FEASIBILITY STUDY REPORT

ON

ALCOGAS PROJECT

IN

MARAGONDON, CAVITE

THE REPUBLIC OF THE PHILIPPINES

VOLUME III APPENDIXES

APPENDIX I SELECTION OF CROP
APPENDIX II NATURAL CONDITIONS
APPENDIX III AGRICULTURE AND AGRO-ECONOMY
APPENDIX IV INFRASTRUCTURE
APPENDIX V ESTATE FARM
APPENDIX VI EVALUATIONS
APPENDIX VII PILOT FARM

MAY 1982

JAPAN INTERNATIONAL COOPERATION AGENCY

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WEIGHTS 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

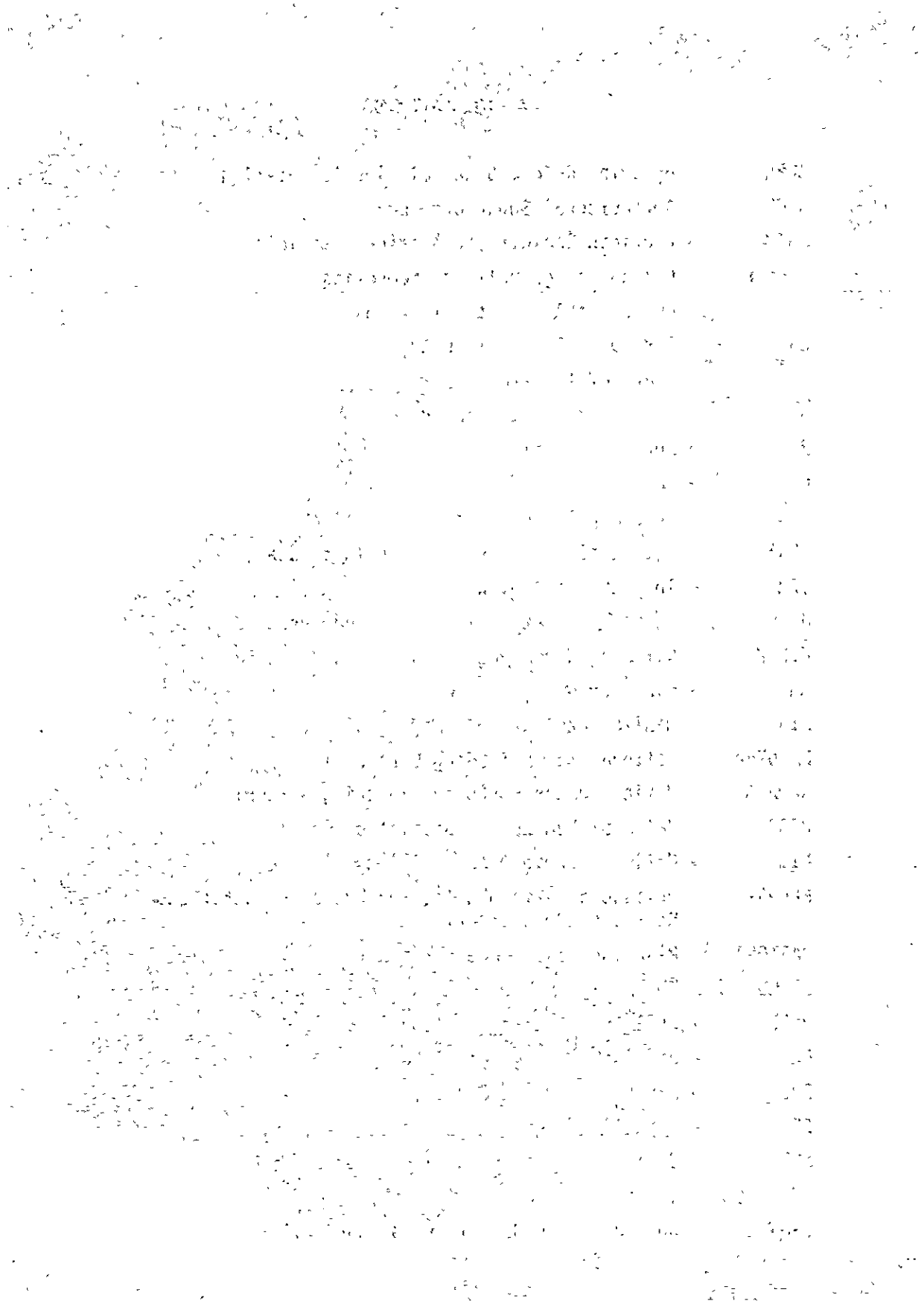
%	:	percent
ppm	:	pert per million
no(s)	:	number
KPH	:	knot per hour
°C	:	degree centigrade
m.eq.	:	milligram equivalent
Lat	:	latitude
Long	:	longitude
pcs	:	pieces
MMBOE	:	million barrels-of oil equivalent

Currency

US$	:	US Dollar
₱	:	Philippine Peso

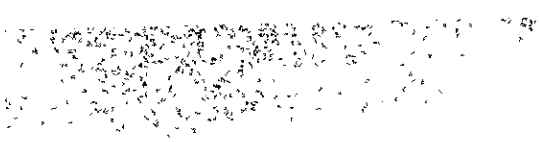
ABBREVIATIONS

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	- Natinal Water Works and Sewering Authority
NCSO	- National Census and Statistics Office
NIA	- National Irrigation Administration
PAGASA	- Philippine Atmospheric, 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 Development Technologist
SN	- Samahang Nayon
USDA	- United States Department of Agriculture



APPENDIX I

SELECTION OF CROP



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APPENDIX I 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 below:

1. Suitability to Soil Conditions

To relatively light soils as the Tagaytay and the Magallanes series the three candidate crops are suitable for cultivation, but to heavy clay soils as the Guadalupe series root crops such as cassava, sweet potatoes are not suitable. Especially, under a condition of excess water content in soils, cassava and sweet potatoes are more sensitive than sugarcane.

2. Tolerance to Typhoon

Generally it is said that sugarcane and cassava are low resistant to typhoon and sweet potatoes are high. However, damages to crop caused by typhoon are largely varied by conditions of wind velocity, rainfall and soils. In addition, as no record on damages of each candidate crop is available in the project area, comparative study on each crop is difficult.

3. Potentiality of Crop Yield

Average yield of each crop on the different soil series in the project area are projected based on the land suitability mainly according to the effective soil depth as follows:

Soil Series	Area (ha)	Yield (t/ha)(av.)	Production (t)
Sugarcane			
Tagaytay	50	50 - 60 (53)	62,010
Guadalupe	1,120		
Magallanes	2,710	35 - 45 (38)	102,980
Total	3,880	(43)	164,990
Cassava			
Tagaytay	50	20 - 30 (25)	1,250
Magallanes	2,710	13 - 17 (15)	40,650
Total	2,760	(15)	41,900
Sweet Potatoes			
Tagaytay	50	18 - 14 (20)	1,000
Magallens	2,710	10 - 14 (12)	32,520
Total	2,760	(12)	33,520

Note: All values are expressed with the same values in the Interim Report.

4. Potentiality of Alcohol Production

Based on the amount of each crop production in the project area, the alcohol production is estimated applying the rate of raw material tonnage needed for production of one kiloliter alcohol as follows.

	Production of Raw Materials (t)	Percentage of Sugar or Starch	Alcohol Production Rate (t/kl)	Alcohol Production (kl)
Sugarcane	164,990	14.1	12.87	12,820
Cassave	41,900	25.0	6.5	6,450
Sweet Potatoes	33,520	25.0	6.5	5,160

Note: All values are expressed with the same values in the Interim Report except for alcohol production of sugarcane.

In the above table, 14.1% of sugar is estimated as total percentage of sucrose, glucose and fructose.

Sucrose content in cane is estimated at 13.5% which is average percentage for five years from 1974/75 to 1978/79 in the southern Luzon area according to the Factory Performance Data by PHILSUCOM. Glucose and fructose in cane are estimated at 0.3% each referring the data in the Sugar Hand Book by Made and Chen.

5. Planting and Harvesting Time

Sugarcane - The present practice of planting sugarcane from November to early February will be neither extended or moved under without irrigation. Harvesting is done from November to May (200 days).

Cassava - Cassava is planted at the onset of the rainfall from June to September because the first three months after planting are critical to tuber formation and without sufficient moisture good yield cannot be expected. Harvesting is done from March to May (90 days).

Sweet potatoes - Sweet potatoes are planted also at the onset of the rainfall from June to September and harvested after 4 to 5 months from November to early February (120 days).

Characteristically, sugarcane planted in early November and sweet potatoes planted in early June can be harvested from early October, but the weather conditon will not permit field operation of harvesting and transportation until November.

6. Labor Requirement during Harvesting Period

The largest labor requirements for farm operation occur from harvesting. The labor requirements calculated on the basis of projected yield on each crop are as follows.

	Production (t)	Man-day/t	Man-day	Harvesting Days	Man/day
Sugarcane	164,990	1.0	164,990	200	825
Cassava	41,900	2.5	104,750	90	1,164
Sweet Potatoes	33,520	2.3	77,096	120	642

Note: All values are expressed with the same values in the Interim Report.

7. Energy Consumption

Based on the equivalent energy values of all the farm inputs (Table 7.1), energy consumption per hectare was calculated on each crop as follows:

Crop	Energy	Consumption
Sugarcane /1	1,153,290 kcal	26,820 kcal/t
Cassava	1,366,600	91,110
Sweet Potatoes	1,197,600	99,800

8. Net Return

In comparison of three crops, net return was calculated on each crop. The results are shown as follows:

Unit: 1,000 Pesos

	Sugarcane	Cassava	Sweet Potatoes
Gross Income	26,068.4	18,855.0	22,123.2
Production Cost	12,385.1	13,340.3	12,663.8
Net Return	13,683.3	5,514.7	9,459.4
Net Return per ha	3.53	2.00	3.43

Note: Refer to Tables 8.1 to 8.6 and Table 8.7.

/1: Average of plant cane and three ratoon canes

9. Industrial Crop Cultivation Technology

The project area belongs to the Canlubang Sugar Mill District and some planters in the area have been cultivating sugarcane more than sixty years with established technology for selling their proudct to the sugar mill. Although cultivation of cassava and sweet potatoes are familiar to the farmers as food crops, they are grown with primitive method at present. The technology of industrial crop cultivation for root crops never exists and there are many problems to solve in their cultivation technics, for example, mechanization for cassava, protection method from weevils of sweet potatoes (Cylas formicarius FABRICIUS), etc. Consequently, transfer of the industrial cultivation technology for root crops will take a long time in achieving the projected yield.

10. Conclusion

The major items mentioned above were summarized in Table 10.1. Upon the results that sugarcane surpasses other two crops significantly through all the items, it is concluded that the sugarcane should be selected as the raw material crop for alcohol production in the Maragondon area without fail.

Table 7.1 ENERGY EQUIVALENT OF INPUTS

Diesel Oil	10,000 kcal/l
Fertilizers	
Nitrogen (N)	1,000 kcal/kg
Phosphate (P_2O_5)	1,000 kcal/kg
Potassium (K_2O)	1,260 kcal/kg
Labor	3,000 kcal/man-day
Carabao	9,000 kcal/animal-day

Source: Cassava Fuel Alcohol in Brazil, V. Yang, et.al. Centro de Technologia Promon, Rio de Janeiro, Brazil.

Table 8.1 NET RETURN PER HA FOR SUGARCANE IN TAGAYTAY SERIES AND GUADALUPE SERIES

Unit: Peso

		Plant Cane	Ratoon Cane (2.5 times)
A)	Gross Income		
	53 ton x 158 ₱/ton	8,374	
B)	Production Cost (Average)	3,660	
	1) Seed		
	45,000 pcs x 0.0065 ₱/pcs	=293	5,000 pcs x 0.0065 ₱/pcs = 33
	2) Fertilizer		
	N: 180 kg x 5.0 ₱/kg = 900		150 kg x 5.0 ₱/kg = 750
	P: 80 kg x 5.2 ₱/kg = 416		80 kg x 5.2 ₱/kg = 416
	K: 0		0
	3) Labor (man-days)		
	126 days x 15 ₱/day = 1,890		100 days x 15 ₱/day = 1,500
	4) Mechanical Power (tractor-days)		
	4.5 days x 200 ₱/day = 900		
	5) Animal Power (man-animal-days)		
	12 days x 25 ₱/day = 300		12 days x 25 ₱/day = 300
	6) Miscellaneous	= 235	= 150
	Total	4,930	3,150
C)	Net Return (A - B)	4,714	

Table 8.2 NET RETURN PER HA FOR SUGARCANE IN MAGALLANES SERIES

Unit: Peso

A)	Gross Income			
	38 ton x 158 ₱/ton	6,004		
B)	Production Cost (Average)	2,990		
	Plant Cane		Ratoon Cane (2.5 times)	
	1) Seed			
	45,000 pcs x 0.0065 ₱/pcs	= 293	5,000 pcs x 0.0065 ₱/pcs	= 33
	2) Fertilizer			
	N: 120 kg x 5.0 ₱/kg	= 600	80 kg x 5.0 ₱/kg	= 400
	P: 80 kg x 5.2 ₱/kg	= 416	80 kg x 5.2 ₱/kg	= 416
	K: 0		0	
	3) Laborer (man-days)			
	106 days x 15 ₱/day	= 1,590	80 days x 15 ₱/day	= 1,200
	4) Mechanical Power (tractor-days)			
	4.5 days x 200 ₱/days	= 900		
	5) Animal Power (man-animal-days)			
	12 days x 25 ₱/days	= 300	12 days x 25 ₱/day	= 300
	6) Miscellaneous	= 205		= 117
	Total	4,300		2,470
C)	Net Return (A - B)	3,014		

Table 8.3 NET RETURN PER HA FOR CASSAVA IN TAGAYTAY SERIES

Unit: Peso

A)	Gross Income	
	25 ton x 450 ₱/ton	11,250
B)	Production Cost	5,020
	1) Seed	
	13,200 pcs x 0.036 ₱/pcs	475
	2) Fertilizer	
	N: 80 kg x 5.0 ₱/kg	400
	P: 80 kg x 5.2 ₱/kg	416
	K: 120 kg x 3.3 ₱/kg	396
	3) Laborer (man-days)	
	106 days x 15 ₱/day	1,590
	4) Mechanical Power (tractor-days)	
	6 days x 200 ₱/day	1,200
	5) Animal Power (man-animal-days)	
	12 days x 25 ₱/day	300
	6) Miscellaneous	239
C)	Net Return (A - B)	6,230

Table 8.4 NET RETURN PER HA FOR CASSAVA IN MAGALLANES SERIES

Unit: Peso

A)	Gross Income	
	15 ton x 450 ₱/ton	6,750
B)	Production Cost	4,830
	1) Seed	
	13,200 pcs x 0.036 ₱/pcs	475
	2) Fertilizer	
	N: 70 kg x 5.0 ₱/kg	350
	P: 80 kg x 5.2 ₱/kg	416
	K: 110 kg x 3.3 ₱/kg	363
	3) Laborer (man-days)	
	100 days x 15 ₱/day	1,500
	4) Mechanical Power (tractor-days)	
	6 days x 200 ₱/day	1,200
	5) Animal Power (man-animal-days)	
	12 days x 25 ₱/day	300
	6) Miscellaneous	230
C)	Net Return (A - B)	1,920

Table 8.5 NET RETURN PER HA FOR SWEET POTATOES IN TAGAYTAY SERIES

Unit: Peso

A)	Gross Income	
	20 ton x 660 ₱/ton	13,200
B)	Production Cost	5,040
	1) Speed	
	33,000 pcs x 0.02 ₱/pcs	660
	2) Fertilizer	
	N: 80 kg x 5.0 ₱/kg	400
	P: 80 kg x 5.2 ₱/kg	416
	K: 120 kg x 3.3 ₱/kg	396
	3) Laborer (man-days)	
	95 days x 15 ₱/day	1,425
	4) Mechanical Power (tractor-days)	
	6 days x 200 ₱/day	1,200
	5) Animal Power (man-animal-days)	
	12 days x 25 ₱/day	300
	6) Miscellaneous	240
C)	Net Return (A - B)	8,160

Table 8.6 NET RETURN PER HA FOR SWEET POTATOES IN MAGALLANES SERIES

Unit: Peso

A)	Gross Income	
	12 ton x 660 ₱/ton	7,920
B)	Production Cost	4,580
	1) Speed	
	33,000 pcs x 0.02 ₱/pcs	660
	2) Fertilizer	
	N: 60 kg x 5.0 ₱/kg	300
	P: 80 kg x 5.2 ₱/kg	416
	K: 110 kg x 3.3 ₱/kg	363
	3) Laborer (man-days)	
	75 days x 15 ₱/day	1,125
	4) Mechanical Power (tractor-days)	
	6days x 200 ₱/day	1,200
	5) Animal Power (man-animal-days)	
	12 days x 25 ₱/day	300
	6) Miscellaneous	218
C)	Net Return (A - B)	3,340

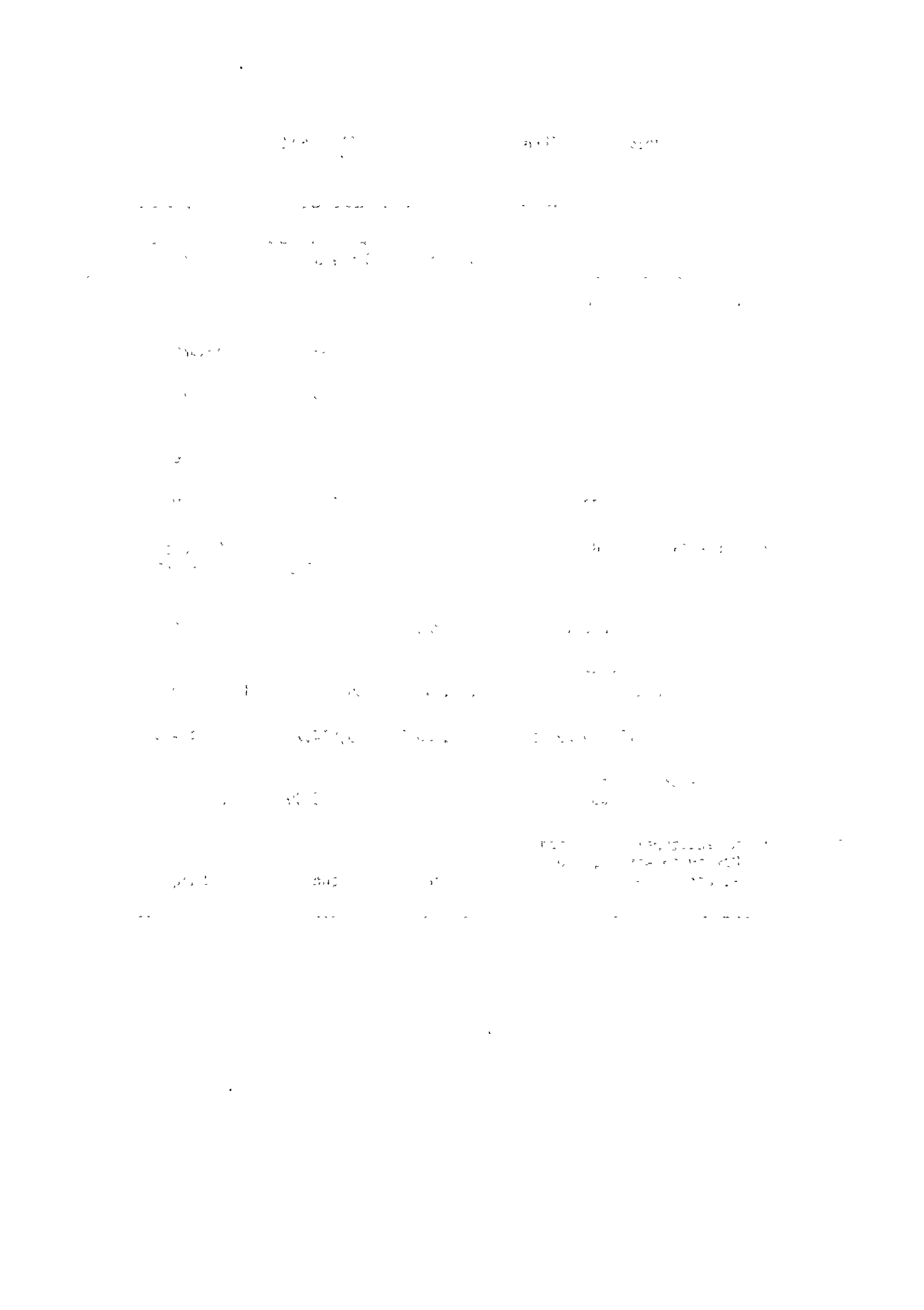
Table 8.7 NET RETURN FOR THE CANDIDATE CROPS IN THE PROJECT AREA

Unit: 1,000 Pesos

Soil Series	Sugarcane	Cassava	Sweet Potatoes
A) Tagaytay Series (50 ha)			
Gross Income	418.7	562.5	660.0
Production Cost	183.0	251.0	252.0
Net Return	235.7	311.5	408.0
B) Guadalupe Series (1,120 ha)			
Gross Income	9,378.9	-	-
Production Cost	4,099.2	-	-
Net Return	5,279.7	-	-
C) Magallanes Series (2,710 ha)			
Gross Income	16,270.8	18,292.5	21,463.2
Production Cost	8,102.9	13,089.3	12,411.8
Net Return	8,167.9	5,203.2	9,051.4
D) Total			
Gross Income	26,068.4	18,855.0	22,123.2
Production Cost	12,385.1	13,340.3	12,663.8
Net Return	13,683.3	5,514.7	9,459.4
E) Net Return per Ha			
Total area (ha)	(3,880)	(2,760)	(2,760)
	3.53	2.00	3.43

Table 10.1 COMPARISON OF THE CANDIDATE CROPS

Major Items	Sugarcane	Cassava	Sweet Potatoes
1. Production Area (ha)	3,880	2,760	2,760
2. Production (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 Production	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



APPENDIX II

NATURAL CONDITIONS

APPENDIX II NATURAL CONDITIONS

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APPENDIX II NATURAL CONDITIONS

CHAPTER 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 rnages from 10 meters to 300 meters above the mean sea level. The plateau is highly dissected in parallel by many streams, forming small lands with steep slope or escarpment at their edges. The streams are narrow and deep, and discharge is small in the dry season. Since the groundwater level is characteristically deep on the volcanic plateau, the water supply for drinking and agricultural purposes is insufficient in the dry season.

CHAPTER 2 CLIMATE

2.1 Meteorological Records

Meteorological observation and data collection in the Republic of the Philippines are conducted principally by the Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA). For this study, the meteorological data of PAGASA were gathered from 12 observations of which nine have only rainfall data and other three have various kind of records.

Data were also collected from eight rainfall gauging stations under the jurisdiction of the National Irrigation Administration (NIA) in and around the objective area. The location of the said meteorological observatories and the list of the data collected from these observatories are shown in Fig. 2.1.1 and Table 2.1.1, respectively. Among the said observatories, Manila International Airport (MIA) has the most complete records. Although this station may seem somewhat distant from the objective area, its location does fall within the same climate zone, and its data are utilized as basic meteorological data of the objective area, for the other observatories nearer to the objective area have only rainfall record.

2.2 Climate Condition Other than Rainfall and Typhoon

The objective area is situated between 14°10' and 14°25' North Latitude, and between 120°45' and 120°55' East Longitude. The weather of the area is governed by a tropical monsoon climate consisting of two distinct seasons, 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 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 November to April born by prevailing northeasterly winds, while a southwesterly wet monsoon imposes a rainly season from May to October. The data of MIA on the temperature, relative humidity, wind velocity, sunshine hours and evaporation are presented in Tables 2.2.1 and 2.2.2 and summarized as follows;

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 April Min. 4.0 KPH in Oct.
Average annual evaporation	1,516 mm

2.3 Rainfall

2.3.1 Rainfall Records

Rainfall observation records were collected from 20 observations in and around the objective area as indicated in Table 2.3.1 Among these 20 observatories, eight NIA maintained rain gauging stations are situated in the objective area or quite close to it. Though these stations have only records for five years at maximum, they are considered to show the local rainfall characteristics of the objective area. Hence, the average of the records at six stations which have rather longer record period among the said eight stations will be utilized as the basic hydrological data.

2.3.2 Rainfall Characteristics

Annual and monthly average rainfall amounts are indicated in Table 2.3.1. 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 a minimum of 2.6 mm in February. The southwesterly monsoon brings an abundance of rainfall from May to October, with a full 92% of the entire yearly precipitation occurring during this period.

Rainfall intensity generally peaks during August, wherein over half of the precipitation is typhoon born. According to the data accumulated, the maximum rainfall observed for single month is 1,989 mm recorded at R-19 station in May 1976. For the same month, over half of the remaining rainfall gauging stations recorded precipitation in excess of 1,500 mm. The maximum rainfall amount for a single 24-hour period is 508 mm observed at R-22 station as shown in Table 2.3.2. Rainfall distribution is erratic due to the fact that storms generally affect only a very limited area at hazard and are usually of short duration.

2.4 Typhoon

As shown in Table 2.4.1, the Philippine Archipelago is generally affected by typhoons and tropical cyclones 20 times or more per year. Central Luzon including the objective area, however, is affected less frequently by typhoons than Northern Luzon, and when such do occur, wind velocity and rainfall is generally less.

CHAPTER 3 GEOLOGY

3.1 General

Cavite Province including proposed project area is characterized by volcanic rocks of pyroclastic fragments derived from Taal Volcano. In other words, geological property of the area consists of igneous and sedimentary rocks that occupies respective 75% and 25% of total acreage in the province.

The igneous bassets are generally products of volcanism, while formation of the sedimentary rocks involves the weathering, transportation, accumulation of volcanic chips, ashes, cinder, etc.

According to the classification carried out by the Bureau of Soils (BS), the geological units are classified into six subdivisions as follows:

Sedimentary rocks

1) Alluvium (R) ; Recent
2) Corregidor Conglomerates (N_3C) ; Pliocene-Pleistocene
3) Sandstone and Shale (N_2) ; Upper Miocene-Lower Pliocene

Igneous rocks

4) Tagaytay Pyroclastics (QVP) ; Pliocene-Pleistocene
5) Sungay Volcanics (QVC) ; Upper Miocene-Pleistocene
6) Tall Tuffs (Q_1V) ; Upper Miocene-Pleistocene

The project area is identified as Taal Tuffs (Q_1V). The general geological map of Cavite Province is shown in Fig. 3.1.1.

Sedimentary rocks occur essentially along the coastal area. Quaternary alluvium overlies flood plains, coastal areas and minor valley floors. The Corregidor Conglomerates, a thick sequence of shale, sandstone and conglomerates is a well indurated sedimentary unit.

Quaternary volcanic cones, massive andesitic to basaltic lava flow, lava breccia and agglomerates appear at the western portion of the province; Mt. Sungay is a typical example of these cones.

Pyroclastics blanket the area near the Tagaytay Ridge, while tuffs which is very extensive, thick, consisting mostly of laminated ash and black cinder masked the lower elevation or lowlands.

A major fault skirts the western boundary of Laguna Province, but gradually curves towards the west as it approaches the Batangas-Cavite boundary at Tagaytay ridges.

3.2 Investigation of Main Bridge Sites

Main bridge sites are prospected at Malainen Luma on the Clong Clong river and at Kabuka on the Alemang river.

Weathered tuff and tuffbreccia are observed on the shoulders of the valleys in both areas and are strong enough to support the bridge foundation, however, in order to obtain the quantitative data of strength and deformation characteristics which are required during the detail design stage, it is deemed that in-situ and laboratory test are required.

Those necessary matters of investigation to identify the depth of foundation, bearing capacity and foundation practice matching to the scale of the bridge are the degree of weathering of the bed rock and its strength.

In order to obtain these data, core observation by core boring is the main item in association with standard penetration test, borehole horizontal loading test and uniaxial compression test using core samples with such number of test as:

1) Core boring (ø66 mm) ..... 10 m
2) Standard penetration test ..... every one meter excluding the fresh rock
3) Borehole horizontal loading test... two times
4) Uniaxial compression test ..... three times

These test would be carried out at each site of Malainen Luma and Kabuka.

3.3 Foundation Survey along Main Road A

Constructions of the Main Road A are planned at the Halang area and at the Palangui area. Soils of the areas are Guadalupe series with profile of deep loam layer and underlying solid volcanic ash and clay layers with poor drainage.

In order to collect the soil engineering data required for proposed road plan, soil samples were collected by means of testing pits and auger boring, and soil mechanical test was carried out with American Society for Testing and Materials (ASTM) at BS.

A summary of results is presented on Table 3.3.1. Sample No.S-1, 2, 4, 5, 7 are volcanic cohesive soil and S-3, 6 are volcanic coarse-grained soil, respectively.

The consistency of volcanic cohesive soil is high in comparison of that of non-volcanic cohesive soil. As it is classified as CH/1 based on ASTM soil classification system, volcanic cohesive soil is clay characterized high plasticity, viscosity and dry strength.

The same results was obtained along the above mentioned line during the portable cone penetrometer test carried out to determine the strength of the road foundation. Accordingly, the trafficability of the volcanic cohesive soil is recognized appreciable.

Volcanic coarse-grained soil is the solid volcanic ash deposit classified as SC/2 based on ASTM soil classification system. In this case, the static cone resistance of the soil is high and the traffic ability was strong enough.

Concerning with the evidence to be utilized as farm road and the result of the present test, it is confirmed that operation of the construction machinery can be done with less trouble in the area.

The degree of remolding loss of the volcanic cohesive soil is evident rather than that of the non-volcanic cohesive soil in general,

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/1: C represents cohesive soils or clay, and H represents high liquid limit. ($W_L \geqq 50\%$, W_L: liquid limit).

/2: S represents sand and C represents cohesive soils or clay.

and reaction against acidity in response to changing of moisture content is sensitive as well. For these reasons, it is desired that excavated materials should be cleared out and leveled so as not to remain rutting to prevent rain water pool on the surface of the excavating site.

3.4 Investigation on Construction Materials

There are two major rivers, the Maragondon river and the Balsahan river in Cavite district. Suitable gravel and sand for construction materials are found only on the Maragondon river.

Hard andesitic or basaltic volcanic gravel is found on the Pingoanghan river, a distributary of the Maragondon river, where the Government's crusher plant is working; boulders are crushed into cobble and pebble size, and these materials are used as good road substratum.

Black sand mixed with cement is found in the downstream of the Maragondon river, where a private company is running excavation of the sand of which the selling price is ₱130 of six-wheeled truck load or ₱180 of ten-wheeled truck load at the site.

CHAPTER 4 SOILS

4.1 Introduction

The objectives of the soil survey are to: (1) identify major soil groups and their distribution in the objective area; (2) examine nutrient status or fertility of the soils; and (3) provide basic information on soil suitability for the cultivation of the raw material crops for alcohol production.

In 1935, the soil map of Cavite Province on a scale of 1:75,000 was prepared by the Department of Agriculture and it was modified in 1970. According to this map, the soils of the objective area belong to three series, i.e., Guadalupe on the lower part, Magallanes on the middle part and Tagaytay on the higher part of the objective area.

4.2 Procedure of Soil Survey

4.2.1 Field Survey and Sampling

The field survey was carried out over the total area of about 13,000 ha using the topographic map on a scale of 1:50,000 as a base map. For selection of test pitting and soil sampling sites, the soil distributions shown by the soil map mentioned above were taken into consideration. At each sampling site, a test pit was dug one meter deep or up to bedrock, hard pan or gravel layer, and profile observations were made in accordance with the Guidelines of Soil Profile Description, Food and Agriculture Organization (FAO) in 1977. As well, boring exploration with hand auger or stick was practiced to ascertain soil group boundaries. Furthermore, these boundaries were rivised with the information of land use and geomorphology which were interpreted from aerial photographs on a scale of 1:15,000 taken in 1978.

For physico-chemical analyses in laboratory, 13 soil samples and 14 cores were taken from the representative horizons of six profiles, and they were sent to BS, Ministry of Agriculture (MA).

4.2.2 Laboratory Test

Chemical and physical properties of soils were examined at BS. The items of tests are as follows:

1) pH(H_2O), pH($CaCl_2$) with soil-water or chloride ratio 1:1 and 1:2, respectively
2) Exchangeable cation of Ca, Mg, K and Na
3) Cation exchange capacity (CEC)
4) Total nitrogen
5) Organic carbon
6) Available phosphate
7) Phsophate absorption coefficient
8) Particle size distribution (mechanical analysis), and
9) pH (moisture retention analysis)

The detailed results of soil profile description and physico-chemical analyses are shown in Tables 4.2.1 to 4.2.7.

4.3 Soil Classification

Soil classification on the soil series level is available. Three soil series are identified in the objective area as follows:

1) Guadalupe series
2) Magallanes series, and
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 4.3.1 and mapped in Fig. 4.3.1.

4.4 Some Descriptions of the Soil Series

The main features of the soil series are summarized as follows. In this description the physical and chemical status are rated by the criteria which are preliminarily estimated based on the specific degree generally accepted as shown in Table 4.4.1.

4.4.1 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.

Their topsoils are brownish black in color, fine in texture, weak subangular blocky in structure, slightly sticky and plastic in consistence when wet. Their subsoils are dull yellow in color, fine in texture, structureless massive in structure, very sticky and very plastic in consistence when wet.

As for their physico-chemical properties, the acidity of soils is strong to moderately strong throughout the profile. The organic matter content is low in topsoil and very low in subsoil. CEC value is high throughout the profile ranging from 30 to 60 m.e. which is saturated by bases at 65 to 70% in which calcium and magnecium are dominant bases. The contents of available plant nutrients such as nitrogen, phosphate and potassium are moderately high throughout the profile. Total available water holding capacity is moderately high in topsoil and very high in subsoil.

The lands of these soils are mainly planted paddy with or without irrigation, pasture grasses and sugarcane. This series has three phases in the objective area, i.e. Flat-deep, Flat-moderately deep and Sloping-moderately deep.

4.4.2 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.

Their topsoils are dark brown in color, fine in texture, moderately fine subangular blocky in structure, slightly sticky and plastic in consistence when wet. In general, A horizon of these soils is shallow to very shallow due to the severe sheet erosion and underlain by the consolidated tuffaceous rock of undetermined depth. As a result, A and B horizon are not clearly distinguishable in the most of these soils, and the effective soil depth varies greatly depending on the degree of erosion.

Regarding their physico-chemical properties, the soils have strong acid reaction throughout the profile. The content of organic matter is low in both topsoil and subsoil. CEC value is high throughout the profile ranging from 40 to 50 m.eq. which are saturated by bases at 60 to 70% in which calcium is dominant base. The contents of available plant nutrients such as nitrogen, phosphate and potassium are moderately high to high throughout the profile. Total available water holding capacity is moderately high in both topsoil and subsoil.

Main crop growth in these soils is upland rice in the wet season. During the dry season, however, the lands are left fallow due to lack of water. This series consists of five phases, i.e. Flat-very shallow, Flat-shallow, Sloping-very shallow, Sloping-shallow and Steep-very shallow.

4.4.3 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.

The soils have horizon sequence of A/C and comprise deep effective soil in general. Their topsoils are dark brown in color, fine in texture, weak medium subangular blocky in structure, slightly sitcky and plastic in consistence when wet. Their subsoils are

brownish black in color, fine in texture, medium subangular blocky in structure, sticky and plastic in consistence when wet.

They have moderately strong acid reaction throughout the profile. The content of organic matter is moderately high in topsoil, while low in subsoil. CEC and base saturation degrees are high in both topsoil and subsoil. The contents of available plant nutrients such as nitrogen, phosphate and potassium are very high throughout the profile. Total available water holding capacity is moderately high in both topsoil and subsoil.

At present, the lands covered with these soils are used for the cultivation of perennial crops such as coconut, coffee, papaya, pine-apple, etc. This series includes three phases, i.e. Flat-deep, Sloping-deep and Steep-very shallow.

4.5 Land Classification

4.5.1 General

This study aims to assess the land suitability for cultivation of three raw material crops, sugarcane, cassava and sweet potato for alcohol production. The land suitability is classified by the application of the following publications with some adjustments to suit to the local conditions.

1) Procedure of Productive Capability Classification of Land: Ministry of Agriculture, Forestry and Fisheries of Japan,
2) Land Capability Classification: Soil Conservation Service, U.S. Department of Agriculture.

4.5.2 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 or 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 of 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.

The suitability class is decided by the grade of the land characteristics which are considered as the limiting factors or constraints for the cultivation of said crops. The land characteristics to be evaluated in the objective area are the thickness of effective soil depth and the slope of land. The grades of each land characteristic are as follows:

Grade	Criteria	Specification
Thickness of effective soil depth		
1	Deep	more than 60 cm
2	Moderately deep	30 - 60 cm
3	Shallow	15 - 30 cm
4	Very shallow	less than 15 cm
Slope of land		
1	Flat	less than 3° (5%)
2	Sloping	3° - 8° (5 - 14%)
3 - 4	Steep	more than 8°

The land suitability class is defined at the lowest grade of the factors.

4.5.3 Evaluation of Land Suitability

Based upon the gradient of limiting factor to land suitability, the class of land suitability for the cultivation of the said crops is evaluated by soil phase. The acreage and proportional extent of each land suitability class are summarized in Table 4.5.1 and mapped in Fig. 4.5.1. In view of the topographic and soil conditions, contour farming should be practiced.

4.6 Land Suitability for Sugarcane

The lands of Class I and II are suitable for the cultivation of sugarcane, and extend over 3,800 ha or 29.9% of the objective area. They have almost no limitations or hazards for sugarcane proudction 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 susceptibility to water erosion, severe effect of past erosion such as the outcrops of bedrock, steep slope and valley bottom. They extend over 5,230 ha or 40.2% of the objective area.

CHAPTER 5 HYDROLOGY

5.1 River Discharge

5.1.1 Available Discharge Records

As shown in Fig. 5.1.1, a number of rivers flow through the objective area, including the Maragondon, Balsahan, and Alemang rivers, and principal tributaries of the Balayugan, Clong Clong, and Sahing rivers.

Long term discharge observation records until 1976 are available for the Maragondon and Balsahan rivers, in which the general information of the gauging stations are shown in Table 5.1.1.

5.1.2 Discharge Characteristics

The annual and monthly average discharge values for the Marangondon and Balsahan rivers are shown in Tables 5.1.2 to 5.1.5 and summarized below:

	Maragondon River	Balsahan 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
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	3,047.00 m^3/s	279.00 m^3/s
Daily min. discharge	0.195 m^3/s	0.004 m^3/s

Standard deviation of monthly discharge for the two rivers is as shown in Table 5.1.6. As shown in Figs. 5.1.2 and 5.1.3 and Tables 5.1.7 to 5.1.10, the annual stream flow pattern varies widely accordingly to the year. The wet season flow appears during the month of

June through November, but occasionally, the Maragondon river has a small discharge less than 1.0 m^3/sec in June, and the Balsahan river less than 0.3 m^3/sec in June and November.

The drought flow appears during the months of January through April; especially the stream flow becomes extremely small in March and April. The average drought/1, low/2 and ordinary/3 river discharge are1.33 m^3/sec, 2.33 m^3/sec, 420 m^3/sec, at Mabaco (the Maragondon) and 0.053 m^3/sec, 0.087 m^3/sec, 0.450 m^3/sec at Palangui (the Balsahan). December is transitional month to the dry season flow and May is also a transitional month to the wet season flow, but occasionally, large discharge occurs in May caused by heavy rainfall. Extreme flood discharge records are; Marangondon - 4,247.0 m^3/sec, Balsahan - 315.0 m^3/sec. These discharge amounts were the result of flooding caused by typhoon born precipitation. Coefficient of river regime, a ratio of the maximum discharge to the minimum discharge, are very big: Maragondon - 15625, Balsahan - 69750. Specific discharge are: Maragondon - 11.72 m^3/sec/km^2, Balsahan - 12.67 m^3/sec/km^2.

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 is 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.

/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

5.1.3 Actual Measurement of Discharge

In the course of the field survey, the river discharge and river cross section were measured on the main rivers in the objective area, and their results are given in Fig. 5.1.4.

5.2 Water Quality

In the course of the field survey water samples were collected at the locations shown in Fig. 5.1.4, and their water quality analysis was conducted by NIA laboratory. The results of the analysis are listed in Table 5.2.1. In view of chemical characteristics all river waters 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 has been recorded rather high value. This was considered as the effect of flood.

5.3 Groundwater

Tables 5.3.1 and 5.3.2 show the number of existing artesian well and their groundwater levels in the objective area. This table was prepared based on the data collected at the National Water Works and Sewering Authority (NAWASA) and the information from a local well bores. According to the data accumulated, at least one public artesian well exists per barangay. The water levels of these wells general fluctuate approximately 10 feet from the dry to wet season. In addition, a report on groundwater conditions in Cavite Province prepared by NIA for the Laguna de Bay Development Project was also collected. According to this report, the potential groundwater recharge for the Cavite area is estimated at 25 MCM/year. Annual discharge from existing wells is calculated at 9 MCM. Total yield is estimated at 16 MCM and safe yield at 5.3 MCM. Transmissibility, as well as other factors showing ground water conditions, are as indicated in Table 5.3.3.

Table 2.1.1 LIST OF METEOROLOGICAL OBSERVATIONS

Station	Location (Lat.) (Long.)	Maintained by	Available Record /1	Record Period	Missing or Lost
Nasugbu, Batangas	14-04, 120-38	PAGASA	R	Jan. '73 - Nov. '80	Dec. '77 - Dec. '78
Bayabasan, Batangas	14-10, 120-38	PAGASA	R	Jan. '77 - Dec. '78	
Puting Tubig, Batangas	14-10, 120-37	PAGASA	R	Jan. '74 - Dec. '75	
Ambulong, Batangas	14-05, 121-04	PAGASA	E,T,W,R,H	Jan. '64 - Dec. '79	Nov. '70 - Dec. '75
Amadeo, Cavite	14-10, 120-57	PAGASA	R	Jan. '72 - Oct. '80	May '77
Indang, Cavite	14-12, 120-53	PAGASA	R	Jan. '77 - Dec. '79	
Tagaytay City	14-07, 120-58	PAGASA	R	Jan. '77 - Dec. '80	
Sangley Point, Cavite	13-30, 120-55	PAGASA	R	Jan. '75 - Apr. '80	Dec. '78 - Dec. '79
Mabolo, Cavite	14-27, 120-56	PAGASA	R	Jan. '76 - Apr. '80	
Molino, Cavite	14-25, 120-59	PAGASA	R	May '69 - Nov. '76	
MIA, Pasay City	14-31, 121-00	PAGASA	T,W,R,H, S,P	Jan. '61 - Dec. '79	Aug. '73, Jan. - Jul. '75 Jul. '77, Jan. '78 - Jul. '79
Balora, Quezon City	14-39, 121-05	PAGASA	T,W,R,H, SR, P	Apr. '64 - Apr. '77	Nov. - Dec. '70, Dec. '72 Dec, '78
NIA, Naic	Naic, Cavite	NIA	R	Jul. '73 - Dec. '78	
Tatlong Pritil	Naic, Cavite	NIA	R	Jan. '73 - May '78	
Calibuyo Patulog	Tanza, Cavite	NIA	R	Jan. '78 - Apr. '79	
Alulod	Indang, Cavite	NIA	R	Jan. '74 - Mar. '80	
Caluangan	Magallanes, Cavite	NIA	R	Jan. '76 - May '80	
Luksuhin	Alfonso, Cavite	NIA	R	Jan. '76 - May '80	
Pulo ni Sara	Maragordon, Cavite	NIA	R	Jan. '76 - Feb. '80	
Talipusngo	Maragondon,	NIA	R	Jan. '76 - May '80	

Note /1 E; Evaporation, T; Temperature, W; Wind velocity and direction, R; Rainfall, H; Humidity
S; Sunshine hours, SR; Solar radiation, P; Barometric pressure

Table 2.2.1 SUMMARY OF CLIMATIC CONDITIONS (1)

		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Mean Tenperatue (°C)													
MIA, Pasay City	(1961-1979)	25.3	26.0	27.3	28.7	29.5	28.8	27.8	27.5	27.6	27.6	26.9	26.0
Balora, Quezon City	(1961-1975)	25.1	25.5	26.8	28.5	28.9	27.8	27.0	26.8	26.9	26.7	26.1	25.4
Ambulong, Batangas	(1976-1980)	26.2	26.5	27.4	28.8	28.5	28.2	27.5	27.2	27.1	27.3	26.9	25.8
Maximum Temperature (°C)													
Ambulong, Batangas	(1976-1980)	33.5	33.0	35.9	36.7	36.3	35.4	33.8	33.5	33.3	34.1	32.8	32.1
Minimum Temperature (°C)													
Ambulong, Batangas	(1976-1980)	18.9	19.2	19.3	21.6	21.7	22.4	22.1	22.0	22.0	21.4	21.1	19.4
Mean Relative Humidity (%/day)													
MIA, Pasay City	(1961-1979)	71	69	66	65	66	74	82	83	82	80	79	79
Balora, Quezon City	(1961-1979)	73	69	66	64	69	78	81	82	82	80	79	79
Mean Evaporation (mm/month)													
MIA, Pasay City	(1971-1980)	104.3	133.8	173.8	177.3	156.1	127.8	117.7	104.2	110.1	111.9	91.9	107.9

Table 2.2.2 SUMMARY OF CLIMATIC CONDITIONS (2)

		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Mean Wind Velocity (knot/h)													
MIA, Pasay City	(1961-1979)	6.0	7.0	8.0	9.0	7.0	6.0	5.0	5.0	5.0	4.0	4.0	5.0
Balora, Quexon City	(1961-1978)	7.0	7.0	8.0	9.0	7.0	5.0	5.0	6.0	5.0	4.0	5.0	5.0
Maximum Wind Velocity (knot/h)													
MIA, Pasay City	(1961-1979)	32.0	40.0	76.0	76.0	70.0	60.0	43.0	70.0	45.0	52.0	65.0	30.0
Balora, Quezon City	(1961-1978)	46.0	30.0	30.0	29.0	36.0	62.0	43.0	36.0	36.0	40.0	60.0	37.0
Mean Sunshine (min/day, %)													
MIA, Pasay City	(1962-1979)	350	430	480	518	497	415	361	330	339	353	352	333
%		52	62	67	70	65	54	47	44	46	40	41	49

Source: PAGASA

Table 2.3.1 MONTHLY AVERAGE RAINFALL AT NIA STATIONS

Unit: mm

Station	Month Period	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
R1. Cflis Compd	1974-1978	22.0	2.9	4.1	11.7	286.0	176.5	184.5	596.7	353.1	206.5	105.5	145.4	2,094.9
R2. Tatlong Pritil	-													
R4. Cilibyo Patlog	-													
R18. Alulod Indang	1976-1980	1.8	0.8	32.8	54.3	559.2	188.2	271.6	788.2	605.9	382.4	99.8	46.7	3,031.7
R19. Luksuhin	1976-1980	11.1	5.9	18.6	28.5	509.8	248.7	389.2	783.9	572.6	335.5	122.6	37.2	3,026.3
R20. Caluangu	1976-1980	16.9	3.9	7.6	18.5	390.7	265.2	376.0	682.0	622.2	281.3	47.5	52.6	2,766.2
R21. Puloni Sana	1976-1980	14.9	1.7	118.5	29.4	577.4	265.7	314.8	834.0	579.5	374.1	98.6	52.0	3,260.6
R22. Talipusngo	1976-1980	11.5	0.4	24.3	18.9	479.8	231.0	358.8	827.9	496.1	66.9	65.9	8.6	2,590.1
Mean		13.1	2.6	34.3	26.9	467.2	229.2	315.8	752.4	538.2	274.5	90.0	57.1	2,795.0
Wet Season (May - Oct.)								2,577						
Proportion (%)								92						

Source: NIA

Table 2.3.2 PATTERN OF RAINFALL

Year	Station/1	Continuous Day		Rainfall in mm		
		Dry	Rain	24 hrs.	48 hrs.	72 hrs.
1974	R1	54	18	202.0	293.0	374.0
	R2	-	-	-	-	-
	R18	-	-	-	-	-
	R19	-	-	-	-	-
	R20	-	-	-	-	-
	R21	-	-	-	-	-
	R22	-	-	-	-	-
	Mean	54	18	202.0	293.0	374.0
1975	R1	80	6	215.9	381.0	431.9
	R2	88	10	203.2	355.6	381.0
	R18	-	-	-	-	-
	R19	-	-	-	-	-
	R20	-	-	-	-	-
	R21	-	-	-	-	-
	R22	-	-	-	-	-
	Mean	84	8	209.6	368.3	406.5
1976	R1	89	7	329.0	589.0	799.0
	R2	58	10	329.0	589.0	799.0
	R18	61	7	373.1	733.8	1,059.2
	R19	39	8	373.1	733.8	1,059.2
	R20	36	11	504.4	1,008.3	1,146.5
	R21	33	12	480.6	906.6	1,128.6
	R22	40	11	508.0	914.4	1,160.4
	Mean	43	11	413.9	782.2	1,021.7
1977	R1	78	8	165.0	211.0	248.0
	R2	54	16	187.0	234.0	274.0
	R18	107	14	199.1	248.4	293.1
	R19	45	16	238.3	300.0	300.0
	R20	34	18	193.0	224.0	226.5
	R21	33	16	128.8	177.3	215.1
	R22	110	8	146.6	167.9	168.4
	Mean	66	14	179.7	223.3	246.5
1978	R1	111	13	250.0	500.0	650.0
	R2	-	-	-	-	-
	R18	75	16	203.2	393.2	571.0
	R19	29	16	261.9	357.5	515.7
	R20	28	14	209.6	403.9	435.7
	R21	30	18	206.8	411.3	528.0
	R22	40	13	233.4	385.8	578.0
	Mean	53	15	185.9	408.2	546.4
1979	R1	-	-	-	-	-
	R2	-	-	-	-	-
	R18	88	8	181.4	288.1	399.6
	R19	54	14	247.0	453.9	578.6
	R20	78	23	156.2	285.7	404.0
	R21	66	16	296.7	409.2	674.4
	R22	86	8	309.0	437.0	568.0
	Mean	75	14	238.1	374.8	524.9

Note: /1 The locations of gauging stations are plotted in Fig.2.1.1.

Table 2.4.1 FREQUENCY OF TYPHOON AND TROPICAL CYCLONE IN THE PHILIPPINE ARCHIPELAGO (1961-1978)

Year \ Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
1961	1	1	1	-	1	3	4	4	4	1	1	2	23
1962	-	1	-	-	2	-	4	6	4	2	-	2	21
1963	-	-	-	-	1	3	4	2	3	1	-	2	16
1964	-	-	-	-	3	1	9	5	5	4	3	2	32
1965	2	1	1	-	1	3	5	3	3	1	1	-	21
1966	-	-	-	1	3	1	5	4	2	1	3	2	22
1967	1	-	1	1	1	2	3	5	-	2	3	1	20
1968	-	-	-	-	-	2	3	3	2	2	3	-	15
1969	-	-	-	1	1	-	3	3	3	1	3	-	15
1970	-	1	-	-	-	2	3	3	5	3	3	1	21
1971	1	-	1	2	4	2	5	2	3	5	2	-	27
1972	3	-	-	-	-	1	3	3	4	1	1	1	17
1973	-	-	-	-	-	-	1	2	3	2	3	1	12
1974	-	-	-	-	-	3	5	4	1	5	2	2	22
1975	1	-	-	-	-	-	1	3	3	4	2	1	15
1976	1	1	-	1	1	3	3	3	4	-	2	3	22
1977	1	-	-	-	1	-	5	1	5	2	2	2	19
1978	-	-	-	1	-	3	1	7	6	2	-	-	20
Total	11	5	4	7	19	29	67	63	60	39	34	22	360

Source: PAGASA

Table 3.3.1 LABORATORY ANALYSIS DATA FOR MAIN ROAD A

Sample No.	Depth (cm)	Bulk Density	Mechanical Analysis(%)			Tex-ture Class	LL (%)	PL (%)	PI	WHC (%)
			Sand	Silt	Clay					
S-1	20-30	1.32	25.6	27.2	47.2	C	53.6	26.0	27.6	64.6
S-2	5-10	1.24	29.6	27.2	43.2	C	54.8	20.7	34.1	69.8
S-3	25-30	1.17	61.2	14.6	24.2	SCL	-	-	-	51.2
S-4	10-30	1.71	21.6	10.2	68.2	C	56.5	29.9	26.6	70.9
S-5	10-15	1.23	21.6	36.2	42.2	C	57.0	31.4	25.6	69.6
S-6	15-20	1.03	62.4	12.4	25.2	SCL	-	-	-	49.0
S-7	15-20	1.66	19.8	17.0	63.2	C	58.1	20.0	38.1	75.9

Note: Location: Palangui, Naic
Soil name: Guadalupe Series
Parent material: tuff

LL: Liquid Limit
PL: Plastic Limit
PI: Plasticity Index (PI = LL - PL)
WHC: Water Holding Capacity

$$(WHC = \frac{\text{Weight of moisture} \times 100}{\text{Weight of the oven-dry soil}}(\%))$$

C: Clay
SCL: Sandy Clay Loam

Table 4.2.1 SOIL PROFILE DESCRIPTION
(Flat-Shallow Phase of Magallanes Series)

1. Information on the site

a.	Pit number	:	1
b.	Soil name	:	Magallanes Series Flat-shallow Phase
c.	Location	:	Tanauan, Tanza (4 km northwest of TRECE MARTIRES)
d.	Elevation	:	70 meters
e.	Land form		
	Physiographic position	:	on the volcanic plateau
	Surrounding land form	:	flat or almost flat
	Microtopography	:	nil
f.	Slope on which profile is sited	:	flat or almost flat (1° - 2°)
g.	Vegetation or land use	:	grassland

2. General information on the soil

a.	Parent material	:	tuff
b.	Drainage	:	well
c.	Moisture condition in profile	:	moist
d.	Depth of groundwater table	:	not measured
e.	Presence of surface stones	:	fairly stony
f.	Evidence of erosion	:	none at site, but severe sheet erosion in adjacent sloping field
g.	Human influence	:	abandoned after cultivation

3. Profile description

Horizon symbol	Depth (cm)	Remarkable features
Ap	0-33	Dark brown (10YR3/3) moist; clay; moderate, fine, subangular blocky, sticky and plastic when wet; few, weathered tuffaceous rock (2 to 4 cm in diameter); few, fine roots of grasses; hardness 14; abrupt, smooth boundary.
C1	33-43	Yellowish brown tuffaceous rock, soft, diggable with spade, many cracks coarted by cutans.
C2	below 43	Yellowish brown tuffaceous rock, slightly compact but diggable with hand auger.

Note : Sample for analyses is taken from Ap horizon.

Table 4.2.2 SOIL PROFILE DESCRIPTION
(Flat-Shallow Phase of Magallanes Series)

1. Information on the site

a.	Pit number	: 2
b.	Soil name	: Magallanes Series Flat-shallow Phase
c.	Location	: Palangui 3, Naic
d.	Elevation	: 110 meters
e.	Land form	
	Physiographic position	: on the volcanic plateau
	Surrounding land form	: flat or almost flat
	Microtopography	: nil
f.	Slope on which profile is sited	: flat
g.	Vegetation or land use	: banana field

2. General information on the soil

a.	Parent material	: tuff
b.	Drainage	: well
c.	Moisture condition in profile	: moist
d.	Depth of groundwater table	: not measured
e.	Presence of surface stones	: none
f.	Evidence of erosion	: none at site, but severe sheet erosion in adjacent sloping field
g.	Human influence	: none

3. Profile description

Horizon symbol	Depth (cm)	Remarkable features
A	0-27	Dark brown (10YR3/3) moist; clay; moderate, fine, subangular blocky; slightly sticky and plastic when wet; common, medium, faint manganese mottlings; few, medium roots of banana and common, fine roots of grasses; hardness 18; abrupt, smooth boundary.
C	below 27	Yellowish brown tuffaceous rock, slightly compact but diggable with hand auger.

Note: Sample for analyses is taken from A horizon.

Table 4.2.3 SOIL PROFILE DESCRIPTION
(Sloping-Very Shallow Phase of Magallanes Series)

1. Information on the site

a.	Pit number	:	3
b.	Soil name	:	Magallanes Series Sloping-very shallow phase
c.	Location	:	Balayungan, Maragondon
d.	Elevation	:	60 meters
e.	Land form		
	Physiographic position	:	on the volcanic plateau
	Surrounding land form	:	sloping
	Microtopography	:	nil
f.	Slope on which profile is sited	:	gently sloping
g.	Vegetation or land use	:	grassland

2. General information on the soil

a.	Parent material	:	tuff
b.	Drainage	:	well
c.	Moisture condition in profile	:	moist
d.	Depth of groundwater table	:	not measured
e.	Presence of surface stones	:	none
f.	Evidence of erosion	:	none at site, but severe sheet erosion in adjacent sloping field
g.	Human influence	:	previously planted to cassava

3. Profile description

Horizon symbol	Depth (cm)	Remarkable features
Ap	0-10	Dark brown (7.5YR3/3) moist; clay; moderate, fine, subangular blocky; slightly sitcky and plastic when wet; few, fine roots of grasses; hardness 19; abrupt, smooth boundary.
B1	10-18	Dark yellowish brown (10YR4/4) tuffaceous rock; compact (hardness 30) but diggable with spade; common, medium, prominent manganese mottlings; abrupt, broken boundary.
B2	18-62	Dark brown (10YR3/3) moist; clay, weak, medium, subangular blocky; slightly sticky and plastic when wet; few, medium, distinct manganese mottlings; many clay skins on the peds; hardness 22; gradual, smooth boundary.
C1	62-80	Yellowish gray heavy clay, sticky and very plastic.
C2	below 80	Yellowish gray heavy clay, sticky and very plastic.

Note: Samples for analyses are taken from Ap, B1 and B2 horizon.

Table 4.2.4 SOIL PROFILE DESCRIPTION
(Flat-Deep Phase of Guadalupe Series)

1. Information on the site

a.	Pit number	:	4
b.	Soil name	:	Guadalupe Series Flat-deep Phase
c.	Location	:	Halang, Naic
d.	Elevation	:	40 meters
e.	Land form		
	Physiographic position	:	on the volcanic plateau
	Surrounding land form	:	flat
	Microtopography	:	small gilgai
f.	Slope on which profile is sited	:	flat
g.	Vegetation or land use	:	grassland (pasture)

2. General information on the soil

a.	Parent material	:	tuff
b.	Drainage	:	poor internally
c.	Moisture condition in profile	:	moist
d.	Depth of groundwater table	:	not measured
e.	Presence of surface stones	:	none
f.	Evidence of erosion	:	none at site
g.	Human influence	:	none

3. Profile description

Horizon symbol	Depth (cm)	Remarkable features
A	0-10	Brownish black (10YR2/3) moist; silty clay; weak, medium, subangular blocky, slightly sticky and plastic when wet; hardness 11; few, fine roots at grasses; clear, smooth boundary.
B	10-20	Very dark grayish brown (10YR3/2) moist;silty clay; moderate, medium, subangular blocky; slightly sticky and plastic when wet; few, fine, manganese concretions; hardness 14; few, fine roots of grasses; clear, smooth boundary.
BC	20-35	Dull yellow (2.5Y6/3) moist; clay; moderate, coarse, subangular blocky; sitcky and plastic when wet; few, fine roots of grasses; hardness 20; diffuese, smooth boundary.
C	below 35	Dull yellow (2.5Y6/3) moist; clay; structure-less massive; very sticky and very plastic when wet; evidence of washing down of surface soil into the fissures in 4 cm width; up to 70 cm in depth; hardness 18.

Note: Samples for analyses are taken from each horizon.

Table 4.2.5 SOIL PROFILE DESCRIPTION
(Flat-Deep Phase of Tagaytay Series)

1. Information on the site

a.	Pit number	: 5
b.	Soil name	: Tagaytay Series Flat-deep Phase
c.	Location	: Banaba cerca
d.	Elevation	: 230 meters
e.	Land form	
	Physiographic position	: on the volcanic plateau
	Surrounding land form	: flat
	Microtopography	: nil
f.	Slope on which profile is sited	: flat
g.	Vegetation or land use	: coconut plantation

2. General information on the soil

a.	Parent material	: volcanic ash
b.	Drainage	: well
c.	Moisture condition in profile	: moist
d.	Depth of groundwater table	: not measured
e.	Presence of surface stones	: none
f.	Evidence of erosion	: none
g.	Human influence	: none

3. Profile description

Horizon symbol	Depth (cm)	Remarkable features
A	0-10	Dark brown (7.5YR3/2) moist; silty clay; weak, medium, subangular blocky; slightly sticky and plastic when wet; few, fine and medium roots of coconut; hardness 12; gradual, smooth boundary.
B21	10-31	Dark brown (7.5YR3/2) moist; silty clay; weak, medium, subangular blocky; slightly sitcky and plastic when wet; few, medium roots of coconut; hardness 18; clear, smooth boundary.
B22	below 31	Brownish black (7.5YR2/2) moist; clay; moderate, medium, subangular blocky; sticky and plastic when wet; few, medium roots of coconut; hardness 26.

Note: Samples for analyses are taken from each horizon.

Table 4.2.6 SOIL PROFILE DESCRIPTION
(Sloping-Very Shallow Phase of Magallanes Series)

1. Information on the site

a.	Pit number	: 6
b.	Soil name	: Magallanes Series Sloping-very shallow Phase
c.	Location	: Tabara Malayu
d.	Elevation	: 150 meters
e.	Land form	
	Physiographic position	: on the volcanic plateau
	Surrounding land form	: undulating
	Microtopography	: nil
f.	Slope on which profile is sited	: gently sloping
g.	Vegetation or land use	: banana filed

2. General information on the soil

a.	Parent material	: tuff
b.	Drainage	: well
c.	Moisture condition in profile	: wet
d.	Depth of groundwater table	: not measured
e.	Presence of surface stones	: none
f.	Evidence of erosion	: none of site, but severe sheet erosion in adjacent sloping field
g.	Human influence	: plowghing

3. Profile description

Horizon symbol	Depth (mm)	Remarkable features
Ap	0-23	Dark brown (7.5YR3/3) moist; silty clay; weak, fine, subangular blocky; slightly sticky and plastic when wet; clay linings in pores; few fine roots of grasses; hardness 14; abrupt, smooth boundary.
C	below 23	Strongly weathered tuff layer; slightly compact but possible to dig with spade; common, fine manganese mottlings in the upper 10 cm; hardness 28.

Note: Sample for analyses is taken from Ap horizon.

Table 4.2.7 LABORATORY ANALYSIS DATA

Pit No.	Soil Series	Hori-zon	Depth (cm)	Mechanical Analysis (%)			Tex-ture	EC (mmhos/cm)	PH		Organic Matter		C/N	Available P_2O_5	Abs. Co. P_2O_5	Exchangeable Cation (m.eq./100g)					CEC (m.eq/	Base Sat.	Field Cap.	Perm Wilt.	Avail.
				Sand	Sit	Clay		1:1	(H_2O) 1:1	($CaCl_2$) 1:2	C (%)	N (%)		(mg/100g)	(mg/100g)	Ca	Mg	K	Na	Sum	100g)	(%)	(1/3bar)	(15bar)	Moist.
1.	Magallanes	AP	0-33	24.2	35.0	40.8	C	0.25	6.2	5.5	0.95	0.13	7	9.3	1,186	22.0	9.1	1.5	0.3	32.9	46.4	71			
2.	Magallanes	A	0-27	24.2	35.4	40.4	C	0.19	5.5	4.9	0.63	0.04	16	8.4	1,163	17.7	7.7	0.3	0.3	26.0	41.9	62			
3.	Magallanes	Ap	0-10	22.2	32.0	45.8	C	0.23	5.1	4.7	0.89	0.11	8	5.0	1,296	23.6	4.9	0.7	0.2	29.4	49.1	60	34.6	19.8	14.8
		B1	10-18	30.2	28.0	41.8	C	0.22	5.3	4.8	0.52	0.05	10	3.3	1,392	24.9	6.9	0.4	0.4	32.6	52.0	63			
		B2	18-62	10.2	24.0	65.8	C	0.21	5.9	5.0	0.44	0.03	15	3.5	1,310	27.2	3.1	0.4	0.4	31.1	47.7	65	40.4	22.8	17.6
4.	Guadalupe	A	0-10	12.2	40.0	47.8	SiC	0.18	5.5	5.0	0.98	0.06	16	7.4	870	17.0	5.2	0.4	0.2	23.7	36.3	65	37.1	18.8	18.3
		B	10-20	12.2	42.0	45.8	SiC	0.22	5.6	4.9	0.59	0.05	12	7.4	765	13.2	7.4	0.2	0.4	21.2	31.5	67			
		BC	20-35	11.2	32.0	56.8	C	0.21	5.6	5.1	0.34	0.02	17	5.2	1,012	17.3	10.5	0.2	0.5	28.5	40.2	71			
		C	35+	6.2	13.0	80.8	C	0.33	5.2	4.8	0.30	0.02	15	5.1	1,365	24.4	16.4	0.3	1.0	42.1	59.1	71	49.9	17.5	32.4
5.	Tagaytay	A	0-10	10.2	44.0	45.8	SiC	0.30	5.7	5.4	1.24	0.11	11	126.3	288	23.7	4.1	0.8	0.2	28.8	47.2	61	34.5	19.5	15.0
		B21	10-31	7.2	42.0	50.8	SiC	0.21	5.7	5.2	0.90	0.09	10	86.9	1,012	20.7	5.6	0.8	0.3	27.4	43.9	62			
		B22	31+	8.2	35.0	56.8	C	0.15	5.9	5.4	0.96	0.07	14	100.0	898	24.2	4.6	0.6	0.3	29.7	47.0	63	31.1	18.6	12.5
6.	Magallanes	Ap	0-23	18.2	41.0	40.8	SiC	0.15	5.3	4.8	0.66	0.07	9	28.3	1,012	19.3	3.8	0.4	0.2	23.7	41.3	57	35.1	18.6	15.5

Table 4.3.1 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	FTat-very shallo	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
	Steep-very shallow	8	1,420	10.9
			8,880	68.3
Tagaytay Series	Falt-deep	9	1,190	9.2
	Sloping-deep	10	440	3.4
	Steep-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%)	Shallow	15 - 30 cm
		Very shallow	less than 15 cm

Table 4.4.1 RATING OF SOIL CONDITION

1. Textural classes

Coarse textured:	sands, loamy sands and sandy loam with less than 15% clay, and more than 65% sand.
Medium textured:	loam, silty loams, sandy clay loams, clay loams and silt clay loams with less than 25% clay.
Fine textured:	sandy clays, light clays, silty clays and heavy clays with more than 25% clay.

2. Total available water capacity (%)

High	more than 20
Moderately high	10 to 20
Low	less than 10

3. Soil acidity pH (H_2O)

Slightly acid to neutral	6.1 to 7.5
Moderately strong acid	5.6 to 6.0
Strong acid	5.1 to 5.5
Very strong acid	4.6 to 5.0
Extremely strong acid	less than 4.5

4. Soil fertilities

	High	Moderately High	Low
Organic carbon (%)	more than 2.0	1.0 to 2.0	less than 1.0
Total nitrogen (%)	more than 0.05	0.01 to 0.05	less than 0.01
CEC (m.eq./100g)	more than 20	10 to 20	less than 10
Base saturation (%)	more than 50	20 to 50	less than 50
Exchangeable bases (m.eq./100g)			
Ca	more than 7	4 to 7	less than 4
Mg	more than 1.2	4.5 to 1.2	less than 0.5
K	more than 0.3	0.1 to 1.3	less than 0.1
Available P_2O_5(mg/100g)	more than 10	2 to 10	less than 2

Table 4.5.1 LAND SUITABILITY FOR THE CULTIVATION OF SUGARCANE

Suitability	Suitability Class	Soil		Mapping Symbol in Soil Map	Objective Area	
		Series	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	Steep-very shallow	11	240	1.8
					5,230	40.2
			Total		13,000	100.0

Table 5.1.1 GENERAL INFORMATIONS OF THE GAUGING STATION

	River	
	Maragondon	Balsahan
Location	Mabacao	Palagui
Barrangay	Mabacao	Palangui
Municipality	Maragondon	Naic
Lat.	14°16'20"	14°16'59"
Long.	120°44'20"	120°43'30"
Period of Records	1946 - 1976	1954 - 1976
Gauge Station Condition		
Drainage Area	260 km^2	22 km^2
Elevation of Zero of Gauge	1.773 meters above MSL	34.172 meters above MSL
Remarks	4 kms. east of the town of Maragondon	About 7 kms. from Naic, Cavite

Source: NWRC

Table 5.1.2 MEAN MONTHLY DISCHARGE OF MARAGONDON RIVER AT MABACAO (Drainage Area: 260 km^2)

Unit: m^3/sec

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
1946	2.38	2.20	1.66	1.39	1.39	8.37	7.22	17.65	43.98	11.26	4.69	3.31
1947	2.69	2.32	1.93	2.77	1.79	10.33	21.29	27.87	8.10	8.33	31.69	111.87
1948	6.20	4.40	2.94	3.24	2.93	3.16	33.17	32.32	127.58	9.00	4.80	26.36
1949	2.91	2.95	1.85	1.61	1.40	5.72	3.14	5.92	5.48	16.13	6.84	2.07
1950	1.84	2.05	1.69	2.15	3.01	4.05	22.37	62.61	14.54	19.00	5.05	2.23
1951	2.66	2.12	1.54	1.44	10.52	18.45	17.58	49.51	24.76	9.47	6.35	5.78
1952	2.50	2.65	1.89	1.71	13.80	21.53	20.62	129.15	9.19	20.55	7.13	5.96
1953	4.24	4.89	3.33	2.54	6.30	28.65	21.50	64.23	15.37	11.90	12.80	6.35
1954	2.80	2.90	2.40	2.00	1.79	1.99	5.10	29.72	31.37	3.51	8.76	1.72
1955	1.65	2.21	1.37	1.13	1.34	1.43	9.40	6.54	8.14	8.18	10.64	3.53
1956	1.67	2.05	1.46	1.47	1.32	1.51	15.59	16.61	69.48	15.37	3.18	4.57
1957	2.22	1.97	1.32	1.16	1.11	6.98	27.98	15.65	15.24	53.50	2.20	1.77
1958	1.39	1.17	1.21	1.23	1.26	12.21	98.39	4.16	16.91	5.93	2.93	1.86
1959	1.66	1.84	1.31	1.18	1.32	1.53	10.84	43.34	9.31	2.10	3.26	1.84
1960	4.76	1.91	1.36	1.99	7.34	47.00	9.48	104.50	11.89	48.83	2.99	3.15
1961	2.42	2.37	1.64	1.73	2.04	45.59	11.76	29.74	12.11	12.19	28.05	5.40
1962	2.83	3.53	3.41	2.25	1.62	3.05	61.28	30.15	75.15	4.48	5.48	3.91
1963	3.27	2.53	2.09	1.79	1.90	42.26	47.64	33.52	112.88	7.98	3.86	3.14
1964	2.62	2.53	1.85	1.63	2.70	98.33	24.73	66.71	17.10	33.30	13.26	20.44
1965	2.83	2.67	1.91	1.85	2.26	2.82	22.02	21.73	24.25	8.32	3.06	2.17
1966	1.65	1.92	1.33	1.15	47.15	7.92	10.62	11.60	98.05	3.28	6.50	9.47
1967	4.28	1.86	1.44	0.96	0.88	33.94	17.02	46.50	78.87	8.07	119.55	3.32
1968	2.58	3.33	3.00	2.32	2.43	9.48	69.09	28.20	35.70	6.03	2.57	1.93
1969	0.95	2.11	1.46	1.12	1.83	3.46	23.64	31.02	24.01	25.43	3.36	2.25
1970	1.80	1.67	1.58	1.51	2.87	5.52	16.18	17.20	58.74	164.42	36.24	4.61
1971	2.65	2.39	2.26	1.47	2.00	20.08	32.15	10.92	5.24	84.63	4.35	4.68
1972	7.28	4.45	2.08	1.78	3.30	28.53	109.88	46.56	13.35	8.82	3.94	3.10
1973	2.69	2.23	1.55	1.18	0.98	0.84	7.67	30.63	12.49	28.34	30.95	1.44
1974	1.12	1.34	1.25	1.00	0.71	26.68	24.74	187.20	3.79	31.59	85.48	11.83
1975	1.42	1.17	0.72	0.66	0.82	10.50	0.58	18.28	12.50	16.57	22.28	1.50
Mean	2.73	2.46	1.83	1.69	4.30	16.89	26.77	40.66	33.19	22.88	16.41	7.84
Wet season (June - Nov.)								156.8				
Proportion (%)								88				

Source: NWRC. According to NWRC data, the records over 100 m^3/sec are less credible than those below 100 m^3/sec.

Table 5.1.3 MEAN MONTHLY DISCHARGE OF BALSAHAN RIVER AT PALANGUI (Drainage Area: 22 km^2)

Unit: m^3/sec

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
1955	0.22	0.14	0.12	0.03	0.18	0.12	1.50	1.30	0.83	0.67	0.35	0.38
1956	0.11	0.12	0.11	0.09	0.18	0.20	0.44	1.50	11.26	0.38	0.19	0.24
1957	0.20	0.10	0.02	0.04	0.27	0.69	0.64	1.96	1.00	0.55	0.23	0.11
1958	0.18	0.07	0.10	0.02	0.03	1.60	0.65	0.36	0.99	0.39	0.20	0.12
1959	0.12	0.09	0.07	0.09	0.12	0.08	0.31	0.44	0.15	0.04	0.07	0.04
1960	0.20	0.10	0.02	0.04	0.27	0.69	0.64	1.96	1.00	1.55	0.23	0.11
1961	0.18	0.13	0.12	0.13	0.43	0.69	0.93	1.40	1.50	1.36	0.73	0.67
1962	0.23	0.22	0.21	0.13	0.12	0.17	1.58	1.81	4.47	0.61	0.18	0.15
1963	0.12	0.09	0.06	0.05	0.05	3.66	0.21	0.27	0.95	0.19	0.10	0.08
1964	0.07	0.07	0.05	0.04	0.06	2.93	4.91	3.69	7.78	5.42	4.62	3.52
1965	0.09	0.12	0.16	0.13	0.24	4.99	12.17	1.16	6.19	0.57	0.21	0.17
1966	0.10	0.12	0.11	0.09	3.57	3.26	4.17	3.06	7.97	0.22	2.02	1.54
1967	1.85	0.16	0.06	0.05	0.06	1.71	4.22	3.09	1.23	5.22	14.86	0.80
1968	0.13	0.20	0.11	0.09	2.14	2.29	17.89	5.78	2.01	1.74	0.07	0.05
1969	0.11	0.06	0.06	0.08	0.75	2.41	3.67	10.06	7.05	1.37	0.34	0.27
1970	0.05	0.05	0.05	0.04	0.29	4.55	3.16	3.60	4.89	7.76	5.22	1.80
1971	0.17	0.17	0.22	0.17	0.54	8.74	7.38	6.57	1.07	7.60	1.59	1.78
1972	1.30	0.67	0.17	0.09	0.37	0.27	1.10	5.42	8.05	1.01	0.14	0.10
1973	0.06	0.04	0.05	0.06	2.08	1.34	2.82	2.90	0.27	0.38	0.34	0.21
1974	0.29	0.32	0.67	0.46	3.19	2.00	1.86	4.39	0.49	1.21	1.47	0.20
1975	0.35	0.23	-	-	-	-	-	-	-	-	-	-
Mean	0.29	0.16	0.13	0.10	0.75	2.12	3.51	3.04	3.46	1.96	1.66	0.62
Wet season (June - Nov.)								15.75				
Proportion (%)								88				

Source: NWRC. According to NWRC data, the records over 5 m^3/sec are less credible than those below 5 m^3/sec.

Table 5.1.4 MONTHLY DISCHARGE OF MARAGONDON RIVER (1946 - 1975) AT MABACAO (Drainage Area: 260 km^2)

Unit: m^3/s

	Mean	Maximum	Minimum
Jan.	2.73	6.2	0.95
Feb.	2.46	4.45	1.17
Mar.	1.83	3.33	0.72
Apr.	1.69	3.24	0.66
May	4.30	47.15	0.71
Jun.	16.89	98.33	1.43
Jul.	26.77	109.88	0.58
Aug.	40.66	187.20	4.16
Sep.	33.19	127.58	3.79
Oct.	22.88	48.84	2.10
Nov.	16.41	119.57	2.20
Dec.	7.84	111.87	1.44
Annual	14.80	40.66	1.69

Source: NWRC. According to NWRC data, the records over 100 m^3/sec are less credible than those below 100 m^3/sec.

Table 5.1.5 MONTHLY DISCHARGE OF BALSAHAN RIVER (1955 - 1976) AT PALANGUI (Drainage Area: 22 km^2)

Unit: m^3/s

	Mean	Maximum	Minimum
Jan.	0.29	1.85	0.05
Feb.	0.16	0.67	0.04
Mar.	0.13	0.67	0.02
Apr.	0.10	0.46	0.03
May	0.75	3.57	0.05
Jun.	2.12	4.99	0.12
Jul.	3.51	17.89	0.21
Aug.	3.04	10.08	0.27
Sep.	3.46	11.26	0.27
Oct.	1.96	5.42	0.04
Nov.	1.66	14.86	0.07
Dec.	0.62	3.52	0.04
Annual	1.48	3.51	0.10

Source: NWRC. According to NWRC data, the records over 5 m^3/sec are less credible than those below 5 m^3/sec.

Table 5.1.6 MONTHLY DISCHARGE CHARACTERISTICS

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	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 - 1976, 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	110.79	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 5.1.7 MAXIMUM AND MINIMUM AVERAGE DAILY DISCHARGE

Unit: liters/sec.

	Maragondon River at Mabacao (1946 - 1976)		Balsahan River at Palangui (1955 - 1976)	
	Max. Average	Min. Average	Max. Average	Min. Average
Jan.	96,400	950	10,580	29
Feb.	21,500	10,500	1,480	35
Mar	7,830	675	1,230	4
Apr.	17,800	625	700	4
May	255,800	625	10,800	10
Jun.	820,000	775	30,360	20
Jul.	1,693,000	205	114,100	20
Aug.	2,943,900	315	83,600	30
Sep.	1,241,900			
Oct.	3,047,000	1,530	40,330	10
Nov.	2,187,000	215	94,900	5
Dec.	154,000	195	8,160	5

Source: NWRC

Table 5.1.8 MAXIMUM AND MINIMUM AVERAGE DAILY DISCHARGE ORDER

Unit: liters/sec.

Order	Maragondon R. at Mabacao/1		Balsahan R. at Palangui/2	
	Max.	Min.	Max.	Min.
1st	3,047,000	195	279,000	4
2nd	2,943,000	205	114,000	5
3rd	2,187,000	315	94,900	10
4th	1,693,000	625	83,100	15
5th	1,297,600	675	58,100	20
6th	1,279,600	740	50,900	25
7th	1,241,900	775	48,100	30
8th	1,013,200	850	46,900	35
9th	950,800	950	40,330	38
10th	820,000	1,050	36,700	40
11th	801,100	1,070	30,360	41
12th	769,600	1,150	22,000	43
13th	675,000	1,220	19,240	44
14th	659,800	1,230	16,900	45
15th	567,200	1,250	12,800	50

Note: /1 Records from 1946 to 1976
/2 Records from 1955 to 1976

Source: NWRC

Table 5.1.9 EXTREME DISCHARGE RECORDS IN FLOOD AND DROUGHT

FLOOD

River	Ranking Date	Maximum Discharge (liters/sec.)	Gauge Height (m)
Maragondon (at Mabacao)	1st Oct. 1970	4,247,000	15.50
	2nd Nov. 1967	3,987,000	15.25
Balsahan (at Palangui)	1st Sep. 1954	315,000	5.60
	2nd Sep. 1962	18,060	6.82

DROUGHT

River	Ranking Date	Maximum Discharge (liters/sec.)	Gauge Height (m)
Maragondon (at Mabacao)	1st Dec. 1975	195	0.02
	2nd May 1974	625	0.25
Balsahan (at Palangui)	1st Apr. 1960	4	-
	2nd Dec. 1959	5	-

Source: NWRC

Table 5.1.10 FREQUENCIES OF MAXIMUM PROBABLE FLOOD DISCHARGE

Unit: liters/sec.

Return Period Years	Probability	Maximum Flood	
		Maragondon River (at Mabacao)	Balsahan River (at Palangui)
200	0.5	3,585,000	341,000
100	1.0	3,263,000	297,800
50	2.0	2,846,000	255,300
20	5.0	2,294,000	199,200
10	10.0	1,867,000	155,300
5	20.0	1,422,000	109,900
2	50.0	751,000	41,460
1.25	80.0	250,000	9,690

Source: NWRC

Table 5.2.1 RESULTS OF WATER ANALYSIS

River System	River		EC ($x10^6$, 25)	Cations (meq./li.)			Anions (meq./li.)				Fe (ppm)	$CaCO_3$ (ppm)	Total Evaporation Residue (ppm)	Sediment Concentration (ppm)
				Na	Ca	Mg	SO_4	Cl^-	CO_3	HCO_3				
Maragondon	Maragondon	7.2	70	0.11	0.206	0.239	0.100	0.05	0	0.479	0	22	2,436	2,228
	Balayungan	7.8	84	0.14	0.309	0.295	0.198	0	0	0	0.04	30	3,244	3,006
Balsahan	Balsahan	7.8	235	0.480	0.876	0.559	0.138	0.06	0	1.944	0	72	221	21
Alemang	Alemang	8.1	232	0.580	0.876	0.559	0.167	0.06	0.253	1.818	0	72	267	37
	Sahin	7.4	135	0.260	0.618	0.223	0.075	0	0	1.085	0.01	42	375	156

Note: $EC_{25} \times 10^6$ - Electrical Conductivity at 25°C (micromhos/cm.)

Table 5.3.1 GROUNDWATER DEPTH IN MARAGONDON AND NAIC

Unit: ft.

Name of Barangay	Nos. of Artensian Well /1	NAWASA Records /2	Local Borer's Information	
			Wet	Dry
(Maragondon)				
Barangay 1	37		12-10	20-18
Barangay 2	41	57-30	60-50	70-67
Barangay 3	16	40	66-64	70-68
Barangay 4	4	80-70	72-70	76-74
Bucal 1	8		12-10	20-18
Bucal 2	22	28-25	60-58	70-67
Bucal 3	52	60-50	66-64	70-68
Bucal 4	7	73-70	72-70	76-74
Pantijan 1	4	67-65	74-70	86-80
Pantijan 2	4		74-70	86-80
Pantijan 3	3	63	70-68	76-70
Pantijan 4	1	-	65-64	68-66
Caputatan	36	20-12,40	20	24
Mabacao	8	84,90	66-64	72-68
Pinagsanhan	4	25,52	62-60	66-64
Mabato	2	-	70-66	76-74
Talipusngo	0	-	>360	>360
(Naic)				
Sabang	13	-	40	50
Calubcob	7	-	25	30
Halang	8	58	30	40
Palangui 1	16	0	40	45
Palangui 2	16	-	40	45
Palangui 3	16	-	40	45
Molino	6	-	45	50
Malainen Luma	11	15	45	50
Malainen bago	45	15		

Note: /1 Data source - Municipality offices of Maragondon and Naic

/2 National Water Works and Sewering Authority, Cavite City

Table 5.3.2 GROUNDWATER DEPTH IN INDANG, G.E. AGUINALDO AND MAGALLANES

Unit: ft.

Name of Barangay	NAWASA Record/1	Local Driller's Information	
		Wet	Dry
(Indang)			
Calumpang	95	50	60
Lejos			
Agus-us	-	60	70
Banaba Lejos	79	80	90
Banaba Cerca	140	90	100
Dayni	90	90	100
Indang (Poblacion)	345	90	100
(G.E. Aguinaldo)			
Lumpia	-	80	
Tabora	148	100	120
Batas	-	30	50
Kaypaaba	50	120	130
Kabulusan	-	130	150
(Magallanes)			
Magallanes (Poblacion)	98	80	100

Source: /1 National Water Works and Sewering Authority

Table 5.3.3 DATA OF GROUNDWATER

Transmissibility (Average)	240 m^2/day
Storage Coefficient (Average)	0.005
Static Water Level (Average)	About 10 meters below ground surface
Annual Potential Recharge	25 MCM/1
Annual Discharge from Existing Well	9 MCM
Safe Yield	5.3 MCM
Specific Capacity	160 m^3/day/m
Hydraulic Gradient (Average)	1:70 (Upper 1:45)

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

Source: NIA

Fig. 2.1.1 LOCATION OF METEOROLOGICAL OBSERVATORY

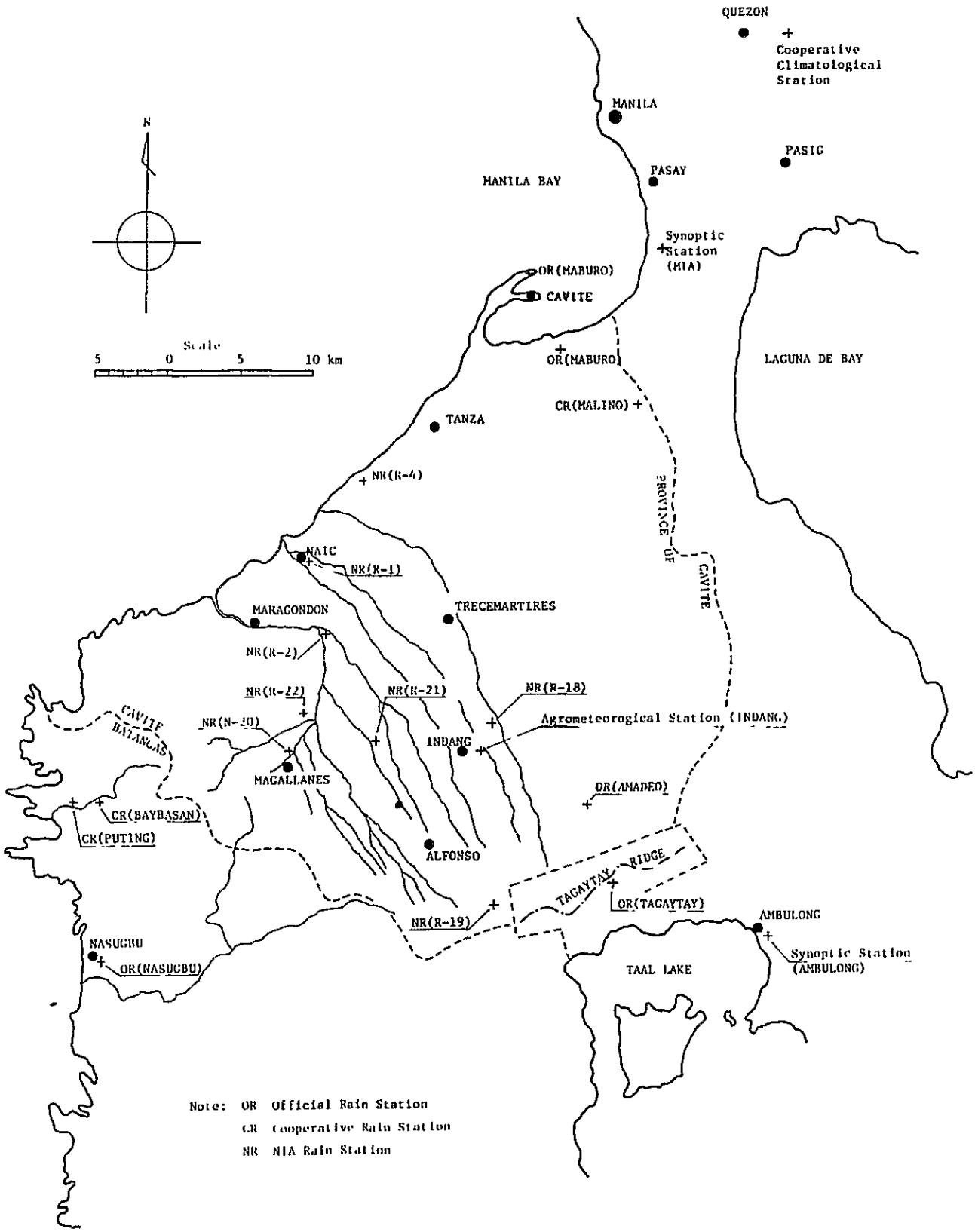


Fig.3.1.1 GEOLOGICAL MAP

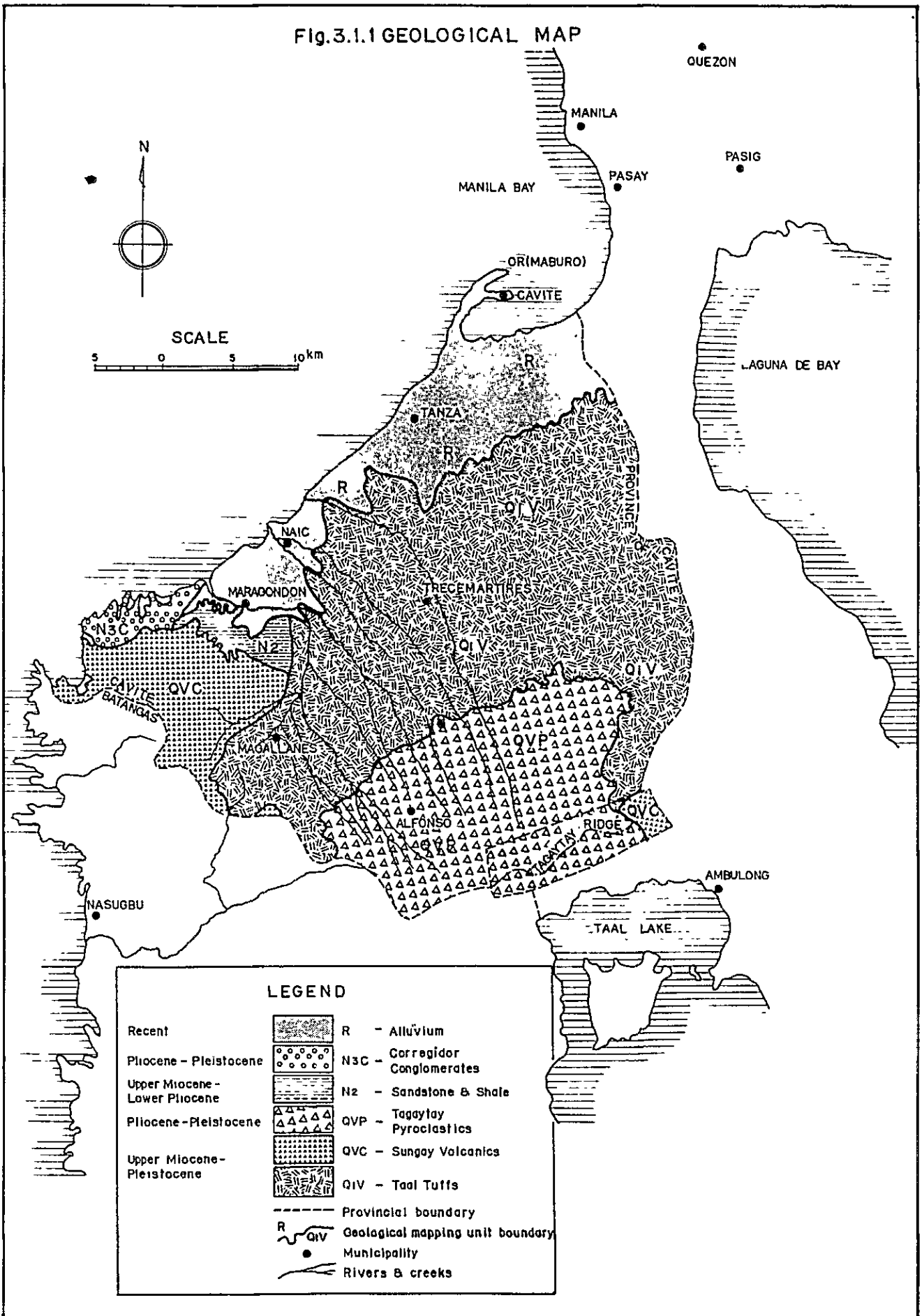
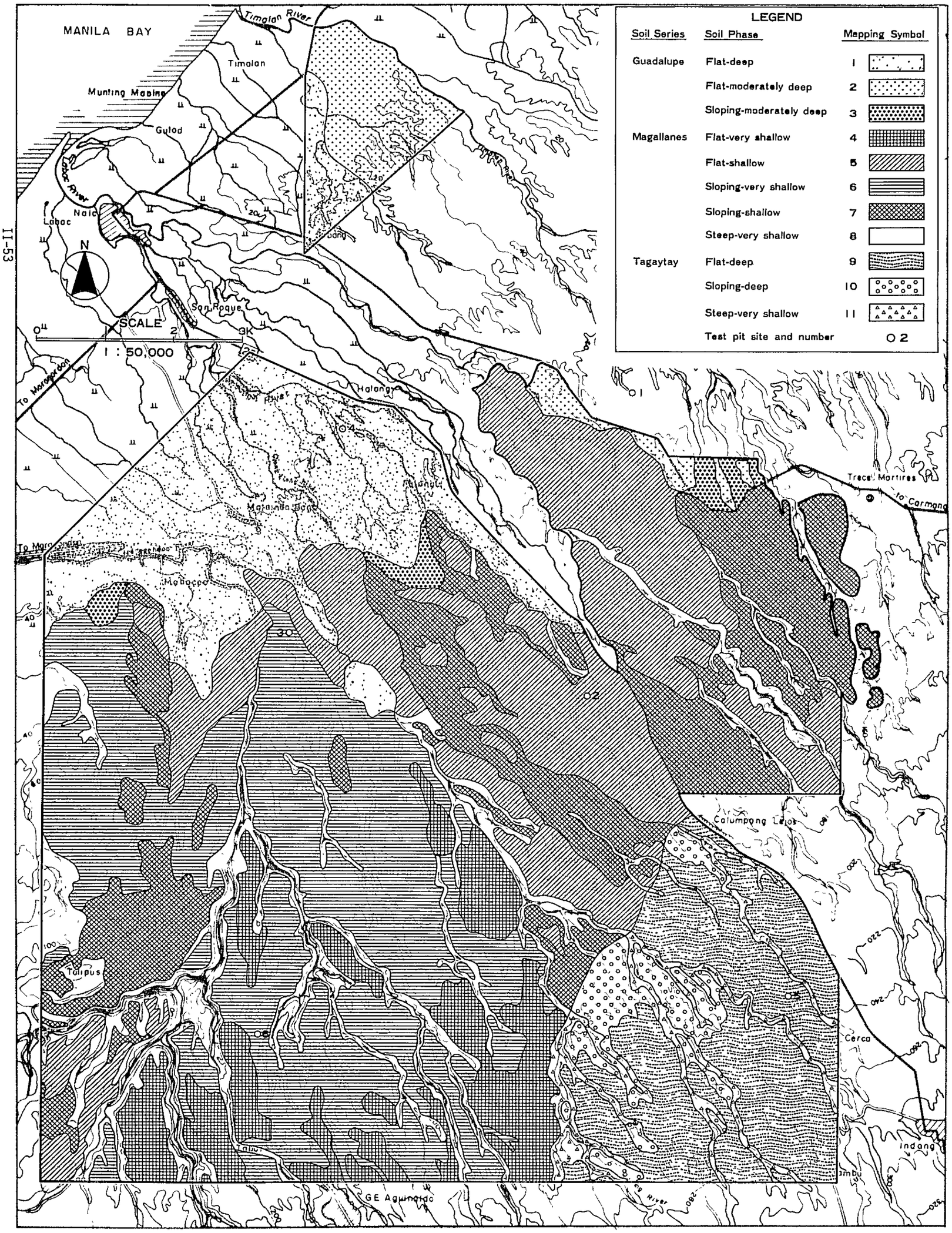


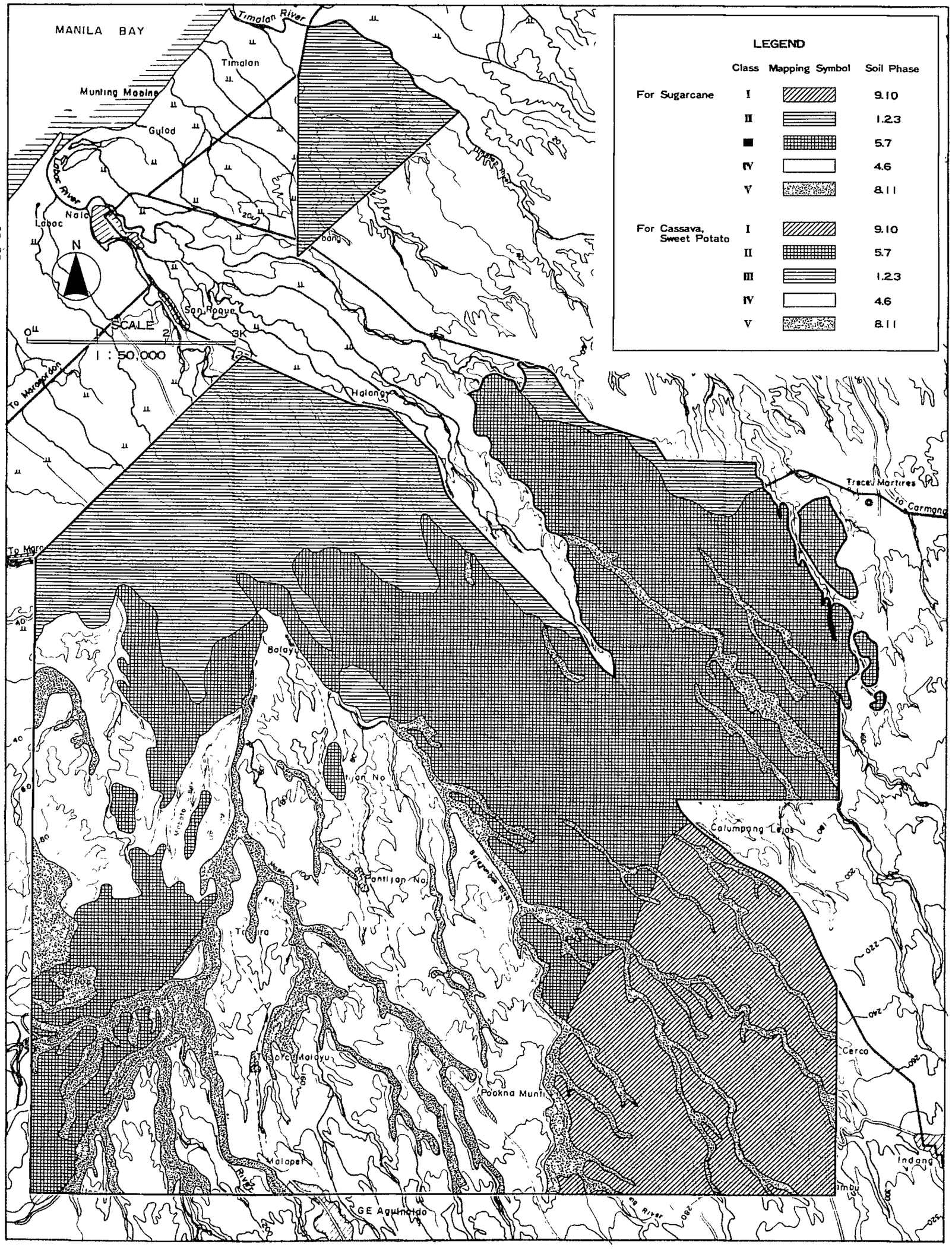
Fig. 4.3.1 SOIL MAP



LEGEND

Soil Series	Soil Phase	Mapping Symbol
Guadalupe	Flat-deep	1
	Flat-moderately deep	2
	Sloping-moderately deep	3
Magallanes	Flat-very shallow	4
	Flat-shallow	5
	Sloping-very shallow	6
	Sloping-shallow	7
	Steep-very shallow	8
Tagaytay	Flat-deep	9
	Sloping-deep	10
	Steep-very shallow	11
	Test pit site and number	02

Fig. 4.5.1 LAND SUITABILITY MAP



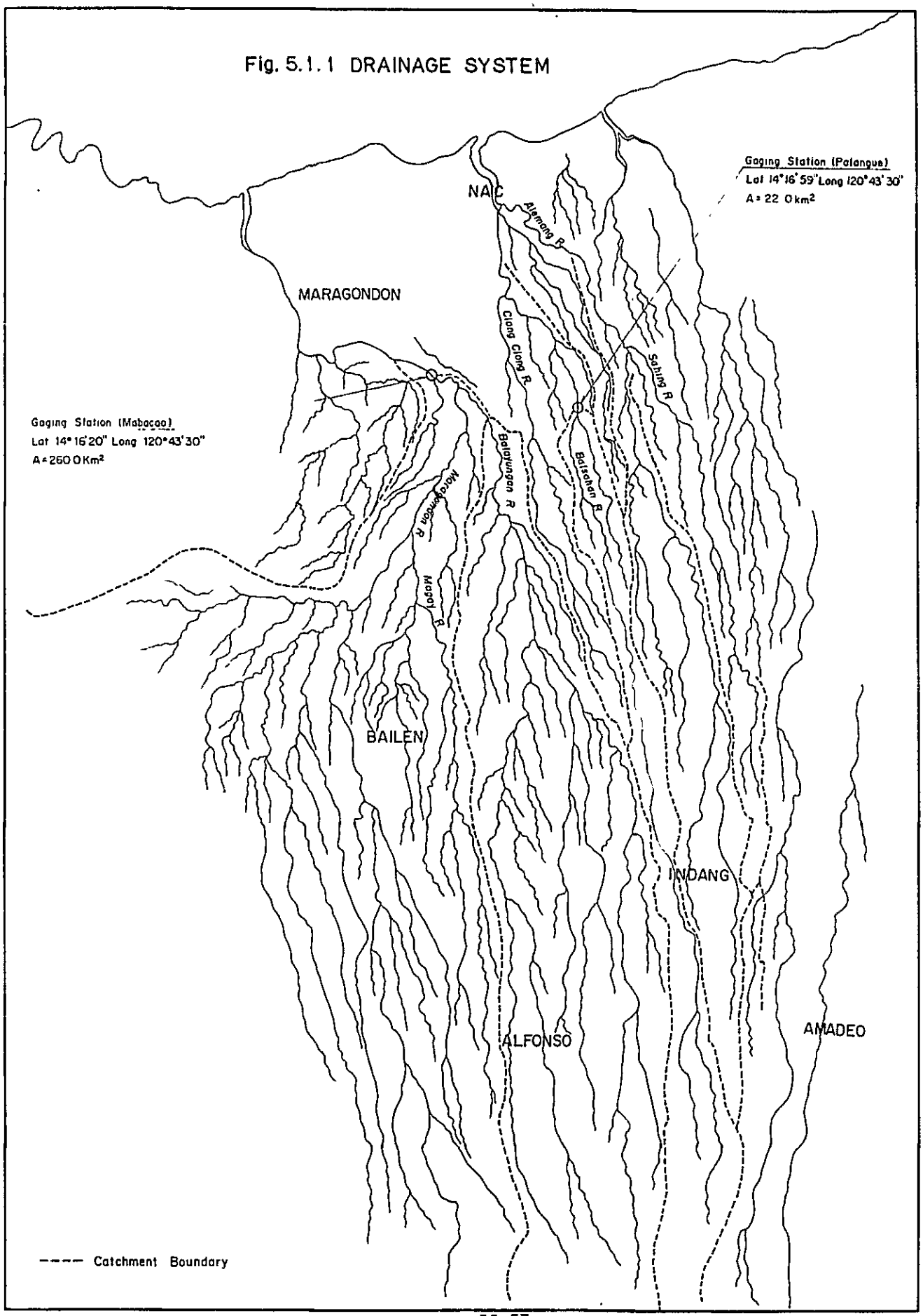


Fig. 5.1.1 DRAINAGE SYSTEM
Gaging Station (Palangue)
Lat 14°16'59" Long 120°43'30"
A = 22.0 km²
NAIC
Alapang R.
MARAGONDON
Ciang Ciang R.
Sahing R.
Gaging Station (Mabacao)
Lat 14°16'20" Long 120°43'30"
A = 260.0 Km²
Balayungan R.
Balsahan R.
Maragondon R.
Maypi R.
BAILEN
INDANG
ALFONSO
AMADEO
Catchment Boundary

Fig. 5.1.2 ANNUAL MEAN DISCHARGE AT MARAGONDON RIVER

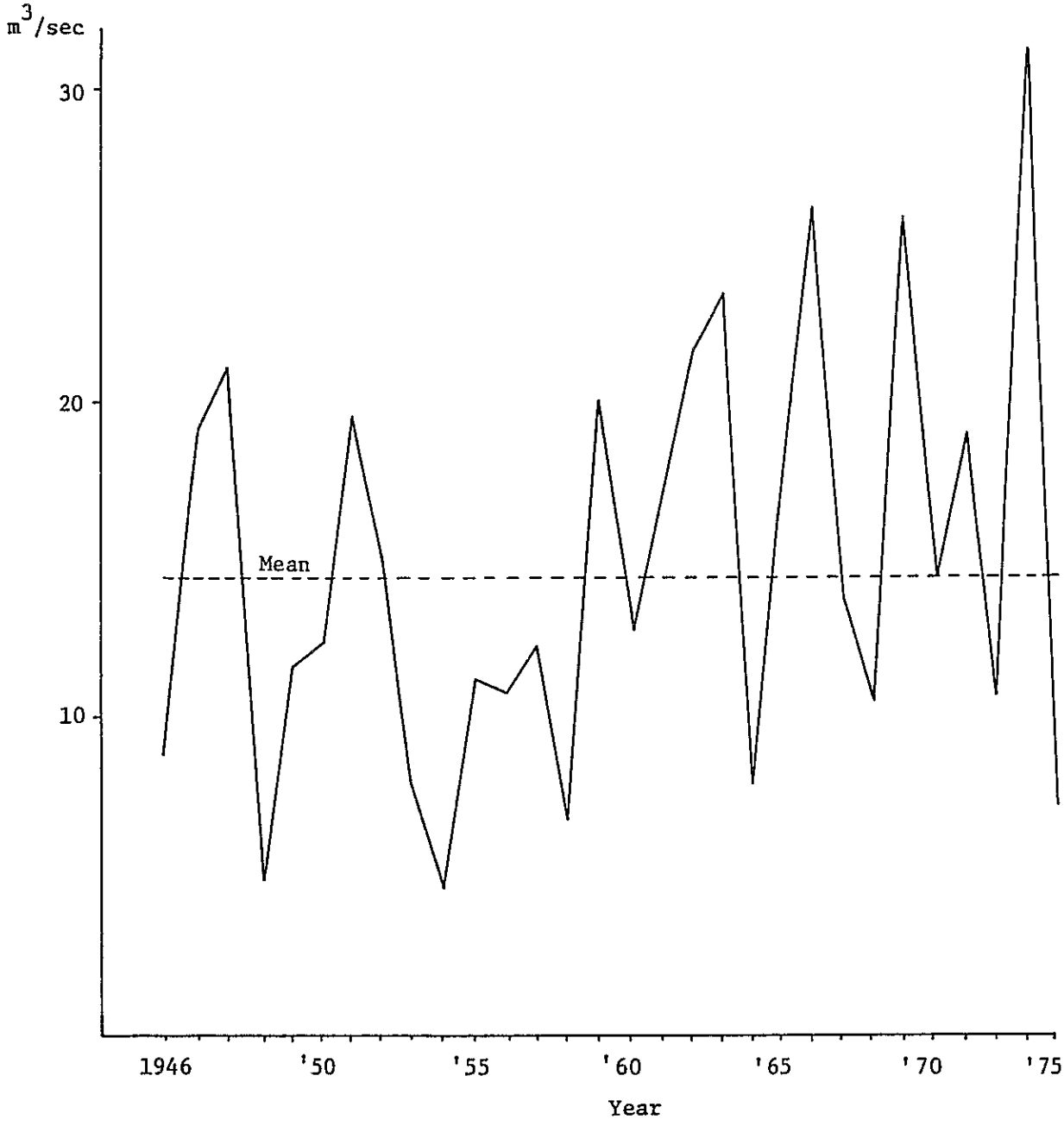


Fig. 5.1.3 ANNUAL MEAN DISCHARGE AT BALSAHAN RIVER

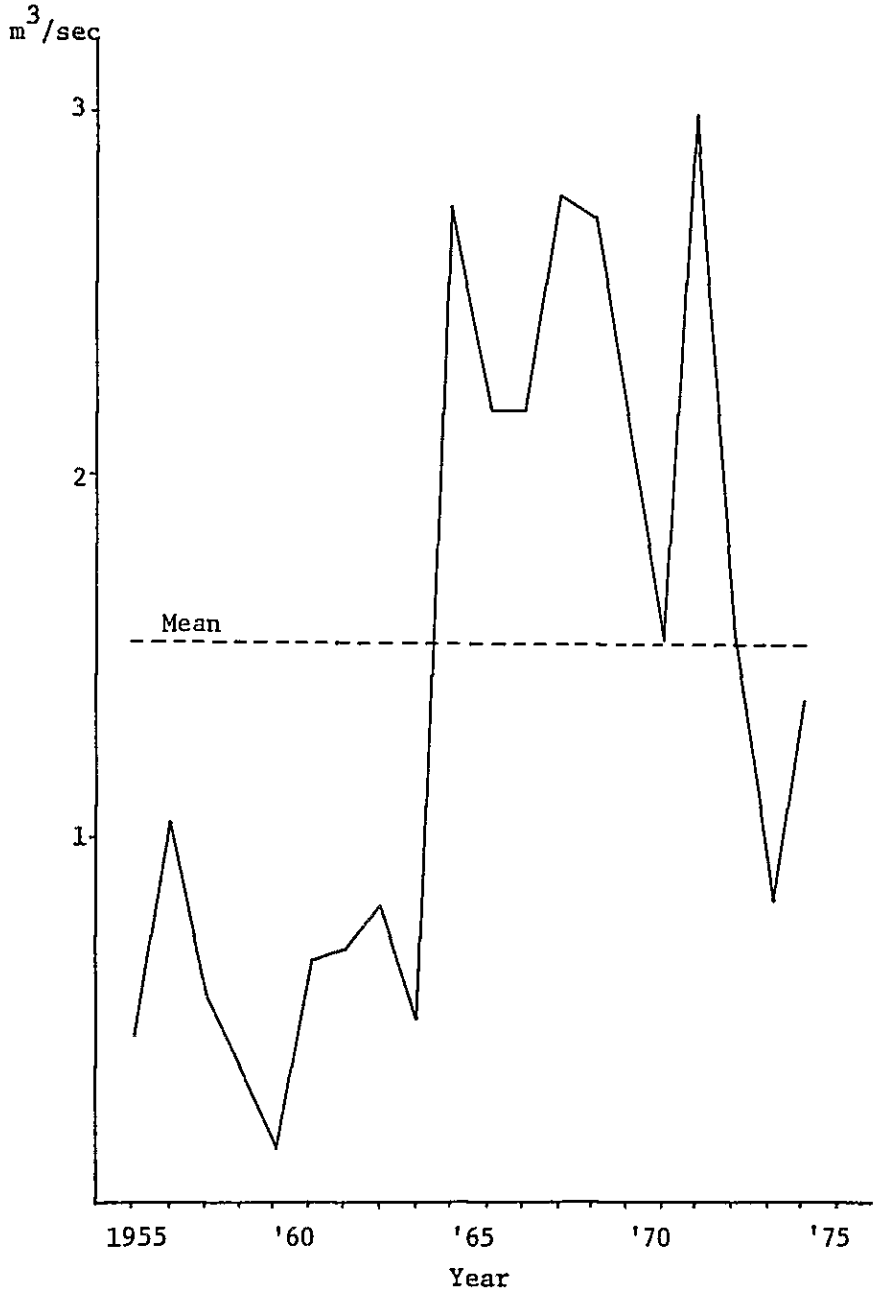
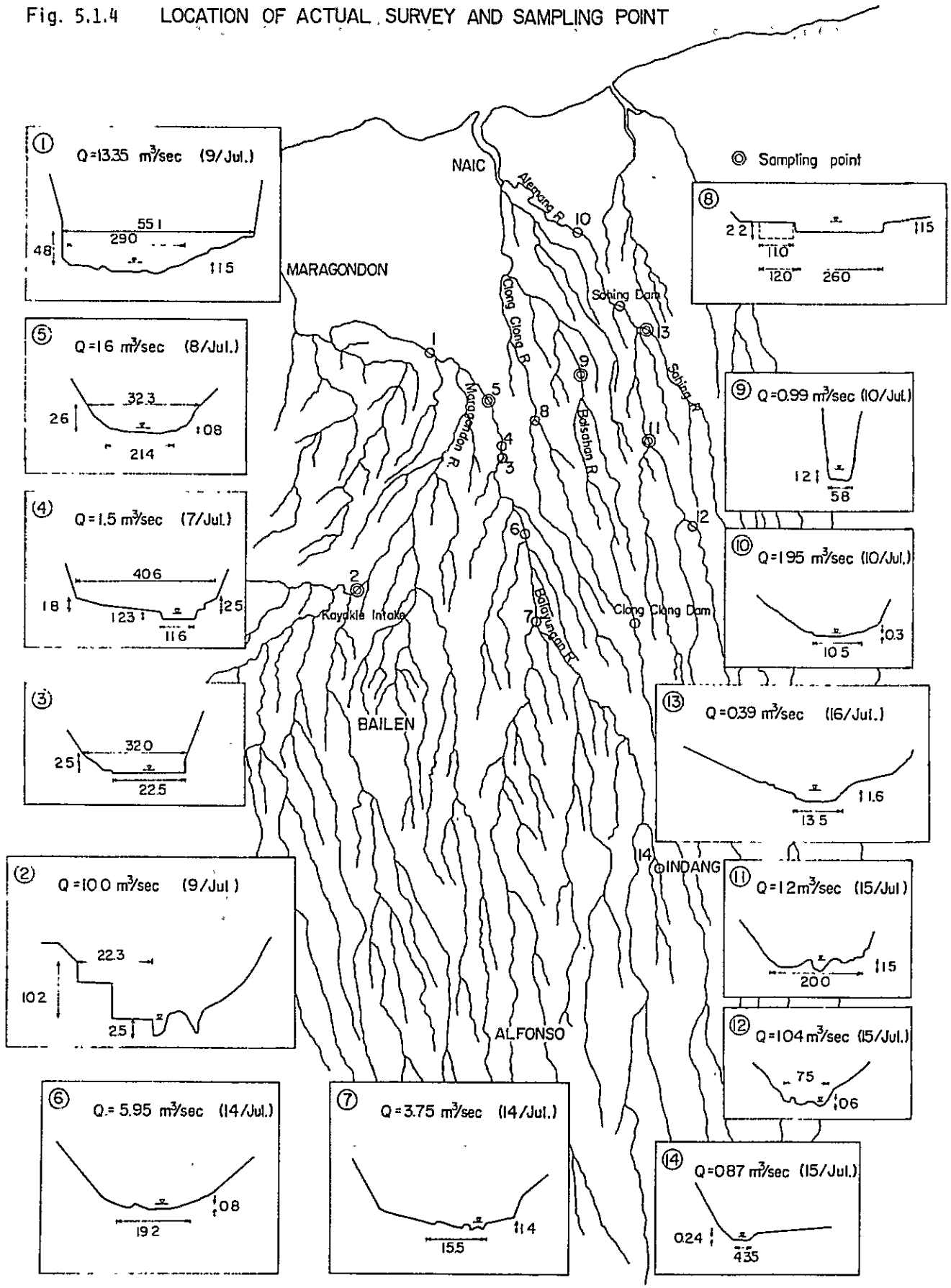


Fig. 5.1.4 LOCATION OF ACTUAL SURVEY AND SAMPLING POINT



APPENDIX III

AGRICULTURE AND AGRO-ECONOMY

APPENDIX III AGRICULTURE AND AGRO-ECONOMY

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APPENDIX III AGRICULTURE AND AGRO-ECONOMY

CHAPTER 1 PRESENT CONDITION

1.1 Population and Labor Force

Basic socio-economic data in 17 barangays related to the project area are shown in Tables 1.1.1 and 1.1.2. The population in the related barangays is 16,998 consisting of 2,933 households in 1980 and comprises 51% of male and 49% of female. The population growth rate is estimated at 2.87% per annum from 1975 to 1980. The population density is estimated at about 202 persons per km^2. Average family size is 5.8 persons.

With regard to occupation, 80% of total households are farmers as shown in Table 1.1.3. Most of them are engaged in upland crops and perennial 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. The remaining 3% is engaged in governmental works, private employees, vendors, ordinary labors, etc.

The total farm households related to the project area are estimated at about 860, comprising about 5,000 in population. The barangay survey and the farm economic survey indicate that about 20% of the population, or about 1,000 persons are farmers.

Labor force available for farming in the project area is estimated based on the following assumptions:

1) Yearly workable days/person: 365 days x 0.8 = 292 days

2) Total labor force : 1,300 persons
   from farmers : 1,000 persons
   from landless workers : 300 persons

Labor force available in the project area is calculated at 379,600 man-days/year or 31,600 man-days/month, as shown in Table 1.1.4.

On the other hand, the actual labor requirement for farming in the project area is estimated at 177,300 man-days per year on the basis of present cropping pattern and land use conditions as shown in Table 1.1.4.

Only about 47% of the total available labor force is employed by farming in the project area. The balance between abailable labor force and actual labor requirement, or excess of labor force amounts 202,300 man-days per year.

1.2 Land Use

The land use in the objective area is studied by the interpretation of the aerial photos on a scale of 1:15,000 which were taken in 1978. The land use is categorized into six groups; perennial crop field, upland field, paddy field, shrub land or valley, idle land and residential area. The area occupied by each group and its extent are summarized in Table 1.2.1 and mapped in Fig. 1.2.1.

The perennial crop fields include coconut, banana and mango. Coconut fields extend over the higher portion of the objective area, while banana and mango fields are scattered in limited scale on the plateu.

The upland fields extend over the middle portion between in the perennial crops and paddy fields. Almost all of the upland fields are frilled with banana trees.

The extents of the shrub land and valley coincide with those of valley and its wall.

The land use in the project area is estimated by the interpretation of the aerial photos mentioned above, the field investigations, and referring the crop production data in the five Municipalities and Trece Martires City concerned to the project area in 1980 (Table 1.2.2). It is given as follows:

	Area (ha)		Proportional Extent (%)
Cultivation area	3,000		97.1
Upland rice		1,900	61.5
Sugarcane		500	17.8
Corn		350	11.3
Cassava		200	6.5
Other/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.			

Note: /1: It is grown after corn.

1.3 Cropping Pattern and Farming Practices

1.3.1 Cropping Pattern

The present cropping pattern of the project area is shown in Fig. 1.3.1. Upland rice occupies 62% of the total area and is grown from late May to early November; corn is grown 11% from June to September followed by peanut cultivation of 100 hectares 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 area all year round and cassava is cultivated 7% of the total area from June to March.

The cropping pattern mentioned above is an average percentage of the project area and small farms have usually a higher percentage of subsistence crops such as upland rice and corn while sugarcane is only found in larger farms.

1.3.2 Farming Practices

The predominant method of farming in the project area, with a small exception of sugarcane growing, is the traditional one. The vast majority of farmers use local seeds taken from their fields. Chemical fertilizer is used for the crops except for cassava. As fertilizer prices are high compared to the prices of grain, farmers use this input only to a limited extent. Farmyard manure is used to a very limited extent because of lack of animals and difficulty of transportation. Green manure crops are almost unknown and farmers are reluctant to introduce them into the existing cropping pattern due to no space to plant and no cash income.

1.3.3 Farming Practice of Sugarcane

All the sugarcane grown in the project area is milled at the Canlubang Sugar Mill. The average milling season stretches over 200 days beginning early November and finishing end of May. The milling season correlates closely with the period of very low rainfall. The cane is normally loaded directly onto trucks in the field and transported directly to the mill.

Sugarcane varieties with a growing period of 12 to 15 months are grown in the project area and so the planting or ratooning period more or less coincides with the milling period, that is between early November and late May. The number of ratooning from 1974/75 to 1978/79 is as shown in the following table:

	Area planted in Calamba Mill District (ha)		
	Plant cane	Ratoon	Ratio
1974/75	6,760	12,150	1:1.8
75/76	8,764	10,984	1:1.25
76/77	7,813	11,719	1:1.5
77/78	7,022	16,077	1:2.29
78/79	4,910	15,068	1:3.07

Source: Sugar Licensing & Control Division,
Production Regulation and Control Office, PHILSUCOM

1) Variety

Many new sugarcane varieties are available commercially and are used by most of the farmers, and such popular varieties like Phil-56226, Phil-58260 are characterized as below.

Phil-56226 (POJ 2878 x CP 36-105) - This variety has characteristics of high yield, high sugar content, short growing period (11 - 12 months), nonlodging and good ratooning, profusion of tasseling, highly resistant to yellow spot, red rot, pokka boeng, moderately resistant to leaf scorch and smut.

Phil-58260 (Q 47 x POJ 3016) - It is characterized by high yield, high sugar content, short growing period, nonlodging and good ratooning, profusion of tasseling, highly resistant to leaf scorch, red rot, pokka boeng, and moderately resistant to smut and yellow spot.

2) Land Preparation

Most farmers in the objective area use hired tractors for land preparation which normally consists of a plowing, two harrowings and a furrowing. Oxen are used for later cultivations.

3) Planting

Cane-setts are usually cut from newly harvested cane having two to three good eyes (nodes). Generally the cane-setts are soaked in fresh water for 48 hours and planted in the furrows at a density of approximately 40,000 pieces per ha. They are laid horizontally in the furrow. A hoe is used to cover them with soil which is then pressed down by foot. The spacing between rows is usually 80 cm which allows for the following off-barring and hilling up by oxen or carabao drawn plow.

4) Weeding and Pest Control

Normally farmers do not use either herbicides or insecticides. Weeds are controlled by hand and the hilling-up operations are carried out when the plants are one and four months old. The last hilling-up is usually just before the rainy season and the fields are thereafter left untouched until harvest time.

5) Fertilization

Although the balanced fertilization is recommended, by PHILSUCOM as shown in Table 2.3.1 farmers practice that half of the nitrogen of 40-50 kg/ha is given during the planting operation, and remainder of the nitrogen is applied as a top dressing during the last hilling-up.

6) Harvesting

Before harvesting the cane is burned to reduce the amount of trash. After burning the cane should be harvested immediately and milled within the short time possible.

7) Ratooning

The farmers usually ratoon two or three times depending on the yield level of the previous crop. The ratooning involves burning off the remaining trash, cutting the stubble and plowing of the soil away from the stubble rows in order to cut off most of the old roots. After replanting of missing plants the cultural practices are similar to those for a planted crop.

1.4 Agricultural Production

1.4.1 Crop Yield and Production

Present crop yield and production based on the data from local sources, (BAEcon/1, BAEx/2) or on the mission's field investigations are as shown in the following table:

Crop	Area (ha)	Av. Yield (t/ha)	Production (ton)
Upland rice (paddy)	1,900	0.6	1,140
Sugarcane	550	37	20,350
Corn	350	0.55	193
Cassava	200	5.4	1,080
Peanut	100	0.53	53

/1: BAEcon - Bureau of Agricultural Economics

/2: BAEx - Bureau of Agricultural Extension

1.4.2 Livestock

Livestock is not a main line of the agricultural activity in the project area. There are no large scaled livestock raising in the area. Most farm households raise a few chickens, ducks or pigs in and around the field on a small scale. Many farmers have either carabao or oxen.

Number of livestock and poultry in the related municipalities is shown in Table 1.4.1.

1.5 Land Tenure and Holdings

1.5.1 Land Ownership

There are three big owners in the project area namely Mr. Narvaez, San Diego farm and MYC farm. They own or keep leased land totaling about 850 ha which is about 20% of the project area. Among them, only MYC farm has a plan to introduce 50 ha of Napia grass in their farm. Remaining 80% is owned by absentee landlords and small farmers. No government land is found in the project area.

1.5.2 Land Tenure and Holding

Based on the results of the farm economic survey, it is estimated that the average farm size in the project area is about 3.7 ha. However, the average farm size in the area which is excluded big owners' farm is 2.6 ha.

The farmers in the project area are categorized into three types of typical farmers. The most of the farmers; of type I exist at the northern part of the project area where the paddy field area fringes, the type II is found mainly in middle upland area, and the most of the type III exist at the southern part of the project area where the perennial crop area surrounds.

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

As for the land reform, Naic, Tanza and Maragondon Municipalities and Trece Martires City have prepared the land reform program, but for the other municipalities the program has not yet been prepared as of December 1981.

Data on land holding and land tenure in the related municipalities and city are shown in Tables 1.5.1 to 1.5.4.

1.6 Marketing and Prices

1.6.1 Marketing of Agricultural Outputs 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 is located about 50 km far from the project area. The Canlunbang Sugar Mill contracts with planters on production of sugarcane, but no contract planter was found in the project area. The sharing arrangement of sugar between planters and the mill is 68:32.

The sugar produced by the Canlubang Sugar Mill is sold to the National Sugar Trading Corporation (NASUTRA), which is the subsidiary organization of the Philipping 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 reserve by NASUTRA. Sugar flow chart is shown in Fig. 1.6.1.

(2) Other Agricultural Products

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

(3) Situation of Sugarcane Production

Data on sugarcane production in the Calamba mill district are shown in Table 1.6.1. The sugarcane production and cropping area have decreased into about 20% between 1976/77 and 1979/80. In the project area, the sugarcane area in 1978 was about 1,200 ha as shown in the land use map Fig. 1.2.1. However, it was confirmed through field investigation that the sugarcane area have decreased to less than half or 550 ha in 1981. This decline of sugarcane area

are due to the following reasons on the basis of the information obtained from the sugar mill and big planters:

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

As a result, shortage of sugarcane has occurred in the mill district and the sugar mills compete with each other for getting sugarcane.

(4) Distribution of Agricultural Inputs

The planters in the project area use past harvested cane top or stalk as cane-setts generally. When the planters want to renew their sugarcane, however, seeds are provided by the Canlubang Sugar Mill. Fertilizers, agricultural chemicals and feeds for livestock are distributed to the farmers by dealers (see Table 1.6.2).

1.6.2 Prices of Agricultural Outputs and Inputs

For the economic evaluation of the individual farm development, the estimation of economic prices for sugarcane, rice, fertilizer, etc. is done on the basis of the information obtained from the governmental agencies and the some publications/1. The economic farm gate prices of sugarcane, rice and fertilizer are as follows:

Sugarcane	Paddy	Fertilizer		
		N	P	K
(₱/t)	(₱/t)	(₱/kg)	(₱/kg)	(₱/kg)
165	2,035	6.5	7.8	3.3

/1: Price Prospects for Major Primary Commodities prepared by the World Bank and Philippines Estimated of Shadow Prices and Country Parameters prepared by the World Bank.

The economic price of sugarcane is adopted the price for the Canlubang sugar mill and/or other mills as an opportunity price for the evaluation of the individual farm development because the sugarcane produced in the project area has an opportunity for sugar mills.

The economic and financial prices for agricultural outputs and inputs are shown in Tables 1.6.3 to 1.6.7.

1.7 Farm Economy

The farmers in the project area are categorized into three types according to the farm size, tenurial status and land use categories. The general characteristics on each type of farmers are summarized as follows:

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

Farm budget for three types is shown in Tables 1.7.1 to 1.7.3 and summarized as follows:

(Unit: ₱1,000)

Item	Type I	Type II	Type III
I) 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
II) Gross Outgo	10.8	10.7	10.9
- Production cost	2.2	2.1	2.3
- Living expenses	8.6	8.6	8.6
III) Net Reserve (I - II)	0	0	0.2

Living expense of typical farmer having family size of 5.8 persons is estimated at about ₱8,600 per household on the basis of the information obtained from farm economic survey.

The characteristics on the farm economy are summarized as follows:

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 derived from off-farm incomes consisting of wage earning from farm work and 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 2 AGRICULTURAL DEVELOPMENT PLAN

2.1 General

The agricultural development plan of the project area which extends 3,040 ha (net) is made based on the conclusion that the sugarcane is the most suitable crop for alcohol production. (See Fig. 2.2.1).

The development plans of sugarcane production and transportation of the project area are made corresponding to the operation program of the alcohol distillery which will be established in or around the project area.

Production of sugarcane is planned with two production systems; production systems by the individual farms and an estate farm belongs to the distillery.

(1) Individual Farm

Most of sugarcane in the project area will be produced by the individual farms under contract with the distillery.
Harvesting and transportation of products will be carried out according to the schedule made by the distillery.

(2) Estate Farm

The estate farm will be established by the distillery to produce raw materials for himself. The important role of the estate farm is not only for stabilized supply of raw materials to the distillery, but also for increase of cane yield and decrease of raw material production cost by applying the most rational farming practices.
The estate farm will be established in Halang area. Four hundred ha of the cultivable land will be provided and road networks and facilities necessary for management will be constructed.
The synopsis of the estate farm is summarized in Appendix V.

2.2 Proposed Land Use

In regard to the proposed land use in the project area, the whole lands will be used laying emphasis on growing sugarcane. For the individual farms a rotation system which consits of three years for sugarcane and one year for upland rice within four years is proposed. While for the estate farm, a continuous growing of sugarcane is proposed. As a result, the land use (net area) in the project area is as follows:

Unit: ha

	Sugarcane	Upland rice	Total
Individual Farm	1,980	660	2,640
Estate Farm	400	-	400
Total	2,380	660	3,040

The cropping intensity of whole project area is 1.0. Change of the land use under without and with project conditions is shown in Table 2.2.1.

2.3 Proposed Cropping Pattern and Farming Practices

2.3.1 Proposed Cropping Pattern

Sugarcane varieties with a growing period of 12 to 15 months will be used. To coincide the operation of distillery, planting of sugarcane will be done from November to February and harvesting from November to May. Ratooning follows immediately after the harvesting of previous crop. In the individual farms, sugarcane cultivation complete 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. As for the cropping pattern for sugarcane growing two times of ratooning is proposed taking account of protection from yield reducing caused by smut.

The feature of the proposed cropping pattern is shown in Fig. 2.3.1.

2.3.2 Proposed Farming Practice

2.3.2.1 Farming Practice in Individual Farm

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

(1) Variety

Phil-56226, Phil-58260 which are used in the project area at present are proposed.
However, these varieties have been bred aiming at the higher sugar production. In view of lacking of breeding program of sugarcane varieties for higher alcohol production, the use of these popular varieties in the area is proposed until the time when the new varieties will appear.

(2) Fertilization

PHILSUCOM Technologist in charge of the Cavite area recommends fertilizer amount on each area based on laboratory soil analysis (see Table 2.3.1). Since the soil conditions of the project area are almost similar to those of Dasmarinàs and Trece Martires City, application rates were tentatively decided at 180 kg of nitrogen and 80 kg of phosphate per ha for Guadalupe soil series and 140 kg of nitrogen and 80 kg of phosphate per ha for Magallanes soil series. According to the recommendation of PHILSUCOM, no potassium fertilizer is required.
However the optimum amount of fertilizers for sugarcane as the raw materials for alcohol production should be determined by fertilizer trials in the future.

(3) Land Preparation

Since most of the area belongs to the Magallanes soil series of which the effective depth of soil is shallow, deep plowing may prove detrimental to the crop, while deep plowing by tractor is effective to the Guadalupe and the Tagaytay soil series.
Generally farmers like to use tractor for land preparation because of high efficiency of tractor. Fortunately when land preparation is done the cultivation of paddy fields around the project area is off-season; therefore, tractors will be easily available from the paddy field area.

(4) Planting

Since 550 ha of sugarcane has been grown in the project area, cane-setts for initial planting of 816 ha will be provided from the existing sugarcane field. Rate of planting is 37,500 cane-setts per hectare. Preparation of furrows at a depth of 25 cm with a spacing of 100 cm will be done.

(5) Cultivation and Weeding

The soil will be cultivated with cultivator pulled by a tractor for the purpose of loosening the soil and killing weeds. Hired animal-drawn plow will also be used for cultivation whenever tractors cannot be used due to high plant height.
The first cultivation (shallow breaking of the ridge soil between the furrows) will be done three weeks after planting to bring part of the ridge soil to the base of the plant.
Hilling up will be carried out 7 weeks to 10 weeks after planting to control tillering. Final hilling up is done 15 to 16 weeks after planting.
Manual weeding along the furrows is also carried out.

(6) Harvesting

Determination of the optimum harvesting time is very important to get high efficiency of alcohol production.
The followings are guides in ascertaining cane maturity.

i) Brix reading by the use of hand refractometer
ii) Visual observation - a cane field ready for harvest exhibits these characters:

   a. Yellowing of the leaves in the whole field is uniform.
   b. The stalks become yellowish.

Harvesting Practice - Sugarcane is harvested manually by cane knife, because the project area is consisted of so many scattered lands separated by deep valleys that mechanized harvesting is inefficient.
Cut cane should be hauled immediately to the Plant to prevent sucrose deterioration.

Ratooning Practice - Sugarcane crop cycle in the project area consists of a plant crop and two ratoon crops. After canes are harvested, the exposed portion of the stubble or even a part of the underground portion is cut or removed. Sharp knife is used for stubble shaving.

After stubble shaving such practices normally done as replanting, fertilization, cultivation and weeding are carried out in the ratoon crop fields.

(7) Disease Control

The yield reduction is mainly due to the smut disease. The variety Phil-56226 is susceptible to this disease and control measures of smut are recommended as follows:

i) To prohibit ratooning of the severely affected field;
ii) To soak cane-setts in one minute in the solution of Orthocide 75 (Captan) before planting.

2.3.2.2 Farming Practice in Estate Farm

(1) Farming Practices

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

(2) Establishment of Nursery for the Multiplication of Seed-setts

At the average planting rate of 37,500 seed-setts per hectare, the entire estate farm of 400 ha will require 15,000,000 setts at the opening year of the project. 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 scheduled planting month of the raw material production field in November. Cane-setts for the 40 ha of nursery should be purchased from the PHILSUCOM's nursery or the ordinary sugarcane fields in or around the project area.

Fertilizers for nursery will be applied 120 kg of nitrogen and 80 kg of phosphate per hectare. For nursery, the soil is cultivated with cultivator pulled by a tractor for the purpose of loosing and the killing weeds one to two times and the furrows are burried with the ridge soils with a furrower drown or pulled by a tractor one or one and half months after planting, hilling up is generally not practiced.

2.4 Anticipated Yield and Production

2.4.1 Yield and Production in Individual Farm

2.4.1.1 Anticipated Yield

Comparative production performance obtained in MYC farm in the project area and the Canlubang Sugar Mill is as follows:

	(Canlubang S.E.) Phil-6607	(MYC Farm) Phil-56226
Area harvested (ha)	87.0	131.3
Total tons cane	6,055.0	6,210.0
Ave. picul sugar/ton cane	1.82	2.00
Total piculs sugar	11,076.70	12,420.00
Tons cane per ha	69.59	47.29
Piculs sugar per ha	126.86	94.58

Source: PHILSUCOM Journal Aug.-Sep. 1980

The project area is also in the Calamba mill district and the factory perfomance data shows average annual yield is 51 tons per hectare as follows:

	Area Cropped (ha)	TC/ha/1	PS/ha/2
1979/80	17,182	50.0	90.87
78/79	19,978	44.4	80.19
77/78	19,923	58.9	105.39
76/77	19,533	50.4	90.95
		50.9	

Note: /1: Tons cane per hectare
/2: Piculs sugar per hectare

Source: Factory Performance Data, special operation office, PHILSUCOM

Since the individual farm area is consisted of 465 ha of soil class I and II where are as productive as in the Calamba mill district and 2,175 ha of soil class III where are less productive than that of class I and II and easily susceptible from drought because of shallow soil. The yield is targeted as follows:

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

Yield per ha from initial yield to achievement of the target yield with proposed farming practices is forecasted as follows:

	Present	Year 1	2	3	4	5
Soil Class I & II (465 ha)	50	52	53	54	55	55
Soil Class III (2,175 ha)	37	40	43	47	50	50

2.4.1.2 Sugarcane Production

According to the construction schedule, 816 ha in the first year, 912 ha each of the second and third year will be constructed. Based on the construction schedule and annual increase yield with the project is estimated as the following table and the detailed production program is shown in Table 2.4.1.

Annual Sugarcane Production Increase

Year	1	2	3	4	5	6	7
Production (ton)/1	3,800	30,280	61,030	89,790	95,350	99,200	100,740
Percentage (%)	3.8	30.0	60.6	89.1	94.6	98.5	100.0

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

2.4.2 Yield and Production in Estate Farm

The soil types of the estate farm consists of soil class I, II of 185 ha and the soil class III of 215 ha, total 400 ha.

Construction for 400 ha of the estate farm will be completed at the initial year.

The anticipated yield from the first year to the target year are estimated as follows:

Year	1	2	3
Soils Class II (185 ha)	54	57	60
Soils Class III (215 ha)	43	49	55

The production increase is estimated as follows:

Year	1	2	3
Production of sugarcane/1 (tons)	19,210	21,070	22,930
Percentage (%)	83.8	91.9	100.0

Note: /1 Production is indicated with the fiscal year.

2.4.3 Total Sugarcne Production in the Project Area

The total sugarcne production by the individual farms and the estate farm from the first year to the full development year is projected as below:

Unit : ton

Year	1	2	3	4	5	6	7
Individual Farm/1	3,800	30,279	61,027	89,787	95,354	99,197	100,744
Estate Farm/1	19,213	21,069	22,925	22,925	22,925	22,925	22,925
Total	23,010	51,350	83,950	112,710	118,280	122,120	123,670
Percentage	18.6	41.5	67.9	91.1	95.6	98.7	100.0

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

The detailed feature of cane production in the project is shown in Table 2.4.1

2.4.4 Change of the Land Use and Agricultural Production

Traditional land use and crop production consisting mainly of food-grains will change into sugarcane production with project. (See Table 2.2.1)

Despite that the big area of upland rice is decreased, reduction of paddy production will be little due to high increase of the yield with introduction of improved farming practice, and 103,320 tons of incremental sugarcane production will be expected with the project.

2.4.5 Transportation System of Sugarcane

The harvesting and transportation program in the whole project area should be made taking account of the field and road conditions.

In November and May transportation of cane from the most part of the individual farm will be difficult due to bad field and road conditions; so the transportation of cane in these months should be done from the estate farm or the individual farms which are adjacent to the main or secondary road paved by asphalt or gravels.

Harvesting and transportation program of sugarcane should be made 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, 613 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.

2.5 Agricultural Support System

2.5.1 Research and Extension

(1) Philippine Sugar Commission (PHILSUCOM)

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

The PHILSUCOM operates two major research centers, namely: Luzon Experiment Station in Pampanga and La Granja Sugarcane Experiment Station in Negros. As a part of increased productivity program, many high yielding varieties bred by above stations are propagated and distributed to the planters.

The PHILSUCOM's district office in the Calamba mill district covers the project area and provides various services to the planters. The major services of the district office for the planters are summarized as follows:

1) Extension Service

The Sugarcane Development Technologist (SDT) has a responsibility on extension service and development activities such as propagation of new vaieties, transfer of new technology, etc.

The planters in the Cavite province are served by two SDTs.

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

2) Research

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

3) Others

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

The activites 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.

In case of "With Project", the extension service will become important to up-grade farmers' knowledge on sugarcane cultivation techniques such as introduction of new high yield varieties, improvement of fertilizer application methods and control of insects and diseases. 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.

(2) Ministry of Agriculture (MA)

The Bureau of Plant Industry (BPI) in the Ministry of Agriculture conducts researches on agricultural crops in collaboration with the research institutes such as the International Rice Research Institue (IRRI), the University of the Philippines College of Agriculture, etc. Concerning the transfer of agricultural technology to the farmers, the Bureau of Agricultural Extension (BAEx) plays the leading role for improvement of the rural life through stregthening of agricultural extension services in conjunction with many organizations and various ways and means: through a network of agricultural field technicians or mass media and so on.

2.5.2 Credit (loan)

On the top of banking institutions, the Central Bank of the Philippines (CBP) makes available increased loan subsidy to its subordinate banks; government banks (Philippine National Bank, Land Bank of the Philippines, Development Bank of the Philippines, Agricultural Credit Administration), rural banks and private banks.

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

- RPB gives a priority to the planter 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 the farmers in the project area will not be able to avail this privilege of ASCL because they have not had any experience of sugarcane cultivation.

However, it is necessary to provide ASCL to farmers in order to ensure the successful implementation of the farming.

2.5.3 Farmer's Organization

To ensure the sugarcane planter's interests, they have been conducting their own organization called planters association.

Besides, the government has been making efforts to organize farmers into cooperatives or associations. As a result, some kind of farmer's organization was established.

The characteristics of the planters association and the farmer's 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 sugar-cane planters for protection of members' interest. The major roles of the association are as follows:

1) To watch over the sugar mill as a representative of planters
2) To help member's farm management

There are three major planters associations in the Calamba mill district, namely the CABALAG Planters Association/1, the Eastern Tagalog Plnaters Association, and Batangas Integrated Planters Association. The planter in the project area can be a member of the CABALAG Planters Association, but all of them in the project area do no participate in the association at present.

(2) Agrarian Reform Beneficiaries Association (ARBA)

In order to achieve total development of its members, ARBA intends to provide socio-political support to all components of the agrarian reform program.

(3) Samahang Nayon (SN)

Samahang Nayon is farmer's organization primarily composed of some farmers and other rural workers. Being a barangay-based organization, it specifically aims to educate the tenant-farmers on saving and different aspects of organization.
The Lilusang Sabuhayan at Kaunlaran (K.K.K.) or national livelihood program was lately adopted as a current priority program. The nation-wide movement aims to achieve the following items.

- To promote attitudes in the communities, especially in the country side
- To promote the establishment of viable local productive enterprices in every town
- To encourage people to use their locl resources

/1 : CABALAG means Cavite, Batangas and Laguna.

2.5.4 Farmers' Association Setup

All the farmers in the project area will conclude milling contract with the distillery before planting their sugarcane. Hold pace with conclusion of contract, the farmers will organize their own organization like planters association under the help of the agricultural departemnt of the distillery. The contract between farmers and the distillery and farmers association setup will be finished before the first planting in 1984.

For the smooth and efficient operation of the project-wide sugarcane production, the distillery and farmer's association should work incloser cooperation. Cooperation between the distillery and farmer's association will be carried out through the section chief of the individual farm section of the agricultural department of the distillery.

2.6 Benefit

The benefit from agricultural viewpoint to be expected is defined as the difference of primary profit from crops with project and without project conditions. On the basis of the estimated production cost and gross income, primary profit for crop per hectare is calculated on both the future with and without project conditions as follows, and details are shown in Tables 2.6.1 to 2.6.9.

(Unit : Peso)

	With Project			Without Project		
	Gross Income	Pro-duction Cost	Primary profit	Gross Income	Pro-duction Cost	Primary Profit
1) Sugarcane	8,395	4,594	3,801	6,105	2,620	3,485
2) Upland Rice	3,053	2,029	1,024	1,221	1,363	-142
3) Corn	-		-	704	975	-271
4) Cassava	-	-	-	3,375	2,027	1,348
5) Peanut	-	-	-	2,168	1,982	186

Note : Estate farm area (400 ha) is excluded.

Applying the primary profit of each crop estimated above total primary profits of the project are estimated on both with and without project conditions. The benefit will be expected to increase linearly year by year and reach the full benefit in and after five years after the completion of the agricultural development project. The benefit at the full stage is estimated at about ₱6.4 million as shown in Table 2.6.10

The estate farm is not included in this calculation because the benefit from the estate farm is calculated by way of benefit comes from alcohol planned by the Industrial Sector Team.

2.7 Farm Economy

In order to assess the project from farmers' economy view point, analysis of farm budget for typical farmer is examined under both the future without project and the future with project conditions.

After the implementation of the project, most of the project area will be changed into sugarcane and upland rice fields. On the other hand, the present condition will little be changed under the without project condition. The typical farm budgets in both future without and with project conditions are shown in Tables 2.7.1 to 2.7.3 and outlined as below.

1) Without Project Condition

(Unit : ₱1,000)

	Item	Type	Type II	Type III
1)	Gross Income	10.8	10.7	11.1
	(1) Farm income	4.2	4.2	5.6
	(2) Off-farm income	6.6	6.5	5.5
II)	Gross Outgo	10.8	10.7	10.9
	(3) Production cost	2.2	2.1	2.3
	(4) Living expenses	8.6	8.6	8.6
III)	Net Reserve (Capacity to pay)	0	0	0.2
IV)	Net Farm Income (1-3)	2.0	2.1	3.3

2) With Project Condition

(Unit ₱1,000)

	Item	Type	Type II	Type III
I)	Gross Income	18.7	22.8	22.5
	(1) Farm income	12.1	16.3	17.0
	(2) Off-farm income	6.6	6.5	5.5
II)	Gross Outgo	18.1	20.0	16.9
	(3) Production cost	7.0	8.9	5.8
	(4) Living expenses	11.1	11.1	11.1
III)	Net Reserve (Capacity to pay)	0.6	2.8	5.6
IV)	Net Farm Income (1-3)	5.1	7.4	11.2

Farm income of the typical farm on type I with project condition will be exepcted to be about three times of that of without project condition, about four times on type II, and about three tiems on type III.

Net farm incomes of the typical farm on all types with project condition will be expected increase of around three times.

Annual net reserve or capacity to pay will be about ₱600 on type I, ₱2,800 on type II, and ₱5,600 on type III.

Table 1.1.1 BASIC SOCIO-DATA IN THE RELATED BARANGAYS

	Municipality/City	Population 1975	Population 1980	Population Growth Rate 1975/80	Area	Population Density	Total Household	Family Size	No. of Farm
				(%)	(ha)	(Person/km^2)			
A)	Municipalities/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

Source : Natinal Census and Statistics Office (NCSO)

Table 1.1.2 AGE GROUP IN THE RELATED MUNICIPALITIES/CITY

Municipality/City	0 - 14		15 - 64		65 & Above		Total		
	Male	Female	Male	Female	Male	Female	Male	Femal	Total
1. Indang	6,160	5,810	8,696	8,946	697	677	15,553	15,433	30,986
2. Magallanes	2,219	2,116	2,510	2,557	154	134	4,883	4,807	9,690
3. Maragondon	3,865	3,684	4,934	4,922	337	285	9,136	8,891	18,027
4. Naic	7,954	7,869	10,351	10,861	554	644	18,859	19,374	38,233
5. Tanza	9,750	9,214	11,419	12,035	653	651	21,822	21,900	43,722
6. Trece Martires City	1,919	1,843	2,502	2,143	89	83	4,510	4,069	8,579
Total and Percentage (%)	31,867 (51.1)	30,536 (48.9)	40,413 (49.4)	41,464 (50.6)	2,484 (50.1	2,474 (49.9)	74,763 (50.1)	74,474 (49.9)	149.237 (100.0)
Total of Both Sexes and Percentage (%)	62,403 (41.8)		81,876 (54.9)		4,958 (3.3)		149,237 (100.0)		149,237

Source : Planning Assistance Service to Rural Area (PASTORA) Output, 1980

Table 1.1.3 HOUSEHOLD IN THE PROJECT AREA

Municipalities/City Barangays Related to the Project Area	Total Household /1	No. of Farm Household /2	No. of Landless Laborer Household /2	Others /2
	No. (%)	No. (%)	No. (%)	No. (%)
Indang				
Banaba Lejos	386(100)	327(84.7)	40(10.4)	19(4.9)
Calumpang Lejos	210(100)	159(75.7)	35(16.7)	16(7.6)
Magallanes				
Remires	189(100)	155(82.0)	27(14.3)	7(3.7)
Maragondon				
Bucal IV	186(100)	151(81.2)	28(15.1)	7(3.7)
Mabacao	280(100)	215(76.8)	65(23.2)	-(-)
Mabato	83(100)	66(79.5)	16(19.3)	1(1.2)
Pantihan I	78(100)	65(83.3)	13(16.7)	-(-)
Talipusungo	108(100)	85(78.7)	23(21.3)	-(-)
Naic				
Calubcob	86(100)	71(82.6)	11(12.8)	4(4.6)
Halang	270(100)	219(81.1)	44(16.3)	7(2.6)
Malainen Luma	191(100)	149(78.0)	41(21.5)	1(1.5)
Molino	82(100)	67(81.7)	15(18.3)	-(-)
Palangui	270(100)	213(78.9)	53(19.6)	4(1.5)
Tanza				
Tanawan	235(100)	195(83.0)	34(14.5)	6(2.5)
Trece Martires City				
Aguado	64(100)	50(78.1)	14(21.9)	-(-)
Cabuco	147(100)	107(72.8)	38(25.8)	2(1.4)
Lapidalio	68(100)	53(77.9)	13(19.1)	2(3.0)
Total (8,400 ha)	2,933	2,347(80.0)	510(17.4)	76(2.6)
Project Area (3,090 ha)	1,079	863(80.0)	188(17.4)	28(2.6)

Source /1 : National Census and Statistics Office (NCSO)

/2 : Data on Farm Economic Survey and Barangay Survey

Table 1.1.4 MONTHLY LABOR FORCE IN THE PROJECT AREA

Unit : 1,000 man-days

		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
A)	Labor Force Available/1	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	379.6
B)	Labor Reuirement for Farming at Present	7.9	14.4	5.9	5.2	9.5	31.4	26.5	27.5	12.7	20.3	8.8	7.2	177.3
	1. Upland Paddy (1,900 ha)	-	-	-	-	5.7	20.9	22.8	24.7	11.4	19.0	-	-	104.5
	2. Sugarcane (550 ha)	7.2	6.1	5.9	5.2	3.8	1.0	0.9	-	-	-	6.4	6.4	42.9
	3. Corn (250 ha)	-	-	-	-	-	3.5	2.0	2.0	0.5	1.3	-	-	9.3
	4. Cassava (200 ha)	-	6.0	-	-	-	6.0	0.8	0.8	0.8	-	-	-	14.4
	5. Peanuts (100 ha)	0.7	2.3	-	-	-	-	-	-	-	-	2.4	0.8	6.2
C)	Balance (A-B)	23.7	17.2	25.7	26.4	22.1	0.2	5.1	4.1	18.9	11.3	22.8	24.4	202.3

/1 : (Labor force from farmers + Labor force from landless workers) x Yearly workable days
= (1,000 + 300) x (365 days x 8-%) = 379,600 man-days/year

Labor force from landless workers in the project area is estimated as follows:

Lf = Th x Lw x Fs x Ra x Ar = 1,079 x 0.174 x 5.8 x 0.55 x 0.5 = 300

Where, Lf : Labor force from landless workers
Th : Total households (1,079)
Lw : Percentage of landless workers household (17.4%)
Fs : Family Size (5.8 person/household)
Ra : Ratio of age distribution between 15 and 64 (55%)
Ar : Ratio of available labor force (50%)

Table 1.2.1 LAND USE IN THE OBJECTIVE AREA

	Extent Atea (ha)		Proportion (%)
Perennial Crop Field	2,850		21.9
Coconut		2,540	
Banana		100	
Mango		210	
Uplant Field	5,750		44.2
Sugarcane		1,210	
Other Diversified Crops		4,540	
Paddy Field	1,100		8.5
Shrub Land and Valley	2,860		22.0
Wasted Land	400		3.1
Residential Area	40		0.3
Total	13,000		100.0

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

Table 1.2.2 HARVESTED AREA, TOTAL PRODUCTION AND UNIT YIELD OF MAJOR CROPS IN THE RELATED MUNICIPALITIES/CITY

Municipality/ City	Indang			Magallanes			Maragondon			Naic			Tanza			Tres Martires City			Total or Average		
	HA /4	TP /5	UY /6	HA	TP	UY	HA	TP	UY	HA	TP	UY	HA	TP	UY	HA	TP	UY	HA	TP	UY
	(ha)	(t)	(t/ha)	(ha)	(t)	(t/ha)	(ha)	(t)	(t/ha)	(ha)	(t)	(t/ha)	(ha)	(t)	(t/ha)	(ha)	(t)	(t/ha)	(ha)	(t)	(t/ha)
Paddy	850	405	0.5	1,800	955	0.5	1,670	3,050	1.8	3,695	11,383	3.1	3,260	8,684	2.7	1,205	729	0.6	12,480	25,206	2.02
Irrigated	(-)	(-)	(-)	(-)	(-)	(-)	(620)	(1,785)	(2.9)	(3,100)	(10,060)	(3.2)	(2,830)	(8,010)	(2.8)	(-)	(-)	(-)	6,550	19,855	3.03
Rainfed	(-)	(-)	(-)	(-)	(-)	(-)	(550)	(1,020)	(1.9)	(585)	(1,315)	(2.2)	(290)	(583)	(2.0)	(5)	(9)	(1.8)	1,430	2,927	2.05
Upland	(850)	(405)	(0.5)	(1,800)	(955)	(0.5)	(500)	(245)	(0.5)	(10)	(8)	(0.8)	(140)	(91)	(0.7)	(1,200)	(720)	(0.6)	4,500	2,424	0.54
Sugarcan /1	100	350	3.5	520	2,070	4.0	220	740	3.4	260	1,020	3.9	150	550	3.6	600	2,315	3.8	1,850	7,045	3.81
Cassava	55	290	5.3	35	175	5.0	40	195	4.9	10	40	4.0	7	28	4.0	250	1,420	5.7	397	2,148	5.41
Corn	273	123	0.5	378	170	0.4	107	43	0.4	42	19	0.5	49	20	0.4	456	212	0.5	1,305	587	0.45
Sweet Potato	-	-	-	-	-	-	6	48	8.0	-	-	-	-	-	-	27	210	7.8	33	258	7.81
Mongo	74	12	0.2	107	17	0.2	82	11	0.1	97	15	0.2	23	2	0.1	105	16	0.2	488	73	0.15
Peanut /2	118	47	0.4	200	90	0.5	13	4	0.3	-	-	-	-	-	-	102	40	0.4	433	181	0.42
Fruit Vegetable	153	202	1.3	17	9	0.5	22	20	0.9	15	20	1.3	62	109	1.8	48	104	2.2	317	464	1.46
Coconut /3	940	4,690	5.0	1,535	6,940	4.5	155	670	4.3	-	-	-	-	-	-	16	60	3.8	2,646	12,360	4.67
Banana	965	7,513	7.8	1,068	8,298	7.8	158	1,069	6.8	29	216	7.4	82	570	6.9	461	3,285	7.1	2,764	20,951	7.58
Mango	118	580	4.9	61	265	4.3	73	374	5.1	13	51	3.9	18	79	4.4	35	150	4.3	133	607	4.56

/1 : Tons of sugar
/2 : Unshelled
/3 : Numbers of coconut (1,000)
/4 : Harvested Area
/5 : Total Production
/6 : Unit Yield

Source: BAEcon, MA, 1980

Table 1.4.1 LIVESTOCK AND POULTRY POPULATION IN THE RELATED MUNICIPALITIES

Unit : Number

	Livestock					Polutry	
	Carabao	Cattle	Horses	Hogs	Goats	Chicken	Ducks
Indang	105	2,815	265	1,530	105	16,605	820
Magallanes	680	1,455	345	2,225	555	6,840	25
Maragondon	1,270	1,430	110	4,550	270	24,180	90
Naic	1,015	390	5	2,820	35	18,080	2,510
Tanza	2,133	1,177	49	2,471	114	14,653	2,100
Trece Martires City	340	1,640	75	990	80	28,190	160
Total	5,623	10,797	1,364	16,366	1,244	118,318	5,725
Cavite Province Total	16,930	28,080	3,750	49,430	2,850	488,420	22,830

Source : BAEcon /BAI liverstock & Poultry Survey, 1978

Table 1.5.1 FARMS-NUMBER, BY SIZE IN THE RELATED MUNICIPALITIES/CITY

	Under 1.0 ha		1.0 - 3.0 ha		3.0 - 5.0 ha		5.0 - 10.0 ha		10.0 - 25.0 ha		25.0 - 50.0 ha		50.0 ha & Over		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Indang	329	14.4	1,293	56.7	467	20.5	144	6.3	42	1.9	2	0.1	2	0.1	2,279	100
Magallanes	27	2.7	494	49.1	367	36.5	98	9.5	16	1.6	3	0.3	-	-	1,005	100
Maragondon	8	1.3	488	79.9	96	15.7	19	3.1	-	-	-	-	-	-	611	100
Naic	35	4.6	588	76.6	125	16.3	18	2.3	1	0.1	1	0.1	-	-	768	100
Tanza	13	1.7	161	20.8	439	56.7	148	19.1	11	1.4	2	0.3	-	-	774	100
Trece Martires City	43	5.9	339	46.9	208	28.8	112	15.5	20	2.8	1	0.1	-	-	723	100
Total	455	7.4	3,363	54.6	1,702	27.6	539	8.8	90	1.5	9	0.1	2	-	6,160	100
Cavite Total	2,790	13.1	11,730	54.9	5,120	24.0	1,441	6.7	238	1.1	21	0.1	19	0.1	21,359	100

Source : NCSO, Sensus of Agriculture, 1971

Table 1.5.2 FARMS-AREA, BY SIZE IN THE RELATED MUNICIPALITIES/CITY

	Under 1.0 ha		1.0 - 2.0 ha		3.0 - 5.0 ha		5.0 - 10.0 ha		10.0 - 25.0 ha		25.0 - 50.0 ha		50.0 ha & Over		Total	
	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%
Indang	163	2.9	2,275	39.7	1,680	29.3	862	15.1	550	9.6	58	1.0	138	2.4	5,726	100
Magallanes	8	0.3	875	28.8	1,271	41.8	579	19.0	232	7.6	76	2.5	0	-	3,041	100
Maragondon	3	0.3	714	62.4	312	27.2	116	10.1	0	-	0	-	0	-	1,145	100
Naic	14	0.9	938	61.8	428	28.2	100	6.6	10	0.7	28	1.8	0	-	1,519	100
Tanza	6	0.2	303	10.5	1,538	53.1	857	29.6	143	4.9	50	1.7	0	-	2,897	100
Trece Martires City	14	0.6	586	24.9	757	32.2	688	29.3	277	11.8	29	1.2	0	-	2,351	100
Total	208	1.3	5,692	34.1	5,986	35.9	3,202	19.2	1,212	7.3	241	1.4	138	0.8	16,679	100
Cavite Total	1,282	2.4	19,641	36.4	18,109	33.5	8.543	15.8	3,031	5.6	604	1.1	2,776	5.2	53,986	100

Source : NCSO, Census of Agriculture, 1971

Table 1.5.3 FARM -NUMBER, BY TENURE OF OPERATER IN THE RELATED MUNICIPALITIES/CITY

	Full Owner		Part Owner		Tenant		Other		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Indang	1,752	76.9	178	7.8	337	14.8	12	0.5	2,279	100
Magallanes	582	57.9	150	14.9	269	26.8	4	0.4	1,005	100
Maragondon	107	17.5	14	2.3	490	80.2	-	-	611	100
Naic	134	17.4	16	2.1	618	80.5	-	-	768	100
Tanza	9	1.2	8	1.0	757	97.8	-	-	774	100
Trece Martires City	242	33.5	188	26.0	228	31.5	65	9.0	723	100
Total	2,826	45.9	554	9.0	2,699	43.8	81	1.3	6,160	100
Cavite Total	8,976	42.0	2,262	10.6	9,794	45.8	329	1.6	21,361	100

Source: NCSO, Census of Agticulture, 1971

Table 1.5.4 FARMS-AREA, BY TENURE OF OPERATOR IN THE RELATED MUNICIPALITIES/CITY

	Full Owner		Part Owner		Tenant		Others		Total	
	ha	%	ha	%	ha	%	ha	%	ha	%
Indang	4,136	72.2	683	11.9	887	15.5	19	0.4	5,725	100
Magallanes	1,804	59.3	504	16.6	702	23.1	31	1.0	3,041	100
Maragondon	251	22.0	36	3.1	856	74.9	0	-	1,143	100
Naic	195	12.8	54	3.6	1,270	83.6	0	-	1,519	100
Tanza	40	1.4	61	2.1	2,796	96.5	-	-	2,897	100
Trece Martires	758	32.2	726	30.9	686	29.2	182	7.7	2,352	100
Total	7,184	43.0	2,064	12.4	7,197	43.2	232	1.4	16,677	100
Cavite Total	20,006	37.1	7,789	14.4	23,887	44.2	2,304	4.3	53,986	100

Source : NCSO, Census of Agriculture, 1971

Table 1.6.1 SUGARCANE PRODUCTION
IN THE CALAMBA MILL DISTRICT

Year	Area Cropped (ha)	Production of Cane (1,000 ton)	Cane Yield (t/ha)	Production of Sugar (1,000 ton)	Sugar Yield (t/ha)
1976/77	21,672	1,092	50.4	124.7	5.7
1977/78	19,243	1,134	58.9	128.3	6.7
1978/79	19,978	887	44.4	101.3	5.1
1979/80	17,182	858	50.0	98.8	5.7

Source : PHILSUCOM, Factory Performance Data

Table 1.6.2 DEALERS OF AGRICULTURAL SUPPLY
IN THE RELATED MUNICIPALITIES/CITY

Municipalities/City	Number of Dealers
1. Indang	5
2. Magallanes	0
3. Maragondon	4
4. Naic	4
5. Trece Martires	2
6. Tanza	0
Total	15

Source : M.A. Cavite

Table 1.6.3 FINANCIAL AND ECONOMIC PRICES OF MAJOR COMMODITIES AT FARM-GATE

Unit : ₱/ton

Major Commodities	Financial Price	1987 Economic Price
1. Farm Products		
- Sugarcane	160(125)/1	165
- Paddy	1,455	2,035
- Corn	1,070	1,280/2
- Cassava	490	625/2
- Peanuts (un-shelled)	4,210	4,090/2
2. Farm Inputs/4		
- Fertilizer (₱/kg)		
N: (Uria)	5.0	6.5
P: (T.S.P.)	5.2	7.8
K: (M.O.P.)	2.7	3.3

Note : /1 The price for Canlubang Sugarmill (see Table 1.6.5).

/2 Economic price of corn, cassava and peanuts is estimated based on the price projections forecasted by IBRD.

/3 The prices are converted to nutrient prices (see Table 1.6.7).

Table 1.6.4 ECONOMIC PRICE STRUCTURE OF SUGARCANE (1987)

Unit : ₱/ton

Export F.O.B. Manila	2,800
Cost, Loading port	60
Cost, terminal warehouse	50
Land and transport ex-mill	70
Ex-mill value	2,620
Milling cost	540
Millgate sugarcane value (excluding by-products value)	210
By-products value	5
Millgate sugarcane value	215
Transport to mill	50
Farmagate sugarcane price	165

Note : The price is estimated based on the projected international market price forecasted BY IBRD for the period of 1985 to 1990 based on 1981 constant U.S. Dollar.

Table 1.6.5 FINANCIAL PRICE STRUCTURE OF SUGARCANE

Unit : ₱/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

Note : /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 1.6.6 FINANCIAL AND ECONOMIC STRUCTURE OF RICE

Unit : ₱/ton

	1987	
	Financial	Economic
Export F.O.B. Manila	2,645	3,520
Cost, loading port	65	60
Cost, terminal warehouse	60	50
Milling cost	205	165
By-product value	(135)	(110)
Ex-mill value	2,450	3,355
Rice equivalent (63%)	1,545	2,110
Procurement costs	90	70
Farm gate price	1,455	2,035

Note : The economic price is estimated based on the projected international market price forecasted BY IBRD for the period of 1985 to 1990 based on 1981 constamt U.S. Dollar.

Table 1.6.7 ECONOMIC PRICE STRUCTURE OF FERTILIZER (1987)

Unit : ₱/ton

	Urea	Triple Superphosphate	Muriate of Potash
Import price CIF Manila	2,335	2,985	1,365
Importer expenses	205	205	205
Import gate cost	2,540	3,190	1,570
Transport to wholesale outlet	75	75	75
Expenses at wholesale outlet	155	155	155
Wholesale cost	2,770	3,420	1,800
Transport to retail outlet	55	55	55
Expenses at retail outlet	100	100	100
Sales price to farmer	2,925	3,575	1,955
Nutrient farm gate price (₱/kg)	6.5	7.8	3.3

Table 1.7.1 TYPICAL FARM BUDGET AT PRESENT CONDITION (FARM SIZE 2.0 HA)

(1) Type I (TENANT)

Item	Area (ha)	Unit Yield (t/ha)	Production (t)	Unit Price (₱/t)	Amount (₱)
I) Gross Income					10,757
1) Farm Income					4,189
- Rainfed paddy	0.4	2.0	0.80	1,455	1,164
- Upland rice	0.9	0.6	0.54	1,455	
- Cassava	0.5	5.4	2.70	490	1,323
- Peanuts	0.2	0.53	0.11	4,210	446
- Livestock					470
2) Off-farm Income					6,568
II) Gross Outgo					10,757
1) Production Cost					2,187
- Seed					221
- Fertilizer					248
- Hired labor	32 man-days x ₱15/day				480
- Harvesting and threshing	1.34 t x 1/5 x ₱1,455/t				390
- Land rent /1					744
- Miscellaneous					104
2) Living Expenses					8,570
III) Net Reserve					0

Note : /1 (₱1,164 + ₱786 - ₱390) x 25% + (₱1,323 + ₱446) x 20%

= ₱390 + ₱354

= ₱744

Table 1.7.2 TYPICAL FARM BUDGET AT PRESENT CONDITION (FARM SIZE 2.5 HA)

(2) Type II (TENANT)

		Area (ha)	Unit Yield (t/ha)	Production (t)	Unit Price (₱/t)	Amount (₱)
I)	Gross Income					10,673
	1) Farm Income					4,215
	- Upland rice	2.0	0.6	1.20	1,455	1,746
	- Cassava	0.2	5.4	1.08	490	529
	- Perenial crop	0.3	70,000 pcs	21,000	70/1,000 pcs	1,470
	- Livestock					470
	2) Off-Farm Income					6,458
II)	Gross Outgo					10,673
	1) Production Cost					2,103
	- Seed	2.0 ha x 75 kg/ha x ₱1.5/kg				225
	- Fertilizer	23 kg/ha x 2 ha x ₱5/kg				230
	- Hired labor	30 man-days x ₱15/day				450
	- Harvesting and threshing	1.2 t x 1/5 x ₱1,455/t				349
	- Land rent /1					749
	- Miscellaneous					100
	2) Living Expenses					8,570
III)	Net Reserve					0

Note : /1 (1,746 - 349) x 25% + (529 + 1,470) x 20%
= 349 + 400
= 749

Table 1.7.3 TYPICAL FARM BUDGET AT PRESENT CONDITION (FARM SIZE 2.7 HA)

(2) Type II (TENANT)

	Area (ha)	Unit Yield (t/ha)	Production (t)	Unit Price (₱/t)	Amount (₱)
I) Gross Income					11,090
1) Farm Income					5,561
- Upland rice	1.7	0.6	1.02	1,455	1,484
- Corn	0.3	0.55	0.165	1,070	177
- Perenial Crop	0.7	70,000 pcs	49,000	70/1,000 pcs	3,430
- Livestock					470
2) Off-farm Income					5,529
II) Gross Income					10,870
1) Production Cost					2,300
- Seed					208
- Fertilizer					230
- Hired Labor	91 man/days x ₱15/day				1,365
- Harvesting and threshing	1.02 t x 1/5 x ₱1,455/t				297
- Miscellaneous					105
- Tax	₱35/ha x 2.7 ha				95
2) Living Expenses					8,570
III) Net Reserve (I-II)					220

Table 2.2.1 LAND USE AND AGRICULTURAL PRODUCTION

Land Use	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	- 165
Cassava	110	594	—	—	- 110	- 594
Other crop/1	(80)	(42)	—	—	- (80)	- (48)
Idle land	90	—	—	—	- 90	—
Road	—	—	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
Road	—	—	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	3,090		3,080			

Note : /1 Crops following corn

Additional description :

When the cropping pattern of a condinuous cultivation of sugarcane, although this pattern has several problems to execute farmer's 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 2.3.1 ELEMENTAL FERTILIZER RECOMMENDATION PER HECTARE BASED ON LABORATORY SOIL ANALYSIS, YEAR 1978

Place	Tons of Lime	Kilogram			Remarks
		N	P	K	
Cavite					
A. Silang					
1. Biga	2				
2. Lalaan	No sample yet				
3. Maguyam	3	157.5	130	0	Incomplete
4. Kaong	Analysis in progress				
5. Sabutan	No sample yet				
6. Bulihan	20				
7. Munting Ilog	2.5	175	0	0	Complete
8. Batas	No sample yet				
B. Dasmarinas					
1. Langkaan	2.75	171	62	0	Incomplete
2. Paliparan	1.0	160	15	0	Complete
3. Piela	1.2	73	0	0	Complete
4. Malinta	Analysis in progress				
5. Bucal	No sample yet				
6. San Agustin	No sample yet				
7. Burol	1.0	109	122	360	Incomplete
C. Trece Martires City					
1. Kanggahan	1.25	175	24	0	Incomplete
D. Gen. Trias					
1. Del Fuego	2.25	130	111	0	Complete
2. San Francisco	No sample yet				
3. Buenavista	No sample yet				
E. Naic					
1. Palangui	No sample yet				
2. M. Luma	1.75	88	43	0	Complete
3. Sabang					
F. Tanza					
1. Tanauan	No sample yet				
2. Amaya	No sample yet				
3. Biga	No sample yet				

Note: Other Barangays of Silang c/o EWA 03 & 04

Table 2.4.1 PRODUCTION SCHEDULE

(1) Individual Farm

Crop Year (Nov. - May)	1	2	3	4	5	6	7
Yield (t/ha)	52	53	54	55	55	55	55
Production form (x 110.25 ha)	5,733	5,843	5,953	6,064	6,064	6,064	6,064
Yield (t/ha)		52	53	54	55	55	55
Production form (x 119.25 ha)		6,201	6,320	6,440	6,559	6,559	6,559
Yield (t/ha)			52	53	54	55	55
Production form (x 119.25 ha)			6,201	6,320	6,440	6,559	6,559
Yield (t/ha)	40	43	47	50	50	50	50
Production form (x 501.75 ha)	20,070	21,575	23,582	25,087	25,087	25,087	25,087
Yield (t/ha)		40	43	47	50	50	50
Production form (x 564.75 ha)		22,590	24,284	26,543	28,237	28,237	28,237
Yield (t/ha)			40	43	47	50	50
Production form (x 564.75 ha)			22,590	24,284	26,543	28,237	28,237
Total production	25,803 /1	56,209	88,930	94,738	98,930	100,744	100,744

By Fiscal Year (Jan. - Dec.)	1	2	3	4	5	6	7
	3,800/1	30,279	61,020	89,755	95,354	99,197	100,744

Note: /1 $3{,}800\ t = 25{,}803\ t \times \frac{24 \text{ days (Dec. 7 - Dec. 31)}}{164 \text{ days (Dec. 7 - May 31)}}$

(2) Estate Farm

		Year 1	2	3
Guadalupe Soil Series	Yield (t/ha)	54	57	60
	Production (x 185 ha)	9,990	10,545	11,100
Magallanes Soil Series	Yield (t/ha)	43	49	55
	Production (x 215 ha)	9,223	10,524	11,825
Total production		19,213	21,069	22,925

Table 2.6.1 PRIMARY PROFIT PER HA FOR SUGARCANE WITH PROJECT (AVERAGE)

Item		(Unit : Peso)
A) Gross Income		8,395
1) ₱9,075/ha x 465 ha/1	= ₱4,219,875	
2) ₱8,250/ha x 2,175 ha/2	= ₱17,943,750	
3) Average : (1 + 2)/2,640 ha/3	= ₱8,395	
B) Production Cost		4,594
1) ₱4,901/ha x 465 ha/1	= ₱2,278,965	
2) ₱4,528/ha x 2,175 ha/2	= ₱9,848,400	
3) Average : (1 + 2)/2,640 ha/3	= ₱4,594	
C) Primary Profit (A - B)		3,801

Note : /1 465 ha : The area of Tagaytay and Guadalupe series

/2 2,175 ha: The area of Magallanes series

/3 2,640 ha: Total area of individual farm