FEASIBILITY STUDY REPORT

ON

ALCOGAS PROJECT

IN

MARAGONDON, CAVITE

THE REPUBLIC OF THE PHILIPPINES

VOLUME I

MAY 1982

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

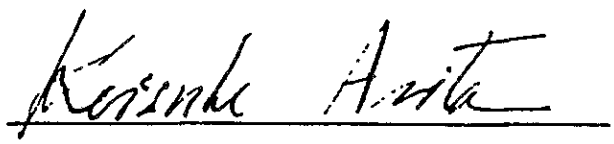
In response to the request of the Government of the Republic of the Philippines the Government of Japan decided to conduct a feasibility study on the Alcogas Project and entrusted the study to the Japan International Cooperation Agency (JICA). The JICA sent to the Philippines a survey team from June to August and November to December, 1981.

The team exchanged views with the officials concerned of the Philippine Government and conducted a field survey in the Maragondon area, Cavite. After the team returned to Japan, further studies were made and the present report has been prepared.

I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

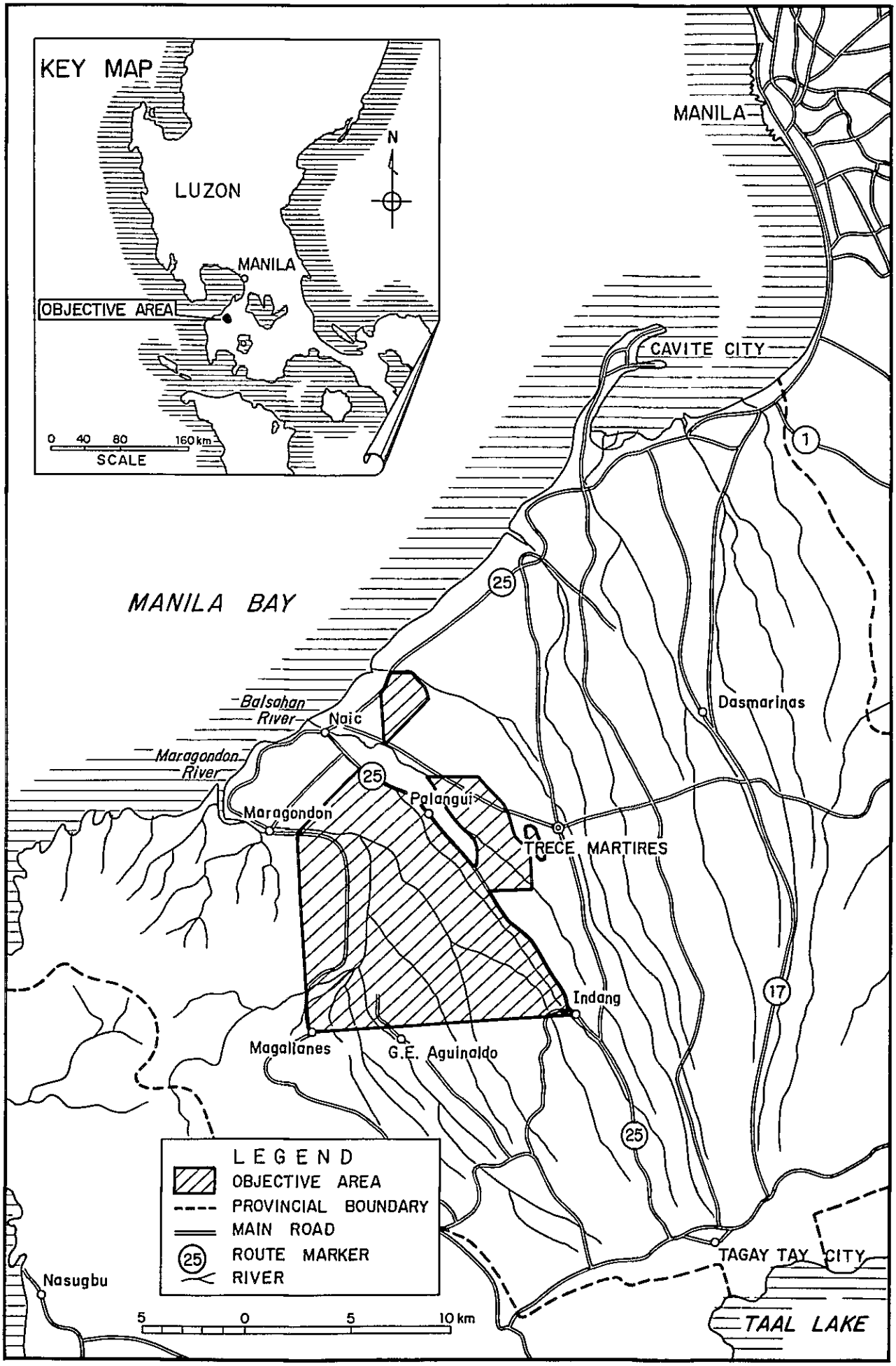
I wish to express my deep appreciation to the officials concerned of the Government of the Republic of the Philippines for their close cooperation extended to the team.

May, 1982



Keisuke Arita
President
Japan International Cooperation Agency

LOCATION MAP



ABSTRACT

1. Outline of Project

(1) General

1) Total Capital Investiment

Approx. 186 (10^6 pesos). In addition to this, governmental investiment of about 24 (10^6 Pesos) would be required.

2) Schedule

Start-up of Distillery is assumed January 1987.
(Construction period of four years will be required.)

(2) Agricultural

1) Farm Area

Estate area ..... 400 ha
Other farmers' land area..... 2,640 ha

2) Expected Sugarcane Yield

123,670 ton/year as total sugarcane yield from both estate and individual farmers' land.

(3) Industrial

Distillery

Plant capacity ..... 48 kℓ/day
Annual operating days ..... 200 days/year

2. Project Evaluation

(1) Economic Analysis

Results of economic analysis give EIRR value of 9.7% which implies that the project can create certain economic benefit to the country and therefore that it should be promoted for realization.

(2) Financial Analysis

Financial analysis gives FIRR on Investiment and FIRR on Equity of 9.2% and 16.8% respectively which imply that the project can have fair profitability if not very high.

FEASIBILITY STUDY REPORT
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WEIGHT AND MEASURES

Length and Height

mm	:	millimeter
cm	:	centimeter
m	:	meter
km	:	kilometer

Area

m^2	:	square meter
km^2	:	square kilometer
ha	:	hectare

Volume

lit,ℓ	:	liter
m^3	:	cubic meter
MCM	:	million cubic meter
MB	:	million barrel
MML	:	million liter
MMBOE	:	million barrels-of oil equivalent

Weight

g	:	gram
kg	:	kilogram
t	:	ton (= 1,000 kg)

Time

s,sec	:	second
min	:	minute
hr	:	hour
yr	:	year

Others

%	:	percent
ppm	:	pert per million
no(s)	:	number
KPH	:	knot per hour
°C	:	degree centigrade
m.eq.	:	milligram equivalent
Lat	:	latitude
Long	:	longitude
pcs	:	pieces
MMBOE	:	million barrels-of oil equivalent

Currency

SU$	:	US Dollar
₱	:	Philippine Peso

ABBREVIATIONS

ARBA	- Agrarian Reform Beneficiaries Association
ASCL	- Agricultural Sugar Crop Loan
ASTM	- American Society for Testing Materials
BAEcon	- Bureau of Agricultural Economics
BAEx	- Bureau of Agricultural Extension
BAI	- Bureau of Animal Industry
BOI	- Board of Investment
BPI	- Bureau of Plant Industry
BS	- Bureau of Soils
CBP	- Central Bank of the Philippines
FAO	- Food and Agriculture Organization
IRRI	- International Rice Research Institute
IRR	- Internal Rate of Return
JICA	- Japan International Cooperation Agency
K.K.K.	- Kilusang Kabuhayan at Kaunlaran
MA	- Ministry of Agriculture
MIA	- Manila International Airport
NASUTRA	- National Sugar Trading Corporation
NAWASA	- National Water Works and Sewering Authority
NCSO	- National Census and Statistics Office
NIA	- National Irrigation Administration
PAGASA	- Philippine Atomspheric, Geophysical and Astronomical Services Administration
PASTORA	- Planning Assistance Service to Rural Area
PHILSUCOM	- Philippine Sugar Commission
PNAC	- Philippine National Alcohol Commission
PNOC	- Philippine National Oil Company
RIS	- River Irrigation System
RPB	- Republic Planters Bank
SDT	- Sugarcane Developemnt Technologist
SN	- Samahang Nayon
USDA	- United States Department of Agriculture

INTRODUCTION

The Government of the Republic of the Philippines requested the Government of Japan to give a cooperation for execution of a feasibility study on the Alcogas Project as a part of the National Energy Development Program. In reply to the request the Government of Japan despatched the S.W. Mission to the Philippines and the Implementing Arrangement on the Alcogas Project in Dasmarinas, Cavite was agreed between the both governments on December 16, 1980.

After that the project site was changed from Dasmarinas to Maragondon by the request of the Philippine National Alcohol Commission (PNAC), and the Amended Implementing Arrangement was agreed between the both Governments on March 30, 1981.

The Japan International Cooperation Agency (JICA) despatched the survey team composed of the Agricultural Sector Team and the Industrial Sector Team to the Philippines and the Feasibility Study on the Alcogas Project In Maragaondon, Cavite was carried out from June, 1981 to March, 1982 in accordance with the Implementing Arrangement.

The JICA Team prepared and submit herewith the Final Report of the Feasibility Study on the Alcogas Project to PNAC.

BACKGROUND

1. National Energy Program

In the Republic of the Philippines the toatl crude oil consumption was 80.31 million barrels and it occupied 88% of the total commercial energy consumption in 1980 as shown in Table B-1. Out of the total oil consumption the production of domestic oil occupied only 10%. Consequently, the import bill of oil reached to US$2.688 billion and it compelled a deficit of US$2.179 billion in the merchandise trade in 1980 as shown in Table B-2.

To realize reduction of outflow of the foreign currency, the Government of the Philippines enacted the "Energy Five-year Program".

The Engergy Five-year Program shows that the total commercial energy is projected to rise from 91.76 million barrels-of-oil equivalent as of 1980 to 133.70 million barrels-of-oil equivalent in 1985 as shown in Table B-3. While the dependence on oil is projected to reduce from 88% as of 1980 to 55% in 1985.

The program of reducing imported oil is planned to increase production of domestic oil, coal and geothermal, hydroelectric, uranium and non-conventional energy as shwon in Table B-3. The non-conventional energy program is composed of alcogas, solar water heating and biogas programs.

2. National Alcogas Program

In February, 1980 the Government of the Philippines enacted the "Alcogas Five-year Program" through the creation of PNAC. This Alcogas Five-year Program was revised in its projection in June, 1981 in order to be corresponding to the circumstances of 1) reduce of gasoline demand 2) changes in the status of application of alcogas project proponents.

According to the Alcogas Program, hydrous alcohol is projected 234.3 million liters and will be blended in gasoline at a rate of 15% for vehicle fuel in 1985.

In order to meet the demand projected in the Alcogas Five-year Program, PNAC planned to establish 14 units of alcohol distillery by 1985. The distilleries are planned to be divided into three models.

Model I is a distillery attached to a existing sugar factory, having a capacity of 30 to 60 kℓ per day. This distillery will use by-product of sugar mill i.e. molasses as a row material.

Model II is a large scale distillery which is attached to the existing sugar factory or established indepently, having a capacity of 120 to 180 kℓ per day. The raw materials for alcohol production will be sugarcane or cassava and/or sweet potatoes.

Model III is a small scale independent distillery which will be established in a local region, having a capacity of 30 to 60 kℓ per day. The raw materials for this distillery will be sugarcane or cassava and/or sweet potatoes. The establishment plan of each model is shown in B-5.

According to the information of PNAC in December 1981, the progress of the Alcogas Program is as follows:

1) As of October, 1981, some 8.2 million liters of alcohol have been produced by the Victorias Milling Co., and sold as 15% alcogas blend in the whole province of Negros Occidental.

2) Feasibility studies which have been completed are as follow:

Study	Number
PNAC Proposed Feasibility Studies	None
Private Proponents	8

3) On-going feasibility studies are as below:

	Location	Implementing Agency
Model III	Canyan, Isabela	IFA GRARIA
	Ubay, Bohol	- do -
	Maragondon, Cavite	JICA

3. Governmental Measures for Promotion of the Alcogas Project

As shown in the first Alcogas Five-year Program enacted in 1980, total area of cassava and sugarcane required for alcohol production in 1988 is projected 262,800 ha. According to the government policy, the area for alcohol production should be selected the area of which does not disturb the national food and industrial plans.

To successfully implement the Alcogas Program, the Government decided the following incentive policies to alcohol processing investors.

1) Major incentives

- Deduction of pre-operating expenses
- Accelerated depreciation
- Net operating loss carry over
- Tax exemption on imported capital equipment
- Tax credit for withholding tax on interest
- Deduction for expansion reinvestments
- Exemption from government taxes (except income tax) on a graduated basis
- Deduction of labor training expense
- Preference in government loans
- Access to private finanical assistance
- Deduction of research and development expenses

2) Other incentives

- Anti-dumping protection
- Protection from government competition
- Post-operative tariff protection
- Exemption from minimum 10% compensating tax on imported capital equipment

PURPOSE OF STUDY

The purpose of this feasibility study is to clarify the feasibility on the agricultural and industrial development plan of raw materials and alcohol production by establishment of a distillery having a capacity of 30 to 60 kℓ of alcohol per days as Model III in Maragondon, Cavite.

To perform the above purpose, the Agricultural Sector Team and the Industrial Sector Team have carried out the studies with close coordination each other.

STUDY ON SUGARCANE PRODUCTION

SUMMARY AND CONCLUSION

Introduction

1. This is the final report prepared in accordance with the Implementing Arrangement on the Alcogas Project in Maragondon, Cavite which was agreed between the Japan International Cooperation Agency (JICA) and the Philippine National Alcohol Commission (PNAC) on December 16, 1980. This report covers the agricultural development plan which will be applicable to the objective project. The study of the Agricultural Sector was carried out from June 17 to September 8, 1981 in Phase I and from November 9, 1981 to February 12, 1982 in Phase II.

2. In the Phase I study, 1) Delineation of the Project area, 2) Selection of the most suitable crop for alcohol production among three candidate crops such as sugarcane, cassava, sweet potatoes, 3) Formulation of the basic agricultural development plan were carried out. As a result, the sugarcane was selected as the most suitable crop for alcohol production and 3,090 ha was delineated as the productive area for development. The study in the Phase II stage clarified more detailed conditions to be required for design of the production program. The proposed development plan on the agricultural infrastructure and prodution program on sugarcane was prepared with technical and economical soundness.

Objective Area

3. The objective area delineated is about 13,000 ha, administratively, the objective area extends over six municipalities and one city, namely Maragondon, Naic, Magallanes, G.E. Aguinaldo, Indang, Tanza and Trece Martires.

4. The topographic condition of the objective area is sloping from Tagaytay Ridge in Southeast to Manila Bay in the Northwest with slope of 2%. The plateau is highly dissected in parallel by the many stream, forming small lands with steep slope or escarpment at their edge.

The soils in the Maragondon area are classified into three series; Guadalupe Series, Magallanes Series and Tagaytay Series. The soils of Guadalupe Seires which occupy 17% of the total area are suitable for

sugarcane but not suitable for cassava and sweet potatoes due to heavy subsoils. The soils of Magallanes Series occupy 68%, suitable for almost all upland crops except at very shallow soils. The soils of Tagaytay Series occupy 15%, suitable for almost all upland crops.

5. Climate of the objective area is governed by the tropical monsoon climate consisting of two distinct seasons, i.e. a dry season and a wet season. The mean annual reinfall varies from less than 2,100 mm in the northern portion to over 3,000 mm in the southern mountainous portion. Out of total rainfall through a year, about 90% of rainfall precipitates in the wet season.

6. There are two major rivers, the Maragondon river and the Balsahan river, flowing through the objective area. These rivers and their tributaries dissect the land into many small lands in parallel. Annual mean discharge values of the Maragondon is 14.5 m^3/sec, and annual maximum and minimum dischargesare 31.4 m^3/sec, 4.7 m^3/sec, respectively. While, annual mean discharge values of The Balsahan is 1.54 m^3/sec and annual maximum and minimum discharges are 2.8 m^3/sec, 0.5 m^3/sec, respectively. According to the record of the National Irrigation Administration (NIA), the potential ground water recharge for the Cavite area is estimated at 25 MCM/year.

7. Population in the six municipalities and one city concerned with the objective area are 158,810 in 1980 and the population density is 262 persons per km^2.

8. Land use in the objective area is divided into three groups. The perennial crop fields which are cultivated with coconuts, mango and banana, etc. extend over the higher part of the area.

The upland crop fields which are cultivated mainly with upland rice, sugarcane, cassava and peanuts extend over the middle part of the area.

The Northern part of the area is mainly cultivated with low land rice.

Selection of Crop

9. The selection of the most suitable crop for alcohol production among three candidate crops such as sugarcane, cassava and sweet potatoes was carried out by comparative studies on suitability to soils, resistance to typhoon, potenciality of yield, alcohol productivity, energy consumption for crop production, labor requirement, industrial crop cultivation technology, etc. And it was concluded that the sugarcane is the most suitable crop for alcohol production in the Maragondon area. In accordance with this conclusion all studies including the agricultural developmemt plan of the project area were carried out on sugarcane prodution.

Project Area

10. The project area was delineated on the basis of land suitability conditions for sugarcane cultivation. The total project area is 4,000 ha in gross, 3,090 ha of net cultivable land. Administratively, the project area extends over five municipalities and one city, namely Maragondon, Magallanes, Naic, Indang, Tanza and Trece Martires.

11. The Population in the project area is estimated at 6,260 in 1980. The population growth rate is 2.87% per annum from 1975 to 1980. The population density of the project area is estimated at about 202 persons per km^2. The total house holds are estimated at 1,079. An average family size is 5.8 persons.

12. The total farm house holds in the project area are estimated at about 860, comprising about 5,000 in population.. Labor force available in the project area is estimated at 379,600 man-days/year.

Based on the results of the farm economic survey, it is estimated that the average farm size in the area is 2.6 ha, except big owners' farms. The farmers in the project area are categorized into three types of typical farmers according to the farm size, tenurial status and land use categories.

13. Major crops grown in th project area are upland rice and sugarcane. Generally the farming practice for crop cultivation are still primitive.

Upland rice is grown from late May to early November. A cultivation practice of sugarcane consists of one plantcane and three ratoon canes followed by upland rice in five years. Planted area, unit yield (tons per hectare) and production of upland rice are 1,900 ha, 0.6 ton/ha and 1,140 tons, respectively, and those of sugarcane are 550 ha, 37 ton/ha and 20,350 tons.

14. Sugarcane produced by planters in the project area is transported and sold to the Canlubang Sugar Mill in Laguna Province which is located about 50 km far from the project area. Upland rice, corn and cassava are used for self consumption.

15. Cropping area of sugarcane in the project area has decreased to less than half in three years from 1978 to 1981 due to lower price of sugar, higher price of farm inputs, and higher transportation cost from farm to the mill.

Taking these matters into consideration, the financial price of sugarcane at farm gate is adopted ₱160/ton excluding transportation cost from farm to the mill.

16. As to the farm budgets of typical farmers in the project area, all types show marginal balnace due to low yields of crops.

Agricultural Development Plan

17. Sugarcane development plan is made dividing into two production systems, i.e. production by the individual farm and the estate farm.

18. The area of the individual farm in the project area is 2,640 ha and that of estate farm is 400 ha, total 3,040 ha in net. Cropping pattern for the individual farm is three canes consisting of one plantcane and two ratoons followed by upland rice.

Varieties of average 12 month growth period cane is proposed. Planting will be done from Novermber to February, harvesting from Novermber to May. Fertilizers will be used 180 kg of nitrogen, 80 kg of phosphate per hectare for Guadalupe seires soil and 140 kg of nitrogen and 80 kg of phosphate for Magallanes seires soil. Harvesting will be done by manual.

19. The cropping pattern for the estate farm is proposed continuous three cane cropping system. The proposed farming practices are almost same as those of the individual farm other than more higher mechanization.

20. Yield of agricultural production of the project area will remarcably increase under with-project condition. The necessary years for yield development are projected four years for the individual farm and three years for the estate farm. The production of sugarcane at the full development stage is projected at 100,740 tons in the individual farms and 22,930 tons in the estate farm, total 123,670 tons.

21. Harvesting and transportation program of sugarcane should be made to be coressponding to the operation program of the distillery. As capacity of the distillery is 48 kℓ/day, 610 tons of sugarcane should be harvested and transported to the distillery a day, 35 numbers of six-ton trucks are needed at a rate of three trips of each truck. Those trucks will be provided by the distillery.

Infrastructure and Farming Facilities

22. Existing national and provincial roads are used for transportaion of raw materials and farm inputs. For smooth and successful operation of the project the following road network is planned.

1) Two main orads with 6 m width, asphalt pavement, total length of 3.9 km.
2) 104 numbers of secondary roads with 3 m width, gravel pavement, total length of 118.2 km
3) Farm roads in the estate farm with 3 m width, dirt road, total length of 9.1 km
4) As related structures, 2 bridges and 8 box culverts and 15 pipe culverts.

23. Land consolidation works are planned to be made in the proposed estate farm. For the farms other than the estate farm, no land consolidation will be made.

24. The time reguired for construction of the infrastructural works of the project is estimated to be 41 months, including the time necessary for both the preparatory works and the main construction works.

25. No irrigation facility is to be made in the project area. However, the waste water of the distillery will be diluted by water and spread over 40 ha of cane field by sprinkler in the estate farm.

26. The following facilities necessary for farm management of whole project area will be constructed in the estate farm site. One field office, one warehouse, one garage, one work shop and 3 living guarters. For farming practice and management, 5 tractors and 4 sets attachments for tractor, 40 trucks, one jeep and 5 motorcycles will be provided.

27. For farm management, an agricultural department consisting three sections will be organized in the estate farm. Total numbers of staff are 61 including 38 drivers, 5 tractor-operators and 4 permanent laborers.

Agricultural Support System

28. PHILSUCOM is taking important role on research and extension services for sugarcane development. The district office conducts adaptability test of new varieties which are bred in the breeding station in Pampanga province. Research works for crops other than sugarcane are conducted by Ministry of Agriculture (MA). Research on sugarcane for alcohol production is still not undertaken. The extension service activity in the project area is not active. It is desired to increase number of Sugarcane Development Technologist (SDT) in order to diffuse the improved farming techniques to the farmers. Appropriate command area per SDT would be about 500 ha of sugarcane field.

As for credit of sugarcane planters, the Republic Panters Bank (RPB) provides crop loan called Agricultural Sugar Crop Loan (ASCL). Most of the farmers in the project area will not be able to utilize this privillege of ASCL because they have not had any experience of sugarcane cultivation. It is recommended to provide ASCL to farmers in order to ensure the successful implementation of the project.

29. Farmers in the project area will organize their own organization under the help of the agriculture department in the distillery. For smooth and efficient operation of the sugarcane production, it is recommended that the distillery and the farmers' association should be closely interlinked.

30. In view of the present sugarcane researches which are done for sugar production, researches on sugarcane for alcohol production are very important and urgent matter. To succeed the project establishment of a pilot farm in the estate farm or around the project area is recommended.

31. Total construction costs of the individual farm and the estate farm development including direct construction cost, compensation cost for lands, procurement cost of farm machinery and equipment, engineering and administration cost, physical contingency, and price contingency are estimated as follow.

Unit : ₱1,000

	Foreign Currency	Local Currency	Total
For Individual farm	10,460	13,940	24,400
For Estate farm	13,721	16,092	29,813
Total	24,181	30,032	54,213

32. The annual operation and maintenance costs of the individual farm and the estate farm are estimated at ₱785 thousand and ₱3,449 thousand, respectively.

Evaluation

33. The financial aspects is evaluated by calculating the capacity to pay to confirm the soundness of the project from the farmers' viewpoint. From the results of farm budgets analysis in both with and without project conditions, the annual net reserve or capacity to pay under with project condition will be ₱555 on the typical farmer of Type I and ₱2,766 on Type II and ₱5,606 on TYpe III, respectively.

34. The annual operation and maintenance cost for the road constructed in the individual farm estimated at ₱297 per hectare. This amount of charge to be collected from the farmer and/or the land owner would have to be within a reasonable range.

35. The annual repayment of the capital cost for the individual farm development is estimated around ₱1,480 per hectare. It is very hard to cover this payment with the net reserve or capacity to pay of the typical farmers and the land owners.

36. The indirect benefits of the project are 1) Much increase of employment opportunity occurred by the project and 2) Improvement of local transportation. The incremental farm labor requirement is estimated at 145,000 man-day per annum in the project area. The road construction in the project area will be used not only for cane-transportation but also for another local economic activities. This means the road will contribute to local people's life in and around the project area.

RECOMMENDATIONS

To be successful implementation of the project the follwing items are recommended.

1. To commence the research works on sugarcane for alcohol production.

2. To strengthen the extension services to the sugarcane cultivation farmers.

3. To strengthen the credit services to encourage the farmer's intention for sugarcane cultivation.

4. To obtain strong support of the government to the executing agency of the project.

CHAPTER 1 INTRODUCTION

1.1 General

This is the final report prepared in accordance with the Implementing Arrangement on the Alcogas Project which was agreed between the Japan International Cooperation Agency (JICA) and the Philippine National Alcohol Commission in December 16, 1980.

This report presents the agricultural development plan which will be applicable to the objective project.

In the course of the formulation of the said development plan, the investigation and the study were made through Phase I and Phase II stages scheduled from June 17 to September 8, 1981 and from November 8, 1981 to February 12, 1982, respectively.

In the Phase I stage, the study was mainly concentrated on; (1) demarcation of the development area, (2) selection of the most capable product among such specific crops, sugarcane, cassava, and sweet potatoes, and (3) formulation of the basic development plan.

Sugarcane was taken up as the most suitable product in the objective area and 3,090 ha is delineated as the productive area for development.

The study in the Phase II stage clarified more detailed conditions to be required for design of the production program. The proposed development plan on the agricultral infastructure and production program on sugarcane was prepared herein with the technical and economical soundness.

JICA Team would like to express their gratitude to Mr. H. C. Zayco, PNAC Executive Director, Governor of Board of Investment (BOI) and Dr. E. L. Rosario, PNAC Deputy Executive Director, Mr. N. Balce, PNAC Chief of Industrial Service from the Philippine National Oil Company (PNOC) and all counterparts of PNAC to their cordial activities to the survey team.

JICA Team would also like to gratefully acknowledge the kind assistance and support by the staff of all government and administrative offices concerned.

1.2 Members Assigned

The members assigned for the Feasibility Study on the Alcogas project through Phase I and Phase II are as follows:

(1) JICA Team

1) Advisory Committee

Mr. M. Hiura	Chairman of Committee
Mr. H. Maeda	Member of Committee
Mr. T. Miyazaki	- do -
Dr. K. Muto	- do -
Mr. T. Kawakita	- do -
Mr. Y. Harada	- do -

2) Survey Team

Mr. M. Shimamura	Team Leader	(Phase I, II)
Mr. K. Sakata	Agronomist	(- do -)
Mr. M. Matsui	Pedologist	(Phase I)
Mr. M. Iwama	Land Consolidation & Irrigation Engineer	(Phase I)
Mr. K. Inoue	- do -	(Phase II)
Mr. I. Inamori	Hydrologist	(Phase I)
Dr. R. Takahashi	Biochemist	(- do -)
Mr. M. Ishizuka	Agro-economist	(Phase I, II)
Mr. K. Fukuda	Geotechnical Engineer	(Phase II)
Mr. Y. Ibusuki	Servey/Design Engineer	(- do -)
Mr. I. Sakamoto	- do -	(- do -)

3) Philippines Counterparts

Dr. E. L. Rosario	Deputy Exec. Director	
Mr. R. B. Carating	Project Coordinator	(Phase I, II)
Ms. P. G. Librando	- do -	(- do -)
Mr. C. Herrera	Agronomist	(- do -)
Mr. S. Arandia	Pedologist	(- do -)
Mr. D. F. Valenzuela	Irrigation Engineer	(Phase I)
Ms. T. Cutaran	- do -	(Phase II)
Mr. P. Evangelista	Hydrologist, Geologist	(Phase I, II)
Mr. P.H. Espiritu	Biochemist	(Phase I)
Ms. E. Abastillas	Agro-economist	(Phase I, II)
Mr. W. Reodica	Survey/Design Engineer	(Phase II)

CHAPTER 2 OBJECTIVE AREA

2.1 Location

The objective area is located at Maragondon, Cavite Province, Luzon Island, 50 km southwest from Metro Manila. It extends between 14°10' and 14°25' North Latitude and between 120°45' and 120°55' East Longitude.

The area which was tentatively demarcated is about 13,000 ha. Administratively, this area extends over six municipalities and one city; namely Maragondon, Naic, Indang, Magallanes, Tanza, G.E. Aguinaldo Municipalities and Trece Martires City.

2.2 Natural Resources

2.2.1 Topography

The objective area is situated on the volcanic plateau formed mainly by Taal Volcano, sloping from Tagaytay Ridge in the southeast to Manila Bay in the northwest with slope of 2% on an average. The elevation ranges from 10 m to 300 m above the mean sea level. The plateau is highly dissected in parallel by the many streams, forming small lands with steep slope or escarpment at their edges. The streams are narrow and deep, and discharge is little in the dry season.

2.2.2 Climate

(1) The weather of the area is governed by a tropical monsoon climate consisting of two distinct seansons, i.e. a dry season and a wet season. The climate of the Philippine Archipelago as a whole can be roughly divided into four zones according to the characteristics of rainfall distribution. The objective area lies in what is referred to as the first type zone which is identifiable by dry weather from Nomvember to April borne by prevailing northeasterly winds, while a southwesterly wet monsoon imposes a rainy season from May to October. The teperature, relative humidity, wind velocity, sunshine hours and evaporation obtained from MIA/1 are summarized as follows.

/1 : MIA - Manila International Airport

Monthly average temperature	Max. 29.5°C in May Min. 25.3°C in Jan.
Monthly average relative humidity	Max. 83% in Aug. Min. 65% in April
Monthly average evaporation	Max. 177.3 mm in April Min. 91.9 mm in Nov.
Monthly average sunshine hours	Max. 8.6 hr in April Min. 5.5 hr in Aug.
Monthly average wind velocity	Max. 9.0 KPH in Apr. Min. 4.0 KPH in Oct.
Average annual evaporation	1,516 mm

(2) Rainfall

The mean annual rainfall varies from less than 2,100 mm in the northern portion to over 3,000 mm in the southern mountainous portion. The variation is caused by the effect of the topography. Average monthly rainfall reaches a maximum of 752,4 mm in August, and drops to minimum 2.6 mm in February. The southwesterly monsoon brings an abundance of rainfall from May to October, with 92% of the entire yearly precipitation occurring during this period.

(3) Typhoon

The Philippine Archipelago is generally affected by typhoons and tropical cyclones 20 times or more per year. The maximum record wind velocity for such storms is 323 KPH over the sea, and 275 KPH on land. The maximum daily rainfall record for typhoon born precipitation is 995 mm. Central Luzon including the objective area, however, is affected less frequently by typhoon than Northern Luzon. The heavy rainfall and high winds accompanying the more severe typhoons sometimes cause serious damages to crops and property.

2.2.3 Geology

Cavite Province including the objective area is characterized by volcanic rocks of phroclastic fragments derived from Taal Volcano. In other words, geological property of the area consists of igneous and sedimentary rocks, and the objective area was identified as Taal Tuffs.

Taal Tuffs are very extensive, thick, consisting mostly of laminated ash and black cinder masked the lower elevation or lowlands.

The geological component at the proposed bridge sites is weathered-tuff and tuffbreccia which are strong enough to support the bridge foundation.

Suitable gravel and sand for construciton materials are found only on the Maragondon river. Hard andesitic or basaltic volcanic gravel is found on the Pingsanghan river, the distributary of the Maragondon river. Black sand mixed with cement is found on the downstream of the Maragondon river.

2.2.4 Soils

The field survey was carried out over the total area of about 13,000 ha using the topographic maps on a scale of 1/50,000 as the base map.

(1) Soil Calssification

Soil calssification on the soil series level established by the Philippines is available. Three soil series are identified in the objective area as follows:

1) Guadalupe series
2) Magallanes series
3) Tagaytay series

They are, furthermore, classified into soil phase for practical use based on the slope and effective soil depth which is defined as the depth up to base rock or hard pan in which plant roots can not penetrate. Eleven soil phases are identified in the objective area. The area of each soil phase and its extent are summarized in Table 2.2.1 and mapped in Fig. 2.2.1.

Guadalupe Series

The soils in this group extend over the flat to gently sloping lands lying on the lower portion of the plateau. The lands covered with these soils are about 2,250 ha or 17.3% of the objective area. The soils have deep effective soil with fine texture throughout the profile. However, these soils will become hard and compact and large crack occurs in the dry season.

Magallanes Series

The soils in this group develop over the flat to undulating land above Guadalupe series in elevation. The lands covered with these soils amount to about 8,880 ha or 68.3% of the objective area.

Tagaytay Series

The soils in this group are volcanic ash soils extending over the highest portion of the sloping plateau. The land of this series is about 1,870 ha or 14.4% of the objective area.

(2) Land Classification

The land suitability is classified by the application of the following publication with some adjustments to suit to the local conditions.

1) Procedure of Productive Capability Classification of Land: Ministry of Agriculture, Forestry and Fishery of Japan,

2) Land Capability Classification: Soil Conservation Service, U.S. Department of Agriculture.

Description of Land Classes

Lands in the objective area are classified into five suitability classes, I, II, III, IV and V. Each class is defined as follows:

Class I : Lands have almost no limitations of hazards for crop production and/or risks of soil damage.

Class II : Lands have some limitations or hazards and/or risks of soil damage, and some improvement practices are required for normal crop production.

Class III : Lands have many limitations or hazards and/or risks of soil damage, and fairly intensive improvement practices are required.

Class IV : Lands have greater natural limitations and/or risks soil damage than those in Class III, but can be cultivated for some crops under very careful management.

Class V : Lands have severe limitations that preclude their use for agricultural production.

(3) Land Suitability for Sugarcane

The lands of Class I and II are suitable for the cultivation of sugarcane, and extend over 3,880 ha or 29.9% of the objective area. They have almost no limitations or hazards for sugarcane production and risks of soil damage. However, the lands of Class II which consist of Guadalupe series have unfavorable subsoil of heavy texture affecting tillability and drainability in the wet season.

The lands of Class III are covered with flat and sloping-shallow phase of Magallanes series, and have shallow effective soil depth underlain by the consolidated tuffaceous rock. They extend over 3,890 ha or 29.9% of the objective area. They have moderately severe hazards of drought in the dry season and risks of soil erosion in the wet season. When these lands are cultivated, a contour farming to prevent sheet erosion should be practiced.

The lands of Class IV and V are not suitable for the cultivation of crops because of very shallow effective soil depth, severe susceptivility ot water erosion, severe effect of former erosion such as the outcrops of bedrock, steep slope and vallley bottom. They extend over 5,230 ha or 40.2% the objective area.

The detailed feature of the above are shown in Table 2.2.2.

2.2.5 Hydrology

A number of rivers flow through the objective area, including the Maragondon, Balsahan, and Alemang rivers and principal tributaries of the Balayungan, Clong clong and Sahing rivers.

(1) Discharge Characteristics

The annual and monthly average discharge values for the Maragondon and Balsahan rivers are summarized as shown in the following table:

Item	Maragondon River	Balashan River
Annual mean discharge	14.48 m^3/s	1.54 m^3/s
Annual max. discharge	31.39 m^3/s	2.78 m^3/s
Annual min. discharge	4.67 m^3/s	0.48 m^3/s
Annual mean specific runoff	1,756.31 mm	2,200.83 mm
Monthly max. discharge	187.20 m^3/s	17.89 m^3/s
Monthly min. discharge	0.58 m^3/s	0.02 m^3/s
Daily max. discharge	3,047.0 m^3/s	279.0 m^3/s
Daily min. discharge	0.195 m^3/s	0.004 m^3/s

The annual stream flow pattern varies widely according to the year. The wet season flow appears during the month of June through November. The drought flow appears during the months of January through April, especially the stream flow becomes extremely small in March and April. (See Fig. 2.2.3.)

The average drought/1, low/2 and ordinary/3 river discharge past 30 and 20 years are 1.33 m^3/sec, 2.33 m^3/sec, 4.20 m^3/sec at Mabacao (Maragondon) and 0.054 m^3/sec, 0.087 m^3/sec, 0.450 m^3/sec at Palangui (Balsahan).

/1 : Discharge with a probability of 355 days a year
/2 : Discharge with a probability of 275 days a year
/3 : Discharge with a probability of 185 days a year

Water conservation capacity of the basin is small, from the precipitation patterns and river condition, geological and topographical factors of the basin, basin size, shape, and plant covering point of view. Runoff coefficient is large; peak flood is of very short duration, and total surface runoff and flood discharge are extremely large. Furthermore, ground water recharge and storage capacity are small, while interflow of free water and evaporation are considerably large.

As a consequence, base flow is very small. Although discharge is large and water level is high during period of flooding, flood damage to the upland field has never occurred because of deep valley. Soil erosion, however, seems to be rather serious in the objective area owing to the large amount of surface runoff.

(2) Water quality

In the course of the field survey water samples were collected and their water quality analyses were conducted by the National Irrigation Administration (NIA) laboratory. In view of chemical characteristics all river water are within the tolerable limit of irrigation water and would serve as a satisfactory irrigation water source. However, sediment concentration on the Maragondon and Balayungan rivers has been recorded rather high value, this was considered as the effect of flood.

2.3 Infrastructure

2.3.1 Road Network

There exist two asphalt-surfaced national highways running through the objective area, i.e. one from the provincial capital of Trece Martires and the other from Tagaytay city. There are also a few provincial roads paved with gravel. All these roads lead to Naic, a major town around the area. The Province of Cavite has five major road development plans in and around the area, out of which two are under way. Under this plan, all the provincial roads will be surfaced with asphalt or concrete, and will be available as principal sugarcane transportation roads for the project together with the national highways.

Inside the objective area, transportation and communication are throught dirt tracks, bridle paths and existing canal banks, which are passable only during the dry season by heavy duty vehicles. Further, these tracks or paths are sometimes blocked by natural streams and rivers. Lack of adequate road networks inside the area, thus, has limited the opportunity for the agricultural development of the area.

2.3.2 Irrigation Facilities

There are five intake weirs in the objective area, which are directly providing irrigation water for about 3,300 ha of paddy fields. Besides, there are four supporting weirs diverting river water through tunnels to the intake weirs on different rivers. All of these river works are classified as River Irrigation System (RIS), and their operation and maintenance are conducted by NIA through Cavite Frair Lands Irrigation System. Though most of them are the structures constructed in the Spanish-governed period, they are still working effectively through regular maintenance and occasional rehabilitation.

There are no irrigation facilities in the upland area.

2.3.3 Land Consolidation

No significant land consolidation for upland area has been conducted in the objective area except a couple of private estate farms in which farmers made land consolidation in a small scale, and are taking an advantage of high productivity.

In the paddy field zone, there is well-organized land consolidation scheme which mainly owes to the distribution system of irrigation water.

2.4 Socio Economy

2.4.1 Demography

The total population of six municipalities and one city is 158,810 in 1980, occupying 20% of the total population in Cavite Province. Average population density in six municipalities and one city is 262 persons per km^2, which is only about half of average population density in Cavite Province. The population growth rate is 2.84% per annum from 1975 to 1980 in the six municipalities and one city. The population

growth rates of Maragondon, Trace Martires City, Naic and Tanza are relatively high at 3.97%, 3.56%, 3,48% and 3.15% respectively. In the other municipalities the population growth rate are rather low ranging from 0.76% to 2.23%. The basic socio-data in the related municipalities and city are summarized in Table 2.4.1.

2.4.2 Land Use

The land use in the objective area is studied by the interpretation of the areal photoes on a scale of 1:15,000 which were taken in 1978.. The land use is summarized in Table 2.4.2 and mapped in Fig. 2.4.1.

CHAPTER 3 SELECTION OF CROP

In the Phase I study, selection of the most suitable crop for alcohol production on the three candidate crops such as sugarcane, cassava, sweet potatoes was carried out as shown in Table 3.1.1, and concluded that the sugarcane is the most suitable crop for alcohol production in the Maragondon area. The details on the selection of crop are shown in Appendix I.

All studies including the agricultural development plan in the project area carried out in Phase II were done in accordance with the above conclusion.

CHAPTER 4 THE PROJECT AREA

4.1 Delineation of the Project Area

The project area is delineated on the basis of land suitability and socio-economic conditions/1 for sugarcane cultivation as shwon in Fig. 4.1.1.

The total project area is 4,000 ha in gross, 3,090 ha in net cultivable land.

Administratively, the project area is consisting of five municipalities and one city namely; Indang, Magallanes, Maragondon, Naic, Tanza and trece Martires City.

4.2 Population and Labor Force

The population in the project area is estimated at 6,260 in 1980. The population comprises 51% of male and 49% of female. For the age distribution, 42% of the total population is less than the age 14 and only 3% are above the age 65. The population growth rate is 2.87% per annum from 1975 to 1980. The population density of the project area is estimated at about 202 persons per km^2. Total household in the project area is estimated at 1,079. An average family size is 5.8 persons.

With regard to occupation, 80% of total households are farmers. Most of them are engaged in upland crops and perenial crops culture. In addition landless workers who make their living primarily as farm labors occupy about 17% of total households. These landless workers have played an important role in supply of farm labor force in the area.

Basic socio-economic data in the project area are summarized in Table 4.2.1.

/1 : The Triangle area of 300 ha located at the nothesat of the project area was delected on the reason that the area is prospected for industrial use.

4.3 Agriculture Condition

4.3.1 Land Use

The present land use of the project area is estimated as follows:

	Area (ha)		Proportional Extent (%)
Cultivation area	3,000		97.1
Upland rice		1,900	61.5
Sugarcane		550	17.8
Corn		350	11.3
Cassava		200	6.5
Other crop/1		100	3.2
Total of cropping area		3,100	100.3
Idle land	90		2.9
Total	3,090		100.0

The cropping intensity indicates at 1.0

/1 : It is grown after corn.

4.3.2 Land Holding and Tenure

There are three big owners in the project area. They own or keep leased land totaling about 950 ha which is about 20% of the project area. Remaining 80% are owned by absentee land-lords and small farmers.

The average farm size in the project area is about 3.7 ha. However, the average farm size which is excluded big owners' farm is 2.6 ha.

The farmers in the project area are categorized into three types of typical farmers as shown in the folloing table:

Type	Farm Size (ha)	Tenurial Status	Major Farm Products
Type I	2.0	Tenant	Rainfed Paddy, Cassava
Type II	2.5	Tenent	Upland Rice, Perennial Crop
Type III	2.7	Owner	Upland Rice, Perennial Crop

The farmers of Type I exist mostly at the north of the project area where the paddy field area fringes, Type II is found in the middle upland area, and Type III exists at the south of the project area where the perennial crop area surrounds.

Most of the farmers in the northern area and the middle upland area are tenants and most of the southern area are owner farmers.

4.3.3 Cropping Pattern,Farming Practice and Production

(1) Cropping Pattern

The present cropping pattern of the project area is shown in Fig. 4.3.1. Upland rice occupies 62% of the project area and is grown from late May to early November, corn is grown 11% from June to September followed by peanut cultivation of 100 ha from late October to middle of February. Sugarcane consisted of one third of plant cane and two thirds of ratoon canes occupies 18% of the project area. Cassava is cultivated 7% of the total area from June to March.

(2) Farming Practices and Production

The present farming carried out by the farmers in the project area is still primitive except for sugarcane which is produced by the big farms.

The present crop yield per hectare and production are as shwon in the following table:

Crop	Area (ha)	Av. Yield (ton/ha)	Production (ton)
Upland rice (paddy)	1,900	0.6	1,140
Sugarcane	550	37.0	20,350
Corn	350	0.55	193
Cassava	200	5.4	1,080
Other crop (peanut)	100	0.53	53

4.4 Marketing and Price

4.4.1 Marketing of Agricultural Output and Inputs

(1) Marketing Structure of Sugarcane

Sugarcane produced by planters in the project area is collected and milled at the Canlubang Sugar Mill in Laguna province which located about 50 km far from the project area. Canlubang Sugar Mill contract with planters on production of sugarcane. The sharing arragement between planters and the mill is 68 : 32. The sugar produced by Canlubang Sugar Mill is sold to the National Sugar Trading Corporation (NASUTRA), which is the subsidiary of the Philippine Sugar Commission (PHILSUCOM) for controlling the sugar price and the amount to be sold. A part of the sugar is exported overseas and a part is distributed to domestic consumption or reserved by NASUTRA.

(2) Other Agricultural Products

Through the farm economic survey, it was confirmed that most of agricultural products such as upland paddy, cassava, corn in the project area are used for home consumption, and peanuts are sold in local market or to buyers.

(3) Situation of Sugarcane Production

The cropping area of sugarcane and its production have decreased about 20% in three years from 1976/77 to 1979/80. The sugarcane area was about 1,200 ha in the project area in 1978 as shown in the land use map Fig. 2.4.1. However, it was confirmed through field investigation and farm economy survey that the sugarcane area have decreased to less than half or 550 ha in 1981. The reasons of this decline of the sugarcane area are summarized as follows:

1) Lower price of sugar
2) Higher price of farm inputs
3) Higher transportation cost from farm to the mill

(4) Distribution of Agricultural Inputs

The planters in the project area use previously harvested cane top or stalk as sugarcane-setts for new planting. Fertilizers, agricultural chemicals and feeds for livestocks are distributed to the farmers by 15 dealers in the municipalities and city related to the project area.

4.4.2 Prices of Agricultural Products and Inputs

The financial prices of farm products and inputs at farm gate are estimated based on the information obtained from the governmental agencies, farm economic survey, and local market survey. The estimated financial prices of farm products and inputs are shown in Table 4.4.1.

The financial price structure of sugarcane is shown in Table 4.4.2. The present sugarcane price at farm gate in the project area is estimated at ₱125/ton. However, this price discourage farmer's intentions for sugarcane production as mentioned before. Taking these matters into consideration, the financial price of sugarcane at farm gate is adopted ₱160/ton as the price which is not include the transportation cost from farm to the mill. This price would encourage the farmer's intentions for sugarcane production in the project area. Further, the price is confirmed on the farm budget analysis in Chapter 7 whether the farmers will acquire enough net reserve or not in future with project condition. The transportation cost from farm to the distillery will be borne by the distillery.

4.5 Farm Economy

The farmers in the project area are categorized into three types acording to the farm size, tenurial status and land use categories as mentioned previously.

Farm budgets for three types are summarized as shown in the following table.

Unit : ₱1,000

	Type I	Type II	Type III
1) Gross Income	10.8	10.7	11.1
- Farm income	4.2	4.2	5.6
- Off-farm income	6.6	6.5	5.5
2) Gross Outgo	10.8	10.7	10.9
- Production cost	2.2	2.1	2.3
- Living expenses	8.6	8.6	8.6
3) Net Reserve	0	0	0.2

The characteristics of the farm economy are :

1) The typical farmers in the project area remain on the subsistence level, especially Type I and Type II.

2) About a half of the gross income deriverd from off-farm incomes consisting of wage earning from farm work, nonfarm work and remittance from their family working at Metro Manila or abroad.

3) In spite of sufficient family labor, farming works such as transplanting, weeding, harvesting and threshing, which require much labor requirement, have been traditionally carried out by hired labors.

CHAPTER 5 AGRICULTURAL DEVELOPMENT PLAN

5.1 General

The sugarcane production and transportation plans of the project area are established to be corresponding to the operation program of the distillery.

Production plan of sugarcane is divided into two system; by an individual farms and an estate farm.

(1) Individual Farms

Most part of sugarcane production is planned by cultivation of the individual farms under contract with the distillery. Harvesting and transporation of the products will be carried out in accordance with the plans established by the distillery.

(2) Estate Farm

An estate farm is provided by the distillery to produce raw materials himeself. The 400 ha cultivable land will be prvided in Halang area, and constructed road networks and facilities necessary for management in farm site.

5.2 Cropping Pattern and Farming Practices

5.2.1 Cropping Pattern

To coincide the operation of the distillery, planting of sugarcane will be done from November to February and harvesting from November to May. Ratooning follows immediately after harvesting of previous crop. In the individual farms, sugarcane cultivation completes with one plantcane and two ratoon canes by the end of May, then upland rice will be grown from June to October followed by new plantcane. While in the estate farm the cropping pattern with one plantcane and two ratoons, no other crop is proposed. The feature of the proposed cropping pattern is shown in Fig. 5.2.1.

The cropping area under the above cropping pattern in the project area will be as follows:

Unit : ha

	Sugarcane	Other Crop	Total
Individual farm	1,980	660	2,640
Estate farm	400	-	400
Total	2,380	660	3,040

5.2.2 Farming Practices in Individual Farm

The planters in the project area would practice the following farming practices.

(1) Variety

Phil-56226, Phil-58260 which are popular varieties are recommended, but since these varieties have been bred aiming at the higher sugar production, after selection of varieties to be suitable for alcohol production these varieties should be changed.

(2) Fertilization

For sugarcane 180 kg of nitrogen and 80 kg phosphate per hectar for the soils of Guadalupe series and 140 kg of nitrogen and 80 kg of phosphate for the soils of Magallanes series are proposed referring to the recommendation of PHILSUCCOM. According to the recommendation of PHISUCOM no potassium fertilizer is required.

(3) Land Preparation

Since most of the area belong to the Magallanes soil series of which the effective depth of soils is shallow, deep plowing may prove detrimental to the crop. While, the area of Guadalupe soil series has deep soil, deep plowing will be efficient. The farmers will use hired tractor due to high efficiency for land preparation of sugarcane cultivation. Fortunately, it will be easily available from paddy field because of off-season of paddy cultivation.
In view of the topographic and soil conditions, contour farming should be practiced.

(4) Planting

Planting will be done with spacing of 100 cm row to row, rate of 37,500 cane setts per hectare.

(5) Cultivation and Weeding

The soil is cultivated with cultivator pulled by a tractor for the purpose of loosing soil and killing weeds 3 weeks after planting. Hired animal-drawn plow is also used for cultivation. Two times of hilling up is done 7 weeks after planting and 16 weeks after planting.

(6) Harvesting and Ratooning

Optimum harvesting time is decided by checking Brix in the field and visable observation of cane. Sugarcane is harvested manually by cane knife. Mechanical harvestor is not use because of land conditions. Harvested cane is immediately transported by truck to the distillery to prevent sucrose deterioration.

After harvesting of cane, ratooning is done by stable shaving of the previous crop for good shooting.

For ratoon cane same amount of fertilizer is applied.

(7) Disease Control

Protection methods from smut recommend by PHILSUCOM are use of resistant varieties, prohibition of ratooning of the infected cane field and soaking of cane-setts with solution of Orthocide 75 (Captan) in one minute before planting.

5.2.3 Farming Practices in Estate Farm

(1) Farming Practices

The farming practices for the estate farm are basically same as that of the individual farm except for operation with more higher mechanization and partinent farm management.

(2) Establishment of Nursery

At average planting rate of 37,500 cane-setts per hectare, the entire estate farm of 400 ha will require 15,000,000 cane-setts at the commencement year. These setts will be produced in the nursery of 40 ha. To produce the required cane-setts from the nursery farm it must be established in May exactly six months ahead of the schedule planting month of the raw material production field in November. Cane-setts for 40 ha of nersery should be purchased from PHILSUCOM's nursery farm or the ordianry sugarcane field in and around the project area.

5.3 Anticipated Yield and Production

5.3.1 Anticipated Yield of Individual Farm

The target yield of sugarcane in the individual farm area is estimated taking account of the yield records of Canlubang Sugar Mill and the MYC farm and furthermore the soil conditions, the proposed farming practices under with-project in the future as follows.

Unit : ton/ha

	Soil Class I and II (465 ha)	Soil Class III (2,175 ha)
Plant Cane	60	55
Ratoon Cane 1	55	50
Ratoon Cane 2	50	45
Average	55	50
Weighted Average	51	

Under the with-project condition, yields of cane from the initial yield to the target yield are forecasted as follows:

Unit : ton/ha

Soil Class \ Year	Present	Year 1	2	3	4
Soil Calss I, II (465 ha)	50	52	53	54	55
Soil Class III (2,175 ha)		40	43	47	50

5.3.2 Anticipated Yield of Estate Farm

The yields of the estate farm under the with-project condition from the initial yield to the target yield are estimated as follows:

Unit : ton/ha

Soil Class \ Year	1	2	3
Soil Class I, II (175 ha)	54	57	60
Soil Class III (215 ha)	43	49	55

5.3.3 Sugarcane Production

The total sugarcane production of the individual farms and the estate farm from the first year to the target year is projected as follows:

Farm \ Year		1	1	2	3	4	5	6	7
Individual Farm/1	(ha)/2		90	713	1,397	1,980	1,980	1,980	1,980
	(ton)/3		3,800	30,279	61,027	89,787	95,354	99,197	100,740
Estate Farm/1	(ha)		400	400	400	400	400	400	400
	(ton)		19,213	21,069	22,925	22,925	22,925	22,925	22,925
Total	(ha)		490	1,113	1,797	2,380	2,380	2,380	2,380
	(ton)		23,010	51,350	83,950	112,710	118,280	122,120	123,670
Percentage of Production			18.6	41.5	67.9	91.1	95.6	98.7	100.0

/1 : The amount of production is indicated with the fiscal year.

/2 : Area

/3 : Production

5.4 Change of Agricultural Production

Prevailing crop production consisting mainly of food grains at present will change into sugarcane production with the project in the future.

Despite that the big area of upland rice is decreased, total paddy production will be kept at the level of present condition due to high increase of the yield with introduction of improved farming practice and 103,320 tons of sugarcane production will be increased (see Table 5.4.1).

5.5 Transportation System of Sugarcane

Harvesting and transportation program of sugarcane will be established to be corresponding to the operation program of the distillery. Since the capacity of distillery is planned at 48 kℓ of alcohol production per day, 610 tons of cane should be harvested and transported to the distillery a day. For transportation of this amount, 35 numbers of six ton trucks are needed at a rate of three trips of each truck. These trucks will be provided by the distillery and the transportation program to collect sugarcane will also be executed by the distillery.

5.6 Infrastructure Development Plan

5.6.1 General

As explained in Appendix IV, the detailed investigations and studies on the project have revealed that the irrigation plan of the sugarcane farmers proposed in the Interim Report have some technical problems including existing water rights, limited ground water availability, etc., and are proved economically unprofitable. Further, it is concluded that no drains would be required for the project in view of the good drainability of the project lands mainly owing to the well-defined natural streams flowing in the area and rather steep slopes of the lands.

For the infrastructure development of the project proposed, accordingly, only the provision of a road network covering the whole project area and the land consolidation of the estate farm are to be established.

5.6.2 Proposed Road Network

The smooth and successful operation of the project depends on the existence of an adequate road networks in the project area, which can be effectively used for the transportation of farming materials and sugarcane products into or out of farms.

The proposed road network comprises 1) trunk roads, 2) main roads, 3) secondary roads and 4) farm roads. The trunk roads consist of the existing national or provincial roads including the roads which are presently under consturction or proposed to be constructed by the Provincial Government. All these roads are of all-weather type surfaced with asphalt or concrete, and have sufficient width for passage of trucks carrying sugarcane products under the project.

The main roads are to connect the trunk roads with the below-mentioned secondary roads, and are proposed to be provided almost perpendicularly to the trunk roads, traversing the project area from west to east. The main roads are planned to have an effective width of six meters with asphalt pavement so that trucks carrying sugarcane products can pass each other at an ordianry speed.

The secondary roads will branch off from the main roads and are provided so as to penetrate into respective blocks. The roads will have and effective width of three meters and gravel pavement.

The Farm roads are to connect the secondary roads with individual fields for the easier and speedy transportation of sugarcane products from the fields. The farm roads will also function as field boundaries as well as buffer lines in firing for sugarcane harvesting. The roads will be dirt roads formed on the ground surface, having a total width of three meters. They will be aligned to run parallel at an interval of 200 meters. Under the project, the farm roads will be provided only for the proposed estate farm. For the remaining areas, the roads are proposed to be constructed by concerned farmers themselves during the farming practices.

In connection with the road network, a large number of bridges and culverts of various types will be required where the roads cross natural streams or rivers.

The principal features of the proposed road network are summarized as the following table. More detailed explanations on the roads are given in Appendix IV.

Principal Features of Proposed Road Network

	Description	Number & Length
Trunk roads	. Existing national and provincial roads . Asphalt or concrete pavement . Effective width: 6 m	7 nos., 75.8 km
Main roads	. Asphalt pvaement . Effective width: 6 m	2 nos., 3.9 km
Secondary roads	. Gravel pavement . Effective width: 3 m	104 nos., 118.2 km
Farm roads	. For Estate Farm only . Dirt road . Width: 3 m	44 nos., 9.1 km
Related structures	. Bridges . Box culverts . Pipe culverts	2 nos. 8 nos. 15 nos.

5.6.3 Land Consolidation

The land consolidation works are planned to be made in the proposed estate farm in order to ensure efficient farming operations in the sugarcane farm. Under this plan, the farm will be divided into several farm blocks, each of which will be further divided into a number of field lots. Each field lot will have an acrage of 2 ha and a dimension of 200 m x 100 m in its typical shape, facing at least one farm road on its shorter side. Where any fields have an excessively undulated topography, such field will be graded by cutting higher points and filling depressions so that no drainage problem will occur and smooth and efficient farming operations can be secured.

For the farms other than the estate farm, no land consolidation works will be made under the project, but recommended to be executed by farmers themselves during the farming practices.

5.6.4 Implementation Schedule of Infrastructural Works

The time required for the construction of the infrastructural works of the project is estimated to be 41 months, including the time necessary for both the preparatory works and the main construction works.

The preparatory works are proposed to be started in January 1983 and completed by September of the same year, including detailed surveys, designs, preparation of tender documents, tendering and contract award. The main construction works are scheduled to start from the beginning of the dry season in 1983 and be executed for the consecutive three and a half years. The construction works will be concentrically carried out in the dry seasons, since no efficient construction operation can be expected during the rainy seasons. The whole construction works are scheduled to be completed by May 1986.

It is assumed that all the construciton works will be undertaken by contractors selected through a competitive bidding.

5.7 Estate Farm

5.7.1 Establishment of Estate Farm

In order to smoothly supply raw materials to the distillery, establishment of an estate farm belongs to the distillery is proposed.

5.7.2 Location and Land

The estate farm is located in the Harang area being adjacent to the MYC Farm. The land is relatively flat and consists of 190 ha of Guadalupe Soil Series (Class I and II) and 220 ha of Magallanes Soil Series (Class III).

5.7.3 Present Land Use

At present the lands are used for cultivation of upland rice, corn, cassava and other diversified crops, there is no sugarcane in the site.

5.7.4 Infrastructure and Facilities

In order to carry out the appropriate farming practices and to hence the productivity, the following construction plans of infrastructure and facilities will be carried out.

(1) Road Network

The secondary roads with 3 m-wide and 15 cm-thick gravel pavement are planned. The total length of the roads is 25,160 m.

(2) Land Consolidation

Land consolidation will be performed in conjunction with the farm road construction. No major earth works are expected.

(3) Irrigation

The provision of irrigation facilities in the estate farm is proved unprofitable due mainly to the limited availability of both the surface and ground water and to the complicated topography prevailing in the area.

(4) Waste Water Treatment

The waste water of the distillery will be diluted with water and will spread over the sugarcane fields of the estate farm. Sprinkler set will be used in order to ensure light-even application of the waste water over 40 ha of the sugarcane.

(5) Farming Machinery and Farming Facilities

Farming machinery and equipment to be provided are five wheel tractors and four sets of attachments to be pulled by tractor, 40 number of trucks (6-tons capacity), one Jeep and five motorcylces.

The buildings such as one field offices, one work shop, one warehouse, one garage and three living quarters will be constructed in the estate farm.

5.7.5 Sugarcane Production

Based on the soil condition and farming practices with project the sugarcane yield in the estate farm at the full development stage is projected at 22,900 tons.

Increase of yield from the initial year to the target year and annual production are projected as follows.

Soil Series \ Year		1	2	3
Guadalupe	Yield (t/ha)	54	57	60
Soil Series (185 ha)	Production (t)	9,990	10,545	11,100
Magallanes	Yield (t/ha)	43	49	55
Soil Series (215 ha)	Productin (t)	9.223	10,524	11,825
Total (400 ha)		19,210	21,070	22,900

5.7.6 Organization and Staffing

An agriculture department will be organized in the overall organization of the distillery. The Agriculture Department will be composed of three sections: (1) Estate farm secion, (2) Individual farm section and, (3) Mechanization section. Numbers of staff in the department will be 61 persons including 38 drivers and 4 permanent laborers.

5.8 Cost Estimate

5.8.1 Conditions

The cost for agricultural development plan mentioned above is estimated based on the following conditions.

1) The conversion rate between Peso and U.S. dollar is assumed at US$1.00 = ₱8.00 = ¥230.

2) All the construction works would be executed by full contract basis using contractor's own machinery.

3) The unit prices are divided into the foreign and local currency components. The ratio of foreign and local currency components of each unit price is estimated on the basis of the following assumption referring to the NIA criteria.

Item	Foreign Currency	Local Currency
	(%)	(%)
Cement	75	25
Steel Bars and Hardware	80	20
Fuel and Oil	50	50
Equipment Rental	75	25
Sheet Pile and Steel Pile	100	0
Labour	0	100

All of the costs are estimated based on the current prices in November 1981.

4) Physical contingecy of the cost estimate is 15% of the construction cost except compensation cost for land acquisition of the estate farm and the price contingency applied in the estimate is : 6.5% per annum for the foreign currency component and 10% per annum for the local currency component.

5) The associated costs to be financed by the Government, such as the costs for strengthening the extension services, improvement of the social infrastructure and so on are not included in the estimate.

5.8.2 Cost Estimate for Individual Farm Development

(1) Estimate

The total costs for the individual farm development are estimated at ₱24,400 thousand, which comprise ₱10,460 thousand of foreign currency and ₱13,940 thousand of local currency. The summary of the cost estimate is as shown in Table 5.8.1.

The annual disbursement schedule is worked out based on the construction time schedule as shown in Table 5.8.2.

(2) Operation and Maintenance Cost

The annual operation and maintenance costs for the infrastructures in the individual farm are estimated at ₱785 thousand.

5.8.3 Cost Estimate for Estate Farm

(1) Estimate

The total costs for the estate farm are estimated at ₱29,810 thousand which comprise ₱13,720 thousand of foreign currency and ₱16,090 thousand of local currency. The summary of the cost estimate and the annual disbursement schedule are as shown in Tables 5.8.3 and 5.8.4

(2) Operation and Maintenance Cost

The annual operation and maintenance costs include the salaries for staff in the agricultural department of the distillery, procurement cost of the farm inputs, labour cost, and the operating cost of farm machinery and equipment for sugarcane production, and the materials and labour costs for the repair and maintenance of farm machinery and equipment, farming facilities, and farm roads. The estimated costs are ₱3,449 thousand per annum in total.

(3) Replacement Costs

Some of the facilities in the estate farm have shorter useful life than civil works and are required replacement at a certain time within the project useful life. The useful lives of the farm machinery and equipment are assumed 7 years.

CHAPTER 6 AGRICULTURAL SUPPORT SYSTEM AND ORGANIZATIONS

6.1 Research and Extension Services

(1) Philippine Sugar Commission (PHILSUCOM)

PHILSUCOM is taking important role on the sugar industry in the Philippines. The main services to the sugarcane planters/1 are extension and research.

1) Extension

The Sugarcane Development Technolgist (SDT) has a responsibility on extension service and development activities such as propagation of new varieties, transfer of new technology, etc. The planters in Cavite Province are served by two SDTs.

2) Research

The district office conducts adaptability test of new varieties which are bred in the breeding station in the Pampanga Province.

3) Others

The office demonstrates new varieties, operates the cane-setts propagation farm, and serves soil analysis for planters.

The activities of PHILSUCOM mentioned above are mainly for sugar industry not for alcohol production. Research on the sugarcane for alcohol production in the Philippines is still under-developed.

The extension service will become important to up-grade farmers' knowledge on sugarcane cultivation techniques. It is desired to increase number of SDT in order to spread evenly the improved farming techniques to the individual farmers. Appropriate command area per SDT would be about 500 ha of sugarcane field.

/1 : Sugarcane producer in the Philippines is called planter.

(2) Ministry of Agriculture (MA)

Concerning the transfer of agricultural thechnology especially for paddy cultivation to the farmers, the Bureau of Agricultural Extension (BAEx) plays the leading role for improvement of the rural life through strengthening of agricultural extension services in conjunction with many organizations and various ways and means: through a network of agricultural field technicians (AFT) or mass media and so on.

6.2 Credit (loan) Services

For sugarcane planters, the Republic Planters Bank (RPB) provides crop loan called Agricultural Sugar Crop Loan (ASCL). The characteristics and loan conditions are as follows:

- The RPB gives a priority to the planters who has milling contract with sugar mill,
- Borrower should have minimum three years experience of sugarcane cultivation,
- Maximum amount of loan is ₱103 per picul on an average production of last three to five years,
- Collateral is a production and/or a farm land,
- Interest rate is 12% per annum, and
- Repayment schedule is the end of crop year.

Most of farmers in the project area will not be able to utilize this privilege of ASCL at present because they have not had any experience of sugarcane cultivation.

After commencement of the Project it is recommended to provide ASCL to farmers in order to ensure the successful implementation of the farming.

6.3 Farmer's Organization

To ensure the sugarcane planter's benefits, they have been organized their own organization called planters association. The characteristics of the planters association and the farmers' organizations found in the barangays related to the project area are as follows.

(1) Planters Association

The planters association is a non-profit organization of sugarcane planters. The major roles of the associations are as follows:

1) To watch over the sugar mill as a representative of planters

2) To help member's farm management

The planters in the project area can be a member of the CABALAG/1 Planters Association, but all of them in the project area do not participate in the association at present.

(2) Others Associations

Agrarian Reform Beneficiaries Association (ARBA) and Samahang Nayon (SN) are organized in the barangays related to the project area, but their activities are not active except a few organizations.

6.4 Farmer's Association Setup

All the farmers in the project area will conclude milling contract with the distillery before planting their cane. Holding pace with conclusion of contract, the farmers will organize their own organization like planters association under the help of the agriculture department in the distillery. For smooth and efficient operation of the sugarcane production, it is recommended that the distillery and the farmers' association should be closely interlinked.

/1 : Cavite, Batangas and Laguna.

6.5 Establishment of Pilot Farm

Although the research on cultivation of sugarcane is being carried out by the experiment stations of PHILSUCOM and other institutes, these researches are aimed to get high yield of sugar. Therefore the research on sugarcane for alcohol production is an important and urgent problem, and establishment of a pilot farm which is located in the estate farm or around the project area is recommended.

The establishment plan of the pilot farm is explained in Appendix VII.

CHAPTER 7 EVALUATION

7.1 General

The evaluations of the project are made in order to ascertain the feasibility of the project in view of financial and socio-economic aspects.

The financial aspects is evaluated by calculating the capacity to pay to confirm the soundness of the project from the farmers' viewpoint.

Intangible socio-economic impacts of the project from the farmers' viewpoint are also briefly studied in due consideration of the effect of the project.

7.2 Financial Evaluation

7.2.1 Fund Requirement for Individual Farm Development

All costs for individual farm development are taken as the fund requirement for the project implementation. The annual disbursement schedule of the fund is shown in Table 5.8.2.

7.2.2 Farm Budget Analysis

In order to assess the project from farmers' viewpoint, analysis of farm budgets for the typical farmers are examined under both the future without and with project conditions. The typical farm budgets in both future without and with project conditions are outlined below.

1) Without Project Condition

Unit : Peso

	Item	Type I	Type II	Type III
)	Gross Income	10,757	10,673	11,090
	(1) Farm income	4,189	4,215	5,561
	(2) Off-farm income	6,568	6,458	5,529
II)	Gross Outgo	10,757	10,673	10,870
	(3) Production cost	2,187	2,103	2,300
	(4) Living expenses	8,570	8,570	8,570
III)	Net Reserve (Capacity to Pay)	0	0	220
IV)	Net Farm Income(I.1-II.3)	2,002	2,112	3,261

2) With Project Condition

Unit : Peso

	Item	Type I	Type II	Type III
I)	Gross Income	18,675	22,798	22,520
	(1) Farm income	12,107	16,340	16,991
	(2) Off-farm income	6,568	6,458	5,529
II)	Gross Outgo	18,120	20,032	16,914
	(3) Production cost	6,980	8,892	5,774
	(4) Living expenses	11,140	11,140	11,140
III)	Net Reserve (Capacity to Pay)	555	2,766	5,606
IV)	Net Farm Income(I.1-II.3)	5,127	7,448	11,217

Net farm income with project of the typical farms will be expected 2.6 to 3.5 times of that of without project condition.

While, annual net reserve or capacity to pay in the future with project condition will be ₱555 on the farm of Type I, ₱2,766 on Type II, and ₱5,606 on Type III, respectively.

7.2.3 Charge on O&M Cost for Road

The annual operation and maintenance cost for the road constructed in the individual farm is estimated at ₱785 thousand, equivalent to ₱297 per hectare.

This amount of charge on operation and maintenance cost will be divided into halves between tenants and owners because owners also will get profit from the project. These are summarized as shown below:

Unit : Peso

Type	Sugarcane Area (ha)	Capacity to Pay or Land Rent	Charge on O&M Cost	Balance
Type I	1.6	555	238/2	317
Owner of Type I		2,328	238	2,090
Type II	2.2	2,766	327/3	2,439
Owner of Type II		2,880	327	2,553
Type III/1	2.0	5,606	594/4	5,012

/1 : Type III is owner-operated farm.
/2 : Charge on O&M cost/ha x Sugarcane area ÷ 2
= ₱297 x 1.6 ha ÷ 2 = ₱238
/3 : ₱297 x 2.2 ha ÷ 2 = ₱327
/4 : P297 x 2.0 ha = ₱594.

The charge on operation and maintenance cost to be collected from the farmer and/or the owner would have to be within a reasonable range.

7.2.4 Repayment of the Capital Cost

The annual repayment of the capital cost for the individual farm development is estimated at about ₱3.9 million, which is equivalent to ₱1,480 per hectare.

Unit : Peso

Type	Sugarcane Area (ha)	Capacity to Pay or Incremental Rent	Repayment of Capital Cost	Balance
Type I	1.6	555	1,184/2	-629
Owner of Type I		2,328	1,184	1,144
Type II	2.2	2,766	1,628/3	1,138
Owner of Type II		2,880	1,628	1,252
Type III/1	2.0	5,606	2,960/4	2,646

/1 : Type III is owner-operated farm.

/2 : Annual repayment of capital cost/ha x Sugarcane area ÷ 2
= ₱1,480 x 1.6 ha ÷ 2 = ₱1,184

/3 : ₱1,480 x 2.2ha ÷ 2 = ₱1,628

/4 : ₱1,480 x 2.0 ha = ₱2,960

According to the information obtained from the Industrial Sector Team, the annual repayment of the capital cost of the individual farm development shows also very hard in their financial evaluation. As a results, regarding the repayment of the capital cost, the Government subsidy would be needed.

While, the annual operation and maintenence cost of the road constructed in the individual farm will be covered with the net reserve of the typical farms and owners' income as the land rent paid by tenants.

7.3 Socio-Economic Impact

In addition to the direct benefits stipulated previously intangible socio-economic impacts are expected from the implementation of the project.

(1) Increase of Employment Opportunity

The individual farm development will create a demand for farm labor requirement occurred from increased farm activities due to intensive use of the land and high productivity. The incremental farm labor requirement is estimated at 145 thousand man-days per annum for farming.

(2) Improvement of Local Transportation

The road constructed in the project area will be used not only for cane-transportation but also for another local economic activities. This means that the road will contribute to rural people's life in and around the project area.

Table B-1 NATIONAL ENERGY SOURCE

Unit : MMBOE

Source	1980		1981		1985	
	Volume	%	Volume	%	Volume	%
Power						
Hydro	6.62	7.21	7.26	7.42	17.08	12.78
Geothermal	3.84	4.19	5.34	5.46	16.34	12.22
Coal	0.42	0.46	1.15	1.18	8.38	6.27
Oil/Diesel	19.39	21.13	19.50	19.93	7.02	5.25
Nuclear	-	-	-	-	2.81	2.10
Non Conventional	-	-	0.09	0.09	1.37	1.02
Sub-Total :	30.27	32.99	33.34	34.08	53.00	39.64
Non Power						
Oil	69.92	66.39	63.16	164.55	66.44	49.70
Coal	0.52	0.57	1.17	1.20	9.55	7.14
Non Conventional	0.05	0.05	0.17	0.17	4.71	3.52
Sub-Total :	61.49	67.01	64.50	65.92	80.70	60.36
Total Commercial Energy	91.76	100.00	97.84	100.00	133.70	100.00
Oil Share	80.31	87.52	82.66	84.50	73.46	54.94
Total Indigenous	16.51	17.99	22.48	22.97	65.37	48.89
Per Capita		1.90		2.00		
Nonenergy Consumption/1	3.10		3.40		3.70	2.47
Memo Total/2	94.86		101.24		137.40	

Note :

/1 Nonenergy consumption refers to petroleum only

/2 Memo total is the sum of total commercial energy and nonenergy comsumption.

Source : Energy Five-year Program

Table B-2 BALANCE OF PAYMENT, 1978-1980

Unit : US$10^6

Item	1978 Actual	1979 Actual	1980 Actual
I. Current Transactions			
A. Merchandise Trade	-1,307	-1,541	-2,179
Exports	3,425	4,601	5,635
Imports	4,372	6,142	7.814
B. Nonmerchandise Trade	-178	-390	-642
Inflow	1,413	1,576	2,051
Outflow	1,519	1,966	2,693
C. Transfers (donations, etc.)	197	355	411
Inflow	200	369	440
Outflow	3	14	29
Current Transaction, Total	-1,173	-1,576	-2,410
II. Nonmonetary Capital			
D. Long-Term Loans	891	1,151	985
Inflow	1,850	2,110	1,535
Outflow	959	959	550
E. Direct Investments	171	99	95
Inflow	205	225	288
Outflow	34	126	193
F. Short-Term Capital	168	-49	796
Inflow	3,442	4,231	7,318
Outflow	3,274	4,280	6,552
Errors & Omissions	-143	-264	-2
Nonmonetary Capital, Total	1,087	937	1,874
G. Monetrization of Gold	32	41	127
H. Allocation of SDRs	-	28	29
Overall Surplus (deficit)	-54	-570	-380

Source : Philippine Development Report, 1980 by National Economic and Development Authority

Table B-3 PROJECTED ALCOHOL MIX IN GASOLINE

Year	Alcohol Production		Gasoline Demand	Ave. % Alcohol in Gasoline
	MML	MB	MB	
1981	13.1	83.4	10,187	0.8
1982	52.5	330.2	9,472	3.5
1983	163.7	1,029.5	9,071	11.3
1984	209.1	1,315.1	9,838	14.9
1985	234,3	1,473.6	8,661	17.0

Source : Alcogas Five-Year Programm-PNAC, 1981

Table B-4 TARGET DISTILLERY CAPACITY AND ALCOHOL PRODUCTION

Year	Model I		Model II		Model III		Total	
	Unit	MML/Y	Unit	MML/Y	Unit	MML/Y	Unit	MML/Y
1981	2	13.1	-	-	-	-	2	13.1
1982	7	52.5	-	-	-	-	7	52.5
1983	9	91.7	3	72.0	-	-	12	163.7
1984	9	118.5	3	81.6	1	9.0	13	209.1
1985	9	118.5	3	96.0	2	19.8	14	234.3

Source : Alcogas Five-Year Program - PNAC, 1981

Table B-5 INVESTMENT SUMMARY IN THE POWER ALCOHOL PROGRAM (1981-1985)

Unit : ₱10^6 at 1981 Prices

Year	Model I	Model II		Model III		Total Alcohol Production Facilities		Total Alcohol Logistical Facilities		Annual Total
	Distillery	Distillery	Agriculture	Distillery	Agriculture	Distillery	Agriculture	Tanks	Barges	
1981	145.0	315.0	40.2	-	-	460.0	40.2	-	-	500.2
1982	100.0	-	-	95.0	30.7	195.0	30.7	9.2	11.0	245.9
1983	-	-	-	90.0	40.0	90.0	40.0		22.0	152.0
1984	-	-	-	-	-	-	-	-	11.0	11.0
1985	-	-	-	-	-	-	-	-	-	-
Total:	245.0	315.0	40.2	185.0	70.7	745.0	110.9	9.2	44.0	909.1

Note : /1 Distillery and agricultural investments are recorded in the year of start of construction and farm development.

Source : Alcogas Five-Year Program; PNAC, 1981

Table 2.2.1 SOIL CLASSIFICATION

Soil Series	Soil Phase	Mapping Unit	Objective Area	
			Extent Area (ha)	Proportion (%)
Guadalupe Series	Flat-deep	1	1,730	13.3
	Flat-moderately deep	2	410	3.2
	Sloping-moderately deep	3	110	0.8
			2,250	17.3
Magallanes Series	Flat-very shaoow	4	920	7.1
	Flat-shallow	5	2,130	16.4
	Sloping-very shallow	6	2,650	20.4
	Sloping-shallow	7	1,760	13.5
	Stee-very shallow	8	1,420	10.9
			8,880	68.3
Tagaytay Series	Flat-deep	9	1,190	9.2
	Sloping-deep	10	440	3.4
	Stee-very shallow	11	240	1.8
			1,870	14.4
Total			13,000	100.0

Note :

Slope of Land		Thickness of Effective Soil Depth	
Flat	less than 3° (5%)	Deep	more than 60 cm
Sloping	3° - 8° (5 - 14%)	Moderately deep	30 - 60 cm
Steep	more than 8° (14%)	Very shallow	less than 15 cm

Table 2.2.2 LAND SUITABILITY FOR THE CULTIVATION OF SUGARCANE

Suitability	Suitability Class	Soil		Mapping Symbol in Soil Map	Objective Area	
			Phase		Extent Area (ha)	Proportion (%)
Suitable	I	Tagaytay	Flat-deep	9	1,190	9.2
		Tagaytay	Sloping-deep	10	440	3.4
	II	Guadalupe	Flat-deep	1	1,730	13.3
		Guadalupe	Flat-moderately deep	2	410	3.2
		Guadalupe	Sloping-moderately deep	3	110	0.8
					3,880	29.7
Marginally Suitable	III	Magallanes	Flat-shallow	5	2,130	16.4
		Magallanes	Sloping-shallow	7	1,760	13.5
					3,890	29.9
Not Suitable	IV	Magallanes	Flat-very shallow	4	920	7.1
		Magallanes	Sloping-very shallow	6	2,650	20.4
	V	Magallane	Steep-very shallow	8	1,420	10.9
		Tagaytay	Steepvery shallow	11	240	1.8
					5.230	40.2
			Total		13,000	100.0

Table 2.2.3 MONTHLY DISCHARGE CHARACTERISTICS

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Agu.	Sep.	Oct.	Nov.	Dec.	Annual
Maragondon River at Mabacao (Drainage Area : 260 km^2) (1946 - 1976, except 1970 - 71)													
Mean in m^3/s	2.77	2.49	1.82	1.66	4.47	17.37	26.96	42.56	33.27	15.62	15.77	9.01	14.48
Mean in MCM/1	7.42	6.02	4.87	4.30	11.97	45.02	72.21	113.99	86.24	41.84	40.88	24.13	456.64
Mean Specific Run Off in mm	28 54	23.17	18.75	16.55	46.05	173.17	277.73	438.43	331.68	160.91	157.21	92.82	1,756.31
Standard Deviation	1.45	0.92	0.66	0.60	8.90	21.37	27.04	40.03	34.79	13.11	26.38	20.96	6.78
Balsahan River at Palangui (Drainage Area : 22 km^2) (1955 - 1967, except 1958 - 60, 70 - 71)													
Mean in m^3/s	0.34	0.17	0.14	0.10	0.91	1.83	3.76	3.44	4.08	1.40	1.62	0.55	1.54
Mean in MCM	0.91	0.41	0.37	0.26	2.44	4.74	10.07	9.21	10.58	3.75	4.20	1.47	48.42
Mean Specific Run Off in mm	41.39	18.69	17.04	11.78	110.69	215.61	457.76	418.80	480.70	170.44	190.87	66.96	2,200.83
Standard Deviation	0.50	0.15	0.15	0.10	1.21	1.45	4.75	2.61	3.51	1.60	3.72	0.86	0.87

Note : /1 1,000,000 m^3

Source : NWRC

Table 2.4.1 SUMMARY OF BASIC SOCIO DATA IN THE RELATED MUMICIPALITIES

	G.E. Aguinaldo	Indang	Magallanes	Maragondon	Naic	Tanza	Trece Martires City	Total or Average	Cavite Province
Physical Area (km^2)	51	89	79	165	86	96	39	605	1,420
Population (1980)	9,570	30,990	9,690	18,030	38,230	43,720	8,580	158,810	771,880
Population Density (Nos./km^2)	188	348	123	109	444	455	220	262	543
Population Growth Rate per annum (1975 - 1980)	2.23	1.58	0.76	3.97	3.48	3.15	3.56	2.84	4.11
Total Household	1,760	5,520	2,040	3,140	6,910	7,615	1,470	38,455	138,940
Family Size	5.4	5.6	4.7	5.7	5.5	5.7	5.8	5.6	5.6

Source : PASTORA Output, 1980

Table 2.4.2 LAND USE IN THE OBJECTIVE ARE

	Extent Area (ha)		Proportion (%)
Pernnial Crop Field	2,850		21.9
Coconut		2,540	
Banana		100	
Mango		210	
Upland Field	5,750		44.2
Sugarcane		1,210	
Other Diversified Crop		4,540	
Paddy Field	1,110		8.5
Shrub Land and Valley	2,860		22.0
Wasted Land	400		3.1
Residential Area	40		0.3
Total	13,000		100

Note : Compiled by the interpretation of aerial photographs taken in 1980.

Table 3.1.1 COMPARISON OF THE CANDIDATE CROPS

Major Items	Sugarcane	Cassava	Sweet Potatoes
1. Production Area (ha)	3,880	2,760	2,760
2. Produciton (t)	164,990	41,900	33,520
3. Yield (t/ha)	43	15	12
4. Alcohol Production Rate (t/kl)	12.87	6.5	6.5
5. Alcohol Produciton	12,820	6,450	5,160
6. Harvesting Period	200 days (Nov. - May)	90 days (Mar. - May)	120 days (nov. - Feb.)
7. Daily Labor Requirement (man/day)	825	1,164	642
8. Energy Consumption of Farm Input (kcal/ha)	1,153,290	1,366,600	1,197,600
9. Net Return (1,000 pesos)	13,683.3	5,514.7	9,459.4
Net Return per ha (1,000 pesos)	3.53	2.00	3.43
10. Agricultural Development Period to Achieve the Target Yield	Short	Long	Long

Table 4.2.1 BASIC SOCIO DATA IN TEH PROJECT AREA

Municipality/City	Population 1975	Population 1980	Population Growth Rate (%)	Area (ha)	Population Density (Person/km^2)	Total Household	Family Size	No. of Farm
A) Municipality/City Related to the Project Area								
Indang	28,789	30,986	1.48	8,920	347	5,524	5.6	3,778
Magallanes	9,330	9,690	0.76	7,860	123	2,043	4.7	1,835
Maragondon	14,785	18,027	4.04	16,549	109	3,146	5.7	1,683
Naic	32,130	38,233	3.54	8,600	445	6,910	5.5	1,658
Tanza	37,353	43,722	3.12	9,630	454	7,615	5.7	1,265
Trece Martires City	7,179	8,579	3.63	3,917	219	1,472	5.8	1,060
Total or Average	129,566	149,237	2.87	55,476	269	26,710	5.6	11,279
B) In the Related Barangays	14,756	16,998	2.87	8,400	202	2,933	5.8	2,288
C) In the Project Area	5,432	6,258	2.87	3,090	202	1,079	5.8	863

Source : National Census and Statistics Office

Table 4.4.1 FINANCIAL PRICES OF FARM PRODUCTS AND INPUTS AT FARM GATE

Unit : Peso

1. Farm Products	
- Paddy	1,455/ton
- Sugarcane	160/ton
- Corn	1,070/ton
- Cassava	490/ton
- Neanuts	4,210/ton
- Banana	70/1,000 pcs
2. Farm Inputs	
- Sead (Paddy)	1.5/kg
(Sugarcane)	0.0065/1,000 pcs
(Corn)	0.5/kg
(Peanuts)	4.2/kg
- Fertilizer /1 N:	5.0/kg
P:	5.2/kg
K:	2.7/kg
3. Labour	15/man.day
	30/man.animal.day
4. Mechanical power	900/ha

/1 : The pirces are converted to nutrient prices.

Table 4.4.2 FINANCIAL PRICE STRUCTURE OF SUGARCANE

(Unit : Peso/ton)

	W/Project Condition	Present Condition
Export F.O.B. Manila	2,280	2,280
Cost, loading port	65	65
Cost, terminal warehouse	60	60
Land and transport ex-mill	85	85
Ex-mill value	2,070	2,070
Milling cost	660	660
Taxes	45	45
Millgate sugarcane value/1 (excluding by-products value)	147	147
By-products value/2	12	12
Millgate sugarcane value	160	160
Transport to mill/distillery	-	50
Transport subsidy	-	15
Farmgate sugarcane price	160	125

/1 : Millgate sugarcane value : ₱147/ton cane

₱2,070 - ₱660 - ₱45 = ₱1,365/ton = ₱86/picul

₱86/picul x 1.7 picul = ₱147

- 1 ton cane produce 1.7 piculs of sugar

/2 : 0.03 t/ton cane x ₱565/ton x 68% ≒ ₱12

- Mollasses is produced 0.03 ton from 1 ton cane.
- Price of Mollasses is estimated based on the price of F.O.B. Manila.
- Sharing rate of sugar and Mollasses between the planters and the Miller is 68:32.

Table 5.4.1 LAND USE AND AGRICULTURAL PRODUCTION

	Present		W/Project		Difference	
	Area (ha)	Production (t)	Area (ha)	Production (t)	Area (ha)	Production (t)
Individual Farm						
Upland rice	1,630	978	660	990	- 970	+ 12
Sugarcane	550	20,350	1,980	100,740	+1,430	+ 80,390
Corn	300	165	—	—	- 300	- 300
Cassava	110	594	—	—	- 110	- 594
Other crop/1	(80)	(42)	—	—	- (80)	- (48)
Idle land	90	—	—	—	- 90	—
Roads	—	—	40	—	+ 40	—
Total	2,680		2,680			
Estate Farm						
Upland rice	270	162	—	—	- 270	- 162
Sugarcane	—	—	400	22,930	+ 400	+ 22,925
Corn	50	28	—	—	- 50	- 28
Cassava	90	486	—	—	- 90	- 486
Other crop	(20)	11	—	—	- (20)	- 11
Roads	—	—	10	—	+ 10	—
Total	410		410			
Total						
Upland rice	1,900	1,140	660	990	-1,240	- 150
Sugarcane	550	20,350	2,380	123,670	+1,830	+103,320
Corn	350	193	—	—	- 350	- 193
Cassava	200	1,080	—	—	- 200	- 1,080
Other crop	(100)	(53)	—	—	- (100)	- (53)
Idle land	90	—	—	—	- 90	—
Roads	—	—	50	—	+ 50	—
Total	3,080		3,090			

Note : /1 Crops following corn

Additional description :

When the cropping pattern of a continuous cultivation of sugarcane, although this pattern has several problems to execute farmers' farming practices and to maintain soil fertility, is used, the total quantity of cane production will be calculated at 157,250 tons in the project area.

Table 5.8.1 TOTAL CONSTRUCTION COST
FOR INDIVIDUAL FARM

Item	Amount (₱10³)		
	F.C./1	L.C./2	Total
1. Direct Construction Cost			
1) Main Road A	1,126	1,220	2,346
2) Main Road B	764	823	1,587
3) Secondary Roads	4,683	4,869	9,552
2. Compensation Cost for Land Acquisition	-	1,102	1,102
3. Engineering & Administration Cost	750	754	1,504
4. Physical Contingency	1,007	1,202	2,209
Sub-Total	8,330	9,970	18,300
5. Price Contingency	2,130	3,970	6,100
Total	10,460	13,940	24,400

/1 : Foreign currency

/2 : Local currency

Table 5.8.2 DISBURSEMENT SCHEDULE OF CONSTRUCTION COST FOR INDIVIDUAL FARM

Unit : ₴10³

	Total			1983			1984			1985			1986		
	F.C.	L.C.	TOTAL	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total
1. Direct Construction Cost															
1) Main Road A	1,126	1,220	2,346	220	219	439	906	1,101	1,907	-	-	-	-	-	-
2) Main Road B	764	823	1,587	-	-	-	113	108	221	651	715	1,366	-	-	-
3) Secondary Roads	4,683	4,869	9.552	309	317	626	1,374	1,429	2,803	1,762	1,823	3,585	1,238	1,300	2,538
2. Compensation Cost for Land Acquisition	-	1,102	1,102	-	1,102	1,102	-	-	-	-	-	-	-	-	-
3. Engineering & Administration Cost	750	754	1,504	590	170	760	40	152	192	60	216	276	60	216	276
4. Physical Contingency (15%)	1,007	1,202	2,209	81	242	323	367	380	747	367	386	753	192	194	386
Sub-Total	8,330	9.970	18,300	1,200	2,050	3,250	2,800	3,070	5,870	2,840	3,140	5,980	1,490	1,710	3,200
5. Price Contingency	2,130	3,970	6,100	170	440	610	590	1,020	1,610	820	1,460	2,280	550	1,050	1,600
Total	10,460	13,940	24,400	1,370	2,490	3,860	3,390	4,090	7,480	3,660	4,600	8,260	2,040	2,760	4,800

Note : F.C. Foreign Currency

L.C. Local Currency

Table 5.8.3 TOTAL CONSTRUCTION COST FOR ESTATE FARM

Item	Amount (₱10³)		
	F.C./1	L.C./2	Total
1. Farm Land Acquisition Cost	-	10,135	10,135
- Compensation cost for land acquisition	-	9,840	9,840
- Engineering and administration cost	-	295	295
2. Cane Farm Construction Cost	1,670	1,730	3,400
- Secondary roads	1,314	1,375	2,689
- Farm roads	41	52	93
- Engineering and administration cost	130	94	224
- Physical contingency	185	209	394
3. Procurement Cost of Farm Machinery and Equipment	8,572	-	8,572
- Procurement cost	7,454	-	7,454
- Physical contingency	1,118	-	1,118
4. Construction Cost for Farm Building	-	1,186	1,186
- Construction cost	-	973	973
- Engineering and administration cost	-	58	58
- Physical contingency	-	155	155
Sub-Total	10,242	13,051	23,293
5. Price Contingency	3,479	3,041	6,520
Total	13,721	16,092	29,813

/1 : Foreign currency

/2 : Local currency

Table 5.8.4 DISBURSMENT SCHEDULE OF CONSTRUCION COST FOR ESTATE FARM

Unit : P10^3

	Total			1983			1984			1985			1986			1987			1988		
	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total
1. Compensation Cost for Land Acquisition	-	10,135	10,135	-	10,135	10,135	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
- Compensation cost	-	9,840	9,840	-	9,840	9,840	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
- Engineering & administration cost	-	295	295	-	295	295	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2. Cane Farm Construction Cost	1,670	1,730	3,400	500	400	940	1,170	1,290	2,460	-	-	-	-	-	-	-	-	-	-	-	-
- Secondary roads	1,314	1,375	2,689	333	343	676	981	1,032	2,013	-	-	-	-	-	-	-	-	-	-	-	-
- Farm Roads	41	52	93	11	15	26	30	37	67	-	-	-	-	-	-	-	-	-	-	-	-
- Engineering & administration cost	130	94	224	110	30	140	20	64	84	-	-	-	-	-	-	-	-	-	-	-	-
- Physical contingency	185	209	394	46	52	98	139	157	296	-	-	-	-	-	-	-	-	-	-	-	-
3. Procurement Cost for Farm Machinery & Equipment	8,572	-	8,572	-	-	-	1,579	-	1,579	961	-	961	2,294	-	2,294	1,495	-	1,495	2,243	-	2,243
- Procurement cost	7,454	-	7,454	-	-	-	1,373	-	1,373	836	-	836	1,995	-	1,995	1,300	-	1,300	1,950	-	1,950
- Physical contingency	1,118	-	1,118	-	-	-	206	-	206	125	-	125	299	-	299	195	-	195	293	-	293
4. Construction Cost for Farm Buildings	-	1,186	1,186	-	-	-	-	1,186	1,186	-	-	-	-	-	-	-	-	-	-	-	-
- Construction cost	-	973	973	-	-	-	-	973	973	-	-	-	-	-	-	-	-	-	-	-	-
- Engineering & administration cost	-	58	58	-	-	-	-	58	58	-	-	-	-	-	-	-	-	-	-	-	-
- Physical contingency	-	155	155	-	-	-	-	155	155	-	-	-	-	-	-	-	-	-	-	-	-
Sub-Total	10,242	13,051	23,293	500	10,575	11,075	2,749	2,476	5,226	961	-	961	2,994	-	2,294	1,495	-	1,495	2,243	-	2,243
5. Price Contingency	3,479	3,041	6,520	67	2,221	2,288	572	820	1,392	275	-	275	849	-	849	686	-	686	1,030	-	1,030
Total	13,721	16,092	29,813	567	12,796	13,363	3,321	3,296	6,617	1,236	-	1,236	3,143	-	3,143	2,181	-	2,181	3,273	-	3,273

Note : F.C. Foreign Currency, L.C. Local Currency

Fig. 2.2.1 SOIL MAP

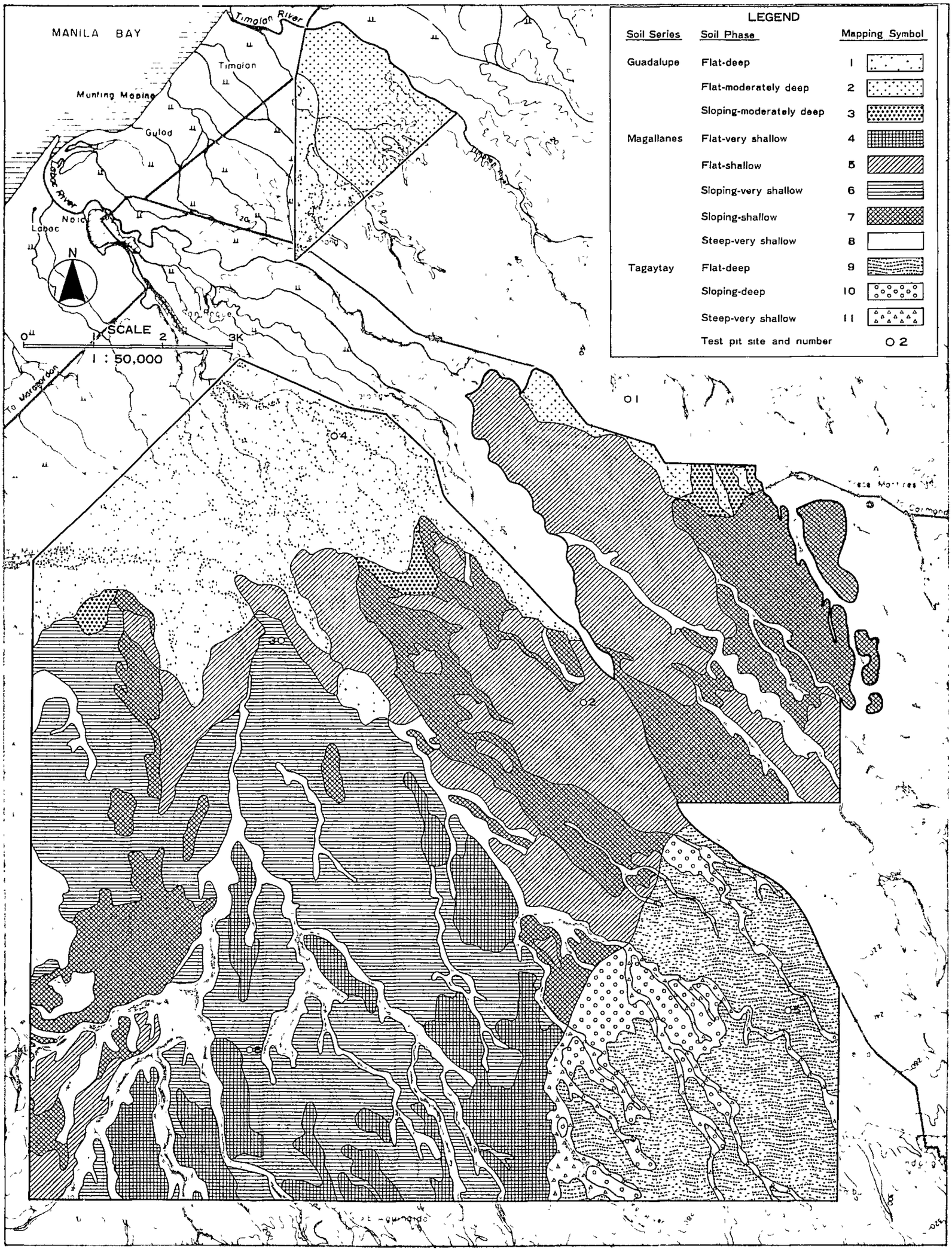

Fig. 2.4.1 LAND USE MAP

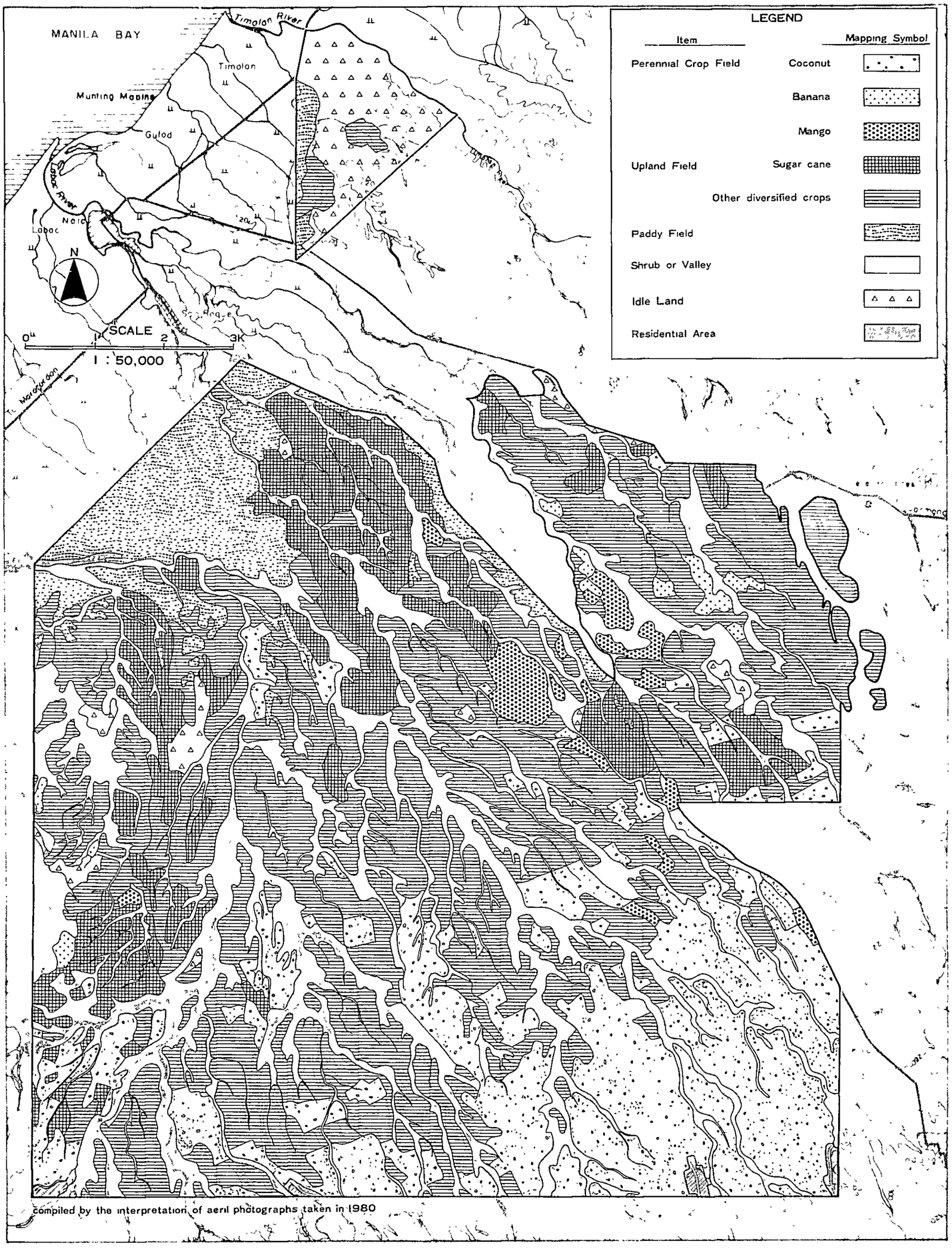

Fig.4.1.1 PROJECT AREA

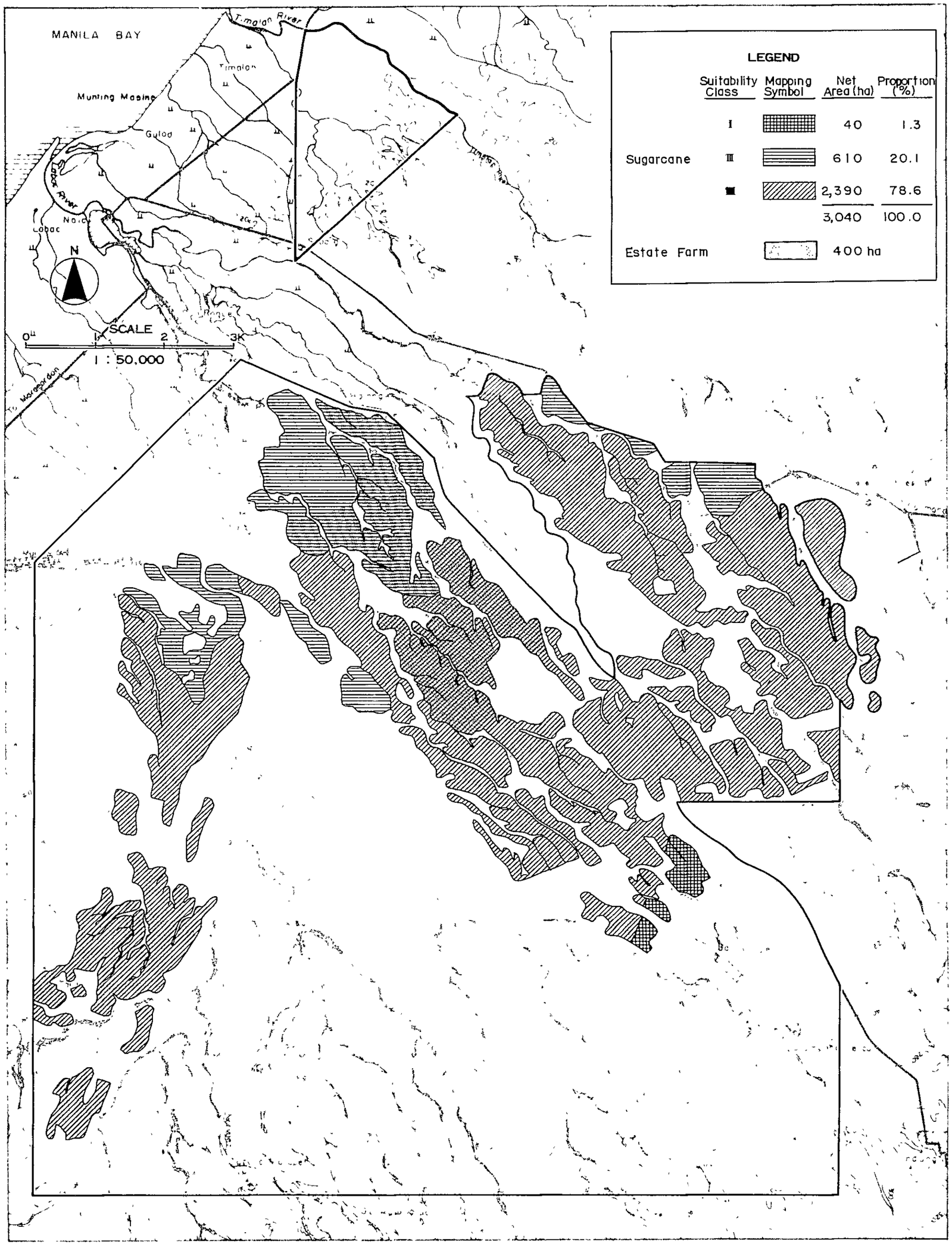

Fig. 4.3.1 PRESENT CROPPING PATTERN

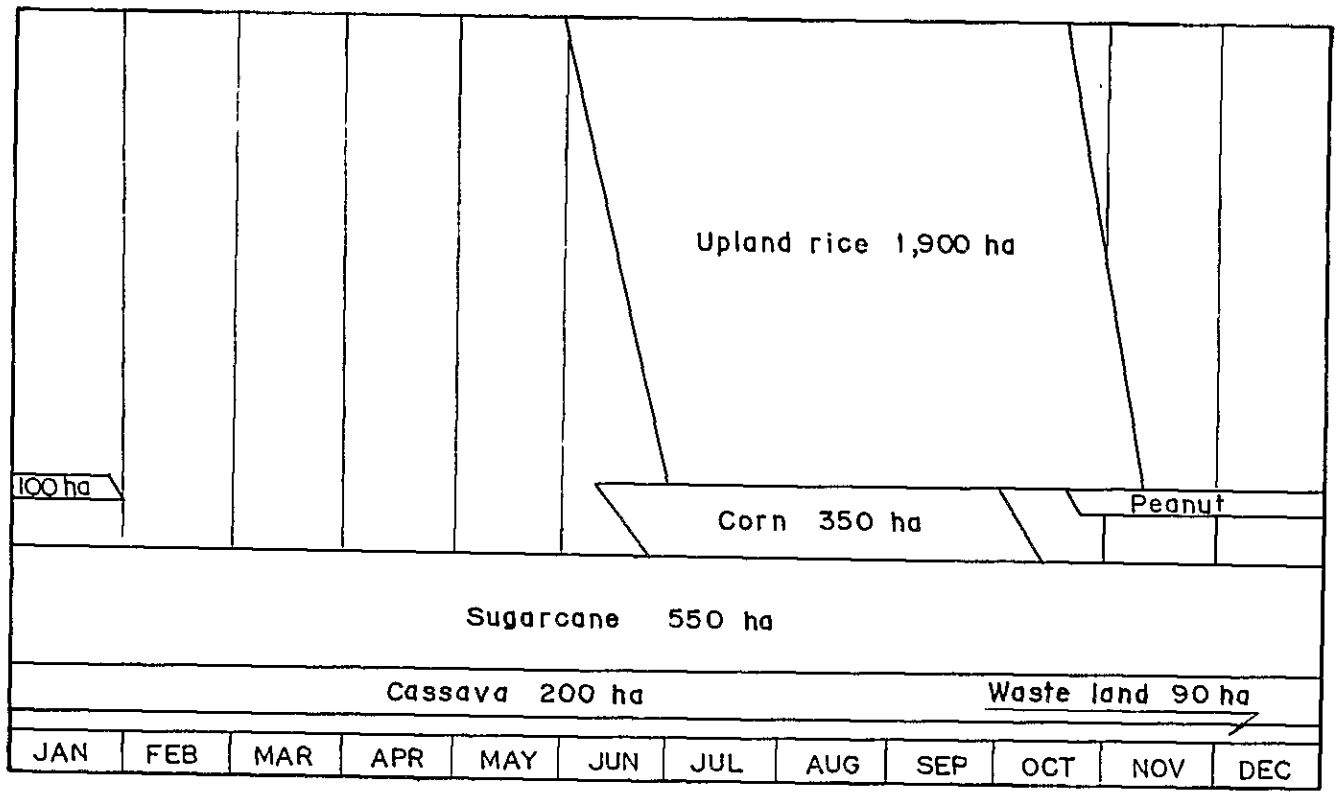

Fig. 5.2.1 PROPOSED CROPPING PATTERN

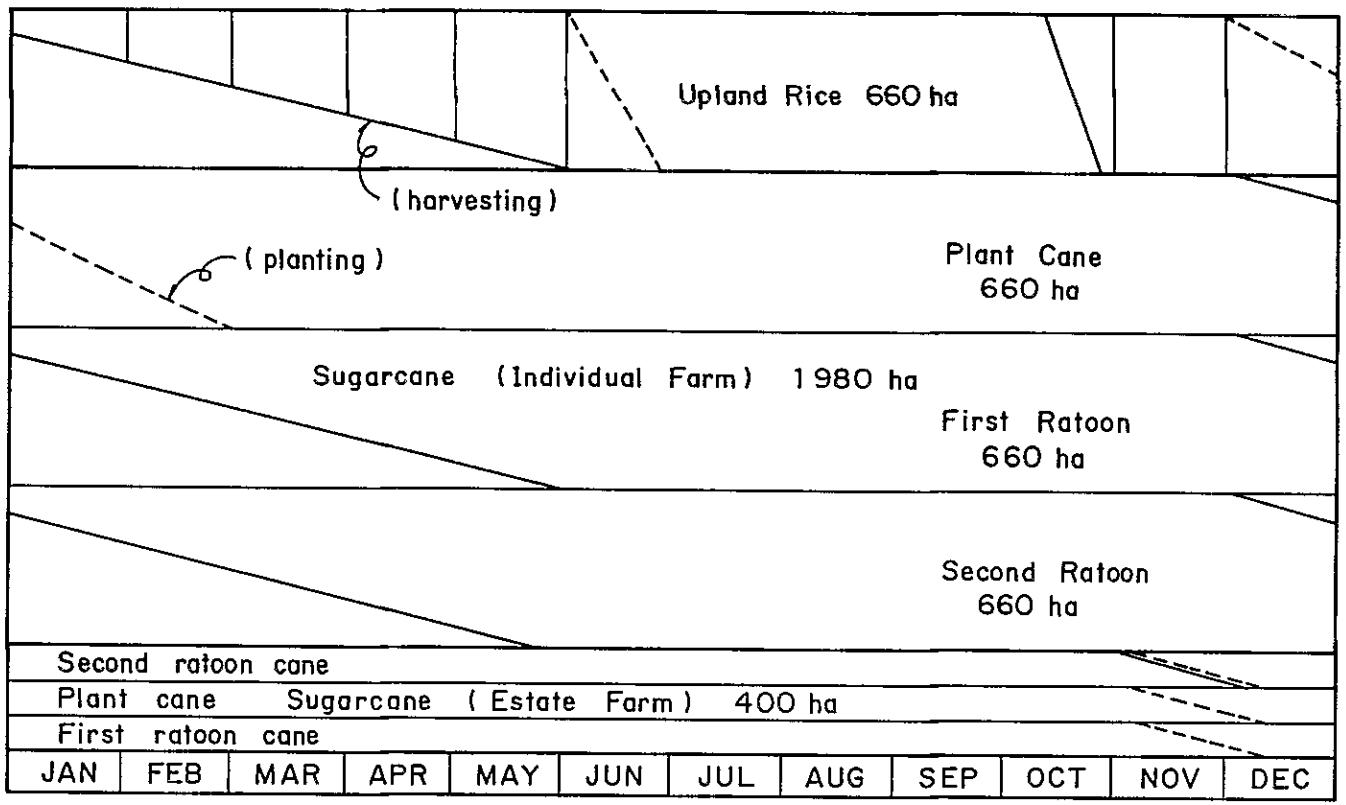

Fig. 5.6.1 ROAD NETWORK