March 31, 1986

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CENTRE FOR RESEARCH
OF HUMAN RESOURCES AND THE ENVIRONMENT

UNIVERSITY OF INDONESIA

DRAFT FINAL REPORT

IMPACT STUDY OF SWAMP DEVELOPMENT

JALAN SALEMBA 4, JAKARTA 10430
PHONE 330318 (DIRECT); 330337 ETN 32
CABLE : UNIVERSITAS INDONESIA JAKARTA
TELEX : 45680 UI JKT

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DEPARTEMEN PEKERJAAN UMUM
DIREKTORAT JENDERAL PENGAIRAN
DIREKTORAT RAWA
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Mr. Pratt

The World Bank
IBRD - RSI
Lippo Life Building 3 rd Floor
Jl. Rasuna Said Kavling B-10
K u n i n g a n,
J A K A R T A S E L A T A N.

Jakarta, August 24, 1987.
Our Ref: HL. 02.03-Ar/833

Mr. Fox

01 SEP 1987

Attention : Mr. Owen T.W. Price,
Chief, Agriculture Division-RSI

Subject : IBRD Loan Nr. 1958-IND.
Progress Report.

Dear Mr. Owen T.W. Price;

We have a pleasure in submitting you each 3 (three) copies the following Pro - gress Report :

- Draft Final Report, Impact Study of Swamp Development in South and Central Kalimantan, Contract Nr. HK. 02.03.01-Da/355 dated March 31, 1986, by University of Indonesia.

  We would wait your comments on this draft for printing the final ones.

Please, accept accordingly and thank you for your attention with kind regards.

DEPARTEMEN PEKERJAAN UMUM ★ DIREKTORAT RAWA ★ DIREKTORAT JENDERAL PENGAIRAN

Yours Sincerely,

Ir. Sumartono Aslar.
Chief, Administration Div.

C c :

Mr. Kramer.

Preparatory Notes

It has been stated by the World Bank (1977) that tidal swamp development is one of the most important land transformation projects undertaken in Indonesia. It is a series of large-scale experiments in the utilization of marginal lands as well as a classical endeavour to create environmental strategy and to exploit natural resources.

For more than two decades, the Ministry of Public Works has ben working with great perseverance on the development of tidal swamps in Kalimantan. For this purpose, research has been conducted with a view to - among other things - eliminating controversies and doubts as to the economic viability and the ecological feasibility of the project undertaken.

The efforts to develop the tidal swamps are connected mainly with programmes to win new lands for transmigration with food production as the main basis.

Ever since the First Five-Year Development Plan, Government policy in regard to tidal swamps has been aimed at stepping up food production in areas where arable land still has to be extracted and at reclaiming the new lands for transmigration settlements. This policy was initially implemented by means of low-cost and simple technology.

In the Second Five-Year Development Plan, the policy was adjusted so as to be more in line with the ongoing national deelopment with rice production as the principal target through the expansion of arable lands for transmigrants. Low-cost and simple technology was still employed, although a beginning was gradually made of applying more appropriate technology.

In the Third Five-Year Development Plan, the technology already in use was further developed through the introduction of ways to intensify the utilization of water-processing facilities for reclaimed swamp areas already cultivated by the inhabitants. Thus the programme aimed at a more intensive exploitation of reclaimed lands with the purpose of increasing food production.

In the Fourth Five-Year Development Plan, priority in swampy land development was given to areas already occupied by transmigrants, in accordance with which attention was mainly focussed on the development and rehabilitation of canals.

The success of the development of the newly opened areas is highly dependent on the capability of creating conditions conducive to the growth of more varied activities beside the agricultural activities. This is usually accompanied by a process of the development of new centre of growth.

The desire to manage wisely tidal swamp areas and to search for ways to develop the areas without at the same time harming the environment has prompted the Ministry of Public Works to conduct environmental evaluation study in South and Central Kalimantan with World Bank sponsorship. It is for this reason that collaboration was effected between the Ministry of Public Works and the Centre of Studies for Human Resources and the Environment University of Indonesia in the environmental evaluation study of tidal areas in the transmigration settlement units of Jelapat, Purwasari, Barambai, Tamban Luar, Maliku and Sebangau.

The evaluation study was conducted for 14 months - too short considering the magnitude of the project - and the results are contained in this report. Time and difficult terrains were constraints that rendered impossible the achivement of maximum results. Nevertheless, the members of the research team, particularly those from the Ministry of Public Works, have been able to accomplished their task, mainly thanks to the great tolerance shown and assistance given by different parties to whom all the members of the team owe their deepest gratitude.

LIST OF CONTENTS

1 INTRODUCTION

The environment is a system of integrating space and all objects, conditions, energy and living matter including human beings with their behaviour which sustain their life and welfare as well as the life of other creatures. This can be further elaborated as follows:

a The environment constitutes a single system with interrelated, interconnected, and interdependent components. All are limited although the degree of limitation as well as that of imfortance and dependence vary. Consequently, for every problem the significant context should be found out progressively (Vayda 1982) in order that the approach would not get entangled, but would follow a certain direction, increase in efficiency, and contribute to the speedy completion of the project.

b Man and his behaviour are of great importance and are highly decisive in many situations. Therefore, human behaviour has to be put under control in order that environmental sustainability would not be upset by changes beyond its capacity of resilience.

c The environment is not intended to sustain mere life, but good life which should be getting even better.

d Owing to our limited understanding and capacity, we have only been able to focus environmental management on man's

interest, as if the aim of good environmental management were solely man's wellbeing. With regard to other creatures, we lack in knowledge as to what key feel to be a good life. However, it is essential to realize our dependence on the other components and on other living beings. It is therefore imperative that other living beings be given the opportunity to occupy their proper positions within the environment. At least this means that theey should be protected and be safeguarded against negative impacts resulting from human activities. This is part of the efforts to conserve and protect the system or the resources of nature, and to rehabilitate the system of natural resources which have been damaged by human hands or by natural disasters.

e In the mean time, man must keep on protecting himself against possible negative effects of his interaction with the environment, and also against living element that are potentially dangerous as carriers of disease harmful to man's efforts to manage the environment. Self-protection is a natural instinct common to all living beings.

In view of the above, as Soemarwoto (1983) points out, environmental management can be interpreted as a conscious effort to maintain, improve, and enhance environmental quality in order that the environment may fully function to sustain the continued existence of man and other living beings. As far as people are concerned, each individual

must at least be enable to meet his basic needs, although it must be recognized that different sections of society have different perceptions in regard to these needs and also that these needs vary according to time. Environmental management, therefore, must have sufficient flexibility. Soemarwoto (1983) further points out that with this flexibility we do not prevent any section of society from trying to meet their basic needs, nor do we close any possibility for people to make a choice for the future. A clear example is the dilemma of using up our oil resources now and investing the proceeds for the benefit of later generations or leaving intact part of the oil resources so that future generations could utilize them for new technologies with greater chances. But the flexibility should never lead to maladaptation, i.e. adaptation to excessively adverse conditions such as polluted environment unhygienic water, or any morbidity.

Basically, a symnptom of entropy has arisen in the environment, i.e. the gradual deterioration of environmental quality as risk of efforts to achieve gain. It is a platitude that in this life nothing can be got for freed. In this connection Beale (1980) says that "the deterioration of environmental quality of life is engendered by the increase in the GNP of a producing, consuming, and squandering society. To stem the deterioration of environmental quality, environmental management is imperative".

Beale further points out that product is a combinations of resources and technology, and that the impact on the biosphere is dependent upon the way technology ismanaged. A greater harmony between managament, resources, and technology - and integration of these three within the same biosphere - will produce more beneficial results.

Since a system of social and cultural values also exists in any particular society, the harmony and balance to be managed concern people, institutions, resources, and technology (Soerjani 1984).

In this connection it would be well to remember that not a single activity or technology merely produces gain, as there are bound to be risks. This conforms to the essence of the second law of thermodynamics according to which no energy use can be completely efficient. Waste can never be avoided. No technology exists without waste; there is only technology with a minimum of waste. Consequently, the important thing is to find out which components are affected, how the impact affect the environmental quality, and how the impact can be prevented, minimized, and managed. The components affected are the chemical-physical, biological, and the social-cultural ones.

For this reason, environmental management need to pay due attention to these components in an integrated manner. We must find out the interconnection of the problems, and attempt to solve them. In regard to this interconnection,

it is necessary first to try to identify the context of any one of the problems. The interconection with other contexts can subsequently be progressively traced.

Environmental management necessitates an integral approach. Yet, since there is one main context, not all measures need to be taken although the framework as a whole may never be disregarded. A problem may only need one course of action. But this course of action should be part of an integrated management as the connection with other problems has been considered.

With a strategic course of action, the remainder of the problem will undergo a homeostatic process so that in time the balance will be returned. More important, however, is management of a preventive nature, or trying to prevent a problem from arising, i.e. taking preventive measures or steps bearing the character of maintenance. For this purpose, monitoring, evaluation, and supervision are most needed.

Since around 1969 the Indonesian Government has attempted to develop tidal swamp areas in Sumatera, Kalimantan, Irian Jaya, and other provinces. Tidal swamp areas are very extensive in Indonesia and are potentially promising when developed. EUROCONSULT/BIEC (1986) reported that potentially arable tidal swamps in Indonesia amount to 5,600,000 hectares, or 35.67 percent of all the tidal swamps in the country which cover a surface of 15,700,000 hectares.

In Kalimantan alone potentially arable tidal swamps cover an area of 1,400,000 hectares, or 8.99 percent of all the tidal swamps in Indonesia.

Aware of the potentials of the tidal swamps, the Indonesian Government in its drive for self-sufficiency in food has persuaded farmers to plant these areas with crops, such as rice, cassava, cereals, and vegetables. The plan of the Government to encourage transmigrants to cultivate this type of land is evident from the tidal swamp development project which has been included in the fourth Five-Year Development Plan with a view to stepping up food production. Transmigration evidently does not only aim at increasing the production of food, but also at balancing population distribution, creating new employment opportunities, and improving living standarts through opening up new production areas.

The development of new production areas in tidal swamps is carried out by changing the natural swamp ecosystem into a swamp area environment. The activities to alter the swamp ecosystem include the creation of irrigation canals, ricefield plots, settlements with all the facilities, surface water regulation devices, drainage systems, etc. All these activities, however well prepared on paper, will have some inimical impact on the environment, beside the beneficial. The accumulation of these impacts will be manifested in the quality of the environment. Therefore, a

study with the purpose to evaluate is highly necessary since this will enable us to find out whether the environmental quality of certain transmigrant settlements has changed for the better or worse.

2 SCOPE AND AIM OF STUDY

The scope of this study to evaluate the tidal swamp development will cover both the macro and micro aspects.

On the macro level, the scope will include the river basin ecosystems of the Barito, Kapuas, Kahayan, and Sebangau rivers with their estuaries which cover an area of 98,500 square kilometers. Afterwards, the scope will be narrowed down in order that certain objects of study wchich call for more detailed and more intensive investigation could be dealt with. For this purpose, the focus will be directed to the delta or sub river basin area which constitutes an ecosystem unit.

On the micro level the scope of study will only include the area of each of the development units, irrespective of whether they wer initiated by the Government or the population themselves.

Further explanation of each of the environmental components, i.e. the chemical-physical, the biological, and the social-economic-cultural, will be given below.

In conformity with the scope of study forth above, the aim of this study of the environment is to find out the impact of tidal swamp development on environmental quality in terms of the chemical-physical, biological, and social-economic-cultural components. On the basis of the knowledge of environmental quality thus obtained, a plan of environmental management and that of environmental monitoring will be drawn up.

3 GENERAL POLICIES AND LEGAL BASIS

The General Lines of Government Policy stipulates that long-term national development be directed towards a just, prosperous, and egalitarian society based on Pancasila and the 1945 Constitution. Expressed more specifically, national development should benefit the individual as well as the whole Indonesian society and be felt as an improvement in their standards of living.

In argument with the pollicy above, natural resources and the environment have to be managed in such a way that they provide the greates benefit for the population without at the same time overlooking the problems of balance and maintenance in order that posterity could also share in their benefits. Concurrently, efforts to rehabilitate natural resources and the environment should be continued and even intensified.

Development is a conscious effort to manage and utilize resources for the purpose of improving the quality of life of the people. At the same time natural resources are not unlimited either in quantity or in quality, while the demands for the resources increase as result of the increase in the total population and the increase in their needs. Along the same line, the carrying capacity of the environment may be disturbed and the quality of the living environment may decline.

The implementation of development as an effort at increasing rates brings with it the risk of polluting and damaging the environment in such a way that the basic structure and function of the ecosystem as a support of life could also be impaired. Such conditions would constitute a burden to the society, since at the end it is the people and the government who hace to bear the burden of restoring the environment.

The maintenance of a good and healthy ecosystem is a responsibility which requires the participation of each member of the community in improving the carrying capacity of the environment. Therefore, a wise and sound development should be based upon environmental considerations as a means of achieving continuity and the well-being of present and future generations.

Article 33 of the 1945 Constitutions stipulates that soild, water, and the natural riches of Indonesia as gift of God should be utilized solely with a view to increasing the prosperity of the whole Indonesian people. Transmigration, i.e. the moving of people from densely populated areas to less densely population ones, is one implementation of said article as transmigration aims at opening up waste lands and utilizing natural resources in order that many people could prosper. More specifically, transmigration is a means to distrbute the population and the labour force more equallu in addition to bring an effort to open up new production areas particularly for agriculture. Viewed from local

development, transmigration could provide a stimulus and thus speed up development in relatively baclward areas.

It is further explicitly specified in Act no. 3, 1972, on the Principles of Transmigration that the aim of the programme is agro-development. Consesquently, the key to its succcess lies in the methods of guiding the transmigrants so that ultimately they are able on their own to take the greates advantage of the natural potentials for the agriculture that they undertake.

The general policy in transmigration according to this law is to stimulate regular spontaneous, voluntary transmigration on the largest possible scale. This brings with it that such conditions should be created that prospective transmigrants could be convinced of bright prospects and an improvement in their living standards in the new areas. Success of the programmes will -- besides improving the transmigrants' living standards and those of the local people -- assist the Government in pursuing people to tranmigrate voluntarily. This is one of the multiplier effects of transmigration. The aims of transmigration -- as contained in said law -- are :

(1) improvement of living standards;

(2) regional development;

(3) balance in population distribution;

(4) the utilization of natural resources;

(5) equal distribution of development;

(6) national unity;

(7) national resilience.

Government policies in the IIIrd IVth Five Year Development Plan (Repelita) as concerns tidal swamp areas are comprehensively and technically called "Panca Karsa Utama" (the Five Principal Intentions) and comprise:

(1) stepping up food production, mainly rice;

(2) increasing transmigration programmes, both in quality and quantity;

(3) stimulating the development of isolated areas;

(4) more equal distribution of local/regional development;

(5) strengthening the nation's defence in border areas.

Implied in the above policies is the priority given to food production with a view to maintaining self-sufficiency.
In the IVth Five Year Development Plan, priority in the development of tidal swamp areas is directed towards those already sttlked by transmigrants and where some cultivation has been effected. Accordingly, the irrigation systems become the first and foremost priority of rehabilitation and improvement development efforts.

It has been stated that the development of transmigration in the tidal swamp areas is oriented mainlu to maintaining self-sufficiency in food. Operationally this is backed up by the so-called "Panca Usaha Tani" (Five Agro-Undertakings) comprising :

(1) better land cultivation techniques;

(2) the planting of high-yielding crop varieties;

(3) better application of irrigation systems;

(4) the use of organic fertilizers;

(5) pest control.

In the periods of the former Five Year Development Plans, the cultivation of transmigration areas was restricted to the food-crop pattern since most of the transmigrants originated from places where this pattern was dominant. In the IV Five Year Development Plan, however, emphasis has been given to potential natural resources in each of the transmigration areas, in consequence of which different patterns have been developed such as those of plantation, animal husbandary, mining, fishery and industry. For this reason, each tranmigration area necessitates a specific type of treatment and management suted to the area, in that the types of technology to be developed and apllied are also different.

From the environmental point of view, a settlement constitutes an aggregate of interrelated human activities wihtin a dynamic and sustainable environment. On the basis of this view, the concept of "Optimum Settlement" has been developed, comprising the following aspects :

(1) housing, in the sense of proper place to live in;

(2) roads, and various types of means and infrastructure;

(3) work, or the availability of adequate employment opportunities for the settlers;

(4) amenities, or the availability of facilities for the settlers' convenience, comfort and enjoyment, so that they are willing to stay in the locality permanently.

The implementation of eco-development and the wise control of natural resource utilization constitute the main objective of environmental management. To achieve the objective, from the beginning of the planning of the activities, the positive and negative changeswhich resulted from the new environmental condition should habe been earlierly assessed.

Article 16, Act No. 4, 1982, on the basic Principles of Environmental Management stipulated that every planned activities which are considered as having important impacts on the environment should be equipped with environmental impact analysis.

Environmental evaluation study serve as an accurate and profound analysis of the impacts resulted from the carrying out of development activities. Integrated in this study is the environmental evaluation presentation which comprises general analysis of the existing activities and environmental conditions while the presentation is being carried out, environmental impacts caused by those activities, and the planning of control actions against the negative impacts. The study should be completed with environmental management and monitoring planning.

According to article 18, Goverment Regulation no. 29, 1986, environmental management and monitoring planning serve as basic consideration for licensing, because environmental management and monitoring planning are considered as preventive efforts against environmental deterioration and pollution. These plans are employed by the Goverment to evaluate and monitor the environment while activities are being carried out.

The various government policies have been realized operationally for some time in the transmigration programmes. Quantivatively, the programmes have been quite successful, but the same cannot be said yet as to the quality. It is for this reason that continuous and adequate care is an absolute necessity for every single transmigration programme, and it is for this purpose also that environmental evaluation study is carried out.

4 IDENTIFICATION OF PROBLEMS

4.1 General

Most of the coastal areas in Indonesia are fresh-water swamp forests lined by mangroves. Mangrove area is not suitable for rice cultivation unless development of water constructions and reclamation efforts be carried out.

In fact, in its natural condition, the mangrove forests have a high economic significance to the local people since mangroves provide habitats and hatcheries of various species of crustacea and fish. Henceforth, instead of giving attentions and emphasis to the mangrove areas, priority should be given to the peat swamp forest.

The development of coastal area for agricultural purposes had been initiated even before the independence of the Republic of Indonesia, and earlier before that the Netherland Hindia government had also started the transmigration programme.

In fact, suitable techniques and period of rice and coconut planting in swamp areas to prevent the risks caused by the salt water or flood have been developed for centuries by the Bandjar people in South

Kalimantan. They made the use of navigation canals constructed in simple forms by the Dutch. The attention of the Netherland Hindia Government to the mangrove areas was started during the 20s, marked by widespread geological surveys conducted at the mangrove areas. From the very beginning of its development, considerations were particularly given on various regional development adaptation techniques which was technologically more developed than the traditional ones.

The development plans and activities of transmigra-tion at swamp areas then were devided into 5 main periods, i.e. :

a Pre-World War II surveys and limited placements of transmigrants in Kalimantan;

b one huge folder system plan in Kalimantan; the implementation was very limited, during the period of 1948 - 1953;

c transition to simpler canal systems, i.e. without using pumps and water control equipment, planned by Ministry of Public Works/Steam Power Plant for 15 year period in Sumatra and Kalimantan; tidal swamps;

d opening plan of tidal swamp area, the total acreage was 5,25 million ha (15 years), 1967 - 1968, and during the Repelita I (1969 - 1974) the acreage was reduced to 500,000 ha.

e The area of pilot project of Pelita I was in-creased, thus covered an area of 1 million ha; later on reduced to 250,000 ha.

In general, the whole programme proved to be not so successful. The failure was due to over-optimistic projection which was also the result of the fact that the swamp areas in Kalimantan consist of peat layers over marine clay sand. In dry condition, the clay sand is oxidized into an acid sulphate soil. In humid condition the base layer of the soil is considered good enough for rice cultivation. The peat layer with a thickness of 1.5 m can be used for rice planting; while those thicker than 4 - 5 m (as found in Riau) is not fertile enough; moreover, it would not be suitable for deep-root plants.

However, the local people from Banjar and other new comers from Bugis have been able to cultivate rice by using simple drainage system. By implementing this system the flood pattern and specific seepage of salinity can be adapted.

The programmes carried out by the government use the technology of simple canal construction, i.e. by dredging a 30 m wide and 5 m deep canal. The system enables the occurance of water exchange since the tidal movements can push the river water 100 km up to

the upstream area. But based on field observation, the tidal irrigation system can only reach 30.50 km from the coast line. The canals also open the possibility of brackish water seepage if their location is near the estuary.

Eventually, such project requires very high budget allocation. Several mechanization techniques for canal construction using closed canal system which requires pumping has been considered since 30s, yet due to its costly development, the pumping system has never been realized.

The Ministry of Public Works has set its aim to develop the tidal swamp areas. Therefore, various surveys on tidal swamp areas have been already conduc-ted. The survey results are expected to answer dis-agreements in its investment feasibility (economically as well as ecologically) of the project.

For a long term plan, the success or failure of tidal rice cultivation project will be regarded as the most important yardstick, namely : will this agriculture area be able to support its population and yield at least 2 - 2.5 ton/ha rice annually ?

The projects were deemed successful and the aimed target was achieved although the rate of return of the investation was low.

From a broader environmental prespective, the success of the tidal swamp development has also brought other impacts outside rice cultivation. Various activities starting from forest clearings to the construction of canals have caused ecological damages. If the process of this environmental deterioration continued beyond nature's capacity to heal itself in addition to the low capacity of the local people in managing their environment, then it is most likely that the depleted area would be abandoned by its people.

Other problems may arise from the impacts of development on other natural resources which are not within the scope of the food production improvement project. An example of this is the impacts of this development on the estuary fisheries. Thus, although the main objective within the short-term period can be achieved, yet several side-effects may occur.

The objectives of tidal swamp areas development which have ecological and other supporting aspects for the successful development of tidal swamp areas are :

a Settlement areas with a capacity to cater its own basic needs such as drinking water supply for the whole year, smallest probability of contagious disease out-breaks, good housing, etc;

b Stimulating the development of self-sufficiency in rice production, and increasing the marketing of various export commodities;

c Social stability among the settlement units;

d Continuity in production of annual crops and other forest crops (excluding rice production);

e Development of stable and efficient physical infra-structures;

f Conservation of nature reserve areas, or areas for limited use;

g Minimizing or eliminating the side effects of the projects on the components and other natural resources in coastal ecosystem;

h Conservation of pattern of natural resources use in connection with the on going local culture

i Conservation of game reserve area

In fact, with a reliable management, careful selection of location, sufficient budget and efficient supervision of the needs and rights of the local peasant groups, transmigration to the marginal environment could lead to the formation of a stable agriculture society.

Financial matters are not only the critical limiting factors such as what had been true previously.
The further achievement or failure of the project in the future will be determined by the following factors, i.e. :

a Sosial and ecological consequences as the results of a not-well-prepared plan and evaluation;

b Structural and plan problems, also its implementation by institutions/departments directly involved;

c The impacts of foreign financial and expertise supports within a large scale.

Several problems on ecological and social consequen-ces such as unstable production, social order, settlement etc would provide a feedback to the continuity of the project and would add an additional dimension to the scopes of the project. Increasing income level and nutrition status in several marginal ecosystems can only be achieved by planting the secondary crops. By planning an intensive and inte-grated regional development such as fisheries, fores-try, erosion control, optimal scheduling of planting seasons and minute monitoring, the would be culti-vated areas will not be neglected nor abandoned.

Swamp areas are considered marginal land due to its fragile characteristics and difficult location to reach, not to mention the difficulties in turning the land into arable agriculture areas despite the recla-mation works. Besides its fragile conditions and low producivity, marginal land also has a high production fluctuation due to :

a All year long dry season provides a favourable climate for pests and plant diseases.

b Unstable tropical ecosystem

c Tropical plant pests which have developed a greater resistency to pesticide compared to other pests originally come from temperate climate.

d Very low fertility.

Most of the forest at the tidal swamp areas is in the hand of concession holders. Hence, it is obvious that the forest had been intended for wood production by the Government. It has been generally known that the obligation to conduct replanting had not been met by the concession holders. A larger part of the settlers consists of the local people and spontanous transmigrants from Java. In the beginning, they grow rice, but after several years they usually start planting coconut. However, due to the prevalent weeds and rat attacks, production is still low and rice can only be planted once a year.

The first effort in tidal swamp development in Kalimantan was marked by the construction of canal, connecting the Barito and Kapuas rivers near Banjarmasin in 1880 - 1890. Although the previous main objective was to provide a better transportation facility , the canal which is 30 km long opens better opportunities for agricultural activities. The Banja rese made drainage ditches from the swamp areas to the

canal. This made the areas several kilometers from both sides of the canal (anjir) can be cultivated for rice-growing, coconut and rubber .

The government had made 5 canals connecting Kahayan, Kapuas and Barito rivers, and thus providing better transportation facility for the people and forest production.

Almost all of the swamp forest along each canal had been cleared for agriculture activities. This is another proof that even with a little assistance from the government a vast land can be changed into a food-producing area.

After the World War II, the Indonesian Government initiated another transmigration project to the tidal swamp areas in Kalimantan in 1953. By implementing the folder system to pump the water and making dams in the canals, another 8,700 Ha swamp areas was opened. Unfortunately, during a visit several years ago it was noted that the folders was not functioning.

Within the framework of achieving self-support in food production (particularly rice production), the efforts done to increase food production have been an important factor for the Indonesia people. Through intensification program, the total production and average production of rice have been significantly improving. The intensification programme is supported

by extensification programme which also supports the distribution of the people and increase their welfare.

Regarding this extensification programme, the government decided to open the tidal swamp areas, particularly those in Central and South Kalimantan. The estimated total area potentially can be developed (1968) in Central and South Kalimantan is 1,720,000 ha of the total 7,000,000 ha tidal swamps area in Kalimantan.

The physical characteristics of the tidal swamp areas are marked by layers of peat soil at the upper layers and mineral layers at the lower part, In general the pH of the soil is low, but has a high content of Al, SO4, Cl and Fe. Therefore, necessary measures to solve these problems had been taken. A technical team from Gadjah Mada University, for example, had invented a water system for rice-field areas known as "GAMA system" (Sastrosoedardjo, 1977).

By applying this irrigation system, most of the problems on physical conditions can be solved.

> Potential rice production may reach up to 2.5 - 3.5 ton dry paddy/Ha for local variety, and 3.5 - 4.5 ton dry paddy for ...prime variety (PB-5). Supported by better irrigation system, now these people can grow rice twice a year, and rice production in tidal rice-fields (Central

Kalimantan) may reach 7.0 - 9.0 ton dry paddy/Ha/year.

Economically, the cost of turning the tidal swamp areas into ricefield areas is relatively low, i.e. 0.1 - 0.2 times the cost of opening ricefield using conventional irrigation system; the rentability (profitability) is about twice as much as traditionally irrigated ricefield. (Sastrosoedardjo, 1977).

In fact, the Province of South and Central Kalmantan still need more human resources to develop the natural resources. Thus, the transmigration program is highly related with the efforts to develop this tidal swamp areas. Central Kalimantan Province, for example, during the REPELITA IV plans to prepare an area of about 14,175 for about 9,450 HH; while the Central Kalimantan Province has set high priority for transmigration program for 127,759 HH with an area of 190,139 Ha. Both are for government-sponsored and spontanous transmigrants as well as for resettlement areas.

It is a fact that both provinces are still lack of human resources in generating the potential natural resources. Therefore, the transmigration program should be connected with the efforts in persuing the effective use of the tidal swamp areas. For example, during Repelita IV the Central Kalimantan Province plans to prepare an area of about 14,175 Ha for 9,450 HH, while the Central Kalimantan Province has set forth a priority for transmigration program for 127,759 HH by preparing an area of 190,139 Ha. Both programs are intended for government-initiated and spontanous transmigrants as well as for resettlement.

The transmigration program in tidal swamp areas is in line with the Guidelines of State Policy, inwhich it is stated that transmigration program is to be implemented in order to increase the population and man-power distribution as well as to open and develop a new productive region within the efforts to provide development equity in all provinces. It is stipulated in Act No.3 of 1972 on Basic Provision for Transmigration that the orientation of the transmigration program is agro-development. The main key towards successful achievement of the development and guidance of transmigration program is how to guide and motivate the transmigrants and the local inhabitants so as to be able to use in the most effective way the natural resources

and henceforth will have the capacity to develop their own agricultural undertakings in a self-reliant manner for the advancement of their general welfare.

The tidal swamp areas is a plain area located along the coast line with specific geo-graphical characteristics. Its water system is directly and indirectly influenced by the tidal movement. Soemantri Sastrosoedirdjo (1977) points out that the tidal movement of the sea is caused by the pull of moon and sun. The sea when high tides would act as a dam at the river estuary, hence the river water flowing into the sea is as if being dammed, causing the river water to flood its water into the left and right banks and to the upland of the river.

The influence of tidal movement on river flow can be differenciated into 3 levels :

1. Intrusion of saline water into the river water.
2. Changes in velocity and direction of river flow during high tides and low tides
3. Periodic fluctuation of water level in accordance with the frequency of tidal movement.

During flooding, mud from the upper part of the big rivers is transported, causing sedimentation which forms natural dykes along the river banks, while the finer particles will be transported even farther from the river. Eventually, a basin between two big rivers, or a vast swamp area, will be formed.

The shallowing process of the river as the result of sedimentation will continue until finally the area becomes a mangrove forest.

After reclamation, tidal swamp areas may become cultivatable, and the existing water system is strongly influenced by the tidal movement of the sea and river water either directly (inundation water) or indirectly (ground water). Before reclamation, tidal swamp areas are inundated by relatively deep water; but due to the ditches dug by the local people, a large part of such areas is no longer affected by the tidal movement. These areas are now influenced by the rain water instead. (P4S, PU, 1977).

The total population of Central Kalimantan Province (1980 Census) is about 960,834 with a density of 6.3 people/km2. The population of Central Kalimantan is not evenly distributed. Most of the people prefer to live at the south part of the province, while the rest are isolated tribes living in remote areas.

According to the 1980 Census, the total population of South Kalimantan Province was approximately 2,063,227 with an average density of 56 people/km2. The majority of the inhabitants (73 %) live in rural areas and sometimes remote areas. The rest (27 %) live in urban areas. The main occupation of the people in both provinces is agricultural activities (including forestry).

Therefore, the agricultural sector plays a very important economic role in both provinces, comprising 70.95 % of the total provincial income in South Kalimantan and 42.5 % in Central Kalimantan. The industrial sector has not been very successful, contributing only 4.08 % of the whole South Kalimantan's provincial income and 8.92 % of Central Kalimantan's provincial income. The trading and service sectors are relatively important, contributing as much as 9.84 % and 9.87 (South Kalimantan) and 8.69 % and 13 28 % (Central Kalimantan). Transportation sector 2.6 % (South Kalimantan) and 8.69 % (Central Kalimantan). The main potential of both provinces is agricultural and forest productions, particularly timber and secondary wood industries.

In general, the productivity of the foodstocks in both provinces is relatively low since the irrigation infrastructure (half-technical irrigation) has not been sufficiently provided. The fertility of the soil is relatively low and the potential production has not been effectively used because not all of the ricefield areas have been cultivated. Furthermore, low productivity is also caused by the intensification programme which should be practised more and the rural institutions which should be well established.

Before the areas are disturbed by human activities, the influence of tidal movement of the river flow on the

condition of the water system depends on the topography of the plain and its distance from the river and the sea (Soedardjo, 1977).

Human activities affecting the natural condition of the areas among others are the activity of digging ditches (anjir) from one river to the other rivers which eventually brings significant changes in water system and tidal movement in the river as well as at the upper part of the swamp areas. The water in the swamp areas decreases and by applying certain techniques the areas can be cultivated as ricefield areas.

Areas closer to the river would be strongly influenced by tidal movement, but those located farther from the river will be less influenced. Because of the tidal movement of the river, the ricefields will be inundated during the high tides and will dry during the low tides. This condition is effectively used by the local farmers in rice cultivation.

Beside the water condition, there are several other factors wghich may determine the use of tidal swamp areas, namely,

a. characteristics of the peat layers, its thickness and maturity;
b. characteristics of the lower layers, namely mineral layers, textures and chemical properties;
c. the presence/absence of catclay, potential cat clay which is toxic to agricultural crops.

The most influencing condition of climate among others are annual rainfall, distribution and intensity, also humidity.

The farmers have put lots of efforts to change the tidal swamp areas into ricefield areas with a high tolerance to water inundation. Such ricefields are managed based on a principal view, in which the techniques of rice planting is adjusted with the characteritics of the water and tidal movement.

Together the farmers would dig ditches (handil) starting from the big rivers (Barito, Kapuas) and would end in the farther part of the tidal swamps areas. Because of these handil the level of the swamp water will decrease, and thus providing higher possibility of cultivating the area. The planted rice can be harvested after 8 - 10 months, and the total yield depends on water condition and the intensity of the pest.

Beside digging handil, the local people also dig wider canals, known as anjir. Anjir connects 2 big rivers and is used as water transportation way. The newly cultivated tidal ricefields are at the left and right banks of anjir. Other plants such as coconut, fruit trees and vegetables are also planted along the left and right banks of the anjir. However, it can be noted that there are several units which have to face a decrease in production level or even fail to produce anything. This

is mainly due to the wrong cultivating techniques, bad water system (acid sulphate soil), later on some of the ricefields was even abandoned. The decreasing production may also due to the intensity of the pest such as rat (chiefly Rattus argentiventer), rice stem borers (Tryporyza incertulas, Tryporyza innotata,etc), stink bug (Podops vermiculata), rice bug (Leptocorisa acuta), and brown planthopper (Nilaparvata lugens) or because of plant desease (bacterial leaf blight) and virus (tungro, grassy stunt virus,ragged stunt virus, etc) Nevertheless, the application of pesticides and herbisides should be supervised carefully considering the negative impacts they may bring on human beings and environment.

Regarding the above failure, P4S PU indicates that the rehabilitation of the water system should be followed by the use of water in better ricefields which also should consider the needs of the cultivated plants. By rehabilitating the water system of tidal ricefields, the farmers will be able to plant paddy twice a year, or they might be able to harvest paddy once and secondary crops once/year.

Other income-generating activities in tidal swamp areas are by planting horticulture plants and other industrial plants using 'tembokan-tembokan'. This multicropping system will keep the balance of the environment and thus will be able to minimize production failure.

Practically, the tidal movement in all units is not similar. In Barambai, for example, there are 3 areas of tidal movement, i.e. :

a. perfect tidal areas, from which the water can overflow the ricefield areas, both during the single and double tide.
b. single tide areas , from which only the single areas can overflow the ricefield areas.
c. areas where the water can not overflow to the ricefield areas (rain-fed or water forest water sources).

In fact, a conservation forest is a water supply resources and the condition stabilator of the regional ecology. However, the high intensity of logging has brought adverse impacts on the environmnet of tidal swamp areas.

Changes in environmental condition may change the development and growth of the population, therefore further and better guidance would be needed . The effective use of tidal swamp for ricefield and settlement areas should be carried out carefully, selectively, and adaptively while bearing in mind the existing conditions. Water resources as one of determining natural resources in tidal areas should be managed as optimum as possible, and the selection of technology should be considered carefully, requiring a series of study in depth.

Beside technical-agronomical aspects, an intergrated use of tidal swamps areas should consider various socio-economical factors, such as :

4.2 Macro level

During the macro stage, various activities potentially causing adverse impacts on environment among others are:

a. logging and agro-development activities, the impacts would be particularly on the quality of river water, canals, estuaries and fisheries.
b. Swamp development activities on water quality, chemically and bacteriologically, during the rainy and dry seasons.
c. Swamp development activities on water regime, such as flood, and water situation, during the rainy and dry seasons.

The study at macro level will cover the barine ecosystem of Barito, Kahayan, Kapuas and Sebangau Rivers on an area of 98,500 km2

4.3. Micro level

At micro level, it is necessary to evaluate the impacts of tidal swamps development on :

a. Possibility of pest and disease outbreak, such as malaria.
b. Changes in soil productivity

d. Changes in water quality, chemically as well as bacteriologically, during the rainy and dry seasons.

At this level the study is conducted at the settlement units of the transmigrants.

4.4 Socio-economic level

For socio-economic level, it is already stated above that the evaluation will be given based on income, population density, institutional development and social interaction.

Furthermore, at this level the study will also evaluate the development of the transmigrant's quality of life, both among the government-initiated and spontanous transmigrants.

5. METHODOLOGY

5.1 Determining the area of study

In conformity with the statement of the Inception Report, the Directorate of Swamps, Department of Public Works, and the Research Center for Manpower and the Environment, University of Indonesia, jointly agreed on six locations of swamp development areas to be the locations for the study of environmental evaluation.

The above mentioned assessment of locations for the purpose of evaluation study is based on the need to know the differences in the quality of environment for some units of transmigration settlements, by type of population and the length of time during which the units in question had been developed.

The following transmigration settlements will be examined:

1) The transmigration settlement unit at Barambai in Kabupaten Batola, Province of South Kalimantan. This unit has been developed as a transmigration settlement area since 1970 using the tides of the Barito river. This unit is for general, government-sponsored transmigration.

2) The transmigration settlement unit at Jelapat, Kabupaten Batola, Province of South Kalimantan. This unit has been developed into a transmigration settlement unit using the tides of the Barito river since 1977, for spontaneous transmigrants.

3) The colonized settlement unit at Purwosari, Kabupaten Batola, Province of South Kalimantan. It has been developed since 1937, developing the tidal agricultural system from Anjir Tamban which is under the impact of the tides of the Barito and the Kahayan Murung rivers.

4) The transmigration settlement unit at Tamban Luar, Kabupaten Kapuas, Province of Central Kalimantan. Developed since 1974, using the tides of the Kahayan Murung river. The population for this location came here through general, government-sponsored transmigration.

5) The transmigration settlement unit at Maliku, Kabupaten Kapuas, Province of Central Kalimantan, developed since 1981. These transmigrants are hoped to be able to develop the agricultural system using the tides of the Kahayan river. The location is populated by general, government-sponsored transmigrants.

6) The transmigration settlement unit at Sebangau, Kabupaten Kapuas, Central Kalimantan, developed since 1984. These transmigrants are expected to be able to use the agricultural system influenced by the tides of the Sebangau river. This location has been occupied since 1986 by general, government-sponsored transmigrants.

5.2 Methodology in Data-collection

In order to obtain representative data, data collection was carried out in two phases; in line with the tropical climate in Indonesia which is marked by a dry and a rainy season, it was done in each of these seasons. The collected data comprise information on physical-chemical, organic and socio-economic and cultural components of environment.

The methodology used in this study consists of several techniques suited to the type of the data to be collected.

5.2.1 Macro-level

The components of environment needed for this study are grouped in three kinds of data components, i.e. physical-chemical, organic and socio-economic and cultural data components.

The physical-chemical data components collected comprise quantitative and qualitative data on water and the type and productivity of land. To obtain data on the quantity of water, the water surface fluctuation was measured at the primary channel and the secondary channel during 26 hours. Data on the quality of water were obtained by adjusting its parameter to the allocation of the waters in question.
The existing waters are used for agriculture, i.e. the tidal channels, and for the standard quality of drinking water, i.e. well water.
The parameter used for agriculture was adjusted to the parameter for the C group of PERMENEG KLH (Regulation of the State Minister for Population and the Environment), while well water as standard quality for drinking water was adjusted to PERMENKES (Regulation of the Ministry of Health).

The type of soil was examined by shape of stone, while the productivity of land was measured by the rate of concentration of N, P, and K, and other by-elements.

In order to explain the characteristics of the organic element, data needed comprise the ecosystem of the yards, the peat swamp forest ecosystem, the sawah ecosystem and the ecosystem of the waters. Yard ecosystem indicators collected are the variety of types, frequency of types, the compactness of types and their prevalence. Collected data on the sawah

ecosystem comprise the variety of cultivated plants, grasses and germs. Indicators of the ecosystem of the waters are variety and abundance of plankton, periphyton, benthos and fish. Data types needed to explain the characteristic of the socio-economic and cultural component of environment are population, transportation, land use and farming efforts.

5.2.2 Micro-level

Primary Data

As mentioned in the foregoing, the data to be collected comprise data on the chemical-physical, organic and socio-economic and cultural environment. The following is a description of the method applied for the data-collecting foreach of the above mentioned parameters.

a) The chemical-physical component

The quantity and the quality of water

Data collected on the quantity of water include the fluctuation level of the watersurface, both of the main river and the sidestreams, which are within the transmigration settlement units. These data are collected every hour during the period of one tidal cycle (± 26 hours).

Data on the quality of the measured waters comprise parameters for the standard quality of drinking water and parameters for agricultural uses. The parameters in question are grouped in two phases, i.e.
(i) parameters measured on the spot, pH, temperature, salinity, Desolved Oxygen (DO) and turbidity; and
(ii) laboratory-analysed parameters and their methododlogy, as in Table 5.1.

Table 5.1 WATER QUALITY PARAMETERS

	PARAMETER	METHOD OF ANALYSIS*)
-	TEMPERATURE (^{o}C)	THERMOMETER, ELECTRO-THERMOMETER
-	CONDUCTIVITY (M/C.HOS/CM)	SCT-METER
-	SUSPENDED SOLID MATERIAL CONTENT (PPM)	GRAVIMETRIC
-	TURBIDITY (NTU)	NEPHELO TURBIDITY METER
-	ALCALINITY (ppm $CaCo_3eq$)	TITRIMETIC, HCL
-	HARDNESS (ppm $CaCo_3eq$)	TITRIMETIC, EDTA
-	CA HARDNESS (ppm $CaCo_3eq$)	TITRIMETIC, EDTA
-	DISSOLVED OXYGEN (ppm O_2)	DO METER, TOA AQUAMATE
-	BOD_5 - $20^{o}C$ (ppm O_2)	TITRIMETIC, MODIFICATION, WINKLER
-	COD (ppm O_2)	TITRIMETIC, CALIUMBICROMATE
-	TOM (ppm $KMnO_4$)	TITRIMETIC, CALIUMPERMANGANATE
-	pH LAB	ELECTRONIC, pH METER
-	FIELD pH	ELECTRONIC ,pH METER
-	SOIL ALCALY (K, NA, CA, M_q)	ATOMIC ABSORPTION SPECTRO PHOTOMETER (AAS)
-	METALS (Fe, Cu, Mn, Ni, Cd, Zn, Pb, Cr)	AAS
-	AMONIA (ppm)	SPECTROPHOTOMETRIC, NESSLER
-	PHOSPHATE (ppm)	SPECTROMETRIC, CHLORIDE
-	SULPHIDE	SPECTROPHOTOMETRIC
-	SULPHITE	SPECTROPHOTOMETRIC
-	BACTERIA	MEMBRANE FILTRATION

*) STANDARD METHODS FOR EXAMINATION OF WATER AND WASTE WATER, 14 ed, APHA - AWWA - WPCF (1975)

Measurement of pH (acidity) was carried out every hour, identical to the measuring of the fluctuation level of the water surface; this was done in order to know the rate of relationship between the change of the level of surfacewater (tides) and the change in pH value (level of acidity). Water samples were taken at the water-measuring stations, flood pools and the wells of the population. These water samples were taken at the lowest and at the highest point of the water level. The total number of water samples is indicated in Table 5.2.

Land

The assessment of the points of observation, expected to represent the condition of the soil in that particular area, was based on the land map which had been made up as a result of a previous survey.

In this observation, special attention was given to the bottom layers, the level of pH, "pirit" indications, the depth of the soil, and other parameters which are analysed at the laboratory, in order to know the level of fertility.

In order to know the layers of the soil, boring was done at several places assessed as the locations for sampletaking, and samples were taken up to a depth of 80 - 100 cm.

pH was measured, both in the field and at the the laboratory. Measurement of pH in the field used pH paper.

Table 5.2 NUMBER OF WATER SAMPLES

SETTLEMENT UNIT	Dry Season			Rainy Season		
	Flood	Ebb	Well	Flood	Ebb	Well
1. Purwosari	4	4	2	5	4	2
2. Jelapat	5	5	1	7	6	-
3. Barambai	5	5	2	5	5	2
4. Tamban Luar	4	4	2	4	4	-
5. Maliku	6	6	1	5	5	-
6. S e b a n g a u	4	4	2	3	3	1

"Pirit" was also checked both in the field and at the laboratory. In the field, pirit indication was observed through H2O2 liquid.

Parameters which were not easy to measure in the field were measured at the laboratory. The number of samples examined is indicated in Table 5.3.

Table 5.3 NUMBER OF LAND SAMPLES

	LOCATION	DRY SEASON	RAINY SEASON
1.	Purwosari	3	5
2.	Jelapat	7	5
3.	Barambai	8	5
4.	Tamban Luar	7	11
5.	Maliku	6	12
6.	Sebangau	5	6

b) The organic component

Ecosystem of the house yards

Data on the ecosystem of house yards were obtained from the house yards of the population along the village road heading to the area of rice fields. Datafinding was conducted through the method of point centered quarter. At each point the type and diameter of each quadrant was noted down. The number of samples taken is indicated in Table 5.4.

Table 5.4 NUMBER OF YARD VEGETATION SAMPLES

Location	Number of Samples
1. Purwosari	6
2. Jelapat	6
3. Barambai	5
4. Tamban Luar	6
5. Maliku	7
6. Sebangau	5

The outcome of the data analysis of yard vegetation is expected to give a picture of the variety, frequency, compactness and prevalence of type, which could give a picture of economic potentials.

Peat swamp forest ecosystem

Data on the peat swamp forest ecosystem were only collected around the transmigration settlement unit at Sebangau. This unit is rather new and there are still peat swamp forests in its surroundings. In order to know the forest potential, 20 plot samples measuring 20 m x 20 m were taken. This would reveal its variety, frequency and compactness of type, as well as its ecological and economic potentials.

Wild animals

Data on wild fauna were collected through the method of meeting (direct and indirect census). Indirect census means observation of fauna through track-tracing of animals, such as sounds, scent, footprints, faeses and their hide-outs. This observation was carried out at each of the settlement unit.

Domestic animals

Data on pets were collected through direct observation in the field, information from officials and from the local population.

Sawah Ecosystem

Data on the types of paddy and other cultivated plants were obtained through direct inventarisation in the field and through interviews with the population. Grass inventarisation was done through direct observation in the field, while other plant diseases were learnt of through interviews with the local farmers.

Ecosystem of the waters

Indicators for the ecosystem of the waters are plankton, benthos, periphyton and fish (Nekton).

Data-finding for plankton, benthos and periphyton was conducted in the same place of tample-taking for the quality of water. The sample for plankton was obtained by concentrating 50 l of water in the plankton net, after which it was preserved with 10% formalin.

The periphyton sample was obtained by installing, during 24 hours, 6 pieces of object glass at each station of sample-taking for the quality of water. The obtained sample was then preserved with 10% formalin. Benthos data sample was taken with the Petersen dreclege instrument from every station of watersample; mud which came along was then preserved with 10% formalin.

Plankton, benthos and periphyton were then checked at the lab to find the variety, the rate of abundance , which revealed the fishery potential of the waters in question. In addition, data-finding was also carried out for fish, by taking samples with a net and by interviewing officials and the local population.

5.2.3 The socio-economic level

5.2.3.1 Organization of data-finding

Socio-economic and cultural data according to the TOR are of primary and secondary nature, and able to give a picture of the distinction between local and general transmigrants. Particular emphasis is laid on distinction in income, demographic changes, service facilities and other supporting facilities. For the purpose of data-finding for the evaluation study of the environment, both for primary and for secondary data, a number of field staff is needed in addition to the main staff which is included in the team. These workers come from the Potential Institute, a private institution which is active in the demographic sector. 40 Members have been involved as workers, divided as follows: 3 as senior staff in supervision, 37 students of an over-Bacholr's-degree-level, coming from various universities at Banjarmasin. They helped in data-finding at 5 locations within easy reach of Banjarmasin. These 5 locations were the tidal areas at Barambai, Jelapat, Purwosari in South Kalimantan, as well as the locations at Tamban Luar, and Maliku in Central Kalimantan. One location which geographically and transportationwise was only reachable by a field officer from Palangkarya, is the tidal location of Sebangau. Field staff for Sebangau was a student from the Academy for Local Administration at Palangkaraya. The number of field staff was 12, including 2 supervisors.

5.2.3.2 Collection of primary data

a) Observation

In order to obtain a picture for each location of survey, field staff's observation starts from the secondary channel up to the tertiary channel observing the location of settlement, the location of agricultural land, the situation of the dwelling, the blue print of the dwelling, as well as the allocation of dwellings at the site of settlement. Furthermore, observation was carried out for the various local facilities, the population's behaviour and habits. Field officers stayed with the population.

b) Interview of sources

In order to obtain a complete picture of the socio-economic and cultural data, interviews were held with the administrators, the prominence, and with people who were considered to be able to give information. The report on the description of location has been put together with the reports of each location compiled by the chief of each field staff.

c) Interview with the population

Population sample

Primary data have also been obtained from responses of the population to a number of questions. This required population samples. Sampling technique is determined by primary sampling area,

Village/Neighbourhood Organization/Organization of Neighbourhood Members, and is determined through systematic selection. Then a list of inhabitants of the easiest reacheable village is made up as a sampling frame. After that, the respondents to be interviewed are determined.

Means

For the purpose of data-collection from the population samples, a questionnaire was distributed comprising questions on the respondents' background, their socio-cultural matters, ties with the village of origin and the region of neighbours, the use of clean water, knowledge of tidal-bound agriculture, language.

5.2.3.3 Secondary data collection

The needed secondary data comprise general data covering topographical situation, area, population, agricultural production, handicraft/smallscale industry. Socio-cultural data consist of tradition and customs, institutional structures, the rate of selfsupport of the people. Furthermore, data on facilities and infrastructure, covering communications, production, marketing, social structure, education, recreation and worship. Secondary data are also obtained from reports of the Regional Transmigration Office and from the regional administration.

5.3 Methodology of impact-estimation

The phases of estimation will divided as follows:

Identification of impact

For the identification of impact, identification of the net and the trend diagram will be used to know the impact of the component of activities on the component of environment.

Appraisal of the quality of environment

To carry out an appraisal on the quality of the environment, the matrix method of interaction of the component of activities will be used at the horizontal line, with components of environment at the vertical line. Every interaction between the component of activities and the component of environment will be given a quality value as a baseline for environment,

obtained from the collection of environmental data. The value of the quality of environment will be evaluated with the value of the quality of the destined environment or the value of potentials of the quality of the environment for optimation. For the estimation of the quality of environment, the standard quality for environment is used with a scale of 1-5, 1 is for a bad condition, while 5 is for a good condition. Estimation by percentage will also be used as needed, 0% - 100% or relative estimation 0,00 - 1,00.

The following table gives the degree of quality.

Table 5.5 Degree of the Quality of Environment and Its Relationship With Various Figures of Estimation

	Degree of Estimation		
	1 - 5	0% - 100%	0,00 - 1,00
Very good	5	81 - 100	0,81 - 1,00
Good	4	61 - 80	0,61 - 1,00
Sufficient	3	41 - 60	0,41 - 0,60
Insufficient	2	21 - 40	0,21 - 0,40
Bad	1	0 - 20	0,00 - 0,20

The figure at every interaction reflects the quality of the environment. Every obtained figure at every interaction will be evaluated for the possibility of optimation. The value of this obtimation will give a picture of the possibilities for optimation of the component/variable of that environment.

6 TIDAL SWAMP LANDS DEVELOPMENT

6.1 General Description

The tidal swamp areas which was formerly considered as marginal areas proved to be potential natural resources to be developed as agricultural and settlement areas. It has been true for a long period with the success of the Buginese and Banjarese people in the Eastern coast of Sumatra and along the western and southern coastal areas of Kalimantan, where with their own efforts and simple technology they had successfully managed the tidal swampy environment for their agricultural activities.

In several provinces such as South and Central Kalimantan, according to their particular topographical conditions, the tidal swamp areas are natural resources possessing large potential ready to be developed as agricultural and settlement areas. Both provinces have tidal swamp areas respectively 935,500 Ha and 2,879,100 Ha (Nedeco/Euroconsult - BIEC, 1984, vol. I:33).

To take advantage of this natural resources within the frame of the national development program from the set off of the PELITA I, The Indonesian

Government c.q. Directorate of Swamp, Directorate General of Water Recources, the Department of Public Works, has started to implement the tidal swamp project in a large scale, among others in the provinces of South and Central Kalimantan. This project is a part of the tidal swamp lands development program included in the agricultural sectors, subsector irrigation.

6.1.1 Objectives of the tidal swamp lands development

The developement of the tidal swamp areas aims as follows :

a. To provide areas for the new agricultural and settlement areas to support the transmigration program;
b. To extend the agricultural areas within the frame of improvement of food production program as well as agricultural export commodities witha wider spectrum;
c. To build and develop the remote areas out of Java within the framework of equity in national development;
d. To stimulate regional development;
e. To strengthen the HANKAMNAS (National Security) in the boundary areas.

6.1.2 Principle of tidal irrigation

Tidal swamp lands are swamp areas influenced

by tidal movement of the the sea tide through tidal rivers. The tidal movement of the sea (and its characteristics) is influenced by the ellipsoidal movement of the moon around the earth. The sea during high tide is functioning as barrage at the river mouths and forces the river water level to rise.

The elevated water level at the river mouth effects the water levels of the river to a certain length, sometimes to about more than 100 kilometer upland. This elevated water level will cause flooding in the lower plains. The natural levees alongside the river banks prevent the occurance of a complete drainage of accumulated water caused by these floods and rain water, and thus swamps are formed.

By digging cabanals through the levees and thus connecting the swamps to the rivers, drainage of these inundated areas is provided during ebb tide by low water levels. In addition to this, fresh and good quality of water will be diverted to the swamps during the high/spring tide. By this mechanism, natural environment quality can be enhanced in such a way a man-made environment will be

created suitable for agricultural cultivation, settlement and other utilizations.

6.1.3 Development stages of the tidal swamp areas

To gain an optimum results, the development process of the tidal swamps is implemented in stages according to the socio-economic and socio-cultural development of the community utilizing as well as occupying the areas. Conceptually, the stages are as follows :

Stage I, is the pioneering stage primarily aimed for extending the subsistence agricultural areas based on low cost or simple technology concept. In this stage, the government intervention is in the construction of infra-structure for a simple irrigation (uncontrolled drainage system), partial land clearing, housing, roads, bridges and other public utilities for educational and public health purposes. Goals expected from this intervention is a rainfed agricultural system in the unleveled land with no water control facilities.

With this government intervention it is expected that the peasants step by step will be able to modify their virgin land to cultivated land and that they will mobilize

the available labour force to develop the areas as a whole, covering land clearing, construction of canals, soil leveling and drainage for the areas.

If all of the production factors and land use had been optimally used, and yet several constraints could not be solved by the community, then another government intervention would be needed to develop the second stage of the tidal swamps project. It is assumed that the most possible main bottleneck is the water-control problems. Therefore, Government intervention is needed to solve this problem by improving the control system construction at the tertiary level. Its aims is to create a more intensive agricultural condition system. The development of this Second Stage can be implemented only after the soil is mature, i.e. about 5 - 7 years after the drainage canal system has been functioning during the First Stage.

After passing the period of consolidation in agricultural production which is followed by the extensification of land use, the following Stage III will be needed, i.e.

construction of hydraulic infrastructure for technical irrigation system at the individual development units, For example by using water pump to raise the water from the river. At last, during the Fourth Stage the whole process of regional development in a river basin/catchment area will be completed, including a construction of a fresh water reservoir both at the upper part of the river as well as at the border of the estuaries. Thus, the carrying capacity and the quality of environment can be continuously increased according to the need of the society.

Each of the above development stage is a unity of regio-nal development, covering several sectoral activities involving some related instances, including the Swamp Directorate and its vertical instances.

At present, most of the stage of development of the tidal swamp areas in several locations/units in South and Central Kalimantan is between Phase I and Phase II.

6.2 Development of physical environment

Principally, the development of physical environment of the tidal swamp areas is mainly related with the reclamation efforts to increase the chemical-

physical quality of soil and water through the process of leaching, maturing and ameliorization in such a way that they will qualify requirements for agricultural cultivation and settelement. Therefore, it requires construction of infrastructure for irrigation, settlement, and also site preparation for agricultural activities.

6.2.1. Construction of hydraulic infrastructure

The main activity involves land clearing along the right of way of the canals, digging of canals and construction of water control structures.

The infrastructure constructed in tidal swamps in South and Central Kalimantan generally applies typical form of a canal net, known as the fork system. This system consists of primary canal, secondary and tertiary canal with pond.

The primary canal begins at the natural river with a length of 1 to 2 Km. At the end of it the canal is devided into 2 or 3 secondary canals. Each of the secondary canals has some tertiaries. The primary canal serves areas between 2000 to 3000 ha and the secondary canals with a length of 4 to 5 Km serve 900 to 1500 ha. The tertiaries with an

interval of 200 to 400 m serves areas about 90 ha.

The canal net has a dual purpose, i.e. during the low tide it functions as a drainage canal, while during the high tide as asupplly canal. The particular characteristic of this system is that there is a tidal pond or "kolam" at the end of the secondary canal. The function of this pond is to store the acid water that should be pushed from the system during the low tide. However, because it can not flow out then it remain in the secondary and primary canals. During the following tide this acid water will be pushed into the pond and hence do not pollute the arable areas. Other function of this pond is to increase the volume of water entering the system and the pushing capacity of the water movements in the secondary as well as the primary canals during the low tide.

The primary and secondary canals are also designed for transportation purposes. The form and dimention of each fork system vary according to the topographical and soil conditions, also the local tidal characteristics.

6.2.2. Construction of settlement infrastructure

The activities cover among others :

a. Site preparation for settlement areas, i.e. land clearing at the location for transmigrants;
b. Construction of houses for transmigrants;
c. Construction of infrastructure for public utilities, such as roads, bridges, quays, market and schools, etc.

6.2.3. Site preparation for agriculture

The activities are land clearings in areas prepared for the effort I.

6.3 Development of Social Environment

6.3.1 Demography

The main activity related to the social environment is the localization of the transmigrants, for the govern-ment sponsored transmigrants coming from densely populated area such as Java, Madura and Bali, as well as for the local transmigrants. Total number of transmigrants in each location/unit is 500 families.

6.3.2 Economy

Labour opportunity available for these transmigrants is the agricultural sector. For this purpose, a 2,25 ha of arable land is given to each family of transmigrant. The arae consists of :

- 0.25 ha home-garden, including a ready to use house;
- 1.00 ha area for agricultural activities I, ready to be planted;
- 1.00 ha area for agricultural activities II, still in the form of forest;

To start their agricultural activities, they were provided with agricultural tools such as hoe, a short sword, paddy seeds, secondary crop seeds, fertilizer and insecticides. Whereas to support their life before harvesting the first crop, they will receive facilities. With this facilities, the transmigrants are expected will be able to support their daily need (at a subsistence level) and gradually will gain sufficient additional income from their crops to cultivate the second area, and eventually can manage their whole agricultural area properly. It is expected that these

susbsistence life can be passed by these transmigrants within 3 years.

To support the development of the farmers, the Tidal Swamps Irrigation Project had organized a test farm, a unit of water management study and a demonstration plot. Basically, these activities have the nature of research activities, in which the results will be used as a feedback to improve the design of irrigation system. The test farm also serves as a media of education and guidance to the farmers on the correct methods of cultivating tidal swamp areas.

In connection with the possibility of environmental impact caused by socio-economic activities, the following daily activities are considered:

a) farming and other cultivation
b) land clearing
c) extension of farm land
d) marketing of agricultural products
e) trading
f) off-farm activities
g) domestic water utilization (drinking, bathing, washing, and lavatory)
h) waste disposal

6.3.3 Institution

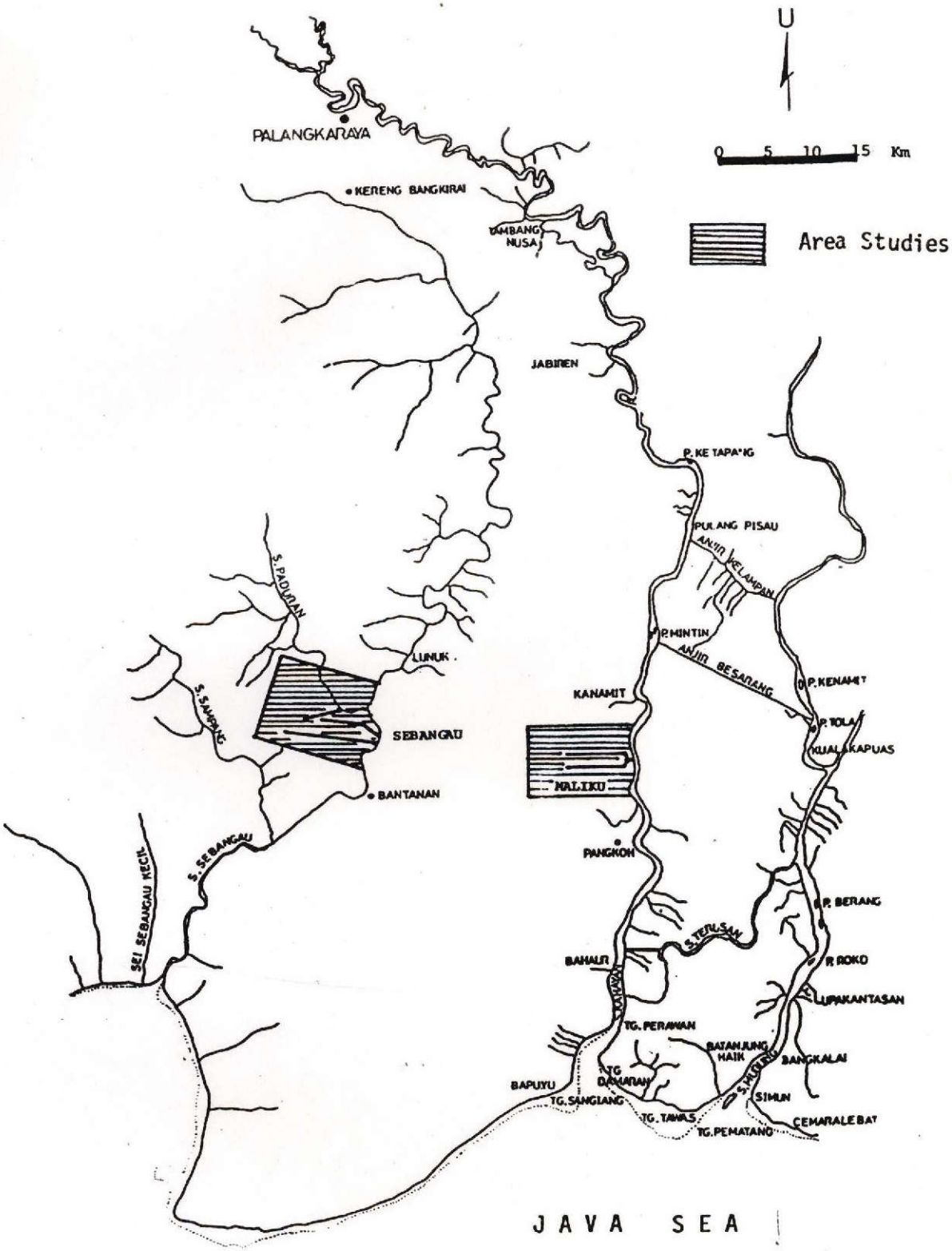
For a temporary period of 5 years, the administration of village authority is guided by the apparatus from the transmigration settlement project, later to be integrated into the local government system.

6.4 Developed Areas

During the period of PELITA I, II, and III, the government has developed the tidal swamp areas in the Province of South and Central Kalimantan, respectively covers an area of 43,105 ha and 89,078 ha.

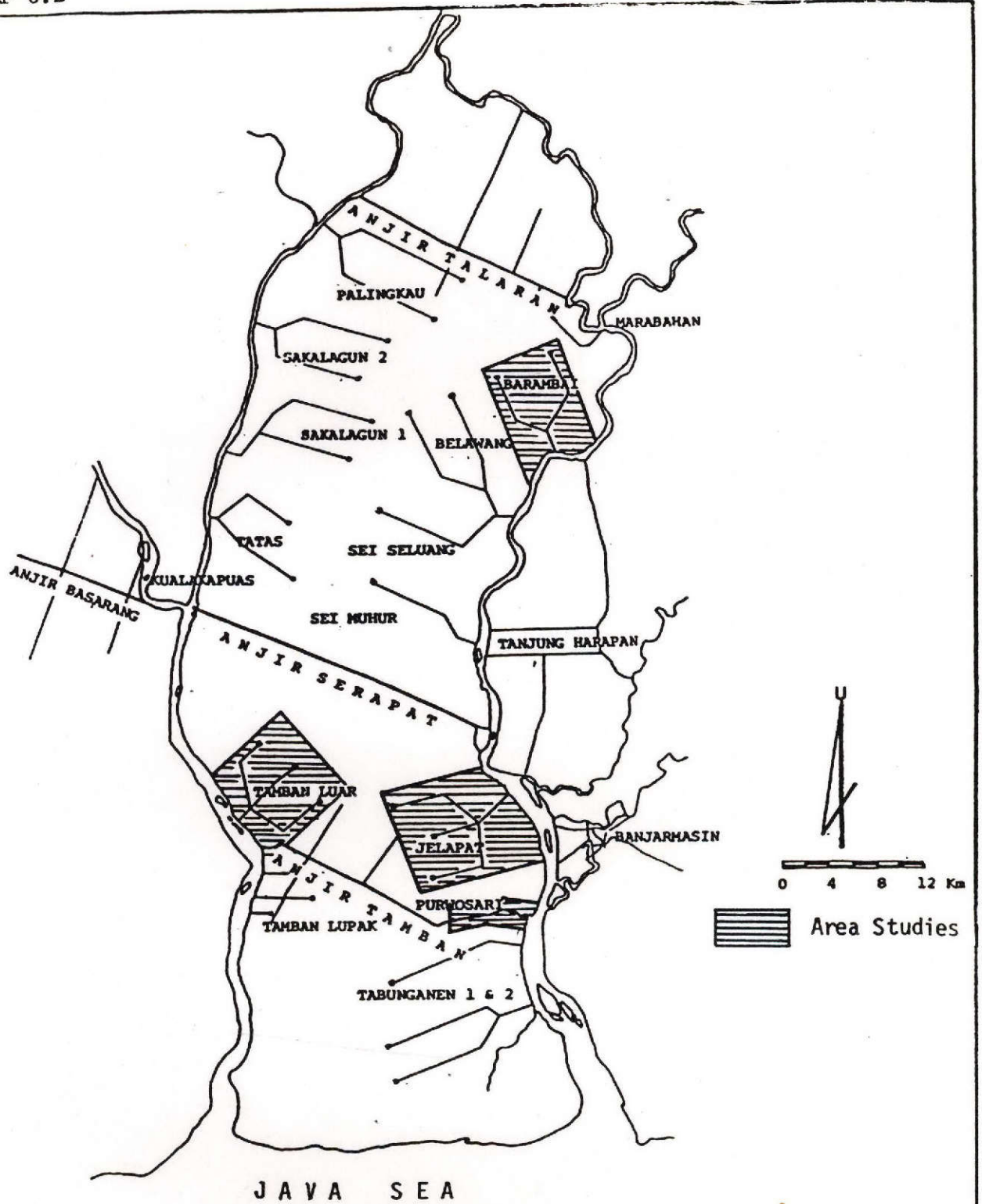
At present, during this PELITA IV, development of tidal swamps in Central Kalimantan has covered an area of 67.295 ha. Also a rehabilitation covering an area of 19.000 ha had been carried out too. In South Kalimantan,the present main activities are rehabili-tation/improvement. Further details of location are shown in Map 6.1 and 6.2.

To conduct this Environmental Evaluation Study, 6 (six) units had been selected as samples, namely Barambai, Jelapat, Purwasari in the Province of South Kalimantan, and Tamban Luar, Maliku and Sebangau in the Province of Central Kalimantan.



Area Studies SEBANGAU AND MALIKU
CENTRAL KALIMANTAN

MAP 6.2



Area Studies BARAMBAI, JELAPAT, PURWOSARI, TAMBAN LUAR
SOUTH KALIMANTAN AND CENTRAL KALIMANTAN

6.4.1 Barambai

The Barambai project is located in South Kalimantan, to the northe of Banjarmasin town on the western side of the Barito river. It belongs to the Subdistrict Rantaubadauh with its capital in Gampa of Barito Kuala District. The project is located at about 60 km gfrom the sea and can be reached by waterways from nbanjarmasin, or by motorcycle from Marabahan, the centre of the District. The total area of this development unit is 4,200 Ha

a. Hydraulic infrastructure

The hydraulic infrastructure in this area is a fork system with two branches of secondary canals. The primary canal is planned for 1600 m long, 40 m wide and 3 m deep. Each of both secondary canals (left and right secondary canals) consists of two parts, i.e. estuary secondary canal with a width of 25 m and upland secondary canal with a width of 15 m. The length of the left and right secondary canals are respectively 6,840 m and 6,560 m, with a depth of 2 m. The length of the tertiary canals is approximately 2 km with an interval distance

of 400 m. The designed tidal pond is 300 m x 300 x with a depth of 2 meters (Figure 6.1).

The construction of the irrigation infrastruucture had been implemented during 1969/1970 and 1970/1971.

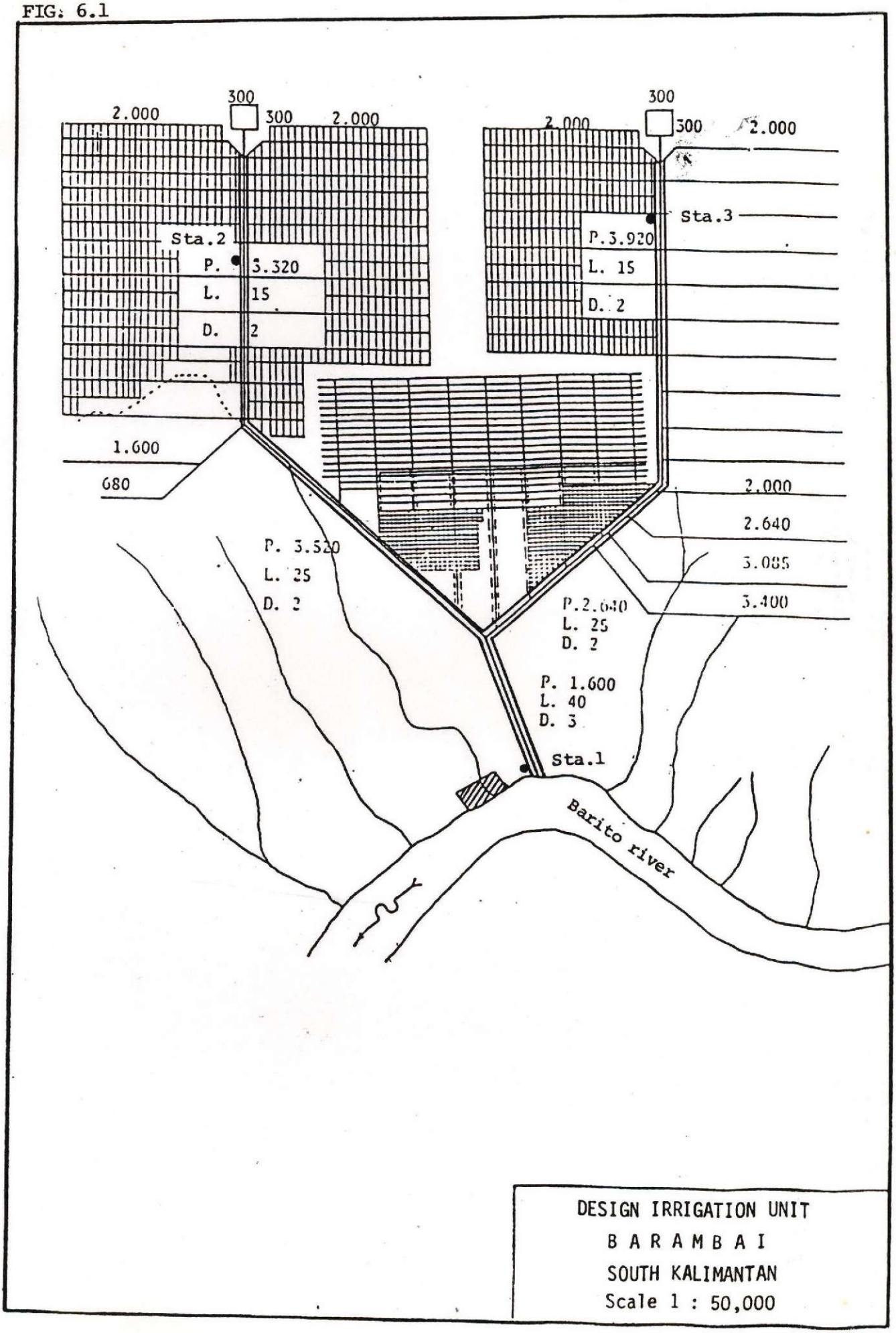
b. Infrastructure for the settlement area

The location of the transmigrant settlement has been designed in three locations, respectively at the surrounding area of the estuary secondary canal, left secondary canal and right secondary canal. The total area including public utilities is 5,000 ha. It is expected that the area will have the capacity to receive a maximum number of 4,517 transmigrants. The placement of the transmigrants had taken place gradually. starting from 1969/1970 until 1972/1973.

6.4.2 Jelapat

The Jelapat unit is situated at the western river bank of the Barito river at the other side of banjarmasin, about 25 km from the estuary. This unit belongs to the Tamban Subdistrict, Barito Kuala Regency and South Kalimantan Province. The total area of this unit is 3,238 ha.

FIG. 6.1


300
2.000
300
2.000
300
2.000
300
2.000
Sta.2
P. 3.320
L. 15
D. 2
Sta.3
P.3.920
L. 15
D. 2
1.600
680
2.000
2.640
3.085
3.400
P. 3.520
L. 25
D. 2
P.2.640
L. 25
D. 2
P. 1.600
L. 40
D. 3
Sta.1
Barito river
DESIGN IRRIGATION UNIT
B A R A M B A I
SOUTH KALIMANTAN
Scale 1 : 50,000

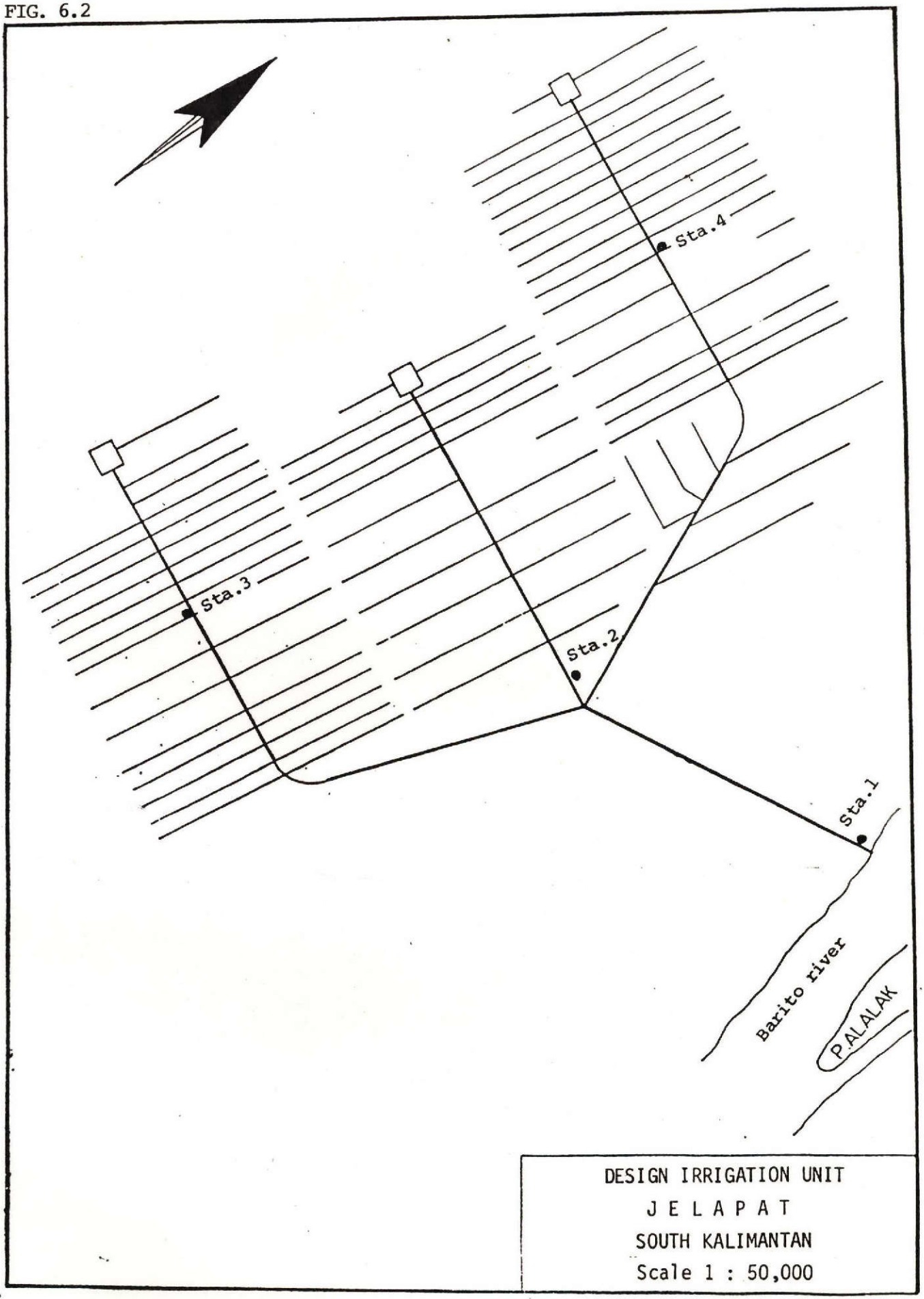
a. Hydraulic infrastructure

The irrigation net in this unit also takes the form of a fork with three branches of secondary canals (Figure 6.2). The primary canal is planned to be 3500 m long, 50 m wide and 3 m deep. The width of the secondary canals vary between 15 to 20 m with the deep of 2.50 m. The length of the left, middle, and right secondary canals is respectively 7.25 km, 3.10 km and 7.60 km. The tertiary canals which have a width of 2 m and a depth of 1.5 m also has a length varied between 1.5 km and 2 km, with a distance interval of about 200 -400 m from eavh other. The tidal ponds were designed for 200 m x 200 m witha depth of 2.5 meter. These infrastructure had been contructed during the budget year of 1974 /1975.

b. Settlement infrastructure

Jelapat area is inhabited by the local peasant, therefore the development of this area is more characterized by landuse rehabilitation programme for these local people. Referring to the implementation of resettlement, some of the area is also for the local transmigrants.

FIG. 6.2


Sta.4
Sta.3
Sta.2
Sta.1
Barito river
PALALAK
DESIGN IRRIGATION UNIT
J E L A P A T
SOUTH KALIMANTAN
Scale 1 : 50,000

6.4.3 Purwasari

The Purwasari unit is located at the left and right sides of Anjir Tamban, connecting the Barito and Kapuasd rivers. The distance from Barito River is about 6 Km. This area is under the authority of Tamban Subdistrict, Barito Kuala Regency and South Kalimantan Provinces. The development of this area was conducted by the Netherland Indies gobernement in 1937.

a. Hydraulic infrastructure

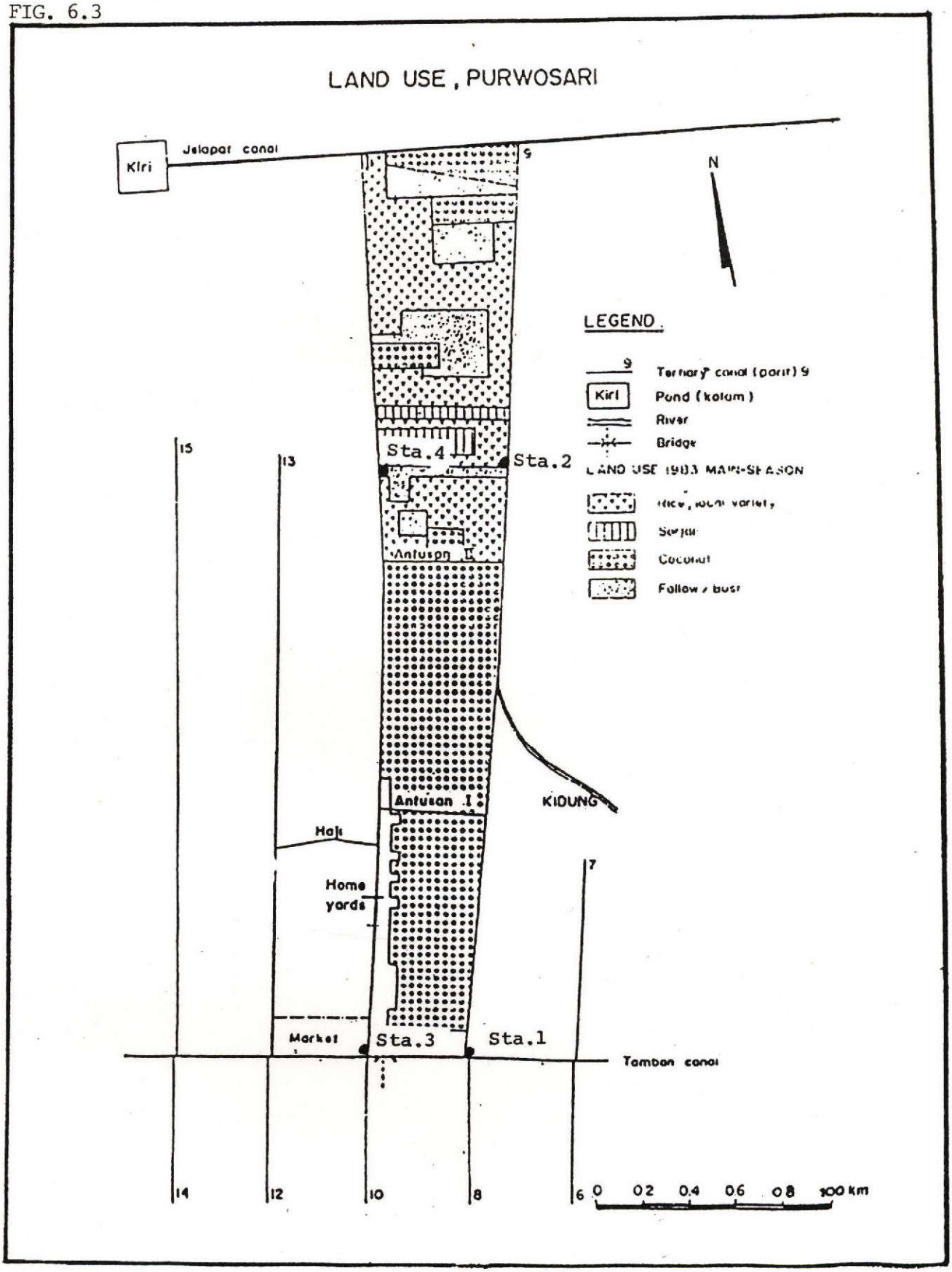
The irrigation net in this area consists of some tertiaries emptying into Anjir Tamban, with the longest interval of 400 m from each other (Figure 6.3) . The length of the tertiary canals is about 1 to 5 km.

The Anjir Tamban is built by the government, but the tertiary canals are constructed by the transmigrants.

b. Settlement Infrastructure

The settlement area of the transmigrants was developed in several phases since 1937 until 1940 to provide a shelter for a total number of 600 families. Site preparation for the settlement area and housing was done by

FIG. 6.3


LAND USE , PURWOSARI
Jelapat canal
Kiri
9
N
LEGEND
Tertiary canal (parit) 9
Kiri
Pond (kolam)
River
Bridge
LAND USE 1983 MAIN-SEASON
Coconut
15
13
Sta.4
Sta.2
Antuson II
Antuson I
KIDUNG
Haji
Home yards
7
Market
Sta.3
Sta.1
Tamban canal
14
12
10
8
6
0 0.2 0.4 0.6 0.8 1.00 km

the transmigrants themselves with building materials provided by the government. Also land clearing for agricultural areas was done by the transmigrants themselves. Each family was entitled for an area of 1.25 - 1.40 ha. During the construction phase of the settlement area, the transmigrants were located in barracks for 7 months, provided with a 10-month supply of foodstuff, but were not allowed to work outside the settlement area.

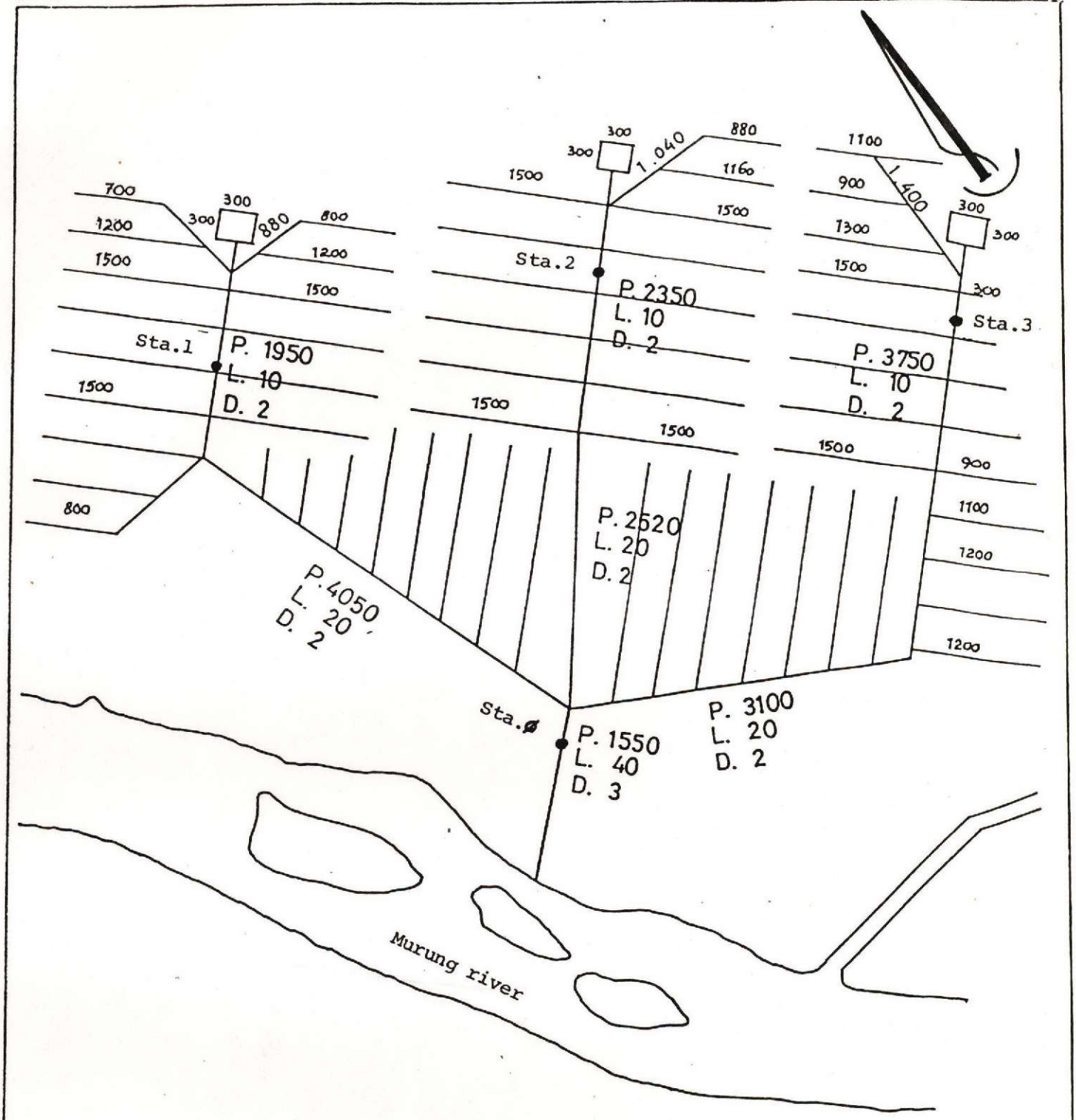
6.4.4 Tamban Luar

The Tamban Luar unit is located at the eastern river bank of the Kapuas river, about 20 km from the estuary. This area belongs to the Kapuas Kuala District, Kuala Kapuas Regency, Central Kalimantan Province. Tamban Luar is 35 km from Banjarmasin, and can be reached by water transportation through Anjir Tamban.

a. Hydraulic Infrastructure

The irrigation canal system also has the form of a fork with three secondary branches. The primary canal is 1.55 km long, 40 m wide and 3 m deep. The width of the secondary canals

FIG. 6.4



DESIGN IRRIGATION UNIT

T A M B A N L U A R

CENTRAL KALIMANTAN

Scale 1 : 50,000

7 ENVIRONMENTAL BASE LINE

Before evaluating the impacts of activities which have been going on for a certain period, or before calculating the quality level of an environment in the near future, it is very important to observe the quality of the base line carefully.

The activities to be evaluated is as put forward in the previous report i.e. the development of the tidal swamps are in six transmigration settlement units.

Following is description on the environment baseline of the studied area grouped in three big parts as described above.

7.1 The Natural Environment Baseline

The tidal swamps ecosystem was previously regarded as an ecosystem with a low ability to support life compared to the coastal low land ecosystem . The main limiting factors of tidal swamps ecosystem are the inundation, thick peat layer and brackish water. Hence it is important to know several components of natural environment, physical as well as biological aspects.

7.1.1 Physical

In order to know the quality of soil, water and climate several physical elements of the tidal swamps ecosystem should be studied.

7.1.1.1 Soil

Field observation and laboratory analysis had been conducted to know the quality of soil in the studied area. The activities were carried out in two seasons, i.e. during the rainy and the dry season.

During the dry season, 32 samples were taken from 5 transmigration settlements units, while in the rainy season 45 samples were taken from 6 transmigration settlement units.

Some important components of the soil to be put forward are electric conductivity, N, P, K, and pyrite content, peat thickness and pH.

During the dry season the electrical conductivity in the transmigration settlement units varies largely, i.e. between 0.00002 umhos until 0.005 umhos.
Based on data per unit, the findings are as follows: Barambai Unit (0.0003 - 0.0008 umhos), Jelapat (0.0005 - 0.002 umhos), Purwasari (0.001 - 0.005 umhos), Maliku (0.00002 - 0.0009 umhos) and in Tamban Luar (0.0001 - 0.0006 umhos).

During the rainy season the electric conductivity is 0.00003 - 0.001 umhos. Detailed based on settlement units we have the following result: Barambai Unit (0.0001 - 0.0005 umhos), Jelapat (0.0002 - 0.001 umhos), Purwasari (0.0005 - 0.001 umhos), Maliku

(0.00003 - 0.0006 umhos), Sebangau (0.00009 - 0.0008 umhos) and in Tamban Luar (0.0001 - 0.0004 umhos).

Viewing the above data, except the Sebangau unit which does not have a comparison of season, it can be concluded that all units have a higher electric conductivity during the rainy season compared with the condition during the dry season.

The scale value of that electric conductivity above is rather difficult, therefore this factor is not used as a basis in evaluating the soil quality.
Analysis result of N, P, and K, contents taken from the laboratory analysis we have the following result: in the dry season the N, content varies from (0.17 - 1.78%), P, (0.31 - 37.24 ppm) and K, (0.01 - 0.07 me/100 gr); while in rainy season N content (0.1 - 1.68%), P, (0.48 - 60.17 ppm) and K, content (0.014 - 0.167 me/100 gr).

If the N, P, and K, content detailed on the basis of settlement units we have the following result: in dry season the N content in Barambai is (0.23 - 18.52%), Jelapat (0.17 - 0.54%), Purwasari (0.22 - 0.37%), Maliku (0.28 - 1.78%), and in Tamban Luar (0.27 - 0.96%); while in rainy season in Barambai (0.15 - 0.26%), Jelapat (0.08 - 0.25%), Purwasari (0.10 - 0.32%), Maliku (0.16 - 1.33%), Sebangau (0.22 - 1.68%) and in Tamban Luar (0.09 - 0.92%).

Thus it means that the N content decreases in the rainy season.

In confirmity with the difficulties in scaling the value for the electric conductivity, to make a scale for the N element is not easy, because the N changes very rapidly in the soil (Koeswara & Leiwakabessy, 1986).

Therefore only the P and K content will be the basis parameters of land fertility evaluation. If the Table 7.1 and 7.2 are carefully studied, we understand that the P content in the dry season in Barambai varies between (0.78 - 8.39 ppm), Jelapat (0.31 - 1.88 ppm), Maliku (0.37 - 37.24 ppm), Purwasari (0.31 - 0.63 ppm) and in Tamban Luar (0.06 - 0.22 ppm). In rainy season the P content in Barambai is (0.91 - 13.60 ppm), Jelapat (1.14 - 5.57 ppm), Purwasari (1.86 - 14.18 ppm), Maliku (5.07 - 48.56 ppm), Sebangau (1.96 - 24.24 ppm) and in Tamban Luar (0.48 - 60.17 ppm). It means that the P content increased in rainy season.

Therefore if classified according to the classification made by the Depertment of Agronomy, University of Illinois, Urbana, USA (in Koeswara & Leiwakabessy) as follows: the lower (relative) class (0 - 15 ppm), middle (16 - 30 ppm) and high (higher than 30 ppm), and compared with the scale of quality

Table 7.1

ANALITYCAL SOIL SAMPLE OR THE WES TIDAL LANDS IN SOUTH AND SOUTH EAST KALIMANTAN

No.	Location	Sample Number *	Texture Sand %	Loam %	Clay %	Textural class	pH H_2O	pH KCL	pH H_2O_2	Electrical Conductivity $\mu mhos^{-1}$ 25°C	C %	N %	C/N	Org. Matter	P.Bray I (ppm)	Exchangeable Cation (me/100 gram) Na	K	Ca	Mg	CEC me/100 g	Saturated Basic %	Saturated Basic (1 N KCl) H me/100 g	Saturated Basic (1 N KCl) Al me/100 g	Saturation Al %	Pirit (H_2O_2) FeS_2 %
			1				2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
I	Barambai	1	43,6	36,1	20,3	Clayey	3,8	-	3,6	$3,0835 \times 10^4$	4,80	0,24	17,14	8,28	0,78	0,13	0,04	0,75	0,32	25,92	4,78	3,49	10,21	68,34	1,40
	South Kalimantan	2	44,1	28,5	27,4	Clayey	3,8	-	2,7	$0,8533 \times 10^4$	4,80	0,34	13,18	7,72	0,86	0,11	0,03	0,81	0,54	34,08	4,37	2,37	43,27	77,47	2,10
		3	51,3	32,4	16,3	Clayey	3,9	-	2,7	$0,3218 \times 10^4$	4,96	0,42	11,84	8,56	1,57	0,15	0,01	0,81	0,54	33,76	4,47	2,42	10,75	73,23	2,10
		4	36,8	28,1	35,1	Clay-Clayey	4,4	-	2,8	$3,7562 \times 10^4$	3,22	0,25	12,88	5,55	0,39	0,09	0,01	1,24	0,91	31,63	11,81	2,87	5,91	53,58	2,10
		5	Organic Matter			-	4,3	3,5	-	$4,0174 \times 10^4$	10,62	0,81	20,36	31,93	2,06	0,31	0,06	1,10	0,64	134,06	1,80	2,74	7,22**	60,37	-
		6	24,1	31,8	44,1	Clayey	3,6	-	2,6	$0,8734 \times 10^4$	3,36	0,23	14,70	5,83	2,04	0,08	0,04	0,81	0,69	33,33	6,07	7,30	13,86**	68,12	1,40
		7	55,7	28,6	16,1	Clayey	3,4	-	2,6	$0,8734 \times 10^4$	5,59	0,49	11,41	9,64	0,39	0,10	0,02	0,43	0,22	37,84	2,03	15,06	11,29	41,66	2,10
		8	55,2	28,6	16,2	Clayey	3,8	-	2,8	$0,4866 \times 10^4$	3,36	0,48	7,04	6,83	1,57	0,08	0,02	0,43	0,22	36,13	2,08	2,24	8,40	73,75	2,10
II	Jelapat	1	31,4	40,6	28,0	Clayey	3,4	-	3,1	$0,3216 \times 10^4$	3,63	0,41	8,11	6,09	0,31	0,08	0,02	0,65	0,43	29,03	4,05	3,00	12,36	74,73	1,40
	South Kalimantan	2	31,7	44,2	24,1	Clayey	4,0	-	3,7	$0,5479 \times 10^4$	4,48	0,35	12,80	7,72	1,88	0,09	0,02	0,59	0,48	36,23	3,28	2,14	7,74	69,98	1,40
		3	32,5	43,4	24,1	Clayey	3,3	-	2,4	$1,2254 \times 10^4$	3,38	0,29	11,66	6,83	0,86	0,09	0,01	0,69	0,48	27,96	4,54	0,86	16,47	89,62	0,70
		4	35,2	40,1	24,7	Clayey	3,4	-	2,9	$0,8533 \times 10^4$	3,22	0,34	9,47	5,56	0,86	0,13	0,04	0,65	0,54	53,22	2,66	5,11	8,06	86,47	3,33
		5	43,4	40,2	16,4	Clayey	3,5	-	3,0	$0,0349 \times 10^4$	4,80	0,64	8,69	8,28	0,63	0,11	0,07	0,48	0,32	49,44	2,42	10,75	10,75	75,97	2,80
		6	35,5	28,3	36,8	Clayey	4,2	-	2,8	$1,2264 \times 10^4$	6,69	0,17	38,36	11,53	0,63	0,24	0,03	0,69	0,38	40,11	3,34	1,86	10,21	76,14	2,10
		7	43,2	36,2	20,6	Clayey	4,4	-	2,4	$2,7729 \times 10^4$	3,86	0,22	17,5	6,64	0,31	0,50	0,04	1,30	0,69	39,46	6,41	2,56	2,98	36,20	0,70
III	Purwasari	P_8	27,8	44,0	28,1	Clayey	4,0	-	2,7	$1,0402 \times 10^3$	2,69	0,38	7,4	4,47	0,63	0,15	0,04	1,34	0,81	30,64	7,67	2,52	8,12	62,26	1,40
	South Kalimantan	P_9	29,9	40,1	30,0	Loam clay-Clayey	3,7	-	2,1	$0,5479 \times 10^3$	6,38	0,22	29,00	11,00	0,31	0,45	0,04	1,34	0,81	30,08	9,82	8,92	6,46	36,81	7,00
		P_{10}	23,5	32,3	44,2	Clayey	4,8	-	3,2	$2,2406 \times 10^3$	3,22	0,37	8,70	5,55	0,31	0,45	0,07	1,30	0,96	26,23	10,60	1,12	1,88	21,69	1,75
IV	Tamban Luar	1_A	Organic Matter			-	4,3	3,6	-	$1,6409 \times 10^4$	15,90	0,96	16,56	27,41	1,86	0,24	0,03	1,10	0,54	94,68	2,02	2,72	7,38**	61,06	-
	Central Kalimantan	1_B	51,4	40,1	8,5	Clayey	4,3	-	4,1	$5,8253 \times 10^5$	4,32	0,72	6,00	7,45	0,78	0,10	0,02	0,81	0,43	31,18	4,36	1,19	4,38	62,28	2,10
		2	43,3	44,6	12,1	Clayey	4,2	-	2,6	$6,6875 \times 10^4$	4,38	0,38	11,79	7,72	0,86	0,22	0,02	1,30	0,69	45,37	5,36	1,05	8,82	71,71	2,45
		3	32,2	35,6	32,3	Clay-Clayey	4,2	-	3,2	$5,8253 \times 10^4$	3,53	0,39	9,06	6,09	0,31	0,20	0,03	1,34	0,54	33,66	6,27	1,49	8,39	69,97	2,80
		4	20,1	35,7	44,2	Clayey	4,0	-	3,0	$1,4837 \times 10^4$	1,96	0,29	6,76	3,38	1,72	0,06	0,03	0,81	0,27	26,02	4,50	1,22	12,90	84,37	1,75
		5	24,0	39,8	36,8	Clay-Clayey	4,4	-	3,1	$2,2944 \times 10^4$	3,22	0,27	11,93	5,55	0,63	0,07	0,02	0,81	0,69	31,39	5,17	1,20	11,83	80,92	2,10
		6	45,5	34,3	20,2	Clayey	3,8	-	2,2	$1,8493 \times 10^4$	14,17	0,68	20,84	24,43	0,37	0,13	0,05	1,34	0,81	73,28	2,17	3,22	10,05	64,42	2,80
		7	24,0	39,8	36,2	Clay-Clayey	4,6	-	2,6	$4,1609 \times 10^4$	4,17	0,28	14,89	7,20	6,63	0,15	0,02	1,24	0,91	35,90	6,49	0,88	5,91	64,87	2,10
V	Maliku	1	Organic Matter			-	4,0	2,6	-	$1,2945 \times 10^4$	39,31	1,25	31,45	67,77	33,19	0,09	0,07	1,24	0,91	126,27	7,32	1,98	1,10**	20,41	-
	Central Kalimantan	2	31,7	40,1	28,2	Clay-Clayey	4,2	-	2,6	$1,0951 \times 10^4$	4,96	0,28	17,71	8,55	7,02	0,10	0,02	1,24	0,75	39,36	5,36	0,85	14,52	83,07	1,40
		3	Organic Matter			-	3,2	3,0	-	$9,3956 \times 10^4$	29,64	1,43	20,66	50,93	0,37	0,08	0,05	0,54	0,43	67,17	1,64	2,93	16,32**	80,20	-
		4	Organic Matter			-	6,0	3,3	-	$1,7133 \times 10^4$	29,64	1,78	16,60	50,93	13,50	0,12	0,05	0,91	0,69	64,48	2,75	2,64	7,30**	62,23	-
		5	Organic Matter			-	3,9	3,0	-	$1,2945 \times 10^4$	32,52	1,38	23,57	56,06	22,53	0,07	0,05	0,65	0,43	75,33	1,59	1,04	6,26**	73,65	-
		6	Organic Matter			-	3,5	2,5	-	$2,8777 \times 10^5$	38,54	1,72	22,41	66,44	37,24	0,11	0,05	1,10	0,54	97,68	1,84	3,05	3,58**	42,54	-

Note :

* Location/Soil sample number showed on observation field-map

** Al, assumed as dissolved aluminium coming from mineral soils of primary, secundary, tertiary old-consolization channels (pH : 4,7) running along up and downward, a moment just the side bouncing up, water infiltrated trough to the vicinity while Al was adsorped by organic matter (peat).

Analytical soil sample results of hacing layer (0 - 40 cm).

Table 7.2

ANALITYCAL SOIL SAMPLE ON THE WES TIDAL LANDS IN SOUTH KALIMANTAN

No.	Location	Texture Sand %	Texture Loam %	Texture Clay %	Texture class 1	pH KCL 2	pH H_2O 3	pH H_2O_2 4	Electrical Conductivity $mhos^{-1}_{25^oC}$ 5	C % 6	N % 7	C/N 8	Org. Matter 9	P.Bray I (ppm) 10	Exchangeable Cation (me/100 gram) Na 11	K 12	Ca 13	Mg 14	CEC me/100 g 15	Saturated Basic % 16	Saturated Basic (1 N HCl) H_{dd} me/100 g 17	Saturated Basic (1 N HCl) Al_{dd} me/100 g 18	Saturation Al % 19	Pirit (H_2O_2) FeS_2 % 20	Sulfat SO_4 % 21
1.	Barambai (B_1)*	46.300	28.350	26.350	Clayey		3.93	2.29	0.000333	2.800	0.170	16.470	4.830	13.60	0.059	0.047	1.470	1.440	15.520	19.430	0.690	9.240	71.370	0.563	0.901
2.	(B_2)*	49.500	30.170	20.230	Clayey		4.60	3.37	0.000182	1.970	0.170	11.590	3.400	0.91	0.025	0.098	1.640	1.450	19.76	24.780	0.510	0.350	48.420	0.862	1.441
3.	(B_3)*	22.310	34.290	44.500	Clay		4.21	1.99	0.000160	2.800	0.150	18.670	4.830	4.770	0.046	0.350	1.640	1.620	22.960	14.720	1.800	11.140	57.870	0.250	0.400
4.	(B_4)*	59.600	24.310	16.090	Clay clayey		4.11	1.72	0.000537	3.900	0.220	17.720	6.720	3.020	0.062	0.029	1.820	1.440	24.690	13.650	1.200	5.750	55.71	1.813	2.901
5.	(B_5)*	39.410	26.420	34.170	Clay clayey		4.02	1.88	0.000288	7.170	0.260	27.580	12.360	5.380	0.046	0.032	2.180	1.270	24.680	14.290	0.28	11.32	74.83	0.281	0.450
6.	Julapat (J_1)*	26.270	41.230	32.500	Clay clayey		4.38	2.85	0.000258	2.580	0.080	32.250	4.450	3.200	0.083	0.054	1.730	1.270	21.180	14.81	0.460	5.660	61.140	0.281	0.450
7.	(J_2)*	20.240	34.260	45.500	Clay		3.83	2.15	0.000743	2.100	0.110	19.090	2.350	1.840	0.095	0.030	1.820	1.450	19.940	17.020	1.380	11.690	71.000	0.500	0.800
8.	(J_3)*	34.570	39.130	26.300	Clayey		3.95	2.28	0.000568	3.540	0.250	14.160	6.100	5.570	0.089	0.040	3.190	1.670	20.780	24.000	0.510	8.830	61.620	0.912	1.459
9.	(J_4)*	32.700	7.000	60.300	Clay		4.51	1.80	0.001062	4.970	0.160	31.060	8.570	3.820	0.209	0.048	3.240	1.670	27.790	18.590	1.110	5.010	44.390	0.765	1.224
10.	(J_5)*	45.370	34.230	20.400	Clayey		4.33	1.61	0.001223	7.800	0.190	26.800	13.450	1.140	0.248	0.039	3.620	1.840	29.650	19.380	0.690	7.060	52.300	0.719	1.150
11.	Purwosari (P_1)*	51.200	28.610	20.190	Clayey		4.22	1.66	0.001660	10.160	0.320	31.750	17.520	3.990	0.285	0.167	3.000	1.730	20.430	25.360	0.510	7.020	55.230	0.750	1.200
12.	(P_2)*	28.310	28.340	43.350	Clay		5.04	2.99	0.000238	1.770	0.100	17.700	3.050	6.740	0.171	0.049	3.390	1.860	16.260	33.580	1.060	3.580	35.000	0.203	0.325
13.	(P_6)*	20.400	32.250	47.350	Clay		4.98	2.73	0.000947	1.970	0.200	9.850	3.400	1.860	0.263	0.032	3.400	1.804	14.480	38.220	1.060	1.220	16.000	0.187	0.229
14.	(P_3)*	32.410	32.090	35.500	Clay clayey		4.400	1.76	0.000894	3.310	0.160	20.680	5.710	4.770	0.214	0.065	2.910	1.820	13.740	36.450	1.940	7.430	62.000	0.800	0.900
15.	(P_4)*	31.250	32.250	36.500	Clay clayey		4.43	2.25	0.000593	4.000	0.170	23.530	6.900	3.820	0.120	0.065	2.000	1.770	19.630	20.250	2.210	5.380	47.000	0.938	0.501
16.	(P_5)*	43.260	28.130	28.610	Clayey		3.96	1.97	0.001193	4.550	0.180	25.270	7.840	14.180	0.173	0.038	3.000	1.320	24.500	18.490	2.400	6.210	46.200	1.950	1.219

Note :

* Soil sample taken at dept 0 - 40 cm

Table 7.2 Continued

ANALITYCAL SOIL SAMPLE ON THE WES TIDAL LANDS IN CENTRAL KALIMANTAN

No.	Location	Texture			Texture class	pH			Electrical Conductivity	C	N	C/N	Org. Matter	P.Bray 1 (ppm)	Exchangeable Cation (me/100 gram)				CEC	Saturated Basic	Saturated Basic (1 N KCl)		Saturation	Pirit (H_2O_2)	Sulfat
		Sand %	Loam %	Clay %		KCL	H_2O	H_2O_2	umhos^{-1} 25°C	%	%				Na	K	Ca	Mg	me/100 g	%	H_{dd} me/100 g	Al_{dd} me/100 g	Al %	FeS_2 %	SO_4 %
		1				2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
I	Paduran I Sebangau																								
1.	Paduran I : 1A, SP_2SK_2 0 - 60 cm	-	-	-		3.09	4.04	-	$9.7_5 10^{-5}$	28.10	1.68	16.73	48.45	24.108	0.028	0.062	5.00	1.64	99.19	6.78	2.40	9.06	49.81	-	-
2.	Paduran I : 1B, SP_2SK_2 60 cm	12.1	20.1	67.8	Clay	-	4.62	1.90	$1.86_5 10^{-4}$	3.11	0.46	6.76	5.36	14.308	0.049	0.049	2.10	2.00	25.96	16.36	1.57	3.63	37.77	0.375	0.600
3.	Paduran I : 2A, SP_1SK_1 0 - 50 cm	-	-	-	-	3.81	4.64	-	$1.66_5 10^{-4}$	17.27	0.94	18.37	29.78	8.069	0.116	0.055	2.95	1.69	50.40	9.54	2.21	3.31	32.04	-	-
4.	Paduran I : 2B, SP_1SK_1 50 cm	23.7	16.2	60.1	Clay	-	4.25	1.48	$8.78_5 10^{-4}$	4.97	0.15	33.13	8.57	2.234	0.111	0.049	3.37	1.55	36.05	14.09	1.89	6.07	46.55	1.973	3.157
5.	Paduran I : 3A, SK_3 - 4	-	-	-	-	3.36	3.99	-	$1.55_5 10^{-4}$	19.81	0.76	26.07	34.15	10.557	0.186	0.175	2.10	1.58	99.57	4.06	2.07	8.61	58.49	-	-
6.	Paduran I : 3B, SK_3	47.9	24.1	28.0	Sand clay-clayey	-	3.34	1.25	$6.90_5 10^{-4}$	12.46	0.28	44.50	21.48	1.960	0.046	0.038	1.77	1.10	41.90	7.05	1.84	12.04	71.53	1.740	2.784
II	Maliku																								
7.	M-L Secondary St-20	-	-	-	- -	3.45	4.60	-	$1.30_5 10^{-4}$	14.49	1.07	13.54	24.98	8.075	0.104	0.051	4.73	2.00	71.68	9.60	1.24	4.76	36.94	-	-
8.	M-R Secondary St-32	32.0	36.0	32.0	Clay-clayey	-	4.08	2.25	$1.22_5 10^{-4}$	2.80	0.16	17.50	4.83	7.525	0.042	0.044	1.57	1.62	27.55	11.89	1.98	9.29	63.87	1.187	1.899
9.	M-R Secondary St-12	67.7	18.1	14.2	Sand clayey	-	5.18	1.82	$6.00_5 10^{-5}$	5.92	0.24	24.67	10.21	48.563	0.040	0.028	4.73	3.10	36.93	21.39	0.74	1.31	13.17	0.188	0.301
10.	M-R Secondary St-20	66.5	28.0	16.5	Sand clayey	-	4.03	1.63	$2.15_5 10^{-4}$	7.80	0.22	35.45	33.45	7.182	0.049	0.034	2.29	2.71	82.36	9.71	0.88	10.61	63.80	0.875	1.400
11.	M-L Secondary St-27	-	-	-	-	4.14	4.12	-	$1.07_5 10^{-4}$	22.63	1.33	17.01	39.02	34.449	0.028	0.055	4.91	1.97	132.28	8.26	1.98	2.40	21.16	-	-
12.	M-R Secondary St-26, 27	-	-	-	-	4.80	4.49	-	$5.10_5 10^{-5}$	18.74	1.28	14.64	32.31	34.510	0.017	0.018	5.10	2.40	43.39	17.37	1.20	1.36	13.47	-	-
	Incomplete analysis																								
13.	M-R Secondary St-12	15.8	24.1	60.1	Clay	-	3.78	1.70	$6.04_5 10^{-4}$															0.794	1.270
14.	M-R Secondary$_4$ St-12	39.8	22.0	38.2	Clay-clayey	-	4.07	2.20	$6.50_5 10^{-5}$															0.125	0.200
15.	M-L Secondary St-20	32.0	29.9	38.1	Clay-clayey	-	3.62	1.51	$4.35_5 10^{-4}$															0.500	0.800
16.	M-L Secondary St-27	34.0	29.8	36.2	Clay-clayey	-	4.39	2.52	$3.10_5 10^{-5}$															0.109	0.174
17.	M-R Secondary St-26, 27	53.9	18.1	28.0	Sand clay-clayey	-	4.53	2.42	$6.00_5 10^{-5}$															0.125	0.200
18.	M-L Secondary St-32	27.9	30.0	42.1	Clay	-	4.53	1.90	$1.03_5 10^{-4}$															0.219	0.350
III	Tamban Luar																								
19.	TL-3	56.0	24.0	20.0	Sand clayey	-	4.25	1.63	$1.15_5 10^{-4}$	9.13	0.24	38.04	15.74	14.634	0.042	0.043	3.19	1.73	30.62	36.34	1.24	7.84	55.66	0.297	0.475
20.	TL-9	-	-	-	-	3.75	4.13	-	$1.64_5 10^{-4}$	22.25	0.92	24.18	38.36	60.170	0.058	0.038	4.73	3.37	117.13	7.00	0.83	0.23	2.84	-	-
21.	TL-1	47.7	40.1	12.2	Clayey	-	4.69	1.56	$4.20_5 10^{-4}$	10.42	0.28	37.21	17.65	6.174	0.151	0.040	6.00	2.84	63.50	12.65	1.15	3.76	29.05	0.824	1.318
22.	TL-2	47.9	30.0	22.1	Clayey	-	5.04	3.01	$2.30_5 10^{-4}$	6.78	0.24	20.25	11.69	1.073	0.073	0.079	3.28	2.18	26.36	21.29	0.65	1.22	16.31	0.719	1.150
23.	TL-4	-	-	-	-	3.33	4.42	-	$1.42_5 10^{-4}$	18.88	1.22	15.47	32.55	5.933	0.072	0.059	4.00	1.46	107.19	5.21	1.15	8.97	57.10	-	-
24.	TL-5	48.0	43.9	8.1	Sand clayey	-	2.92	1.70	$1.76_5 10^{-3}$	2.37	0.10	23.70	4.09	0.980	0.043	0.014	1.29	1.25	10.66	24.36	2.90	6.52	54.26	2.250	3.600
25.	TL-6	20.0	36.0	44.0	Clay	-	4.71	1.99	$1.03_5 10^{-4}$	3.39	0.25	13.56	5.84	4.292	0.073	0.032	2.28	2.11	21.37	20.69	1.06	10.06	64.42	0.125	0.200
26.	TL-7	59.9	24.1	16.0	Sand clayey	-	4.62	1.43	$1.29_5 10^{-4}$	11.12	0.77	14.44	19.17	0.486	0.055	0.031	2.31	1.46	48.66	7.92	1.06	6.47	63.27	0.563	0.901
27.	TL-8	20.1	35.9	44.0	Clay	-	4.60	2.17	$1.37_5 10^{-4}$	1.32	0.10	13.20	2.28	1.483	0.056	0.044	3.19	1.38	110.64	4.22	1.15	10.33	63.96	0.250	0.400
28.	TL-10	32.0	32.1	35.9	Clay-clayey	-	4.67	2.24	$1.02_5 10^{-4}$	4.29	0.09	47.67	7.40	2.355	0.068	0.023	2.73	1.10	24.90	15.75	1.82	9.60	63.82	0.344	0.550
29.	TL-11	12.0	44.1	43.9	Loam clay	-	4.82	2.16	$3.32_5 10^{-4}$	2.37	0.18	13.17	4.09	36.750	0.100	0.046	3.69	1.77	24.11	23.25	0.65	6.34	50.33	0.313	0.501
	Incomplete analysis																								
30.	TL-1	12.0	40.0	48.0	Clay	-	3.32	1.86	$3.68_5 10^{-3}$															2.250	3.600
31.	TL-2	8.1	26.9	65.0	Clay	-	5.28	2.20	$8.60_5 10^{-5}$															0.219	0.350
32.	TL-3	10.0	28.0	64.0	Clay	-	4.94	1.77	$1.13_5 10^{-4}$															0.141	0.226
33.	TL-4	19.6	32.2	48.2	Clay	-	4.49	1.75	$1.49_5 10^{-4}$															0.250	0.400
34.	TL-5	25.9	27.0	47.9	Clay	-	3.69	1.32	$1.29_5 10^{-3}$															1.590	2.544
35.	TL-6	4.2	37.8	58.0	Clay	-	4.06	1.63	$5.37_5 10^{-4}$															0.469	0.750
36.	TL-7	12.0	30.0	58.0	Clay	-	4.69	1.95	$1.42_5 10^{-4}$															0.187	0.299
37.	TL-8	8.1	27.9	64.0	Clay	-	4.06	2.06	$1.97_5 10^{-4}$															0.281	0.450
38.	TL-9	10.2	21.8	68.0	Clay	-	4.31	2.38	$1.51_5 10^{-4}$															0.188	0.301
39.	TL-10	8.0	22.0	70.0	Clay	-	5.81	1.79	$1.07_5 10^{-4}$															0.313	0.501
40.	TL-11	8.2	27.7	64.1	Clay	-	5.08	2.16	$1.56_5 10^{-4}$															0.125	0.200

evaluation made by Soerjani enclosed in the Inception Report, the result is: during the dry season nearly all soil in the settlement units of transmigrations had a low P content, (scale 1) except Maliku which had high P content (scale 5).

Also during the rainy season the P content of the soil in Barambai, Jelapat, Purwasari, and most part of Sebangau (six of the seven samples) and Tamban Luar (nine of eleven samples) had a low scale (scale 1).

A small part of soil in Sebangau (one of seven samples) can be clasified into medium (scale 3) and some parts of soil in Maliku (three of six samples) belonged to the group with a high P content (scale 5).

The K content during the dry season in Barambai was (0.01 - 0.05 me/100 gr), Jelapat (0.01 - 0.07 me/100 gr), Purwasari (0.04 - 0.07 me/100 gr), Maliku (0.02 - 0.07 me/100 gr) and in Tamban Luar (0.02 - 0.07 me/100 gr). While during the rainy season the K content in each unit area as follows: in Barambai about (0.029 - 0.35 me/100 gr), Jelapat (0.03 - 0.054 me/100 gr), Purwasari (0.032 - 0.167 me/100 gr), Maliku (0.018 - 0.055 me/100 gr), Sebangau (0.038 - 0.175 me/100 gr) and in Tamban Luar (0.014

- 0.079 me/100 gr). Hence it can be concluded that the K content during the rainy season increased.

Koeswara & Leiwakabessy (1986) mention that the critical point of K in clay-textured soil generally found all unit is about 0.32 me/100 gr.
Thus it means the K content in all units was under the critical point. The analized K content can be classified into scale 5, except the result of one sample in Barambai during the rainy season which was above the critical point, and thus classified into scale 1.

If we compare the pyrite content during the dry season to the content during the rainy season, the data obtained would be as follows: during the dry season the pyrite was about 0.70 - 7.00%, while during the rainy season 0.125 - 2.25%.

The highest pyrite content during the dry season was found in Purwasari unit, i.e. 7%. And during the rainy season, the highest pyrite content was found in Tamban Luar unit, i.e. 2.25%.

This pyrite content is also not used as a basis in defining the fertility value of the soil.

From the observation results it is known that the thickness of the peat in the studied area, particularly at the already cultivated area was

decreasing and at some other areas peat no longer exist. For example, the previous thickness of peat soil in Tamban Luar was 100 cm, but now the thickness is only 15-30 cm. This is due to various factors, and one among others is due to peat fier while the decomposition level of organic matters is more mature, i.e. sapric.

In conformity with the value scale determined in the Inception Report, soil with peat thickness below 70 cm, is classified into good soil or included in scale 5.

Although there is a small difference in the pH level of soil during the dry season and rainy season, yet the difference was still considered significant.

During the dry season, the pH of the soil in Barambai was between (2.8 -4.4), Jelapat (3.3 - 4.4), Purwasari (3.7 - 4.8), Maliku (3.2 - 4.0), and Tamban Luar (3.8 - 4.6).

During the rainy season, the soil pH in Barambai was between (3.93 - 4.60), Jelapat (3.53 - 4.51), Purwasari (3.96 - 5.04), Maliku (3.62 - 5.18), Sebangau (3.34 - 4.64) and Tamban Luar (2.92 -4.69).

Thus, the value scale of pH in Barambai during the dry season was 2, then it increased to 3 in rainy season. It is also true for Jelapat, Purwasari,

Maliku, Sebangau and Tamban Luar. In a small part of Purwasari (one of the six samples), Maliku (one of the twelve samples) and Tamban Luar (one the eleven samples) they even reached scale 4, which means that the pH was between 4 - 5.

If the scale of each unit is summed up, and the average is calculated, then the classification of soil quality in each unit is as follows : the quality scale of Barambai was (3), Jelapat (4), Purwasari (4), Maliku (5), Sebangau (4) and Tamban Luar (4).

7.1.1.2 Water

It is known that the study areas are located on the banks of big rivers, i.e. Barito, Kapuas, Kahayan and Sebangau. Such location influences the water system of that area, especially refering to the tide.

The tidal movement can occur twice within 24 hours and each day the movement day occurs 50 minutes, later in accordance with rotation of the moon. (Report from the local government, the Barito Kuala Regency, 1984). The difference in water level between the high and low tide may reach more than 1 meter.

This difference can effect the inundation condition, such as the extent as well as the dept and the length of inundation. The movement of the tides can also cause the intrusion process of sea water into the uppersteam area, particularly during the dry season. Considering the above conditions, this section will describe the water quality in every unit for irrigation as well as drinking water.

A. Water for irrigation

Beside knowing the available water for irrigation it is also necessary to know its quality. In order to know the water supply for irrigation, it is important to know the water fluctuation in the river as well as in the canals. And to know its quality, the following elements should be studied, i.e. pH and electric conductivity.

a. Water fluctuation

To know the characteristic of the fluctuation of the water level at the canals caused by tidal movements, observation had been conducted at several stations i.e. : Barambai (3 stations), Jelapat (4 stations), Purwasari (4 stations), Maliku (5 stations), Sebangau (4 stations) and Tamban Luar (4 stations). Observation at each station was carried out for one cycle which at least required 24 hours observation.

The difference of the water level during the highest tide and the lowest ebb in dry season in each unit is as follows: Barambai (1.66 - 1.87 m), Jelapat (1.07 - 1.97 m), Purwasari (0.53 - 1.18 m), Maliku (1.02 - 1.97 m), Sebangau (0.34 - 1.04 m) and Tamban Luar (0.62 - 2.41 m).

While the difference of water level during the rainy season in each unit is as follows: Barambai (0.46 - 0.71 m), Jelapat (o.63 - 2.35 m), Purwasari (0.58 - 1.01 m), Maliku (0.22 - 1.79 m), Sebangau (0.14 - 0.48 m) and in Tamban Luar (0.95 - 1.14 m).

From the data above, it can be concluded that, the fluctuation of water level in every transmigration settlement unit varied, some is showing an in increasing fluctuation during the rainy season, e.g. in Jelapat, but others indicating a decreasing fluctuation, e.g. in Barambai.

b. pH

The pH level during the dry season in nearly all areas was about 3.5 - 4.5, that means it could be clasified in to scale 2 group. During the rainy season the level was better, i.e. about 4.5 - 5, and thus could be classified into scale 3 group. Some areas were even classified into scale 4, such as in Purwasari.

Based on the above findings, it can be concluded that the water quality for irrigation in each units was similar, i.e. classified into scale 3.

B. Drinking Water

The physical and chemical evaluation of drinking water was obtained from two sources, i.e. direct measurement in the field and laboratory test.

Some physical parameter of water quality such as temperature, electric conductivity and turbidity and also chemical parameter such as DO were obtained from direct measurement in the field. While the results of chemical analysis such as pH, heavy metal and bacteriology were obtained from laboratorial results. Except the evaluation based on bacteriological aspect, the water from all units could be classified unsuitable for drinking water or can be classified into scale 1. While the quality of other parameters varied greatly.

During the rainy season, the physical quality of water in each units are as follows : In Barambai, the water temperature varied between 27.90 ^{o} - 28.40 ^{o}C, thus classified into scale 4; the electric conductivity in this unit was 0.10 - 0.40 umhos/cm or classified into scale 5. The turbidity was between 3.70 - 7.70 ppm, or classified into scale 4.

Physically, this unit had a high average water quality since at can be classified into scale 5.

In Jelapat, the water temperature was 26.30° - 29.30° C (scale 4), and the electric conductivity was 6.60 umhos/cm (scale 5), while the turbidity was 2.80 - 3.20 ppm (scale 5), thus the average scale is 5.

If the parameters in Table 7.3 until 7.8 were put into scales, then the results show that the physical quality of the water in Purwasari, Maliku, Sebangau and Tamban Luar was high, i.e. classified into scale 5.

The analysis results of chemical paramter, i.e. Dissolved Oxygen (DO), are as follows. During the dry season in Barambai the DO at the estuary canal was 8.4 ppm, while at the tidal pond only 5 ppm. It means the DO at the estuary belongs to scale 5, while at the tidal pond scale 3. The average of the DO level in this unit can be classified into scale 4.

In Jelapat the level of DO is much better, i.e. about 9.2 ppm - 10.4 ppm, respectively, or classified into scale 5.

In Maliku the pattern of Do level was similar to the pattern of DO level in Barambai, i.e. 6.4 ppm at the

Table 7.3

Topic : Drinking Water Investigation Results
Sample Taken From : Barambai

No.	Elements	Units	Drinking Water Condition			RAINY SEASON										DRY SEASON						Standard of Class C
						STATION										STATION						
			Min. Allowed	Max. Advisable	Max. Allowed	MUARA ST B1P	SK KR ST 2 B2P	SK KN ST 3 B3P	KL KR B 4P	KL KN B 5P	MUARA B 1S	SK KR B 2S	SK KN B 3S	KL KR B 4S	KL KN B 5S	SUMUR KL KR	MUARA	KOLAM KANAN	ST 2	AIR MINUM SK KR	ST 3 AIR SUMUR	
	I. Physics																					
1.	Water Temp.	°C	-	-	Air Temp	28.4	28	29	28	27	27.9	27.5	27	27.5	27	26	29.	28	29	28,5	27.5	± 3°C from normal water temperature
2.	Colour	Unit (Pt-Co Scale)	-	5	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
3.	D.O.	-	-	-	-	4.8	5.0	5.0	3.4	4.1	6.4	5.4	3.6	4.8	3.5	-	-	-	-	-	-	⩾3
4.	Taste	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5.	Turbidity ppm	Unit (Silica Scale)	-	5	25	77	1.00	1.00	47	37	-	-	-	-	-	-	-	-	-	-	-	-
	II. Chemistry																					
6.	Acidity (pH)	-	6.5	-	9.2	5.3	5	4.5	5	4	3.9	4.8	4.5	4.0	4.	4	3.5	3.5	3,5	3,4	3,5	6 - 9
7.	Solid Substance/Total	mg/l	-	500	1,500	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8.	Organic Substance (KMnO4)	"	-	-	10	73,6	19,7	21.2	20.3	78.4	10.1	20.1	20.1	54.8	7.1	14.6	26.7	6.1	25,1	12,0	6,7	-
9.	Agresive Carbondioxide (as CO_2)	"	-	-	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0,0	0,0	0,0	-
10.	Alkalinity Total	°D	5	-	10	25.2	17.6	12.6	6.3	20.1	22.6	15.1	23.9	6.3	25.1	10.1	.9	3.3	6,3	4,1	5,6	-
11.	Calcium (as Ca)	mg/l	-	75	200	3.6	5.4	2.7	5.4	7.2	5.4	4.5	3.6	2.7	2.7	3.6	4.4	9.9	11,1	9,9	10,3	-
12.	Magnesium (as Mg)	"	-	30	150	2.2	5.4	6.5	7.5	3.2	7.5	5.4	8.1	4.8	8.1	8.6	1.2	8.1	20,2	6,9	18,1	-
13.	Iron/Total (as Fe)	"	-	.1	1.0	2.63	5.05	2.95	1.79	2.53	28.4	6.42	2.42	1.47	3.16	4.74	2.5	1.75	6,4	7,12	1,4	-
14.	Mangaan (as Mn)	"	-	.05	.5	.0	.0	.11	.0	.0	.22	.0	.22	.0	.22	.23	.0	0.0	0,0	0,0	1,1	-
15.	Cuprum (as Cu)	"	-	.05	1.5	.0	.0	.0	.0	.0	.0	.0	.03	.0	.0	.0	.0	0.0	0,0	0,0	0,0	0,02
16.	Zinc (as Zn)	"	-	1.0	15	.0	.0	.0	53.2	.0	1.88	.0	.0	.0	.0	5.0	.0	0,5	1,0	0,7	6,0	0,02
17.	Chloride (as Cl)	"	-	200	600	59.9	43.2	63.2	16.81	33.2	39.9	29.9	33.2	36.6	36.6	46.6	70.1	49,5	70,1	134,8	47,8	0,003
18.	Sulphate (as SO4)	"	-	200	400	.52	25.49	10.27	.0	28.85	30.27	29.03	29.73	18.23	28.32	61.11	.0	5,0	4,75	11,0	7,0	0,02
19.	Sulphide (as H2S)	"	-	-	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0,0	0,0	0,0	0,0	-
20.	Flouride (as F)	"	1.0	-	2.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0,0	0,0	0,0	0,0	1,5
21.	Ammonia (as NH4)	"	-	-	.0	.81	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	3.0	1,9	6,9	3,0	4,0	-
22.	Nitrate (as NO3)	"	-		20.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0,0	0,0	0,0	0,0	-
23.	Nitrite (as NO2)	"	-	-	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0,0	0,0	0,0	0,0	0,016
24.	Phenolic (as Phenol)	"	-	.001	.002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.001
25.	Arsenic (as As)	"	-	-	.05	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0,0	0,0	0,0	0,0	1
26.	Plumbum (as Pb)	"	-		.10	.17	.039	.0	.0	.0	.17	.039	.07	.0	.02	.02	.0	0,0	0,0	0,0	0,0	0,03
27.	Selenium (as Se)	"	-	-	.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0,05
28.	Chromium (as Cr)	"	-	-	.05	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0,0	0,0	0,0	0,0	0,05
29.	Cyanide (as CN)	"	-	-	.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0,02
30.	Cadmium (as Cd)	"	-	-	.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0,012
31.	Mercury (as Hg)	"	-	-	.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0,002
32.	DO	mg/lt				14,4	8,0	7,1	7,2	74	-	-	-	-	-	8,3	-	-	-	-	-	
33.	BOD	mg/lt																				

Table 7.4

Topic : Drinking Water Investigation Results and Agriculture perpuse

Sample Taken From : Jelapat

No.	Elements	Units	Drinking Water Condition			RAINY SEASON													DRY SEASON								Standard of Class C
						STATION													STATION								
			Min. Allowed	Max. Advisable	Max. Allowed	Muara 1 P	ST 2 2 P	SKKR 3 P	SKKN 4 P	KLKR 5 P	KLKN 7 I	MUARA 1 S	ST 2 2 S	SKKR 3 S	SKKN 4 S	KLKR 5 S	KL TENGAH 6 S	KLKN 7 S	AIR SURUT KOLAM	SUMUR PRIMER	SKKN ST 4	SE TENGAH ST 2	AIR MINUM	ST 3 SUMUR	HANDIL JELAPAT	KOLAM KIRI	
	I. Physics																										
1.	Water Temp.	°C	-	-	Air Temp	265	26.3	26.5	26.5	27	27	26.8	27.0	26.5	26.5	27	26.5	26.	26,5	27	26,5	27	25°C	26	27°C	27	± 3°C from Normal water temperature
2.	Colour	Unit (Pt-Co Scale)	-	5	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
3.	D.O.	-	-	-	-	2,6	4,3	2,4	4,6	5,8	2,1	3,4	2,0	4,9	5,3	4,0	2,6	2,4	-	4,2	8,6	9,0	4,3	4,4	7,8	6,8	> 3
4.	Taste	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5.	Turbidity	Unit (Silica Scale)	-	5	25	-	2.8	-	-	-	-	-	24	-	-	-	-	-	100	100	100	100	100	100	100	100	-
	II. Chemistry																										
6.	Acidity (pH)	-	6.5	-	9.2	4.5	4.5	4	4	4.5	5	-	3.8	4	4	4	4	5	3,5	4,0	3,0	5,5	5,0	3,2	3,8	3,0	6 - 9
7.	Solid Substance/Total	mg/l	-	500	1,500	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8.	Organic Substance (KMnO4)	"	-	-	10	39.6	38.7	8.4	13.1	11.9	10.7	5.6	7.1	8.6	22.1	5.1	17.16	74.5	16,2	8,9	14,4	21,2	14,7	13,8	13,9	11	-
9.	Agresive Carbondioxide (as CO_2)	"	-	-	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	-
10.	Alkalinity Total	°D	5	-	10	10.1	11.3	16.4	16.4	6.3	15.5	15.1	18.9	27.7	15.1	4.5	30.2	25.2	15,7	9,9	11,2	4,9	2,4	15,6	8,0	12,4	-
11.	Calcium (as Ca)	mg/l	-	75	200	5.4	6.7	6.7	3.6	4.5	2.7	4.5	10.3	8.5	4.5	5.3	5.8	1.8	27,7	15,8	20,6	23,8	4,1	23,1	12,7	26,9	-
12.	Magnesium (as Mg)	"	-	30	150	1.1	8.1	2.9	4.8	5.4	48.5	3.8	1.9	6.7	3.8	6.2	9.4	9.7	68,1	32,8	35,6	6,6	8,1	53,2	26,6	37,1	-
13.	Iron/Total (as Fe)	"	-	.1	1.0	2.32	2.05	1.36	2.86	1.23	2.18	1.36	1.23	.96	2.46	4.23	3.27	13.36	39,9	1,8	11,5	0,0	0,0	5,2	1.	21,0	-
14.	Mangaan (as Mn)	"	-	.05	.5	.11	.0	.23	.11	.0	.23	.33	.0	.33	.22	.0	.11	.0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	-
15.	Cuprum (as Cu)	"	-	.05	1.5	.185	.0	.0	.0	.0	.0	.0	.61	.0	.0	.0	.295	1.5	seangin	0,0	seangin	0,0	0,0	seangin	0,0	0,0001	0,02
16.	Zinc (as Zn)	"	-	1.0	15	.25	.25	.0	.0	.0	.0	.25	.5	.0	.0	2.0	.5	.0	0,0	2,0	3,4	0,0	0,0	10,0	7,0	5,0	0,02
17.	Chloride (as Cl)	"	-	200	600	46.6	58.2	44.9	41.6	63.2	34.9	48.2	21.6	6.5	38.2	68.2	48.2	54.9	290,1	273,1	184,3	61,4	58,0	372,1	140,1	494,9	0,003
18.	Sulphate (as SO4)	"	-	200	400	.1	.02	1.33	3.73	1.54	2.28	1.93	2.17	2.7	2.4	2.81	3.46	2.0	11,0	7,0	11,0	0,25	0,5	2,0	5,0	10,0	-
19.	Sulphide (as H2S)	"	-	-	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	-
20.	Flouride (as F)	"	1.0	-	2.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	1.5
21.	Ammonia (as NH4)	"	-	-	.0	1.3	1.46	.54	.23	.54	.54	.65	.46	.58	.39	.85	.62	.62	4,6	3,5	3,0	2,0	3,0	3,6	3,0	2,9	-
22.	Nitrate (as NO3)	"	-	-	20.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	-
23.	Nitrite (as NO2)	"	-	-	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,016
24.	Phenolic (as Phenol)	"	-	.001	.002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25.	Arsenic (as As)	"	-	-	.05	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	1
26.	Plumbum (as Pb)	"	-	-	.10	.039	.0	.0	.0	.076	.0	.0	.0	.0	.0	.0	.0	.0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,03
27.	Selenium (as Se)	"	-	-	.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0,05
28.	Chromium (as Cr)	"	-	-	.05	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,05
29.	Cyanide (as CN)	"	-	-	.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0,02
30.	Cadmium (as Cd)	"	-	-	.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0,012
31.	Mercury (as Hg)	"	-	-	.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0,002
32.	BOD					9	12	12	8	12	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Table 7.5

Topic : Drinking Water Investigation Results and Agriculture perpose

Sample Taken From : Purwasari

No.	Elements	Units	Drinking Water Condition			RAINY SEASON										DRY SEASON						Standard of Class C
			Min. Allowed	Max. Advisable	Max. Allowed	STATION										STATION						
						PR 1P	PR 2P	PR 3P	PR 4P	PR 1S	PR 2S	PR 3S	PR 4S	Irrigation water	SUMUR	PR I_1	PR I_2	SUMUR II_1	PR II_1	PR II_2	SUMUR I_1	
	I. Physics																					
1.	Water Temp.	°C	-	-	Air Temp	27	28	27.5	26.5	27.5	28.1	27	27.5	27.5	26	28.5	27.5	26	27.5	27.5	26	± 3°C from normal water temperature
2.	Colour	Unit (Pt-Co Scale)	-	5	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
3.	D.O.	-	-	-	-	3,6	3,9	8,0	6,8	4,0	4,1	1,4	1,8	2,8	3,0	4,0	4,0	4,0	4,1	4,40	4,50	≥ 3
4.	Taste	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5.	Turbidity	Unit (Silica Scale)	-	5	25	-	7.7	-	-	-	7.1	-	-	-	-	-	-	-	-	-	-	-
	II. Chemistry																					
6.	Acidity (pH)	-	6.5	-	9.2	6.0	6.2	6.0	6.5	6.0	5.1	5	5.0	5	5	6,0	6,0	6,1	4,0	4,0	4,5	6 - 9
7.	Solid Substance/Total	mg/l	-	500	1,500	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8.	Organic Substance (KMnO4)	"	-	-	10	107.94	78.22	7.29	77.59	65.39	12.52	14.39	101.06	11.5	36.61	25,8	24,5	28,8	2,4	15	31,6	-
9.	Agresive Carbondioxide (as CO_2)	"	-	-	.0	.0	.C	.0	.0	.0	.0	.0	.0	.0	.0	0,0	0,0	0,0	0,0	0,0	0,0	-
10.	Alkalinity Total	°D	5	-	10	6.9	4.53	5.03	4.41	4.4	6.17	3.5	3.65	5.41	12.84	4,2	3,9	18,8	6,6	5,0	11,6	-
11.	Calcium (as Ca)	mg/l	-	75	200	35.1	18.5	26.1	17.97	18.9	31.5	17.1	13.5	26.07	67.42	8,3	9,1	26,9	9,9	8,7	34,8	-
12.	Magnesium (as Mg)	"	-	30	150	5.9	8.1	5.9	8.09	7.6	7.6	4.85	7.6	7.55	14.56	13,1	11,4	64,4	2,6	16,1	29,1	-
13.	Iron/Total (as Fe)	"	-	.1	1.0	6.28	1.78	.6	2.44	4.71	.1	1.67	4.47	.7	.0	0,3	1,0	2,5	0,5	1,0	0,0	-
14.	Mangaan (as Mn)	"	-	.05	.5	.0	.0	.22	.0	.0	.22	.11	.0	.11	.0	0,0	0,0	0,0	0,0	0,0	0,0	-
15.	Cuprum (as Cu)	"	-	.05	1.5	.0	.0	.0	.016	.0	.0	.0	.01	.0	.0	0,0	0,0	0,0	0,0	0,0	0,0	0,02
16.	Zinc (as Zn)	"	-	1.0	15	.0	.0	.125	.0	.0	.0	.125	.0	.0	.25	129,7	0,0	0,0	0,0	0,0	0,0	0,02
17.	Chloride (as Cl)	"	-	200	600	169.63	133.1	86.48	136.4	139.7	149.67	93.13	149.67	139.7	622.0	0,5	131,4	740,7	221,9	174,1	614,4	0,003
18.	Sulphate (as SO4)	"	-	200	400	9.86	8.53	22.79	3.68	2.79	30.15	10.44	7.06	25.44	.15	0,0	0,5	2,0	1,5	1,5	0,0	-
19.	Sulphide (as H2S)	"	-	-	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0,0	0,0	0,0	0,0	0,0	0,0	-
20.	Flouride (as F)	"	1.0	-	2.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	3,0	0,0	0,0	0,0	0,0	0,0	1,5
21.	Ammonia (as NH4)	"	-	-	.0	.41	.39	.38	.45	.32	.16	.20	.47	.14	5.32	0,0	3,0	3,0	3,0	3,0	6,6	-
22.	Nitrate (as NO3)	"	-	-	20.0	.0	.0	.0	.0	.0	.0	.0	1.0	.0	.0	0,0	0,0	0,0	0,0	0,0	0,0	-
23.	Nitrite (as NO2)	"	-	-	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	-	0,0	0,0	0,0	0,0	0,0	0,016
24.	Phenolic (as Phenol)	"	-	.001	.002	-	-	-	-	-	-	-	-	-	-	0,0	-	-	-	-	-	-
25.	Arsenic (as As)	"	-	-	.05	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0,0	0,0	0,0	0,0	0,0	0,0	1
26.	Plumbum (as Pb)	"	-	-	.10	.0	.0	.0	-	.0	.0	.0	.0	.0	.0	-	0,0	0,0	0,0	0,0	0,0	0,03
27.	Selenium (as Se)	"	-	-	.01	-	-	-	-	-	-	-	-	-	-	0,0	-	-	-	-	-	0,05
28.	Chromium (as Cr)	"	-	-	.05	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	-	0,0	0,0	0,0	0,0	0,0	0,05
29.	Cyanide (as CN)	"	-	-	.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0,02
30.	Cadmium (as Cd)	"	-	-	.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0,012
31.	Mercury (as Hg)	"	-	-	.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0,002
32.	Electric					38	8.5 21	19.5	19.0	-	0.7 -	-	-	8	12	-	-	-	-	-	-	
33.	BOD5																					

Table 7.6

Topic : Drinking Water Investigation Results
Sample Taken From: Maliku

No.	Elements	Units	Drinking Water Condition			RAINY SEASON										DRY SEASON								Standard of Class C
			Min. Allowed	Max. Advisable	Max. Allowed	STATION										STATION								
						ST Q P	ST. 1 P	ST. 2P	ST. 3P	ST. 4P	ST Q S	ST. 1S	ST. 2S	ST. 3S	ST. 4S	ST 2	SK KR Blok B.V	ST. 4 SK. KANAN	SL PRIMER ST. 5	F.KAMAYAN PABRIK	ST. 3 PASANG TERTINGGI	SUMUR ST 1	SK KANAN BLOK B VI	
	I. Physics																							
1.	Water Temp	°C	-	-	Air Temp	28	27.5	26.8	27	27	27.5	28	27.5	27	28.5	23,5°C	26°C	28°C	26	26,5°C	27,5°C	25°C	28.3°C	± 3°C from Normal water temperature
2.	Colour	Unit (Pt-Co Scale)	-	5	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
3.	D.O.	-	-	-	-	6,7	5,7	4,6	5,5	4,8	7.0	6,8	5	6,3	6,2	4,6	5,2	4,9	4,4	4,4	4,0	6,1	6	≥ 3
4.	Taste	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5.	Turbidity	Unit (Silica Scale)	-	5	25	0.75	0.75	0.75	100	100	100	110	110	100	110	100	125	150	100	100	25	25	210	-
	II. Chemistry																							
6.	Acidity (pH)	-	6.5	-	9.2	4.0	4.0	4.0	3.7	4.0	4.0	4.0	3.6	3.5	3.7	4.0	4,0	3,5	4,0	4,9	3,9	3,8	4,4	6 - 9
7.	Solid Substance/Total	mg/l	-	500	1,500	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8.	Organic Substance (KMnO4)	"	-	-	10	109.2	207.1	150.5	193.7	120.1	145.2	179.6	46.6	218.1	93.5	50.9	177,3	154	50,6	49,4	55,5	20,5	171,2	-
9.	Agresive Carbondioxide (as CO_2)	"	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	-
10.	Alkalinity Total	°D	5	-	10	1.5	1.1	1.8	1.6	1.3	1.1	1.1	1.4	1.9	1.0	1.3	1,9	2,1	1,2	0,9	1,4	5,9	5,9	-
11.	Calcium (as Ca)	mg/l	-	75	200	2.7	5.4	9.1	7.2	3.4	4.5	3.4	8.1	2.7	4.5	5.1	6,7	8,4	4,2	4,2	4,2	10,1	10,3	-
12.	Magnesium (as Mg)	"	-	30	150	6.5	2.8	4.3	4.3	4.8	2.2	5.4	5.4	3.8	4.2	2.5	4,0	4,0	2,5	1,5	3,2	19,2	18,7	-
13.	Iron/Total (as Fe)	"	-	.1	1.0	2.0	.72	.8	.4	1.76	3.88	.86	.91	1.36	5.06	0.8	4,88	2,6	1,953	1,79	2,279	12,778	7,977	-
14.	Mangaan (as Mn)	"	-	.05	.5	.0	-	.11	.0	.0	.0	.0	.33	.0	.17	0.0	0,0	0,0	0,0	0,0	seongin	2,42	seongin	-
15.	Cuprum (as Cu)	"	-	.05	1.5	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,02
16.	Zinc (as Zn)	"	-	1.0	15	.0	.0	.0	.0	.0	.0	.0	.4	.0	.0	0.0	0,0	0,0	0,0	0,0	0,0	2,0	0,0	0,02
17.	Chloride (as Cl)	"	-	200	600	49.9	236.1	156.2	249.5	66.5	66.5	259.4	26.6	315.9	49.9	40.9	1027,1	853,3	27,3	20,5	30,7	20,5	938,7	0,003
18.	Sulphate (as SO4)	"	-	200	400	.0	.0	1.25	.0	.0	.19	.0	.5	.0	.0	4.0	3,5	4,0	5,0	3,0	4,0	7,0	8,0	-
19.	Sulphide (as H2S)	"	-	-	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	-
20.	Flourida (as F)	"	1.0	-	2.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	1,5
21.	Ammonia (as NH4)	"	-	-	.0	.39	1.66	.56	.92	.88	.85	1.87	.67	.99	.56	0.0	137	126	0,0	0,0	0,0	26,7	1,5	-
22.	Nitrate (as NO3)	"	-	-	20.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	-
23.	Nitrite (as NO2)	"	-	-	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,016
24.	Phenolic (as Phenol)	"	-	.001	.002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25.	Arsenic (as As)	"	-	-	.05	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	1
26.	Plumbum (as Pb)	"	-	-	.10	.0	.0	.017	.035	.0	.0	.0	.0	.0	.068	0.0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,03
27.	Selenium (as Se)	"	-	-	.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0,05
28.	Chromium (as Cr)	"	-	-	.05	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,05
29.	Cyanide (as CN)	"	-	-	.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0,05
30.	Cadmium Tes CD)	"	-	-	.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0,02
31.	Mercury (as Hg)	"	-	-	.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0,012
32.	EL Index					8.5					0.3													0,002

Table 7.7

Topic : Drinking Water Investigation Results
Sample Taken From : Sebangau

No.	Elements	Units	Drinking Water Condition			RAINY SEASON							DRY SEASON							Standard of Class C
			Min. Allowed	Max. Advisable	Max. Allowed	STATION							STATION							
						ST 1	ST 2	ST 3	ST 4	ST 5	SUMUR I	SUMUR II	ST 1	ST 2	ST 3	ST 4	ST 5	SUMUR I	SUMUR II	
	I. Physics																			
1.	Water Temp	°C	-	-	Air Temp	26	27	27	26.5	27	26	27	27	26	28	28	28	27	27	± 3°C from formal water temperature
2.	Colour	Unit (Pt-Co Scale)	-	5	50	-	-	-	-	-	-	-	250.0	200.0	60.0	20.0	10.0	200.0	10.0	
3.	D.O.	-	-	-	-	4,1	9,2	5,8	8,3	-	4,0	4,0	2,8	6,2	2,0	3,0	3,0	4,0	7,0	≥ 3
4.	Taste	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5.	Turbidity	Unit (Silica Scale)	-	5	25	100	110	110	100	100	100	100	35.0	30.0	55.0	20.0	15.0	45.0	7.0	-
	II. Chemistry																			
6.	Acidity (pH)	-	6.5	-	9.2	4.2	4.5	4.5	4.0	4.1	4.2	4.5	4,4	3,5	4,2	4,3	4,1	4,3	4,6	6 - 9
7.	Solid Substance/Total	mg/l	-	500	1,500	-	-	-	-	-	-	-	50,0	50,0	280.0	60.0	60.0	60.0	40.0	-
8.	Organic Substance ($KMnO_4$)	"	-	-	10	44.4	89.2	30.9	112.6	51.3	113.6	116.1	105.25	225.62	151.83	28.82	105.34	150.0	2.50	-
9.	Agresive Carbondioxide (as CO_2)	"	-	-	.0	.0	.0	.0	.0	.0	.0	.0	22,7	18,61	38,81	40.96	22.75	22.75	4.14	-
10.	Alkalinity Total	°D	5	-	10	1.3	1.0	1.1	1.4	1.3	1.1	1.6	-	-	-	-	-	-	-	-
11.	Calcium (as Ca)	mg/l	-	75	200	5.4	2.7	6.3	4.5	5.4	4.5	7.2	50.0	100.0	40.0	40.0	885.0	100.0	10.0	-
12.	Magnesium (as Mg)	"	-	30	150	2.2	1.1	2.2	3.2	2.5	2.7	1.6	50.0	100.0	100.0	110.0	4965.0	100.0	10.0	-
13.	Iron/Total (as Fe)	"	-	.1	1.0	1.36	3.09	1.27	2.55	4.91	1.64	.7	0.50	0.11	2.25	0.55	0.10	1.15	0.70	-
14.	Mangaan (as Mn)	"	-	.05	.5	.0	.0	-	.0	-	.0	.0	0.05	0.22	0.16	0.38	0.15	0.06	0.10	-
15.	Cuprum (as Cu)	"	-	.05	1.5	.0	.0	.0	.0	.0	.0	.0	-	-	-	-	-	-	-	0,02
16.	Zinc (as Zn)	"	-	1.0	15	.0	.0	.0	.0	.0	.0	.0	-	0.05	0.05	0.07	0.05	0.05	0.05	0,02
17.	Chloride (as Cl)	"	-	200	600	59.9	186.3	29.9	133.0	46.6	89.8	189.6	170.0	255.0	51.0	204.0	34680.0	170.0	10.2	0,003
18.	Sulphate (as SO_4)	"	-	200	400	1.3	1.0	.0	1.9	1.21	.0	.0	30.0	22.0	54.0	24.0	150.0	27.5	0	-
19.	Sulphide (as H_2S)	"	-	-	.0	.0	.0	.0	.0	.0	.0	.0	-	-	-	-	-	-	-	-
20.	Flouride (as F)	"	1.0	-	2.0	.0	.0	.0	.0	.0	.0	.0	•	•	0.09	0.09	2.26	•	•	1,5
21.	Ammonia (as NH_4)	"	-	-	.0	.22	1.12	.42	.32	.56	1.27	1.23	0.626	0.408	1.061	1.816	2.325	0.632	0.177	-
22.	Nitrate (as NO_3)	"	-	-	20.0	.0	.0	.0	.0	.05	.0	.0	0.0905	0.0774	0.0977	0.3827	0.0309	0.0821	0.3363	-
23.	Nitrite (as NO_2)	"	-	-	.0	.0	.0	.0	.0	.0	.0	.0	0.196	0.112	0.012	0.036	0.141	0.137	0.032	0,016
24.	Phenolic (as Phenol)	"	-	.001	.002	-	-	-	-	-	-	-	0.18	0.13	0.22	0.03	0.24	•	0.05	•
25.	Arsenic (as As)	"	-	-	.05	.0	.0	.0	.0	.0	.0	.0	•	•	•	•	•	•	•	1
26.	Plumbum (as Pb)	"	-	-	.10	.0	.0	.0	.0345	.0	.0	.017	0.05	•	•	•	•	•	•	0,03
27.	Selenium (as Se)	"	-	-	.01	-	-	-	-	-	-	-	-	-	-	-	•	•	-	0,05
28.	Chromium (as Cr)	"	-	-	.05	.0	.0	.0	.0	.0	.0	.0	•	•	0.07	0.09	•	•	•	0,05
29.	Cyanide (as CN)	"	-	-	.05	-	-	-	-	-	-	-	•	•	•	•	•	•	•	0,02
30.	Cadmium (as Cd)	"	-	-	.01	-	-	-	-	-	-	-	•	•	•	•	•	•	•	0,012
31.	Mercury (as Hg)	"	-	-	.001	-	-	-	-	-	-	-	•	•	•	•	•	•	•	0,002
32.	BOD																			

Table 7.8

Topi : Drinking Water Investigation Results
Sample Taken From: Tamban Luar

No.	Elements	Units	Drinking Water Condition			RAINY SEASON								DRY SEASON						Standard of Class C
			Min. Allowed	Max. Advisable	Max. Allowed	STATION								STATION						
						ST 0 P	ST 1 P	ST 2 P	ST 3 P	ST 0 S	ST 1 S	ST 2 S	ST 3 S	SUMUR I	TL SUMUR II	MUARA	KOLAM TENGAH	KOLAM KIRI	KOLAM KANAN	
	I. Physics																			
1.	Water Temp.	°C	-	-	Air Temp	27	26,5	27	27,5	26	26	27	28	26,5	27	26,5	26,5	26,5	27	± 3°C from normal water temperature
2.	Colour	Unit (Pt-Co Scale)	-	5	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
3.	D.O.	-	-	-	-	5,1	3,9	3,9	4,1	5,3	3,9	4,0	3,4	4,2	4,6	4,3	4,1	5,0	5,2	≥ 3
4.	Taste	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5.	Turbidity (ppm.)	Unit (Silica Scale)	-	5	25	1.00	1.00	110	100	1.00	110	110	100	110	100	100	110	110	110	-
	II. Chemistry																			
6.	Acidity (pH)	-	6.5	-	9.2	4.4	4.5	6.0	5.2	4.2	5.0	6.0	5.2	4.0	3,5	4.0	4,0	3,5	5,5	6 - 9
7.	Solid Substance/Total	mg/l	-	500	1,500	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8.	Organic Substance (KMnO4)	"	-	-	10	5.0	51.62	51.1	77.28	48.5	4.38	71.02	96.99	9,5	14.7	30.7	13,5	10,4	20,8	-
9.	Agresive Carbondioxide (as CO_2)	"	-	-	.0	.0	0.0	.0	.0	.0	.0	.0	.0	0.0	0.0	0.0	0,0	0,0	0,0	-
10.	Alkalinity Total	°D	5	-	10	2.8	1.4	1.5	1.8	2.4	1.6	1.3	2.0	6.7	6,5	1,4	8,5	10,3	6,1	-
11.	Calcium (as Ca)	mg/l	-	75	200	3.4	2.7	1.8	2.7	4.5	4.5	5.4	8.1	10,7	13,9	9,5	40,8	13,9	12,3	-
12.	Magnesium (as Mg)	"	-	30	150	9.7	4.3	5.4	5.9	7.6	4.3	2.2	3.8	26,8	4,1	0,5	12,3	35,6	18,8	-
13.	Iron/Total (as Fe)	"	-	.1	1.0	.9	.7	4.55	.4	2.64	.3	5.46	.5	23,2	1,35	5,65	0,37	0,7	0,37	-
14.	Mangan (as Mn)	"	-	.05	.5	.22	.0	.0	.0	.0	.28	.0	.0	0,055	0,0	0,0	0,0	0,0	0,0	-
15.	Cuprum (as Cu)	"	-	.05	1.5	.0	.0	.0	.0	.0	.0	.0	.0	0,0	0,0	0,0	0,0	0,0	0,0	0,02
16.	Zinc (as Zn)	"	-	1.0	15	.0	.0	.0	.0	.0	.0	.0	.0	0,0	0,2	0,0	0,0	0,0	0,0	0,02
17.	Chloride (as Cl)	"	-	200	600	29.9	23.3	66.5	71.5	49.9	33.3	123.1	182.9	319,1	216,7	52,9	367,4	472,0	256,1	0,003
18.	Sulphate (as SO4)	"	-	200	400	1.4	.0	.0	.0	1.35	1.70	2.0	.0	1.39	4,5	2,25	0,0	5,0	2,0	4,75
19.	Sulphide (as H2S)	"	-	-	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0,0	0,0	0,0	0,0	0,0	0,0
20.	Flouride (as F)	"	1.0	-	2.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0,0	0,0	0,0	0,0	0,0	0,0
21.	Ammonia (as NH4)	"	-	-	.0	.32	.42	.53	.56	.56	.39	.59	.78	12,5	9,1	3,0	3,0	3,0	2,0	1,5
22.	Nitrate (as NO3)	"	-	-	20.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0,0	0,0	0,0	0,0	0,0	0,0
23.	Nitrite (as NO2)	"	-	-	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0,0	0,0	0,0	0,0	0,0	0,0
24.	Phenolic (as Phenol)	"	-	.001	.002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0,016
25.	Arsenic (as As)	"	-	-	.05	.0	.0	.0	.0	.0	.0	.0	.0	.0	0,0	0,0	0,0	0,0	0,0	-
26.	Plumbum (as Pb)	"	-	-	.10	.0	.0	.017	.0	.0	.017	.0345	.0	0,0	0,0	0,0	0,0	0,0	0,0	1
27.	Selenium (as Se)	"	-	-	.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0,03
28.	Chromium (as Cr)	"	-	-	.05	.0	.0	.0	.0	.0	.0	.0	.0	.0	0,0	0,0	0,0	0,0	0,0	0,05
29.	Cyanide (as CN)	"	-	-	.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0,05
30.	Cadmium (as Cd)	"	-	-	.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0,02
31.	Mercury (as Hg)	"	-	-	.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0,012
																				0,002

estuary canal and 4.6 ppm at the tidal pond. Accordingly,the average DO level in this unit was 3.

During the rainy season the average level DO in Barambai was 3.83 ppm (scale 2) Jelapat 4.23 ppm (scale 2), Purwosari 1 ppm (scale 1), Maliku 6 ppm (scale 3), Sebangau 6.3 ppm (scale 4).

Put into the quality scale which is based on laboratory analysis, the pH level (see :Appendix for drinking water) in Barambai, Jelapat, Maliku, Sebangau and Tamban Luar can be classified into scale 2, while in Purwosari scale 3.

If the concentration of heavy metal in the water of each unit as shown in table 7.3 until 7.8 were put into scales, the obtained results are as follows : Barambai (scale 2), Jelapat (scale 1), Purwasari (scale 3), Maliku (scale 2), Sebangau (scale 1) and Tamban Luar (scale 1).

If the results of field observation and laboratory in scales were combined, then the obtained average quality level was scale 3.

7.1.1.3 Climate

Annual rainfall at the study areas is relatively high, i.e. more than 2.000 mm/year. Data recorded by several weather stations at the transmigration settlement areas is as follows: Barambai (2.167 mm),

Jelapat (2.627 mm), and Sebangau (2.210 mm).

Rainfall less than 60 mm/month does not occur at the areas mentioned above. The minimum monthly rainfall at the three stations are as follows: Banjarmasin (82 mm), Kuala Kapuas (63 mm) and Marabahan (75 mm).

It means that monthly rainfall less than 100 mm usually occurs during the period of June, July and August, and gradually will rise after August.

It is noted that during the period of November-April the average monthly rainfall can even reach up to more than 200 mm/month. Therefore, based on Koppen's classification of climate, the climate of the study areas can be classified as Afw climate. This type of climate has several characteristics, i.e.

1 Dry climate (coldest month) > 18 grades C.
2 Monthly rainfall > 60 mm
3 Rainy season with inclination towards autumn season.

Based on Schmidt and Ferguson classifications, it is classified as climate A. Thus included in scale 5.

7.1.2 Biological environment

7.1.2.1 Forest vegetation

In general, the condition of forest vegetations around transmigration units are similar. As a representative example of forest vegetation in six studied areas, a description of those vegetation in Sebangau could be presented as the following :

Along both side of Sebangau River there are secondary forest which grown bu grasesse ans sedges family, but the big trees were scared. The most dominant aquatic plant is bakung (Crinum sp.). The other important aqautic plants are prupuk (Phragmites sp.) and piyae (Acrosticum sp.). These aquatic plants often create a serious transportation problem, becouse it close the river as long as its with.

Mangrove forest is mostly located the shoreline. In this forest grew bakau (Rhizophora sp.), Api-api (Avicenia sp.), Nipah (Nypa sp.), and Pandan (Pandanus sp.). There are twpo formations of vegetation in mangrove forest along the Sebangau River, i.e. Nipah and Pandang formation. The Nipah formation indicates that the surrounding water is brackish and the a Pandan formation indicates its surrounding is freshwater.

Every units of transmigration settlement areas is bodered by a small forest which is still in a good condition. The forest consist of primary and scondary forest. The common plant species in the secondary forest are galam (Melaleuca leucodendron L.), plantan (Alstonia pneumatophora Back.), mahang (Macaranga maingayi), and terentang (Campnosperma macrophyla).

In the inner side, next to the secondary forest, there are primary forest which is dominated by big and tall trees. There are also found many lianas such as rotan. The best growing trees in the primary forest in ramin (Gonystylus bancanus Kurz.). The occurence of ramin in a location indicates that the peat layer in that area is deep and the forest potential is cery high (Department of Soil Science, Faculty of Agriculture Gadjah Mada University, 1980).

Common weeds in the rice field

Weeds growing in the rice field ecosystem are a member of the families Cyperaceae, Poaceae, Melastomaceae, Polygonaceae, Commenlinaceae, and Emiliaceae. Along the tertiary canals of transmigrant settlement units are found 7 species of weed belonging to the family of

Cyperaceae, Poaceae, and Melastomaceae. In Barambai, Cyperaceae is more dominant than Poaceae. Those species are Eleocharis dulchis (Burm.F.) Trin. ex Henschel, E. retroplexa (Poir.) Urb., Scirpus grossus L.F., Fimbristylis sp., Panicum repens L., Paspalum conjugatum Berg., and Melastoma affine D. Don.

Fallow land has turn back into secondary forest dominated by Melaleuca leucodendron (L.).
The composition of aquatic macrophytes in Tamban luar differ from that barambai. In Tamban Luar Poaceae is more dominant than Cyperaceae and Tamban Luar are richer in species (Sastrosoedardjo et al., 1986). In Tamban Luar, there are 11 species of aquatic macrophyte and a grass species, Eragrostis uniloides (Retz.) Nees ex Steud., has the widest distribution.

Sastrosoedardjo et al. (1986) further reports that some species of aquatic macrophytes mentioned above can serve as an indicator of water quality in tidal swamps. E. dulchis is an indicator of permanent-stagnant water with a low pH, while E. retroplexa is an aquatic weed indicating acid water. M. affine is a species which thrives best on land of the poorest quality. Commelina, Polygonum, and Emilia are

indicator of tidal swamp water with pH higher than 5.

7.1.2.2 Animals

Peatswamp forest do not support an abudance of terrestrial wild life. An investigation primate densities in peatswamps of Peninsular Malaysia found that away from rivers in the species-poor forest, few primate species existed and thos species present lived at densites less thatn three groups per square kilometer (Whitten et al., 1984). During the survey in peatswamps of Sebangau, Central Kalimantan, there are only found an orang utan (Pongo pigmeus Hoppius) with its young. Orang utan is classified as a rare species and has been protected by law. Thus, sustainable quality of the forest in Sebangau should be carefully maintained, becouse primates depend on tree and vine fruit for most of their diet.

Harmful animals and carriers of plant disease are insects, rats, some species of birds, fungi, bacteria and virus. According to Willis et al. (in : Gabriel

at al., 1986) harmful insect living in tidal swamps more than 50 species. Some important species that found in studied area are wereng hijau, Nephotettix virescens (Distant), penggerek batang, Scirpophaga innotata (Walker), and walang sangit, Leptocorisa oratoria (Fabricius). Adulst and nymphs of wereng hijau transmit several serious virus diseases. When their population are high, they directly damage rice plants. Prevention of virus infection is more difficult the control of wereng hijau itself. Wereng hijau are more abundant in the rainy season. Adults feed and rest on the upper portions of the rice plant. Egg masses of penggerek batang are lead near leaf tips and are covered with hair. Only one larvae occurs in a stem. The larvae remain dormant at the base of plants during the dry season. The pupae are found at the extremme base of the plant, often below the soil. Penggerek batang occurs predominantly in areas where there is only one wet season rice crop per year.

Walang sangit feed on grains of rice

plant. Factors that cause high population of this pest are nearby woodlands and extensive weedy areas near rice fields.

Harmful rat species are represented bu tikus sawah, Rattus argentiventer (Robinson & Kloss) that cause rice crop damage. Crop damage occur at all stages of rice growth but reach their peak while grain is maturing. Crop damage greater during wet season than those dry season.

Rice plant disease in the tidal swamp ecosystem is caused by fungi, bacteria, and virus.

The fish species of important economic value living in the secondary and tertiary canals of the irrigation canals in the transmigration units are gabus (Channa striata Fowler), betok, Anabas testudineus (Bloch), and sepat siam Trichogaster pectoralis (Regan). In the secondary canals found biawak (Varanus salvator).

7.1.2.3 Microorganism

Samples of plankton were taken from 24 sampling stations which were also the stations for the measurement of water quality parameters. Samples were also taken from several ponds at the end of irrigation canals.

Water in those irrigation canals is derived from four big rivers. Irrigation canals in Barambai and Jelapat get the water from Barito River. The water from Anjir Tamban flows through irrigation canals in Purwasari. Anjir Tamban is a relatively small river that connects Barito and Kapuas River. Water in the irrigation canals in Maliku is derived from Kahayan River and the irrigation canals in Tamban Luar get the water from Murung River or Kapuas Murung River. The water from Sebangau River flows through irrigation canals in Sebangau.

The samples of plankton collected from irrigation canals in six studied locations had been identified and the result is

presented in Table 7.9. Among the six locations, the irrigation canal in Barambai contained the highest concentration of plankton, i.e. 9.694 indiv./l, consisting of 24 genus. The most dominant plankton in Barambai was Oscillatoria (5.516 indiv./l), followed by Brachyonus (2.152 indiv./l). Brachyonus was the most dominant genus in Jelapat (493 indiv.l/) and in Maliku (953 indiv./l). Besides in Barambai, Oscillatoria was found in the other five locations.

The most dominant plankton in Purwasari and Tamban Luar was Navicula, and the total number in each studied location was 112 and 867 indiv./l. This genus was in the second larges number in Sebangau (207 indiv./l). The most dominant genus in Sebangau was Zygnema (498 individu/l). This genus was also found in the other five locations. Besides Oscillatoria and Zygnema, plankton frequently found in the six studied units were Euglena and Fragillaria.

Based on the Diversity Index, it is known that the diversity of plankton in Station 1 and Stattion 3 in Purwasari was almost similar, but there were significant

Table 7.9 Composation of plankton genus in irigation channel in Purwosari, Jelapat, Maliku, Tamban Luar and Sebangau

No.	Genus	Purwosari	Barambai	Jelapat	Maliku	Tamban Luar	Sebangau
1.	Anabaena	-	-	-	17	-	-
2.	Ankistrodesmus	-	15	13	-	-	-
3.	Arcella	-	-	13	-	-	-
4.	Bacteriastrum	-	-	-	19	36	-
5.	Bidulphia	-	-	-	73	19	-
6.	Brachyonus	-	2.152	493	953	-	18
7.	Chaetoceros	-	-	-	33	18	-
8.	Ciliata	8	-	-	-	11	-
9.	Closterium	-	431	-	56	-	11
10.	Cocconeis	-	13	-	-	-	-
11.	Copepoda	21	13	13	-	-	-
12.	Coscinodiscus	-	-	-	71	121	-
13.	Cyclops	-	17	72	88	19	-
14.	Cymbella	-	-	-	-	30	-
15.	Difflugia	-	13	-	-	-	-
16.	Detilum	-	-	-	-	7	-
17.	Euglena	62	67	93	52	578	18
18.	Fragillaria	34	327	80	150	63	122
19.	Gyrosigma	18	-	-	-	17	9
20.	Hydrodiction	-	15	-	-	-	-
21.	Lecane	-	75	-	102	-	-
22.	Lyngbia	-	58	13	-	-	-
23.	Melosira	10	-	-	-	5	-
24.	Merismopedia	-	-	-	-	-	-
25.	Moina	-	33	-	-	-	-
26.	Monostyla	-	-	-	-	-	-
27.	Mougeotia	-	88	33	115	57	78

Table 7.9 Continued

28. Nauplius	-	-	-	98	25	-
29. Navicula	112	13	-	312	867	207
30. Nitzschia	-	49	-	92	56	-
31. Oedogonium	-	-	120	18	-	9
32. Oscillatoria	97	5.516	46	319	25	118
33. Pediastrum	-	160	13	9	-	-
34. Peridinium	-	-	-	76	-	-
35. Philodina	-	87	-	-	-	-
36. Pleurosigma	-	-	-	17	14	22
37. Pleurotaenium	-	20	-	-	-	-
38. Rzizosolenia	-	-	-	-	22	-
39. Scenedesmus	-	-	13	9	-	-
40. Spirogyra	-	26	13	-	-	-
41. Surirella	-	13	-	-	-	-
42. Synedra	-	60	26	127	5	-
43. Tabellaria	-	-	13	18	14	-
44. Zygnema	18	433	119	96	14	498
Total plankton/ha	380	9.694	1.186	2.920	2.023	1.145
Total genus	9	24	17	24	22	13

difference between diversity plankton in Station 2 and Station 4. The average Diversity Index in secondary canals is 0.6198 (Table 7.10).

Table 7.10 Total number of plaankton and its Diversity Index at the secondary canal in Purwasari, South Kalimantan

No.	Genus	Sta.1	Sta.2	Sta.3	Sta.4	Total (indiv./l)
1.	Ciliata	-	-	8	-	8
2.	Copepoda	21	-	-	-	21
3.	Euglena	10	-	15	37	62
4.	Fragillaria	-	16	-	18	34
5.	Gyrosigma	-	-	-	18	18
6.	Melosira	10	-	-	-	10
7.	Navicula	21	24	30	37	112
8.	Oscillatoria	42	16	30	9	97
9.	Pleurosigma	-	-	-	18	18
	Total	104	56	83	137	380
	H	0,6410	0,4723	0,5500	0,8159	

Average Diversity Index(H) in the secondary canal=0,6198

From Table 7.11, it can be seen that the Diversity Index of plankton in Left pond, Station 2, Right pond, and Station 3 was lower than Diversity Index of plankton in Station 1 that is located nearer to Barito River. Diversity of plankton in irrigation canals at Barambai has certain distribution pattern. Sampling station which is located nearer to the main river has higher diversity of plankton.

The Diversity Index of plankton in each sampling station in Jelapat are presented in Table 7.12. The distribution pattern of plankton diversity in Jelapat was similar to that in Barambai. Sampling station which is located nearer to the main river has higher diversity of plankton. However, the diversity of plankton in the secondary irrigation canals in Maliku was slightly different. The diversity in the left secondary canal (Station 1 and Station 2) was lower compared to the diversity in primary canal (Station 5) which is located near Kahayan River, but the community of plankton in the right secondary canal (Station 3 and Station 4) proved to have a higher diversity than that in Station 5. In general, the

Table 7.11 Total and Diversity Index of plankton genus at the secondary canal in Barambai, South Kalimantan

No.	Genus	Sta 1	Sta 2	Sta 3	Left kolam	Right kolam	Total plankton/l
1.	Akistrodesmus	-	-	15	-	-	15
2.	Brachyonus	13	939	720	240	240	2152
3.	Closterium	13	-	58	-	360	431
4.	Cocconeis	13	-	-	-	-	13
5.	Copepoda	-	-	13	-	-	13
6.	Cyclops	-	-	17	-	-	17
7.	Difflugia	13	-	-	-	-	13
8.	Euglena	-	67	-	-	-	67
9.	Flagillaria	67	-	-	60	200	327
10.	Hydrodyction	-	-	15	-	-	15
11.	Lecane	-	35	-	-	40	75
12.	Lyngbya	-	58	-	-	-	58
13.	Moina	13	-	-	-	20	33
14.	Mougeotia	-	28	-	60	-	88
15.	Navicula	13	-	-	-	-	13
16.	Nitzschia	-	-	49	-	-	49
17.	Oscillatoria	35	113	308	940	4120	5516
18.	Pediastrum	-	-	-	40	120	160
19.	Philodina	-	52	35	-	-	87
20.	Pleurotaenium	-	-	-	-	20	20
21.	Spirogya	13	-	13	-	-	26
22.	Spirella	13	-	-	-	-	13
23.	Synedra	-	-	-	-	60	60
24.	Zygnema	-	393	40	-	-	433
	Total :	206	1685	1283	1340	5180	
	H :	0.8749	0.5829	0.6010	0.3958	0.2995	

Average Diversity Index (H) in the secondary canal = 0.4698

average Index of Diversity (H) in the secondary canals was almost similar to the Index of Diversity in the primary canals or station 5 (Table 7.12).

The total number and Diversity Index of plankton in Tamban Luar is presented in Table 7.13. The Diversity Index of plankton in Station 2, 3, and 4 were lower than that in Station 1 which was located near Murung River or Kapuas Murung (Table 7.14).

The average Diversity Index of plankton in the secondary canals (H) was lower compared to the Diversity Index in Station 1. The distribution pattern of plankton diversity in irrigation canals at Tamban Luar was similar to those in Barambai and Jelapat, i.e. the sampling station located near the main river (Kapuas Murung) would have higher diversity of plankton.

The total number and the Diversity Index of plankton in each sampling station in Sebangau are shown in Table 7.15 . The Diversity Index in Station 1 and Station 3 were lower than that in Station 2 which located nearer to Sebangau River, and also lower than the Diversity Index in Station 4 which is nearer

Table 7.13. Total and Diversity Index of plankton genus at the secondary canal in Maliku, Central Kalimantan

No.	Genus	Sta 1	Sta 2	Sta 3	Sta 4	Sta 5	Total plankton/l
1.	Anabaena	-	17	-	-	-	17
2.	Bacteriastrum	-	-	-	-	19	19
3.	Biddulphia	-	-	54	-	19	73
4.	Brachyonus	-	884	-	69	-	953
5.	Chaetoderos	14	-	-	-	19	33
6.	Closterium	-	-	-	56	-	56
7.	Coscinodiscus	17		18		36	71
8.	Cyclops	29	21	19	-	19	88
9.	Euglena	-	-	-	52	-	52
10.	Fragillaria	-	-	108	42	-	150
11.	Lecane	-	102	-	-	-	102
12.	Mougeotia	-	-	40	17	58	115
13.	Nauplius	42	20	36	-	-	98
14.	Navicula	22	52	75	54	109	312
15.	Nitzschia	-	-	36	-	56	92
16.	Oedogonium	-	-	-	18	-	18
17.	Oscillatoria	88	36	56	139	-	319
18.	Pediastrum	-	-	-	9	-	9
19.	Peridinium	-	-	47	-	29	76
20.	Pleurosigma	-	17	-	-	-	17
21.	Soenedesmus	-	-	-	9	-	9
22.	Synedra	-	52	56	19	-	127
23.	Tabellaria	-	-	18	-	-	18
24.	Zygnema	-	42	54	-	-	96
Total :		212	1257	617	484	364	
H :		0.6871	0.5242	0.0660	0.9268	0.8550	

Average Diversity Index (H) in the secondary canal = 0.8010

Table 7.14 Total and Diversity Index of plankton genus at the secondary canal in Tamban Luar, Central Kalimantan

No.	Genus	Sta 1	Sta 2	Sta 3	Sta 4	Total plankton/l
1.	Bacteriastrum	16	-	6	14	36
2.	Bidulphia	5	-	-	14	19
3.	Chaetoceros	-	7	11	-	18
4.	Ciliata	5	-	6	-	11
5.	Coscinodiscus	16	54	22	29	121
6.	Cyclops	5	-	-	14	19
7.	Cymbella	10	-	6	14	30
8.	Detilum	-	-	-	-	7
9.	Euglena	62	68	45	403	578
10.	Fragillaria	16	7	11	29	63
11.	Gyrosigma	-	-	17	-	17
12.	Melosira	5	-	-	-	5
13.	Mougeotia	10	27	6	14	57
14.	Navicula	47	82	112	626	867
15.	Nauplius	-	14	11	-	25
16.	Nitzschia	16	7	11	22	56
17.	Oscillatoria	-	14	11	-	25
18.	Pleurosigma	-	-	-	14	14
19.	Rhizosolenia	-	-	-	22	22
20.	Synedra	5	-	-	-	5
21.	Tabellaria	-	-	-	14	14
22.	Zygnema	-	14	-	-	14
	Total :	218	301	275	1.229	2.023
	H :	0,9212	0.8598	0.8751	0.5773	

Average Diversity Index (H) in the secondary canal = 0.4698

to Paduran River. Average Diversity Index of plankton in the primary canals is lower than the Diversity Index in Paduran River (Station 4).

Table 7.15. Total number of plankton and its Diversity Index at the irrigation canal in Tamban Luar, Central Kalimantan

No.	Genus	Sta 1	Sta 2	Sta 3	Sta 4	Total plankton
1.	Brachyonus		18			18
2.	Closterium	11				11
3.	Euglena		18			18
4.	Fragillaria	22	62	25	13	122
5.	Lecane		9			9
6.	Merismopedia		9			9
7.	Monostyla				26	26
8.	Mougeotia	22	44	12		78
9.	Navicula	22	97	50	38	207
10.	Oedogonium		9			9
11.	Oscillatoria	42		50	26	118
12.	Pleurosigma	22				22
13	Zygnema	281	167		50	498
	Total :	422	433	137	153	1145
	H :	0.4289	0.7313	0.5475	0.6587	

Average Diversity Index (H) in the primary canal = 0.5692

Based on the result of the analysis of plankton community found in acid water of irrigation canals at six transmigration units in South and Central Kalimantan, it can be concluded that:

1. The distribution pattern of plankton diversity in the secondary canals in Barambai, Jelapat, Maliku, Tamban Luar, and in the primary canals in Sebangau were similar, i.e. those sampling station located nearer to the main river would have a higher diversity of plankton, except in the right secondary canal in Maliku which had higher diversity than that in the Station 5, although the Station 5 is located nearer to the main river.

2. The average Diversity Index of plankton in the secondary canals in Barambai, Jelapat and Tamban Luar was lower than the Diversity Index of plankton in the primary canal.

3. The washing of the peat soil by tide water from the main river in Barambai, Jelapat and Tamban Luar had not been able to increase pH. That is why diversity of the plankton in the secondary canals is not as high as in the primary canal.

4. The washing of peat by the river water in Maliku had not been able to increase the diversity of the plankton in the left secondary canals, but had been able to increase the diversity of plankton in the right secondary canal.
   It can be concluded that in general the diversity of the plankton in the secondary canal was almost similar to that in the Station 5 which is located not too far from the Kahayan river.

5. The washing of the peat soil by the river water in Tamban Luar had been able to increase the diversity of the plankton although it had not reached up to the diversity found in Station 1 which is located near the Kapuas Murung.

7.2 Base Line of Man-Made Environment

The transmigration settlement areas are located at 3 (three) River Basin Areas, respectively Barambai, Jelapat, and Purwasari are located at the left side of Barito River Basin Area; Maliku and Tamban Luar II at the Kahayan Sebangau River Basin Area; while Sebangau is at the Sebangau River Basin Area.

From the topographyc point of view, the study area can be classified into plain area with slope of between 0% - 8%. The altitute is between 2 - 3 m above the sea level. As the result of such topography, the surrounding areas of this transmigration units, particularly at Sebangau, are inundated by the river water during the high tide period. The inundated area will be wider during the rainy season.

The study areas have been developed at different number of years. The following Table 7.16 shows the location of those settlement units, the number of years the units have been developed and the types of their settlers.

Table 7.16 The study of transmigration settlement units. its location, the beginning of its inhabited and the types of its settlers.

Location of settlement units	Inhabited since	Types of its settlers	Area (HA)
South Kalimantan			
1 Purwosari	1937	spontaneous	377
2 Barambai	1970	government - initiated	5306
3 Jelapat II	1977	spontaneous	2407
Central Kalimantan:			
4 Tamban Luar II	1974	government-initiated	3436
5 Maliku (Pangkoh V & VI)	1981	government-initiated	3682
6 Sebangau	1984	government-initiated	?

These transmigration settlement units can be reached by waterways. The distance between the units and the towns or villages which can be reached by motor vehicles varies greatly. Cargo or passengers usually use motor vehicles heading to the capital of the Districk or the nearest village/ town, and then the trip can be continued by waterways before reaching the study settlements.

The largest area of the transmigration settlements are used as ricefields. Other uses of the land among others are home-garden/plantation, dry-fields, settlement (housing, cattle-breeding, home industry) and public facilities. The settlement and public facilities are located along the main water transportation routes, i.e. stream of a river or canal (anjir). This water transportation routes is also water source used for irrigation during the high tide. During the low tide the water transportation routes is used as drainage canal. The need for washing and bathing of the people in this settlement are catered by this river or canal water. According to the government planning, at the beginning of the development of this areas, a green buffer should be provided between the housing and the river or canal. But now, some locations intended for green buffer are already developed for housing or other activities such as market, etc.

The following Table 7.17 shows the land use in each location of the transmigration settlements

Table 7.17 Land use in the transmigration settlement in February 1987

Location of settlement units	Ricefield (ha)	Dry-field field (ha)	Hutan prod. (ha)	Settl. & p.f (ha)	Total area (ha)
South Kalimantan					
1 Purwosari	75	-	16,35	285,65	377
2 Barambai	3232	924,5	-	1149,5	5306
3 Jelapat II	2169	-	120	118	2407
Central Kalimantan					
4 Tamban Luar II	2626	257	57	496	3436
5 Maliku	3086,5	110	-	485,5	3682
6 Sebangau	?	?	?	?	?

Drinking water for the people of the studied area is supplied by rain water or taken from the forest during the rainy season. While during the dry season drinking water must be taken from the river or canals. The following section describes several activities which may bring environmental impacts. From the survey results of the activities and its impacts the standard quality of life can be judged based on the criteria previously determined.

7.2.1 Housing

It has been set forth by the Government regulation that every transmigrant family should receive 2 Ha of land, comprising of 0,25 ha for housing and home garden, 0.75 ha for the I stage farm undertaking and 1 ha for the second stage. The house built by the Government for each transmigrant family is of the same type and size, i.e. 54 square meters. These houses have a regular distance from each other. Between the row of the houses and the river or canal there is an open space for a green buffer. But it can be noted that, there are some buildings for housing or shops/stores in the green buffer. Such situation is found in Purwosari, Jelapat II (South Kalimantan), Tamban Luar, and Sebangau (Central Kalimantan). Accordingly, activities in this buffer zone along the river or canal banks have negative impacts on the river or canal water.

The family members of the respondent varied in number.Most of the respondents from South Kalimantan have 4 members of the family.
In Barambai, the family members varied between 3 to 11 persons. A great part (35%) of the them had family members of 4 persons.

10% of the respondents consists of 6 persons in the family.

In Jelapat, the family members of the respondents varied between 1 - 12 persons, but most of them (25%) were families with 4 members of the family. While those who had 5 members of the family was about 23.3%. In Purwosari, the number of family members was between 2 - 10 persons. 23.3% of the respondents were family with a member of 5 persons, 15% with 4 members and the other 15% with 6 members.

The family members of respondents in Central Kalimantan also varied, i.e: generally consist of 4-6 persons.
In Tamban Luar, although the members of the family was between 2 - 13, but most of them (18.3%) are members of the family consisting of 5 and 7 persons. Family with 4 members was 13,3% and 15% with 6 persons.

Most of the respondents (25%) in Maliku consists of families with 5 persons and 20% with 4 persons and 20% consists of 6 persons. Among the respondents there was one persons with 11 members of the family and another one with 9 persons.

The situation in Sebangau was not very different from the other studied areas. Most of them (26.6%) were respondents with 4 family members. Then 16.6% were families with 3 family members, while those having 2 to 5 members was respectively 13.3%. Although Sebangau is a new settlement unit, but it also has a respondent with 12 family members.

Considering that the house built by the Government is 54 m2/family and it is known that most of the family consists of 4 - 6 persons, thus, the allotted space for each number of family is 9 - 13.5 m2. Such space is sufficient, because it is about the same or higher than the standard space of houses used by the Perum Perumnas. Besides, the space of the house is of no problems in this studied area, because there are still ample possibilitiess of enlarging the house since they have sufficient home garden.

Based on the building material of the house, the condition of the houses of the respondents can be classified into several categories as shown in the following :

Table 7.18 The condition of houses based on the building material used.

Location / Building Material	Barambai	Jelapat	Purwosari	Tamban Luar	Maliku	Sebangau
	in percentage					
1. Wooden wall sagopalm leaf roof	56.6	70.0	26.6	55.0	0.0	0.0
2. Wooden wall roof of zinc	21.6	28.0	1.6	23.3	98.3	100.0
3. Wooden wall roof of shingle	21.6	0.0	71.6	20.0	0.0	0.0
4. Bricktile wall and roof of zinc	0.0	1.6	0.0	0.0	0.0	0.0
5. Bricktile wall and roof of shingle	0.0	0.0	0.0	1.6	0.0	0.0

It seems that the use of building materials for houses differs in each location. The use of wooden wall and sago leafs is found most in Barambai, Jelapat and Tamban Luar. In Maliku most of the houses use wooden wall

and roof. While in Sebangau and Maliku, the material used are i.e. wooden wall and zinc roof. Most of the house in Purwosari use shingle roof and also wooden wall. Wall of bricks is used only in one house of the respondent in Jelapat and 1 house of respondent. in Tamban Luar.

Respondents perceptions about the condition of houses in the studied area were obtained by interview. Table 7.19 shows their perceptions. Evidently, most of them have the opinion that their present housing condition was much better than the former condition in the origional place.

Table 7.19 Perception on precent housing condition compared to the condition of the place of origin.

Location House condition	Barambai %	Jelapat %	Purwosari %	Tamban Luar %	Maliku %	Sebangau %
1.Better	35.0	46.6	48.3	71.6	60.0	36.6
2.The same	20.0	26.6	1.6	18.3	35.0	15.0
3.Worse	26.6	15.0	3.3	10.0	5.0	15.0
4.No reply	0	0	33.3	0	0	31.6
5.Not knowing	1.6	11.6	13.3	0	0	1.6

Some of the respondents from Purwosari (33.3%) and Sebangau (31.6%) did not give any answers. Probably it is because Purwosari had been settled in 1937, that they didn't know or remember the condition of their place of origin or the origin of their parents. Sebangau is just developed in 1984, therefore many of the respondents could not judge or compare the present condition with the condition in their place of origin.
Based on the above statements the condition of the existing houses is known and from their explanation criteria can be made to determine the quality of their housing environment.

Since every construction always requires maintenance in order to keep it in a good condition, hence the time factor, as noted in Table 7.19 will be used as the first parameter in determining the criteria. Also, the security and comfortability of the house can be measured among others by the selection of building materials, the allotted space per person and the location (design) of house. Because in general the space per person and the lay out of the house is quite the same therefore only the materials used will be the

second parameter to determine the quality criteria of the housing environment.

It can be concluded that the criteria of the quality level of the housing environment is as follows:

Scale :

Bad 1 : 10 years occupied; 70% wooden wall, roof of sago

Fair 2 : 10 years occupied; + 50% wooden wall, roof of sago leafs ; + 20% wooden wall, zinc roof; 20% wooden wall, shingle roof.

Medium 3 : 2 - 10 years occupied; wooden wall, zinc roof.

Good 4 : 10 years occupied, wooden wall, zinc roof

Excelent 5 : 10 years occupied; wooden wall/brick, shingle roof/roof tile.

Location	Quality scale
South Kalimantan :	
1. Purwosari	5
2. Barambai	2
3. Jelapat II	1
Central Kalimantan :	
4. Tamban Luar II	2
5. Maliku (Pangkoh V & VI)	3
6. Sebangau	3

7.2.2 Home-garden plants

Survey on home-garden plants was carried out in all transmigration settlement units, except Sebangau considering that this unit has not been fully occupied. Moreover, the plants at the houses already occupied were very small in number and most of them were in seedling stages .

Not less than 29 species of home-garden plants, including 15 ordo/families had been noted at the 5 studied units (Table 7.20). The table shows that there were very slight differences in the planted species. The highest number of species was found in Maliku, i.e. 16 species, but its total abundancy was the lowest, i.e. 169 trees/ Ha. Tamban Luar has the highest total abundancy, i.e. 367 trees/Ha although only consists of 13 species.

The total species and total abundancy of the home-garden plants in Purwosari was almost similar to those in Tamban Luar. The species found in the 5 transmigration units are kelapa (Cocos nucifera L.), mangga (Mangifera indica L.), nangka (Artocarpus heterophylla Lamk.) and rambutan (Nephelium lappaceum L.).

Table 7.20 Composition of home-garden plants in Purnosari (Pur), Barambai (Bar), Jelapat (Jel) Maliku (Mal) and Tanbun Luar (Tal)

	Species	Local names	Ordo/Family	Number of plants				
				Pur.	Bar.	Jel.	Mal.	Tal.
1	Albizzia chinensis Merr.	Sengon	Mimosaceae	-	-	-	6	-
2	Parkia speciosa Hassk.	Petai	Anacardiaceae	-	-	-	-	1
3	Leucaena glauca Benth.	Lantoro	Mimosacea	-	-	-	1	-
4	Mangifera indica L.	Mangga	Anacardiaceae	7	17	30	3	4
5	Anacardium occidentale L.	Jambu mede	Anacardiaceae	-	2	3	5	1
6	Melaleuca leucodendron L.	Galam	Myrtaceae	-	7	2	4	1
7	Eugenia malaccensis L.	Jambu bol	Myrtaceae	-	-	-	1	1
8	E. aquea Burm. f.	Jambu air	Myrtaceae	5	-	1	1	1
9	Eugenia sp.	Jambu agung	Myrtaceae	1	-	6	-	-
10	Cocos nucifera L.	Kelapa	Palmae	54	47	47	13	37
11	Areca catechu L.	Pinang	Palmae	-	-	4	1	-
12	Ceiba pentandra Gaertn.	Kapuk	Bombacaceae	-	1	-	39	4
13	Nephelium lappaceum L.	Rambutan	Sapindaceae	9	14	11	22	18
14	Artocarpus heterophylla Lank.	Nangka	Moraceae	7	23	7	20	32
15	Coffea arabica L.	Kopi	Rubiaceae	-	-	-	1	-
16	Hevea brasiliensisa M.A	Karet	Euphorbiaceae	-	-	-	1	-
17	Hibiscus tiliaceus L.	Waru	Malvaceae	-	-	-	1	-
18	Carica papaya L.	Pepaya	Caricaceae	-	-	-	1	-
19	Sandoricum koetjape Merr.	Kecapi	Meliaceae	23	4	5	-	1
20	Mangifera caesia Jack ex Wall	Binjai	Anacardiaceae	1	-	-	-	-

21 *Averrhoa bilimbi* L.	Belimbing	Oxalidaceae	5	-	-	-	-
22 *Artocarpus integra* Merr.	Cempedak	Moraceae	1	-	-	-	-
23 *Syzigium aromatica* O.K.	Cengkeh	Myrtaceae	1	-	-	-	-
24 *Durio zibethinus* Murr	Durian	Bombacaceae	2	-	-	-	-
25 *Pithecollobium lobatum* Benth.	Jengkol	Mimosaceae	-	3	-	-	-
26 *Aleurites aplusiana* Wild	Kemiting		2	-	-	-	-
27 *Baccaurea montleyana* M.A.	Rambai	Euphorbiaceae	-	2	-	-	-
28 *Achras zapota* L.	Sawo	Sapotaceae	1	-	-	-	-
29 *Annona muricata* L.	Sirsak	Annonaceae	2	-	-	-	2
Total species			14	10	11	16	13
Total trees/ha			366	364	288	169	367

Other home-garden plants found in 4 units were jambu air (Eugenia aquea Burm. f.), jambu mede (Anarcadium occidentale L.) kecapi (Sandoricum koetjape Merr.) and galam (Melaleuca leucodendron L.). Although the number of the sengon trees (Albizzia chinensis Merr.) was quite high, they could only be found in Maliku.

Every 2 units of transmigration settlement areas is bordered by a forest which is still in a good condition. During the survey an orang utan (Pongo pygmaeus Hoppius) with its young were seen . Orang utan is classified into rare species protected by law. Thus, sustainable quality of the forest in the units should be carefully maintained.

Table 7.21 Vegetation analysis results of the home-garden plants in Purwosari, South Kalimantan

Species	RF (%)	RA (%)	RD (%)	IV (%)	Ranking IV	n/N	log n/N	n/N.log n/N
Nephelium lappaceum L.	9.09	7.50	4.56	21.15	3	0.07	-1.15	-0.0805
Artocarpus heterophylla Lamk.	7.74	5.83	4.39	17.96	5	0.06	-1.22	-.07328
Sandoricum koetjape Merr.	22.56	19.17	10.78	52.51	2	0.17	-0.77	-0.1309
Cocos nucifera L.	30.30	45.00	66.71	142.01	1	0.47	-0.33	-0.1551
Mangifera indica L.	7.74	5.83	4.94	18.51	4	0.06	-1.22	-0.0732
Averrhoa bilimbi L.	5.72	4.17	1.24	11.13	7	0.04	-1.40	-0.0560
Artocarpus integra Merr.	1.01	0.83	1.52	3.36	12	0.01	-2.00	-0.0200
Syzigium aromatica O.K.	1.01	0.83	0.15	1.97	14	0.007	-2.15	-0.0151
Durio zibethinus Mury	2.36	1.57	0.91	4.94	9	0.02	-1.70	-0.0340
Eugenia malaccensis L.	5.72	4.17	1.69	11.58	6	0.04	-1.40	-0.0560
Eugenia sp.	1.01	0.83	1.69	3.53	11	0.01	-2.00	-0.0200
Aleurites moluciana Wild	2.36	1.67	1.31	5.34	8	0.02	-1.70	-0.0340
Achras zapota L.	1.01	0.83	0.29	2.13	13	0.007	-2.15	-0.0151
Annona muricata L.	2.36	1.67	0.36	4.39	10	0.01	-2.00	-0.0200
								-0.7831
						Index of Diversity	H =	0.7831

The results of vegetation analysis of the home-garden plants in Purwosari are presented in Table 7.21. From Table 7.20 and Table 7.21it can be concluded that :

a. The total number of home-garden plants in Purwosari is 366 trees/ha.
b. The Diversity Index of home-garden plants in Purwosari is also quite high, i.e. H= 0,7831
c. Home-garden plants with the highest Importance Value was coconut (Cocos nucifera L.). This means that coconut has a very important role in the home-garden community and the growth of other plants depends on its association with it. Plants which can positively grow together with coconut will also grow well. The second and third highest Importance Value are held respectively by kecapi (Sandoricum koetjape Merr) and rambutan (Nephelium lappaceum L.).

Based on the data presented in Table 7.20 and Table 7.22 , it can be concluded that :

a. The total number of home-garden plants in Barambai is 364 trees/ha.
b. The Diversity Index in Barambai is relatively high (H = 7047).
c. As in Purwosari, the plant with the highest Importance Value is kelapa (Cocos nucifera L.), followed by nangka (Artocarpus heterophylla Lamk.) and mangga (angifera indica L.)

Table 7.22 Vegetation analysis results of the home-garden plants in Barambai, South Kalimantan

Species	RF (%)	RA (%)	RD (%)	IV (%)	Ranking IV	n/N	log n/N	n/N.log n/N
Cocos nucifera L.	30.43	39.17	63.37	132.97	1	0.44	-0.36	-0.1584
Mangifera indica L.	14.62	14.17	7.21	36.00	3	0.12	-0.a2	-0.1104
Anacardium occidentale L.	2.77	1.67	0.66	5.10	8	0.02	-1.70	-0.0340
Artocarpus hetrophylla Lamk.	23.72	19.17	13.70	56.59	2	0.19	-0.72	-0.1368
Melaleuca leucodendron L.	7.91	5.83	1.64	15.38	5	0.05	-1.30	-0.0650
Sandoricum Koetjape Merr.	5.14	3.33	3.13	11.60	6	0.04	-1.40	-0.0560
Nephelium lappaceum L.	9.09	11.67	5.43	26.19	4	0.09	-1.05	-0.0945
Pithecollobium lobatum Benth.	3.95	2.50	3.89	10.34	7	0.03	-1.52	-0.0456
Ceiba pentandra Gaertn.	1.19	0.83	0.60	2.62	10	0.07	-2.00	-0.0020
Baccaurea montleyana M.A.	1.19	1.67	0.35	3.21	9	0.01	-2.00	-0.0020
								-0.7047
						Index of diversity	H =	0.7047

The following Table 7.20 & Table 7.23 show that :

a. Total number of trees in Jelapat is less than those in Purwosari and Barambai, i.e. 288 trees/ha.
b. The Diversity Index in Jelapat is almost similar to that in Purwosari (H = 0.7831)
c. Home-garden plant with the highest Importance Value is kelapa (Cocos nucifera L.), followed by mangga (Mangifera indica L.) and rambutan (Nephelium lappaceum L.).

Table 7,23 Vegetation analysis results of the home-garden plants in Jelapat, South Kalimantan

Species	RF (%)	RA (%)	RD (%)	IV (%)	Ranking IV	n/N	log n/N	n/N.log n/N
Nephelium lappaceum L.	8.33	9.17	4.24	21.66	3	0.07	-1.15	-0.0805
Artocarpus heterophylla Lamk.	9.58	5.83	2.30	17.71	5	0.06	-1.22	-0.0732
Cocos nucifera L.	32.08	39.17	45.13	116.38	1	0.39	-0.41	-0.1599
Mangifera indica L.	25.00	25.00	23.41	73.41	2	0.24	-0.62	-0.1488
Anacardium occidentale L.	2.92	1.67	1.37	6.79	10	0.02	-1.70	-0.0340
Eugenia aquea Burm.f.	1.25	0.83	0.10	2.18	11	0.007	-2.15	-0.0151
Areca catechu L.	4.17	3.33	1.01	8.51	8	0.03	-1.52	-0.0456
Mangifera caesia Jack ex Wall	4.17	3.33	11.16	18.66	4	0.06	-1.22	-0.0732
Malaleuca leucodendron L.	2.92	1.67	2.66	7.25	9	0.02	-1.70	-0.0340
Eugenia sp.	5.42	5.00	2.92	13.34	7	0.04	-1.40	-0.0560
Sandoricum koetjape Merr.	4.17	4.17	5.69	14.03	6	0.05	-1.30	-0.0650
								-0.7853
							Index of Diversity H =	0.7853

The results of vegetation analysis in Maliku are as presented in Table 7.20 & Table 7.24 , describing as follows :

a. Total Abundancy of Home-garden plants found in Maliku could be classified as the lowest among those in Purwosari Barambai even Jelapat, i.e. only 169 trees/ ha.

b. The Diversity Index was the highest i.e. H = 0.9183.

c. Home-gardenm plants with the highest Importance Value in Maliku were kapuk (Ceiba pentandra Gaertn.), followed by rambutan (Nepheleum lappaceum L.), nangka (Artocarpus heterophyllaLamk.) and kelapa (cocos nucifera L.).

Table 7.24 Vegetation analysis results of home-garden plants in Maliku, Central Kalimantan

Species	RF (%)	RA (%)	RD (%)	IV (%)	Ranking IV	n/N	log n/N	n/N.log n/N
Melaleuca leucodendron L.	2.58	3.33	8.14	8.14	8	0.03	-1.52	-0.0456
Eugenia aquea Burm. f.	1.11	0.83	2.44	4.38	9	0.01	-2.00	-0.0200
E. malaccensis L.	1.11	0.83	1.28	3.22	12	0.01	-2.00	-0.0200
Anacardium occidentale L.	6.27	4.17	4.38	14.82	6	0.05	-1.30	-0.0650
Ceiba pentandra Gaertn.	26.94	32.50	18.52	77.96	1	0.26	-0.59	-0.1534
Hevea brasiliensis M.A.	1.11	0.83	0.88	2.82	14	0.01	-2.00	-0.0200
Cocos nucifera L.	14.76	10.83	13.90	39.49	4	0.13	-0.89	-0.1157
Coffea arabica L.	1.11	0.83	0.72	2.66	15	0.01	-2.00	-0.0200
Leucaena glauca Bentn.	1.11	0.83	1.84	3.78	10	0.01	-2.00	-0.0200
Mangifera indica L.	3.69	2.50	2.84	9.03	7	0.03	-1.52	-0.0456
Artocarpus heterophylla Lank.	14.76	16.67	17.18	48.61	3	0.16	-0.80	-0.1280
Carica papaya L.	1.11	0.83	1.33	3.27	11	0.01	-2.00	-0.0200
Areca catechu L.	1.11	0.83	0.98	2.92	13	0.01	-2.00	-0.0200
Nephelium lappaceum L.	17.34	18.33	25.34	61.01	2	0.20	-0.70	-0.1400
Albizzia chinensis Merr.	4.79	5.00	5.80	15.59	5	0.05	-1.30	-0.0650
Hibiscus tiliaceus L.	1.11	0.83	0.32	2.26	16	0.01	-2.00	-0.0200
								-0.9183
						Index of diversity	H =	0.9183

The above data from Table 7.20 & Table 7.25 conclusions can be drawn, i.e.:

a. Total Abundancy of the home-garden plants in Tamban Luar was almost similar to the Total Abnundancy in Purwosari, i.e. 367 trees/ha.

b. Diversity Index of home-garden plants in Tamban Luar was the lowest among the other settlement units , where H = 0.6963.

c Home-garden plant with the highest Importance Value was rambutan (Nephelium lappaceum L.)

Table 7.25 Vegetation analysis results of the home garden plants in Tanban Luar, Central Kalimantan

Species	RF (%)	RA (%0)	RD (%)	IV (%)	Ranking IV	n/N	log n/N	n/N.log n/N
Mallepca leucodendron L.	1.54	0.96	0.11	2.61	13	0.009	-2.05	-0.0185
Eugenia aquea Burm. f.	1.54	0.96	0.25	2.75	11	0.009	-2.05	-0.0185
Eugenia malaccensis L.	1.54	0.96	0.28	2.78	8	0.009	-2.05	-0.0185
Anacardium occidentale L.	1.54	0.96	0.22	2.72	12	0.009	-2.05	-0.0185
Ceiba pentandra Gaertn.	4.63	3.85	5.32	13.80	5	0.05	-1.30	-0.0650
Sandoricum koetjape Merr.	1.54	0.96	0,26	2.76	9.5	0.009	-2.05	-0.0185
Cocos nucifera L.	31.27	35.58	67.28	134.13	1	0.45	-0.35	-0.1575
Mangifera indica L.	7.34	3.85	3.00	14.19	4	0.05	-1.30	-0.0650
Artocarpus heterophylla Lamk.	26.64	30.77	14.83	72.24	2	0.24	-0.62	-0.1488
Parkia speciosa Hasak	26.64	30.77	0.39	2.89	7	0.01	-1.00	-0.0100
Baccaurea montleyana M.A.	26.64	30.77	0.26	2.76	9.5	0.01	-1.00	-0.0100
Nephelium lappaceum L.	17.76	17.31	7.36	42.43	3	0.14	-0.85	-0.1190
Annona muricata L.	1.54	1.92	0.43	3.89	6	0.01	-2.00	-0.0200
								-0.6963
						Index of Diversity H =		0.6963

Furthermore, the values of Sorensen Similarity Index and Dissimilarity Index of the above 5 home-garden communities were then calculated based on the Importance Value of each species of home-garden plants. The results are presented in the form of matrix of Similarity Index and Dissimilarity Index. See Table 7.25.

The matrix indicates that there was quite a high percentage of similarity between the home-garden communities in Barambai and Purwosari (67.30 %), between Jelapat and Purwosari (64.40 %), also between Tamban Luar and Purwosari (65.60 %). But very slight similarity occurred between Maliku and Purwosari (30.60 %) which was mainly caused by the difference in its Relative Frequency.

From the above findings it can be concluded that :

a. Total Density of home-garden plants in Barambai was 364 trees/ha and in Tamban Luar 367 trees/ha , almost similar to the Total Abundancy in Purwosari , i.e. 366 trees/ha), while less number was found in Jelapat, i.e. 288 trees/ha, and the lowest was found in Maliku, i.e. 169 trees/ha).

Table 7.26 Matrix of Sorensen Similarity Index and Dissimilarity Index based on the Importance Values of 5 home-garden communities in South Kalimantan and Central Kalimantan.

	Similarity Index				
	Purwosari	Barambai	Jelapat	Maliku	Tamban Luar
Purwosari	x	67,3	64,4	30,6	65,6
Barambai	32,7	x	71,9	46,4	81,1
Jelapat	35,6	28,1	x	35,8	60,1
Maliku	69,4	53,6	64,2	x	54,7
Tamban Luar	34,4	18,9	29,9	45,3	x
	Dissimilarity Index				

b. In general, the Diversity Index of home-garden plants in all studied units was quite high, respectively in Maliku ((0,9183), Jelapat (0,7853), Purwosari (07831), Barambai (0,7831), Barambai (0,7047) and Tamban Luar (0,6963). The diversity of plants in Jelapat was almost similar to that in Purwosari, while the plants in Tamban Luar were also almost similar to that in Barambai.

c. The most important home-garden plant in all units was kelapa (Cocos nucifera L.), except in Maliku which was dominated by kapuk (Ceiba pentandra Gaertn.). This eventually means that the tidal area is

highly suitable for kelapa (Cocos nucifera L.). Other important plant was rambutan (Nephelium lappaceum L.), nangka (Artocarpus heterophylla Lamk.), mangga (Mangifera indica L.) and kecapi (Sandoricum koetjape Merr.).

7.2.3 Public facilities

The availability of public facilities is determined by the basic needs of the people. A higher facility standard in a settlement unit indicates that the settlement has a higher quality. Higher standard of public facilities means that the facilities provided are in better condition and have been utilized by all social stratum. This explains that the types and the extent of the provided public facilities depend on the total population and their needs for collective life.

It is known that most of the people at the study area are farmers (94.7 %). The characteristics of the farmer community are used as the basis to determine the collective needs which are to be provided by the public facilities. The government provides public facilities in the form of land and building constructiona. However, not al constructions are provided by the government. Some such as shops, kiosks, stores etc are usually built by the community themselves.

The activities of man in utilizing the public facilities have certainly brought impacts on the environment. Generally, the impacts on the environment occurs when the land use intended for the public facilities is not suitable for its purpose, or the construction of tye building does not meet the

condition of the natural environment. For example, when the location of the market and shops are directly along the rivers and canals, then it is obvious that the river and canal water can be easily polluted by domestic waste.

Social impacts of the utilization of public facilities may occur when all basic needs of the inhabitants can not be fulfilled equally.

based on the above description, it can be concluded that the level of environment quality of a settlement unit is determined by whether the needs of its people of public utilities are fulfilled or not. Referring to this fact, the factor of total population, type and number of public facilities will be the parameters used to determine the quality level of a settlement.

The level of fulfilled collective needs of the population studied is presented in Table 7.26.

Table 7.27 Public facilities provided for the six settlement units.

Type of Facility	Total unit 4497 person	Barambai 1448 person	Jelapat 1776 person	Purwosari Tamban Luar 7699 person	Maliku 3190 person	Sebangau 5000 person (projected)
1. Elementary School	8	1	4	15	7	-
2. Junior High School	2	1	1	4	-	-
3. Senior High School	-	-	-	-	-	-
4. Sport field	10	5	11	21	10	-
5. Gathering Hall	3			4	4	1
6. Daily market	-	1	-	1	1	-
7. Weekly market	2	1	1	4		-
8. Kiosks/shops	14	3	8	41	38	
9. Stores	5	-	50	2	-	
10. Medical Centre	2	-	1	3	4	4
11. Puskesmas	1	1	1	2	-	-
12. Langgar	10	5	2	25	34	-
13. Mosque	3	1	1	6	7	4
14. Church	1	-	-	4	4	4
15. Temple	1	-	-	4	-	-
16. Others						
- Government office	1	1	1	1	1	1
- Cooperative office	1	1	1	1	1	1
- Agricultural information	yes	yes	yes	yes	yes	yes
- office, post office, bank		1	1	1	1	1
- pier	1	1	1	1	1	1
- others						

Note :

* The extent and form of the sport field varies, and the total area is not measured.
* Included in the government office area village institutions such as public information service, security, etc.

Based on dat presented above, the criteria of the settlement quality can be determined, i.e. :

Scale	Criteria
1 :	Every 3000 persons should have 1 elementary school, 2 sport fields, 2 langgar and other facilities, or every 1500 persons should be provided with 2 shops, 1 sport field, 1 langgar, 1 other public facilities.
2 :	
3 :	Every 3000 persons have 2 elementary schools, 1 Junior High School, 4 shops, 4 sport fields,4 langgar, 2 mosques/1 church 1 weekly market and other public facilities, or every 1500 persons have 1 elementary school, 2 shops, 2 sport fields, 2 langgar, 1 mosque and other public facilities.
4 :	
5 :	Every 3000 persons have facilities as mentioned in scale 3,also 1 medical centre or Puskesmas and 1 gathering hall.

based on the above criteria, the condition of the study area can be determined as follows :

Location	Scale
South Kalimantan	
1. Purwosari	5
2. Barambai	5
3. Jelapat II	5
Central Kalimantan	
4. Tambam Luar II	5
5. Maliku (Pangkoh V & VI)	1

Referring to the type of facilities, if the condition of the study area is compared to the Jakarta DKI City Planning Standard (1976), then it can be concluded that these study area had met the standard, except its educational facilities. According to the Jakarta DKI Standard City Planning, every 3000 persons should be provided with 1 Senior High School, while in the study area non is available. Tamban Luar which is populated by more than 7000 persons does not even have Senior High School. In fact, it is not appropriate to compare the standard of public facilities of city with that of a village. However, since the difference is in educational facilities and the development of these people depends on their level of education, hence this have to be considered.

7.2.4 Agriculture

7.2.4.1 Foodstock

Foodstock agriculture covers development of wet and dry agriculture. The important wet agriculture is sawah or wet rice agriculture, while the other is dry rice agriculture and "polowijo" or secondary crops. The irrigation systems are technical and non-technical irrigation system. The sawah pattern applied is rice-field surrounded by dykes. The paddy variety planted is of national prime seed. Other parts of the field which have no dyke system must apply the planting pattern of tidal paddy (local variety). The tidal water can be regulated according to the need of the cultivated plants. The secondary crops are planted at the guludan system, and on a prepared soil for monoculture purpose, e.g. rice with non-technical irrigation (rainfed ricefields). The agriculture area consists of wet field and dry field, home-garden, plantation, productive forest etc. The composition of land use is presented in the following

Table 7.28 The composition of land use is presented in the following table.

The varieties produced are the wet field and the dry field rice and other food stocks such as cassava, sweet potato, maize.

Table 7.28 Agricultural land-use in Central and South Kalimantan.

Land-use	Central Kalimantan in Ha			South Kalimantan in Ha		
	Tamban	Maliku	Sebangau	Barambai	Jelapat	Purwosari
Wet field	2,626	3,086	-	2,000	2,169	75
Dry field	257	110	-	300	-	-
House yard	270	4,855	-	-	8	205
Garden	4	-	-	-	10	262.65
Fish pond	29	-	-	-	-	0.5
Pasture	12	-	-	6	-	-
Productive forest	57	-	-	-	120	16,35
Others	81	-	-	-	180	-

Land use cultivation in the settlement area is adjusted to the characteristics of the tidal land, i.e. by using the kolam system to regulate the tidal water according to the need of the cultivated plants.

The applied soil cultivation is "guludan" system which are planted with multiple cropping. Dry field areas are irrigated by technical irrigation system in which the water is distributed through simple canals along the field.

Agricultural assisstance provided by the Department of Transmigration to the transmigrants consists of three packages containing seeds, fertilizer and pesticides. The production yield in the transmigrant settlement in Central and South Kalimantan are as follows :

Table 7.29 Production yield in the Transmigration settlement

Type of food stocks	South Kalimantan in Ha				Central Kalimantan in Ha			
	Tamban luar	Maliku	Sebang.	Aver. ton/Ha	Barambai	Jelapat	Purwa. sari	Aver. ton/Ha
Rice	4,675	4,650	-	3,108	2,700	800	3,515	2,338
Cassava	4,951	3,350	-	2,767	76,125	-	-	25,375
Maized	6,000	33,900	-	13,300	-	-	2,000	660

Based on the interviews with the respondents, conclusion can be drawn, i.e. at that several locations the ricefield can not be harvested because the yield is too low which is due to the acid irrigation water. Other crops such as cassava and maize also have unsatisfactory yield.

7.2.4.2 Non Food-stocks

Horticulture

The cultivated horticulture in the transmigration settlement units in South and Central Kalimantan are fruits and vegetables. The fruits are of several varieties, i.e. Jambu air (E.aquea Burm.f.), rambutan (Nephelium lappaceum L.), papaya (Carica papaya L.), pisang (Musa paradisiaca L.), nenas (Ananas comosus L.), nangka (Artocarpus heterophylla Lank.), jeruk (Citrus nobilis Lour), sawo (Achras Zapota), Mangga (Mangifera indica L.), jambu mente (Anacardium occidentale L.).

The vegetables are lombok (Capsicum annuum L.), tomato (Solanum lycopersicum L.), waluh, cucumber (Cucumis sativus L.) etc. The yield of horticulture in Central Kalimantan in 1986 is as follows: lombok 1.2 ton/ha, tomato 12,150 ton/ha, long bean 22 ton/ha, egg plant 2 ton/ha , jackfruit 7435 pieces/ha/ papaya 30,79 kg/tree, banan 3,502.1 kg/ha, pineapple 2062.76 kg/ha, rambutan 2kg/tree. Based on data from each unit, the production of horticultura in six settlement units in Central and South Kalimantan are :

Table 7.30 Total Production of Horticulture in the Study Area

Apecies	Production (ton/ha/year)					
	Purwosari	Barambai	Jelapat	Tamban Luar II	Maliku (P V & VI)	Sebangau
1 Padi	3,515	2,700	0,800	4,675	4,650	
2 Cassava	-	76,125	-	49,516	3,350	
3 Maize	2,000	-	-	6,000	33,900	

From the above table, the average vegetable production in South Kalimantan is 21,349 ton/ha yearly, while in South Kalimantan 18,333 ton/ha and the production of fruit in Central Kalimantan is 7,366 ton/ha, and 2,688 ton/ha in South Kalimantan. The horticulture production in South Kalimantan is lower compared to the production in Central Kalimantan.

Field observation shows that there are heaps of fruit, especially rambutan and pineapple along the anjir of Central Kalimantan which cannot be marketed and without proper post-harvest handling. Many already ripe fruit are not harvested. These facts indicate that the horticulture production has not been properly managed.

Plantation

In 1983 and 1984 there have been an extensification in the areal of some plantations, especially the highly economical commodities such as rubber, coconut, coffee, clove. pepper, kemiri and sugar cane.

To develop these plantations, the P.I.R. (Perkebunan Inti Rakyat) was introduced, and this efforts has been successfully carried out in several Kabupatens in South Kalimantan (Neraca Lingkungan Hidup Daerah, Kalimantan Selatan, 1984).

From the surveys in six units, the total production of several plantations are as follows :

Table 7.31 Total production of plantation plants in the study area

Species	Production (Kg/ha) per year					
	Purwosari	Barambai	Jelapat	Tamban Luar II	Maliku (P.V & VI)	Sebangau
1 Vegetables	2,200	23,010	-	49,060	14,987	-
2 Fruit	3,265	48,000	-	61,000	16,000	-

The table shows that coconut plantation is developed in 3 locations of transmigration units. This is due to the topographic condition of South Kalimantan which is generally plain. Coffee is more cultivated in Central Kalimantan (Tamban Luar II and Maliku), while clove is only planted in Tamban Luar II.

7.2.5 Livestocks

In general, livestock breeding in the study area is home breeding. This livestock breeding by the people is practised by the farmers as their own activity, the large livestocks bred are, cows, buffalo, goat, sheep, pig, while the poultry are chicken and duck (poultry husbandry). This livestock breeding is the additional occupation of these farmers beside their other farming activities.

The stock pen is in the yard, near the house. The farmers usually do not intensively and regularly take care of their livestock The livestock are herded in grassfield, bushes, yard and forest, except the pigs which are kept in the pen. Number of livestocks in the study area is presented in the following Table 7.32

Table 7.32 Number of livestocks in the study area

Livestocks	Number					
	Purwosari	Barambai	Jelapat	Tamban Luar	Maliku P.V&VI	Sebangau
Cow/Buffalow	38	137	-	243	1,781	-
Goat/Sheep	499	499	6	403	314	-
Chicken/duck	780	12,688	250	12,992	19,236	-
Pig	170	125	-	152	14	-

7.2.6 Fishery

Fishery sector in South as well as in Central Kalimantan can be classified into two types, i.e. fresh water and sea water fisheries. Geografically, South Kalimantan has a long coastline, and thus possessing a great potential for developing of seawater fishery. While Central Kalimantan with its many rivers, lakes and other water sources, has a great potential in developing its fresh water fishery.

In general, sea water fishery plays an important role in South Kalimantan. Fishing activities usually take place along the seashore, about 4 miles from the coast line.

The fishing tools of these fishermen are still very simple i.e. various types of net, fishtrap and hooks. The productivity of sea fishery in South Kalimantan in 1984 is ± 0,2 ton/fisherman.(Neraca Lingkungan Hidup Daerah Kalimantan Selatan 1984).

The transmigrants in the study area are fishing only for individual consumption. Fresh water fishery in Central as well as in South Kalimantan is not the source of living for the inhabitants. They do not cultivate fresh water fishery. The people in the study area use the fresh water fishery for individual consumption. Fresh water fishery consists of several types, i.e. brackish water fishery (bandeng, belanak, udang putih), pond fishery (mas, tawes, mujair, nila, sepat siam, lele), in keramba (gabus, baung).

7.2.7 Industry

The type of industry in transmigration settelement units in South and Central Kalimantan is home industries. Most of them are agricultural industry such as manufacturing agricultural tools or home industries for agricultural productions. There is also wood industry such as saw

mills. Basic materials used by such industries come from the local area, except agricultural industry requiring metal materials. The processed agricultural crops are limited to coconuts and soybean. The processed non food commodities is rosella i.e. as the basic material for plaiting industry. The following table will present data on number and condition of industrial activities in the six transmigration settlement units in South Kalimantan and Central Kalimantan.

Table 7.33 Type and number of home industries

Type of Industry	South Kalimantan				Central Kalimantan							
	Barambai		Jelap.		Purwa.		Tamb.Lu		Maliku		Sebangau	
	Unit	%	Unit	%	Unit	%	Unit	%	Unit	%	Unit	%
1. Coconut drying	-		-		1	8.3	-		-		-	
2. Coconut oil	1	11.11	-		6	50	2	14.28	-		-	
3. Tempe	-		-		-		-		10	33.33	3	50
4. Tahu	-		-		-		-		1	33.33	-	
5. Blacksmith	-		-		-		-		6	20	2	33.33
6. Agri. tools	1	11.11	-		2	16.66	8	57.14	3	10	-	
7. Plaiting ind	2	22.22	100.100		2	16.66	4	28.57	10	33.33	-	
8. Saw Mills	-		-		-		-		-		1	16.66
9. Furniture	-		-		1	8.3	-		-		-	
10. Others	5	55.55	-		-		-		-		-	

The products produced by this home industries in several transmigration settlement units are to supply the demand of local need. The supply for this local consumption is still too limited in quantity as well as in the number of items. Considering that the most available basic materials in several settlement units are agricultural crops, hence there are ample possibilities to develop industries based on agricultural crops, or a post-harvest industries. This manufacturing of the agricultural crops is especially aimed for surplus commodities after the local or inter local needs are already met with. The following table is the potential of home garden and plantation yields in two kabupaten with samples taken from Kabupaten Kapuas and Kabupaten Barito Kuala.

7.2.8 Transportation

Communication facilities or transportation infrastructure to the transmigration settlement units or in the settlement units consist of water and land transportation. Due to its swampy condition, water transportation is more widely used. Therefore, the new comers have to learn how to use the water transportation because they are not familiar with such transportation.

The route of water transportation is along the canals, handils and ray, using speed boat/long boat, and "kelotok". For example, transportation from the capital of the Province of Central Kalimantan , Palangka Raya, to the transmigration settlement unit in Pangkoh V and VI & VI (Maliku), Kapuas district, Kapuas Regency would be served by 2 water taxis/ buses operating 2 times a week with a capacity for ± 80 persons and some cargo.

Land transportation using bicycle or motorcycle is mostly for limited activities in a settlement area. This is because several transmigration locations such as Sebangau in Central Kalimantan cannot be reached by land

transportation. Besides, transportation infrastructure is still very few, and most of them are unasphalted roads.

Water transportation is smoother than land transportation because the infrastructure and transporation means are better provided . Therefore, communication among the transmigration units or between the transmigration units with marketing centers of their production are usually performed by water transportation. However, sometimes there are also constraints in this transportation because several places depend on the tide movement. Thus, during the ebb tide such places can not be reached by water transportation.

An easy transportation will bring high accessibility to the location of the transmigrants, and eventually will bring positive impacts to the inhabitants.

Considering its efficiency aspect, the would be covered distance also plays an important role in transportation. For example, Purwosari is relatively near the capital of South Kalimantan, i.e. Banjarmasin compared to the location of other study area. This makes the transportation to Banjarmasin from

Purwosari easy and thus provide high accessibility to Purwosari.

Low accessibility to the settlement units and difficult transportation may limit the communication scope of the people. This will affect the level of knowledge/education and the socio-economic develop-ment of the people.

Based on the availability of the transportation infrastructure in the studied transmigration settlement units, the condition of transportation infrastructure is as follows :

Table 7.34 Condition of transporatation infrastructure in the study area, 1987.

Location	Length of the road		
	Water	Sand	Asphalt
South Kalimantan			
1. Barambai	14	100	3.6
2. Jelapat	20	10	-
3. Purwosari	2.3	10.75	2.35
Central kalimantan			
4. Maliku	14.85	125.54	-
5. Tamban Luar	30	37	-
6. Sebangau	-	-	-

Of course, the length and condition of the road do not necessarily affect the accessilibity to a certain area. Accessibility which highly influences the development of a settlement unit depends on the distance of a place to the centre of various functions (city/town), and it also depends on the transportation system because transportation system will influence the mobility of the inhabitants.

In general, the transportation system in the six study area is similar, i.e. mainly depends on water transportation system.

7.2.9 Irrigation system

Survey on the condition of tidal irrigation system in South Kalimantan and Central Kalimantan had been carried out by Nedeco-Euroconsult/IDC (1984) and LAPI-ITB (1985). Data presented here is based on the above surveys, added with short field observation during the dry and rainy seasons.

a. Barambai

Hydraulic infrastructure

The canal system is the so-called fork system, in which a short, wide primary canal is devided into two secondary canals each ending in a large pond or "kolam pasang". Tertiary canals then serve the area and leave the secondary canals at regular distances.

The primary canal is 140 m long, 50 m wide and 4.5 m deep. The left secondary canal serves 1.550 ha of project area and 2.200 ha ricefields outside the area. It is 6.800 m long. Its width decreases from 31 to 19 m, and its depth from 3 to 2 m. The right secondary canals serves 1.150 ha of project area and 1.100 ha of ricefields and forest outside the area. It is 6.600 m long. Its width decreases from 34 m to 19 m, and its depth from 3 to 2.5 m. The secondary canals

run parallel to each other at the distance of 4.6 km. The tertiary canals are 400 m apart. In left and right ponds they serve 88 ha, while in Muara the service area varies from 120 to 60 ha. All canals are in open connection with the Barito River. There are no structures to regulate the flow, but the farmers usually close the tertiary canals during certain periods of the year to maintain proper water level.

The condition of the primary and secondary canals is fair. The sideslopes are irregular but the canals are reasonably clean. Condition of tertiary canals differ considerably. Close to the secondary canals they area good, but at the further distance the conddition deteriorates (Nedeco-Euroconsult/IDC, 1984 Vol. III; 77 - 79)

Water System

The water level of Barito River is affected by tidal movement all year long . During the rainy season the water level is also affected by the upper-river stream. This tidal has a mixed-mainly diurnal. The survey in rainy and dry seasons pointed out that the amplitude of the tidal is 0.71 m (neap tide)

and 1.87 m (spring tide). According to Euroconsult, the tidal amplitude (tidal range) in this region is about 0.60 - 1.50 m during the rainy season and 0.90 - 1.80 m during the dry season.

The river water enters the tertiary canals smoothly at the right pond in the west and at the area of the estuary in the east. Some parts of the ricefield areas are even inundated during the high tide. In other areas the water has some difficulties to enter the tertiary canals because of the higher topographical condition of this areas. Consequently, the agricultural land stays dry. At the lowest areas, i.e. the right pond and at the estuary, there area stagnant water causing bad quality of water. Water from the forest and wet ricefields of the local inhabitants in the surrounding area of Barambai unit also affect the water system of this unit.

b. Jelapat

Irrigation infrastructure

Irrigation network in this unit is a fork system with three branches of canals. This canal network is the cross section of handils made by the local inhabitants. Handils which

are quite wide connect the secondary canals of the left and right estuaries with Barito River through long and meandering tributaries.

There are seven handils crossing the secondary canals at the left estuary and five at the secondary canals at the right estuary with a width of about 4 - 6 m and a depth which varies between 1 - 1.8 m. The shallowing process of these canals in this unit can be obviously seen. The process is caused by sedimentation.

Water system

Compared to Barambai, this unit is nearer to the sea. Therefore, the effect of the tide is greater. Survey result of tide at the mouth of the primary canals during the dry and rainy seasons gives the amplitude of the tide, respectively 1.97 m and 1.35 m. The tidal movement reaches the tidal pond. The tidal amplitude in the middle of the secondary canals decreases about 70 cm.

The results of LAPI-ITB (1985;18) points out that there are some areas inundated by the water during the rainy season with a depth of about 50 cm, especially in Jelapat II and Tinggiran Tengah. During a long dry season

intrusion of saline water can reach the tidal pond.

c. Purwosari

Hydraulic infrastructure

The project area is served by a large number of tertiary canals which are 400 m apart and take off from the Tamban canal. The Tamban canal is an important link between the Barito and the Kapuas Rivers. It serves the water supply and is used for transportation purposes. There are no structures to regulate the flow of water. At the project site, 6 km from the Barito there is a cross section between the banks of 98 m, a width of 40 m and depth of 4 m.

The tertiary canals of Purwosary I have cross sections from 14.5 m to 3 m with a depth of 2.2 - 1.9 m, depending on the distance from the main canals. The canals of Purwosari Baru are also connected with the Barito River by small canals. The cross section is about 10 m with a depth of 2 m.
The tertiary canals of Purwosari Baru are equipped with structures to prevent the inflow of saline water and to facilitate drainage when the rice reaches the maturing

stage. It was built and maintained by the local people.

Water system

The water level in the canals is effected by the tidal movement from Barito as well as Kapuas rivers. The tide is mixed-mainly diurnal with an amplitude between 0.6 - 2.2 m. Tidal survey carried out in October 1986 and April 1987 pointed out that the tidal amplitude in Purwosari (Anjir Tamban, Station 2) are respectively 126 cm and 72 cm. The water inflow from the Barito and the Kapuas Rivers meet in the middle of Anjir Tamban. Some of the anjirs are dry during the low tide.

The tidal water can flow towards the end of the canals in the tertiary canals of Purwosari Baru. It was noted that these canals are not completely dry during the ebb tide in dry season. During the rainy season, the level of the tidal water in the tertiary canals is higher than the ground surface, and hence it can inundate the wet ricefields.
In Purwosari I, the inflow tidal water enters the tertiary canals more than 2.200 m, while the rest (1600 m) stay dry during the dry season.

d. Tamban Luar

Hydraulic Structure

The project area is served by a drainage system consisting of a primary canal, 13 secondary canals and 47 tertiary canals. All canals are in open connection with the Kapuas river.

The primary canal is 1.5 km long and has a cross-section varying from 120 m at the river to 90 m at its junction with the secondary canals. The three secondary canals end in huge ponds. Each of the outer secondary canals, serving an area of 1250 ha, has a length of 6.9 km and cross section from 61 m close to the primary canal to 16.1 m at the end. The middle secondary canal serves 975 ha and has a length of 4.9 km.

The tertiary canals serve 76 ha each. They have a length of 1.5 to 2.2. km and cross sections which vary from 1.0 to 3,8 m.

Water system

The canal water is affected by the tidal movement from the Kahayan River. The tidal range at the mouth of the primary canal in October 1986 (in dry season) is 197 cm. In the middle of the left secondary canal this

tidal amplitude decreases to 102 cm, while in the middle of the right secondary canal decreses to 110 cm.

Water circulation in the canal network system is sufficient, and the drainage process flows smoothly. According to LAPI- ITB (1985) some areas are inundated during the rainy season because of its topographycal condition.

f. Sebangau

Hydraulic structure

The network of the canal is constructed according to the design presented in 1983/1984 and 1984/1985 budget years. Therefore, this unit is the most recently built unit.

Water System

The canal water level is affected by the tidal movement of Sebangau River. The tidal amplitude near the estuary of the primary I is 1.04 m during the dry season of 1986. In the middle part of the primary canal the amplitude decreases to 34 cm.

7.3 Social Base Line

7.3.1 Demography

In general, a study of a place with a transmigration program where the waters are under tidal impact, will observe its characteristics, and one characteristic is the concentration of people. The population density for Kabupaten Barito Kuala is 66 persons/km2, for Kabupaten Kapuas 12 persons/km2. The population density of a location under impact of tidal waters is very high, between 47 and 2368/km2. As a result of a concentration of transmigrants, almost the whole location of this tidal-influenced area is visibly different from locations without such a program. However, Jelapat is an exception, due to the fact that its population density is relatively the lowest compared to the other tidal-influenced areas. The highest rate in population density is found at the transmigrants location of Purwosari, which is due to its amalgamating population and to its level of development as a self-supporting village.

Viewed from the standard quality for the demographic condition, the project's impact on demography can be considered low (1), however, viewed from its impact on the population density, social problems will emerge as soon as this area is to be developed into a more modern area of tidal waters.

On the other hand, these human resources can be used through an approach of the existing institutions. Viewed from the available human resources, further development would bring this location up to a more advanced level, as the percentage of the under-15 years age group is between 25% and 51%.

The population structure of this tidal-waters location cannot be ranged under the structure for younger people, neither can it be ranged under the structure for old people. The male population ratio in 4 locations, i.e. Barambai, Purwosari, Tamban Luar, Sebangau, is over 1, while it is between 0.60 and 0.90 in Jelapat and Maliku, so that it is considered high, except for Jelapat, which is considered good.

The number of ethnic groups ranges from 3 to 5; in this transmigrants group it is considered positive and supportive of the program, as it has sufficient variety.

7.3.2 The community and the culturalbackground of the population

The majority of the transmigrants are from Java and Bali. The ethnic groups here can be distinguished as follows: 69.7% Javanese, 7.8% Sundanese, 3.1% Balinese, 0.6% from Nusa Tenggara, 0.3% Bataks, 17.5% Banjarese. The population of ethnic Banjarese origin have settled at the location with waters under tidal impact.

The way of life and their traditional customs have not changed from those of their home region; the only visible change is in their way of farming. The ties with the area of origin and its traditional customs are still very strong; in addition, there are customs which do not exist in their home area, such as the ceremonies of namegiving to a child, the celebration of important events like wedding ceremonies.

In general, the way of farming is almost the same as in Java, in spite of their having been explained (so they say) how to do proper farming before departure. The custom of mutual aid

is more remarkable as they feel they share the same fate, and so they are willing to help each other in ploughing the rice fields, planting the seed and harvesting the paddy.

Another bond lies in their cultural activities, like "klenegan", Balinese gamelan, and other traditional cultural activities. According to the population, it is these cultural values which help them adjust themselves, although they feel that adjustment does not come the easy way.

Many of the transmigrants come from the same village, there are also some who are of the same kin, so that the impact of customs of the area of origin is very strong. This is visible in the division of the yards, the partition of the house, the way of setting the location of the swimming pool, the place of paddy stamping, as well as the place for the cattle.

Barambai location

This location is the nearest to the Kabupaten city of Barito Kuala, it is a 20-30 minutes' drive on the motor cycle. This smooth connection gives a certain colour to the activities of the transmigrans and to the transmigrants' adjustment to the local population. It also makes life here very much different from the transmigrants' area of origin. The openness with which newcomers are met, the way of receiving visitors, and the fluency in Bahasa Indonesia, illustrate the way of life and customs at this location. The transmigrants are starting to get used to the water condition, however, to find additional income is still a challenge which needs to be met, for instance by increased planting of various crops. The structure of communal Javanese is still being maintained; the value of hard and diligent working is still a stronghold.

This location also has transmigrants from Bali. Balinese culture and the structure of its community is still being kept. The Balinese transmigrants hold to the motto "no return to Bali without success."

Banjarese culture with its irrigation system does not work here, and, consequently, they had to change their method by moving to more fertile soil using the tidal system. With regard to the system of rice planting, both the Javanese and the Balinese have learnt much from the Banjarese.

Jelapat location

The majority of the population of this location consist of Banjarese; there are also Javanese, which is mainly due to the job opportunities at the plywood companies. Generally, the Banjarese community stays home during the rainy season, to plough and plant, while they try to go to Banjarmasin during the time of waiting for the harvest. The method of Banjarese farming comes from the Bugis people, with some changes. Daily activities of the Banjarese community is much influenced by the tidal conditions of the Barito river.

The majority of the Jelapat population have only basic education, and, therefore, a lot of intiative comes from the prominence of society. As almost 100% of the Jelapat population is moslem, the prominence in question is a religious prominence.

At present, the haramay plant is being developed to provide fiber for a kind of thread, used for the handicraft industry of rattan lampit for export. In contrast to transmigrants of other locations, they do not mind the decrease in the produce of paddy agriculture. Using a tractor for the sawahs has been tried out, but the result was unsatisfactory.

Purwosari location

Purwosari is exemplary for an advanced village in Java, if not for the river and "anjir", one would not feel being in Kalimantan. Village Purwosari I being the village of our study,it will give the same outcome as a village in Java. This location was colonised under the Dutch rule, and, therefore, the members of this community are rather well developed. Many members of this community are educated and have a degree, or are functionaries in other areas, both within and outside Kalimantan.

Tamban Luar location

The first transmigrants to this location came in 1971--1972. They came from East, Central and West Java, Bali and Lombok. This location, which was planned for 5,000 heads of family, has since 1985 become an area covering several villages; the villages of our study are Tamban Luar II and Warnasari.

In general, the settlements of the transmigrants have changed, as many of them have built their own houses after marriage. Neither marriage with people from the region of origin, nor marriage with those from other areas, have brought about much change in the social structure of the people originating rom Java/Bali/Lombok. The system of using water has penetrated into their lives, and a merge of water use and the Javanese is visible; they make a well or bathroom somewhere in the yard of their house, while using tidal pipe water for irrigation. Mutual-help activities indicate their togetherness in this land of hope.

Maliku location

The tidal area of our study is Pangkoh V and Pangkoh VI, each consisting of 2 units. Pangkoh VA, VB, VIA, VIB are located on lowland, surrounded by swamp forests and the stream of Kahayan river. Transmigrants have populated this location since 1982. In general, they come from Java; the Javanese way of life is the main characteristic of this community; this is for instance visible in the way of farming, although some already use the "tajak" (a local type of hoe), many of them still use the "cangkul" (the Javanese version of hoe). The rate of participation in joint activities is very high; activities like "arisan" a kind of lottery/cooperative, and religious activities are still part of daily life, just like in their place of origin in Java. Tying them to their place of origin are also the cultural groups like "ketoprak", "ludruk", "jaranan", "wayang kulit", "jangger", "karawitan" (all expressions of traditional culture) and "pencak silat" (traditional martial art). When there is a circumcision, "jaranan" is performed all day long.

Sebangau location

This location has had transmigrants only since July 1986. The longest period of stay is 9 months (SEL March 1987). The activities of the population are still limited to preparing the soil and experimenting in agriculture. Here and there, the rate of fertility and the problem of agriculture is still very outstanding. Some of them come from a non-farming Javanese background, and as a consequence, they have yet to learn a lot from those who are used to farming. This all make them very inter-dependent and tied to each other, just as in the place of their origin.

Daily activities are still dominated by agricultural work, although they have also developed a pattern of reciting Koranic verses and "arisan". This community is still characterized by responsive features. When on day their food supplies were stolen, it aaroused spontaneous joint reaction with regard to security measures. Those who like gambling would just bet on their rice ransom and side-dishes received from the cooperative.

7.3.3 Religion

In general, religion is lived after in accordance with its teachings, with a high rate of tolerance towards other religions. Almost at all locations of study the development of moslem believers is carried out by the "Majelis Dakwah Islamiah"(Council of Moslem Preachers). As is generally the case in these transmigration areas, the religious congregation, both Moslem and Christian, are self-supporting in the construction of their places of worship, in addition to a government-built mosque at every location of study.

Religious conflicts have occurred, for example in Barambai, when the moslem population declined to consume the food offered by Balinese. Especially the Banjarese were involved, because Balinese in this area raise pigs.

"Yasin" and "tahlilan" activities (recitation of the confession of faith and relgious teachings) take place once a week. The christians usually have their worship services once a week, having it alternately in one and then in the other church; in this way, however small the community, the church always looks crowded. Tradition is predominant in the relgious life of the transmigrants. Although the whole

population of Jelapat is moslem, the mosque is only filled on Fridays. Their devotion has not yet penetrated daily life, community prayers, for example, are actually not only restricted to Fridays.

As for Sebangau, where the environs are still populated by the Dayak Kahayan group, some are still animistic.

7.3.4 Social Relations

The existing challenges in managing nature give both stimulation and the firm belief that without a good cooperation, there iw little solution for many problems. In general, the inter-transmigrants relationships are rather close and they have a sense for mutual help. Social interaction with the administrators is rather close, as they have to be involved for solutions of the many needs and problems. In fact, the involvement of the village administrators have been felt very strongly with every opening of a location. With the increase of activities, expecially for the areas of Barambai, Tamban Luar and Maliku, the regional government activities also increase as a result of marketing demands for the agricultural produce of the transmigrants. Social relations with the surrounding population are very close, marked by marriage. For example, people of the Balinese ethnic goup marry people of the Banjar ethnic group at Barambai. This inter-ethnic process of integration is facilitated by the natural environment.

7.3.5 Economy

Economy is closely related to demography; on the one hand, a high rate of population density at the location of study may be supportive, but on the other hand, it may also prove a burden.

Another problem emerging from the demography point of view, is the high rate of human resources, whereas quantitatively job opportunities are still scarce. The challenges in smallscale home-industry should be supported by improvement of quality.

Viewed from the standard quality, the per capita income has been surpassed in general. However, the cost of living, especially in Kalimantan, is still higher than in Java. The annual per capita income in Central Kalimantan, in particular Kabupaten Kapuas, is Rp. 23.699 (Constant Price in 1975), and in South Kalimantan Rp. 91.951,99 (Constant Price 1975). Five of the locations of study are already at a level over the standard quality, except for Sebangau, which is still at a consolidation level.

Although the incomes are in general rather high, the expenditures of agricultural production are still Government subsidised, which may be a constraint in calculating the bid for the increase of the farmers' per capita income if the condition of other commodities are not simultaneously developed.

Additional income is in general relatively small at the five locations, except for Purwosari, which is already at such an advanced level that the additional income, next to agriculture, is one-third of the main produce, which is also relatively high. Prices of daily needed commodities are also very much influenced by transmportation facilities and the distance to the centre of trade and economic activity.

Two locations, i.e. Tamban Luar and Maliku, have easy transportation possibilities to Banjarmasin. Sebangau as an

area with problems in transportation factilities, both from Palangkaraya and Banjarmasin, is hoped to be a new centre of development. When the roadplan for transportation from Pangkoh and Sebangau materializes, market chances for the produce of this transmigration location will certainly be better.

7.3.6 Institutional Structures

The institution which plays a marked role in community activities is the religious institution. Other important parantas are those involved in the provision of commodities for daily needs and social service institutions. In this respect, our study will underline its functions. KUD (Village Cooperatives), LKMD (Village Community Resilience Commitee), Siskamling (Neighbourhood Security System), recital of Koranic verses, as well as the Majelis Dakwah (Council of Moslem Preachers), are alle included in the facilities which serve the needs of the community.

Village administrators not only administer formal matters, they usually also attend to the social needs of the people; at this location of transmigration, they also give advice and take decisions in various family disputes. At Barambai, the function of the village cooperative is not perceptibly helpful, as most people here would rather deal directly with the seller. This may be due to the fact that Barambai is not far away from the kabupaten city of Barito Kuala.

For Jelapat, the conditions are different, because the social structure here is not yet aware of the function of the village cooperative (KUD), and whenever people would need a loan, they would go to a "tengkulak" (middleman) who uses the "ijon" (purchase of paddy when it is still green and get it when it is ripe) system. This is felt to be easier, as the

procedure for loan applications to the KUD is too bureaucratic; they would for instance be asked for a land certificate, where this is felt unnecessary.

Purwosari has already advanced institutional structures and they are able to have private secondary schools run from private funds.

For the other locations, the condition of institutional structures is the same as in the transmigrants' place of origin, where, in spite of there being an institution available, its function is not felt. In fact, an agricultural information centre and a test-farm are needed, but in almost all locations, neither the administration nor the people make proper use of it. Less supportive is furthermore the lack of a follow-up after planting seedlings by the test-farm.

Diversification in agriculture is not yet popular due to limited government funds needed to make people familiar with tidal-area-adjusted agriculture.

The lurah (village chief) at Barambai, Jelapat, and TAmban Luar, also deals with loans for paddy seeds. At the Sebangau location, one community member as a private individual had to be a middleman, because there was no KUD available . Of course, paddy tends to be cheap at harvest, but expensive at planting time, when the farmer needs it for the seedlings.

As transportation facilities are rare, particularly for the newly opened locations like Sebangau, agricultural produce, like aubergines, cassava and other kinds of secondary crops, rot away instead of being used.

For Purwosari, institutional structures, both economic and social are already working smoothly.

8 ENVIRONMENTAL QUALITY EVALUATION

8.1 Evaluation of the Irrigation System

1 Barambai

On the whole, the drainage system that has been developed id functioning well, altrhough in some places depressions cause the formation of water pools and elevated topography obstructs the system. On the scale it can be classed as 4. As an irrigation system, it functions well as wet agricultural land irrigation and for domestic use. On the scale it can be classed as 5, which means that the system is capable of supplying the needs of more than 40% of the whole area. Viewed as a system of waterways, it can be placed on 5 on the scale, which is very good.

2 Jelapat

By and large, the drainage system is almost similar to that of Barambai, but on the scale it can be placed only on 3, which means that it functions reasonably well and only the maintenance is rather poor. As an agricultural irrigation system, it can be placed on 3 on the scale, which means that it supplies the needs

of 21 - 30% of the whole area. As a waterway system, it can be put on 3 on the scale, which is reasonably good despite some drawbacks, mainly at low tide.

3 Purwosari

The system of canals is on the whole reasonably good. As a drainage system it can be classed as 3 on the scale, which means that it functions quite well and only the maintenance is rather poor. As an irrigation system, it can be placed on 4 since it has the capacity of supplying the need for water of 31 - 40% of the whole area. As a system of waterways, its place is 4 on the scale, which is reasonably good.

4 Tamban Luar

The system of canals functions well as drainage, and can therefore be classed as 4 on the scale. As an irrigation system, it can be put on 4, which means that it is capable of supplying the need for water of 31 - 40% of the whole area. As a waterway system, it is classed as 3, which means that it is reasonbly good except the maintenance. Trasportation by

water is hampered at low tide.

5 Maliku

The system of canals at Maliku settelement unit is on the whole reasonably good. As a drainage system, it can be put on 3 on the scale, which means is unsatisfactory. As an irrigation system, it can be classed as 3 since it can supply the need for water of 21d - 30 % of the whole area.

As a waterway system, it is unsatisfactory and only earns 3 on the scale. It definitely needs improving.

6 Sebangau

On the whole, the system of canals in Sebangau settlement unit is reasonably good. It can be put on 3 the scale as a drainage system as it functions fairly well and only the maintenance is rather poor. As an irrigation system, it can supply the need or water of 21 - 30 % of the whole area, and can thus be placed on 3 on the scale. As a waterway system it is reasonably good, and can therefore be classed as 3, but the maintenance needs improving.

8.2 Evaluation of the Transmigration Settelements

The transmigration settlement units studied began to be occupied at different times. The following are some specifications :

(1) Purwosari transmigration settlement unit was the earliest to be occupied, i.e. in 1934. It is situated a short distance from Banjarmasin, and is accessible by water.

It takes a speedboat about half an hour to reach the place, while a "long boat" will need about one hour. The relatively short distance from Banjarmasin explains why activities resembling these found in places in transitional process to becoming towns - such as trade and services - can be noticed in this settlement unit.

(2) Barambai unit - also in South Kalimantan - began to be occupied in 1970. It is not far away from the capital of Barito Kuala District, only about half an hour by motorbike. Influence of this proximity to the district capital is noticeable in the daily activities of the population.

(3) Tamban Luar unit in Central Kalimantan began to be occupied in 1971. It takes a speedboat about three hours to reach the place. Despite this

distance, the activities of the population are showing signs of variation, and are no longer confined to agriculture. Some trade and even small-scale industry are found in this unit, which are proof of fair development.

(4) Jelapat unit is not far way from Banjarmasin, only about half an hour by speedboat, yet it is far behind Barambai, Purwasari, and Tamban in development.

(5) Maliku unit has been settled since 1982. In terms of physical quality the unit is the most favourably endowed, so that agriculture practised by the transmigrants is thriving well, even better than what can be observed in Jelapat, for example.

(6) Sebangau unit has been settled the most recently, i.e. only since 1986. This explains why the activities there are not varied as yet, and are confined to only agriculture.

8.3 Evaluation of the Natural Environment

The quality of the natural environment in each transmigration settlement unit has been touched on above. They are actually description of environmental quality following activities of tidal swamp development. The aspects of nature to be evaluated in this section are the physical and

the biological.

8.3.1 Physico-chemical aspects

a Water Quality

Physico-chemical evaluation of water components will be undertaken with the ultimate utilization of the water bodies in view. Secondary canals in tidal areas have been used for different purpose. Drainage and irrigation are their main functions, whereas their function as waterways can be effected so long as this does not interfere with the first two. Transportation is confined only to primary and secondary canals, while tertiary canals with pond system (Barambai area) are not used as waterways. According to the population, a lot of problems arise from this pond system as it hampers mobility to the agricultural areas. Another fact is that these tidal canals are also utilized by the population for bathing, washing, as a toilet, and even as drinking water source, in addition to their function for agriculture.

Evaluation based on drinking water

standards as provided in the Regulation of the Minister of Health, no. 01, 1975, concerning physical, chemical, and metal parametres, indicates that the six locations have an average environmental quality of the same scale, i.e. physical parametre scale 5 with varying percentages of 86 % for Barambai, Purwasari, Tamban Luar, and Maliku, and 93 % for Jelapat. The chemical parametre shows an environmental quality scale 4, but with percentage value varying between 67 and 77.5 %, i.e. 67 % for Jelapat, 75 % for Barambai, Purwasari, and Tamban Luar, and 77.5 % for Maliku and Sebangau.

The chemical parametre employed in the environmental quality evaluation indicates low and average qualities, i.e. pH with scale 2, low oxygen content (KMnO4), and low ammonia content, particularly in the dry season. The low level of pH, KMnO4, ammonia and dissolved oxygen is due to the influence of nature in peat swamp forests.

The water streaming from the peat swamps is blackish and generally very acid (pH 3.0 - 4.0), containing more inorganic ions than fresh water, and having low dissolved

oxygen content, and high humus acid content (22,23). Acidity degree of 6 is the lowest pH limit for agricultural water standard. The lowest pH level at one obeserrvation point indicates the figure 3.2. Water pH in this area is on scale 2-3. Acidity level is below 5.5, thus retarding bacteria activity, including transformative bacteria. The drop in pH affects the ease in the exchange of Ca ion and Mg, and the supply of phosphorus. There is some correlation between pH and soil, such as the supply of green element, activity of micro-organism, and the toxicity of certain solutions.

Low oxigen content may be the result of scarcity of water plants, while high acidity may be engendered by humus acids.

Sample measurements for matals such as iron, tin, lead. cadmium, chromium, zinc, magnesium, and manganese, indicate that the iron (Fe) element exceeds the standard for drinking water (>1 mg/lt). The high iron content in the water body is caused by the high pyrite content of the soil.

Apart from the parametres above, another

parametre of great influence to soil fertilitly is the high chloride and sulphate-chloride content in the six locations. Excessive chloride content can poison fruit trees, causing the leaves to dry. Irrigation water is considered safe when the chloride content is below 150 ppm, whereas 300ppm and above will be dangerous for agriculture. High sulphate content will limit the absorption of calcium by plants, which will cause a relative rise in sodium and potassium absorption. Thus sulphate content will affect the exchange value of cation.

Bacteriology

The bacteriological quality of the water as standard drinking water in the six transmigrantion settlements studied can be put on scale 5 altrough there is some variation in terms of percentage, which means that the water is still very good as standard drinking water for the population, or has MPN value far below MPN standard for drinking water. The MPN figure in all of these locations is still 3 below 10.10 MPN/100 ml.

In all six locations, the same river water as standard drinking water in the six transmigration, bathing, washing, and as toilet. Yet measurements of bacteria indicate that the coliform is fairly low and can be put on scale 5. This is probably caused by the tides, i.e. dilution at high tide and washing down to the river mouth at low tide. Another factor is the high poison content which is difficult for micro-organismes to digest. Phenol compound has a negative effect on mikoriza, fungi, bacteria, roots, vertebrates, insects, and worms, so that decomposition proceeds very slowly in the peat swamp ecosystem. On the other hand, when acidity and phenol value are low, the use of the water body as a washing place and toilet will cause bacteria population explosion.

Escherichia bacteria is related to pathogen. The presence of pathogen bacteria in water can cause stomach disorder (vomiting and diarrhea) and skin disease for those who use the water for washing up domistic utensils and for bathing. Some cases of vomiting and

diarrhea have been noted as a consequence of the washing of domestic utensils with water contaminated by pathogen bacteria.

Escherichia coli content amounting to 1,000 MPN/100 ml is indicative of the presence of pathogen bacteria. Virus and pathogen bacteria can accumualte in biota tissues and digestive channels.

b Soil

Using indicators to test soil fertility and the feasibility of agriculture, obserbations have been made on the physical and chemical parametres of soil quality, covering pH parametre, alectric conductivity, pyrite (FeS) and fertility elements, as well as other elements related to fertility and green element transfer in Barambai, Jelapat, Purwosari, Tamban Luar, Maliku, and Sebangau transmigration settlement units.

Examinations of N,P,K content and organic matter indicate that in those settlement units they exceed the average arable soil quality in Indonesia, with the exception of the K element, which is lower (see Table 8.1). Measured by P and K elements,

fertility in the areas of Barambai, Jelapat, Purwosari, Tamban Luar, and Sebangau can be placed on scale 3, whereas the figure for maliku area is 5.

Natural fertility level of organic matter in peat swamp forests can to a high degree be affected by human activity. Unwise land cultivation for agriculture by neglecting environmental conditions will disrupt the transportation of green elemen ions to plants.

Table 8.1 Arable Soil Stratum in Indonesia

Matter	% desired	mg/100 gr sample
Organic matter	0.40 - 10.00	-
N	0.02 - 0.50	20 - 500
P	0.01 - 0.20	10 - 200
K	0.17 - 3,30	170 - 3300

Findings of research on pyrite in the six locations indicate a variation of 0.70 - 7.00 % in the dry season, and a variation of 0.125 - 2.25 % in the rainy season.

In the rainy season pyrite content drops

as it is washed off by rain water, thus lowering concentration. This pyrite content in arable soil hampers the mobility of green element ions to plants. Complex pyrite reactions to organic compound (chellate) can also affect the activity of ions in soil solution.

Pyrite content greatly affects land cultivation methods. When the soil is turned, pyrite will oxidize, thus causing soil to harden, and plants will hardly grow on it. Pyrite content in arable soil on the lowest location and on the highest during both seasons can be seen in Table 8.2.

The presence of pyrite in agricultural land is also reflected in soil pH, particularly through soil pH measurement with H2O2 (hydrogen peroxide). See Table 8.3 which shows acidity level lower than 4, with environmental quality category scale 1 and 2.

Low soil pH (acid) will result in the gradual weakening of the function of pH as buffer. Both pH and pyrite will cause a weakening of green element ion activity,

which in turn will hamper growth.

High chloride and sulfide content of water quality in acid pH can result in the poisoning of plants and other organisms.

High pyrite content and soil acidity will by natural process increasingly affect organisms if human activity is not adjusted to these natural conditions. Lime treatment to reduce soil acidity for the sake of agriculture will engender costs higher than the value of the agricultural produce since the six transmigration settlement units are quite a distance from leme source. A better way is by improving the drainage and irrigation systems an wise soil cultivation adjusted as far as possible to the natrual conditions.

Table 8.2 Lowest and Highest Pyrite Content in the Rainy Season and in the Dry Season

Location	Rainy Season		Dry Season	
	Lowest Location	Highest Location	Lowest Location	Highest Location
1. Barambai	0.400	2.901	1.40	2.10
2. Jelapat	0.430	1.459	0.70	2.93

Tabel 8.2 Continued

3.	Purwosari	0.22	1.219	1.40	7.00
4.	Tamban Luar	0.200	2.600	1.75	2.45
5.	Maliku	0.301	1.899	1.40	-
6.	Sebangau	0.800	2.784	-	-

Table 8.3 Lowest and Highest Soil pH Content by H2O2 Test in the Rainy Season and in the Dry Season.

Location	Rainy Season		Dry Season	
	Lowest pH	Highest pH	Lowest pH	Highest pH
1. Barambai	1.72	3.37	2.6	3.6
2. Jelapat	1.61	2.85	2.4	3.7
3. Purwosari	1.66	2.99	2.1	3.2
4. Tamban Luar	1.26	3.01	2.2	4.1
5. Maliku	1.51	1.52	-	2.6
6. Sebangau	1.25	1.90	-	-

c Thickness of Peat

Peat thickness in the six locations varies greatly, ranging from 25 to 100 cm. Field measurements made in Tamban Luar

unit, which has been under cultivation since 1972, indicate a drop of peat thickness from 100 cm to 15 - 25 cm in the course of 14 years. This drop is also noticeable at the transmigration units of Jelapat and Barambai. It seems that thickness of 25 cm is maintained by more careful land cultivation. This can be observed in Purwosari Transmigrantion Settlement Unit (see picture 8.1).

Purwosari was first occupied in 1939. After 3 generations or 47 years, the remaining peat is still able to support agriculture. The method of land cultivation is different from that practised on the island of Java. Instead of burning the agricultural waste and spading the soil deeply, they adjust their method to the local natural environment, i.e. cutting up the agricultural waste (straw) and weeds, such as "purun tikus", with hoes, and leaving them rot by submerging. The field is then ready for planting. It seems that in this way peat thickness can be maintained (see picture 8.2), and the rice plant protected against pyrite and acidity. This method is also

Picture 8.1 Agricultural Waste Left Roting

Picture 8.2 Planting with tool as no ploughing is possible

bery suitable for local rice species (see picture 8.3 & 8.4).

Natural peat condition with a thickness of 25 - 100 cm qualifies for environmental quality scale 5. Reduction in peat thickness is caused by unwise agricultural methods.

Picture 8.3 High-yielding variety

Picture 8.4 Local Variety

8.3.2 The organic natural environment

a) Forest Vegetation and Fauna.

The forest vegetation found at the six locations have the same characteristics as the several units of agricultural development, in other words, they form a forest ecosystem of peat swamps.

Observation was carried out at the transmigration unit at Sebangau. This area has just been opened up. At the time of the observation, transmigrants here had just started harvesting the crops in their yards, i.e. corn and soy beans, and not all units had been occupied yet.

Among the various kinds of vegetation were types of vegetation with a high economic value, among others a kind of plankton (Alstonia pneumatophonra), Mahang (Macaranga maingayi), Terentang (compnosperma macrophylla), Ramin (Gony stylus bancanus) and Rattan.

The availability of these economic valuable types of vegetation will be very attractive for transmigrants who will use the wood and rattan for additional income. It is estimated that the intensity of wood- and rattan gathering for the purpose of additional income will be parallel with the increase of the

population and the job opportunities.

This occurrence is very well possible as according to the observations in the field (especially at Sebangau) there were illegal wood traders and woodcutters.

In addition to its function as vegetation, the forest also functions as a habitat for wild life, i.e. to support its inhabitants. Damage of the forest as a habitat will cause disturbance of the population of wild animals and can also become a disease because of the damaged niche. The imbalance in population especially between prey and predator, will cause a population disorder of the ecosystem. Continuous population disorders will cause extinction of the species.

On the other hand, a decrease in habitat will cause the wild animals species to look for another niche and it can cause the transformation of some animals into diseases for farming.

Through direct and indirect inventarisation as well as through interviews with the population data were obtained about the kinds of wild animals that could become plant diseases.

The group of animals that could possibly become plant diseases belong to the mammalia, Aves and Insecta. Plant diseases and the class of mammalia comprise wild swines (Sus sp), apes (macaca fascicularis and macaca sp); and rats (ratus ratus sp). Wild swines have the specification of attacking young plants like coconut and cassave. The apes group usually attack fruit-plants and mais. While rats form the main problem for paddy and second crops.

Aves which is a potential disease consist of "gelatik" (Padda Oryzae) and "Emprit (Lonchura Leucogrostroides) and attack ripening paddy and mais is the prey of the "Betet" (Psittacuta alexandri). Hundreds of "gelatik" birds and bats were seen attacking paddy at Barambai.

The group of insects which form the diseases are the paddy plant disease like "wereng hijau (Nilaparfata lugens), and "wereng coklat" (Niphotetix spp), and "penggerek batang" (Scirpophoga spp), walang sangit (Leptocavisa spp).

Diseases to the bean plants are Empoasca sp, Nezora sp, while diseases to coconut planting comprise Artona sp, Sexora sp, Brontispa sp, Oryctes sp ("penggerek pucuk") and the "bajing" disease.

With regard to its variety and ecological potential, peot swamp forests at Sebangau are still good with a scale of 5. The quality of this condition will more and more deteriorate if there is not sufficient job opportunity and marketing for the produce of transmigrants.

b) The ecosystem of the waters

Indicators for the observed water ecosystem were Plankton and Nekton (fish).

There was the same pattern of distribution of the variety of plantkton for the secondary canals at Barambai, Jelapat, Maliku, Tamban Luar, and the primary canals at Sebangau, which is: the closer to a main river, the higher the rate of plankton variety, with the exception of the secondary canals right of Maliku, which have a higher rate of plankton variety. Variety and abundance in the rivers of the peot swamp forests is low in comparison with the other places of fresh water.

The occurrence of the low level of variety in such a big population is estimated to be due to the high rate of phenol, the low rate of pH (its acidity is high), the turbidity of the water (black colour). Plankton appears not to be able to develop with a high rate of

phenol. The difficulty of dissolving phenol is due to the low rate of dissolved oxygen in the water. Dissolving phenol by some micro-organisms very much requires a substrat which is rich in oxygen. In a condition which is poor in oxygen, the problems of micro-organisms in dissolving phenol is not surprising. This reality is already apparent in the very low rate of peculiarities of plankton and in the absence of benthos (basic organisms in a river). The poverty in water organisms i.e. (cladocira), anelida worms, and memotoda, rotifera and protozoa in in the black water swamp rivers has already been reported by Anwar et al (1984).

The variety of fish in the rivers (primary and secondary canals is very low. The majority of the kinds of fish that were met and caught, was the kind that breathe in air or live near to the surface. Remarkable kinds were "ikan betok" (Anabas testudineus), Block, "gabus" (Cahnua Striata Fowler) and "sepat siam" (Trichogaster pectoralis/Regan).

This may be due to the low rate of oxigen, so that only organisms that can live in a low-rate of oxygen or breathe outside of the water are found there. It is also possible that it is due to the binding of protein with secondary kinds like tamin which have a damaging effect on the breathing functions of watar organisms.

8.4 Evaluation of Man-made Environment

The various components of man-made environment to be evaluated consist of Settlement, Agriculture, Gardening, Home Industry, Transportation and Social Facilities.

Each of the above mentioned components of environment will be evaluated at every transmigration settlement unit, i.e. Barambai, Jelapat, Purwosari, Maliku, Sebangau and Tamban Luar.

8.4.1 Barambai

The quality of settlement in the Barambai transmigration unit may be ranged under the classification not so good or low, however, the productivity of farming in this unit is not on a level with the population's ownership.

One opinion describes the quality of settlement as essentially reflecting the level of ownership in a certain area.

The productivity of farming is rather good, to the same degree of productivity of farming at Maliku, and it is even better than the productivity of farming at Sebangau.

In line with the farming productivity, the quality of the gardens is classified as good. This is an indication of the ability of the population in farming and in making good use of their gardens.

As is usual in a developing village, there is as yet not much activity in industry. This is brought about by (i) there not being a surplus yet of the farming activity; and (ii) insufficient transportation facilities to reach this unit

from an area with more activities, like Banjarmasin, so that those wo would carry out activities in the industrial sector, are inclined to choose other areas, such as Purwosari and Jelapat. Nevertheless, social facilities for the inhabitants are already well available.

8.4.2 Jelapat

The quality of settlement at Jelapat is in general low. However, the quality of farming and gardening is rather good.

Remarkable in this unit are the activities in industry and transportation, which are of rather good quality.

8.4.3 Purwosari

The quality of settlement here is already very good. This is probably due to the good results of farming, gardening, the activities in industry and the high rate of accessibility of this area from regions with more complex economic activities like Banjarmasin. Also the general infrastructure is already very good. It is clear then, that the location of an area has a significant impact on its quality.

8.4.4 Maliku

The quality of settlement in this unit is rather good, meaning it is a level higher than the quality of settlement in the Barambai unit.

The quality of farming and gardening is the same as that at Barambai.

The quality of the other components of man-made environment, i.e. activities of home industry, transportation and general infrastructure, are still classified as low, or lower than the previous three units.

8.4.5 Sebangau

In this transmigration unit, the quality of settlement is rather good. However, such a level does not necessarily mena that this unit is successful, as compared to Jelapat for example, but it is just due to the available facilities.

As the unit is new, farming has, understandably, only reached a low level. The same goes for activities in industry.

Nevertheless, this unit seems to be able to improve as its physical quality is good and transportation from the capital of Cetral Kalimantan - Palangkaraya - is easier, compared to Maliku.

8.4.6 Tamban Luar

As in Jelapat, the quality of settlement in this unit is not good. Also the quality of farming may be considered to be of the same degree in both units.

However, they differ in quality with regard to two components of man-made environment, i.e. garding and transportation. The quality of gardens in this unit is better than in Jelapat, but transportation to this unit is more difficult compared to Jelapat. The difficulty does not lie in the lack of transportation, but in the time needed to get here from Banjarmasin.

Home industry in this unit is rather good and social infrastructure is classified as very good.

8.5 Evaluation of the Social Environment

The components of environment to be evaluated are: Demography, Community and Culture, Religion, Social Relations, Economy, Institutional Structures, Health and Education.

As in the man-made environment, each component will be evaluated at every transmigration settlement unit.

8.5.1 Barambai

The institutional structure in the community of transmigrants at Barambai is affected by several activities. The extension of land has a significant impact on the institutional structure, particularly in the activity of land title certificates. Almost every head of family in this area possesses a land title certificate, which provides the landowner with the legal right over his land. Extension of land makes new certificates necessary, which means an increase in the institutional activities.

Indirectly, the activity of land extension has an impact on the population component. It is visible in the decrease of population density as a result of land extension, while during the same period there was hardly any increase in the number of population. In addition, the population component is also affected by trade activities, visible in the mobility of the population.

The increase of agricultural products and the smooth transportation between Barambai and the Kabupaten (= subprovincial/district administrative unit) 's city Barito Kuala have provided the population component with an average value in the quality matrix of environment.

The Health component is under the impact by two kinds of activities, i.e. (i) the opening up of forests; and (ii) the activity of "Mandi, Cuci, Kakus" (MCK = Bath, Washing, Loo). The opening up of the forests by the transmigrants have increased the flooded land area, which gives way to multiplication of agents of diseases and aggravation of health conditions. Besides that, the majority of the population does MCK along the pipelines or canals, using canal water as the only source of water. This causes the epidemic disease of "Muntaber" (Gastro enteritis).

Drinking water is caugt in a basin made of ferocement, a kind of Inpres-made stone (Inpres = Presidential Instruction). Up to the present time, the need of the people for drinking water have not been met.

8.5.2 Jelapat

The area of Jelapat is populated by the people of the ethnic group of Banjar, who arrived here before the government-constructed tidal irrigation. They belong to the group of spontaneous transmigrants.

They left their initial farm land because of its decreasing fertility.

The Institutional component in the community of this area is influenced by the existence of home industries. Nevertheless, the impact of the home industries on institutional structures is quite insignificant. This may be due to the people's ignorance of the importance of instituional structures which could increase the role of the smallscale industries, for example by organizing training courses.

Activities of home industries have an impact on the existing component of economy. Land in this area is limited, and there is no extension of land. As a result, both smallscale industries and non-agricultural products are not developing so well. Therefore, many of the inhabitants leave for Banjarmasin after the planting period and after harvesting, to seek additional income. Beside agriculture and smallscale industry, the local population also cultivate haramay trees which provide the material for yarn to be used for rattan "lampit" handicraft. However, these activities only have a slight impact on the economy of this area.

The availability of drinking water, MCK activities and the system of waste disposal, both of domestic and industrial waste, have an impact on the Health component. As at Barambai, this area has MCKs located along the water canals, using water of those canals for MCK activities. This clearly affects the people's health, as human disposal is mixed with the water used for bathing and washing.

Drinking water is also obtained from rain catch. In addition, if this is not sufficient, gutter water is gathered in a huge basin and is cooked before drinking.

While domestic waste is disposed of in the canals used for taking a bath, washing and sometimes for drinking water, waste of the smallscale industries are disposed of around the house, in the garden. As most industries here deal with plywood and sawmill, preservation are used, which at a certain level can affect health as well.

8.5.3 Purwosari

This transmigration settlement unit has existed since 1938 and, therefore, it is hard to compare it with other locations. The problem faced here deals with maintaining population's activities or possibly increase the existing quality.

The component of Social Relations is influenced by marketing activities for the produce of agriculture, industry and non-industry of that area. Marketing is not only done inside, but also outside the location, especially in Banjarmasin.

The component of Economy is affected by several activities, like trade, non-agricultural work, industry and the use of industrial waste. From an economic point of view, Purwosari is the most advanced among the areas surveyed.

The role of Trade is visible in the level of income, which is rather high; in addition, it has also an impact on the component of Education. Compared to the other surveyed areas, there are many inhabitants with a higher level of education. Work in the non-agricultural sector, such as coconut plantations, fishery, animal husbandery, have a quite significant impact on the component of Economy. Also the existing industry, palm oil, have significant impact on the economy. Furthermore, the use of industrial waste of palm oil, which gave way to the future construction of a hydro-electric power installation (PLTU) which is to use the waste of wood, coconut shell and coconut fiber.

Institutional structures are very much affected by the existence of KUD (village cooperatives) and by the various kinds of other economic activities next to agriculture.

Meanwhile, production of drinking water has not succeeded yet in influencing the existing institutions to make more water suitable, up to the valid standard for drinking water, and equally available for the whole population. Until the present time, drinking water is obtained from a number of hand wellpumps, however, it does not meet the standard for drinking water.

The availability of drinking water clearly has an impact on Health. Other activities having an impact on the health component include MCK activities. Most of the MCKs are in the house, which indicates that the quality of the environment is rather good. In addition, the system of sanitation also supports the health condition; which is rather good. Thus the Health component in this area ranks as rather good.

8.5.4 Tamban Luar

This area has been populated since 1971, but the government-constructed tidal irrigation system has been there since 1968. Contact between the population of Tamban Luar and the capital of the Kabupaten (or district administrative unit) and Banjarmasin, the provincial capital, is quite smooth. This is due to the smooth water transport which uses the moving irrigation canals. As a result, marketing activities from transmigration settlements to the city, both kabupaten and provincial, are smooth. These marketing activities have an impact on the components of Social Relations, Economy, Institutional Structures and Population.

The Institutional component is affected by marketing of non-agricultural produce and work. Marketing activities bring about contacts between farmers, and cooperatives which

have an impact on the institutional structure. Furthermore, non-agricultural work which indicates the availability of various job opportunities besides agriculture, result in the development of institutions to arrange the occupation of those job opportunities.

The component of Social Relations is under particular impact of trade activities, as relations between people within and people outside the transmigration settlement are smoother. The component of Economy is influenced by trade activities and by the availability of non-agricultural work, which all make for the increase of the income of the population. The above mentioned activities also influence the ever increasing mobility of the population, which is an element of the Population component.

The Health component which is affected by drinking water, MCK activities and sanitiation, as well as by waste disposal, is rather good. Except for the availability of drinking water, which needs to be increased, sanitation is rather good, so is the system of domestic waste disposal. In general, MCK is in the house.

8.5.5 Maliku

This area has been populated since 1982. The inhabitants here are still at he level of adjusment to the new environment. Agricultural produce is not yet enough, and many inhabitants have to find additional income as workers of a company at the forest felling site (HPH). As a result, the activities of the population only have a slight or not sufficient impact on the several components of the environment, social, economic and cultural components.

Non-agricultural work, i.e. forest-felling, has very little impact on the component of Social Relations. Neither does the Institutional Structure work adequately. In this area, the population is still trying to adjust themselves to the natural environment, and has not yet been sufficiently successful.

8.5.6 Sebangau

This area has been inhabited by transmigrants since 8 months. As it is relatively very new, evaluation of the social, economic and cultural environment is hard to do and is difficult to be compared with the other surveyed areas.

In view of the very small role of agricultural or any other activity, these people are still very dependent on Government subsidies for daily subsistence. Nevertheless, the Institutional component is remarkable, due to the various kinds of work carried out by way of mutual help.

MATRIX 8.1 : MATRIX OF THE EVALUATION OF TIDAL SWAMP DEVELOPMENT AT BARAMBAI

COMPONENTS OF ENVIRONMENT			BASE LINE		THE ROLE OF THE TRANSMIGRATIONS ACTIVITIES									
			Percentage	Scale	1. Agriculture	2. Land Extension	3. Deforestation	4. Marketing	5. Trade	6. Non-Agricultural	7. Use of Drinking Water	8. M.C.K.	9. Waste Disposal	The Role of Natural Condition
NATURAL ENVIRONMENT	1 Water Quality	Physical Parameter	86	5									2	4
		Chemical Parameter	75	4	3							3	2	4
		Becteriology	99,5	5							2	4	4	3
		Heavy Metal Parameter	82,5	5									1	4
	2 Soil Quality	pH ($H_2 O_2$)	20	1										5
		Soil Fertility /	60	3	1									4
		Subsidence / Peat Thickness	100	5	3	2	2							4
	3 Climate		100	5			2							5
	4 Forest Vegetation													
	5 Fauna		70	4	2		5							5
	6 Plant Disease & Gulma		40	2	3	2	4					2	2	5
	7 Aquatic Ecosystem		76	4										
MAN MADE ENVIRONMENT	8 Irrigation System		93,3	5	4									
	9 Settlement		40	2										
	10 Agriculture / Sawah (Rice-Field)		60	3	4								1	
	11 Fishery & Husbandary			2										3
	12 Home Stead Garden		73	4				2	2					
	13 Small Scale Industry			2				3		2				
	14 Transportation			2										
	15 Social Facility / Public facility			5										
SOCIAL ENVIRONMENT	16 Demography		61	4					3					
	17 Community & Culture		84	5										
	18 Religion		100	5										
	19 Social Relations		86	5		2								
	20 Economy		67	4										
	21 Institutional		60	3		4								
	22 Health		46	3		3						4		
	23 Education		55	3										

MATRIX 8.2 : MATRIX OF THE EVALUATION OF TIDAL SWAMP DEVELOPMENT AT JELAPAT

COMPONENTS OF ENVIRONMENT			BASE LINE		THE ROLE OF THE TRANSMIGRATIONS ACTIVITIES									The Role of Natural Condition
			Percentage	Scale	1. Agriculture	2. Land Extension	3. Reforestation	4. Marketing	5. Trade	6. Non-Agricultural	7. Use of Drinking Water	8. M.C.K.	9. Waste Disposal	
NATURAL ENVIRONMENT	1 Water Quality	Physical Parameter	93	5										4
		Chemical Parameter	67	4	2							2	1	4
		Bacteriology	99	5								4	1	3
		Heavy Metal Parameter	82,5	5									2	4
	2 Soil Quality	pH (H_2O_2)	30	2	2									5
		Soil Fertility	60	3	3									4
		Subsidence / Peat Thickness	100	5	4									4
	3 Climate		100	5										5
	4 Forest Vegetation													
	5 Fauna		65	4	3									
	6 Plant Disease & Gulma		60	3	4									4
	7 Aquatic Ecosystem		56	3	2							2	2	4
MAN MADE ENVIRONMENT	8 Irrigation System		80	4	3									
	9 Settlement			1		2								
	10 Agriculture / Sawah (Rice-Field)		20	1	4			4						
	11 Fishery & Husbandary													
	12 Home Stead Garden		60	3										
	13 Small Scale Industry			3				3	3					
	14 Transportation		60	3				3	3					
	15 Social Facility / Public facility			5										
SOCIAL ENVIRONMENT	16 Demography		44	- 3						1				
	17 Community & Culture		60	3										
	18 Religion		70	4										
	19 Social Relations		80	5						2				
	20 Economy		67	4	2					3				
	21 Institutional		50	3	1									
	22 Health		47	3								3	3	
	23 Education		55	3	3								2	

MATRIX 8.3 : MATRIX OF THE EVALUATION OF TIDAL SWAMP DEVELOPMENT AT PURWOSARI

COMPONENTS OF ENVIRONMENT			BASE LINE		THE ROLE OF THE TRANSMIGRATIONS ACTIVITIES									The Role of Natural Condition
			Percentage	Scale	1. Agriculture	2. Land Extension	3. Deforestation	4. Marketing	5. Trade	6. Non-Agricultural	7. Use of Drinking Water	8. M.C.K.	9. Waste Disposal	
NATURAL ENVIRONMENT	1 Water Quality	Physical Parameter	86	5								2	2	5
		Chemical Parameter	75	4	3							2	3	4
		Bacteriology	99	6								4	2	3
		Heavy Metal Parameter	90	5									1	5
	2 Soil Quality :	pH (H_2O_2)	20	1										5
		Soil Fertility	50	3	3							2		
		Subsidence/ Peat Thickness	100	5	2									4
	3 Climate		100	5		2								5
	4 Forest Vegetation													
	5 Fauna		75	4	4									
	6 Plant Disease & Gulma		50	3	3	3								5
	7 Aquatic Ecosystem		44	3								3	2	5
MAN MADE ENVIRONMENT	8 Irrigation System		73,3	4										
	9 Settlement		100	5		4		3						
	10 Agriculture / Sawah (Rice-Field)		80	4										
	11 Fishery & Husbandary			2										
	12 Home Stead Garden		80	4										
	13 Small Scale Industry			3				4	3					
	14 Transportation		100	5										
	15 Social Facility / Public facility			5										
SOCIAL ENVIRONMENT	16 Demography		60	3										
	17 Community & Culture		80	4										
	18 Religion		60	3										
	19 Social Relations		86	5										
	20 Economy		86	5										
	21 Institutional		80	4				4		3	2	2	4	
	22 Health		67	4						2	3	4	4	
	23 Education		60	3					3					

MATRIX 8.4 : MATRIX OF THE EVALUATION OF TIDAL SWAMP DEVELOPMENT AT MALIKU

COMPONENTS OF ENVIRONMENT			BASE LINE		THE ROLE OF THE TRANSMIGRATIONS ACTIVITIES									The Role of Natural Condition
			Percentage	Scale	1. Agriculture	2. Land Extension	3. Deforestation	4. Marketing	5. Trade	6. Non-Agricultural	7. Use of Drinking Water	8. R.C.K.	9. Waste Disposal	
NATURAL ENVIRONMENT	1 Water Quality	Physical Parameter	86	5								2	2	5
		Chemical Parameter	77,5	4	3							2	2	4
		Bacteriology	98,5	5								4		4
		Heavy Metal Parameter	87,5	5										5
	2 Soil Quality	pH (H_2O_2)	20	1										5
		Soil Fertility	83	5	3								2	5
		Subsidence / Peat Thickness	100	5	4									5
	3 Climate		100	5										5
	4 Forest Vegetation		100	5			2							5
	5 Fauna		95	5	3									5
	6 Plant Disease & Gulma		20	1	4									4
	7 Aquatic Ecosystem		60	3	2								3	4
MAN MADE ENVIRONMENT	8 Irrigation System		53,3	3										
	9 Settlement		60	3		3								
	10 Agriculture / Sawah (Rice-Field)		60	3	4			2	2					
	11 Fishery & Husbandary													
	12 Home Stead Garden		73	4	4			2	2					
	13 Small Scale Industry			1										
	14 Transportation			1										
	15 Social Facility / Public Facility			1										
SOCIAL ENVIRONMENT	16 Demography		48	3	2	1				1				
	17 Community & Culture		72	3	2									
	18 Religion		100	5										
	19 Social Relations		86	5				3		2				
	20 Economy		53	3	3			4		3				
	21 Institutional		40	2	3	3		2		3			2	
	22 Health		47	3		2						3	4	
	23 Education		50	3										

MATRIX 8.5 : MATRIX OF THE EVALUATION OF TIDAL SWAMP DEVELOPMENT AT SEBANGAU

COMPONENTS OF ENVIRONMENT			BASE LINE		THE ROLE OF THE TRANSMIGRATIONS ACTIVITIES									The Role of Natural Condition
			Percentage	Scale	1. Agriculture	2. Lan Land Extension	3. Deforestation	4. Marketing	5. Trade	6. Non-Agricultural		7. Use of Drinking Water	8. Waste Disposal	
NATURAL ENVIRONMENT	1 Water Quality	Physical Parameter	86	5								2	2	5
		Chemical Parameter	77,5	4	3								2	5
		Bacteriology	96,6	5								4	3	3
		Heavy Metal Parameter	87,5	5										5
	2 Soil Quality	pH (H_2O_2)	10	1										5
		Soil Fertility	50	3	3									5
		Subsidence/ Peat Thickness	100	5	4									5
	3 Climate		100	5										5
	4 Forest Vegetation		100	5			2							5
	5 Fauna		95	5	4									
	6 Plant Disease & Gulma		20	1	4									5
	7 Aquatic Ecosystem		56	3										
MAN MADE ENVIRONMENT	8 Irrigation System		60	3										
	9 Settlement		60	3		2								
	10 Agriculture / Sawah (Rice-Field)		40	2	3			1	1					
	11 Fishery & Husbandary													
	12 Home Stead Garden		60	3	2			1	1					
	13 Small Scale Industry			1										
	14 Transportation			2										
	15 Social Facility / Public facility			1										
SOCIAL ENVIRONMENT	16 Demography		72	4		2	1							
	17 Community & Culture		75	4	2									
	18 Religion		46	3										
	19 Social Relations		66	4										
	20 Economy		33	2	2			2	2					
	21 Institutional		30	2	3	4	3		3			3		
	22 Health		47	3		4					2	4	3	
	23 Education		50	3									3	

MATRIX 8.6 : MATRIX OF THE EVALUATION OF TIDAL SWAMP DEVELOPMENT AT TANJAN LUAR

COMPONENTS OF ENVIRONMENT			BASE LINE		THE ROLE OF THE TRANSMIGRATIONS ACTIVITIES									The Role of Natural Condition
			Percentage	Scale	1. Agriculture	2. Land Extension	3. Deforestation	4. Marketing	5. Trade Wagon	6. Non-Agricultural	7. Use of Drinking Water	8. M.C.K.	9. Waste Disposal ah	
NATURAL ENVIRONMENT	1 Water Quality	Physical Parameter	86	5								3		5
		Chemical Parameter	75	4	3							2	3	5
		Bacteriology	20	1								4	3	3
		Heavy Metal Parameter	99	5									2	5
	2 Soil Quality	pH (H_2O_2)	30	2										
		Soil Fertility	50	3	3									5
		Subsidence / Peat Thickness tlan Gambut	100	5	4									4
	3 Climate		100	5										5
	4 Forest Vegetation													
	5 Fauna		65	4	3									
	6 Plant Disease & Gulma		40	2	2									4
	7 Aquatic Ecosystem		60	3	2							2	2	4
MAN MADE ENVIRONMENT	8 Irrigation System		73,3	4										
	9 Settlement		40	2										
	10 Agriculture / Sawah (Rice-Field)		60	3	4			2	2					
	11 Fishery & Husbandary			-										
	12 Home Stead Garden		73	4	4			2	2					
	13 Small Scale Industry			3				2						
	14 Transportation			2				2	2					
	15 Social Facility / Public facility			5										
SOCIAL ENVIRONMENT	16 Demography		44	3				1		1				
	17 Community & Culture		80	4										
	18 Religion		100	5				2		2				
	19 Social Relations		86	5				2		2				
	20 Economy		53	3				3	3	3				
	21 Institutional		60	3				2		1				
	22 Health		87	5								3	4	
	23 Education		60	3								2	1	

9 CONCLUSION AND SUGGESTIONS

9.1 Conclusion

Activities to develop tidal swamps in the transmigration settlement units studied have had an impact on the environment. Environmental components undergoing the impact can be grouped under the following large categories : natural environment, man-made environment, and social environment.

It should be kept in mind that the study of the impact of efforts to develop tidal swamps in South and Central Kalimantan does not deal with the intensity of the impact, but merely evaluates factors that might have influenced environmental quality in such a way that it has reached the present stage. It can be stated in general terms that these factors in each transmigration settlement unit will be spelled out in the following sections.

1 Barambai

The quality of the natural environment in this unit can be specified as follows :

a Water quality in this unit can be classed as very good, which is mainly due to natural causes.

b Soil quality can be classed as reasonably good,

which is due to two factors :

- the role of nature, which is the most important in this case, in regard to pH and fertility;
- transmigration activities as far as thickness of peat is concerned, which include agriculture and forest clearing done wisely resulting in the desired peat thickness.

c The quality of other components of the natural environment, such as climate, forest vegetation, and fauna are reasonably good, which means that nature still has the capacity of maintaining quality as it is at present.

Man-made and social environments as they are now are reasonably good, and are to a great extent influenced by transmigration activities.

2 Jelapat

The situation is similar to Barambai : the quality of the natural environment can still be classed as reasonably good, due - as we know - to the intrinsic quality of the natural environment itself. In contrast, the quality of the man-made environment cannot be judged as good, which indicates that the way the population work the land needs improving. On the other hand, the quality of the social environment is reasonably good, although this is not always due to the efforts of the population

themselves, but rather to the facilities made available to them.

3 Purwosari

The physical quality of this unit is still reasonably good, despite the fact that it has been settled since 1937. The same applies to the man-made and social environments. The only difference is that the quality of the natural environment as it is has been the work of nature itself, while that of the two other kinds of environment is due to human activity.

4 Maliku

The quality of the natural environment is good, while that of the man-made and social environments is reasonably good. The quality of the natural environment as it now stands is mainly due to nature itself, whereas that of the man-made and social environment is brought about chiefly by transmigration activities.

5 Sebangau

It can be easily understood why the natural environment in this unit is in prime condition. At the time of the survey, this area had been settled for only six months, so that nature had not suffered

too much from human exploitation. Nature still plays a dominant role. On the other hand, the quality of the man-made environment is rather poor, which indicates the necessity to improve the activities of the population. The quality of the social environment can be said to be reasonably good, although this is due more to the facilities made available. The same applies to Jelapat.

6 Tamban Luar

In this unit, too, the quality of the natural environment can still be classed as good, whereas that of the man-made environment is rather poor. The quality of the social environment can be classed as reasonably good, which reflects the beginning of growth towards higher standards in the activities of the population. A transition towards urban characteristics is even noticeable in the social life of the population.

9.2 Suggestions for Management and Monitoring

At the end of this report, it would seem proper if suggestions were also put forward as to how to solve the problems found in the transmigration settlement units as set out above. Ideas which could serve as a basis for actions to improve the quality of life in the units will be propounded without leaving the facts as

actually found in the respective units.

1 Barambai

In this unit, components of the natural environment needing attention are soil pH, pests, and weeds.

Components of the man-made environment to which attention should be paid are housing, fishery, animal husbandry, small-scale industry, and transportation. In this connection, the farmers should be made more knowledgeable about better land cultivation technology to avoid the lifting of "cat clay". Another important thing that should be undertaken is the improvement of the pH quality of the soil through better drainage. Well-running drainage can wash the soil better with the result that the soil pH will increase. To contral pests and weeds, it is necessary to introduce varied crops, not merely rice. Besides secondary crops, fruit-bearing plants such as coconut, "rambutan", pineapple, and mango, could be cultivated.

It is hoped that the agricultural sector will produce a surplus, which will affect the population's earnigs favourably. If this can be realized, other branches of agricultural activities, such as fishery and animal husbandry, can be developed. Likewise, , activities in the tertiary

field , i .e. small-scale industry processing agricultural produce and transportation, can be set in motion. For this purpose, social institutions, such as cooperatives, will have to be given a more important role. It is obvious that to realize all that is envisaged above, actions - including constant monitoring - are a must, tasks which are not necessarily to be entrusted solely to the Ministry of Public Works. Other agencies could perform them as well. For instance, agricultural development can better be entrusted to the Ministry of Agriculture, while the development of formal institutions can better be tackled by the Home Ministry.

6 Jelapat

In this unit, components of the natural environment needing our attention are soil pH and forest vegetation. It is true that the latter can still be classed as reasonably good, but it is not so good compared with what can be found in other units, such as Barambai, Maliku, and Sebangau.

Components of the man-made environment needing special attention are housing and agriculture. The management of forest vegetation can better be done by the Ministry of Forestry, whereas information on farming methods and agricultural monitoring are

within the responsibility of the Ministry of Agriculture.

It seems quite possible that the low quality of housing is related to the low productivity of the farmers. Increasing agricultural productivity, then, must be the remedy.

3 Purwosari

In this unit, only soil pH, fishery, and animal husbandry are of poor quality. Ways to improve the pH quality of the soil have been put forward before. For this unit, priority should be given to diversification. Fishery and animal husbandry could be chosen for this purpose. Alabio ducks, quite well-known in Kalimantan, could be raised in this unit.

4 Maliku

Soil pH in this unit is quite poor. Beside, pests and weeds aggravate the situation. Equally poor is the man-made environment, particularly as concerns small-scale industry, transportation, social and general facilities. Ways to improve soil pH and to control pests have been brought forward. Als ways to develop small-scale industry and transportation. Measures that need to be taken here concern social and general facilities, for which purpose social

institutions have to be developed. Another important thing to be endeavoured is to encourage mixing among the ethnic groups.

5 Tamban Luar

In this unit, one aspect of the natural environment to which special attention should be paid because of its poor quality is the bacteria-infested drinking water. A simplle way to get rid of harmful bacteria in drinking water is by boiling it. Another obvious way is by asking the po;ulation not to use the water bodies too much for bathing, washing, and as a toilet. Through their social institutions, which need to be developed, the population should be given to understand that environmental quality has to be maintained to support their economic activities, which - in this unit - have reached a fairly high stage.

6 Sebangau

As the facts found in this unit are similar to those in Maliku, steps to be taken to enhance environmental quality do not differ much from those suggested for Maliku, i.e. priority should be given to the to the eradication of pests and weeds, the improvement of soil pH, and the development of small-scale industry and social institutions.

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