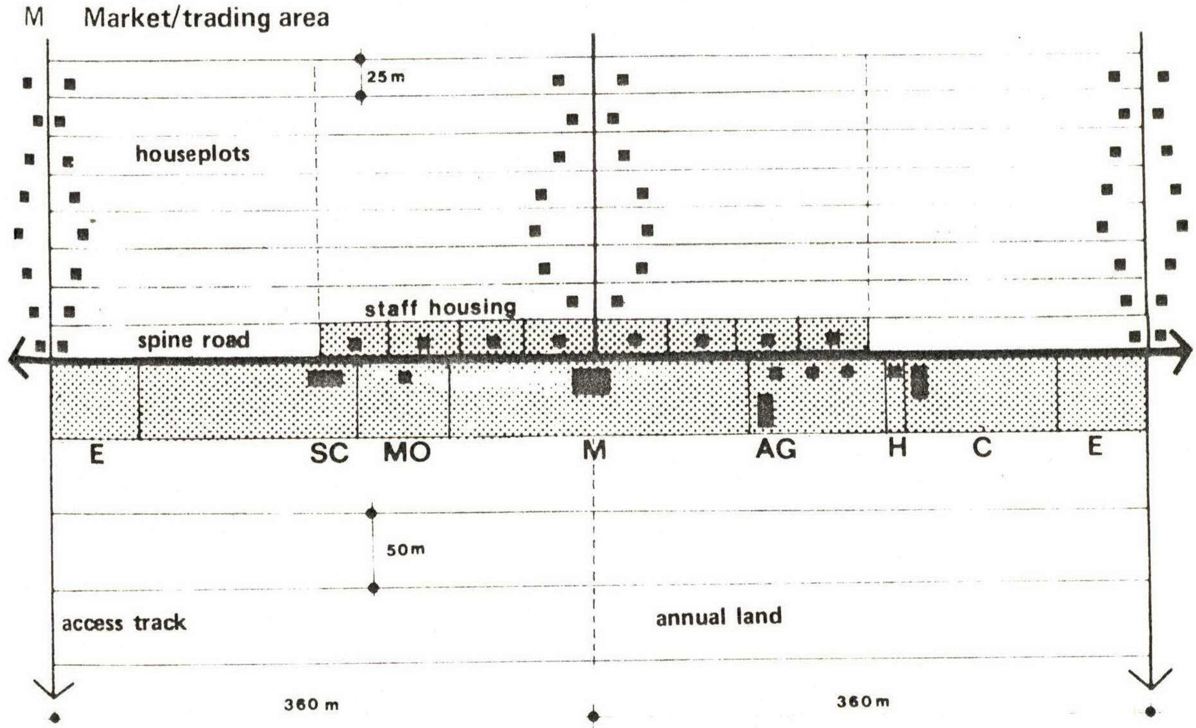
The centre is essentially a land reservation, the provision of facilities would in the short term be very limited. One of the communities shallow bore pump/washing areas would be located there and also, in some of the centres, the rice drying equipment. Local religions and social facilities would be constructed by the community itself, when time and materials are available.

It is inevitable that commercial activities will arise in the community, the population being sufficient to support three or four small shops. These would not have sufficient turn-over to attract outside traders and would be operated by the transmigrants wife or family, giving an additional income of about 300–400 rupiahs per day. If possible, those transmigrants wishing to open shops should be encouraged to settle in houses close to the local centre.

The layout of a typical local centre and related houseplots is shown in Figure 6.4.

6.5 The village centre

E Expansion area/recreation
SC Schools
MO Mosque
M Market/trading area
AG Agricultural administration
H Health
C Community centre



6.5 The village centre

The prototype village centre, shown in Figure 6.5 has the following features:

a The market area forms the focus of the centre around which the major functions are located. The level of activity in each market place will be determined by the rank of the centre[1], but the allocated area of 1 ha should allow the possibility of shop traders to expand on their own plots.

b The major administrative and civic functions are grouped onto one large plot, so that growth and change in these activities can be accommodated more easily. These functions are located adjacent to the market area so that they are not isolated from the day-to-day activities of the centre.

c The school and community centres are located adjacent to the expansion areas so that full use of these spaces may be made before they are required for other purposes.

1 See Chapter 3.

d The staff housing is located within a short walking distance of the centre, the houses fronting onto the village spine road.

e The linear form of the centre makes maximum use of the village spine road and no additional access, at least in the short term, will be required.

The land and building requirements for a typical village centre for 500 families are shown in Table 6.2, the overall area being constant for all ranks of centre. The plots for the staff housing would be equal to the area of the local centre which would normally be located in this position. The remaining land uses would be accommodated on a plot equal in area to two annual plots.

The basis of costing for the types of buildings that would be required in the village centres are detailed in Chapter 9.

Table 6.2 Village centre, land and building requirements

Land use	Buildings type	Buildings area m^2	Total site area ha
Agricultural administration	Project office	73	0.45
	Cooperative and BRI office	73	
	Village unit cooperative store	120	
	Rice store	48	
	Drying slab	32	
	Drying centre	16	
Staff housing	type D (4)[1]	50	1.8
	type E (1)	36	
	type T_1 (1)	63	
	type T_2 (2)	40	
Education[2]	Primary school	270	0.7
	Junior highschool	270	
Religion	Mosque	55.5	0.3
Community centre[3]	Village hall	112	0.5
Health[4]	Sub–centre	54	0.05
	Centre	64	
Market/trading area	Concrete slab	200	1.0
Recreation/expansion area	–	–	0.6
Total			5.4

1 Typical numbers required given in brackets. D and E are standard BAPPENAS types. T_1 and T_2 are standard DGT types.

2 In area and sub-area centres half of the allocated expansion land would be added to the school site.

3 Additional playing fields and recreation areas of around 3 hectares should be provided close to the centre, on areas not suitable for annual plots.

4 In the lowest rank of centre, health facilities will be provided in a first aid post in the village hall, and the community centre site thus increased by 0.55 hectare. Other types of village would either have a health sub-centre or a health centre.

Source: SESP

The existing settlements

7

The settlements constructed by the Directorate General of Transmigration and formerly by the Department of Social Welfare have provided in this study an important source of information for the development of sociological guidelines which could be applicable to their expansion and to the design of future settlements. In our work we have, of necessity, placed reliance on the existing literature for the region, particularly on the preliminary survey undertaken by Hameed[1], based on interviews with 2733 migrant households and his personal observations.

If development is not to be impeded by sociological problems it is essential that any proposal should take full account of the attitudes of migrants, of their aspirations, their traditional customs and beliefs and their potential relationship to the existing population of the areas to which they are moving. All these will be major factors in determining the pattern of development and the eventual success of settlement schemes. It would be wrong to conclude that the opportunity for expansion in the province can be based exlusively on the size of the areas of uninhabited land. The capacity for social absorbtion is less than that for ecological absorbtion[2] and any effective resettlement must therefore be sociologically realistic.

7.1 The indigenous people of South East Sulawesi

The indigenous population of the Study Area is extremenly mixed, although most of the mainland population can be placed in the Bungku–Laki cultural and linguistic group, but with extensive influence from nearby Buginese culture.

The dominant group in this complex are the Tolaki, which themselves are comprised of a number of smaller groups, one of which – the Maronene of the extreme south of the peninsula and the island of Kabaena – is sometimes regarded as a distinct group. In addition, the coastal areas have for many centuries been settled by Buginese migrants and peoples from the neighbouring island of Buton and Muna.

The subsistence economy of these groups is ostensibly based on the shifting cultivation of upland rice, supplemented by sawah in the case of some Tolaki and by the collection of sago flour from semi domesticated Metroxylon and other palms. The hunting of deer, and buffalo in the case of the Maronene, and the collection of forest products is also important.

The traditional settlement pattern of the Tolaki and other indigenous people is of wildely scattered homesteads with houses on stilts and seperate rice graneries . This form of settlement is largely confined to the interior upland forested areas and subsequently gives only limited potential for disagreements over land with transmigrants. Increasingly however, the indigenous people are settling alongside roads and the

1 N.D. Abdul Hameed, 1976, Pelita I settlements in Sulawesi Tenggara, UNDP/FAO Working Document INS/72/005
2 H.I. Heeren 1956, some problems of rural collective settlement in Indonesia. Transaction of the Third World Congress of Sociology II, London, p.305.

administration is pursuing a policy of attempting to group households into such conventional roadside villages. Most families still cultivate temporary dry plots away from major settlements and communications, and maintain two households.

It is likely that they will become increasingly sedentary, cultivating fixed plots and sawah, which will result in more inflexible attitutes to land ownership, giving rise to a greater potential for conflict with transmigrants in the settlement areas. One should not underestimate the potential for such conflict. A particular difficulty is the general absence of land certification among the indigenous population, which should not be allowed to continue to the point where their legitimate rights are threatened. Conflict so far has been limited mostly to the aquisition of land on which there are standing groves of Metatoxylon sago palm. A compromise solution has usually been reached by which sago stands remain untouched until they are either felled for consumption or die naturally. After this the grove land passes to the Directorate General of Transmigration. The situation is eased by the fact that settlers have no interest in consuming sago themselves.

Generally however, there are good relations between hosts and settlers. In some areas marriages have taken place between migrants and locals, resulting in the incorporation of migrants in local villages and locals in migrant settlements. In these cases it appears that women moving to their husbands household have not taken rights in natal land with them. Consequently, loss of land to outsiders through marriage has not become an issue.

Market forces favour the indigenous population in many localities. Settlers require sago thatch for roofing, which they are unable to collect themselves for technical and legal reasons. Local people are also able to increase their cash income by selling timber, bamboo, rattan, meat, fruit and vegetables to settlers. Such benefits to the local inhabitants may only be temporary and the trade may decrease when settlers have sufficient resources of their own.

Notwithstanding our views on the advisability of cultural continuity in the establishment of new communities (Section 7.3) all efforts aimed at encouraging social and economic relations between settlers and the indigenous people should be encouraged. The maintenance of cultural traditions and familiar social forms is not incompatible with good inter-community relations. We would stress, though, that the negative aspects of cultural separatism[1] can only be surely eradicated with good physical communications and by policies which promote such social and economic integration.

7.2 The migrant groups

The areas of representation for the provincial origin of transmigrants in the existing settlements in the province is as follows:

West Java	31%[2]
Bali	30%
East Java	19%
Jakarta	10%
Central Java	7%
South Sulawesi	1%
Yogyakarta	1%

This corresponds to a breakdown according to linguistic and cultural groups. Migrants from Central Java, East Java and Yogyakarta are culturally Javanese; those from Bali, Balinese and those from West Java, Sundanese. Migrants from South Sulawesi are either Macassarese or Bugis. The main exception to this rule are the Jakartans, whose ethnic origins are diverse.

1 Kampto Utomo 1967 "Villages of unplanned resettlers in the subdistrict of Kaliredjo", Central Lampung; in "Villages in Indonesia", Koentjaraningrat (ed.) Ithaca; Cornell University Press, p. 281.

2 Percentage of total population. Data supplied by Provincial Office of Transmigration, Kendari, 1976.

Most migrants are either drawn from among the buruh tani (landless peasants) or from among tanis (peasant farmers) with little land, in most cases less than 0.5 hectares. A number were rural artisans (carpenters, metal-smiths and builders[1]), some tailors and village merchants. Others had been in the armed forces. It would be eroneous, however, to interpret occupational statistics as a rigid division of labour and it is likely that a significant proportion of the unskilled and semi-skilled labour is occupationally mobile.

7.3 Social and political organisation of the communities.

As in some other parts of Indonesia, households in the settlements are grouped into neighbourhood groups (RT-rukun tetangga), comprising about 10 households with a headman, and ward groups (RK-rukun kampung) of about 10 RTs with its own headman. The heads of these units provide leadership in administrative and social matters and are used by Transmigration officials to communicate with settlers.

Before departure to areas of resettlement the local Provincial Office of the Directorate General of Transmigration selects leaders (kepala rombongan) for groups leaving at one time. In some cases the role may persist after resettlement, especially where it serves to identify and represent a particular ethnic or regional group.

Many of the transmigration settlements have local councils or Bamudes. These are composed of the heads of wards and leaders of other bodies, including religious functionaries and other representatives, such as kepala rombongan. Hameed has reported that they are forums for the discussion of problems relating to the new lifestyle and agriculture. The councils are managed by the settlers themselves and are not an arm of the official administration. While their present activities are rather limited they offer potential as representative bodies and as means of further education in social and economic affairs.

Some of the settlements possess social committees – lembaga social desa. These are voluntary self-help associations concerned with collecting funeral funds, maintenance of public buildings and the promotion of gotong-royong activities. Most settlements also possess hansip, (who undertake minor policing duties), a youth organisation and association for sport and cultural activities. Cultural institutions of the homeland areas are being recreated (such as gamelan orchestras, wayang kulit performances and traditional martial arts), providing continuity between old and new lifestyles.

Provision is usually made for places of worship, although the demands of the Balinese are such that they have to rely extensively on their own resources. The spacious layout of the settlements means that the distances many Moslems have to travel to attend the mosque is excessive and this has resulted in the creation of small neighbourhood places of worship (langgar). Balinese too require local neighbourhood temples (seka pura) and rather than use land allocated for houseplots or sawah it would seem sensible in future to make space available for these and similar local purposes. With the end of the pioneering stage, when social life is limited by immediate subsistence need, religious practices begin to return to normal and attention can be paid to mosque and temple construction.

Schools are usually established at some time during the first year of resettlement, though not immediately. This timing is probably correct. Teachers tend to be drawn from a mixture of background, including the migrants own and the indigenous population of the province. In view of the poor knowledge of Bahasa Indonesia among many migrants, and because it is an essential lingua franca for new settlers, we recommend consideration of adult education class, perhaps under the auspices of the lembaga social desa.

Medical facilities in all settlements are limited and facilities for the treatment of serious illness remote. Improved communications would greatly assist the usefulness of available medical and public health services. The lembaga social desa could form the basis for a contributory medical insurance scheme, as it

1 Approximately 12% of the total. See Hameed, op. cit.

presently provides for funerals in some localities. Family planning facilities are restricted. The Indonesian family planning programme has had considerable success in many parts of rural Java and it would be shortsighted not to encourage the provision of similar facilities in South East Sulawesi.

Kinship, which in most cases has been an important aspect of social organisation in the migrant homelands, has a restricted role to play in new communities of transmigrants. Strict genealogical relationships seldom extend beyond the level of the household. There is a certain amount of evidence that settlers who are satisfied with their new found lifestyle encourage relatives to join them. This, together with the natural increase in kinship ties over time, suggests that it is bound to regain its importance in terms of social organisation.

The initial phase of resettlement involves an element of imposed ethnic integration through the presence of a single transmigration administration. However, because of the persistence of strong cultural identities, the eventual division of settlements along ethnic lines, as has happened in Amoito[1], is likely to be repeated. Where ethnic groups occupy blocks in geographically contiguous settlements this is likely to be more difficult, and a possible source of tension.

While not necessarily accepting that ethnic separatism is a welcome development, it is likely that more harm will arise from enforced integration and the concealment of ethnic friction. We would advise that blocks of houseplots and atached agriculture land in new settlements be smaller than in existing locations, giving more independence and identity to separate regional and ethnic groups than is possible with present layouts. There are, however, at least two limitations to this recommendation. First, the numbers of migrants from the same region in new schemes is not always large enough to allow for the creation of viable communities and a certain amount of mixing is therefore inevitable. Second, the advantages gained from the mixing of peoples from different ethnic backgrounds should not be totally lost, as such mixing results in a diversity of talents which gradually become the common stock of groups with different origins. Thus upland cultivators from the dry areas of East Java can learn the finer points of practical irrigation technology from Balinese, while Balinese can absorb knowledge concerning fishfarming typical of the West Javanese.

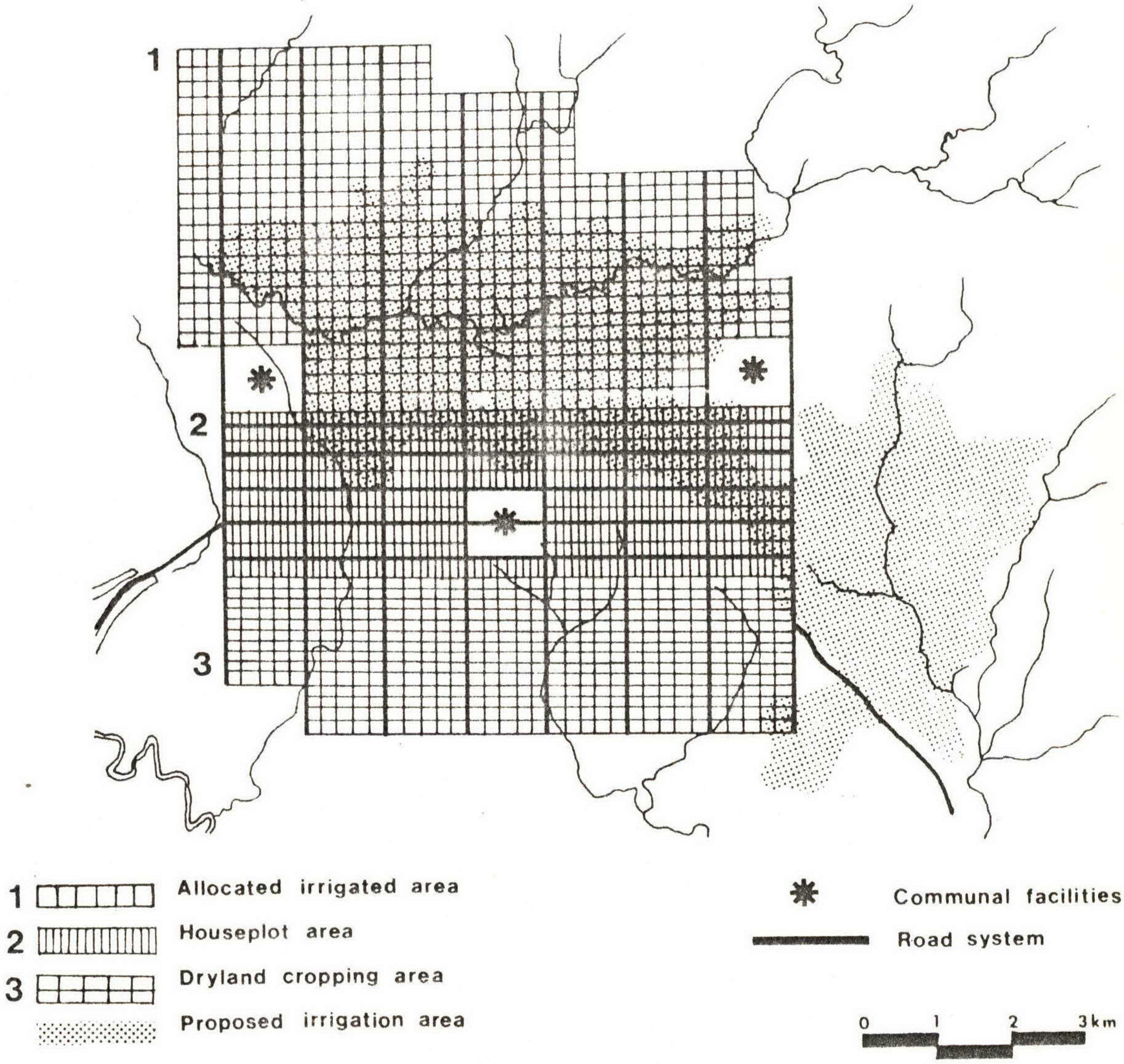
7.4 The form and design of existing settlements

The dangers of determinism based on limited sociological data is well known and in our investigations of the existing settlements we have confined our work to issues which are ameneble to limited field observations. To go further than this and to be able to make detailed recommendations on the form of future settlements would require the investigator to spend a substantial time actually living in transmigrant communities and ideally also in the communities from which the transmigrants originated.

7.4.1 The overall layout

In section 7.3 we have drawn attention to the need for allowing the development of socially viable, ethnically homogenous, communities. This policy has been adopted already in the development of Jati Bali and Sidang Kasih in Amoito and with the Balinese in Uepai. These form "natural" villages which may be separately administered when the Transmigration authorities cease to be responsible for them. While it may be possible for ethnically homogenous blocks within larger settlement grids to attain a fair degree of autonomy their independence is limited by the physical constraints of location. In this respect we are convinced that from a sociological point of view the spatial scale of the settlements in far too great. While large settlements consisting of block groups of different regional origin may be maintained during the period of Transmigration administration, it is likely that this will not be possible, without tension, when the settlements are integrated within the local government framework. In future settlements a flexible multi-nucleated pattern, should be used that would allow for the development of socially viable communities. A suitable size for such neighbourhood units would be around 100 families.

1 Amoito split giving a Sundanese village (Sidang Kasih) and a Balinese one (Jati Bali). These are now quite separate desa within the administrative structure of Ranomeeto kecamatan.

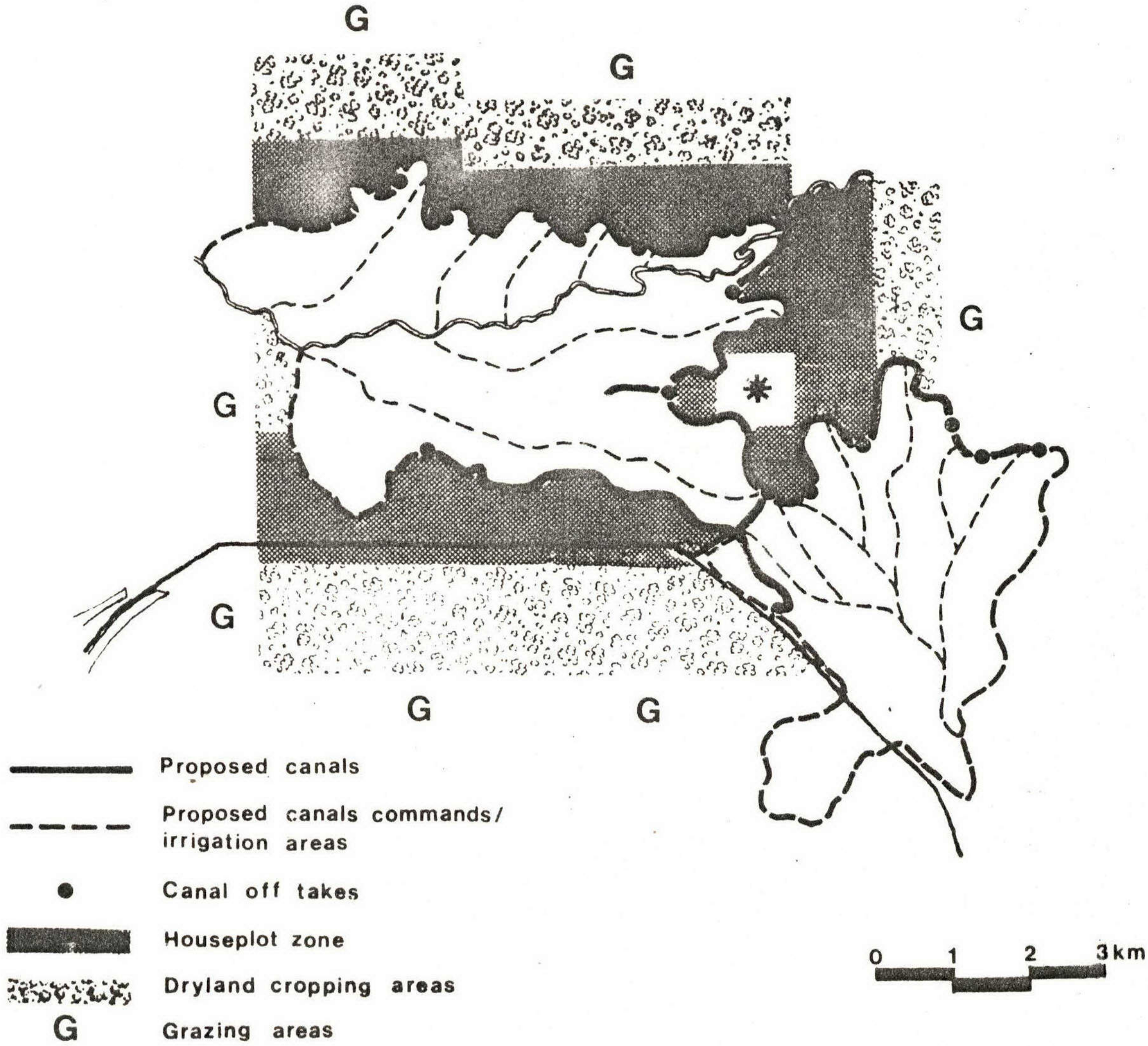


7.1 Lapoa — as built

7.4.2 Agricultural holdings

The general size of plots on the existing settlements is 2 hectares per household of which less than half is usually being cultivated — this area often corresponding to the area originally cleared. Apart from shortage of labour and traction power for clearance, a contributing factor in this situation may be poor demarcation of uncleared plots, with subsequent difficulties arising of not being able to control crop losses due to animal pests.

The use of grid systems in the design of transmigration settlements has many advantages, particularly in allowing for ease of planning and implementation. There is a danger though when they are applied without full understanding. At Lapoa, for instance, the proposed irrigated area crosses the grid in a quite arbitary manner (see Figure 7.1), such that existing houseplots must be lost and subsequently areas planned for dryland cropping must be relocated. In Moramo I the grid system has been so ruthlessly applied that severe soil erosion of the road system must occur. Such Mistakes are not necessary if a grid system is adopted which is more sensitive to the local topography. This need not necessarily be of an orthogonal type, but could still allow the fullest use of available land whilst remaining sufficiently flexible to cater for the spatial needs of different types of communities. Such a system is demonstrated For Lapoa in Figure 7.2.



7.2 Lapoa – modified

The position as regards inheritance of holdings unclear. As long as plots remain available, those who marry within settlements are provided with a standard plot of land, although they are expected to build their own houses. This is also the case for those male transmigrants who marry local woman. Woman marrying out of the settlements appear not to have rights in settlement land. Because of the possibility of problems arising over alienation and inheritance, we would suggest that the process of land certification be speeded up, the risks involved with fragmentation of the holdings not being an important issue, especially in the short term.

7.4.3 Layout of irrigation systems

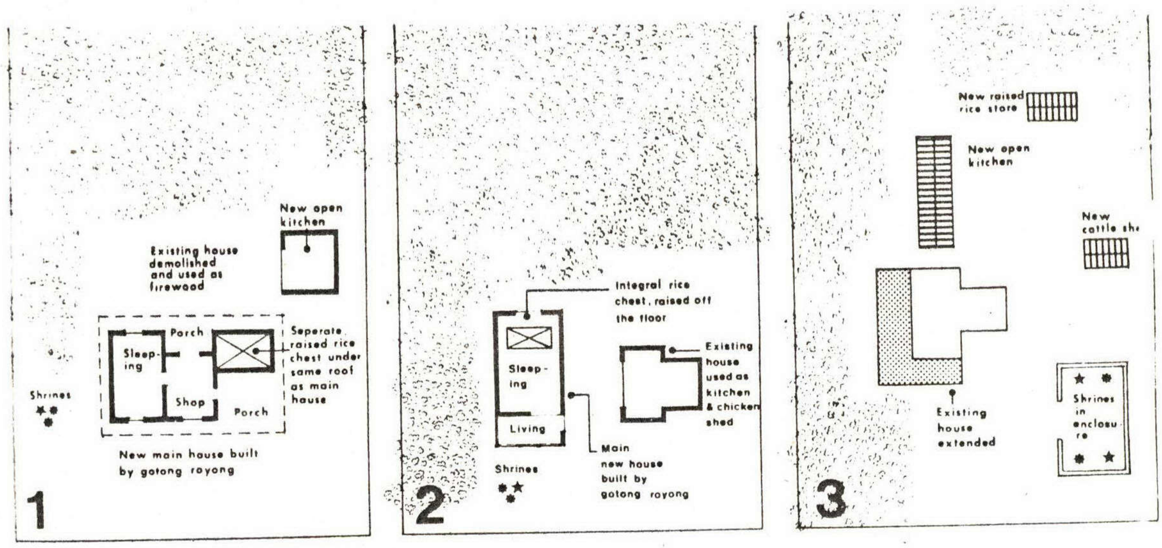
In some settlements traditional social patterns of irrigation have been employed. In Sidang Kasih traditional Sundanese cengteng supervise water distribution in a block of land, working under an ulu-ulu or overall village irrigation supervisor. The centeng may initiate light maintenance on the irrigation system, but heavier work is arranged through the village. In Jati Bali three subaks – traditional Balinese irrigation associations – have been organized, consisting of 60, 70 and 80 households each. The subak, however, may be more than an irrigation association, and serve as an agricultural planning unit, an autonomous legal corporation (arranging such matters as land transfers) and a religious community. A subak in the context of new settlements may be defined as all those plots irrigated from a single major water channel.

Organisations such as these obviously facilitate efficient and rapid development, but to be effective the irrigation channels must be arranged so that members of a single ethnic group have complete control over their own water arrangements. This has been possible in Jati Bali and Sidang Kasih. In Landono I and Ladongi Ia, which on the whole must be regarded as relatively successful settlements, the Balinese have not yet been able to organize subaks, partly because it has proved impossible to coordinate water matters. In the future preparation of detailed irrigation plans for the settlement areas it is important to ensure that groups within larger settlements can independently coordinate their own irrigation arrangements.

7.4.4 The houseplot

In general, settlers seem content with the layout of villages. Communication between houses is straighforward, and some of the disadvantages, which arise from the pattern differing markedly from the tight-clustering of their villages of origin, are outweighed by the advantage of spacious houseplots. Different groups have exploited the possibilities of the layout in different ways. Balinese culture requires adequate houseplots in which shrines and rice graneries can be placed in the traditional manner (see Figure 7.3). In contrast, Javanese and Sundanese culture does not require such elaborate ritual arrangements, with rice being stored in lofts rather than separate structures. The result of this is that Javanese and Sundanese settlers are able to cultivate their houseplots more intensively than the Balinese.

7.3 Balinese settlers



While the spatial requirements of different cultural groups may vary it is not suggested that this should be reflected in land apportionment. The differences in terms of agricultural productivity are, taking other factors into account is probably only slight. From the point of view of allowing for social and cultural requirements, a grid pattern for settlements provides flexibility which might otherwise be lost. The initial allocation of houseplots within ethnic blocks in new settlements is generally made by the migrants themselves on the basis of a loterry. This, however, does not necessarily commit settlers to particularly plots and in some settlements these have been changed several times over, which is possible only so long as vacant plots are available. In Uepai frequent change of houseplot during the first few years of resettlement was particularly characteristic of Jakartan families.

7.4.5 The house

On arrival transmigrants are provided with houses of a standard design, the life of which appears to be around three years, after which they are extensively altered, repaired on enlarged, usually using timber boarding or woven bamboo. The reasons for the changes are partly that the original houses were to small, but more importantly they did not fully allow for agricultural needs such as adequate crop storage and drying facilities. Of the two settlements, dating from 1968, that were originally part of the Amoito transmigration project, the average standard of structures in Sidang Kasih was better than in Jati Bali. However, some houses in Jati Bali were the most sophisticated of all the settlements visited, utilizing concrete foundations, sound timber frames, glass windows and corrugated iron roofs. In Landono I (1971–1972) only 10 per cent of the original Transmigration housing remains. As in Jati Bali, the replacement housing is only moderate compared with that originally provided although in some cases surprising progress is indicated by the installation of glass windows and the use of stone and cement masonry. In Uepai (1974, 1976), on the other hand, many people still inhabit the houses first provided for them.

In general, with the possible exception of the Balinese, the settlers interviewed preferred to have houses provided for them, rather than to be provided with materials in order to construct something to their own design. Whatever the disadvantages of ready-made structures, the benefits of having houses available for newly-arrived migrants is great, as they usually have quite enough work to engage-in without having to build their own houses. Since the life of the structures provided is in any case so short, houses of a more acceptable design and built according to traditional cultural practises would eventually have to be erected, and at a time more convenient to the occupants.

7.5 The population of the existing settlements

The number of families and the population of the existing settlements, for the 1976 base date, is given in Table 7.1, together with details of the age-breakdown of the population. A characteristic of the settlements is the high percentage of the population in the under 15 age group (an average of 47 per cent) and Hameed reports that some 95 per cent are below 45 years of age, reflecting the criteria of selecting as settlers only those heads of households below 45 years of age.

Table 7.1 Existing settlements – 1976 base population

Settlement	Number of families	Popul-ation	Age of population (per cent)		
			under 15	15 – 24	25 plus
Amoito	303	1682	52	14	36
Rambu Rambu (T)	139	651	42	18	40
Landono	523	2322	51	14	35
Mowila Jaya	317	1273	46	17	37
Unaaha	301	1317	54	16	30
Uepai	499	1797	41	15	44
Tanea Baru	514	2006	44	17	39
Moramo IA	489	1388	31	22	45
Moramo IB	478	1762	40	15	45
Lapoa	500	2340	43	19	38
Ladongi IA	666	2925	49	15	36
Ladongi IB	406	1692	48	17	35
Ladongi II	531	2590	49	18	33
Towua	305	1264	51	15	35
Rambu Rambu (DS)	134	718	50	15	35
Pamandati	88	503	51	15	34
Wolasi	43	226	56	12	32
Konda	199	1031	49	14	37
Tanea Lama	163	636	44	17	39
Total	6598	28123			

Source: Provincial office, D.G.T.

Table 7.2 Existing settlements – projections of population, families, labour force and school population

Settlement	1981				1986				1996			
	Total population	Number of families	Labour force	School population	Total population	Number of families	Labour force	School population	Total population	Number of families	Labour force	School population
Amoito	1886	325	590	431	2164	358	713	463	2858	472	942	656
Rambu-Rambu (T)	730	148	242	131	841	162	274	161	1069	206	358	262
Landono	2657	567	817	497	3069	621	991	701	3959	763	1361	918
Moramo IA	1828	592	610	215	2258	676	666	465	2764	770	939	805
Mowila Jaya	1499	351	474	287	1762	390	557	382	2256	473	761	561
Towua	1515	345	444	311	1763	380	534	418	2250	460	766	557
Ladongi IA	3363	725	999	697	3890	796	1271	876	4941	961	1724	1167
Ladongi IB	1968	445	627	409	2304	493	739	472	3034	617	982	742
Ladongi II	3019	603	965	629	3548	675	1145	764	4666	847	1552	1140
Unaaha	1444	312	449	341	1644	337	537	412	2157	615	752	463
Uepai	2164	562	708	360	2591	632	799	566	3277	753	1114	860
Tanea Baru	2411	581	743	427	2879	654	846	621	3712	844	1196	968
Moramo IB	2079	528	717	340	2405	574	801	410	3146	709	1174	764
Lapoa	2818	572	970	525	3347	646	1121	611	4404	811	1443	1111
Konda	1199	221	368	243	1394	245	431	298	1826	321	585	446
Rambu-Rambu (DS)	812	145	253	173	939	160	303	187	1244	212	402	292
Pamandati	566	95	166	119	660	106	200	143	863	139	280	209
Wolasi	248	45	71	58	278	48	90	58	378	66	117	76
Tanea Lama	764	184	235	135	912	207	268	197	1176	267	379	307
Total	32970				38648				49980			

Source: SESP

Since the initial foundation of the settlements, which started in 1968 with Amoito and includes the most recently settled villages in Moramo, the settlements have been subjected to continuous change. The contributing factors to these changes, which have generally produced an increase in the total populations, have been an excess of births over deaths, a relatively small out-migration and the voluntary arrival of new settlers. Hameed reports that in Amoito for example, the number of births exceeded deaths by 49 persons and that in-migration to the settlement exceeded out-migration by some 30 persons. Details of the original planned population for each settlement is given in Chapter 9, Volume 2

In order to make projections of the growth of the existing settlements it was necessary to make a series of assumptions concerning changing family size, economic activity and school attendance, the details of which are given in Appendix A.2. Using a cohort survival projection model results were forecast for three dates: 1981, 1986 and 1996. These are summarised in Table 7.2, which gives the populations, number of families, size of labour force and overall school population for each settlement. The breakdown of the school population by level of education is given in Table 7.3.

Table 7.3 Existing settlements – projected school populations

Settlement	1981			1981			1986		
	Primary	Junior secon-dary	Senior secon-dary	Primary	Junior secon-dary	Senior secon-dary	Primary	Junior secon-dary	Senior secon-dary
Amoito	287	89	55	306	87	70	473	114	69
Rambu Rambu (T)	88	28	15	112	26	23	186	48	28
Landono	351	91	55	464	129	108	645	167	106
Moramo IA	157	39	19	378	53	34	528	165	112
Mowila Jaya	201	57	29	270	62	50	387	106	68
Towua	220	59	32	297	72	49	368	105	84
Ladongi IA	486	132	79	604	162	110	814	215	138
Ladongi IB	272	89	48	323	77	72	525	134	83
Ladongi II	431	127	71	527	133	104	805	208	127
Unaaha	257	58	26	272	91	49	332	81	50
Uepai	264	64	32	419	93	54	588	167	105
Tanea Baru	298	79	50	457	101	63	669	184	115
Moramo IB	204	81	55	299	50	61	539	136	89
Lapoa	329	127	69	431	76	104	777	207	127
Konda	165	50	28	207	50	41	324	81	41
Rambu Rambu	112	38	23	126	32	29	210	51	31
Pamandati	82	24	13	97	27	19	149	38	22
Wolasi	38	13	7	38	10	10	54	13	9
Tanea Lama	95	25	16	146	32	20	214	58	36

Source: SESP

In overall growth terms the predicted population increases for the existing settlements range between 63.8 per cent and 99.1 per cent of the base population. This implies annual growth rates over the twenty year period of between 2.5 per cent and 3.5 per cent. The details of this are given in Table 7.4, the overall growth being expressed as percentage addition on the 1976 base population.

For those existing settlements which are to be expanded by the addition of new settlers (see Volume 2, Chapter 9), Table 7.5 gives projections of the population, number of families, labour force and size of school population comparable to those given in Table 7.2.

Table 7.4 Existing settlements – projected growth rates 1976–1996 (per cent)

Settlement	Overall growth 1976–96	Annual growth rate
Amoito	69.9	2.69
Rambu-Rambu (T)	64.2	2.51
Landono	70.5	2.70
Moramo IA	99.1	3.50
Mowila Jaya	77.2	2.90
Towua	78.0	2.93
Ladongi IA	68.9	2.66
Ladongi IB	79.3	2.96
Ladongi II	80.2	2.99
Unaaha	63.8	2.50
Uepai	82.4	3.05
Tanea Baru	85.0	3.12
Moramo IB	78.5	2.94
Lapoa	88.2	3.21
Konda	77.1	2.90
Rambu Rambu (DS)	73.3	2.79
Pamandati	71.6	2.74
Wolasi	67.3	2.61
Tanea Lama	85.0	3.12

Source: SESP.

Table 7.5 Projections of proposed additional population in existing settlements

Settlement	Base year				After 5 years			
	Total population	Number of families	Labour force	School population	Total population	Number of families	Labour force	School population
Amoito	131	30	41	26	151	33	48	31
Rambu Rambu (T)	65	15	20	13	75	16	24	15
Landono	668	153	209	135	768	166	247	158
Mowila Jaya	1,696	388	529	341	1,949	422	626	401
Unaaha	168	38	52	33	191	41	61	39
Rambu Rambu (DS)	135	31	42	27	156	34	50	32

Settlement	After 10 years				After 20 years			
	Total population	Number of families	Labour force	School population	Total population	Number of families	Labour force	School population
Amoito	176	36	57	36	234	46	74	56
Rambu Rambu (T)	88	18	28	18	117	23	37	28
Landono	896	184	291	181	1,191	232	377	286
Mowila Jaya	2,277	466	737	459	3,020	590	957	726
Unaaha	222	46	72	45	296	58	94	71
Rambu Rambu (DS)	181	37	59	37	241	47	76	58

Note: Uepai and Wolasi are to receive 1 and 7 additional families; the effect of such a small number of additional population is marginal

Source: SESP

7.6 The improvement of existing settlements

The major problems encountered in the existing settlements are not primarily of a type which may be radically altered by the efforts of the physical planner. The most urgently required improvements are those of increased agricultural inputs (see Volume 2, Chapter 9) and of changes to and rehabilitation of irrigation systems (see Volume 3, Chapter 4). We have therefore not made any further recommendations as to the improvement of the existing settlements, except for the following limited cases:

a The provision of shallow bore pumped water supplies is required at Amoito and Moramo 1A, 1B and 2, all of which experience severe drinking water shortages. This is discussed in more detail in section 8.4.2.

b To prevent migrant isolationism and to facilitate marketing, upgrading is required of the regional road system, sections of which should be given priority during the first five year construction period. The details of these road development policies is given in section 8.2.

c Some of the conclusions we have drawn about the design of the existing settlements and the general principles that these conclusions establish (see section 7.4) will have relevance to the development of these settlements. The opportunity should therefore be taken to adopt these principles wherever possible, such as in the rational allocation of new irrigated land in relation to village sub-communities, to their proprietory control over the water sources and the relationship of this irrigated land to their other agricultural land and houseplot. Another example would be in the allocation of the additional hectare of grazing land. Such possible applications of principle cannot be set down at present because of the general lack of adequate maps and more importantly, because they are dependent on detailed surveys and the development of agricultural and irrigation proposals. With this information it is possible for a physical planner to start his task, the nature of which should not result in additional costs, for which reason these potential improvements have not been included in the loan package proposals. Thought should be given, however to the inclusion of a physical planner at the requisite time, so that the improvement plans may be properly prepared.

d In those settlements, formerly under the auspices of the Department of Social Welfare, provision was not made for educational and health facilities. At present, because of the proximity of other villages with such facilities this does not constitute a serious social problem. With increasing population growth however, (see section 7.5) attention should be given by the provincial government to the provision of new services to bring these settlements up to a comparable standard to others in the province.

Infrastructure

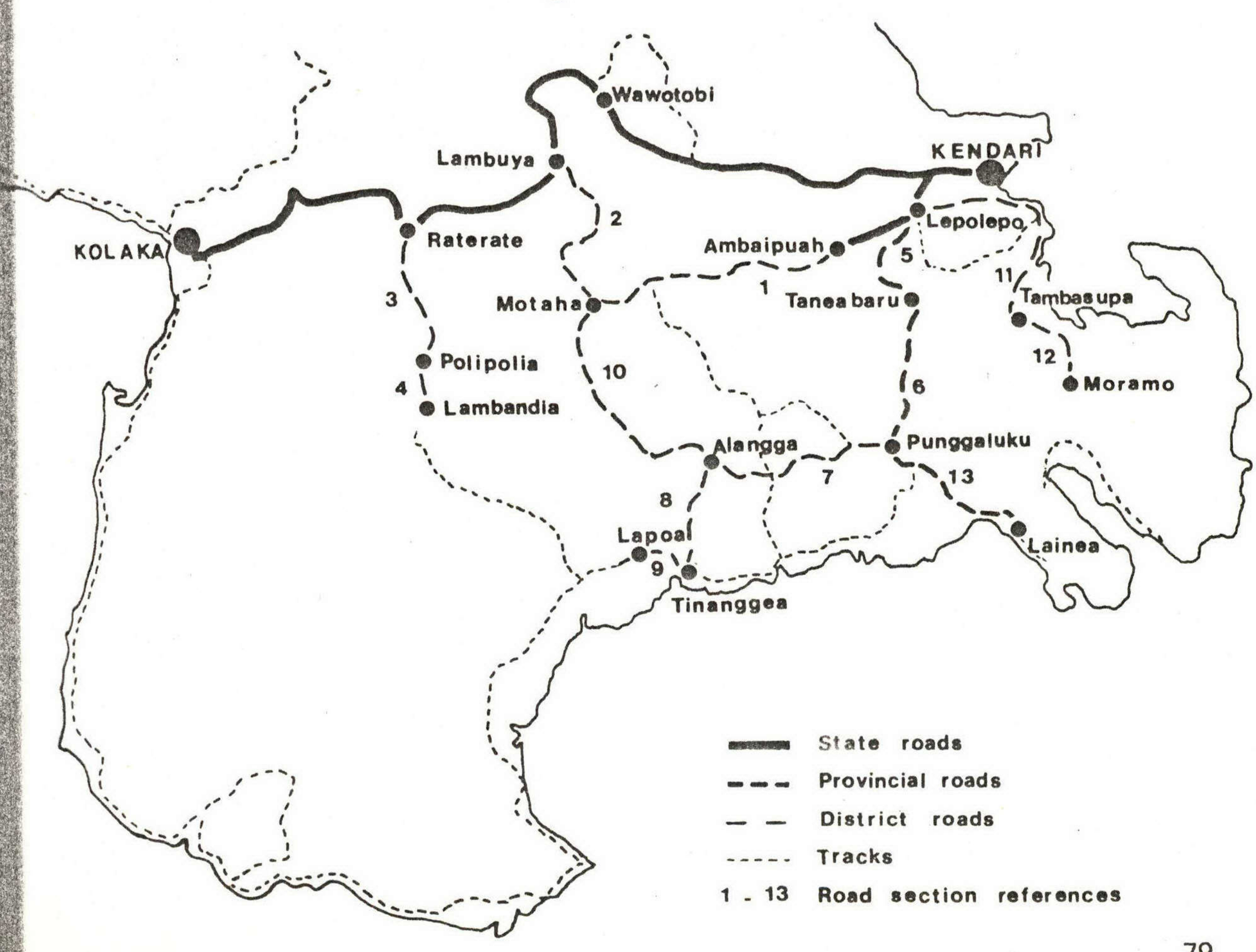
8

8.1 Existing road network

The existing main road network within the Study Area is shown in Figure 8.1. This road system is of a rudimentary nature and for the most part is inadequate to act as a stimulus for the social and economic development of the region.

There are two state roads in the area, the main one being the east-west Kendari to Kolaka highway. This road, which is passable to vehicular traffic throughout the year, has a grouted biuminous macadam surface over most of its length of 173 km and, by comparison with other roads in the area, is in good condition. The other state road runs from Kendari via Lepo-Lepo to the airport near Ambaipuah, a distance of 24 km. This road also has a grouted bituminous surface and is in good order although not all the bridges are ready yet. However, completion of these structures is expected within the next few months.

8.1 Existing roads in the Project Area



There is one provincial road in the Project Area. It runs southwards from Lepo-Lepo for some 43 km to Punggaluku, then south-east for 29 km to Pamandati and Lainea. This road has short stretches of grouted bituminous surface but for the main part, especially in the south, it has a badly deteriorated earth or gravel surface and is closed to traffic on average for ten days every year. It is also apparent that many of the bridge and drainage structures are substandard.

In addition to the state and provincial roads there are some estimated 1700 km of district and village roads in the Province. Of these we have examined 257 km that lie within the Project Area. These roads are of a very low standard and are often little more than earth tracks. Many are impassable to vehicular traffic for up to three months a year and indeed some stretches have become completely abandoned for as long as three years because of collapsed bridge structures or permanent flooding; this resulted in isolating existing settlements alongside these roads.

8.1.1 The condition of existing roads

An indication of the present condition of the provincial and district roads can be obtained from Table 8.1. This analysis has been based on the following criteria:

Fair condition : Alignment satisfactory, surface reasonable though not necessarily gravelled, drainage ditches functioning, bridges and culverts in reasonable order.

Poor condition : Alignment reasonable though could be improved, surface deteriorating, drainage ditches partly blocked or overgrown, bridges and culverts in need of repair or replacement, sometimes impassable to vehicular traffic fort part of wet season.

Very poor condition : Alignment poor and requiring improvement, running surface badly damaged, drainage ditches blocked or non-existent, bridges and culverts in need of repair or replacement, usually impassable for part of wet season.

Table 8.1 Summary of the condition of existing roads in the Study Area

Road Section[1]	Location and type of road		Road condition			
			Length (km)	Fair (km)	Poor (km)	Very poor (km)
	Provincial Roads					
5,6	Lepo-Lepo	– Punggaluku	43.1	15.6	12.7	14.8
13	Punggaluku	– Lainea	29.2	0	15.5	13.7
		Total	72.3	15.6	28.2	28.5
	District (Kabupaten) Roads					
1	Ambaipuah	– Motaha	42.2	1.2	20.3	20.7
2	Motaha	– Lambuya	30.8	2.0	20.6	8.2
7	Punggaluku	– Alangga	31.2	0	10.2	21.0
8	Alangga	– Tinanggea	18.3	0	6.4	11.9
9	Tinanggea	– Lapoa	6.0	0	5.7	0.3
10	Alangga	– Motaha	39.4	8.4	21.2	9.8
3,4	Rate-Rate	– Lambandia	29.5	0	3.5	26.0
11,12	Lepo-Lepo	– Moramo I	59.3	10.8	19.3	29.2
		Total	256.7	22.4	107.2	127.1

Source: SESP

[1] This classification of the roads is used in the development policy for roads (Section 8.2) and in the analysis of costs (Chapter 9)

From Table 8.1 we can see that of the 329 km of provincial and district roads in the Project Area only 38 km or 11.5 per cent are in a fair condition, whereas some 156 km or 47.5 per cent are in a very poor condition. Many of these roads were constructed using only manual labour and with minimal machinery. Consequently, alignments tend to follow the topography closely with very little cut or fill. The result of this is that gradients are often steep, the horizontal alignments can be tortouous with poor sight lines and most bridges and culverts are in poor state of repair.

There are two significant factors that have led to the present condition of these roads. First, there has been little or no maintenance over the years with the effect that deterioration tends to accelerate. The second important factor is the lack of adequate drainage facilities. Drainage ditches are often blocked and overgrown with vegetation, or even non-existent; the road cross-section is lower than the adjacent ground, with the result that the road itself acts as a drain; or there is a narrow road reserve width with trees growing close to the road and preventing the rapid drying out of the road after periods of rainfall.

On some of the recently constructed access roads to settlements, the road construction little accorded with the drawings or specifications. The construction was so poor that in effect the investment in these roads was largely wasted. For any future development it is important that the contractors are properly supervised throughout all stages of the works.

The Provincial Government has a programme for improvement and maintenance of the state and provincial roads in Pelita II and III (1976–81) which is detailed in Table 8.2.

Table 8.2 Provincial Bina Marga coast estimates for road improvements.

Road	Rehabilitation Rp x 10^6	Maintenance Rp x 10^6	Total Rp x 10^6
Kendari – Kolaka	528.0	230.7	758.7
Kendari – Ambaipuah	132.3	29.3	161.6
Kendari – Lainea	361.3	–	361.3

Source: BAPPENAS PELITA II and III.

Exact details of the programme are not available at this stage, except that on the Kendari–Kolaka road the main priority will be the widening of the carriageway to Bina Marga two-lane class III standard. There is no corresponding programme or financial allowance for the improvement of the district roads; these may be provision for it in the Kabupaten budget, to which, however, we had no access.

8.1.2 Traffic in the Province

To date there have been no meaningful traffic counts taken in the Province. Some counts have been made on the state roads at two locations on the Kendari–Kolaka road and at one location on the Kendari–Ambaipuah road. However, little use can be made of the figures since they indicate some 270 vehicles per day in 1973 and only 85 vehicles per day in 1974 on the main road.

Traffic on the main roads consists mainly of motor-cycles, motor cars, light commercial vehicles, trucks and buses up to ten tons. Very little traffic proceeds beyond the state and provincial roads. On the district roads, traffic comprises mainly motor cycles, light commercial vehicles, terrain vehicles, pack animals, animal carts and bicycles.

Some indication of the general growth in traffic over the period 1971–75 can be obtained from the number of vehicle registrations in the Province; these are shown in Table 8.3. They are total figures including both South and South East Sulawesi.

Table 8.3 Vehicle registrations in South and South East Sulawesi.

Year	Motor cars	Buses	Trucks	Motor cycles	Total
1971	3,827	606	4,852	21,229	30,514
1972	4,222	653	5,206	24,543	34,624
1973	4,333	674	5,310	25,733	36,050
1974	4,758	909	5,476	33,303	44,446
1975	5,933	1,085	7,882	52,089	68,989
Average annual increase	11.6%	15.7%	12.9%	25.2%	22.6%

The bulk of this increase in traffic will have occured in South Sulawesi, since economic growth in that Province has greatly exceeded that in South East Sulawesi.

8.2 Road development policy

The Transmigration and Department of Social Welfare settlements within the scope our study are fairly widely dispersed throughout the region among other existing settlements. It is not realistic therefore to evaluate the costs and benefits accruing from the upgrading of any particular stretch of road without taking into account the other settlements as well. Some of the existing settlements, for instance Moramo I and II, Pamandati, the Rorayas and Lapoa, are located at the ends of long roads which are in a very poor condition. It is therefore not very likely that a positive return on road investment would be obtained if such roads were improved. This problem is highlighted by the isolation of the central area around Motaha, whhch results from a collapsed bridge and permanent flooding west of Mowila Jaya, a collapsed bridge at Watumokala and an almost derelict ferry at Mokaleleo.

8.2.1 Priority route improvements

Of those road sections in Table 8.1 which require upgrading, we have selected a number of lengths which should be given priority during the first five year construction period. These priority routes, shown in Figure 8.2, are as follows:

a Road section 1 – Ambaipuah to Motaha (42.2 km)
The upgrading of this road would benefit the study settlement of Amoito, Landono I and II, and Mowila Jaya as well as the other settlements of Boro Boro, Lamooso, Puao and Motaha.

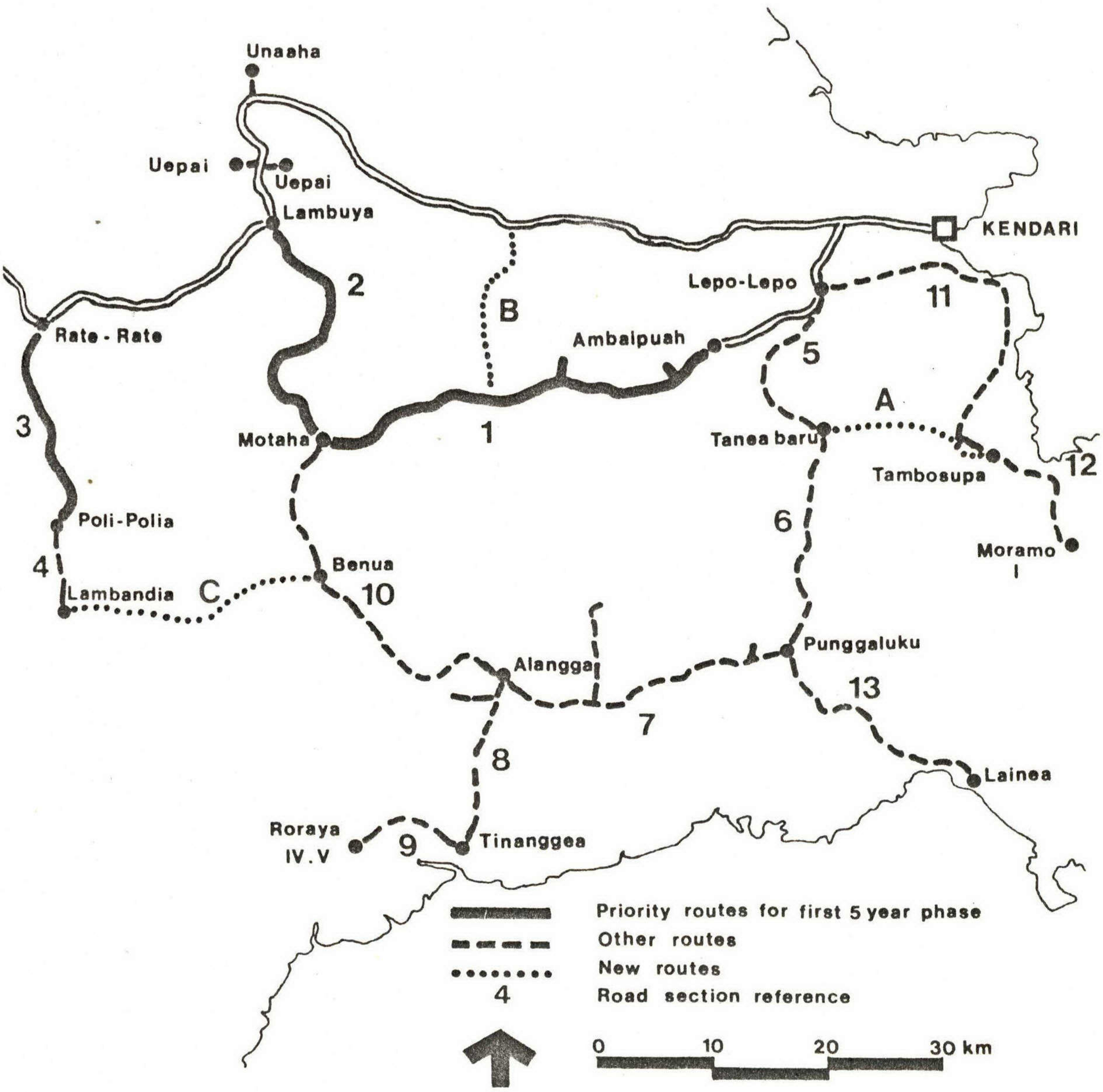
b Road section 2 – Motaha to Lambuya (30.8 km)
The upgrading of this section would complete the Ambaipuah to Lambuya road and thus form an important link to the Kendari–Kolaka road near to the proposed new kabupaten centre at Unaaha. This section is also an integral part of the Makaleo rainfed Project Area, as the main communication artery serving the southern and eastern sectors. The settlements of Mokaleleo, Puriala, Saoni and Meraka, all outside the Study Area, would also benefit by it. There is a major river crossing at Mokaleleo. At this point the Opa river is some 150 metres wide and a bridging structure would not be economically viable at this stage. Instead, we would recommend that the existing ferry is replaced by one that is both more efficient and safer. There does not appear to be a more suitable crossing point in the vicinity.

c Road section 3 – Rate-Rate to Poli-Polia (19.9 km)
The upgrading of this road would be the first stage in the improvement of the Rate-Rate to Lambandia road. The study settlements of Ladongi I and II would benefit as well as the other settlements of Laeya, Ladongi Jaya and Poli-Polia. The upgrading of the Poli-Polia to Lambandia (9.6 km) section could follow at a later stage.

8.2.2 Future route improvements

Other road sections in the Study Area could be upgraded after the completion of the first five-year programme. The most important element of this 'future' route improvement programme would be works to the provincial road from Lepo-Lepo to Lainea, which forms part of the link to Pulau Muna in the south. This route consists of:

8.2 Network of road improvements



a Road Section 5 and 6 – Lepo-Lepo to Punggaluku (43.1 km)
The upgrading of this section would benefit the study settlements of Konda, Tanea Lama, Tanea Baru and Wolasi together with the villages of Aoma and Punggaluku.

b Road Section 13 – Punggaluku to Lainea (29.2 km)
The upgrading of this section would benefit the existing settlement of Pamandati together with other settlements like Ambesia, Lalonggombo and Lainea. This road is in a very poor condition and there is one major engineering problem at the crossing of the Laeya river between Punggaluku and Ambesia. The river is 66 metres from bank to bank and the previous Bailey bridge collapsed in 1974 after a flash flood had demolished the two central piers. Unfortunately there does not seem to be a more favourable crossing point in the vicinity, although a more detailed investigation would be needed to verify this. Assuming that this crossing point is the most feasible, we would suggest a single-span lightweight steel bridge. Our cost estimate (see Chapter 9) is based on using a Callendar-Hamilton structure.

The Provincial government have allocated Rp. 361.3 million for the improvement of the Kendari–Lainea road, which should be taken into account when examining the total costs for improving this route as outlined in Chapter 9.

Although the Kendari–Kolaka road does not form part of our study, it is obviously of prime importance in the regional context. The growth of traffic on this road will be considerable in the next ten years. Both natural and generated growth will increase it, e.g. the new ferry service to Kolaka, and the Makaleo and Wawotobi development projects when they are implemented. The Provincial Government must concentrate their efforts on widening and improving sections of this road during the next decade to cope with anticipated traffic flows.

8.2.3 Proposed new roads to serve existing settlements

In examining the pattern of roads in the Study Area we have concluded that the future development of the area would be assisted by the construction of three new roads, none of which would be of high priority.

a Road section A – Tanea Baru to Tambosupa (19 km)
The construction of this road would be an alternative to the upgrading of the existing Lepo-Lepo to Tambosupa road, (section II), shortening the distance from Moramo II to Kendari by nine kilometres (56.3 km instead of 65.3 km).

b Road section B – Mowila Jaya to Wawolemo (16 km)
This new road would form a useful link between Mowila Jaya and the Kendari–Kolaka road near to the Wawotobi irrigation Project Area. We found evidence that there is a fair degree of communication through this corridor already. A ferry would be required some two kilometres south of Wawolemo across the Konaweha river.

c Road section C – Lambandia to Benua (25 km)
This road would assume importance if the Ladongi extension project area is implemented. It would also serve the useful purpose of closing the link between the Ladongi and Motaha areas.

8.2.4 Costs

The cost of improvements and upgrading of the existing road sections (1–15) and the construction of new roads (A–C), as shown in Figure 8.2, is given in summary form in Chapter 9 and in detail in appendices E 12–15. These estimates are based on the physical condition of the particular road as described in Table 8.1 and include, where appropriate, the cost of replacing or strengthening bridges and culverts.

8.3 Road design and construction

8.3.1 Hierarchy of roads

In developing our proposals for methods of road construction we have distinguished four types of road, corresponding to anticipated function and usage:

i District roads – Class I
This classification relates specifically to the upgrading or extension of existing district roads. It is important that these roads provide all-weather access to vehicular traffic throughout the year, since after the state and provincial roads they are the main communication arteries for the existing settlements.

ii Village access roads – Class II
These roads will link individual village centres to the nearest main road, which may be a state road, a provincial road or a district road. It is necessary that these roads should also be of an all-weather standard but as the traffic intensity will be lower than on the Class I roads the proposed pavement construction thickness is less. However, the geometric standards are similar in order to facilitate upgrading to the higher standard at a later date, should the traffic conditions warrant it.

iii Local roads – Class III
This classification relates to roads linking village centres with local centres which in the proposed developments would form the spine of the new settlement. As most of the traffic using these roads will comprise animal carts, pack animals, and bicycles – with only the occasional truck or car – all-weather vehicular access is not essential. However, the construction suggested will allow access in all but the wettest periods.

iv Tracks – Class IV
This category of access includes farm tracks linking the agricultural land to the Class III road system and also access tracks to the house plots. Construction as such will only consist of land clearance over a five metre width with possibly some minor earthworks in order to limit gradients to seven per cent. Stream crossings whenever possible will be by simple log bridges or paved fords. Some ditching may be necessary in the housing areas. This hierarchy of roads is applicable to both the upgrading of village and district roads presently serving existing settlements and the provision of any new roads, especially in connection with the Wawotobi and Makaleo projects.

8.3.2 General design criteria

a Drainage
Probably the single most important feature of any road construction programme must be the provision of good drainage facilities.

The side ditches should have a minimum longitudinal gradient of 1 in 150, with mitre drains spaced at regular intervals to carry the water away from the road. These mitre or contour drains should be located to suit the local terrain but in any case at about 150 metres centres in flat country and up to about 300 metres in undulating topography. In hilly terrain there are further problems, namely:

i scour of the ditches can occur, but the effects can be minimised by constructing brushwood weirs at suitable intervals to break up the flow of water.

ii many culverts are readily blocked and to obviate this the minimum size of culvert should be 60 cm and trash traps should be provided on the upstream side.

iii erosion of the gravel running surface resulting from water flowing down the road. This can be effectively reduced by setting a baulk of timber into the road and across it at an angle, thus disrupting the flow of water and diverting it into the side ditches via a rubble-filled drain across the shoulder. Another method of reducing scour of the road surface is to tilt the roadway into the slope, regardless of the correct superelevation, in sidehill construction.

Effective drainage of the road formation is also very important, otherwise the subgrade material will exhibit a marked decrease in strength. The extension of base and sub-base materials across the full eidth of the shoulders would not be appropriate for the classes of road proposed. Therefore, to ensure that the subgrade is drained properly simple grips filled with permeable granular material must be provided at regular intervals across the shoulders to a depth of 75 mm below the adjacent sub-base level with a fall of one in ten towards the side ditches. An average spacing of grips at 5 metres has been allowed in the cost estimates.

In areas where swampy conditions exist or where there is a tendency for flooding to occur the road must be raised above the general level of the surrounding land. At present this is not done in the area, with the result that road closures in the wet season are a normal occurrence.

Wherever possible, culverts should be used instead of small span bridges to keep road surface unbroken and to make maintenance easier. However, the culverts must be designed correctly since an underestimate of size will result in a 'washout'. Larger size culverts can be built using Armco steel pipes, but at present these are imported and expensive. However, the pipes manufactured eventually in a plant now being set up in Indonesia may prove to be viable alternative.

b Materials

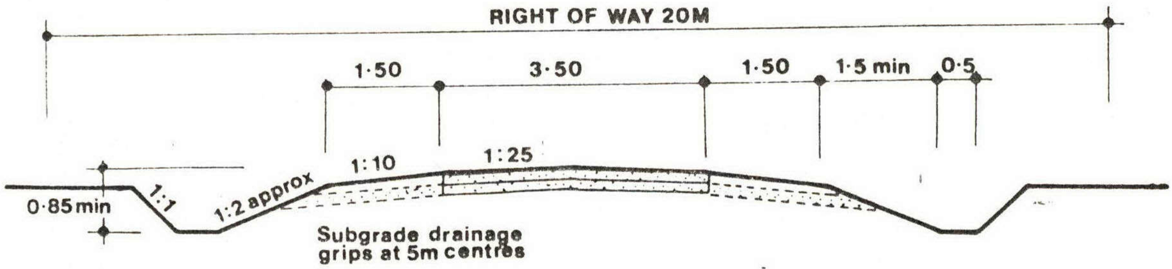
Before construction commences a comprehensive materials testing and location programme should be initiated. Although there appears to be an adequate supply of construction material within the area (see section 10.1.2) engineering tests should be carried out to ascertain suitability. For instance, deficiencies in grading of the natural gravels may have to be compensated for by mixing different materials together. In some areas stabilisation of the local soils and gravels with cement or lime may prove to be an economical alternative to the importation of crushed stone. However, as local contractors have no experience in stabilisation techniques, if such methods are found to be viable and adopted then the work must be competently supervised.

c Traffic growth

Long-term forecasting of traffic growth in developing countries is difficult because of the usual instability in general growth rates both on a local and on a national scale. The British Transport and Road Research Laboratory[1] recommend the adoption of a ten year design life for low cost roads in rapidly developing countries as being the most economic, using a form of construction that can be readily strengthened when traffic volumes necessitate it.

From the figures given in Table 8.3 and from the average annual increase in regional real domestic product in the same period we would estimate the increase in numbers of commercial vehicles in the next ten years to be not more than eight percent per annum. Based on these growth figures the traffic intensity in ten years will not exceed fifty heavy goods vehicles per day and therefore a single lane road will suffice. In addition, single lane bridges will be sufficient since they can accommodate traffic flows of up to 400 vehicles per day, provided sight distances are adequate. It should be noted that with the low initial traffic volumes the road pavement design is fairly insensitive to the growth rate over a ten-year period.

[1] Overseas Unit of Transport and Road Research Laboratory, U.K. Roadmaking Materials and Pavement Design in Tropical and Sub-tropical Countries. Report LR 279 Transport and Road Research Laboratory. U.K.



Pavement construction – class I road.

Surfacing	:	150 mm. crushed stone or gravel, nominal maximum size 20 mm.
Sub-base	:	125 mm. crushed stone or gravel, nominal maximum size 75 mm.
Subgrade	:	Top 150 mm. to be compacted to minimum 95% Proctor at critical moisture conditions. Minimum CBR to be 7%.

8.3 Typical section: Class I road

8.3.3 Road specifications

The designs suitable for different classes of road have been adapted from the appropriate Bina Marga standards for rural highways to give as economic a solution as possible whilst still maintaining an adequate level of service. In particular the standard of the Class I and II roads accords generally with the Class III category of the Directorate General Bina Marga as specified in their "Standard Specification for Geometric Design of Rural Highways."

The details of the road construction are as follows:

a District roads – Class I
The proposed cross section for Class I roads is shown in Figure 8.3. The suggested basic design standards, adapted from the appropriate Bina Marga standards, are shown in Table 8.4.

Table 8.4 Design Standards: Class I roads

Design standard		Type of terrain		
		Flat	Rolling	Hilly
Design speed	(kph)	50	40	30
Min. radius of curvature	(m)	80	55	30
Max. gradient	(%)	6	8	12
Min. sight distance	(m)	70	50	30
Max. super-elevation	(%)	10	10	10

The road reserve width (right of way) is 20 metres. Specifications for the sub-base and surfacing materials are given in Table 8.5, the thicknesses having been established assuming a subgrade CBR of seven percent.

We propose the use of timber bridges for these roads using standard Bina Marga designs for rural conditions. The level of service provided by these roads would not initially justify the increased cost of concrete bridges. Probably not until after eight to ten years, when some stretches of road may need to be widened and strengthened, would there be a requirement for concrete bridges. Culverts would be constructed using reinforced precast concrete pipes, a typical example of which is illustrated in Figure 8.4.

Table 8.5 Road stone specification — grading requirements

B.S. sieve size		Percentage passing		
		For road classes I and II		For road class III
		Sub-base Nom.max.size 75 mm	Surfacing Nom.max.size 20 mm	Surfacing Nom.max.size 75 mm
75	mm	100	–	100
38	mm	80 – 100	–	80 – 100
20	mm	60 – 80	100	60 – 85
10	mm	45 – 65	80 – 100	40 – 70
5	mm	30 – 50	60 – 85	30 – 55
2.36	mm	–	45 – 70	25 – 45
1.18	mm	–	35 – 60	–
600	micron	10 – 30	–	–
425	micron	8 – 27	23 – 44	15 – 30
300	micron	–	20 – 40	–
75	micron	5 – 15	10 – 25	10 – 25

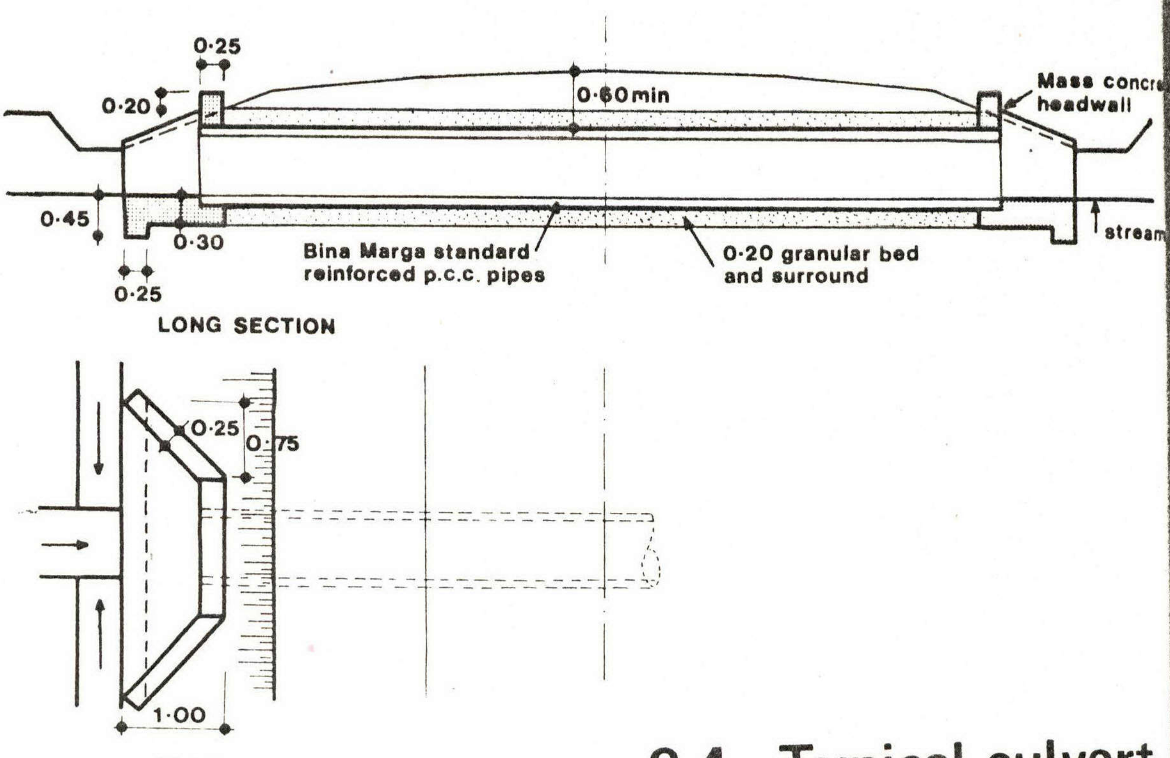
NOTES

1 All gradings should be smooth curves within, and approximately parallel to the grading envelopes.

2 Well-rounded river gravel will need the larger stones crushed to give 40% of the stones angular faces.

3 Sub-base: — material passing the 425 micron sieve shall have a liquid limit not exceeding 25% and a plasticity index not exceeding 6%. Soaked CBR value not less than 25%.

4 Surfacing: — material passing the 425 micron sieve shall have a liquid limit not exceeding 40% and a plasticity index in the range 5—15%.



8.4 Typical culvert

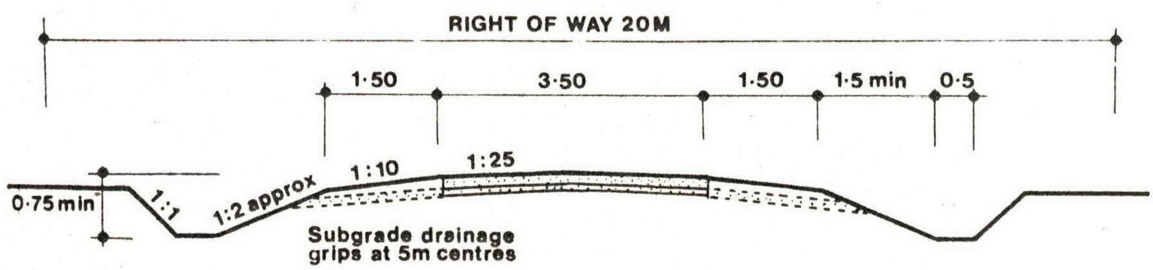
b Villages access roads – Class II

The proposed cross section for Class II roads is shown in Figure 8.5 and the basic design standards in Table 8.6.

Table 8.6 Design standards: Class II roads

Design standard		Type of terrain Flat	Rolling
Design speed	(kph)	50	40
Min. radius of curvature	(m)	80	55
Max. gradient	(%)	6	8
Min. sight distance	(m)	70	50
Max. superelevation	(%)	10	10

The road reserve width (right of way) is 20 metres. Specifications for the sub-base and surfacing materials are given in Table 8.5; thicknesses have been based on an assumed subgrade CBR of seven per cent. Bridges and culverts are to the same standard as Class I roads.



Pavement construction – class II road.

Surfacing : 150 mm. crushed stone or gravel, nominal maximum size 20 mm.
Sub-base : 100 mm. crushed stone or gravel, nominal maximum size 75 mm.
Subgrade : Top 150 mm. to be compacted to minimum 95% Proctor at critical moisture conditions. Minimum CBR to be 7%.

8.5 Typical section: Class II road

c Local roads – Class III

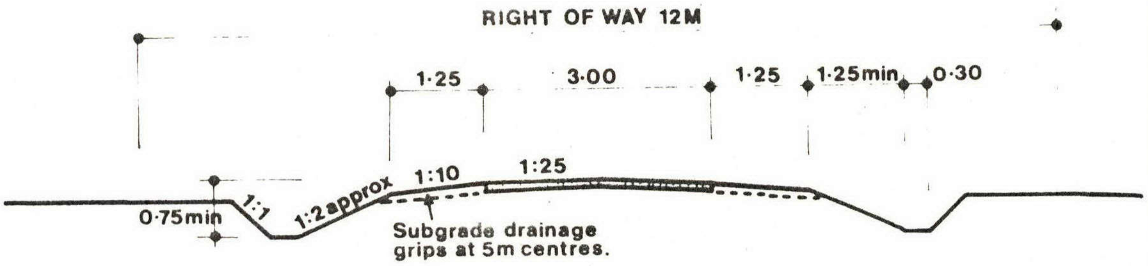
The proposes cross section for Class III roads is shown in Figure 8.6. The suggested basic design standards are as follows:

Design speed 30 kph
Minimum radius of curvature 30 m
Maximum gradient 7%
Minimum sight distance 40 m.

The road reserve width (right of way) is 12 metres[1]. Specifications for the surfacing material are given in Table 8.5.

[1] In some transmigration settlements the road reserve was made 20 metres or more. This practice is not recommended; it is wasteful of land – and obviously regarded as such by the villagers who grow crops within the right of way.

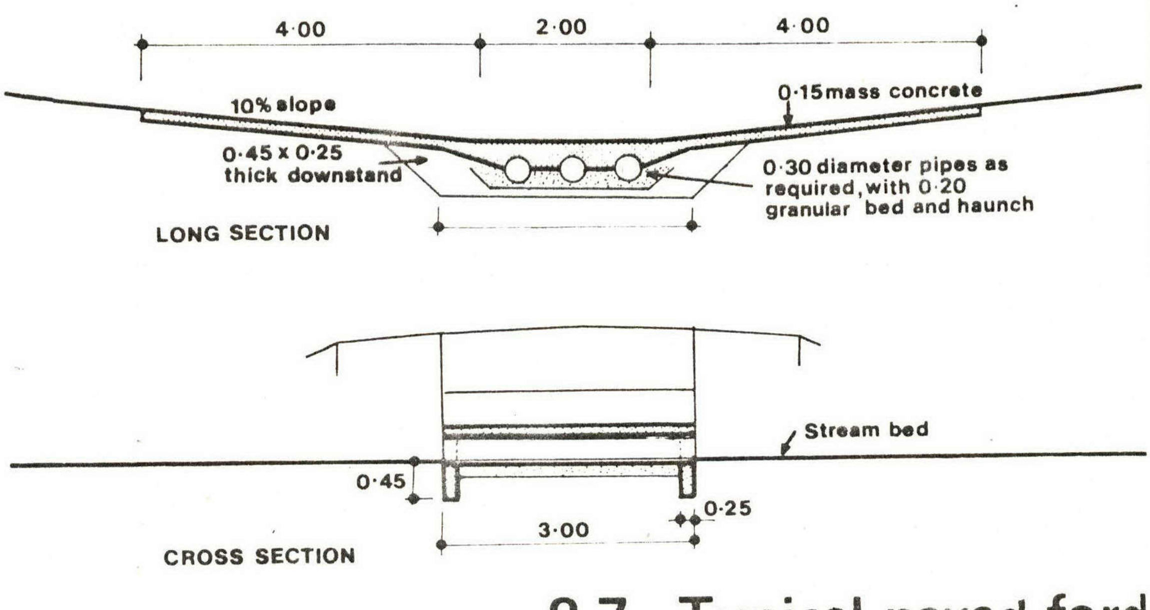
8.6 Typical section: Class III road



Pavement construction – class III road.

Surfacing : 125 mm. crushed stone or gravel, nominal maximum size 75 mm.
Subgrade : Top 150 mm. to be compacted to minimum 95% Proctor at critical moisture conditions. Minimum CBR to be 7%.

The bridges for Class III roads can be of a lower standard of construction than those for Classes I and II. We would suggest that the present type of bridges built by the Department of Transmigration would be suitable for this class of road. Culverts will be as in Class I and Class II roads. The use of paved fords is appropriate to this class of road at suitable stream crossings. On selected streams these fords will allow access at all times except for the heaviest flood conditions. The vertical alignment of the road will be poor at ford crossings and so care should be taken to choose streams with gently sloping banks. A typical paved ford, with the stream allowed to flow through pipes set into the concrete, is shown in Figure 8.7.



8.7 Typical paved ford

8.3.4 Road maintenance

It is essential that a well-organised programme of maintenance is initiated in order to avoid the recurrence of the existing road conditions. The maintenance organisation should come under the responsibility of the Provincial Bina Marga. The work will fall into two categories,

a routine day to day inspection and maintenance of the running surface, structures, drainage ditches, shoulders and verges, using mainly manual labour, and

b major repair or renewal requiring, in addition, the use of machinery.

We have anticipated that the maintenance of the local and farm roads (Classes III and IV) will be carried out by the villagers themselves, but, again, this should be organised on a regular basis and not left to individual initiative.

a Routine maintenance

Routine maintenance of the district and village access roads (Classes I and II) could be carried out by men each responsible for three or four kilometres of road. These men would keep the ditches and culverts clear, check the bridge structures and carry out minor repairs to the running surface and verges. A group of about ten such men would work under a foreman who would have access to machinery if any major problems arose.

b Major maintenance

This will consist of reshaping and regravelling of the running surfaces, both operations being dependent on the traffic intensity, weather conditions and the quality of the road pavement materials.

i Reshaping

This will be necessary to correct the adverse effect of rutting and corrugation. Such work can be carried out by hand to a limited extent but mechanical aids are necessary for it to be really efficient. The use of tractor-drawn drags is effective for lightly trafficked roads. Drags can be made from old tyres or preferably from steel beams. On more heavily trafficked roads motor graders should be used. Whichever technique is adopted, it is important that the reshaping procedure should include the recovery of material pushed to the edges of the road and its respreading across the running surface. The respread material should be compacted with a ten ton roller or an equivalent vibratory roller. The addition of water may be necessary to facilitate compaction. Alternatively, if the work can be carried out at the end of wet periods the gravel will have sufficient residual moisture.

ii Regravelling

This is a major operation necessitated by the loss of material through abrasion by traffic and erosion by weather or simply vehicle pressure pushing it into the subgrade.

Road maintenance costs can only be estimated in broad outline because they comprise both fixed and variable components. The routine maintenance makes up the fixed component, and the reshaping and regravelling make up the variable components, which are governed mainly by the intensity of traffic. An estimate of maintenance costs for Class I and II roads is given in Appendix E 16.

8.4 Water supply

Water quality in the Study Area is generally good. The electrical conductivity (EC) of water from shallow wells, artesian bores and spings is generally less than 1000 micromhos per centimetre indicating low salinity. The results of a survey of water sources in the area is shown in Appendix D.

8.4.1 Drinking water in the existing settlements

The drinking water situation in the existing settlements is indicated in Table 8.7, the main problems experienced being as follows:

a Shortages occur during the dry season when the water table falls below the depth of dug wells and the pump intakes of shallow handpump bores.

b Some shallow handpump bores produce dirty or sandy water. This is probably due to poor design and installation. Handpump life is considerably reduced if the water contains sand or mud.

c Handpump maintenance. There seems to be a shortage of the necessary skills and tools available for maintenance in most of the settlements.

d Lack of supervision of contractors employed to install dug-wells and shallow andpump bores. At Lapos, for instance, wells were dug during the wet season and completed as soon as water was struck; during the dry season most wells become dry.

No tests on the potability other than for salinity of these supplies was undertaken during the study.

8.4.2 Installation of shallow bores

There should be no problem of ensuring a permanent supply of drinking water in new and existing settlements from properly designed and constructed shallow bores. The bores should be drilled to a sufficient depth to take into account the seasonal fluctuation in water tables, and should tap a few metres of saturated material by slotting or perforating the river pipe.

In the alluvial plain, where the water table is generally within 5 metres, a bore depth of at least 12 metres (two standard pipe lengths) is recommended. Bores may have to be deeper near the footslopes of the bordering hill and mountain ranges.

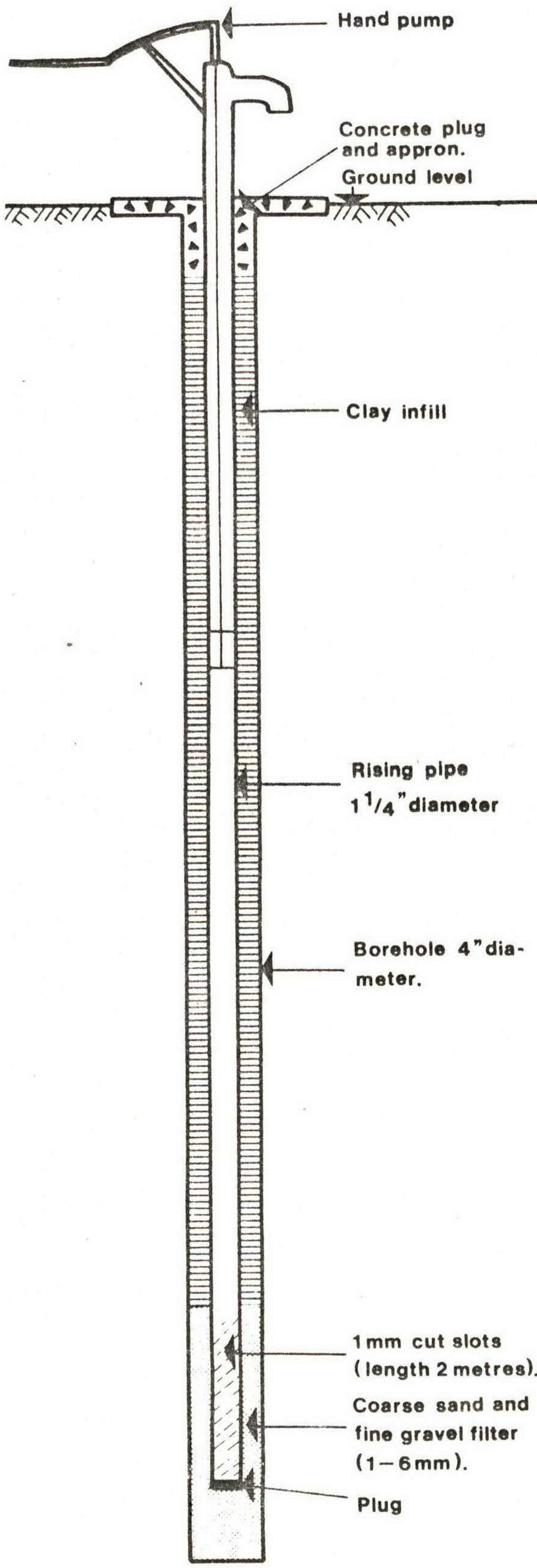
In the plains underlain by the Mio-Pliocene sediments, where the water table is generally within 10 metres, a bore depth of at least 18 metres (three standard pipe lengths) is recommended. Bores should be drilled in the valleys where the water table is likely to be shallowest. In flowing artesions conditions are met the bore should be completed in the artesian water-bearing layer. Any free flowing bores should be equipped with a valve so that water is not continually running to waste.

The recommended design and installation procedure of a shallow bore is shown in Figure 8.8. No complicated or expensive equipment is required to install such a bore as long as the formation is not hard and is reasonably unconsolidated. The rig which is now drilling the well at Alangga for the sugar survey is all that is required – a tripod, water pump, swivel head and drill pipes.

Some problems may be caused by loose formations continually collapsing into the drilled hole, as is being experienced at Unaaha. The use of larger diameter pipe as temporary casing may overcome this problem.

Shallow bores should be provided in the new settlements on the basis of one per fifteen families. In the existing settlements priority should be given to those which experience severe shortages. We would recommend that twelve shallow bores are provided at Amoito and a total of sixty at Moramo 1A, 1B and 2. The unit costs for such an installation, including a washing area, is given in Appendix E.17.

8.8 Typical drinking water bore



Installation:

a drill say, a 4-inch hole by jetting to the required depth (two metres more than the planned riser pipe depth). In loose, caving formations 4-inch flush-jointed pipe should be installed as drilling proceeds to act as temporary casing.

b install the riser pipe to the required depth, with the bottom end plugged and about two metres of slots or perforations along the bottom of the pipe.

c fill the annular space with coarse sand and fine gravel to one metre above the slots or perforations. The remainder of the annular space can be infilled with clay. In loose, caving formations the temporary casing should be removed (by the use of hydraulic jacks) after the sand and gravel filter has been emplaced, and the hole allowed to cave.

d the riser pipe should be flushed or swabbed until the water is clear, to remove fine sediments deposited during drilling and pipe installation.

e the top of the riser pipe should be sealed into the ground by means of a concrete plug and apron to prevent the entry of impure surface water.

Table 8.7 Drinking water supplies in existing settlements

Settlement	Main sources	Situation in dry season	Remarks
Unaaha	Dug wells	No shortage reported	Shallow bores presently being installed, but there are difficulties with caving sand and blocking of pipes
Uepai	Dug wells and shallow bores, except in area near hill where water is probably too deep for dug wells	No shortage reported, except near hills	Several hand pumps on shallow bores not working due to lack of maintenance
Amoito (Jati Bali & Sindangkasih)	Dug wells	Severe shortage, since most dug wells dry up; water obtained from nearby swamps	
Landono I	Irrigation canals, a few dug wells and shallow bores	Dug wells almost dry up, but shallow bores always give water	Hand pumps on shallow bores in need of proper maintenance
Mowila Jaya	Ten shallow bores, all but one producing dirty water and nearby streams	No shortage reported	Hand pumps in need of proper maintenance; shallow bores poorly designed and installed, hence dirty water
Konda	Dug wells and shallow bores	Most dug wells dry up, also shallow bores; water obtained from nearby streams	
Tanea Baru	Shallow, artesian bores, dug wells and streams	Dug wells almost dry up, but artesian bores always give water	Two artesian bores area blocked by caving
Wolasi	Stream from perennial spring	No shortage reported	
Pamandati	Dug wells	Wells almost dry up; water obtained from perennial spring near coast	
Rambu-Rambu	Dug wells	No shortage reported	
Lapoa	Dug wells, but most are not permanent	Only one well reported not to dry up	Wells are generally of insufficient depth and poor construction
Moramo	Rivers	Wells dug to 5 m all dry up	
Ladongi	Dug wells	No wells reported to dry up	
Towua	Dug wells and swamp	No shortages reported	

Source: SESP

Cost estimates

9

9.1 Data sources

The build up of the cost data has been compiled after investigations and discussions with the following government organisations:

i Directorate General of Transmigration – Jakarta, Kendari and Kolaka

ii Public Works Department – Jakarta, Bandung, Kendari and Kolaka.

Further detailed inquiries have also been made from contractors and suppliers in Jakarta, Kendari and Kolaka.

The investigatons revealed overall consistencies in costs provided by the Public Works Department, contractors and suppliers interviewed, in respect of both material and labour costs. Costs provided by the Directorate General of Transmigration, both in Jakarta and Kendari, were generally lower than those supplied by other sources and were also somewhat inconsistant. Figures used by the Kendari office of the Directorate General of Transmigration Kendari for budget estimates for the year 1976/1977, in respect of transmigration buildings, are listed below.

Table 9.1 Summary of labour and material prices, used by the Provincial office of Transmigration, Kendari

Item	Transmigrants houses	Transmigration unit offices
Labourer	300 Rp/Day	350 Rp/Day
Labour/foreman	350 Rp/Day	400 Rp/Day
Skilled worker	400 Rp/Day	500 Rp/Day
Foreman/Supervisor	500 Rp/Day	650 Rp/Day
Cement	1,800 Rp/40 kg	2,500 Rp/40 kg
Sand	500 Rp/m^3	1,000 Rp/m^3
Gravel	1,000 Rp/m^3	800 Rp/m^3

Source: SESP

Appendix E gives the basic costs of labour, plant and materials which has been used in deriving unit rates for the major items such as housing and roads. They represent realistic present day market prices in the Project Area.

It must be appreciated that owing to the large size of the Project Area, variations in prices must be expected between sites in varying locations. In the period of our study it has not been possible to reflect the cost implications of this between each settlement. We have endeavoured in our cost estimates to show what will be the average cost of the works throughout the entire Project Area.

9.2 Unit rates and unit costs

The build-up of labour and material constants used for deriving unit rates has been based on an established British method of estimating, adapted to take into account local labour productivity. Whilst these labour constants cannot be considered to be perfectly accurate they can form the basis of calculating current building estimates. Section 10.2 discusses the limitations which we believe result from the current methods of cost estimating used in the province.

Appendix E.1 gives the build up of major unit rates used in estimating the cost of transmigrants housing and other village buildings and Appendix E.9 those used for estimating the cost of infrastructure works.

The unit costs (with a break-down into the foreign exchange and unskilled labour elements) for buildings are summarised in Table 9.2 and those for roads and bridges in Table 9.3. These estimates include the contractors own overheads, supervision and profit and all taxes. It is assumed that any supervision costs incurred by the Public Works Department will not be charged to the contractors.

Table 9.2 Summary of unit costs for buildings and community services

Component	Unit costs (rupiahs)				
	Unit/ area	Unit rate (rupiahs)	Financial price	Unskilled labour element	Foreign exchange element
Agricultural infrastructure:					
Project office	73 m^2	16,741	1,222,061	82,849	183,309
Regional extension centre	118 m^2	16,211	1,912,901	139,120	887,000
Co-operative store	120 m^2	13,153	1,578,311	106,536	336,962
Rice store	48 m^2	12,693)	677,464	45,729	144,299
hardstanding	32 m^2	2,131)			
Rice drying centre	16 m^2	7,160	114,560	7,733	24,401
Staff housing:					
Type B	120 m^2	–	6,343,814	428,207	1,503,484
C	70 m^2	–	3,447,488	232,705	817,055
D	50 m^2	–	2,385,416	161,016	565,344
E	36 m^2	–	1,603,008	108,203	379,913
T1	63 m^2	16,961	1,068,548	72,127	253,133
T2	40 m^2	17,886	715,445	48,293	169,560
Social infra-structure:					
Transmigrants housing	33.4 m^2	5,838	195,000	13,163	5,200
School	270 m^2	14,014	3,783,915	255,414	547,088
Mosque	55.5 m^2	–	2,000,000	135,000	426,000
Village hall	112 m^2	10,370	1,161,488	78,400	339,346
Health: sub-centre	54 m^2	17,560	948,240	64,006	224,733
centre	64 m^2	18,616	1,191,400	80,000	282,360
Washing area/pump	1 no.	–	159,010	36,390	58,758
Latrines	1 no.	–	12,000	6,000	0
Market slab	200 m^2	1,598	319,600	21,573	17,578
Village centre land clearance	per ha	100,000	100,000	0	43,000

Source: SESP

Table 9.3 Summary of infrastructure unit costs

		Unit	Unit cost (rupiahs)		
			Financial price	Unskilled labour element	Foreign exchange element
Class I roads:	new	1 km	6,202,302		
	upgrade, very poor condition	1 km	6,006,764	1,236,420	621,670
	upgrade, poor condition	1 km	4,973,555	925,820	395,910
	upgrade, fair condition	1 km	4,151,601	708,520	271,825
Class II roads:	new	1 km	5,558,200	1,174,120	530,370
	upgrade, poor condition	1 km	4,098,656	822,960	259,790
	upgrade, fair condition	1 km	3,962,140	657,715	233,766
Class III roads:	new	1 km	3,259,000	628,500	424,960
	upgrade, poor condition	1 km	2,665,532	429,900	267,260
	upgrade, fair condition	1 km	2,512,510	384,414	201,000
Class IV roads:	new		57,750	49,500	0
Bridges*:	in class I and II roads	m span	340,000	22,950	51,000
	in class III and IV roads	m span	98,500	6,650	14,775
Paved fords, 3 m wide, 10 m long		1 no.	159,300	9,900	0
Culverts:	60 cm diameter, 8 m long	1 no.	156,000	8,500	8,500
	90 cm diameter, 8 m long	1 no.	180,000	9,175	8,500
Infrastructure in irrigation areas:					
extra cost for canal roads to class II		1 km	3,200,000	672,169	304,076
extra cost for canal roads to class III		1 km	1,373,180	265,024	178,513
extra cost to regulators for bridge deck to class II road		1 no.	1,040,000	70,200	156,000
extra cost to regulators for bridge deck to class III road		1 no.	455,000	30,710	68,250
extra cost for embankments in class IV field roads		ha	22,500	4,500	16,031
extra cost for culverts in class IV field roads		ha	20,280	1,105	1,105
flood control bunding		m^3	677	0	508

* These costs are for a weighted average metre span: Detailed costs for particular spans are given in Appendix EII.1-EII.6.

Source: SESP

The unit costs of the individual elements, used in making up the total construction costs for buildings and infrastructure, were derived on the following basis:

a Transmigration housing – detailed measurement of SESP designs (see Chapter 6) and application of unit rates. The details of the build up of the unit cost are given in Appendix E.2 and E.3.

b Transmigration staff housing, village halls, schools and stores – detailed measurement of the designs and specifications used by the Directorate General of Transmigration (Book II – Building for Transmigration Project Guide lines 1975) and the application of unit rates. The details of the build up of the unit costs are given in Appendix E.5, E.6, E.7 and E.8. The quantities shown against these buildings are subject to minor variations, due to the fact that the drawings are not fully detailed and, accordingly, some assumptions have had to be made in assessing the construction.

c Staff housing – current Bappenas cost limits for class B, C, D and E housing.

d Mosques – Directorate General of Transmigration current cost estimates.

e Washing area with pump – SESP design and cost estimate, the details of which are given in Appendix E.17.

f Other buildings – calculated on a price per square metre basis derived from an analysis of the detailed costings of transmigration housing and other buildings (see a & b above). In applying this method of estimating it is assumed that the specification of materials for the other buildings will be similar to that used for the buildings costed. In this connection, unless otherwise noted in Chapter 6, the estimated costs have been calculated on the designs and specification shown in Book II "Buildings for Transmigration Project Guide Lines 1975".

g Roads (upgrading and new construction), culverts and paved fords – detailed measurement of SESP designs and application of unit rates, the details of which are given in Appendixes E.10.1 – E.10.9, E.11.7, E.11.8 and E.11.9.

h Timber bridges – detailed measurement and application of unit rates to Bina Marga, and where appropriate Directorate General of Transmigration, standard designs, with suitable modifications to allow extrapolation of a full range of spans. Details of build up of unit costs are given in Appendixes 11.2 – 11.6.

It must be stressed that in the case of the physical infrastructure (roads, bridges etc) there are no details showing existing ground or finished formation levels and that the unit rates are for average conditions only.

The assumptions regarding excavation or fill would require detailed checking by ground survey before any accurate estimate of costs can be obtained. Similarly, the unit rates for buildings assumes a level site. Unfavourable site conditions will occur and an allowance for this has been made for this contingency in the general summaries of village costs (Table 9.10, 9.11 and 9.12).

9.3 Cost estimates and phasing of the road programme

From a route inventory made about the condition of existing roads and bridges in the Study Area detailed estimates for their improvement have been built-up, using the unit rates described in section 9.2. These detailed cost estimates are given for the roads in Appendix E.12, for bridges in Appendix E.13 and for culverts and fords in Appendix E.14. Appendix E.15 gives cost estimates for sections of new road which would be desirable to supplement the road network (exclusive of any roads necessary for new settlement areas – see section 9.4).

In Chapter 8 we have recommended that in the first five-year development phase improvements are only made to a limited number of sections of the existing road network in the Study Area. The estimated cost of these improvements are summarised in Table 9.4. The cost of improvements to the remaining existing roads and the construction of new roads, both of which may be deferred until a later stage, are given in Table 9.5 and 9.6.

Table 9.4 Priority routes — summary of total cost of improvement to existing roads

Road section	Roads (rupiahs)	Bridges (rupiahs)	Culverts and paved fords (rupiahs)	Total, rounded (rupiahs)
1 Ambaipuah to Motaha	267,487,790	49,178,700	9,453,900	326,120,000
2 Motaha to Lambuya	160,014,300	34,619,300	4,176,000	198,810,000
3 Rate-Rate to Poli-Polia	122,581,230	28,051,200	5,199,300	155,832,000
	550,083,000	111,849,000	18.829.000	680,762,000
	Allow for mobilisation 1%			6,808,000
				687,570,000
	Allow for contingencies 5%			34,379,000
	Total estimated cost			721,949,000

Source: SESP

Table 9.5 Future routes — summary of total cost of improvements to existing roads

Road section	Roads (rupiahs)	Bridges (rupiahs)	Culverts and paved fords (rupiahs)	Total rounded (rupiahs)
4 Poli-Polia to Lambandia	57,664,320	11,047,000	1,608,000	70,319,000
5 Lepo-Lepo to Tanea Baru[1]	73,896,950	3,678,000	960,000	78,535,000
6 Tanea Baru to Punggaluku[1]	157,692,590	16,414,000	3,123,300	177,230,000
7 Punggaluku to Alangga	233,252,670	84,712,300	6,165,900	324,131,000
8 Alangga to Tinanggea	136,659,970	37,731,700	3,816,000	178,208,000
9 Tinanggea to Lapoa	83,768,200	12,109,000	2,079,300	97,956,000
10 Alangga to Motaha	199,179,420	58,948,500	6,588,000	264,752,000
11 Lepo-Lepo to Tambosupa[2]	252,580,480	34,417,300	9,852,000	296,850,000
12 Tambosupa to Moramo I	74,898,420	11,048,800	3,693,900	89,641,000
13 Punggaluku to Lainea[1]	163,380,840	117,690,000	3,999,300	285,070,000
14 Unaaha	13,938,270	394,000	939,300	15,272,000
15 Uepai	16,193,900	1,378,000	1,275,300	18,847,000
	1,436,106,000	389,605,000	44,100,000	1,896,811,000
	Allow for mobilisation 1%			18,967,000
				1,915,678,000
	Allow for contingencies 5%			95,784,000
	Total estimated cost			2,011,462,000

1 The Provincial Government have allocated Rp 361.3 million for the improvement of Kendari--Lainea road, of which this forms a part.

2 This section of road improvement would not be required if the new route from Tanea Baru to Tambosupa (section A) is constructed.

Source: SESP

Table 9.6 New routes — summary of total costs for new roads (excluding those directly serving new settlements)

Road section	Roads (rupiahs)	Bridges (rupiahs)	Culverts (rupiahs)	Total rounded (rupiahs)
A Tanea Baru to Tambosupa[1]	117,843,000	8,500,000	2,388,000	128,731,000
B Mowila Jaya to Wawolemo	99,236,800	6,800,000	1,920,000	107,957,000[2]
C Lambandia to Benua	155,057,000	12,240,000	3,396,000	170,693,000
	372,137,000	27,540,000	7,704,000	407,381,000
	Allow for mobilization 1%			4,070,000
				411,451,000
	Allow for contingencies 5%			20,573,000
	Total estimated cost			432,024,000

Source: SESP

1 This section of new road would allow more economic access to Moramo and could be constructed instead of upgrading the road from Lapo-Lapo to Tambosupa (section 11).

2 Exclusive of the cost of a ferry across the Konaweha river, estimated to be some Rp 83,000,000.–.

Table 9.7 Wawotobi settlement — irrigated alternative, agricultural and social infrastructure cost, financial prices (rupiahs)

Component	1980 Village 1 and part of 2 (562 families)	1981 Villages 3 and 4 parts of 2 and 5 (1597 families)	1982 Villages 6, 7, 8, 9 10 & 11, parts of 5 (3445 families)
Agricultural infrastructure:			
Project offices	2,444,122	9,776,500	14,664,700
Cooperative stores	1,578,311	6,313,200	9,469,900
Rice stores	677,464	2,709,900	4,064,800
drying centres	229,120	916,500	1,374,700
Staff housing : type D	9,541,664	38,166,700	57,250,000
: type E	–	6,414,200	6,414,200
: type T1	1,068,548	4,274,200	6,411,300
: type T2	1,480,890	5,723,600	8,585,300
Sub-total	16,970,000	74,295,000	108,235,000
Social infrastructure:			
Transmigrants houses	109,590,000	311,415,000	681,525,000
Schools	3,783,915	22,703,500	30,271,300
Mosques	2,000,000	8,000,000	12,000,000
Village halls	1,161,488	4,646,000	6,968,900
Health sub-centres	–	948,200	1,896,500
Health centres	–	1,191,400	–
Washing areas	5,883,370	16,855,000	37,049,300
Latrines	6,744,000	19,164,000	41,940,000
Market areas	319,600	1,278,400	1,917,600
Village centre land clearance	360,000	1,800,000	2,160,000
Sub-total	129,842,000	388,002,000	815,729,000

Source: SESP

9.4 Cost estimates for the new settlements

The construction of the new settlements will take place over a five year period, the detailed phasing of which is discussed in Chapter 4 for the Wawotobi area and in Chapter 5 for the Makaleo area. From the detailed build up of the total numbers of buildings and community services and an assessment of the physical infrastructure that will be required, and applying the unit rates in Tables 9.2 and 9.3, the following cost estimates have been made:

a the estimated cost for agricultural and social infrastructure for Wawotobi settlement –– irrigated alternative (buffaloes or tractors). See Table 9.7.

b the estimated cost for physical infrastructure for the Wawotobi settlement – irrigated alternative with tractors. See table 9.8.

c the estimated reduction in cost for physical infrastructure for the Wawotobi settlement – irrigated alternative with buffaloes. See Table 9.9.

d a summary of the two alternative Wawotobi settlement irrigated schemes – with tractors or with buffaloes. See Table 9.10.

e the estimated cost for all components of the Wawotobi settlement – dryland alternative. See Table 9.11.

f the estimated cost for all components of the Makaleo settlement – dryland scheme. See Table 9.12.

Table 9-8 Wawotobi settlement – irrigated alternative, with tractors. Physical infrastructure costs, financial prices (rupiahs)

Component	1980 Village 1 and part of 2 (562 families)	1981 Villages 3 and 4 parts of 2 and 5 (1597 families)	1982 Villages 6, 7, 8, 9, 10 & 11, part of 5 (3495 families)
Physical infrastructure:			
Class II roads	–	18,008,600	72,034,000
Class III roads	586,620	5,475,100	27,310,000
Class IV roads	486,833	1,306,300	3,027,800
Bridges in class II roads	–	2,210,000	8,806,000
Bridges in class III and IV roads	31,520	246,300	1,418,000
Culverts	678,600	2,263,660	7,163,500
Extra for canal roads to class II	–	16,128,000	67,200,000
Extra for canal roads to class III	10,710,804	10,216,500	10,793,200
Extra for regulators to class II bridges		1,040,000	5,200,000
Extra for regulators to class III bridges		1,820,000	3,185,000
Extra embankment in field roads		18,967,500	48,273,800
Extra culverts in field roads	17,096,040	43,510,700	74,529,000
Class II road, upgrade (fair)	7,369,580	–	–
Class III road, upgrade (fair)	4,824,020	–	–
Sub-total	63,612,000	156,024,000	373,624,000

Source: SESP

Table 9.9 Wawotobi settlement – irrigated alternative with buffaloes – reduction in infrastructure costs (over tractor alternative), financial prices (rupiahs)

Component	1980 Villages 1 and part of 2 (562 families)	1981 Villages 3 & 4, parts of 2 & 5 (1597 families)	1982 Villages 6, 7, 8, 9, 10 and 11, part of 5 (3495 families)
Physical infrastructure:			
Extra for regulators to class III bridges	– 910,000	– 1,365,000	– 5,915,000
Extra embankments in field roads	– 18,967,500	– 48,273,800	– 82,687,500
Extra culverts in field water	– 17,096,040	– 43,510,700	– 74,529,000
Sub-total	– 36,974,000	– 93,153,000	– 163,132,000

Source: SESP

Table 9.10 Wawotobi settlement – irrigated alternative. Summary costs, financial prices (rupiahs)

Component	1980 Village 1 and part of 2 (562 families)	1981 Villages 3 and 4 parts of 2 and 5 (1597 families)	1982 Villages 6, 7, 8, 9, 10 & 11, part of 5 (3495 families)	Total (5654 families)
Tractor alternative:				
Agricultural infrastructure	16,970,000	74,295,000	108,235,000	
Social infrastructure	129,842,000	388,002,000	815,729,000	
Physical infrastructure	63,612,000	156,024,000	373,624,000	
Sub-total (all prices)	210,424,000	618,321,000	1,297,588,000	
1% mobilisation	2,104,000	6,183,000	12,976,000	
	212,528,000	624,504,000	1,310,564,000	
5% contingencies	10,626,000	31,225,000	65,528,000	
Tractor alternative total	223,154,000	655,729,000	1,376,092,000	
Buffalo alternative:				
Agricultural infrastructure	16,970,000	74,295,000	108,235,000	
Social infrastructure	129,842,000	388,002,000	815,729,000	
Physical infrastructure[1]	26,638,000	62,874,000	210,492,000	
Sub-total (all prices)	173,450,000	525,171,000	1,134,456,000	
1% mobilisation	1,735,000	5,252,000	11,345,000	
	175,185,000	530,423,000	1,145,801,000	
5% contingencies	8,759,000	26,521,000	57,290,000	
Buffalo alternative total	183,944,000	556,944,000	1,203,091,000	

Source: SESP

1 Taking account of cost reductions in Table 9.9

Table 9.11 Wawotobi settlement – dryland alternative. Village building and infrastructure costs, financial prices (rupiahs)

Component		1980 Villages E & F (1000 families)	1981 Villages G & H (1000 families)	1982 Villages I & J (1000 families)	Total (3000 families)
Agricultural infrastructure:					
Project offices		4,888,200			
Co-operative store		3,156,600			
Rice stores		1,354,900			
Drying centres		458,200	ar	ar	
Staff housing:	type D	15,505,200	1980	1980	
	type E	5,610,500			
	type T1	2,137,150			
	type T2	2,861,800			
Sub-total		35,792,500	35,792,500	35,792,500	107,376,000
Social infrastructure:					
Transmigrants houses		195,000,000			
Schools		11,351,700			
Mosques		4,000,000			
Village halls		2,323,000			
Health sub-centre)		948,200	ar	ar	
and centres)		–	1980	1980	
Washing areas		10,653,700			
Latrines		12,000,000			
Market area		319,600			
Village centre land clearance		720,000			
Sub-total		237,316,000	237,316,000	237,316,000	711,948,000
Physical infrastructure:					
Class II roads		47,911,700			
Class III roads		33,861,000			
Class IV roads		4,077,150			
Bridges in class II roads		5,861,600	ar	ar	
Bridges in class III and IV roads		7,190,500	1980	1980	
Paved Fords		876,150			
Culverts		8,112,000			
Bunding		79,862,900			
Sub-total		187,573,000	187,573,000	187,573,000	562,719,000
Sub-total (all prices)		460,681,000			
1% mobilisation		4,606,810			
Sub-total		465,288,000			
5% contingencies		23,264,000			
Total		488,552,000	488,552,000	488,552,000	1,465,656,000

Source: SESP

Table 9.12 Makaleo settlement – village buildings and infrastructure cost, financial prices

rupiahs

Component		1978		1979		Totals
		Village A	Village B	Village C	Village D	–
Agricultural infrastructure:						
Project offices		2,444,122	2,444,122	2,444,122	2,444,122	
Co-operative store		1,578,311	1,578,311	1,578,311	1,578,311	
Rice stores		677,464	677,464	677,464	677,464	
Drying centres		229,120	229,120	229,120	229,120	
Staff housing:	type D	9,541,664	9,541,664	9,541,664	9,541,664	
	type E	–	3,206,016	–	3,206,016	
	type T1	1,068,548	1,068,548	1,068,548	1,068,548	
	type T2	1,430,890	1,430,890	1,430,890	1,430,890	
Sub-total		16,970,119	20,176,135	16,970,119	20,176,135	74,292,[illegible]
Social infrastructure:						
Transmigrants houses		95,355,000	93,990,000	75,465,000	94,965,000	
Schools		3,783,915	7,567,830	3,783,915	7,567,830	
Mosques		2,000,000	2,000,000	2,000,000	2,000,000	
Village halls		1,161,488	1,161,488	1,161,488	1,161,488	
Health sub-centres		–	–	–	948,240	
Health centres		–	948,240	–	–	
Washing areas		5,247,330	5,088,320	4,134,260	5,088,320	
Latrines		5,868,000	5,784,000	4,644,000	5,844,000	
Market area		319,600	319,600	319,600	319,600	
Village centre land clearance		360,000	360,000	360,000	360,000	
Sub-total		114,095,000	117,219,478	91,868,263	118,254,478	441,437,[illegible]
Physical infrastructure:						
Class II roads		17,452,748	–	4,001,904	18,119,732	
Class III roads		25,420,200	31,481,940	26,495,670	31,318,990	
Class IV roads		1,819,125	2,034,532	1,619,310	1,977,360	
Bridges in class II roads		2,135,200	–	489,600	2,216,800	
Bridges in class III and IV roads		3,147,075	3,658,290	2,977,655	3,522,360	
Paved Fords		388,692	434,889	347,274	423,738	
Culverts		3,798,600	3,803,280	3,185,520	4,166,958	
Sub-total		54,161,640	41,412,931	39,116,933	61,745,938	196,437,[illegible]
Sub-total (all prices)		185,226,759	178,808,544	147,955,315	200,176,551	
1% mobilisation		1,852,267	1,788,085	1,479,553	2,001,766	
		187,079,027	180,596,629	149,434,868	202,178,317	
5% contingencies		9,353,952	9,029,832	7,471,244	10,108,920	
Total		196,433,000	189,626,400	156,906,000	212,287,000	755,252,[illegible]

Source: SESP

Implementation 10

Throughout the study we have given serious consideration to the utilisation of local resources, both human and material, to ensure that as much of the benefits as possible of the proposed major investment programme will remain within the local economy. To this effect, we have investigated the availability of construction materials both for buildings and for infrastructure (roads, bridges and irrigation works), and, where possible, we attempted to propose designs or construction technics utilising these materials. We have also investigated the capacity of local firms to participate in the construction programme and sought ways to ensure the involvement of the local population and the transmigrants themselves, at the appropriate level, in as much of the contractual activities as possible. We have also investigated current practices of project preparation, execution and supervision, both at central and provincial levels and are putting forward suggestions for the improvement of these practices. Our findings and recommendations are contained in the following sections of this chapter:

10.1 Locally available materials

10.1.1 Timber

Time has not permitted a detailed investigation of the timber supplies in the vicinity of proposed settlement or development areas. In most localities where settlements are proposed the forest remnants are relatively accessible and the more valuable and durable timbers have already been removed. There are, however, numerous timbers that can be utilised by transmigrants both for improving or rebuilding their houses and for other purposes. As far as possible the settlers should be encouraged to extract and utilise these timbers before any forest is cleared. The following notes provide an indication of the timbers available in the various localities and more detailed notes on the timbers are included in Appendix F.

Forest on alluvial soils between the Lahumbuti and Konaweha rivers. The most abundant timber species is simpur[1] *(Dillenia serrata)* which in addition to providing a good constructional timber include kayu hitam *(Diospyros spp.)*, keledang *(Artocerpus dasyphyllus)* and kandis *(Garcinia celebica)*. Timbers for light constructional work, not exposed to the elements, may be obtained from bayur *(Prerospermum celebicum)*, kenari *(Canarium spp.)*, mendu *(Pimeleodenron amboinicum)*, baru *(Hibiscus sp.)*, and bintangor *(Calophyllum spp.)*.

Swamp forest in Opa Swamp and east of Ladongi. In the limited areas of forest investigated there is little timber of any value for local use. Most of the trees are small in size and produce mainly non-durable timbers. Some difficulty is also likely to be experienced in extracting material from this habitat.

1 Standard vernacular names are used. For local vernacular names, see Appendix F.

Forest remnants on igneous-derived soils at base of Makaleleo Hill, and forests on the hill itself. Most of the more valuable timbers have already been extracted from the forest at the base of the hill but on the slopes there are good constructional timbers including kayu lara *(Metrosideros petiolata)*, berangan *(Castanopsis acuminatissima)* and medang *(Dehaasia sp.)*. Medium hardwoods suitable for light constructional work include kenari *(Canarium spp.)*, nyatuh *(Palaquium spp.)*, and kumpang *(Kuema sp.)*. The principal dominant, *Casuarina sumatrana*, on the lower slopes does not produce a useful timber except for firewood. Rotans are abundant and should be retained to provide many uses for the settlers.

Old secondary forest on mineral soils is frequently dominated by pasang *(Lithocarpus spicatus)*. Although the timber of this species is not widely used at present, it could be utilized for constructional purposes under cover and not in contact with the ground.

10.1.2 Road construction materials

Preliminary investigations have indicated that there is a reasonable supply of road building materials in the Study Area and its environs.

There are widespread deposits of sand and river gravels throughout the region, notably near Boro-Boro, south of Kendari Bay between Lepo-Lepo and Sambuli, between Wolasi and Punggaluku, along the Ahia river near Punggaluku, and generally throughout the Roraya-Rumbia plains. These gravels are well rounded and the larger stones will need to be partly crushed to provide a more mechanically stable road pavement material.

Because of the complex and varied geological history of South East Sulawesi there are numerous types of rock outcropping, including both igneous and metamorphic types, and also metamosphosed sediments. A good source of road pavement material would be the Makaleo mountain range south of Kumapo at approximately km. 102 on the Kendari-Kolaka road. These hills consist mainly of ultrabasic igneous rocks; the material is in fact being used in the extension work to Kendari airport. However, the quarrying and crushing techniques being adopted at the moment are haphazard and piecemeal and would need to be improved considerably it the rocks are to be used extensively. There are also deposits of quartzitic gravel and sand between Lambuya and Kumapo which would be suitable for road construction. Lateritic gravels have been located in the Ambesia Hills area and these could prove to be another useful source of material.

The soils in the area consist of residual soils and both recent and older alluviums. Provided the formation is adequately drained and compacted, these soils will perform reasonably well as subgrades, with CBR values ranging from 5 to 20 per cent, depending on the sand contents and placticity indices. However , good drainage facilities are essential, as poor drainage will drastic ally decrease strength.

10.1.3 Other building materials

The main sources of building materials used in the Study Area as follows:

Material	Source
Lime (non-hydraulic)	Wolasi and Wawotobi
Coral	Hari Hari, Lepo Lepo, Pokara and Angoja
Bitumen	Jakarta
Natural asphalt	Buton
Cement	Ujung Pandang

There are a large number of small builders' merchants in Kendari, though only one (CV Diana) that holds extensive stocks. Much of the material is obtained directly from Ujung Pandang and from Java.

10.1.4 Local industries

The capacity of the local building materials industry to manufacture components for the purposes of the project is rather limited. According to information obtained from the Department of Industry 110 brick kilns exist at present in the Kendari and Kolaka kabupatents; however, those we visited produce very poor quality bricks of standard size, which could only be used for infill and certainly not for load bearing structures. The poor quality of bricks is probably largely due to the method of firing, but the quality of the available clay may be another important factor.

There are two tile kilns in the area, one of which is owned by the Department of Industry. These kilns seen more efficient than the brick kilns, and consequently the tiles produced are of higher quality. But, at a cost of Rp. 50 per tile, the demand for the product is low, and, at the time of our visit, no production was being carried out.

The Department of Industry records show 63 saw mills in the Study Area, but we could only locate one mechanical saw mill in Kendari. The Department of Foresty confirmed that all other saw mills cut timber by hand, when required. Most building contractors cut their own timber, which opens the way to subcontracting arrangements between contractors and groups of transmigrants, who could supply the sawn timber components of buildings for the purposes of the proposed project.

The one mechanically operated saw mill produces only one cubic metre of sawn timber per day, and the length of timber normally does not exceed four metres.

10.2 Existing methods of project estimates

In the course of our study we had access to a document used by the Directorate General of Transmigration for the preparation of project estimates. This document contains both a general outline specification and Bills of Quantities for individual transmigration buildings. It is a generally accepted practice that contractors putting in for tenders receive, along with other documents, these rules and specifications and that the tender price for the quantities listed is calculated accordingly. The prices accepted in preparing current project estimates were also listed.

An examination of these estimates revealed numerous arithmatical errors, together with inconsistencies in pricing material components of identical items used in various buildings. Owing to a lack of detailed information on the drawings, only (spot checking) of certain quantities was possible. We noted for example the following apparent errors. The area of a concrete floor for an elementary school actual floor area 270 m^2 is as 312 m^2, an error of approximately 15 per cent. Further, both the specification and drawing described a cement tiled finish to the floor, but no measurement is listed in the Bills of Quantities for this item. As for the brickwork quantities, these appear overmeasured; this applies also to all other buildings that use brickwork in their construction. Plaster-work quantities on brick walls, shown as 800 m^2 for an elementary school, are grossly overmeasured. The overall area of plaster on walls cannot exceed 677 m^2 even without deductions for doors or windows; after deducting doors and windows it is not more than 596 m^2.

Errors found by spot checking certain items suggest that many of the remaining items may also be incorrect. The trend of most errors found was generally to exceed the correct quantity; this raises serious doubts as to the method in which these inaccurate budget figures are used.

In negotiating contracts directly with a selected contractor for projects under five million Rupiahs, a procedure in accordance with standing government regulations, what is the manner in which the negotiated contract sum is calculated? If the procedure is to negotiate a figure up to the budget estimate, a waste of money is inevitable, should those estimates be over-measured. The same applies to the case when tenders are invited. If the Bills of Quantities list quantities in excess of the actual requirements, it also leads to wastage.

We have endeavoured during the course of our Study to ascertain what variation in price occurs between tenders/negotiated contracts and budget estimates. We were only able to inspect one tender which was insufficient to provide a satisfactory answer to our question, despite requests both in Jakarta and Kendari to examine the accepted tenders for the recent Moramo Project, no details of these were provided.

The current manner in which budgets are prepared must be completely revised and new methods adopted to ensure the preparation of accurate Bills of Quantities, which, prior to presentation, must be checked by a competent independent person. Consistent unit pricing, also checked, must be carried out and extensions must be examined. Producing budget estimates from inaccurate Bills of Quantities incorrectly extended and unchecked must be considered as an unacceptable practice.

The frequent practice followed by both The Directorate General of Transmigratior The Public Works Department and contractors of using a 'Daftar Analisa'[1] as a basis for estimates should be discouraged. Such a document, although an excellent book on the basic simple principles of estimating, can only give average assessments as to:

a the hours required to execute various items of the works,
b the quantity of material required to complete various items of the work, taking into account waste etc.,
c the type of plant needed to execute the works.

Such a standardized estimating method is no basis on which to decide whether one contractor is more efficient than another. A well organised contractor will, by use of proper management and field supervision, execute more work in a given period than another contractor, with a resultant saving in cost. More over, the plant resources of different contractors (concrete mixers, lorries, tilt dozers, cranes etc.) will also show different levels of efficiency. Factors such as the distance to the site, the means of access, availability of labour and material, and site and weather conditions must all be taken into account when preparing any intelligently produced tender.

As profit margins also tend to be standardised, both by contractors and by local government organisations, the tenders will not normally exceed the Department's budget. Nor will they be substantially less; consequently, in many instances the contractor may be paid more than the real contract value. Indeed, if the tender is more than 10 per cent below the budget estimate it is likely to be rejected on the grounds that the workmanship will be poor — apparently without regard to a contractor's past performance or special capabilities.

We strongly recommend that in future the "Daftar Analisa" is not used by local government organisations when preparing budgets and that its use by local contractors is also gradually discouraged. On receiving tenders for various sections of this project the opportunity should be taken to analyse them carefully, so that they can form the basis of future budget estimates. Once local government departments start to revise their methods of budget estimating, local contractors will follow suit, which is the best way of cutting costs.

We cannot stress too strongly the importance of producing consistently priced accurate Bills of Quantities to provide budget costs, particularly if contracts are awarded on the basis of such budget estimates.

[1] Such as the Dasar Penyusunan Anggaran Biaya Bangunan by J.A. Mukomoko, published by Penerbit — Kurnia Esa, Jakarta.

10.3 Tendering requirements

The requirements that must exist in order to obtain fully competitive and accurate tenders, in addition to ensuring the availability of building contractors who can submit competitive and 'bona fide' tenders are as follows:

Drawings, showing the exact constructional details of the works.
Specifications, fully describing the standard of wormanship and materials.
Bills of Quantities, scheduling the exact quantities required for each individual element of the works.
General conditions of contract.

Before dealing with the current tender procedures used by the Directorate General of Transmigration, we must stress that we have been unable to examine any recent contract or tender documents issued by the Directorate General in spite of several requests.

The following observations are, therefore, based on the information given to us, both in Jakarta and Kendari, drawings, standard specifications, bills of quantities and general conditions of contract that, we are assured by the Directorate General of Transmigration, are used by them for current tender purposes.

From an examination of these documents, we could see that, on the whole, the procedures adopted follow our recommendations. However, we suggest that certain points of the existing tender documentation be amended in order to eliminate current deficiencies. We propose now to examine the specific points in some detail.

10.3.1 Drawings

The drawings used for both tendering and construction purposes are illustrated in the Directorate General of Transmigration Guide Book. The drawings dealing with the various buildings are drawn to scales of 1:100, 1:150 and 1:200.

In respect of a transmigrant house the drawings show a general layout, but no exact details are indicated of the following:

a. Sizes of main frame post, intermediate rails, roof trusses, purlins or fascia boards.
b. Foundations.
c. Size and construction of windows and doors.
d. Size and construction of internal partitions.

Drawings of the remaining buildings and bridges are in general more detailed, but we suggest that the following methods be adopted in respect of all the Directorate General of Transmigration buildings for both this and future projects:

a. Produce detailed drawings to a scale of 1:25 of floor and roof plans, elevations, sections and internal partition details, showing the construction and sizes of all the components required.
b. Produce drawings to a scale of 1:10 specifying the exact sizes and constructional details of doors and windows together with all ironmongery components.
c. Provide to a scale of 1:10 foundation detail which will vary according to site conditions. However, standard details should be provided, assuming a level and dry site; variations necessitated by particular site conditions can be given when the exact site conditions are known, prior to the submission of tender documents.
d. Provide to a scale of 1:10 details of all constructional joints between structural and non-structural members, e.g. notchings of rafters to receive purlins. Show whether joints in running lengths of timber members are halving or butt jointed and whether such joints are nailed, screwed or bolted together. The design of boarded timber walls should show the mode of construction, i.e. the size of each board and the method of jointing: butt jointed, tongued and grooved, or weather-boarded.

Similar constructional details should also be provided for bridges and culverts.

These drawings would not take long to produce. Details of foundations, constructional joints, boarded walls should be standard for most buildings. Similarly door and window details could be standardised for the various types of buildings.

We note that it is a generally accepted practice for the provincial offices of the Directorate General of Transmigration to produce their own drawings of the various types of trasmigration buildings constructed in their areas, and, consequently, the details specified above should also be produced by each provincial office.

10.3.2 Specification

The specification is basically adequate, but should be improved and expanded to take into account the following factors:

a. Concrete works.
It must be stressed that cement should be supplied in sealed containers, and any cement left in the open air should be rejected. Exposure of cement, even for a relatively short period, results in a rapid deterioration of the material. Further instructions should be given about mixing concrete. Only so much cement should be mixed as can be placed in position immediately after mixing. Mixed concrete left standing goes off, with a subsequent reduction of strength. The size of concrete aggregate should be specified to pass the recommended sieve sizes for both coarse and fine aggregates.

b. Timber.
Timber is specified according to various classes. However, each type of timber in South East Sulawesi is classified in two ways, according to strength and durability. Certain timbers with a Class 2 strength rating have in fact a Class 3 durability. It should therefore be made clear to which class rating the timber is specified.

It must also be stressed that structural timber should be straight in its length when used in posts and roof tresses, and free from all signs of decay or disease. Again, if timber is required to be finished with a wrought (smooth) finish, this should be stated.

c. Fixings
Nails, screws, bolts, should be specified in accordance with the
type and finish of material;
gauge or diameter or weight;
length and method of fixings.

d. Roof sheeting.
When roof sheeting is laid reference should be made to the minimum lap. In the case of corrugated iron roof sheeting the normal side lap is 50 mm with a 150 mm minimum end lap. In addition, the gauge of the corrugated sheet must be described, and the method of fixing specified. Normally, for corrugated roof sheets fixings to timber are by drive screws, with a metal and felt washer to prevent water penetration through the fixing. Similar information must be included in the specification to describe methods of fixing and minimum laps of all other materials used for roof coverings.

e. Paint.
The type and quality of the paint together with the number of coats required should be specified. If any preparation work is necessary on the surfaces to be decorated, the exact requirements should be stated. Again timber posts set into the ground or concrete bases should be described giving the preservative treatment required.

We have shown some of the basic improvements necessary to the specification. Writing a full specification for use on Transmigration projects would involve no more than two months work, for any competent surveyor architect and could, if necessary, form the basis of a seperate report. However, the objective of a full specification, combined with detailed drawings and a bill of quantities must fully and accurately describe all the labour and workmanship necessary and eliminate any doubts or misunderstandings that may occur during the construction period. Misunderstandings cause delays and inferior workmanship, but, more importantly, could cause financial loss to the Directorate General.

10.3.3 Bills of quantities.

Owing to the lack of sufficient detailed information about the drawings we are unable to verify if all the quantities shown are correct discussed in the last section. We also deal with this problem in the previous section, in connection with the existing methods of budget estimating.

10.3.4 General conditions of contract.

We note that the maintenance periods for buildings currently being used by the Directorate General of Transmigration are either one month or three months. In our opinion these periods are far too short. A period of six months is the minimum that we recommend for the maintenance period in future projects.

For bridges, the maintenance period should be twelve months.

Our recommended maintenance period for roads is three months for village roads and twelve months for all other roads.

The recommendations we suggest to the Directorate General of Transmigration can be summerized as follows:

a. To improve the standard of drawings;
b. To improve the existing specification;
c. To ensure that quantities given in bills of quantities are correct;
d. To amend the times of maintenance periods;

The recommendations proposed above will not require the services of outside specialists; the work can be carried out within the existing structure of the Directorate General of Transmigration.

An examination of the tender documents produced for our inspection by the Bina Marga has shown that they follow very closely our recommendations. The drawings and specifications are well detailed, the Bills of Quantities describe the items of work to be executed accurately and the maintenance periods stated are realistic.

10.4 Proposed tender selection

The method of selecting contractors to invite tenders for the various sections of the project requires careful investigation. Of approximately 150 contractors registered within the Study Area[1] few are able, by experience or resources, to carry out majot infrastructure and irrigation work. During our stay in the Study Area, thirty four contractors were interviewed ranging from the largest to the smaller firms in the area. The results of this investigation showed that few firms have enough experience to carry out major contracts, and possess, or can obtain, sufficient plant and expertise required for executing major parts of the project works within the required construction periods and in accordance with the specifications.

In view of the required programme completion dates for the project we think that larger Indonesian contractors, at present outside South East Sulawesi, will have to assist in the construction of major sections of this project.

1 Trade Department (Perdagangan) Kendari.

Prior to inviting tenders, a list of Approved Contractors should be produced by the Directorates General of the implementing departments or the Project Management Unit, graded into the category and size of contract that each contractor is capable of executing. This list of Approved Contractors should contain only such firms as have already proved in the past or can produce sufficient evidence for the respective Directorate General office that they possess adequate and competent technical supervision to carry out the work.

No contractor whose work on previous contracts has been of an inferior standard should be included. The local government agency, BAPPEDA, have compiled a list of local contractors graded into various classes of work that each firm is capable of executing; we suggest that this list be studied by the implementing departments and observations or amendments made where necessary.

Only contractors included in the List of Approved Contractors should be invited to submit tenders and only for contracts within the scope of their particular grading.

We recommend that tenders are invited for:

a The construction of main roads and associated bridge/culvert work, split into sections of approximately 50 km lengths.

b The construction of the entire Wawotobi Irrigation Project.

c The construction of all housing for each separate transmigration village, together with other buildings for immediate use by the transmigrants.

d The construction of secondary roads and associated bridge/culvert works split into sections of approximately 50 km lengths.

e The improvements and upgrading of existing irrigation works.

f The construction of the remaining buildings in each separate village settlement, together with village roads and land clearing.

We suppose that contractors capable of executing sections *a* and *b* would be larger organizations, possibly from outside the Study Area. Sections *c, d* and *e* could be executed by the large/medium size local firms, and section *f* would be carried out by small local contractors.

We appreciate that overlapping of the above sections could occur. Large firms capable of constructing main-road bridges and irrigation projects could equally well execute the other sections of the project, but in our opinion encouragement should be given to local contractors in order to benefit local people. Our suggested method of inviting tenders presupposes that, provided bona fide tenders are called, outside firms may secure the work described in sections *a* and *b*. But we recommend that only local contractors should be invited for the remaining sections, provided that tenders within the budget estimates are received. The exact method of phasing the construction work, which will dictate when tenders are invited, is very important; this is discussed in detail in the final section of this chapter.

10.5 Assistance given to local contractors

We have considered the possibility of giving financial help to local contractors with the intention of assisting their expansion and for the purchase of plant. Our opinion is that no benefit would be derived from such a help. We believe that any organisation expands through enterprise and efficiency, and the difficulties in selecting which firms to assist, the control over the manner in which funds are spent, and the problem of ensuring that the loan could be repaid would create unnescessary difficulties. Our suggested manner of inviting tenders affords contractors the opportunity of tendering for work within their own particular capabilities and resources. No contractor should be included in the list of approved contractors if he does not already posses or does not have the means of obtaining the necessary finance.

During our discussions with both medium and large local contractors in the Study Area, it became apparent that most firms had limited plant resources. However, the majority of contractors confirmed that, given the opportunity of executing major contracts, they would prefer to buy their own plant without any financial assistance.

However, consideration should be given to financial assistance to promote local industries. Construction work of the project will require vast quantities of timber; the Department of Industry could investigate methods of organising local people to cut and prepare the timber required. Not much investment is required for timber production and at the same time it could greatly benefit part of the local population. We understand that ILO may be interested in providing technical assistance under their programme supporting rural industries.

Once the production capacities have been determined, the Directorates General of the implementing departments should invite tenders from local suppliers to obtain the most competitive prices. The suppliers with the most competitive prices should be made to enter into contract with the Directorate General concerned, guaranteeing that they will supply agreed quantities of materials at agreed prices. Where credit facilities are required by local entrepreneours or transmigrants, these should be provided on condition that they agree to supply material at the lowest competitive price.

When the main tenders are invited for building construction, the contract documents should list the names and addresses of the suppliers, together with the prices quoted and the quantity of material that each firm undertakes to provide each month. Thus, although the contractor may bring in expertise from outside, the employment generating effects will remain largely within the area, and the contractor will have to use supplies negotiated by one of the implementing agencies.

10.6 Supervision and cost control

From our examination of recent transmigration settlements we conclude that the standard of workmanship is generally poor. This is the result of using inexperienced contractors and of bad supervision. The standard of the transmigrant houses and roads constructed at Moramo 2 was appallingly low. The quality of timber used is certainly not in accordance with any conceivable specification.

It is our opinion that the Directorate General of Transmigration should set up an independent inquiry to find out the exact cost of construction in these settlements and whether the specification was adhered to. Should the result of this enquiry prove that the work was not carried out in accordance with the specification and drawings, the contractors responsible should be made to rectify the works at their own expense, or an agreed cash compensation should be made to the Directorate General.

Our organisational recommendations for the implementation of the present proposals are aimed at ensuring that adequate supervision is employed through budgetary controls by the proposed Project Management Unit directly responsible to the interdepartmental Body for Coordination of Expansion of Transmigration Areas. Thus, the Project Management Unit would be strengthened by personnel not only capable of ensuring proper coordination between the various implementing agencies but also capable of exercising quality and cost controls.

Appendices

Demography

A

A.1 Method of estimating net migration

For calculating natural growth, figures estimated by Professor Iskandar[1] were accepted as realistic for crude birth and death rates in Sulawesi for the period 1961–1971. He estimated 49.5 births and 22.5 deaths per 1,000 population. These figures result in a rate of natural increase of 27.0 per 1,000 population, or a 2.7 per cent annual increase. Adopting this overall rate for the Province, and for kabupatens Kendari and Kolaka, Table A.1 shows the projected population allowing for its natural increase only.

Table A.1 Hypothesised natural increase of population

thousand persons

Date	Kendari	Kolaka	Province
1961	159.5	35.1	559.6
1966	182.2	40.1	639.3
1971	208.2	45.8	730.4

Source: SESP

The available statistics on transmigrants show that between 1961 and 1971 a total of approximately 2,500 people moved into the Province, all of them to Kendari. This figure was taken into consideration in projecting the 1971 population and estimates of net migration (excluding the transmigrants) were calculated, as shown in Table A.2.

Table A.2 Estimated net migration, 1961–71

thousand persons

Area	Projected 1971 population	1971 Census population	Estimated net migration
Province	732.9	714.1	– 18.8
Kabupaten Kendari	210.7	190.0	– 20.7
Kabupaten Kolaka	45.8	69.7	+ 23.9

Source: SESP

1 Indonesian Fertility–Mortality Survey, 1973
Sulawesi, Universitas Indonesia, 1974, Preliminary Report.

Using a similar methodology based on 1971 population figures, and revised natural increase rates of 46 births and 17.6 deaths per 1,000 population, the geographic pattern of net migration is changed as shown in Table A.3.

Table A.3 Estimated net migration, 1971–76

thousand persons

Area	Projected 1976 population	Transmi-grants	Hypothe-sised population	Actual popula-tion	Estimated net Migration
Province	821.5	24.1	845.6	816.0	– 27.3
Kabupaten Kendari	218.5	16.1	234.6	244.2	+ 9.6
Kabupaten Kolaka	80.2	8.0	88.2	108.9	+ 20.7

Source: SESP

A.2 Population assumptions

This section outlines the values of the basic variables used to project the population of the existing transmigration settlements and that of a model new settlement. As a prerequisite to such assumptions this section further outlines the reasoning behind the determination of these basic variables.

A.2.1 The prediction of age-specific fertility rates

The basis of our assumptions concerning age-specific fertility rates relies to a large extent upon the Indonesian Fertility–Mortality Survey of 1973, and in particular upon two reports of the Lembaga Demografi, Fakultas Ekonomi, Universitas Indonesia: the preliminary report of the survey for Sulawesi[1], and "Levels and Trends in Fertility and Childhood Mortality in Indonesia"[2].

The adopted bases for the prediction of age-specific fertility rates were the final revised estimates of the McDonald, Yasin and Jones report[2], relating to average annual age-specific fertility rates for the period 1965 to 1970, as calculated for the rural areas of Sulawesi. The revisions resulted from a comparison of the Fertility–Mortality Survey results with the 1971 census figures, and incorporated an adjustment factor to allow for disparities in both sets of data. We have adopted the rates applicable to the rural areas mainly because our settlements will be agricultural based, and the settlers in general are from a similar background. Table A.4 illustrates the resulting fertility rates, from which a total fertility rate of 6.53 is calculated.

1 Universitas Indonesia 1974 Preliminary Report – Indonesian Fertility–Mortality Survey 1973: Sulawesi.

2 McDonald, Yasin and Jones. Levels and Trends in Fertility and Childhood Mortality in Indonesia. Universitas Indonesia 1976.

Table A.4 Base age-specific fertility rates, 1965–70

annual average

	15–19	20–24	25–29	30–34	35–39	40–44	45–49
Numbers of live birth per 1000 women in each group	128	306	310	264	190	95	13

Sources: *Biro Pusat Statistik, 1971 Census*
Fertility–Mortality Survey, 1973
SESP

Implicit in this base assumption is that the settlers of the transmigration villages will adopt similar rates of reproduction to those of the existing resident population within Sulawesi. Although the weighted average of the total fertility rate by the areas of origin of the settlers is lower than that for Sulawesi, we feel that the higher Sulawesi rate is justified on two accounts:

a a characteristic of the transmigrant population is a relatively high proportion of population within the fertile age groups,

b the figures calculated from the Fertility–Mortality Survey for Sulawesi incorporate an element of transmigrant population.

To predict the future age-specific fertility rates, an estimate was made from the data of the Fertility–Mortality Survey of the individual age specific rates of change within rural Sulawesi, which itself was adjusted to the period 1966–1971 as shown in Table A.5.

Table A.5 Hypothesised rates of change in age-specific fertility rates, rural Sulawesi, 1966–71

Age–Group	A.S.F.R. 1966 (1)	A.S.F.R. 1971 (2)	(2) ÷ (1)
15–19	147	130	0.89
20–24	303	302	1.00
25–29	312	331	1.06
30–34	276	289	1.05
35–39	209	198	0.95
40–44	115	113	0.98
45–49	43	34	0.80

Source: Fertility–Mortality Survey, 1973.

Future values of age specific fertility rates were calculated by using the base age-specific fertility rates with the rates calculated in the last column of Table A.5 and with assumptions concerning changing age at marriage, the introduction of family planning into South East Sulawesi and the desire for additional children. The final numerical asssumptions were:

a for women in the age group 15–19, that the ASFR will decline at the 1966–71 rate up to 1986, and thereafter a further decline at 50 per cent higher than the 1966–71 rate.

b for women in the age groups 20–24, 25–29 and 30–34, that the ASFR will increase at the 1966–71 rate up to 1981, they will remain constant at the 1976–81 rate for the period 1981–86, and thereafter they will decline at half the rate estimated for the age group 15–19.

c for women in the age groups 35–39, 40–44 and 45–49, that the ASFR will decline at the 1966–71 rate up to 1986. Thereafter for women in the 35–39 age group a further decline at 50 per cent higher than the 1966–71 rate; but for women in the 40–44 and 45–49 age groups constant ASFR at the estimated 1981–86 levels.

The resulting age-specific fertility rates are shown in Table A.6.

Table A.6 Average annual age-specific fertility rates per 1000 women

Age Group	1971–76	1976–81	Period 1981–86	1986–91	1991–96
15–19	114	101	90	75	63
20–24	306	306	306	281	258
25–29	329	348	348	320	293
30–34	277	291	291	267	245
35–39	181	171	163	151	139
40–44	93	91	89	87	84
45–49	10	8	7	7	7
Total fertility rate	6.55	6.58	6.47	5.94	5.45

Source: SESP

A.2.2 The prediction of age-specific mortality rates

Statistics upon the number of deaths within Indonesia are incomplete and unreliable, and thus no conventional death rates can be calculated. As a result, references had to be made to the internationally accepted model life tables as constructed by Coale and Demeny[1] with their relationships of life expectancy at birth.

Nevertheless, the main problem was the selection of the relative level within the life tables upon which to base our projections. Statistics upon infant mortality are available from the Indonesian Fertility Mortality Survey for Sulawesi, and these formed the basis of our assumptions. Sulawesi data were selected mainly because death rates are more closely related to area of residence representing an index of health care and social conditions therein. Accordingly, only brief reference was made to the death rates of the areas of origin of the transmigrants.

Table A.7 Mortality assumption adopted for period 1966–96

		1966–71	1976–81	1981–86	1986–91	1991–96
Life expectancy	MALE	44.5	47.1	49.6	51.8	54.1
at birth	FEMALE	47.5	50.0	52.5	55.0	57.5
Death rate 0–4	MALE	226	200	177	157	137
per 1,000	FEMALE	205	182	159	139	120
Infant mortality	MALE	155	139	124	111	98
rate per 1,000	FEMALE	132	118	105	93	81

Source: SESP

During the 1960's the infant mortality rate calculated from the Fertility–Mortality Survey was approximately 110 per 1000 live births in the rural areas of Sulawesi. In general terms there has been a slow decline in infant mortality from the 1940's. However, as there was evidence of some misrecording of information in the survey, it has been concluded that the values of the proportion of children dying before the age of 5 are better estimates of childhood mortality. Using data from the 1963–67 birth year

[1] A.J. Coale and P. Demeny Regional Model Life Tables and Stable Populations. Princetown, N.Y. 1966

cohort, and from the 1971 Census, McDonald, Yasin and Jones[1] have prepared estimates from both sources. The resulting levels for rural Sulawesi are respectively 11.6 and 12.1. Further work by Speare as part of his projections of population for Indonesia[2] estimated a level of 12.0 for the region of South and South East Sulawesi. We have therefore assumed that level 12.0 is applicable as the base for the period 1966–71, upon which further assumption were made.

An analysis of the trends experienced in rural Sulawesi regarding the number of children dying before the age of five revealed no consistent pattern over time, and, as a result, our projections of age specific mortality were related to trends in life expectancy at birth from national projections. Implicit in the adoption of the base life table is a life expectancy at birth of 47.5 years for females and 44.5 years for males. Assumptions made in the majority of population forecasts for Indonesia assume an annual increase in life expectancy at birth of between 0.25 years and 0.5 years. Accordingly we have adopted the following assumptions:

a A slow decline in death rate for all age groups between 1971 and 1981, represented by an increase in life expectancy at birth for females of 0.25 years per annum.

b A faster decline in the death rate during the post 1981 period, represented by an increase of female life expectancy at birth of 0.5 years per annum.

Table A.7 illustrates over the forecast period the relative life expectancy at birth, infant mortality rates, and the overall death rate of children in the 0 to 4 age groups implicit in our assumptions.

A.2.3 Age-sex profile

Several sources of data were researched in order to obtain the base age-sex structure of both the existing settlements and those hypothesised for a model new settlement. In both cases we adopted 1976 as the base date.

N.D. Abdul Hameed in his report on the Pelita I settlements in Sulawesi Tenggara[1] has presented statistics on the age-sex structure of 12 transmigrant settlements. These figures resulted from a household survey of the settlements undertaken in December 1975 to January 1976, and can be regarded as realistic estimates. The settlements surveyed were Amoito, Ladongi I, Ladongi II, Towua, Landono, Mowila Jaya, Rambu Rambu, Wolasi, Tanea, Konda, Rambu Rambu (Dep. Soc.) and Pamandati.

The Provincial Office of Transmigration in Kendari hold statistics on the age-sex structure of the settlements under its guidance. This information is collected on a monthly basis from the village head, but because of inconsistencies in the returns, and since no age data on residents over the age of 45 is collected, it was only partly used. No data is held by the Directorate General on the settlements which were administered by the Social Welfare Department.

The above two sources only produced a partial picture of the age-sex composition of the existing transmigration settlements, and in many cases further assumptions were required. In order to make realistic assumptions, we took a random sample of the completed application forms of 569 families accepted for resettlement under the transmigration programme. The survey covered approximately 3000 individuals, and although they all resided in Java, a wide coverage of the island was achieved. Table A.8 records the resulting age-sex composition obtained from the survey, and compares the resulting distribution with the range for each age-sex group obtained from N.D. Abdul Hameed's analysis of individual settlements.

[1] Op cit.

[2] A. Speare Jr., Projections of Population and Labour Force for Regions of Indonesia 1970–2005, National Institute of Economic and Social Research, 1976.

[1] N.D. Abdul Hameed, Pelita I Settlements in Sulawesi Tenggara, UNDP/FAO Working Document, Jakarta, 1976

Table A.8 Age-sex distribution of transmigrants

Age group	Random sample of accepted transmigrants		Hameed's survey of 12 settlements	
	Males	Females	Males	Females
0–4	8.4	7.7	7.0–10.7	5.7–9.8
5–9	8.9	9.4	9.0–10.2	5.8–13.7
10–14	6.8	6.1	5.9–9.7	5.3–7.6
15–19	5.9	5.1	3.6–5.7	2.1–6.0
20–24	3.4	3.7	1.3–4.5	2.4–5.0
25–29	3.0	3.6	0.4–3.6	2.7–6.0
30–34	3.2	4.7	2.0–4.6	3.4–6.2
35–39	5.1	3.2	3.3–5.7	2.3–5.7
40–44	3.4	2.1	2.6–4.5	1.0–2.7
45–49	1.8	1.2	1.2–3.5	0.0–1.3
50–54	1.6	0.7	0.9–1.8	0.0–0.8
55–59	0.5	0.1	0.2–1.5	0.0–0.5
60–64	0.1	0.2	0.0–1.4	0.0–0.4
65 +	0.1	0.0	0.0–0.6	0.0–0.5

Sources: N.D. Abdul Hameed op. cit., SESP

The general correspondence of the two sets of figures is obvious; in every case the values obtained from the survey of accepted transmigrants fall within the range of the existing settlement profiles established from the N. Hameed survey. In the majority of age groups too, the values from the survey correspond to the medium values of the Hameed figures. The general conclusions made were that the survey information was sufficiently accurate to be used as the model age-sex structure for the new settlements, and that the same distribution could be used to hypothesise the age-sex distribution for existing settlements where no other adequate data was available. The latter was the case particularly for the derivation of the age-sex structure of the population of over 45 years of age for all Directorate General of Transmigration settlements.

The age-sex compositions of the existing settlements were calculated with reference to these three sources of information. Table A.9 summarises for each settlement the derivation of the age-sex composition.

A.2.4 Estimates of school population

The prediction of school population within Indonesia has not been undertaken on a comprehensive scale, although satisfactory base data relating to the prevailing levels for 1971, 1972, and 1973 is available. In making our projections we have relied upon a study undertaken by Prof. N. Iskandar to estimate the possible levels of future school attendance.[1]

The fundamental assumption used by Iskandar is that the ratio between school attending and school age population will increase linearly between 1961 and 2001 to reach the same level as was experienced in the Netherlands in 1961. The resulting matrix of school attendance rates predicted for Indonesia are shown in Table A.10.

A comparison of the school attendance rates for the rural areas of South East Sulawesi in 1971 with those estimated by Iskandar reveals a dissimilar distribution amongst the age groups. A basic explanation of the differences is manifest in the lower levels of attendance of secondary schools in South East Sulawesi, and the later age of the pupils within each school grade, particularly at elementary level. We will therefore adopt the following assumptions.

[1] N. Iskandar, Some Monographic Studies on the Population in Indonesia, Jakarta, Lembaga Demografi Fakultas Ekonomi, Universitas Indonesia, 1970

Table A.9 The derivation of age-sex composition

Settlement	Base population	Age-sex derivation
Amoito	1682	N.D.A. Hameed – percentages applied to total population
Rambu-Rambu (1)	651	idem
Landono	2322	Provincial Office of Transmigration and Model age-sex structure
Mowila Jaya	1273	idem
Unaaha	1317	idem
Uepai	1797	idem
Tanea Baru	2006	idem
Moramo IA	1388	idem
Moramo IB	1762	idem
Lapoa	2340	idem
Ladongi IA	2925	idem
Ladongi IB	1692	idem
Ladongi II	2590	idem
Towua	1264	idem
Konda	1031	N.D.A. Hameed – actual figures
Rambu-Rambu (2)	718	idem
Pamandati	503	idem
Wolasi	226	idem
Tanea Lama	636	
Model New Settlement	2185	Model age-sex structure

Sources: *N.D. Abdul Hameed op. cit*
Provincial Office of Transmigration
SESP

Table A.10 School attendance rates for Indonesia 1961–2001

Year	Age group 5–6	7–13		14–16		17–19	
	all	male	female	male	female	male	female
1961	.120	.580	.520	.360	.230	.190	.080
1971	.320	.684	.639	.432	.296	.197	.094
1981	.520	.789	.759	.486	.362	.205	.109
1991	.720	.892	.879	.550	.428	.212	.123
2001	.920	.998	.998	.611	.494	.220	.138

Source: N. Iskandar op. cit.

a that the rates of school attendance in South East Sulawesi recorded in the 1971 census will constitute the basis of our projections.

b that the school attendance rates will linearly approach those hyphothesised by Iskandar, although his 1991 rates will not be reached in South East Sulawesi until 1996.

The two assumptions result in the estimates of overall school attendance rates in South East Sulawesi shown in Table A.11.

Table A.11 Predictions of school attendance in South East Sulawesi

Year	Age group 5–6 male	5–6 female	7–13 male	7–13 female	14–16 male	14–16 female	17–19 male	17–19 female
1971	.103	.096	.663	.434	.614	.443	.282	.130
1976	.226	.221	.709	.523	.601	.440	.268	.129
1981	.350	.346	.755	.612	.588	.437	.254	.127
1986	.473	.470	.800	.701	.576	.434	.240	.126
1991	.597	.595	.846	.790	.562	.431	.226	.124
1996	.720	.720	.892	.879	.550	.428	.212	.123

Source: SESP

The age group classification used for the population forecasts was different from the above, namely 5 year cohorts. Thus, by apportioning according to the age distribution recorded in the 1971 Census for South East Sulawesi rural areas, the rates of school attendance by 5 year age cohorts per 1000 population in each cohort were estimated as shown in Table A.12.

Table A.12 Prediction of school attendance by 5 year age groups in South East Sulawesi

Year	Age group 5–9 male	5–9 female	10–14 male	10–14 female	15–19 male	15–19 female
1971	.312	.286	.754	.677	.397	.204
1976	.414	.389	.769	.698	.389	.206
1981	.516	.491	.784	.718	.380	.209
1986	.618	.594	.800	.739	.372	.211
1991	.720	.696	.815	.759	.363	.214
1996	.822	.799	.830	.780	.355	.216

Source: SESP

A comparison with the statistics collected by the Department of Education indicates that the age groups of the school attending population within South East Sulawesi are wider than the official, nationally accepted ones. Table A.13 shows the differences.

Table A.13 Age distribution by type of school, 1972

Type of school	Age limits South East Sulawesi media range	Age limits Officia age range
Pre-primary/Primary	6–13	5–12
Junior secondary	14–18	13–15
Senior secondary	16–20	16–18

Sources: Department of Education
SESP

To apportion the future school population estimates amongst the various types of school we made two assumptions:

a by 1986, the age distribution of the school population of South East Sulawesi will approximate the official age groupings

b up to 1981, the age distribution will approximate that existing in 1972, at the beginning of the period, and then linearly approach the 1986 levels.

The resulting proportional split between age groups and school types adopted for the transmigration settlements (assuming they follow the typical pattern of the province) is outlined in Table A.14.

Table A.14 Percentage of school attending population by age group and by type of school, 1972–96

Type of school	Age groups by year											
	1972			1976			1981			1986–96		
	5–9	10–14	15–19	5–9	10–14	15–19	5–9	10–14	15–19	5–9	10–14	15
Pre-primary/Primary	100	82	–	100	77	–	100	70	–	100	63	–
Junior secondary	–	18	42	–	23	35	–	30	27	–	37	19
Senior secondary	–	–	58	–	–	65	–	–	73	–	–	81
Total	100	100	100	100	100	100	100	100	100	100	100	100

Source: SESP

The rates in Table A.14 were applied equally to both male and female school attending population.

Using statistics published by the Provincial Office of Transmigration relating to October 1976, a total of 2785 children (1619 males and 1166 females) attend a primary school located within the settlements. Applying the assumed rates of school attendance for South East Sulawesi Province to the population aged 5 to 14 within the transmigrant settlements, we have estimated a total primary school population of approximately 2550. (1500 males, and 1050 fimales). The differences, we feel, are negligible, and, accordingly, we can consider that our assumptions upon primary school attendance are realistic for the transmigrant settlements. No data are available concerning secondary school attendance, but as our implied rates are considerably lower in numerical terms we will assume they provide a realistic first estimate of potential demand.

A.2.5 The prediction of average family size

Several calculations of average family size are possible from statistics obtained from the Provincial Office of Transmigration. We analysed these for two categories:

a average family sizes of actual transmigrants in South East Sulawesi under the Directorate General of Transmigration,

b actual family sizes of the existing population within each transmigrant settlement – including those established by the Department of Social Welfare.

Taking the total transmigrant population of South East Sulawesi under the administration of the Provincial Office of Transmigration, Table A.15 shows the average family sizes of all transmigrants between 1968 and 1976.

However, the overall average conceals differential rates for each year of transmigration, shown in Table A.16.

Table A.15 Average family sizes of the transmigrant population, 1968 – 1976

Area of origin	Average family size
Java	4.03
Bali	4.61
Total	4.18

Source: SESP

Table A.16 Average family sizes by year of arrival

	Year of arrival						
	1968/69	1970	1971	1972	1973	1974	1975
Average family size	4.78	4.16	4.80	4.3	4.81	4.27	3.68

Source: SESP

From the above series we computed the 5 year mean of the average family sizes between 1970 and 1975 inclusive. A value of 4.37 resulted.

The survey of accepted transmigrants undertaken byouselves resulted in an average family size of 5.15, but, in the light of the above evidence, it was considered too large to be applicable to new settlers to South East Sulawesi. Similarly, the overall average of 4.18 throughout the whole transmigration period was considered too small. Accordingly, we have adopted the assumption that for new transmigrants into South East Sulawesi average family size will equal that estimated for transmigrants into the area during the 1970–1975 five year period.

The average family size of 4.37 was thus used to estimate the initial base population of the model new settlement of 500 families.

Table A.17 shows the latest estimates of family sizes in those settlements which were established under the Directorate General of Transmigration.

Table A.17 Average family size of transmigration settlements

Settlement	Average family size	Date
Amoito	5.55	July 1975
Rambu Rambu	4.68	July 1975
Landono	4.44	Oct. 1976
Mowila Jaya	4.02	,,
Towua	4.14	,,
Ladongi IA	4.39	,,
Ladongi IB	4.17	,,
Ladongi II	4.76	,,
Unaaha	4.38	,,
Uepai	3.60	,,
Tanea Baru	3.90	,,
Moramo IA	2.84	,,
Moramo IB	3.69	,,
Lapoa	4.68	,,

Source: Provincial Office of Transmigration.

Only three of these settlements, Amoito, Rambu Rambu and Tanea Baru have had all of their total transmigration population resident for five or more years. Table A.18 compares the average family sizes of these settlements at the time of the initial settlement with those existing in 1976 and illustrates the extent to which family sizes have changed.

Table A.18 Changing family sizes in Amoito, Rambu Rambu and Tanea Baru

Settlement	Initial estimate		Latest estimate		Change percent per annum
	Ave. family size	Date	Ave. family size	Date	
Amoito	4.78	1968	5.55	1975	+ 0.11
Rambu Rambu (T)	4.16	1970	4.68	1975	+ 0.10
Tanea Baru	4.19	1969	3.90	1976	– 0.04

Source: SESP

Thereafter two further assumptions were made:

a Constant average family sizes for the pre 1971 settlements including those of the Department of Social Welfare.

b Further increases at the above annual rate for the remaining settlements up to 1986, but constant thereafter.

For the model new settlement we have assumed that during the first 15 years period, the average family size will increase by 0.05 persons per annum. No further change is predicted thereafter.

Table A.19 Changing family sizes in Rambu Rambu (D.S.) and Pamandati

Settlement	Average family size		Change per cent per annum
	Initial	1976	
Rambu Rambu (DS)	4.75	5.36	+ 0.10
Pamandati	5.39	5.72	+ 0.06

Source: SESP

The remaining transmigrant settlements of the Directorate General of Transmigration, although being in existence for much shorter time periods, exhibit average annual changes in family sizes similar to the pattern illustrated in tables A.18 and A.19.

No detailed analysis of these settlements has been undertaken, since it is difficult to isolate realistic changes in family sizes in view of the fact that available data includes families of much later arrival dates than the year of establishment of the settlement.

In overall terms there has been a general increase in family sizes over the past five years. We have hypothesised a further increase in family sizes up to 1986 for all settlements, at the annual rate of 0.05 persons per family. This assumption was based upon the overall average increases per annum for all settlements in existence over the full five year period of 1971–76.

Applying the assumed changes in average family size to the 1976 base data, Table A.20 presents the resulting projected average family size.

Table A.20 Projected average family size, 1981 – 1996

Settlement	1981	1986	1996
Amoito	5.80	6.05	6.05
Rambu Rambu	4.93	5.18	5.18
Landono	4.69	4.94	5.19
Mowila Jaya	4.27	4.52	4.77
Towua	4.39	4.64	4.89
Ladongi IA	4.64	4.89	5.14
Ladongi IB	4.42	4.67	4.92
Ladongi II	5.01	5.26	5.51
Unaaha	4.63	4.88	5.13
Uepai	3.85	4.10	4.35
Tanea Baru	4.15	4.40	4.40
Moramo IA	3.09	3.34	3.59
Moramo IB	3.94	4.19	4.44
Lapoa	4.93	5.18	5.43
Konda	5.43	5.68	5.68
Rambu Rambu (DS)	5.61	5.86	5.86
Pamandati	5.97	6.22	6.22
Wolasi	5.51	5.76	5.76
Tanea Lama	4.15	4.40	4.40
	After 5 yrs.	After 10 yrs.	After 20 yrs.
Model new settlement	4.62	4.87	5.12

Source: SESP

A.2.6 Future non planned migration

We have only very limited information on the number of transmigrants moving into or from the existing settlements. The records made available to us cover only 10 settlements up to June 1975. These records indicate a very low net outflow of population, about 1 per cent of the number of the original settlers.

In view of the insignificant nature of net outward migration, and in view of lack of information since mid-1975, we decided to restrict population projections to natural increase alone. Thus we have assumed that nil net spontaneous migration will take place over the next 20 year period.

A.2.7 Labour force participation rates

Data relating to the actual rates of labour force participation were unavailable for the existing transmigration settlements, and accordingly we have based our assumptions on information collected, by A. Speare[1] for his projections of population and labour force for regions of Indonesia. Basically these rates were estimated from adjusted 1971 census material according to the methodology suggested by G. Jones[2].

Estimates were made in this study by region, and by adopting those rates applicable to rural South and South East Sulawesi we have the best estimates at present available within our study area. The age-sex specific rates are presented in Table A.21.

1 Op. cit.

2 G. Jones, What do we know about the Labour Force in Indonesia Masalah Demografi Indonesia? No. 2, 1974

Table A.21 Labour force participation rates for the rural areas of South and South East Sulawesi, 1971

Age group	Males	Females
10–14	.24	.11
15–19	.56	.24
20–24	.89	.24
25–29	.95	.23
30–34	.95	.22
35–39	.96	.23
40–44	.94	.23
45–49	.93	.22
50–54	.90	.21
55–59	.85	.19
60–64	.77	.18
65–69	.73	.14
70 +	.50	.11

Source: A Speare op. cit.

Both studies of the projection of future labour force participation rates have assumed constant rates throughout the forecasting period. We feel that such assumptions are justified for age groups 20–24 and above, but we have adjusted those for the lower age groups in accordance with the predicted rise in the rate of school attendance. Table A.22 presents the resulting predictions of labour force participation rates for age groups 10–14 and 15–19.

Table A.22 Prediction of labour force participation rates, 1976–96

Age group	Year							
	1976		1981		1986		1996	
	Male	Female	Male	Female	Male	Female	Male	Female
10–14	.22	.10	.21	.09	.19	.09	.16	.07
15–19	.56	.24	.56	.24	.56	.23	.56	.23

Source: SESP.

The above rates, combined with constant values for all other age groups, were adopted for the prediction of labour supply within the existing and new transmigrant settlements.

A.2.8 Population projection method

Using the assumptions previously discussed, this section briefly outlines the method adopted for the projection of the population of the transmigrant settlements.

October 1976 was selected as the base date for all projections relating to the existing settlements mainly for two reasons:

a it is the latest date for which the majority of information is readily available

b it is almost exactly 5 years since the latest full population census was conducted, from which many of the assumptions have been interpolated.

The majority of the base population data was either supplied by the Provincial Office of Transmigration or was hypothesised from other official data sources.

The method used was the cohort survival model, where the base population of each settlement was disaggregated into 5 year age/sex categories. Age specific birth and death rates for the forecasting interval were applied to each of these categories to derive both their populations and the total population at each forecast year. Mathematically the model can be expressed as:

$$Pop_{(t+n)} = \sum_a Pop_{a(t+n)}$$

$$Pop_{a(t+n)} = Pop_{a(t)} + br_a Pop_{a(t)} - dr_a Pop_{a(t)}$$

where
- Pop = total population
- Pop_a = population in age/sex cohort a
- br_a = birthrate for age/sex cohort a
- dr_a = mortality rate for age/sex cohort a
- t = base year
- n = individual forecasting interval

Social services

B

B.1 Health facilities

B.1.1 Structure

The general structure of the health service within Indonesia comprises a hierarchy of four levels: hospitals, health centres and sub-centres (Puskesmas and Balai Pengobatan), mother and child health care clinics, (B.K.I.A. and Pos Kesehatan) and community health development.

B.1.2 Hospitals

Two major types of hospital are present in Indonesia, general hospitals and specialist hospitals. Within South East Sulawesi 12 hospitals are functioning; of these 11 are general hospitals, and 1 is a specialist leprosy hospital. The accepted classification of general hospitals is based upon the range of facilities present. Four such classes exist in Indonesia ranging from class D with limited facilities up to class A. Only class D hospitals are present in South East Sulawesi. Approximately 300 general hospital beds are available within the province, implying a ratio of 1 bed for every 2,500 people.

B.1.3 Health centres

Health centres are of two types, the larger Puskesmas providing a wide range of facilities for general medical care, and the smaller clinic or Balai Pengobatan. Both centres comprise a clinic building and some staff housing. In January 1976, there were a total of 39 health centres (Puskesmas) and 9 sub-centres were located in Kabupaten Kendari, and 6 health centres and 9 sub-centres in Kabupaten Kolaka. The overall objectives within the health service are to establish one Puskesmas within each kecamatan, and to provide a health centre to serve a catchment population of between 5000 and 20,000. Health centres have a staff of 10, including a qualified doctor, a nurse, a midwife and in every three centres a dental specialist. However this is not the case for all such centres in South East Sulawesi, where several are without a resident qualified doctor. Lower levels of staffing too are evident for the sub-centres, but no general rule applies.

B.1.4 Other health establishments

Below the health centre, usually at the village level there are mother and child health care clinics, which are generally staffed by 2 or 3 people and include a midwife or an auxilliary medical worker. Such facilities however are not located or planned to be located in every village. 43 mother and child health care centres were located in the province at January 1976, of which 9 were located in Kabupaten Kendari and 4 in Kabupaten Kolaka.

The total employment within the health centres and mother and child health care clinics of South East Sulawesi in January 1976 was 861, of which only 25 people were qualified doctors. Table B.1 gives the breakdown of such employment into rural and urban locations.

Table B.1 Employment in health centres and clinics, South East Sulawesi, 1976

Occupation	Number employed		
	Urban areas	Rural areas	Total province
Qualified doctor	15	10	25
Dentist	1	–	1
Nurses-academically qualified	12	–	12
– other qualification	47	23	70
– assistant	148	250	398
– dental	2	5	7
Auxilliary workers	52	81	133
Midwives	19	11	30
Nutritionist – academically qualified	1	–	1
– assistant	3	–	3
Sanitary – academically qualified	4	–	4
– other	13	29	42
Chemists and assistants	11	–	11
Nursery and midwifery teacher	4	–	4
Administrative staff	116	4	120
Total	448	413	861

Source: Department of Health, Kendari

The lowest level of health service provision is basically a self-help procedure encouraged by the Department of Health to expand the extent of the service through the participation of the community. Basically, a volontary village health worker is recruited and given elementary medical training. His main functions are to attend the basic medical needs of a neighbourhood comprising between 10 and 25 families, to educate the population on health and sanitation, to provide some forms of contraception and to undertake surveillance on disease outbreaks. Such health workers normally operate from their own home, although in some cases the community has built a health post.

B.2 Education

B.2.1 Structure

The basic structure of the education system within Indonesia and manifest in the province of South East Sulawesi comprises a three structure:

(1) Pre-primary/primary
(2) Secondary
(3) Higher education

Our prime concern is with the first two levels, and for the purposes of this study no analysis will take place of higher education supply or demand.

B.2.2 Primary schools and Secondary schools

Primary education is divided into two levels, pre-primary education comprising two grades and primary or basic education comprising three to six grades. The official age-groups for pre-primary education are 4–6 and for basic primary education 7–12. Primary school education is generally of one type, but the schools either comprise the full 6 grades or at present comprise a lower number. The latter are basically the result of IMPRES, to expand the extent of the basic education service.

Secondary education is also divided into two levels – junior education covering age 13 to 15 in three grades and senior education for ages 16 to 18 also in three grades. Although these age groups are recommended throughout the state, the present situation in South East Sulawesi is slightly different because of an overlapping of age-groups amongst school types and between grades, due to as implied later starting age for education. Both junior and senior secondary education is undertaken in either of four types of schools segregated according to subject specialisation. The four types of secondary schools are classified in the Table B.2 using the Indonesian abbreviation.

Table B.2 Classification of secondary schools

Type	Junior Secondary	Senior Secondary	
General Education	SMP	SMA	
Economic High School	SMEP	SMEA	
Home Economic High School	SKKP	SKKP	SKKA
Technical High School	ST	ST	STM

Source: Department of Education, Kendari

In addition to these schools at the secondary level, there are also establishments for teacher education (SPG).

B.2.3 Primary education

To analyse the provision of schools, school population and teacher pupil ratios we have used data obtained from both the Department of Education in South East Sulawesi and that in Jakarta. The former set of data relates to the present day (mid 1976) and pertains to cover all educational establishments within the province. However comparisons of this data with that relating to 1972/1973 obtained from the Central Education Department and accepted as the official statistics, reveals that for some types of secondary education only a partial picture has been recorded. We have therefore taken the 1972/73 data as the overall base, upon which areal variations and ranges have been estimated by reference to the later statistics.

No statistics are available regarding the extent of pre-primary education within the province and accordingly the data presented about primary education refers to schools providing basic education – Sekolah Dasar (SD). In 1973 there were some 662 primary schools located in the province, comprising approximately 92,000 pupils and 2800 teachers. The average provincial school size was 139 pupils, there were 33 pupils per teacher overall and the average class size was approximately 24 pupils.

Using the 1976 data, we have estimated a primary school population of approximately 109,000 pupils educated in 790 schools comprising approximately 3800 teachers. Accordingly we have estimated an original reduction in the average school size to 138 pupils, a lowering of overall class size to 22 pupils and an improvement of the pupils to teacher ratio to 21. Nevertheless the overall statistics conceal significant variations between schools and location. Table B.3 presents the primary school statistics by Kabupatens Kendari and Kolaka.

Table B.3 Primary Education Statistics, South East Sulawesi, 1976

Area	No. of schools	Pupils	Teachers	Classes	Average school size	Average class size	Pupils to teacher
South East Sulawesi	790	109,000	3800	5100	138	22	21
Kabupaten Kendari	246	32,000	1300	1600	129	20	25
Kabupaten Kolaka	109	14,000	500	700	126	19	26

Within Kendari the range of total primary school size is between 90 and 250 pupils, whilst that for Kolaka is between 70 and 170 pupils. Similarly, variation are evident in class size according the grade within the schools. In general terms the lower grade class sizes exceed these of the higher levels. For instance average grade VI class sizes are 45–60 per cent of grade I class sizes. First grade class sizes of over 40 pupils are common in Kendari and Kolaka, whilst those of the final grade are usually between 10 and 25.

B.2.4 Secondary education

The secondary education system of the province is more complex, and is not helped by the fact of data discrepancies relating to 1976. We have complete statistics for 1972, but only partial coverage for 1976. Using the official data for 1972, Table B.4 summarises the provision of secondary education in South East Sulawesi.

Table B.4 Secondary Education Statistics, South East Sulawesi 1972

	Type of school								
	Junior secondary				Senior secondary				
	SMP	SMEP	SKKP	ST	SMA	SMEA	SKKA	STM	SPG
Number of schools	55	35	9	3	6	9	3	3	7
Number of pupils	6742	4140	902	1224	1103	1741	224	446	717
Number of teachers	498	334	86	159	100	185	33	56	78
Average school size	123	118	100	408	184	193	74	149	102
Average pupils per class	29	25	21	n.a	26	30	20	n.a	30
Average pupils per teacher	14	12	10	8	11	9	7	8	9

Aggregating the above data we have estimated the following overall ratios

	Junior secondary	Senior secondary
Average school size	128	151
Average pupils per teacher	12	9
Average class size	27	28

Changes since 1972 can be seen by comparing Table B.5 with Table B.4 No statistics were available concerning the number of classes within each school, and although we have presented statistics relating to the average number of pupils per grade they are not strictly comparable to average class sizes. Nevertheless average school size and the pupils to teacher ratios are comparable.

Table B.5 1976 Education Statistics – South East Sulawesi

Type of school	Area	Average school size	Pupils to teacher ratio	Average No of pupils per grade per school
SMP	South East Sulawesi	204	20	70
	Kabupaten Kendari	205	19	68
	Kabupaten Kolaka	137	18	46
SMEP	South East Sulawesi	119	10	40
	Kendari	78	7	26
	Kolaka	82	11	27
STM	South East Sulawesi	177	11	59
	Kendari	85	9	28
	Kolaka	n.a	n.a	n.a
SKKP	South East Sulawesi	101	7	34
	Kendari	105	6	35
	Kolaka	54	7	18
SMA	South East Sulawesi	242	17	81
	Kendari	268	18	90
	Kolaka	176	15	59
SMEA	South East Sulawesi	164	10	54
	Kendari	166	10	55
	Kolaka	94	9	31
STM	South East Sulawesi	202	15	67
	Kendari	248	23	83
	Kolaka	181	12	87
SKKA	South East Sulawesi/Kendari	102	10	34
SPG	South East Sulawesi	274	14	91
	Kendari	205	8	68
	Kolaka	109	18	36

B.2.5 Conclusions

The most significant findings at the provincial level are:

a An increase in the average school size and pupil to teacher ratios for both junior and senior schools for general secondary education.

b Generally similar average school sizes and pupil to teacher ratios for all other junior secondary schools.

c Increases in both average school sizes and pupil to teacher ratios for all other senior secondary education.

This reflects an increasing demand for secondary education, particularly that of a general nature, due to the improving standards of primary education and a tendency for pupils to continue their education.

Variations are evident between Kabupaten Kendari, Kabupaten Kolaka, and the Province, but generally for junior secondary education in both Kendari and Kolaka, the average school sizes and pupils to teacher ratios are lower than the provincial averages.

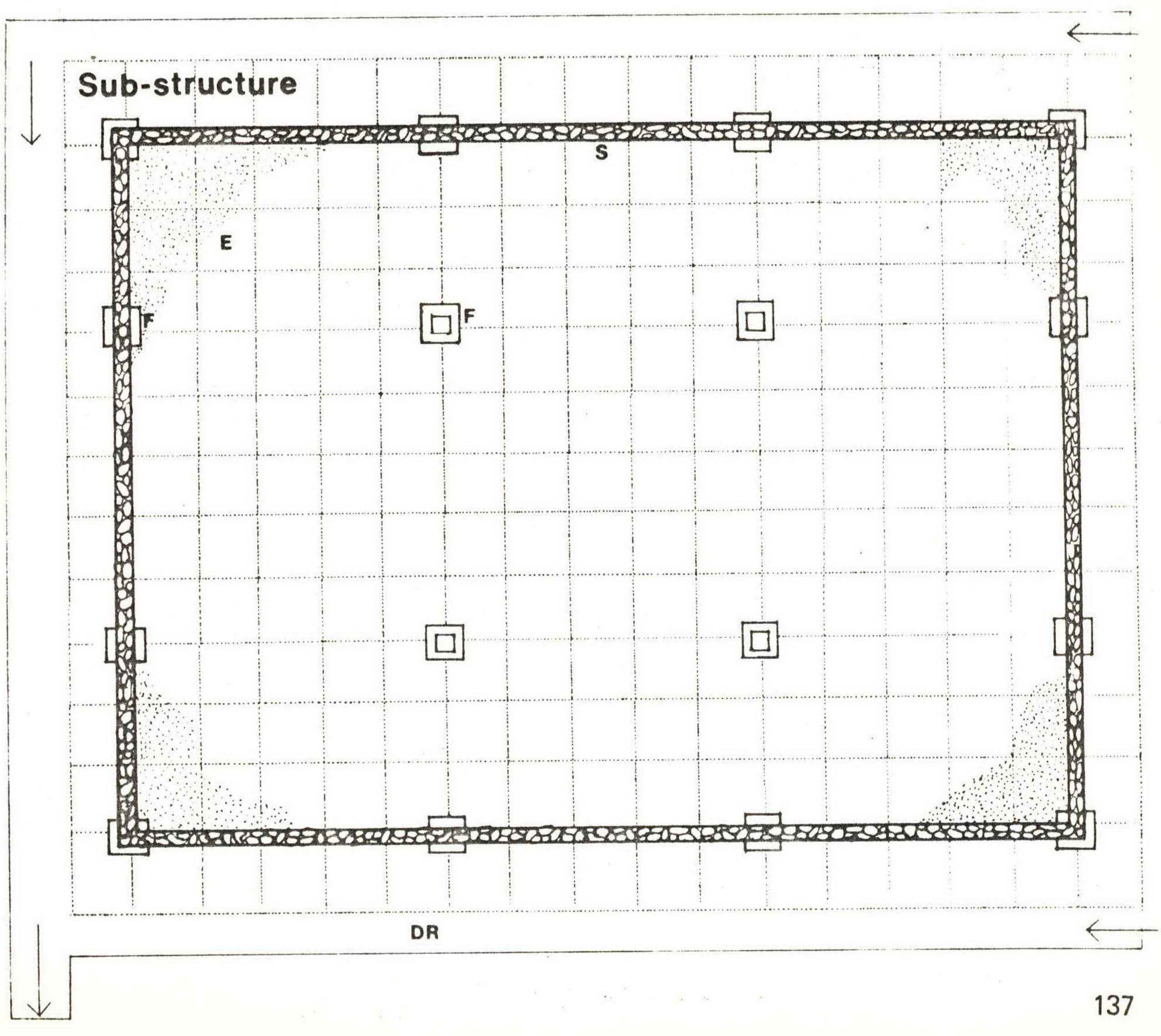
As with the primary education statistics the overall average figures conceal the wide variations between schools themselves. For instance the range of SMP school sizes within Kendari is between 120 and 630 pupils, and for Kolaka between 60 and 300 pupils. Smaller variations are evident for other secondary schools (particularly those at the senior levels), and in general they are closer to the average figures for the kabupaten.

Housing and design studies

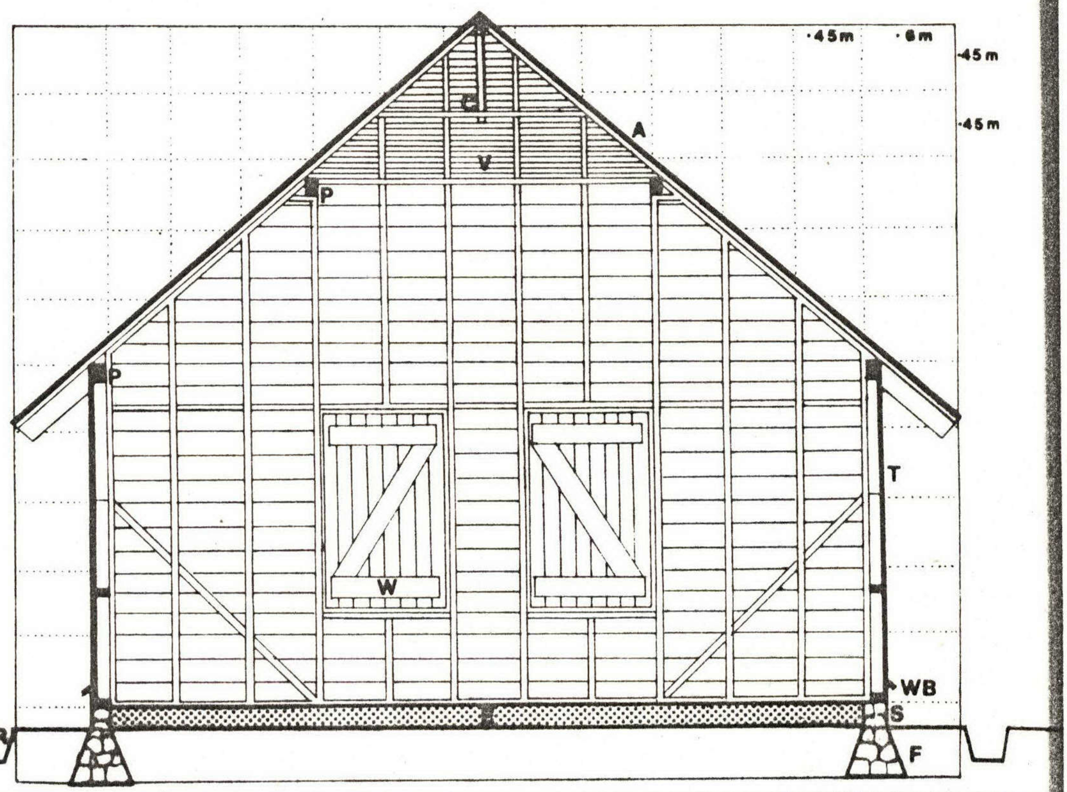
C

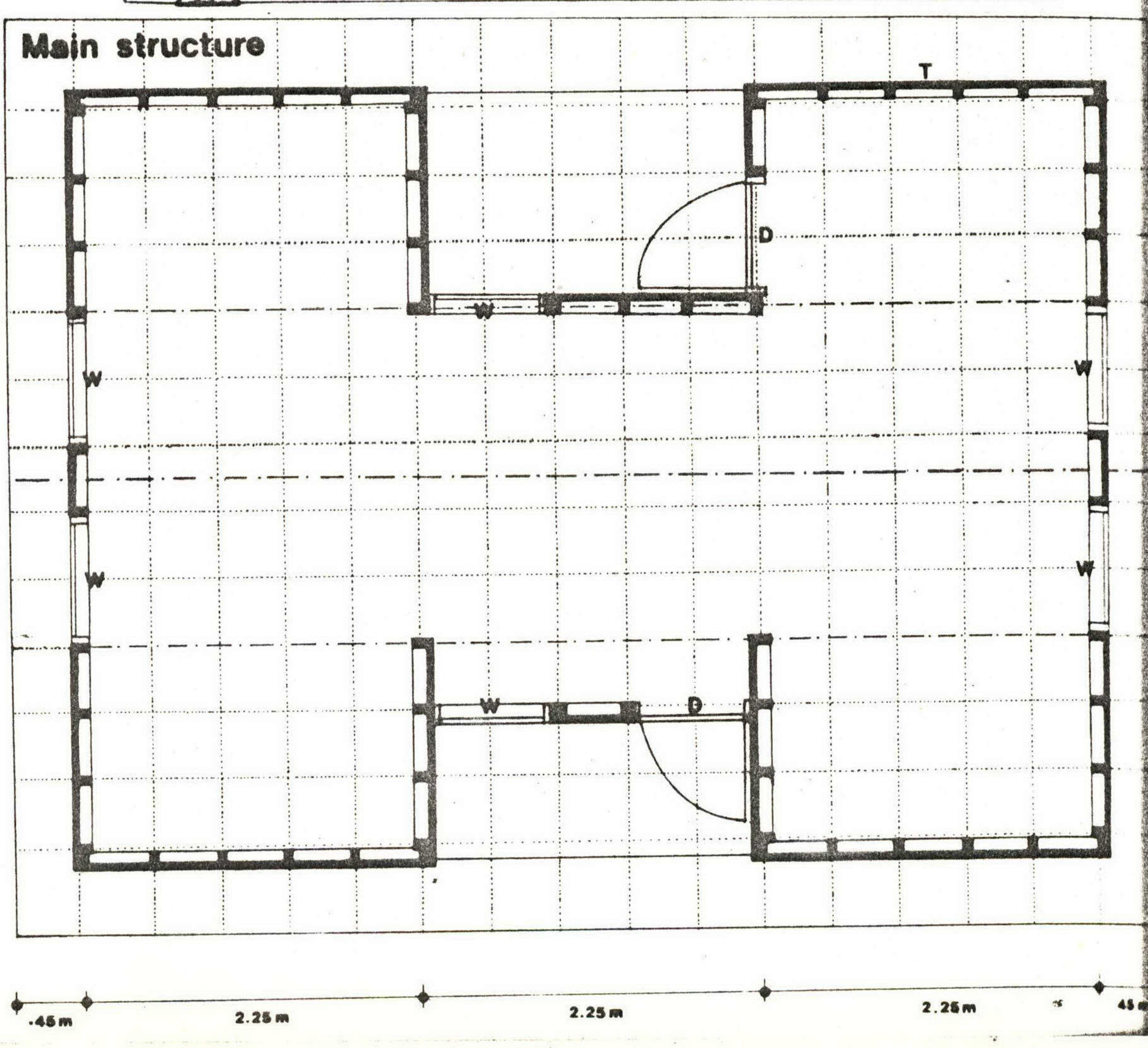
Construction details — balloon frame house

C	bamboo collars and struts	T	timber balloon frame and timber cladding
A	atap rumbia on bamboo rafters	DR	drainage ditch
S	stone fender wall	F	stone foundation
V	vent	P	timber purlin
W	ledged and braced window	B	timber barge board
D	ledged and braced door	WB	timber weather–board
E	consolidated earth floor		

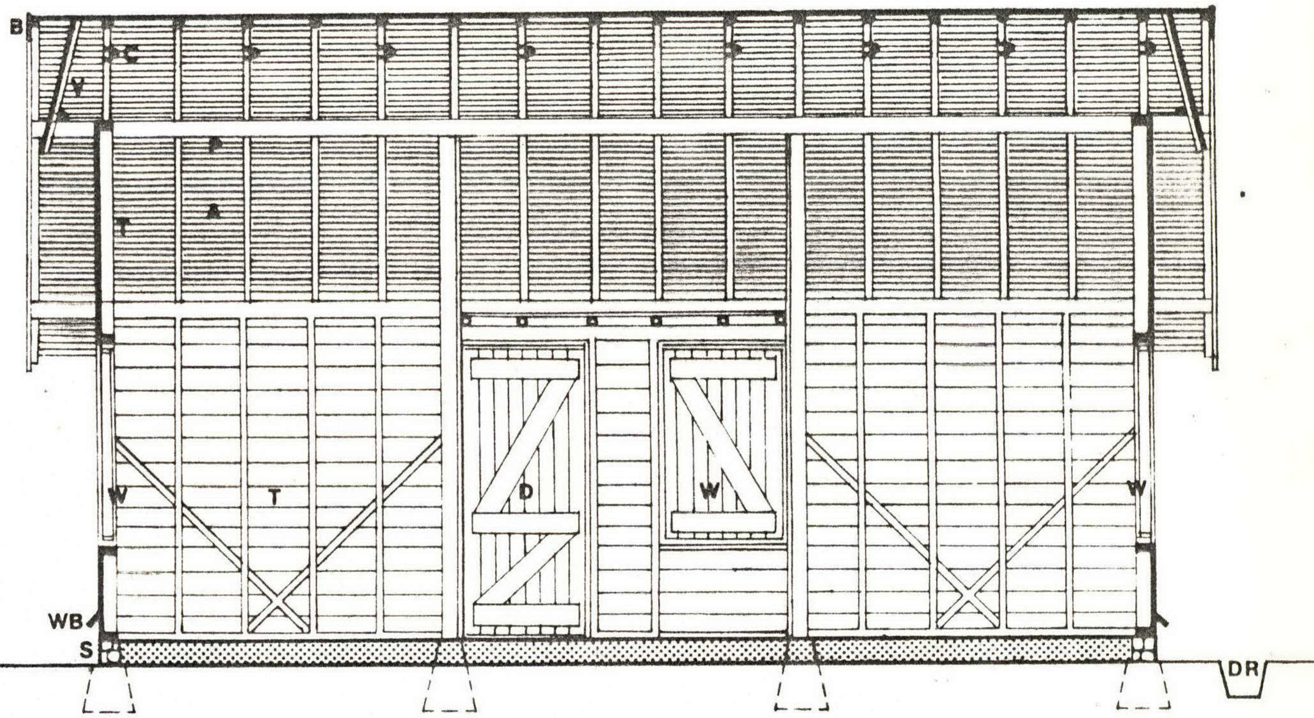


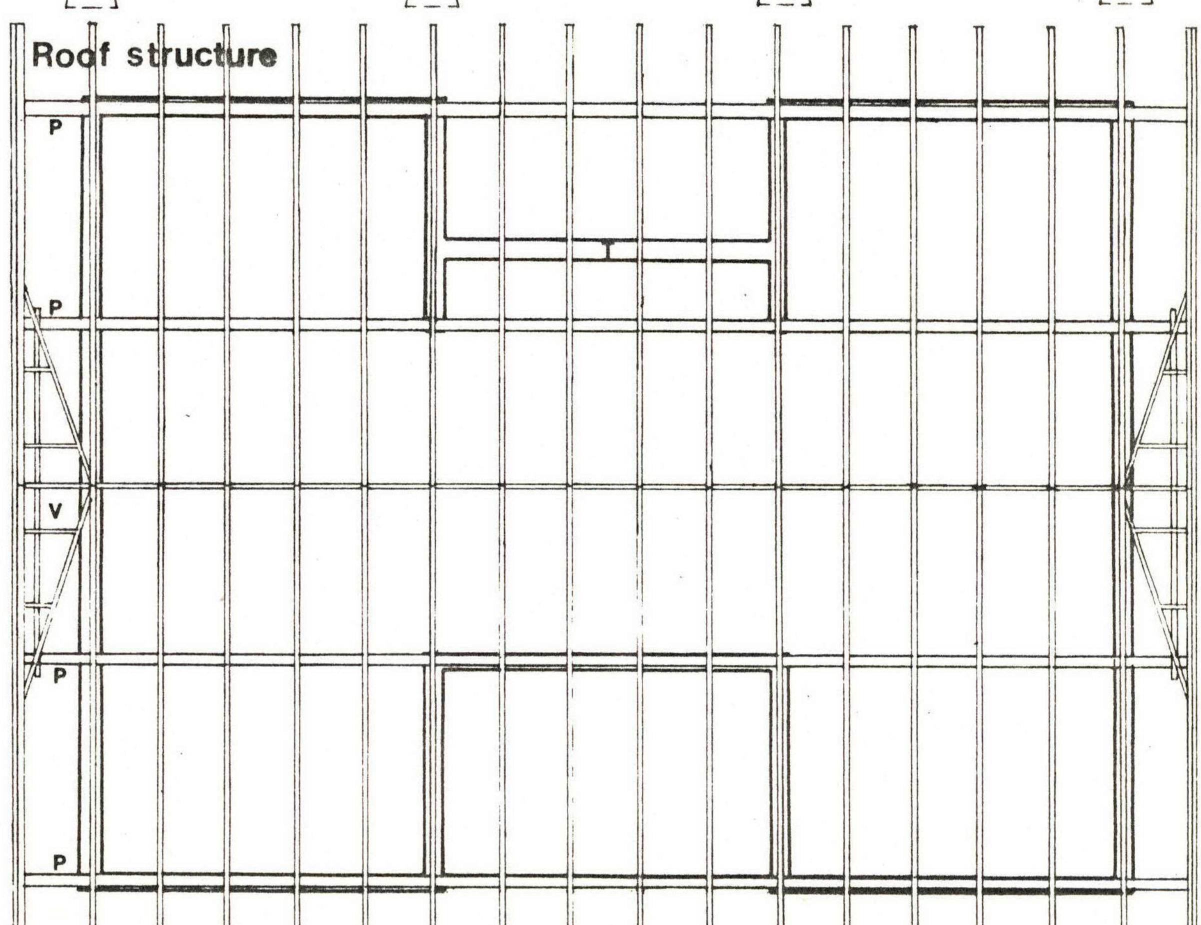
Construction details – balloon frame house

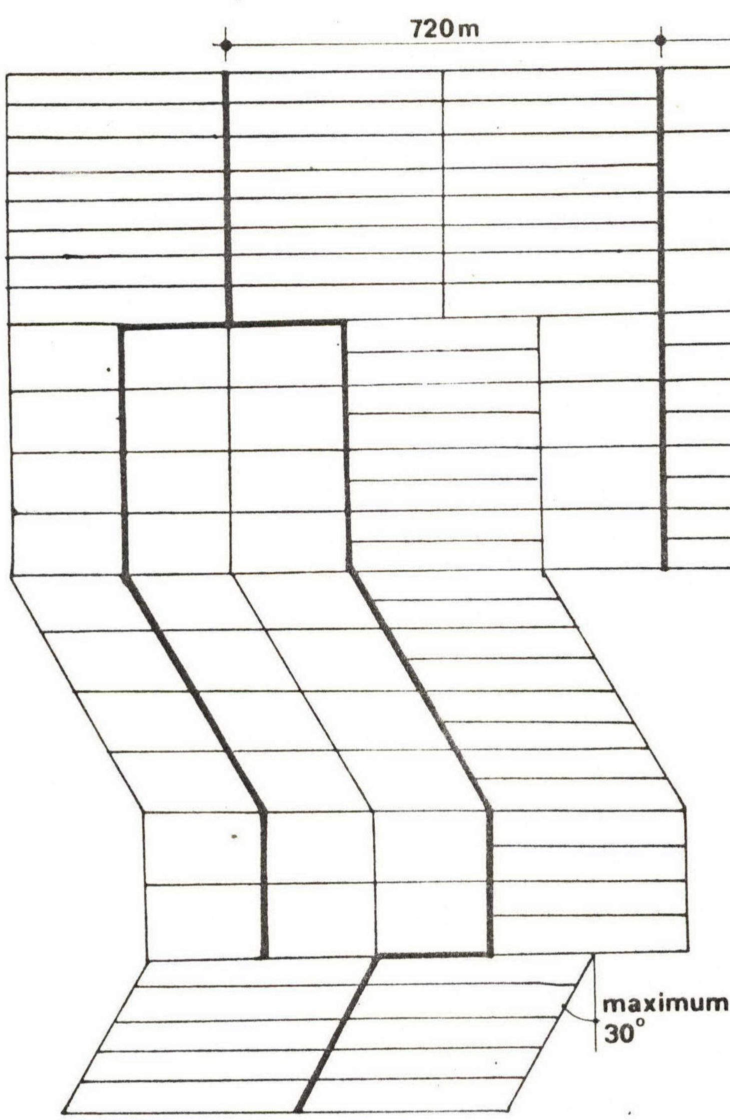




Construction details – balloon frame house



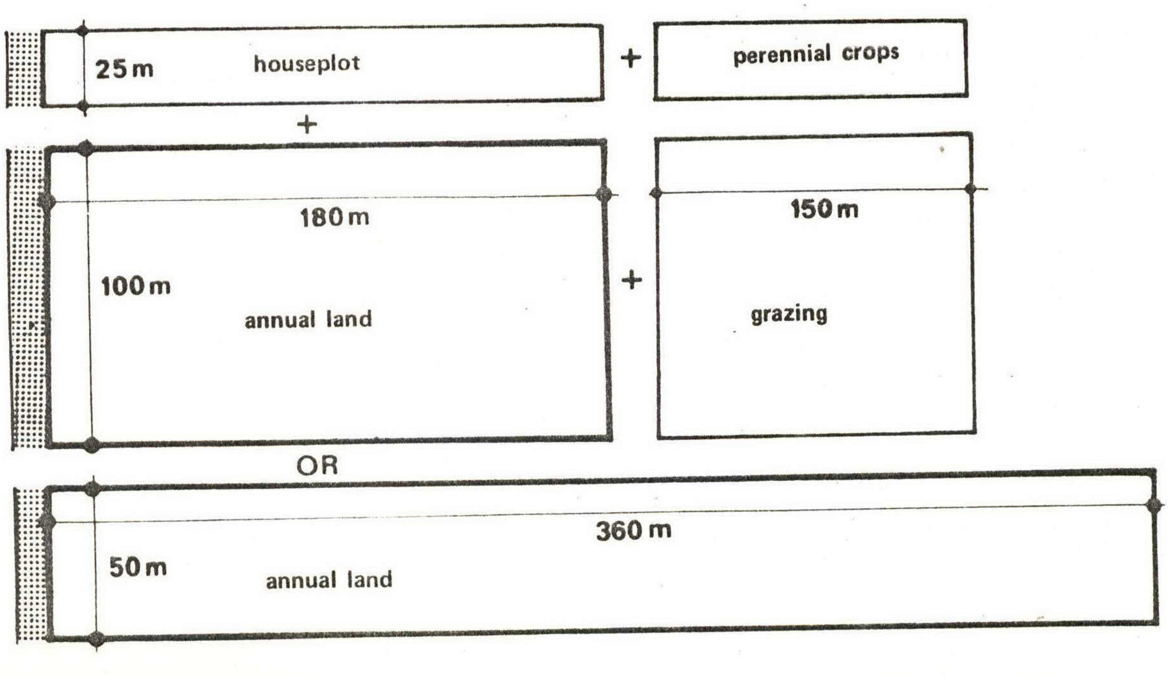




road spacing

twisting of plots

Makaleo – plot dimensions



Water supply

D

Measurements of existing water source.

Location	Source	Visit date	Water level (m)	Depth	EC (u mhos/cm)	Temp (°C)	Remarks
Lambuya	Shallow well	3-12-76	Near ground surface	–	460	30.5	
Lambuya	Hot spring	,,	–	–	4100	42.0	Very slight sulphur smell
Teteona	Shallow pit	4-12-76	Near ground surface	–	340	26.5	Near old river course
Lalohao	PSIG bore-hole	,,	–	152.0	210	27.5	Equipped with hand pump
Jati Bali	Dug well	6-12-76	3.5	7.5	360	27.0	Sand, gravel + cobbles under lie 2.5 m red earth
Sindangkasih	Dug well	,,	4.5	–	400	27.0	Equipped with hand pump
Boro Boro	Stream	,,	–	–	800	25.0	Dutch instal-lation, sup-plying air-port 6km away
Landono I	Dug well	,,	6	–	340	27.0	
Landono I	Shallow bore	,,	–	± 6	670	29.0	
Mowila Jaya	Shallow bore	,,	–	± 9	850	27.0	Water very dirty
Konda	Dug well	7-12-76	0.5	–	650	27.0	
Konda	Shallow bore	,,	–	± 8	280	27.0	
Tanea Baru	Artesian bore	,,	–	–	550	25.5	Water milky
Tanea Baru	Artesian bore	,,	–	–	1000	25.5	
Wolasi	Dug well	,,	3	–	400	25.5	
Wolasi	Stream from spring	8-12-76	–	–	350	24.5	Water source for Dep. Sos. settlement
Pamandati	Dug well	8-12-76	5	–	650	26.5	
Pamandati	Spring	,,	–	–	1750	27.0	Tidal zone. Some mixing with sea water

Lapoa	Dug well	9-12-76	5.5	7.3	350	28.0	Reported be only p manent w in settlem
Lalongasumate	Flowing PSIG well	,,	–	152	280	29.0	
Baito	Dug well	,,	± 4	–	700	25.5	Perennial
Rambu Rambu	Dug well	,,	± 4	7	240	26.0	
Uepai	Dug well	10-12-76	± 4	–	520	28.0	Gravel la
Uepai	Shallow bore	,,	–	–	280	28.0	
Uepai (Bali)	Dug well	,,	± 2	2.5	500	27.0	Perennial
Unaaha	Dug well	,,	1.5	3	1000	27.0	Perennial
Lameuru	Spring	11-12-76	–	–	80	26.0	Dark blu grey, sof micaceou sand, ver
Lameuru	Seep	,,	–	–	210	26.5	

Source: SESP

Cost estimates

E

APPENDIX E

Basic costs of labour, material and plant including transportation used in calculating the major unit rates for transmigration buildings and infrastructure works

Item	Unit	Rate (rupiahs)
Labour (per eight hour day)		
Labourer	day	400
Ganger	day	500
Tradesman	day	750
F)reman Tradesman	day	1,000
Material (all prices delivered to site)		
Coarse filling sand	m^3	500
Concrete sand	m^3	600
Coral stone	m^3	800
River stone	m^3	800
Crushed gravel	m^3	1,500
Crushed granite	m^3	3,000
Broken river stone	m^3	1,000
Crushed stone and gravel mixed	m^3	1,200
Cement	40 kg	2,000
Bricks	each	8
Mild steel reinforcing rods	kg	300
Nails	kg	350
Clout headed nails	kg	1,000
Panel pins	kg	600
Mild steel bots		
a 1/2" diameter	inch	20
b 5/8" diameter	inch	25
Timber		
Class 1		
Ebony	m^3	45,000
Bayam	m^3	50,000
Besi	m^3	50,000
Teak	m^3	60,000

APPENDIX E (contd)

Item	Unit	Rate (rupiahs)
Class 2		
Pooti)		
Enau)	m^3	25,000
Kecapi)		
Class 3		
Naato)	m^3	14,000
Kumo)		
Atap rumbia roof sheets size 1000 mm & 400 mm	each	18
Gedek panels	m^2	100
50 mm diameter bamboo	m^2	25
33 BWG corrugated iron roof sheets 65 cm wide	m	120
33 BWG flat metal sheets size 900 mm x 1800 mm	each	850
2 mm clear sheet glass	m^2	2,000
3 mm ditto	m^2	3,000
5 mm ditto	m^2	7,500
3 mm obscured glass	m^2	4,500
Tar paint	kg	400
Solar paint	kg	400
Emulsion paint	kg	700
Enamel paint	kg	1,000
600 diameter reinforced concrete pipe	m	6,000
900 mm ditto	m	8,000
Lime	m^3	10,000
Plant		
D6c straight blade track type roller	hour	11,985
D3/931 backhoe	hour	6,512
120 g motor grader	hour	9,603

N.B. The above plant costs provided by PT Trackindo Utama, main dealers for caterpiller plan Indonesia.

10 ton roller	hour	1,000
Diesel	1	50

All plant hourly costs are inclusive of operator and all fuel and maintenance costs.

APPENDIX E.1 Build up of the major unit rates used in estimating the cost of a transmigrants house and other village buildings

Item			Unit of measurement	Rate (rupiahs)
Land preparation				
Land clearing, the area of the site of bushes, and other foliage				
One labourer 40 m² per day $\frac{400}{40}$ = 10 Rp			m^2	10
Hand excavation				
Excavation for post holes and cart away surplus excavated material a distance not exceeing 30 metres				
In soft soil				
Excavation	3.25 hours/m^3			
Cart away	0.80 hours/m^3			
	4.05			
Say	4.00 hours			
Labourer 4.00 hours @ 50 Rp		200 Rp		
Foreman 0.40 hours @ 62 Rp		25 Rp		
		225 Rp	m^3	225
In stiff soil				
Excavation	4.50 hours/m^3			
Cart away	1.00 hours/m^3			
	5.50 hours			
Labourer 5.50 hours @ 50 Rp		275 Rp		
Foreman 0.60 hours @ 62 Rp		37 Rp		
		312 Rp	m^3	312
Excavation not exceeing 150 mm deep over area, and cart away surplus excavated material a distance not exceeding 30 metres				
In soft soil				
Excavation	1.80 hours/m^3			
Cart away	0.80 hours/m^3			
	2.60 hours			
Labourer 2.60 hours @ 50 Rp		130 Rp		
Foreman 0.25 hours @ 62 Rp		15 Rp		
		145 Rp	m^3	145
In stiff soil				
Excavation	2.00 hours/m^3			
Cart away	1.00 hours/m^3			
	3.00 hours			

APPENDIX E.1 (contd)

Labourer 3.00 hours @ 50 Rp		150 Rp		
Foreman 0.30 hours @ 62 Rp		19 Rp		
		169 Rp		
	Say	170 Rp	m^3	170

Sand filling
Material

1.1 m^3 coarse sand @ 500 Rp/m^2	550 Rp		
Labour including wheeling a distance not exceeding 30 metres			
Labourer 2.00 hours @ 50 Rp	100 Rp		
Mandor 0.20 hours @ 62 Rp	12 Rp		
	112 Rp		
	662 Rp	m^3	662

Unreinforced concrete
The quantities of materials required for 1 m^3 of set concrete, using broken stone as coarse aggregate with dry sand and cement weighing 1.44 tons per cubic metre are listed in the table below.

Nominal mix by volume — Broken stone 45 % Voids

Coarse aggregate	Sand	Cement	Dry Sand		
			Coarse aggregate	Sand	Cement
			m^3	m^3	Tons
3	2	1	0.75	0.50	0.369
4	2	1	0.88	0.44	0.320
6	3	1	0.92	0.46	0.227

The time required for mixing and placing concrete are listed in the table below

Description — Mixing and placing concrete, using concrete mixers of the size shown per cubic metre

	7/5		10/7		14/10	
	Mixing plant/ hours	Labour hours	Mixing plant/ hours	Labour hours	Mixing plant/ hours	Labour hours
Concrete in small bases	0.70	4.20	0.50	3.40	0.40	3.20
Concrete in mass foundations	0.55	3.30	0.45	3.10	0.35	2.90
Concrete in beds	0.65	4.00	0.50	3.40	0.40	3.20

All the above times exclude wheeling or transporting which are allowed for separately.

The cost of 1 m³ of concrete 6:3:1 mix is : –

Materials				
Coarse aggregate	0.92 m^3 @ 1,000 Rp	=	920 Rp	
Sand	0.46 m^3 @ 600 Rp	=	276 Rp	
Cement	0.227 tons @ 50,000 Rp	=	11,350 Rp	
			12,546 Rp	m^3

The cost of 1 m³ of concrete 4:2:1 mix is : –

Materials				
Coarse aggregate	0.88 m^3 @ 1,000 Rp	=	880 Rp	
Sand	0.44 m^3 @ 600 Rp	=	264 Rp	
Cement	0.32 tons @ 50,000 Rp	=	16,000 Rp	
			17,144 Rp	m^3

The cost of 1 m³ of concrete 3:2:1 mix is : –

Materials				
Coarse aggregate	0.75 m^3 @ 1,000 Rp	=	750 Rp	
Sand	0.50 m^3 @ 600 Rp	=	300 Rp	
Cement	0.369 tons @ 50,000 Rp	=	18,450 Rp	
			19,500 Rp	m^3

The cost of mixing and placing concrete using a 7/5 mixer adaquate for small building works is : –

Insmall bases

Total labour per m^3 = 4.20 hours

6 workmen employed i.e.

$$\frac{4.20}{6} = 0.70 \text{ hours/per workman}$$

Of 5 labourers and 1 tradesman

i.e.			
Labourer 5 x 0.70	= 3.50 hours @ 50 Rp	=	175 Rp
Tradesman	0.70 hours @ 94 Rp	=	66 Rp
			241 Rp
Foreman	0.50 hours @ 125 Rp	=	63 Rp
			304 Rp

The cost of mixing and placing concrete (contd)

In mass foundations

Total labour per m^3 = 3.30/hours

6 workmen employed i.e.

$$\frac{3.30}{6} = 0.55 \text{ hours/per workman}$$

Unreinforced concrete (contd)

i.e.

Labourer 5 x 0.55	= 2.75 hours @ 50 Rp	=	138 Rp
Tradesman	0.55 hours @ 94 Rp	=	52 Rp
			190 Rp
Foreman	0.60 hours @ 125 Rp	=	75 Rp
			265 Rp

In beds

Total labour per m^3 = 4.00 hours

6 workmen employed i.e.

$$\frac{4.00}{6} = 0.67 \text{ hours/per workman}$$

Of 4 labourers and 2 tradesmen

i.e.

Labourer	4 x 0.67	= 2.68 hours @ 50 Rp	=	134 Rp
Tradesman	2 x 0.66	= 1.32 hours @ 94 Rp	=	124 Rp
				258 Rp
Foreman		0.70 hours @ 125 Rp	=	88 Rp
				346 Rp

The cost of wheeling in barrows a distance not exceeding 30 metres is 1.20 hours per m^3

∴ Labourer 1.20 hours @ 50 Rp = 60 Rp

(No supervision required for this work)

N.B. The cost of hire and running of mixers is included in the percentage addition added to the summary of individual costs under "Contractors own overheads and profit".

The total cost of making, mixing and placing and wheeling concrete is : —

Concrete (6:3:1) in:

Small bases			
Material	12,546 Rp		
Mixing and placing	304 Rp		
Wheeling	60 Rp		
	12,910 Rp	m^3	12,910

Mass foundations			
Materials	12,546 Rp		
Mixing and placing	265 Rp		
Wheeling	60 Rp		
	12,871 Rp	m^3	12,871

Beds			
Material	12,546 Rp		
Mixing and placing	346 Rp		
Wheeling	60 Rp		
	12,952 Rp	m^3	12,952
Concrete (4:2:1) in : –			
Small bases			
Material	17,144 Rp		
Mixing and placing	304 Rp		
Wheeling	60 Rp		
	17,508 Rp	m^3	17,508
Mass foundations			
Material	17,144 Rp		
Mixing and placing	265 Rp		
Wheeling	60 Rp		
	17,469 Rp		
Say	17,470 Rp	m^3	17,470
Concrete (4:2:1) in : –			
Beds			
Material	17,144 Rp		
Mixing and placing	346 Rp		
Wheeling	60 Rp		
	17,550 Rp	m^3	17,550
Concrete (3:2:1) in : –			
Small beds			
Material	19,500 Rp		
Mixing and placing	304 Rp		
Wheeling	60 Rp		
	19,864 Rp	m^3	19,864
Mass foundations			
Material	19,500 Rp		
Mixing and placing	265 Rp		
Wheeling	60 Rp		
	19,825 Rp	m^3	19,825
Beds			
Material	19,500 Rp		
Mixing and placing	346 Rp		
Wheeling	60 Rp		
	19,906 Rp	m^3	19,906

APPENDIX E.1 (Contd)

Half brick wall (brick size 215 x 103 x 50 mm) in cement, mortar (1:4)

Material

Bricks 72 No @ 8 Rp			576 Rp	
Allow for breakage 5%			28 Rp	
			604 Rp	
Mortar (1:4) in 1 m^3				
Sand 1.20 m^3 @ 600 Rp		720 Rp		
Cement 0.38 tons @ 50,000 Rp		19,000 Rp		
		19,720 Rp		
In 1 m^2 Brickwork mortar required is 0.022 m^3				
∴ Cost			434 Rp	
			1,038 Rp	
Labour				
Laying bricks				
Labourer 2.00 hours = @ 50 Rp		100 Rp		
Tradesmen 2.00 hours @ 94 Rp		188 Rp		
		288 Rp		
Foreman 0.25 hours @ 125 Rp		32 Rp		
		320 Rp		
Mixing mortar/m^3				
Labourer 9.50 hours @ 50 Rp	475 Rp			
∴ For 0.022 m^3 =		11 Rp		
		331 Rp	331 Rp	
			1,369 Rp	
		Say	1,370 Rp	m^2 1,370

Broken river Stone walling in plinth in cement mortar (1:4)

Material

River stone 1 m^3 @ 800 Rp	800 Rp
Allow for cutting Bonding and waste 20%	160 Rp
	960 Rp

Amount of mortar in 1 m^3 stone walling = 0.30 m^3 @ 19,720 Rp				
per m^3 (As build up for brickwork) 5,916		6,876 Rp		

Labour

Laying stones

Labourer 10.00 hours @ 50 Rp	500 Rp			
Tradesman 10.00 hours @ 94 Rp	940 Rp			
Foreman 1.00 hours @ 125 Rp	125 Rp			
Mixing mortar/1 m^3 = 475 Rp (As build up for brickwork)				
∴ 0.30 m^3	143 Rp	1,708 Rp		
	Say	8,584	m^3	8,600

Broken river stone in filling in cement mortar (1:4) in post bases

Material

River stone 1 m^3 @ 800 Rp	800 Rp			
Allow for cutting and waste 10%	80 Rp			
Amount of mortar in 1 m^3 of stone = 0.18 m^3 @ 19,720 Rp per m^3 (as build up for brickwork)	3,549 Rp			
	4,429 Rp			
Say		4,430 Rp		

Labour

Laying stones

Labourer 3.00 hours @ 50 Rp	150 Rp			
Tradesman 3.00 hours @ 90 Rp	282 Rp			
Mixing mortar/1m^3 = Rp 475 (as build up for brickwork)				
∴ 0.18 m^3	86 Rp			
(no supervision required)	518 Rp	518 Rp		
		4,948 Rp		
	Say		m^3	4,950

Render in cement mortar (1:2) 10 mm thick on brick walls

Material

Sand 1 m^3 @ 600 Rp		600 Rp		
Cement 0.72 tons @ 50,000 Rp		36,000 Rp		
		36,600 Rp		
In 1 m^2 render/mortar required is 0.016 m^3	∴ Cost		m^2	586 Rp

Labour				
Rendering				
Labourer 0.50 hours @ 50 Rp	25 Rp			
Tradesman 0.50 hours @ 94 Rp	47 Rp			
	72 Rp			
Mixing render/m^3				
Labourer 10.00 hours @ 50 Rp = 500 Rp				
∴ For 0.016 m^3 Cost	8 Rp			
	80 Rp			
Foreman 0.25 hours @ 125 Rp	31 Rp			
	111 Rp	111 Rp		
		697 Rp	m^2	697

Roof coverings

33 BWG corrugated, roof sheeting in 650 mm widths, with 50 mm sidelap and 150 mm end laid fixed to timber purlins with galvanised roofing nails and washers.

Material/10 m^2				
10 No 1.8 metre length sheets @ 120 Rp/FtRun i.e. 400 Rp Rp/metre	720 Rp			
Allow for waste 2½%	18 Rp			
	738 Rp			
X 10	7,380 Rp			
53 nails and washers = 1.05 kg @ 1,000 Rp	1,050 Rp			
Allow 5% for waste on nails	53 Rp	8,483 Rp		
Labour/10 m^2				
Labourer 2.00 hours @ 50 Rp	100 Rp			
Tradesman 2.00 hours @ 94 Rp	188 Rp			
Foreman 0.25 hours @ 125 Rp	32 Rp	320 Rp		
		8,803 Rp		
∴ One square metre is (say)		880 Rp	m^2	880

33 BWG flat ridge covering 900 mm girth with 150 mm end lap.
In 10 metres run of ridge laid length of material required = 10.9 metres
Plus waste say 11.0 metres,
(NB. Roofing nails included with roof sheeting).

Material/10 m				
11 m @ 472 Rp	5,192 Rp			
Labour/10 m				
Labourer 2.00 hours @ 50 Rp	100 Rp			
Tradesman 2.00 hours @ 94 Rp	188 Rp			
	5,480 Rp			
∴ 1 m	=	548 Rp	m	548
(No supervision required)				

Atap rumbia roof panels, size 1000 mm x 400 mm with 200 mm laps fixed to timber purlins with cord

Material				
8 No panels @ 18 Rp	144 Rp			
cord (say)	26 Rp			
	170 Rp			
Allow for 10% waste	17 Rp			
	187 Rp	187 Rp		
Labour				
Labourer 0.40 hours @ 50 Rp	20 Rp			
Tradesman 0.40 hours @ 94 Rp	37 Rp			
Foreman 0.04 hours @ 125 Rp	5 Rp			
	62 Rp	62 Rp		
Say		249 Rp	m^2	250

Ceiling coverings

Gedek ceiling panels size 2m x 2m fixed to timber with nails.

Material				
1 m^2 of panel @ 100 Rp	100 Rp			
Allow for waste 5%	5 Rp			
Nails 0.5 kg @ 350 Rp	175 Rp			
Allow for waste on nails 5%	9 Rp			
	289 Rp	289 Rp		
Labour				
Labourer 0.40 hours @ 50 Rp	20 Rp			
Tradesman 0.40 hours @ 94 Rp	38 Rp			
Foreman 0.04 hours @ 125 Rp	5 Rp			
	63 Rp	63 Rp		
Say		352 Rp	m^2	355

APPENDIX E.1 (contd)

Main building frame

Timber class 2 (un-finished) in posts, beams and trusses.

Material				
1 m^3 timber @ 25,000 Rp	25,000 Rp			
Allow for waste 2½%	625 Rp			
Nails, 2 Kg/m^3 @ 350 Rp	700 Rp			
Allow for waste on nails 5%	35 Rp			
	26,360 Rp	26,360 Rp		
Labour				
Labourers 80.00 hours @ 50 Rp	4,000 Rp			
Tradesman 40.00 hours @ 94 Rp	3,760 Rp			
Foreman 4.00 hours @ 125 Rp	500 Rp			
	8,260 Rp	8,260 Rp	m^3	34,620

Timber class 3 (un-finished) in post, beams and trusses.

Material				
1 m^3 timber @ 14,000 Rp	14,000 Rp			
Allow for waste 2½%	350 Rp			
Nails (as previous build up)	735 Rp	15,085 Rp		
Labour (as previous build up)		8,260 Rp	m^3	23,345

Roof

Timber class 2 (un-finished) in purlins and rafters.

Material				
1 m^3 timber @ 25,000 Rp	25,000 Rp			
Allow for waste 5%	1,250 Rp			
Nails 4 kg/m^3 @ 350 Rp	1,400 Rp			
Allow for waste on nails 5%	70 Rp			
	27,720 Rp	27,720 Rp		
Labour				
Labourer 90.00 hours @ 50 Rp	4,500 Rp			
Tradesman 50.00 hours @ 94 Rp	4,700 Rp			
Foreman 5.00 hours @ 125 Rp	625 Rp			
	9,825 Rp	9,825 Rp	m^3	37,545

Timber class 3 (un-finished) in purlins and rafters.

Material				
1 m^3 timber @ 14,000 Rp	14,000 Rp			
Allow for waste 5%	700 Rp			
Nails (as previous build up)	1,470 Rp			
	16,170 Rp	16,170 Rp		
Labour (As previous build up)		9,825 Rp	m^3	25,995

Wall partitions

Timber class 2 (un-finished) in butt jointed wall boarding 25 mm thick, fixed to timber with nails.

Material				
1 m² = 0.025 m³ of timber				
@ 25,000 Rp	625 Rp			
Allow for waste 10%	63 Rp			
Nails 0.4 kg @ 350 Rp	140 Rp			
Allow for waste on nails 5%	7 Rp			
	835 Rp	835 Rp		
Labour				
Labourer 1.00 hours @ 50 Rp	50 Rp			
Tradesman 2.00 hours @ 94 Rp	184 Rp			
Foreman 0.20 hours @ 125 Rp	25 Rp	259 Rp		
	Say	1,094	m^2	1,094

Timber class 3 (un-finished) in butt jointed wall boarding 25 mm thick, fixed to timber with nails.

Material				
1 m² = 0.025 m³ of timber				
@ 14,000 Rp	350 Rp			
Allow for waste 10%	35 Rp			
Nails (as previous build up)	147 Rp	532 Rp		
Labour (as previous build up)		259 Rp		
		791 Rp		
	Say		m^2	790

Gedek wall panels size 2 m x 2 m. fixed to timber with nails.

Material				
1 m² of panel @ 100 Rp	100 Rp			
Allow for waste 5%	5 Rp			
Nails 0.5 kg @ 350 Rp	175 Rp			
Allow for waste on nails 5%	9 Rp	289 Rp		
Labour				
Labourer 0.20 hours @ 50 Rp	10 Rp			
Tradesman 0.20 hours @ 94 Rp	19 Rp			
Foreman 0.03 hours @ 125 Rp	4 Rp	33 Rp		
		322 Rp		
	Say		m^2	325

Flooring

Timber class 2 (un-finished) in butt jointed flooring 50 mm thick fixed to timber with nails

Material		
Timber 1 m² = 0.050 m³		
@ 25,000 Rp	1,250 Rp	
Allow for waste 10%	125 Rp	
Nails 0.5 kg @ 350 Rp	175 Rp	
Allow for waste on nails 5%	9 Rp	1,559 Rp

APPENDIX E.1 (contd)

Flooring (contd)

Labour				
Labourer 1.50 hours @ 50 Rp	75 Rp			
Tradesman 3.00 hours @ 94 Rp	282 Rp			
Foreman 0.30 hours @ 125 Rp	38 Rp	395 Rp		
		1,954 Rp		
Say			m^2	1,95

Timber class 3 (un-finished) in butt jointed flooring 50 mm thick fixed to timber with nails.

Material				
Timber 1 m^2 = 0.050 m^3				
@ 14,000 Rp	700 Rp			
Allow for waste 10%	70 Rp			
Nails (as previous build up)	184 Rp	954 Rp		
Labour (as previous build up)		395 Rp		
		1,349 Rp		
Say			m^2	1,35

Windows and doors transmigration houses

Timber class 3 (un-finished) in doors size 850 mm x 1950 mm high of 150 x 25 mm ledges and braces covered one side with 25 mm butt jointed boarding.

Material				
Timber in 1 No door				
including frame and stops				
= 0.065 m^3 @ 14,000	910 Rp			
Allow for waste 5%	46 Rp			
Nails 0.3 kg/m^2 @ 350 Rp	174 Rp			
Allow for waste on nails 5%	9 Rp	1,139 Rp		
Labour				
Tradesman 6.00 hours @ 94 Rp	564 Rp			
Foreman 0.6 hours @ 125 Rp	75 Rp	639 Rp		
		1,778 Rp		
Say			each	1,8

Timber class 3 (un-finished) in window size 850 mm x 1350 high of 150 x 25 mm ledges and braces covered one side with 25 mm butt jointed boarding.

Material		
Timber in 1 No window including		
frame and steps = 0.049 m^3		
@ 14,000 Rp	686 Rp	
Allow for waste 5%	34 Rp	
Nails 0.3/m^2 @ 350 Rp	121 Rp	841 Rp

Labour (as previous build up)	639 Rp		
	1.480 Rp		
Say		each	1,500

Windows and doors in other village buildings

Timber class 2 (finished) in doors and windows, each size 900 mm x 2000 mm high, of 200 x 25 mm ledges, 150 x 25 mm braces, covered one side with 25 mm butt jointed boarding.

Material				
Timber in 1 No door or window including frame and steps = 0.104 m^3 @ 25,000 Rp	2,600 Rp			
Allow for waste 5%	130 Rp			
Nails 0.4 kg/m^2 @ 350 Rp	252 Rp			
Allow for waste on nails 5%	12 Rp	2,994 Rp		
Labour				
Tradesman 9.00 hours @ 94 Rp	752 Rp			
Foreman 0.8 hours @ 125 Rp	100 Rp	852 Rp		
		3,846 Rp		
Say			each	3,850
(i.e. 2,139 Rp/m^2)				

Timber class 3 (finished) in doors and windows, each size 900 mm x 2000 mm, constructed all as previously described.

Material				
Timber in 1 No door or window including frame and stops = 0.104 m^3 @ 14,000 Rp	1,456 Rp			
Allow for waste 5%	75 Rp			
Nails (as previous build up)	264 Rp	1,793 Rp		
Labour (as previous build up)		852 Rp		
		2,645 Rp		
Say			each	2,650
(i.e. 1,472 Rp/m^2)				

Timber class 2 (finished) in window size 800 mm x 1200 mm high, constructed of 100 x 38 mm rebated frame filled in with 2 mm clear sheet glass, puttied.

Material	
Timber in 1 No window including frame and steps = 0.0152 m^3 @ 25,000 Rp	380 Rp
Allow for waste 5%	19 Rp
(Joints framed together-no nails)	399 Rp

APPENDIX E.1 (contd)

Material (contd)			
Glass	399 Rp		
1 m^2 glass @ 2,000 Rp	2,000 Rp		
Allow for breakage 10%	200 Rp		
Putty			
0.34 kg putty per m^2 @ 1,500 Rp	510 Rp		
Allow for waste on putty 10%	51 Rp		
	3,160 Rp		
Labour			
Building window.			
Tradesman 16.00 hours @ 94 Rp	1,504 Rp		
Glazing.			
Tradesman 3.00 hours @ 94 Rp	282 Rp		
Foreman 1.6 hours @ 125 Rp	200 Rp		
	5,146 Rp		
	Say	each	5,146
	(i.e. 5,360 Rp/m^2)		

In additional costs of glazing windows using the following grades of glass are as follows:

3 mm clear sheet glass			
1 mm^2 @ 3,000 Rp	3,000 Rp		
Allow for breakage 10%	300 Rp		
	3,300 Rp		
Less			
Cost of 2 mm clear sheet glass	2,200 Rp		
Additional cost		m^2 /	1,10
5 mm Clear sheet glass			
1 m^2 @ 7,500 Rp	7,500 Rp		
Allow for breakage 10%	750 Rp		
	8,250 Rp		
Less			
Cost of 2 mm clear sheet glass	2,200 Rp		
Additional cost		m^2	6,05
3 mm Obscured glass			
1 m^2 @ 4,500 Rp	4,500 Rp		
Allow for breakage 10%	450 Rp		
	4,950 Rp		

Less			
Cost of 2 mm clear sheet glass	2,200 Rp		
Additional cost		m^2	2,750

50 mm diameter bamboo in rafters, collars, vent framing and ridge

Material			
1 m bamboo @ 25 Rp	25 Rp		
Allow for waste 10%	3 Rp		
Cord (say)	10 Rp		
	38 Rp		
Labour			
Labourer 0.10 hour @ 50 Rp	5 Rp		
Tradesman 0.10 hour @ 94 Rp	9 Rp		
Foreman 0.01 hour @ 125 Rp	1 Rp		
	53 Rp		
	Say		50

Dowelled connections between bamboo rafters and wall plate.

Material			
(nil – included in previous item)			
Labour			
Tradesman 1.00 hour @ 94 Rp	94 Rp		
Supervision 0.10 hour @ 125 Rp	13 Rp		
	107 Rp		
	Say	each	110

Decoration

Two coats wood preservative on general surfaces of unfinished woodwork.

Material				
1 m^2 requires 0.10 kg per coat ∴ two coats = 0.20 kg @ 400 Rp	80 Rp			
Allow for waste and use of brushes 5%	4 Rp	84 Rp		
Labour				
Tradesman 0.5 hours/per coat/m^2 ∴ 1.00 hour @ 94 Rp	94 Rp			
Foreman 0.10 hours @ 125 Rp	13 Rp	107 Rp		
		191 Rp		
	Say		m^2	190

Two coats solar paint on general surfaces of unfinished woodwork

Material				
1 m^2 requires 0.06 kg per coat				
∴ two coats = 0.12 kg @ 400 Rp	48 Rp			
Allow for waste and brushes 5%	2 Rp			
	50 Rp			
Labour				
Tradesman 0.2 hours/per coat/m^2				
∴ 0.4 hours @ 94 Rp	38 Rp			
Foreman 0.04 hours @ 125 Rp	5 Rp			
	93 Rp			
	Say		m^2	95

Two coats emulsion paint on general surfaces of unfinished woodwork.

Material				
1 m^2 requires 0.15 kg per coat: ∴ two coats = 0.30 kg @ 700 Rp	210 Rp			
Allow for waste and use of brushes 5%	10 Rp	220 Rp		
Labour				
Tradesman 0.2 hours per coat/m^2				
∴ 0.4 hours @ 94 Rp	38 Rp			
Foreman 0.04 hour @ 125 Rp	5 Rp	43 Rp		
		263 Rp		
	Say		m^2	263

Two coats enamel paint on general surfaces of finished woodwork.

Material				
1 m^2 requires 0.18 kg per coat ∴ Two coats = 0.36 kg @ 1.000 Rp	360 Rp			
Allow for waste and use of brushes 5%	18 Rp	378 Rp		
Labour				
(As previous build up)		43 Rp		
		421 Rp		
	Say		m^2	421

APPENDIX E. 2 **Approximate quantities and cost estimates for one balloon framed trans-migrant house.** **Floor area 33.4 m²**

Item	Quantity	Unit rate (rupiahs)	Cost (rupiahs)	Sub-total (rupiahs)
Land preparation				
Land clearing	1000 m^2	10	10,000	
Excavate in soft soil to deep remove top soil (150 mm)	7 m^3	145	1,015	
Excavate in soft soil for post bases	1 m^3	225	225	
Excavate in soft soil for drainage ditches	3 m^3	350	1,050	
Sand/soil filling for floor	7 m^3	662	4,634	
Stone filling in post bases in cement mortar (1:4)	0.2 m^3	4,950	990	
Stone walling in plinth in cement mortar (1:4)	0.5 m^3	8,600	4,300	
	Total land preparation			22,214
Main house frame				
Class 2 unfinished timber in sole plate	0.13 m^3	34,620	4,500	
Class 3 unfinished timber in: Posts 0.73 m^3, Noggins 0.04 m^3, Struts 0.11 m^3, Collars 0.09 m^3	0.97 m^3	23,345	22,645	
Mild steel dowels	8	400	3,200	
	Total main house frame			30,345
Roof				
Class 3 unfinished timber in: Purlins and tie beams 0.29 m^3, Rafters 0.05 m^3, Barge 0.09 m^3	0.38 m^3	25,995	9,878	
50 mm diameter bamboo in: Rafters 133 m, Collars 22 m, Vent fram-ing 9 m, Ridge 8 m	172	50	8,600	
Dowelled connections between rafters and wall plate and struts and collars	40	110	4,400	
Double rumbia atap roofing with 200 mm laps	67 m^2	250	16,750	
	Total for roof			39,628

APPENDIX E. 2 (contd)

Wall partitions					
Class 3 unfinished timber in:					
18 mm butt jointed wall boarding	62	m^2	660	40,920	
Gedek panels in wall	8	m^2	230	1,840	
	Total wall partitions				42,760
Store floors					
Class 3 unfinished timber in:					
Bearer	0.03	m^3	23,345	700	
50 diameter bamboo floor joists	18	m	50	900	
Gedek panels in floor	7	m^2	230	1,610	
	Total store floors				3,210
Doors and windows					
Class 3 unfinished timber in:					
Door size 850 x 1950 mm high	2		1,800	3,600	
Windows size 850 x 1350 mm high	6		1,500	9,000	
Door and window hinges	16		300	4,800	
Bolts	8		450	3,600	
	Total doors and windows				21,000
Finishes					
Two coats solar preservative on gneral surfaces of woodwork	28	m^2	95	2,660	
Two coats lime wash on general surfaces of woodwork	199	m^2	35	6,965	
	Total finishes				9,625

Summary		Average cost per m^2 of floor area
Land preparation	22,214	665
Main house frame	30,345	909
Roof	39,628	1,186
Wall partitions	42,760	1,280
Store floors	3,210	96
Doors and windows	21,000	629
Finishes	9,625	288
	168,782	5,053
Contractors overheads and profit 10%	16,878	505
	185,660	5,558
PPN tax 5%	9,283	278
Transmigrants house total approximate estimated cost averaging per square metre of floor area	194,943	5,836

APPENDIX E. 3 Approximate quantities and cost estimates for one traditional framed Transmigrants house floor area 33.4 m²

Item	Quantity	Unit rate (rupiahs)	Cost (rupiahs)	Sub-total (rupiahs)
Land preparation				
Land clearing	1000 m^2	10	10,000	
Excavate in soft soil to deep remove top soil (150 mm)	7 m^3	145	1,015	
Excavate in soft soil for post bases	1 m^3	225	225	
Excavate in soft soil for drainage ditches	3 m^3	350	1,050	
Sand/soil filling for floor	7 m^3	662	4,634	
Stone filling in post bases in cement mortar (1:4)	0.2 m^3	4,950	990	
Stone walling in plinth in cement mortar	0.5 m^3	8,600	4,300	
Total land preparation				22,214
Main house frame				
Class 2 unfinished timber in sole plate	0.10 m^3	34,620	3,462	
Class 3 unfinished timber in:				
Posts 0.70 m^3				
Beams 0.21 m^3				
Trusses 0.28 m^3				
Struts 0.07 m^3				
Noggins 0.06 m^3	1.32 m^3	23,345	30,815	
Mild steel dowels	12	400	4,800	
Total main house frame				39,077
Roof				
Class 3 unfinished timber in:				
Purlins and tie beams 0.23 m^3				
Rafters 0.43 m^3				
Ridge 0.03 m^3				
Barge board 0.09 m^3	0.78 m^3	25,995	20,276	
50 mm diameter bamboo in vent framing 9 m	181	50	1,629	
Double rumbia atap roofing with 200 mm laps	67 m^2	250	16,750	
Total for roof				38,655
Wall partitions				
Class 3. unfinished timber in 25 mm butt jointed wall boarding	44 m^2	790	34,760	
Gedek panels in walls	8 m^2	230	1,840	
Total wall partitions				36,600

APPENDIX E. 3 (contd)

Store floors					
50 mm diameter bamboo floor joists	16	m	50	800	
Gedek panels in floor	6	m^2	230	1,380	
Total store floors					2,180
Doors and windows					
Class 3 unfinished timber in:					
Door size 850 x 1950 mm high	2		1,800	3,600	
Windows size 850 x 1350 mm high	6		1,500	9,000	
Door and window hinges	16		300	4,800	
Bolts	8		450	3,600	
Total doors and windows					21,000
Finishes					
Two coats solar preservative on general surfaces of woodwork	28	m^2	95	2,660	
Two coats lime wash on general surface of woodwork	179	m^2	35	6,265	
Total finishes					8,925

Summary		**Average cost [per] m^2 of floor a[rea]**
Land preparation	22,214	665
Main house frame	39,077	1,170
Roof	38,655	1,157
Wall partitions	36,600	1,096
Store floors	2,180	65
Doors and windows	21,000	629
Finishes	8,925	267
	168,651	5,049
Contractors overheads and profit 10%	16,865	505
	185,516	5,554
PPN tax 5%	9,276	278
Transmigrants house – approximate estimated cost	194,792	
Averaging per square metre of floor area		5,832

APPENDIX E. 4 Approximate quantities and cost estimates for one number transmigrant house – based one the design and specification shown in Book II – Building transmigration project Guide-lines

Item	Quantity	Unit rate (rupiahs)	Cost (rupiahs)	Sub-total (rupiahs)
Land preparation				
Land clearing	1000 m^2	10	10,000	
Sand/soil filling for floor	8 m^3	662	5,296	
Post bases	13	95	1,235	
	Total land preparation			16,531
Main house frame				
Class 3 unfinished timber in:				
Posts 0.38 m^3				
Beams 0.21 m^3				
Trusses 0.44 m^3	1.03 m^3	23,345	24,045	
	Total main house frame			24,045
Roof				
Class 3 unfinished timber in:				
Purlins 0.35 m^3				
Rafters 0.35 m^3				
Fascia 0.10 m^3	0.80 m^3	25,995	20,796	
33 BWG corrugated roof sheeting	63 m^2	880	55,440	
33 BWG ridge sheeting	8 m	548	4,384	
	Total roof			80,620
Wall partitions				
Class 3 unfinished timber in:				
Battens	0.39 m^3	25,995	10,138	
25 mm boarding	93 m^2	790	73,470	
	Total wall partitions			83,608
Doors and windows				
Class 3 unfinished timber in:				
Doors and windows each size 900 mm x 2000 mm high	11	2,000	22,000	
Padlock	2	350	700	
Hinges	22	300	6,600	
	Total doors and windows			29,300
Finishes				
Two coats limewash on timber partitions and posts	84 m^2	35	2,940	
	Total finishes			2,940

APPENDIX E. 4 (contd)

Summary	
Land preparation	16,531
Main house frame	24,045
Roof	80,620
Wall partitions	83,608
Doors and windows	29,300
Finishes	2,940
	237,044
Contractors overheads and profit 10%	23,704
	260,748
PPN tax – 5%	13,037
Total approximate estimated cost – one Directorate General of Transmigration house for transmigrants	273,785

Averaging 8296 Rp per square metre of floor area.

APPENDIX E. 5 **Approximate quantities and cost estimates for one transmigrant staff house** **Floor area 63 m^2**

Item	Quantity		Unit rate (rupiahs)	Cost (rupiahs)	Sub-total (rupiahs)
Land preparation					
Land clearing	1000	m^2	10	10,000	
Sand/soil filling for floor	18	m^3	662	11,916	
Excavate in soft soil for post bases	1	m^3	225	225	
Stone filling in post bases in cement mortar (1:4)	2	m^3	4,950	9,900	
	Total land preparation				32,041
Main house frame					
Class 2 unfinished timber in:					
Posts 2.13 m^3					
Beams 0.69 m^3					
Trusses 0.88 m^3	3.70 m^3		34,620	128,094	
	Total main house frame				128,094
Roof					
Class 2 unfinished timber in:					
Purlins 0.21 m^3					
Bracings and rafters 0.77 m^3					
Ridge 0.06 m^3					
Fascia 0.31 m^3	1.35 m^3		37,545	50,686	
33 BWG corrugated roof sheeting	118	m^2	880	103,840	
33 BWG flat sheeting in ridge 900 mm girth	11	m	548	6,028	
	Total roof				160,554
Wall partitions					
Class 2 unfinished timber in:					
25 mm butt jointed wall boarding	170	m^2	1,094	185,980	
	Total wall partitions				185,980
Doors and windows					
Class 2 finished timber in:					
Unglazed door size 900 x 2100 mm high i.e. 1.89 m^2 @ 2,139 Rp = 4,043 Rp	9		4,043	36,387	
Glazed window size 1400 x 1500 mm high i.e. 2.10 m^2 @ 5300 Rp = 11,256 Rp	5		11,256	56,280	
Glazed window size 2100 x 1500 mm high i.e. 3.15 m^2 @ 5,360 Rp = 16,884 Rp	1		16,884	16,884	
Extra over cost of glazing					

in 3 mm sheet glass in lieu 2 mm.	14	m^2	1,100	15,400	
Door and window hinges	42		300	12,600	
Locks	3		4,200	12,600	
Door latches	6		2,700	16,200	
Casement stays	12		1,100	13,200	
Casement fasteners	12		1,300	15,600	
	Total doors and windows				195,151
Plumbing					
Asiatic type water closet	1		12,000	12,000	
Septic tank for one W.C. and connecting drains	1		78,000	78,000	
Bath tub	1		7,000	7,000	
	Total plumbing				97,000
Finishes					
Two coats wood preservative on posts, partitions	42	m^2	190	7,980	
Two coats emulsion paint on timber partitions	450	m^2	263	118,350	
	Total finishes				126,330

Summary		**Average cost p m² of floor ar**
Land preparation	32,041	509
Main house frame	128,554	2,034
Roof	160,554	2,549
Wall partitions	185,980	2,952
Doors and windows	195,151	3,097
Plumbing	97,000	1,540
Finishes	126,330	2,004
	925,150	14,685
Contractors overheads and profit 10%	92,515	1,469
	1,017,665	16,154
PPN tax 5%	50,883	807
Staff house total approximate estimated cost (exclusive loose furniture and fittings)	1,068,548	
Averaging per square metre of floor area		16,961

APPENDIX E.6 Approximate quantities and cost estimates for one village hall (Floor area 112 m^2)

	Quantity		Unit rate (rupiahs)	Cost (rupiahs)	Sub-totals (rupiahs)
Land preparation					
Land clearing	1000	m^2	10	10,000	
Excavate in soft soil to remove top soil (150 mm deep)	21	m^3	145	3,045	
Excavate in soft for post bases	3	m^3	225	675	
Sand filling (200 mm thick) under floor slab	28	m^3	662	18,536	
Stone filling in post bases in cement mortar (1:4)	5	m^3	4,950	24,750	
	Total land preparation			57,006	57,006
Floor					
Unreinforced concrete (1:3:6) in floor slab 100 mm thick	14	m^3	12,952	181,328	
	Total floor			181,328	181,328
Main building frame					
Class 2 Unfinished timber in:					
Posts 0.67 m^3					
Beams 0.82 m^3					
Trusses 0.69 m^3	2.18	m^3	34,620	75,472	
	Total main building frame				75,472
Roof					
Class 2 Unfinished timber in:					
Purlins 0.28 m^3					
Bracing and Rafters 1.38 m^3					
Ridge 0.02 m^3					
Fascia 0.20 m^3	1.88	m^3	37,545	70,585	
33 BWG corrugated roof sheeting	224	m^2	880	197,120	
33 BWG flat sheeting in ridge 900 mm girth	6	m^2	548	3,288	
	Total roof				270,993
Wall partitions					
Class 2 Unfinished timber in:					
25 mm Butt jointed wall boarding	104	m^2	1,094	113,776	
	Total wall partitions				113,776
Doors and windows					
Class 2 Unfinished timber in:					
Unglazed doors size 900 x 2100 mm high i.e. 1.89 m^2 @ 2139 Rp = 4043 Rp	1		4,043	4,043	
Ditto size 1800 x 2100 mm high i.e. 3.78 m^2 @ 2139 Rp = 8085 Rp	1		8,085	8,085	

APPENDIX E.6 (contd)

Item	Quantity		Unit rate (rupiahs)	Cost (rupiahs)	Sub-totals (rupiahs)
Doors and windows (cont.)					
Glazed windows overall size 14,000 x 1,100 mm high i.e. 15.40 m² @ 5360 Rp = 82,544 Rp	1		82,544	82,544	
Extra over cost of glazing in 3 mm clear sheet glass in lieu 2 mm	15.4	m²	1,100	16,940	
Door/Window hinges	65		300	19,500	
Locks	2		4,200	8,400	
Casement stays	30		1,100	33,000	
Casement fasteners	30		1,300	39,000	116,840
	Total doors and windows				211,512
Finishes					
Two coats wood preservative on posts, partitions	46	m²	190	8,740	
Two coats emulsion paint on timber partitions	330	m²	263	86,790	
	Total finishes				95,530

Summary	Rupiah	Average cost m² of floor area
Land preparation	57,006	509
Floor	181,328	1,619
Main building frame	75,472	673
Roof	270,993	2,420
Wall partitions	113,776	1,016
Doors and windows	211,512	1,889
Finishes	95,530	853
	1,005,617	8,979
Contractors, overheads and profit 10%	100,562	898
	1,106,179	9,877
PPN tax 5%	55,309	493
Village Hall – Total approximate estimated cost (exclusive of loose furniture and fittings)	1,161,488	
Averaging per square metre of floor area		10,370

APPENDIX E.7

Approximate quantities and cost estimates for one Elementary School (Floor area 270 m²)

	Quantity	Unit rate (rupiahs)	Cost (rupiahs)	Sub-totals (rupiahs)
Land preparation				
Land clearing	1000 m²	10	10,000	
Excavate in soft soil to remove top soil (150 mm deep)	41 m³	145	5.945	
Excavate in soft soil for post bases	7 m³	225	1,575	
Sand filling (150 mm thick under floor slab	41 m³	662	27,142	
Unreinforced concrete (1:3:6) in post bases	10 m³	12,910	129,100	
	Total land preparation			173,762
Floor				
Unreinforced concrete (1:3:6) in floor slab (60 mm thick)	, 16 m³	12,952	207,232	
20 mm x 20 mm x 5 mm thick plain concrete floor tiles bedded and jointed and pointed in cement mortar (1:1) on and including A 60 mm thick cement and sand (1:4) screed	270 m²	1,550	418,500	
	Total floor			625,732
Main building frame				
Reinforced concrete (1:2:4) in columns, including reinforcement and formwork	1 m³	52,000	52,000	
Half brick wall in cement mortar (1:4)	332 m²	1,370	454,840	
Class 2 unfinished timber in: Wall plate 0.57 m³; Trusses 3.01 m³	3.58 m³	34,620	123,940	
5/8 diameter bolts – 150 mm long	26	450	11,700	
	Total main building frame			642,480
Roof				
Class 2 unfinished timber in: Purlins 0.61 m³; Bracing & Rafters 2.10 m³; Ridge 0.30 m³; Fascia 0.77 m³	3.78 m³	37,545	141,920	
33 BWG corrugated roof sheeting	384 m²	880	337,920	
33 BWG flat sheeting in ridge 900 mm girth	32 m	548	17,536	
	Total roof			497,376
Ceiling				
Class 2 unfinished timber in				

APPENDIX E.7 (contd)

Item	Quantity	Unit rate (rupiahs)	Cost (rupiahs)	Sub-to (rupiah
ceiling framing	0.82 m^3	37,545	30,787	
Gedek ceiling panels	316 m^2	355	112,180	
	Total ceiling			142,96
Doors and windows				
Class 2 Finished timber in:				
Plywood faced solid core flush				
doors size 900 x 2100 mm high	10	8,000	80,000	
Glazed windows				
Total area = 22 m^2 @ 5.360 Rp	–	–	117,920	
Extra over for glazing for 3 mm				
clear sheet glass in lieu 2 mm	22 m^2	1,100	24,200	
Door/window hinges	36	300	10,800	
Locks	10	4,200	42,000	
Casement stays	42	1,100	46,200	
Casement fasteners	42	1,300	54,600	
	Total doors and windows			375,72
Plumbing				
Asiatic type water closet	6	12,000	72,000	
Bath tub	6	7,000	42,000	
Septic tank and connecting drains				
for six W.C.-s	1	100,000	100,000	
	Total plumbing			214,00
Finishes				
Render in cement and lower case,				
Sand (1:2) on brick walls	596 m^2	697	415,412	
Two coats emulsion paint on last	596 m^2	263	156,748	
Two coats enamel paint on general				
surface of woodwork	76 m^2	420	31,920	
	Total finishes			604,08

Summary	Cost (rupiahs)	Average cost m^2 of floor area
Land preparation	173,762	644
Floor	625,732	2,318
Main building frame	642,480	2,380
Roof	497,376	1,842
Ceilings	142,967	530
Doors and windows	375,720	1,392
Plumbing	214,000	792
Finishes	604,080	2,236
	3,276,117	12,134
Contractor's overheads and profit 10%	327,612	1,213
	3,603,729	13,347
PPN tax 5%	180,186	667
Elemantary School – Total approximate estimated cost – (exclusive of loose furniture and fittings)	3,783,915	14,014

APPENDIX E.8 Approximate quantities and cost estimates for one store (Floor area 120 m²)

Land preparation	Quantity		Unit rate (rupiahs)	Cost (rupiahs)	Sub-totals (rupiahs)
Land clearing	1000	m²	10	10,000	
Excavate in soft soil to remove top soil (150 mm deep)	18	m³	145	2,610	
Excavate in soft soil for post bases	2	m³	225	450	
Sand filling (150 mm thick) under floor slab	18	m³	662	11,916	
Unreinforced concrete (1:3:6) in post bases	2	m³	12,910	25,820	
	Total land preparation				50,796
Floor					
Unreinforced concrete (1:3:6) in floor slab (60 mm thick)	7	m³	12,952	90,664	
60 mm thick cement and sand (1:4) screed laid on floor slab	120	m³	280	33,600	
	Total floor				124,264
Main building frame					
Reinforced concrete (1:2:4) in columns including reinforcement and formwork	1	m³	52,000	52,000	
Ditto in beams	1	m³	51,200	51,200	
Half brick wall in cement mortar (1:4)	155	m²	1,370	212,350	
Wall plate 0.44 m³					
Trusses 1.45 m³	1.89	m³	34,620	65,432	
5/8 Diameter bolts 150 mm long	48		450	21,600	
	Total main building frame				402,582
Roof					
Class 2 Unfinished timber in:					
Purlins 0.32 m³					
Bracing and rafters 1,16 m³					
Ridge 0.06 m³					
Fascia 0.23 m³	1.77	m³	37,545	66,455	
33 BWG corrugated roof sheeting	237	m³	880	208,560	
33 BWG flat sheeting in ridge 900 mm girth	17	m	548	9,316	
	Total roof				284,331
Office partitions and ceiling					
Class 2 Unfinished timber in:					
Posts	0.25	m³	34,620	8,655	
Ceiling framing	0.08	m³	37,545	3,003	
4 mm thick flat asbestos sheets in wall lining, nailed	13	m²	1,160	15,080	
4 mm thick ditto in ceilings, nailed	6	m²	1,185	7,110	
	Total office partitions and ceilings				33,848

APPENDIX E.8 (contd)

Item	Quantity		Unit rate (rupiahs)	Cost (rupiahs)	Sub-totals (rupiahs)
Doors and windows					
Class 2 Finished timber in:					
Plywood faced solid core door size 900 x 2100 mm high	1		8,000	8,000	
Main entrance door size 4000 x 3600 mm high i.e. 14,4 m^2 @ 2,139 Rp/m^2 = 30,802 Rp	1		30,802	30,802	
Fixed glazed window in 2 mm clear sheet glass size 2000 x 1500 mm high i.e. 3 m^2 @ 5, 360 Rp i.e. 16,080 Rp	1		16,080	16,080	
Timber lourves triangular shaped size overall 2000 x 600 mm high i.e. 0.6 m^2 @ 3,000 Rp = 1,800 Rp	2		1,800	3,600	
Timber grille infilled with wire mesh size 15,000 x 500 mm i.e. 7.50 m^2 @ 3,100 Rp = 23,250 Rp	2		23,250	46,500	
Door hinges	2		300	600	
Heavy duty hinges	6		5,000	30,000	
Heavy duty lock	1		6,000	6,000	102,780
Total doors and windows					141,582
Finishes					
Render in cement and sand (1:2) on brick walls	310	m^2	697	216,070	
Two coats emulsion paint on last	310	m^2	263	81,530	
Ditto on asbestos sheeting	36	m^2	280	10,080	
Two coats enamel paint on general surfaces of woodwork	51	m^2	420	21,420	
Total finishes					329,100

Summary	Rupiah	Average cost m^2 of floor area
Land Preparation	50,796	423
Floor	124,264	1,036
Main building frame	402,582	3,355
Roof	284,331	2,369
Office partitions and ceiling	33,848	282
Doors and windows	141,582	1,180
Finishes	329,100	2,743
	1,366,503	11,388
Contractors overheads and profit 10%	136,650	1,139
	1,503,153	12,527
PPN tax 5%	75,158	626
Store: Total approximate estimated cost (exclusive of loose furniture fittings and weighing machines)	1,578,311	13,153

APPENDIX E.9 Build up of the major unit rates used in estimating the cost of infrastructure works

Item	Unit of measurement	Rate (rupiah)
Roads		
Machine excavation :		
Bulk excavation in soft soil and deposit a distance not exceeding 30 metres		
Plant		
Level ground 95 m³ per hour		
1 in 7 up gradient 72 m³ per hour		
Averaging 84 m³ per hour		
D6 – Tractor cost 11,985 Rp per hour		
∴ cost $\frac{11,985}{84}$	m^3	142
(No banksmen required)		
Excavate in soft soil to form drainage ditches and deposit next excavation		
Plant		
25 m^3 per hour		
D3/931 backhoe costs 6,512 Rp per hour		
Cost $\frac{6,512}{25}$ = 260 Rp		
Labour		
Trimming sides excavation		
Labourer 2.00 hours @ 50 Rp = 100 Rp	m^3	360
Excavate in soft soil to form drainage grips and fill with broken river stone and gravel		
Plant		
Excavating (as previously described) 260 Rp		
Material		
1.28 m^3 broken river stone @ 1,000 Rp 1,280 Rp		
Labour		
Labourer 3.00 hours @ 50 Rp = 150 Rp		
Foreman 0.30 hours @ 62 Rp = 19 Rp		
1,709 Rp		
Say	m^3	1,710
Spread and level excavated material to make up levels		
Plant		
Level ground 120 m^3 per hour		
1 in 7 up gradient 90 m^3 per hour		
Averaging 105 m^3 per hour		

D6 – Tractor costs 11,985 Rp per hour

Cost $\frac{11,985}{105}$ | m³ | 114

NB (Bulk and haulage costs of excavated material in distances over 30 metre's included as a provisional sum in cost estimates of roads)

Grade and compact formation :

Plant				
Grading	140 m² per hour			
D–120 Grader costs	9,603 Rp per hour			
Cost	$\frac{9,603}{140}$	69 Rp		
Compacting				
Roller compacts 29 m² per hour @ 1000 Rp		35 Rp		
Labour				
Labourer 1.00 hour @ 50 Rp		50 Rp		
Foreman 0.10 hours @ 62 Rp		6 Rp		
		160 Rp	m²	160

Crushed stone and gravel in sub-base rolled and consolidated to a finished thickness

100 mm thick			
Plant			
Roller 0.03 hours @ 1000 Rp	30 Rp		
Material			
0.128 m³ mixed stone @ 1,200 Rp	154 Rp		
Labour			
Labourer 1.50 hours @ 50 Rp	75 Rp		
Foreman 0.20 hours @ 62 Rp	12 Rp		
	271 Rp		
Say		m²	270
125 mm thick			
Plant			
Roller 0.04 hours @ 1,000 Rp	40 Rp		
Material			
0.160 m³ mixed stone @ 1,200 Rp	192 Rp		
Labour			
Labourer 2.00 hours @ 50 Rp	100 Rp		
Foreman 0.20 hours @ 62 Rp	12 Rp		
	344 Rp		
Say		m²	345

Crushed gravel in wearing course rolled and consolidated to a finished thickness of 150 mm

Plant	
Roller 0.05 hours @ 1,000 Rp	50 Rp
Material	
0.192 m³ gravel @ 1,500 Rp	288 Rp

Labour				
Labourer 2.25 hours @ 50 Rp	113 Rp			
Foreman 0.30 hours @ 62 Rp	19 Rp			
	470 Rp		m^2	470

Culverts

Unreinforced concrete (1:2:4) in wing walls				
Material				
Refer to Table E.1 where cost of material is		17,144	Rp	
Labour				
Mixing hoisting and placing concrete in walls – total				
labour per m^3 = 20 hours				
7 workmen employed i.e.				
20 ,, 2.85 hours/per workman				
of : 5 labourers and two tradesmen i.e.				
Labourers 14.25 hours @ 50 Rp		712		
Tradesman 5.70 ,, @ 94 Rp		536		
Foreman 1.50 ,, @ 125 Rp		188		
Wheeling in barrows a distance not exceeding 30 metres				
Labourer 3.00 hours @ 50 Rp		150		
		18,730	m^3	18,730
Unreinforced concrete (1:2:4) in foundations				
Refer to Table E.1 where total cost =		17,470		
Allow additional time for wheeling & placing:				
Labourer 4.00 hours @ Rp 50		200		
Tradesman 1.00 hour @ Rp 94		94		
Foreman 0.50 hour @ Rp 125		63		
		17,827		
	Say		m^3	17,800
Formwork to sides of concrete wing walls				
Material				
in 1 m^2 of 50 mm boarding				
Timber = 0.050 m^3				
Props & braces = 0.015 m^3				
0.065 m^3				
Class 2 Timber = 0.065 m^3 @ Rp 25,000		1,625		
Allow for waste 10%		163		
Nails 0.5 kg @ Rp 350		175		
Allow for waste on nails 5%		9		
(assumed one use only)		1,972		
Labour				
Labourer 1.00 hour @ Rp 50		50		
Tradesman 2.00 hours @ Rp 94		184		
Foreman 0.20 hours @ Rp 125		25		
		2,231		
	Say		m^3	2,230

Laying and jointing 600 mm diameter reinforced concrete pipes 8 metres long			
Material			
In 8 m length – No of 1.8 m long pipes required = 5 No @ 6000 Rp	30,000		
4 No joints each requiring 0.0045 m^3 mortar : total quantity of mortar = 0.0180 m^3			
in mortar (1:4) per m^3			
Sand = 1.2 m^3 @ Rp 600 = 720			
Cement = 0.38 tons @ Rp 50,000 = 19,000			
19,720			
∴ 0.0180 m^3 =	355		
	30,355		
Labour			
Tradesman / Labourer			
Laying/Jointing			
Pipe: 3 hours / 5 hours			
Unloading: – / 2 hours			
Labourer 7.00 hours @ Rp 50	350		
Tradesman 3.00 hours @ Rp 94	282		
Foreman 1.00 hours @ Rp 125	125		
	31,112		
Say		Each	31,200
Laying and jointing 900 mm diameter reinforced concrete pipe 8 metres long			
Material			
In 8 m length – No of 1.8 m long pipes required = 5 No @ 8,000 Rp	40,000		
4 No joints each requiring 0.0082 m^3 mortar : total quantity of mortar = 0.0328 m^3			
Cost of mortar (as previous build up) Rp 19,720 : 0.0328 m^3 =	647		
Labour: Tradesman / Labourer			
Laying/Jointing pipe: 6 hours / 12 hours			
Unloading: – / 4 hours			
Labourer 16.00 hours @ Rp 50	800		
Tradesman 6.00 hours @ Rp 94	564		
Foreman 2.00 hours @ Rp 125	250		
	42,261		
Say		Each	42,500
Backfill around culvert with mixed sand and stone			
Material			
1.28 m^3 of fill @ Rp 700	896		
Labour			
Labourer 4.00 hours @ Rp 50	200		
Mandor 0.50 hours @ Rp 62	31		
	1,127		
Say		m^3	1,130

APPENDIX E.10 Approximate quantities and cost estimates for roads

E.10.1 One kilometre length of class I road

Item	Quantity	Unit rate (rupiah)	Cost (rupiah)
Clear site	20,000 m^2	10	200,000
Excavate to remove top soil	975 m^3	142	138,450
Excavate to reduce levels	994 m^3	142	141,148
Excavate to form drainage ditches	1,300 m^3	360	468,000
Excavate to form drainage grips and fill with broken stone	106 m^3	1,710	181,260
Spread and level surplus excavated material in making up levels	2,400 m^3	114	273,600
Grade and compact formation and shoulders	6,500 m^2	160	1,040,000
Crushed stone or gravel in sub base 125 mm thick	3,500 m^2	345	1,207,500
Crushed stone or gravel in wearing course 150 mm thick	3,500 m^2	470	1,645,000
Provide the provisional sum for bulk hauling excavated material a distance up to one kilometre			75,000
			5,369,958
	Contractor's overheads and profit 10%		536,996
			5,906,954
	PPN tax 5%		295,348
	Total		6,202,302
	say Rp 6,202,300.00		

E.10.2 Upgrading one kilometre length of existing district road in a very poor condition to class I road standard

Item	Quantity	Unit rate (rupiah)	Cost (rupiah)
Clear site	10,000 m^2	10	100,000
Excavate to remove top soil	487 m^3	142	69,154
Excavate to reduce levels	994 m^3	142	141,148
Excavate to form ditches	1,300 m^3	360	468,000
Excavate to form drainage grips and fill with broken stone	106 m^3	1,710	181,260
Spread and Level surplus excavated material in making up levels	2,400 m^3	114	273,600
Grade and Compact formation and shoulders	6,500 m^2	160	1,040,000
Crushed stone or gravel in sub base 125 mm thick	3,500 m^2	345	1,207,500

APPENDIX E.10 (contd)

Crushed stone or gravel in wearing course 150 mm thick	3,500 m^2	470	1,645,000
Provide the provisional sum for bulk hauling excavated material a distance up to one kilometre kilometre			75,000
			5,200,662
Contractors overheads and profit 10%			520,066
		5,72	5,720,728
PPN - tax 5%			286,036
Total			6,006,764
say Rp 6,006,700.00			

E.10.3 Upgrading one kilometre length of existing district road in a poor condition to class I road standard

Item	Quantity	Unit rate (rupiah)	Cost (rupiah)
Excavate to reduce levels	650 m^3	360	234,000
Excavate to form drainage ditches	444 m^3	142	63,048
Excavate to form drainage grips & fill with broken stone	106 m^3	1,710	181,260
Spread and level surplus excavated material in making up levels	1,200 m^3	114	136,800
Grade and compact formation and shoulders	6,500 m^2	160	1,040,000
Crushed stone or gravel in sub base 125 mm thick	2,800 m^2	345	966,000
Crushed stone or gravel in wearing course 150 mm thick	3,500 m^2	470	1,645,000
Provide the provisional sum for bulk hauling excavated material a distance up to one kilometre			40,000
			4,306,108
Contractor's overheads and profit 10%			430,611
			4,736,719
PPN tax 5%			236,836
Total			4,973,555
say Rp 4,973,600			

E.10.4 Upgrading one kilometre length of existing district road in a fair condition to class I road standard

Item	Quantity	Unit rate (rupiah)	Cost (rupiah)
Excavate to form drainage ditches	325 m^3	360	117,000
Excavate to form drainage grips & fill with broken stone	106 m^3	1,710	181,260
Spread and level surplus excavated material in making up levels	300 m^3	114	34,200
Grade and compact formation and shoulders	6,500 m^2	160	1,040,000
Crushed stone or gravel in sub base 125 mm thick	1,600 m^2	345	552,000
Crushed stone or gravel in wearing course 150 mm thick	3,50 m^2	470	1,645,000
Provide the provisional sum for bulk hauling excavated material a distance up to one kilometre			25,000
			3,594,460
	Contractor's overheads and profit 10%		359,446
			3,953,906
	PPN tax 5%		197,695
	Total		4,151,601
	say Rp 4,151,600.00		

E.10.5 One kilometre length of class II road

Item	Quantity	Unit rate (rupiah)	Cost (rupiah)
	Quantity		
Clear site	20,000 m^2	10	200,000
Excavate to remove top soil	975 m^3	142	138,450
Excavate to reduce levels	494 m^3	142	70,148
Excavate to form drainage ditches	1,000 m^3	360	360,000
Excavate to form drainage grips and fill with broken stone	106 m^3	1,710	181,260
Spread and level surplus excavated material in making up levels	1,600 m^3	114	182,400
Grade and compact formation and shoulders	6,500 m^2	160	1,040,000
Crushed stone or gravel in sub base 100 mm thick	3,500 m^2	270	945,000
Crushed stone or gravel in wearing course 150 mm thick	3,500 m^2	470	1,645,000
Provide the provisional sum for bulk hauling excavated material a distance up to one kilometre			50,000
			4,812,258
	Contractor's overheads and profit 10%		481,226
			5,293,484
	PPN tax		264,674
	Total		5,558,158
	say Rp 5,558,200		

APPENDIX E.10 (contd)

E.10.6 Upgrading one kilometre length of existing village access road in a poor condition to class II road standard

Item	Quantity	Unit rate (rupiah)	Cost (rupiah)
Excavate to form drainage ditches	250 m^3	360	90,000
Excavate to form drainage grips and fill with broken stone	106 m^3	1,710	181,260
Spread and level surplus excavated material in making up levels	240 m^3	114	27,360
Grade and compact. Formation and shoulders	6,500 m^2	160	1,040,000
Crushed stone or gravel in sub base 100 mm thick	2,000 m^2	270	540,000
Crushed stone or gravel in wearing course 150 mm thick	3,500 m^2	470	1,645,000
Provide the provisional sum for bulk hauling excavated material a distance up to one kilometre			25,000
			3,548,620
	Contractor's overhead and profit 10%		354,862
			3,903,482
	PPN tax 5%		195,174
	Total 4		4,098,656
	say Rp 4,098,700		

E.10.7 One kilometre length of class III road

Item	Quantity	Unit rate (rupiah)	Cost (rupiah)
Clear site	12,000 m^2	10	120,000
Excavate to remove top soil	825 m^3	142	117,150
Excavate to reduce levels	210 m^3	142	29,820
Excavate to form drainage ditches	900 m^3	360	324,000
Excavate to form drainage grips and fill with broken stone	90 m^3	1,710	153,900
Spread and level surplus excavated material in making up levels	1,200 m^3	114	136,800
Grade and compact formation and shoulders	5,500 m^2	160	880,000
Crushed stone or gravel in wearing course 125 mm thick	3,000 m^2	345	1,035,000
Provide the provisional sum for bulk hauling excavated material a distance up to one kilometre			25,000
			2,821,670
	Contractor's overheads and profit 10%		282,167
			3,103,837
	PPN Tax 5%		155,192
		Total	3,259,029
		Say 3,259,000	

E.10.8 Upgrading one kilometre length of existing local road in a poor condition to class III road standard

Item	Quantity	Unit rate (rupiah)	Cost (rupiah)
Excavate to reduce levels	60 m^3	142	8,520
Excavate to form drainage ditches	450 m^3	360	162,000
Excavate to form drainage grips and fill with broken stone	90 m^3	1,710	153,900
Spread and level surplus excavated material in making up levels	600 m^3	114	68,400
Grade and compact formation and shoulders	5,500 m^2	160	880,000
Crushed stone or gravel in wearing course 125 mm thick	3,000 m^2	345	1,035,000
			2,307,820
	Contractor's ovreheads and profit 10%		230,782
			2,538,602
	PPN tax 5%		126,930
		Total	2,665,532
		Say 2,665,500	

E.10.9 One kilometre length of class IV road

Item	Quantity	Unit rate (rupiah)	Cost (rupiah)
Clear site	5,000 m^2	10	50,000
			50,000
	Contractor's overheads and profit 10%		5,000
			55,000
	PPN tax 5%		2,750
		Total	57,750

APPENDIX E.11 Approximate quantities and cost estimates for bridges, culverts and paved fords

E.11.1 Timber bridge in class I and class II roads – 4 m wide and 4 m span

Item		Quantity	Unit rate (rupiahs)	Cost (rupiahs)
Excavation in abutments		20 m^3	500	10,000
Treated timber class I in:				
piles		3.62 m^3	120,000	434,400
abutment cap	1.28 m^3			
deck beams	2.41 m^3			
12 cm decking and running boards	2.58 m^3			
wheel guards	0.40 m^3			
scupper blocks	0.13 m^3			
abutment walls	2.51 m^3	9.31 m^3	75,000	698,250
posts	0.31 m^3			
rails	0.17 m^3	0.48 m^3	80,000	38,400
bolts and connectors		100 kg	700	70,000
				1,251,050
Contractors overheads and profit 1%				125,105
				1,376,155
PPN tax			5%	68,808
Total				1,444,963
			Say	1,445,000

E.11.2 Timber bridge in class I and class II roads – 4 m wide and 6 m span

Item		Quantity	Unit rate (rupiahs)	Cost (rupiahs)
Excavation in abutments		30 m^3	500	15,000
Treated timber class I in:				
piles		4.83 m^3	120,000	579,600
abutment cap	1.28 m^3			
deck beams	3.97 m^3			
12 cm decking and running beams	3.79 m^3			
wheel guards	0.59 m^3			
scupper blocks	0.19 m^3			
abutment walls	2.51 m^3	12.33 m^3	75,000	924,750
posts	0.39 m^3			
rails	0.25 m^3	0.64 m^3	80,000	51,200
Bolts and connectors		120 kg	700	84,000
				1,654,550
Contractors overheads and profit 1%				165,455
				1,820,005
PPN tax			5%	91,000
Total				1,911,005
			Say	1,911,000

E.11.3 Timber bridge in class I and class II roads – 4 m wide and 8 m span

Item		Quantity	Unit rate (rupiahs)	Cost (rupiahs)
Excavation in abutments		30 m^3	500	15,000
Treated timber class I in:				
Piles		6.03 m^3	120,000	723,600
Abutment cap	1.28 m^3			
12 cm decking and)				
running boards)	4.99 m^3			
Wheel guards	0.78 m^3			
Scupper blocks	0.25 m^3			
Abutment walls	2.51 m^3	17.66 m^3	75,000	1,324,500
Posts	0.47 m^3			
Rails	0.34 m^3	0.81 m^3	80,000	64,800
Bolts and connectors		150 kg	700	105,000
				2,232,900
	Contractors overheads and profit		10%	223,290
				2,456,190
	PPN tax		5%	122,810
	Total			2,579,000

E.11.4 Timber bridge in class I and class II roads – 4 m wide and 10 m span

Item		Quantity	Unit rate (rupiahs)	Cost (rupiahs)
Excavation in abutments		50 m^3	500	25,000
Treated timber class I in:				
Piles		7.84 m^3	120,000	940,000
Abutment cap	1.28 m^3			
Deck beams	11.90 m^3			
12 cm decking and)				
running boards)	6.20 m^3			
Wheel guards	0.97 m^3			
Scupper blocks	0.31 m^3			
Abutment walls	2.51 m^3	23.17 m^3	75,000	1,737,750
Posts	0.47 m^3			
Rails	0.42 m^3	0.89 m^3	80,000	71,200
Bolts and connectors		180 kg	700	126,000
				2,900,750
	Contractors overheads and profit		10%	290,075
				3,190,825
	PPN tax		5%	159.541
	Total			3,350,366
			Say	3,350,500

E.11.5 Timber bridge in class I and class II roads – 4 m wide and 12 m span

Item		Quantity	Unit rate (rupiahs)	Cost (rupiahs)
Excavation in abutments		60 m^3	500	30,000
Treated timber class I in:				
Piles		9.05 m^3	120,000	1,086,000
Abutment cap	1.28 m^3			
Deck beams	18.41 m^3			
12 cm decking and)				
running boards)	7.57 m^3			
Wheel guards	1.16 m^3			
Scupper blocks	0.37 m^3			
Abutment walls	2.51 m^3	31.30 m^3	75,000	2,347,000
Posts	0.55 m^3			
Rails	0.50 m^3	1.05 m^3	80,000	84,000
Bolts and connectors		220 kg	700	154,000
				3,701,500
	Contractors overheads and profit		10%	370,150
				4,071,650
	PPN tax		5%	203,583
	Total			4,275,233
			Say	4,275,300

E.11.6 Timber bridge in class III and class IV roads – 4 m wide and 4 m span

Item		Quantity	Unit rate (rupiahs)	Cost (rupiahs)
Excavation in abutments		4 m^3	500	2,000
Treated timber class I in:				
Piles		0.75 m^3	120,000	90,000
Beams	1.08 m^3			
Braces	0.18 m^3	1.26 m^3	75,000	94,000
Posts	0.04 m^3			
Rails	0.14 m^3	0.18 m^3	80,000	14,400
5 cm decking and)				
running boards)		21 m^2	5,000	105,000
Bolts and connectors		50 kg	700	35,000
				340,900
	Contractors overheads and profit		10%	34,090
				374,990
	PPN tax		5%	18,750
	Total			393,740
			Say	394,000

E.11.7 60 cm diameter culvert – 8 m long

Item	Quantity	Unit rate (rupiahs)	Cost (rupiahs)
Excavation	10 m^3	350	3,500
Unreinforced concrete (1:2:4)			
in foundations	2 m^3	17,800	35,600
Ditto in wing walls	1 m^3	18,730	18,730
Formwork to edge of foundations	6 m^2	2,230	13,380
Ditto to walls	10 m^2	2,230	22,300
60 cm diameter reinforced concrete			
pipe 8 metres long	1	31,200	31,200
Mixed sand and gravel surround to pipe	9 m^3	1,130	10,170
			134,880
Contractors overheads and profit		10%	13,488
			148,368
PPN tax		5%	7,418
Total			155,786
		Say	156,000

E.11.8 90 cm diameter culvert – 8 m long

Item	Quantity	Unit rate (rupiahs)	Cost (rupiahs)
Excavation	12 m^3	350	4,200
Unreinforced concrete (1:2:4)			
in foundations	2 m^3	17,800	35,600
Ditto in wing walls	1 m^3	18,730	18,730
Formwork to edge of foundations	6 m^2	2,230	13,380
Ditto to walls	13 m^2	2,230	28,990
90 cm diameter reinforced concrete			
pipe 8 metres long	1	42,500	42,500
Mixed sand and gravel surround to pipe	11 m^3	1,130	12,430
			155,830
Contractors overheads and profit		10%	15,583
			171,413
PPN tax		5%	8,571
Total			179,984
		Say	180,000

E.11.9 Paved ford 3 m wide and 10 m long

Item	Quantity	Unit rate (rupiahs)	Cost (rupiahs)
Excavation and trimming banks	9 m^3	500	4,500
Unreinforced concrete in base and toes	6 m^3	17,800	106,000
Mixed sand and gravel surround to pipe	2 m^3	1,130	2,260
30 cm unreinforced concrete pipe	9 m	2,700	24,300
			137,860
Contractors overheads and profit		10%	13,786
			151,646
PPN tax		5%	7,582
Total			159,228
		Say	159,300

APPENDIX E. 12 Cost estimates for improvements to existing roads

Road Section	Condition of existing road	Length km.	Unit rate (rupiahs)	Sub-total (rupiahs)	Total cost (rupiahs)
Ambaipuah to Motaha					
Class I standard					
	fair	1.2	4,151,600	4,981,920	
	poor	20,3	4,973,600	100,964,080	
	very poor	20,7	6,006,700	124,338,670	230,284,690
Amoito					
To class II standard					
	poor	2.0	4,098,700	8,197,400	
To class III standard					
	poor	1.5	2,665,500	3,998,250	12,195,650
Landono II					
To class II standard					
	poor	2.5	4,098,700	10,246,750	
To class III standard					
	poor	1.5	2,665,500	3,998,250	14,245,000
Mowila Jaya					
To class II standard					
	poor	1.0	4,098,700	4,098,700	
To class III standard					
	poor	2.5	2,665,500	6,663,750	10,762,450
Total : Road Section I — Ambaipuah to Motaha					267,487,790
Motaha to Lambuya					
To class I standard					
	fair	2.0	4,151,600	8,303,200	
	poor	20.6	4,973,600	102,456,160	
	very poor	8.2	6,006,700	49,254,940	
Total : Road Section 2 — Motaha to Lambuya					160,014,300
Rate-Rate to Poli-Polia					
To class I standard					
	poor	3.5	4,973,600	17,407,600	
	very poor	16,4	6,006,700	98,509,880	115,917,480
Ladongi II					
To class III standard					
	poor	1.5	2,665,500		3,998,250
Ladongi I					
To class III standard					
	poor	1.0	2,665,500		2,665,500
Total : Road Section 3 — Rate-Rate Poli-Polia					122,581,230

APPENDIX E. 12 (contd.)

Road Section	Condition of existing road	Length km.	Unit rate (rupiahs)	Sub-total (rupiahs)	Total (rupi
Poli-Polia to Lambandia					
To class I standard	very poor	9.6	6,006,700		57,664
Total : Road Section 4 — Poli-polia to Lambandia					57,664
Lepo-Lepo to Tanea Baru					
To class I standard	fair	13.1	4,151,600	54,385,960	
	poor	2.1	4,874,600	10,444,560	
	very poor	0.4	6,006,700	2,402,680	67,233
Konda					
To class III standard	poor	0.5	2,665,5000		1,332
Tanea Baru					
To class III standard	poor	2.0	2,665,500		5,33
Total : Road Section 5 — Lepo-Lepo to Tanea Baru					73,89
Tanea Baru to Punggaluku					
To class II standard	fair	2.5	4,151,600	10,379,000	
	poor	10.6	4,973,600	52,720,160	
	very poor	14.4	6,006,700	86,496,480	149,59
Wolasi					
To class II standard	poor	1.0	4,098,700	4,098,700	
To class III standard	poor	1.5	2,665,500	3,998,250	8,0
Total : Road Section 6 — Tanea Baru to Punggaluku					157,6
Punggaluku to Alangga					
To class I standard	poor	10.2	4,973,600	50,730,720	
	very poor	21.0	6,066,700	126,140,700	176,8
Rambu-Rambu					
To class II standard	poor	1.0	4,098,700		4,0
Roraya 1					
To class II standard	poor	11.0	4,098,700	45,085,700	

APPENDIX E. 12 (contd.)

Road Section	Condition of existing road	Length km.	Unit rate (rupiahs)	Sub-total (rupiahs)	Total cost (rupiahs)
To class III standard	poor	2.7	2,665,500	7,196,850	52,282,550
Total : Road Section 7 –	Punggaluku to Alangga				233,252,670
Alangga to Tinanggea					
To class I standard					
	poor	6.4	4,973,600	31,831,000	
	very poor	11.9	6,006,7000	71,479,730	103,310,770
Roraya II					
To class II standard					
	new	6.0	5,558,200		33,349,200
Total : Road Section 8 –	Alangga to Tinanggea				136,659,970
Tinangga to Lapoa					
To class I standard					
	poor	5.7	4,973,600	28,349,520	30,151,530
	very poor	0.3	6,006,700	1,802,010	
Roraya IV and V					
To class I standard					
	new	0.8	6,202,302		49,618,416
Lapoa					
To class III standard					
	poor	1.5	2,665,500		3,998,250
Total : Road Section 9 –	Tinanggea to Lapoa				83,768,196
Alangga to Motaha					
To class I standard					
	fair	8.4	4,151,600	34,873,440	
	poor	21.2	4,973,600	105,440,320	
	very poor	9.8	6,006,700	58,865,660	
Total : Road Section 10 –	Alangga to Motaha				199,179,420
Lepo-Lepo to Tambosupa					
To class I standard					
	fair	0.9	4,151,600	3,736,440	
	poor	16.7	4,973,600	83,059,120	
	very poor	27.6	6,006,700	165,784,920	
Total : Road Section 11 –	Lepo-Lepo to Tambosupa				252,580,480

APPENDIX E. 12 (contd.)

Road Section	Condition of existing road	Length km.	Unit rate (rupiahs)	Sub-total (rupiahs)	Total cost (rupiahs)
Tambosupa to Moramo I					
To class I standard					
	fair	9.9	4,151,600	41,100,840	
	poor	2.6	4,973,600	12,931,360	
	very poor	1.6	6,006,700	9,610,720	63,642,920
Moramo II					
To class III standard					
	new	1.0	3,259,000		3,259,000
Moramo I					
To class III standard					
	poor	3.0	2,665,500		7,996,500
Total : Road Section 12 – Tambosupa to Moramo I					74,898,420
Punggaluku to Lainea					
To class I standard					
	poor	15.5	4,973,600	77,090,800	
	very poor	13.7	6,006,700	82,291,790	159,382,590
To class III standard					
	poor	1.5	2,665,500		3,998,250
Total : Road Section 13 – Punggaluku to Lainea					163,380,840
Unaaha					
To class II standard					
	poor	2.1	4,098,700		8,607,270
To class III standard					
	poor	2.0	2,665,500		5,331,000
Total : Road Section 14 – Unaaha					13,938,270
Uepai					
To class II standard					
	poor	2.0	4,098,700		8,197,400
To class III standard					
	poor	3.0	2,665,500		7,996,500
Total: Road Section 15 – Uepai					16,193,900

APPENDIX E.13 Cost estimates for new bridges in improvement to existing roads

Item	Quantity in class road construction I	II	III	IV	Unit rate (rupiahs)	Sub-total (rupiahs)	Total (rupiahs)
Ambaipuan to Motaha Section							
4 m span bridge	7				1,445,000	10,115,000	
6 m span bridge	2				1,911,000	3,822,000	
8 m span bridge	4				2,579,000	10,316,000	
12 m span bridge	3				4,275,300	12,825,900	
22 m span bridge	1				7,370,800	7,370,800	44,449,700
Amoito							
4 m span bridge		1			1,445,000		1,445,000
Landono II							
4 m span bridge		2			1,445,000		2,890,000
Mowila Jaya							
4 m span bridge			1		394,000		394,000
1	Total – Ambaipuan to Motaha section						49,178,700
Motaha to Lambuya Section							
4 m span bridge	13				1,445,000		18,785,000
6 m span bridge	2				1,911,000		3,822,000
8 m span bridge	3				2,579,000		7,737,000
12 m span bridge	1				4,275,300		4,275,300
2	Total – Motaha to Lambuya section						34,619,300
Rate-Rate to Poli-Polia Section							
4 m span bridge	3				1,445,000	4,335,000	
6 m span bridge	6				1,911,000	11,466,000	
8 m span bridge	1				2,579,000	2,579,000	
15 m span bridge	2				4,835,600	9,671,200	28,051,200
3	Total – Rate-Rate to Poli-Polia section						28,051,200
Poli-Polia to Lambandia section							
4 m span bridge	5				1,445,000		7,225,000
6 m span bridge	2				1,911,000		3,822,000
4	Total – Poli-Polia to Lambandia section						11,047,000
Lepo-Lepo to Tanea Baru section							
4 m span bridge	2				1,445,000		2,890,000
Tanea Baru							
4 m span bridge			2		394,000		788,000
5	Total – Lepo-Lepo to Tanea Baru section						3,678,000

APPENDIX E.13 (contd)

Item	Quantity in class road construction I	II	III	IV	Unit rate (rupiahs)	Sub-total (rupiahs)	Total (rupiahs)
Tanea Baru to Punggaluku section							
4 m span bridge	5				1,445,000	7,225,000	
6 m span bridge	4				1,911,000	7,644,000	14,869,000
Wolasi							
4 m span bridge		1			1,445,000		1,445,000
6	Total – Tanea Baru to Punggaluku section						16,314,000
Punggaluku to Alangga section							
4 m span bridge	7				1,445,000	10,115,000	
6 m span bridge	5				1,911,000	9,555,000	
8 m span bridge	4				2,579,000	10,316,000	
10 m span bridge	8				3,350,500	26,804,000	
12 m span bridge	3				4,275,300	12,825,900	
15 m span bridge	1				4,835,600	4,835,600	
22 m span bridge	1				7,370,800	7,370,800	81,822,300
Roraya I							
4 m span bridge		2			1,445,000		2,890,000
7	Total – Punggaluku to Alangga section						84,712,300
Alangga to Tinanggea section							
4 m span bridge	3				1,445,000	4,335,000	
8 m span bridge	1				2,579,000	2,579,000	
10 m span bridge	3				3,350,500	10,051,500	
12 m span bridge	2				4,275,300	8,550,600	
15 m span bridge	1				4,835,600	4,835,600	30,351,700
Roraya II							
4 m span bridge		2			1,445,000	2,890,000	
6 m span bridge		1			1,911,000	1,011,000	
8 m span bridge		1			2,579,000	2,579,000	7,380,000
8	Total – Alangga to Tinanggea section						37,731,700
Tinanggea to Lapoa section							
4 m span bridge	2				1,445,000		2,890,000
Lapoa							
4 m span bridge			1		394,000		394,000
Roraya IV and V							
4 m span bridge	3				1,445,000	4,335,000	
6 m span bridge	1				1,911,000	1,911,000	
8 m span bridge	1				2,579,000	2,579,000	8,825,000
9	Total – Tinanggea to Lapoa section						12,109,000

APPENDIX E.13 (contd)

Item	Quantity in class road construction I	II	III	IV	Unit rate (rupiahs)	Sub-total (rupiahs)	Total (rupiahs)
Alangga to Motaha section							
4 m span bridge	7				1,445,000		10,115,000
6 m span bridge	4				1,911,000		7,644,000
8 m span bridge	3				2,579,000		7,737,000
10 m span bridge	1				3,350,500		3,350,500
12 m span bridge	2				4,275,300		8,550,600
15 m span bridge	1				4,835,600		4,835,600
25 m span bridge	2				8,375,900		16,751,800
10	Total – Alangga to Motaha section						58,984,500
Lepo-Lepo to Tambosupa section							
4 m span bridge	12				1,445,000		17,340,000
6 m span bridge	4				1,911,000		7,644,000
8 m span bridge	2				2,579,000		5,158,000
12 m span bridge	1				4,275,300		4,275,300
11	Total – Lepo-Lepo to Tambosupa section						34,417,300
Tambosupa to Moramo I section							
4 m span bridge	2				1,445,000	2,890,000	
22 m span bridge	1				7,370,800	7,370,800	10,260,800
Moramo I							
4 m span bridge			2		394,000		788,000
12	Total Tambosupa to Moramo I section						11,048,800
Punggaluku to Lainea section							
4 m span bridge	12				1,445,000	17,340,000	
6 m span bridge	7				1,911,000	13,277,000	
8 m span bridge	1				2,579,000	2,579,000	
60 m span bridge	1				84,000,000	84,000,000	117,296,000
Pamandati							
4 m span bridge			1		394,000		394,000
13	Total – Punggaluku to Lainea section						117,690,000
Unaaha							
4 m span bridge			1		394,000		394,000
14	Total Unaaha						394,000
Uepai							
4 m span bridge			2		394,000	788,000	
6 m span bridge			1		590,000	590,000	1,378,000
15	Total Uepai						1,378,000

APPENDIX E.14 Cost estimates for culverts and fords in improvements to existing roads

Item	Quantity in class road construction I	II	III	IV	Unit rate (rupiahs)	Sub-total (rupiahs)	Total (rupiahs)
Ambaipuah to Motaha section							
600 mm culvert	34				156,000	5,304,000	
900 mm culvert	8				180,000	1,440,000	6,744,000
Amoito							
600 mm culvert		2	2		156,000	624,000	
900 mm culvert		1			180,000	180,000	
Paved ford			1		159,300	159,300	963,300
Landono II							
600 mm culvert		2	2		156,000	624,000	
900 mm culvert		1			180,000	180,000	
Paved ford			1		159,300	159,300	963,300
Mowila Jaya							
600 mm culvert		2	2		156,000	624,000	
Paved ford			1		159,300	159,300	783,300
Total: Section 1 – Ambaipuah to Motaha							9,453,900
Motaha to Lambuya section							
600 mm culvert	21				156,000	3,276,000	
900 mm culvert	5				180,000	900,000	4,176,000
Total: Section 2 – Motaha to Lambuya							4,176,000
Rate-Rate to Poli-Polia section							
600 mm culvert	26				156,000	4,056,000	
900 mm culvert	2				180,000	360,000	4,416,000
Ladongi II							
600 mm culvert			2		156,000	312,000	
Paved ford			1		159,300	159,300	471,300
Ladongi I							
600 mm culvert			2		156,000		312,000
Total: Section 3 – Rate-Rate to Poli-Polia							5,199,300
Poli-Polia to Lambandia section							
600 mm culvert	8				156,000	1,248,000	
900 mm culvert	2				180,000	360,000	1,608,000
Total: Section 4 – Poli-Polia to Lambandia							1,608,000
Lepo-Lepo to Tanea Baru section							
600 mm culvert	2				156,000		312,000
Konda							
600 mm culvert			1		156,000		156,000

APPENDIX E.14 (contd)

Item	Quantity in class road construction I	II	III	IV	Unit rate (rupiahs)	Sub-total (rupiahs)	Total (rupiahs)
Tanea Baru							
600 mm culvert			2		156,000	312,000	
900 mm culvert			1		180,000	180,000	492,000
Total: Section 5 – Lepo-Lepo to Tanea Baru							960,000
Tanea Baru to Punggaluku section							
600 mm culvert	16				156,000		2,496,000
Wolasi							
600 mm culvert		1	2		156,000	468,000	
Paved ford			1		159,300	159,300	627,300
Total: Section 6 – Tanea Baru to Punggaluku							3,123,300
Punggaluku to Alangga section							
600 mm culvert	16				156,000	2,496,000	
900 mm culvert	3				180,000	540,000	3,036,000
Rambu-Rambu							
600 mm culvert		2			156,000	312,000	
Paved ford		1			159,300	159,300	471,300
Roraya I							
600 mm culvert		12	3		156,000	1,340,000	
Paved ford			2		159,300	318,600	2,658,600
Total: Section 7 – Punggaluku to Alangga							6,165,900
Alangga to Tinanggea section							
600 mm culvert	16				156,000	2,496,000	
900 mm culvert	2				180,000	360,000	2,856,000
Roraya II							
600 mm culvert		5			156,000	780,000	
900 mm culvert		1			180,000	180,000	960,000
Total: Section 8 – Alangga to Tinanggea							3,816,000
Tinanggea to Lapoa section							
600 mm culvert	2				156,000		312,000
Lapoa							
600 mm culvert			2		156,000	312,000	
Paved ford			1		159,300	159,300	471,300
Roraya IV and V							
600 mm culvert	6				156,000	936,000	
900 mm culvert	2				180,000	360,000	1,296,000
Total: Section 9 – Tinanggea to Lapoa							2,079,300

APPENDIX E.14 (contd)

Item	Quantity in class road construction I	II	III	IV	Unit rate (rupiahs)	Sub-total (rupiahs)	Total (rupiahs)
Alangga to Motaha section							
600 mm culvert	33				156,000	5,148,000	
900 mm culvert	8				180,000	1,440,000	
	Total: Section 10 – Alangga to Motaha						6,588,000
Lepo-Lepo to Tambosupa section							
600 mm culvert	47				156,000	7,332,000	
900 mm culvert	14				180,000	2,520,000	
	Total: Section 11 – Lepo-Lepo to Tambosupa						9,852,000
Tambosupa to Moramo I section							
600 mm culvert	12				156,000	1,872,000	
900 mm culvert	3				180,000	540,000	2,412,000
Moramo II							
600 mm culvert			1		156,000	156,000	
Paved ford			1		159,300	159,300	315,300
Moramo I							
600 mm culvert			3		156,000	468,000	
900 mm culvert			1		180,000	180,000	
Paved ford			2		159,300	318,600	966,600
	Total: Section 12 – Tambosupa to Moramo I						3,693,900
Punggaluku to Lainea section							
600 mm culvert	18				156,000	2,808,000	
900 mm culvert	4				180,000	720,000	3,528,000
Pamandati							
600 mm culvert			2		156,000	312,000	
Paved ford			1		159,300	159,300	471,300
	Total: Section 13 – Punggaluku to Lainea						3,999,300
Unaaha							
600 mm culvert		2	3		156,000	780,000	
Paved ford			1		159,300	159,300	
	Total: Section 14 – Unaaha						939,300
Uepai							
600 mm culvert		2	4		156,000	936,000	
900 mm culvert		1			180,000	180,000	
Paved ford			1		159,300	159,300	
	Total: Section 15 – Uepai						1,275,300

APPENDIX E.15 Cost estimates for construction of proposed new roads to serve existing settlements

Road Section			Quantity		Rate (rupiahs)	Amount (rupiahs)
A	Tanea Baru to Tambosupa					
	Road Class I		19	km	6,202,300	117,843,000
	Bridges		25	km	340,000	8,500,000
	Culverts	0.6 m diam	13	No	156,000	2,028,000
		0.9 m diam	2	No	180,000	360,000
						128,731,000
			add	1% mobilisation		1,287,000
						130,018,000
			add	5% contingencies		6,502,000
						136,520,000
B	Mowila Jaya to Wawolemo					
	Road Class I		16	km	6,202,300	99,236,000
	Bridges		20	m	340,000	6,800,000
	Culverts	0.6 m diam	10	No	156,000	1,560,000
		0.9 m diam	2	No	180,000	360,000
						107,956,000
			add	1% mobilisation		1,079,560
						109,035,560
			add	5% contingencies		5,451,780
						114,487,340
			add cost of ferry accross Konaweha river			83,000,003
						197,487,000
C	Lambandia to Benua					
	Road Class I		25	km	6,202,300	155,097,000
	Bridges		36	m	340,000	12,240,000
	Culverts	0.6 m diam	16	No	156,000	2,496,000
		0.9 m diam	5	No	180,000	900,000
						170,693,000
			add	1% mobilisation		1,706,930
						172,399,930
			add	5% contingencies		8,619,950
						181,019,880
					Say	181,020,000

APPENDIX E.16 Road maintenance costs

Routine maintenance

Assuming a maintenance gang consists of a foreman in charge of 10 men, each responsible for 3.5 km of road we have the following costs:

Consider 35 km of road, annual costs:			
10 labourers @ Rp 500/day	=	Rp	1,560,000
Add 40% for supervision, transport and materials	=	Rp	624,000
		Rp	2,184,000

Therefore routine maintenance cost estimate
= Rp 62,400 per km per annum

Reshaping

Reshaping of the running surface is usually required after the passage of between 1000 and 2000 vehicles. Assuming a basis of 1500 vehicles, an average flow of 50 vehicles per day on the class I roads and 20 vehicles per day on the class II roads, we have the number of gradings required in one year as follows:

Class I	365 x 50/1500	=	12 No.
Class II	365 x 20/1500	=	5 No.

The cost of a motor grader is estimated at Rp 77,000 per day and a 10 tonne roller at Rp 8,000 per day. These costs are fully inclusive of depreciation, maintenance, spares, driver and fuel. Assuming a grader will reshape 10 km of single lane road in a day, the cost of reshaping and compacting 1 km of road would be:

(77,000 + 8,000)/10 = Rp 8,500 each time.

Hence the total cost of reshaping:

Class I	:	12 x Rp 8,500	=	Rp 102,000 per km per annum
Class II	:	5 x Rp 8,500	=	Rp 42,500 per km per annum

Regravelling

From experience it has been found that on average 25 mm of gravel is lost in 1 year for every 100 vehicles using the road per day. This gravel would normally be replaced by a 100 mm layer every 4 years. Hence the amount of gravel lost is:

Class I	:	50 x 25/100	=	12.5 mm per annum
Class II	:	20 x 25/100	=	5.0 mm per annum

and the volume in 1 km for a 3.5 m wide pavement is:

Class I	:	1000 x 3.5 x 0.0125	=	44 m^3 per annum
Class II	:	1000 x 3.5 x 0.005	=	18 m^3 per annum

The estimated price for supply, spread and level and compaction of surfacing material is Rp 3,150 per m^3, therefore the regravelling cost would be:

Class I	:	44 x Rp 3,150	=	Rp 138,600 per km per annum
Class II	:	18 x Rp 3,150	=	Rp 56,700 per km per annum

Summary

Total estimated maintenance costs per kilometre per annum, based on current prices, is as follows:

	Class I Road		Class II Road	
Routine maintenance	Rp	62,400	Rp	62,400
Reshaping		102,000		42,500
Regravelling		138,600		56,700
Total	Rp	303,000	Rp	161,600

APPENDIX E.17 Cost estimate for a washing area with an 18 metre deep shallow hand pump bore

Item	Cost (rupiahs)
Pump	25,000.–
18 m. 1¼" riser pipe	12,000,–
Slotting of 2 m riser pipe	1,000.–
Drilling at 4" to 20 m (@ Rp 3000/metre)	60,000.–
Concrete plug & apron	12,000.–
Sand & gravel filter	1,000.–
12 m² concrete washing area with shallow trough	26,671.–
	137,671.–
Contractors overheads and profit 10%	13,767.–
	151,438.–
PPN tax 5%	7,572.–
	159,010.–

Timber

F

The following notes on the timbers of South East Sulawesi provide guidance on their characteristics and suitable uses. It has not been possible to estimate the stress grades for these timbers as the information is either not available or the species is too variable to give any valid indication of the appropriate grades. For exposed situations especially in contact with the ground, the most important species are:

Merbau (Kayu Bayam)	–	*Intsia spp*
Gadog	–	*Bischoffia javenica*
Gofasa	–	*Vitex cofassus*
Kayu hitam	–	*Diospyros spp*
Lara	–	*Metrosideros petiolata*
Poti	–	*Hopea spp*
Tembusu (Kolahi)	–	*Fagraea fragrans*

APPENDIX F Notes on timbers of South East Sulawesi

Standard name i	Vernicular names ii	Botanical name iii	Specific gravity iv	Timber dura-bility v	Classes strength vi	Notes vii
Agathis	Damar damar, hulo	*Agathis hamii, A. philippensis*	0.4 –0.6	4	3	Confined to submontane and montane forest. A valuable export timber.
Bajur	Badjo, bangoro,	*Prerospermum celebium, P. diversifolium*	0.35 –0.50	4	3	Light constructional work, not exposed. A frequent species in alluvial soils.
Berangan	Eha, leasa	*Castanopsis buruana, C. acuminatissima*	0.6 –0.8	2/3	2	These species have a good reputation in South East Sulawesi and are apparently used extensively for constructional purposes sometimes in contact into the ground.
Binuang	Benua	*Octomeles sumatrana*	0.3	5	4	A very light hardwood. Unsuitable for any constructional work.
Bintangur	Betau, wetai	*Calophyllium spp.*	0.40 –0.9	2/3	2/3	Probably at least ten species, with a large range of properties suitable mainly for light or medium constructional works under cover, thus rather rare and scattered.
Bungur	Langoti	*Lagerstroemia speciosa*	0.65 –0.75	2	2	Suitable for heavy constructional work. Species mainly confined to riverine forest and trees ready attain large size.
Durian	Duren, larie	*Durio zibethinus*	0.6	4	3	The cultivated species, which occurs in the wild, is the only durian in South East Sulawesi. Normally retained for its fruit, it does provide a reasonable medium hardwood.

APPENDIX F (contd.)

i	ii	iii	v	iv	vi	vii
Gadog	Polo	*Bischoffia javanica*	0.75	2	1	Timber suitable for constructional work in exposed situations. A widespread species that rarely attains large size.
Gofasa	Gofasa, biri, kulipapo	*Vitex cofassus*	0.6 –0.8	1/2	2	A good constructional timber, though species rarely attains large size and is usually of poor form.
Hamirung	Bubi, bubuk, kayu rano	*Vernonia arborea*	0.3 –0.45	4	4	Unsuitable for constructional work. Occurs mainly in secondary forest.
Hija	Gia, hia, kolaka	*Homalium spp.*	0.65 –0.95	1/2	1/3	Variable owing to more than one species. Mainly suitable for medium constructional work, though lighter density species should not be used in exposed situations.
Jati	Kayu jati, teak	*Tectona grandis*	0.65	1	2	For all constructional purposes. Teak is mainly exported though some is used locally in furniture. On mainland South East Sulawesi it only occurs in localised small patches.
Kasai	Kasi	*Pometia pinnata*	0.70 –0.85	3	2	Suitable for light constructional work in non-exposed situations. A widespread species, mainly of rather poor form.
Kayu cina	Kayu angin, tandangula, melur	*Podocarpus spp.*	0.4 –0.6	3/4	3	About six species, mainly occurring at higher altitude. These are true softwoods (conifers). Suitable for constructional purposes not exposed.
Kayu hitam	Itam	*Diospyros spp.*	0.7 –1.1	1	2/3	Excluding ebony producing species. Good heavy constructional timbers but should not be used in contact with the ground. At least twelve species – widespread and abundant.

APPENDIX F (contd.)

i	ii	iii	iv	v	vi	vii
Kecapi	Katapi, tapi	*Sandoricum Koetjape,*	0.5	4	3	Suitable for light constructional work.
Kelam-payan	Loera, baniaga, bankali, sugimanai	*Anthocephalus macrophyllus, A. Chinensis*	0.45 0.35	5	4	Light weight timbers that are generally unsuitable for constructional work. Both species are frequent, occurring in primary and secondary forest, particularly on alluvium.
Kenari	Tapi tapi, tara morohulo	*Canarium spp., Santiria spp., Haplobus celebicus*	0.50 –0.65	3/4	3	At least twelve species. Generally suitable for light constructional work. Trees of large size and widely distributed.
Kolaka	Bone	*Parinari spp.*	0.7 –1.0	3	1/2	Heavy constructional timbers but should not be used in contact with the ground.
Lara	Nona, towumea	*Metrosideros petiolata*	1.1	1	1/2	Heavy constructional work in contact with the ground. Attains large size; frequent in hill forests in some localities.
Leda	Galang	*Eucalyptus deglupte*	0.5 –0.75	2/3	2	Good medium constructional timber, though should not be used in contact with the ground. Distribution mainly confined to alluvial sandy soils.
Medang	Ponto, lumeni kedongi	*Cryptocarva spp., Litsea spp., Atseodaphne spp.*	0.3 –0.6	3/4	3	Numerous species with a wide range of properties, though all light hardwoods suitable for interior light constructional work under cover. Abundant and widespread.
Merbau	Kayu bayam, bayam, ipi	*Intsia bijuga, I. palembanica*	0.75 –1.0	1	1/2	One of the best constructional rimbers available in South East Sulawesi, also favoured in the export market. Occurs on mainly alluvial soils.

APPENDIX F (contd.)

i	ii	iii	iv	v	vi	vii
Nyatuh	Neto, kume,	*Sapotaceae spp.*	0.4 –1.0	1/2/3	2/3/4	Numerous species in five genera. The heavier species, which are rarer, are durable constructional timbers but the more abundant lighter timbers are non-durable. Occur in all forest types.
Pasang	Kesuna, pali	*Lithocarpus spp.*	0.5 –0.9	3	2/3	Non-durable constructional timbers. Mainly occur at higher altitude, but *L. spicatus* is abundant in secondary forest.
Perupok	Kabalo	*Lophopetalum javanicum, Siphonodon celastrineum*	0.45 –0.65	4	3/4	Good quality light density timbers, suitable for planting under cover. Rather rare.
Poti	Kayu poti, dama dama	*Hopea gregaria, H. dolosa*	0.85	1/2	2	An excellent and much sought after constructional timber. Occurs in hill forests.
Pulai	Rita, lingaru	*Alstonia spp.*	0.25 –0.35	5	5	One of the lightest timbers in the region and quite unsuitable for any constructional work.
Putat	Puta, wewu *Planchonia valida*	*Baningtonia spp., Planchonia valida*	0.7 –0.9	2/3	2	Suited to constructional work not in contact with the ground. Species rather localised.
Rau	Dao, ragu	*Dracontomelon dao*	0.5 –0.65	4	3	Suitable for light constructional work. Occurs on mainly alluvial soils, and is locally gregarious.
Rengas	Rongas	*Gluta velutina, Semecarpus spp.*	0.45 –0.7	3	3	Gluta velutina is a small tree mainly on river-banks in tidal areas. The main disadvantage of rengas is the poisonous sap.
Resak	Damar dere, hulo dere	*Vatica celebensis, V. flavovirens*	0.65 –0.9	2/3	2	ditto

APPENDIX F (contd.)

i	ii	iii	iv	v	vi	vii
Tembesu	Kolahi	*Fagraea fragrans*	0.75	1/2	1/2	A heavy hardwood suitable for constructional work in contact with the ground. Occurs in primary hill forest but is rare; also found in secondary forest.
Simpur	Dengi, sungi dongi	*Dillenia serrata*	0.65 –0.75	3	2	A useful constructional timber, but should not be used in exposed situations. Frequent in alluvial forest.
Terap	Tea, kuli, saling	*Artocarpus spp.*	0.55 –0.7	3/4	3/4	A light constructional timber. At least six species with a wide range of properties. Frequent in hill forest.
Ubah	Obah, jambu	*Eugenia spp.*	0.65 –0.9	3/4	2/3	Numerous species which have a bad reputation as constructional timbers. Frequent and widely distributed in all forest types.

Source: SESP