

REPUBLIC OF THE PHILIPPINES

**MASTER PLAN STUDY
ON
THE INTEGRATED AGRICULTURAL DEVELOPMENT PROJECT
IN MARINDUQUE**

APPENDIX II

JANUARY 1990

JAPAN INTERNATIONAL COOPERATION AGENCY

AFT
XXXXXXXXXX
89-75

ARY

REPUBLIC OF THE PHILIPPINES

MASTER PLAN STUDY
ON
THE INTEGRATED AGRICULTURAL DEVELOPMENT PROJECT
IN MARINDUQUE

APPENDIX II

JICA LIBRARY



1084588111

21476

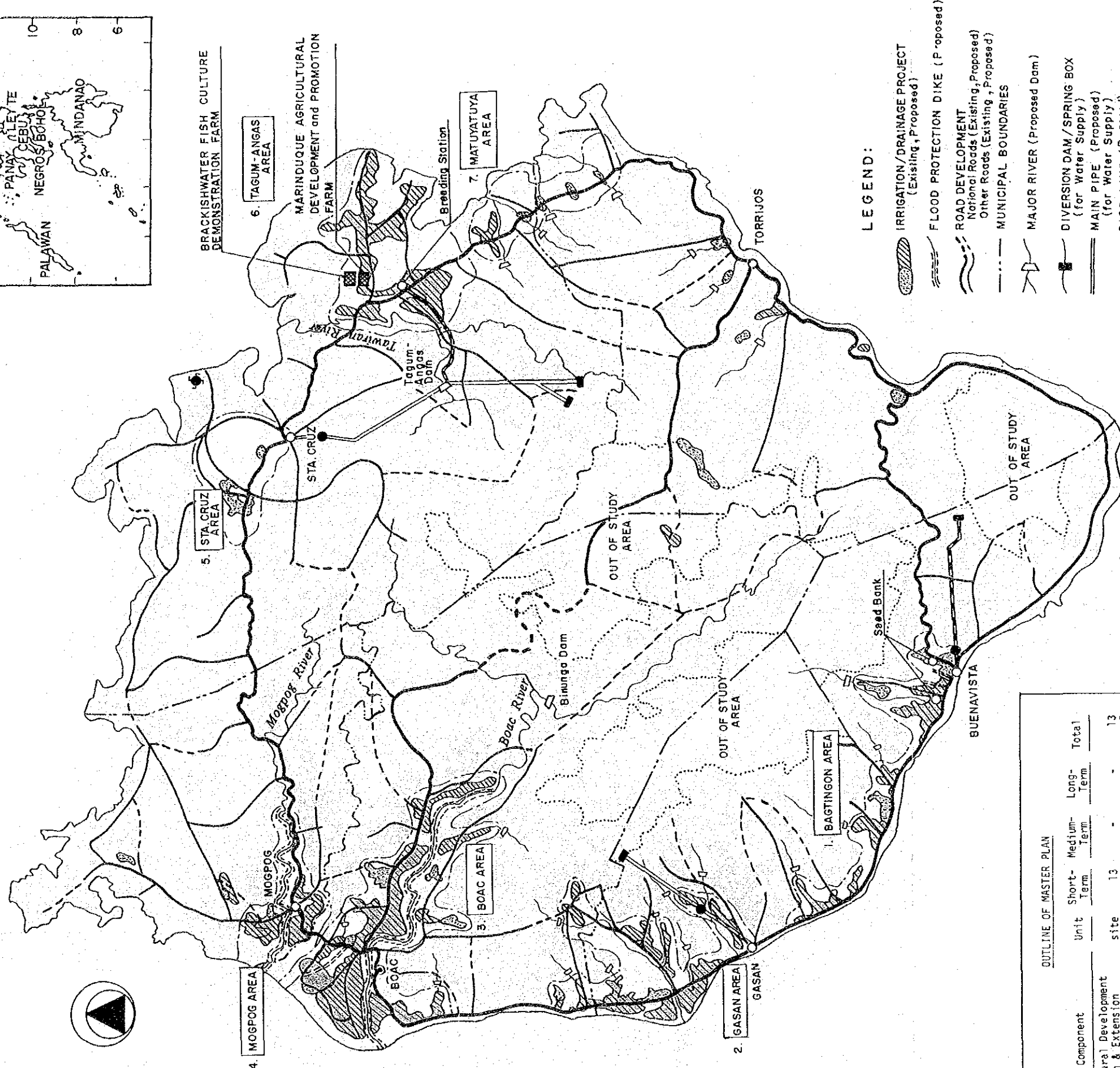
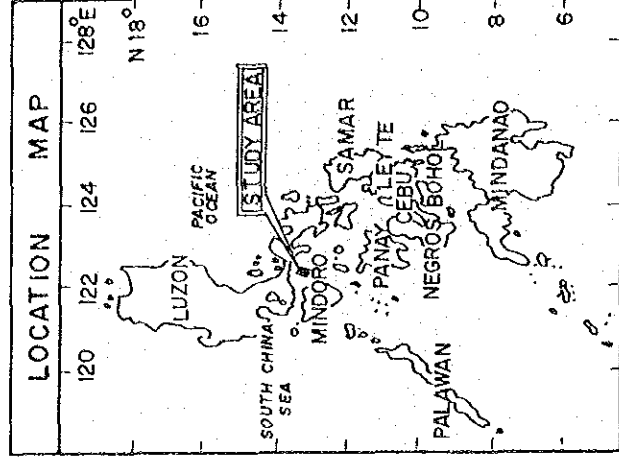
JANUARY 1990

JAPAN INTERNATIONAL COOPERATION AGENCY

国際協力事業団

21476

GENERAL PLAN THE INTEGRATED AGRICULTURAL DEVELOPMENT PROJECT IN MARINDUQUE



LEGEND:

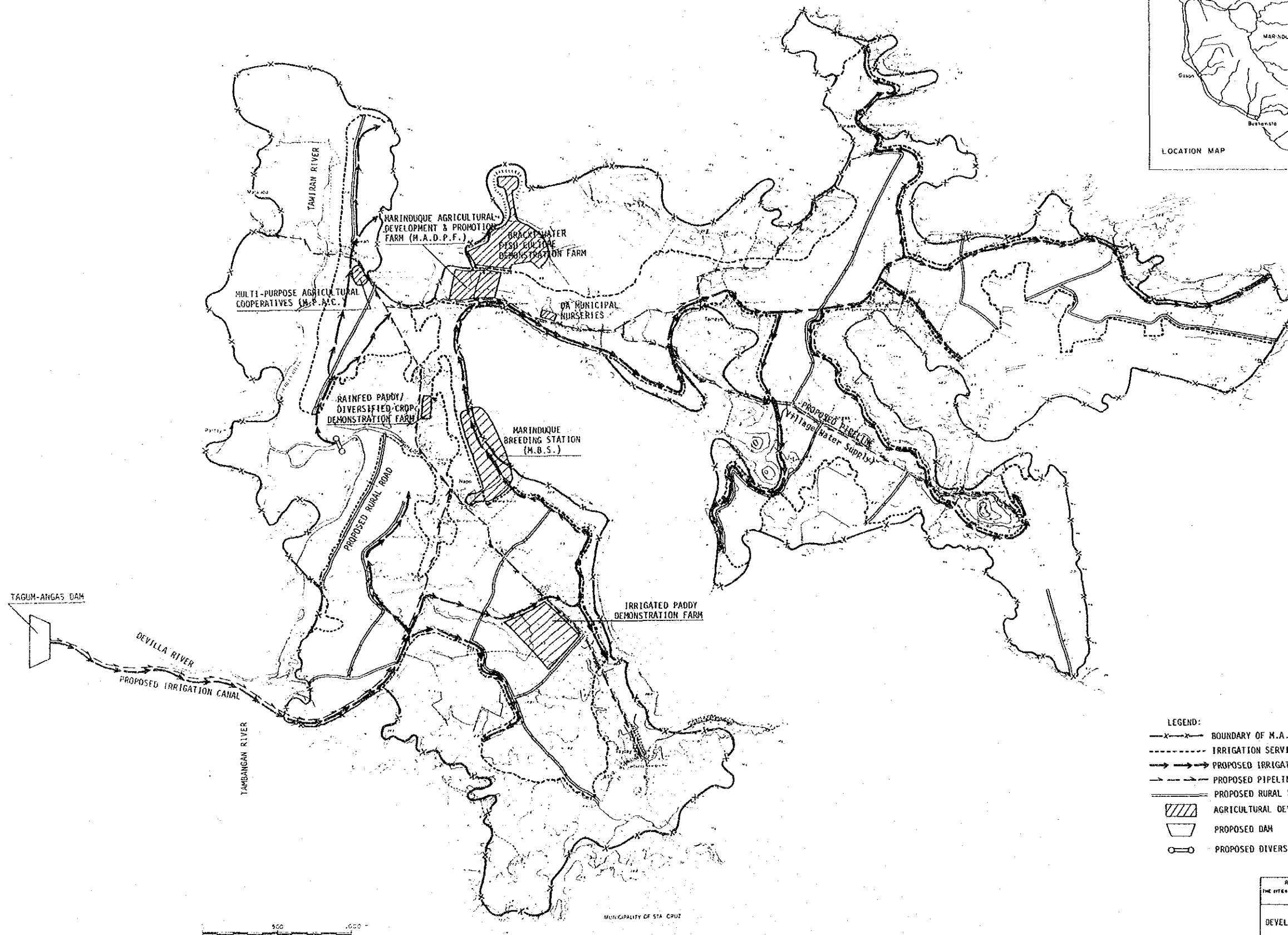
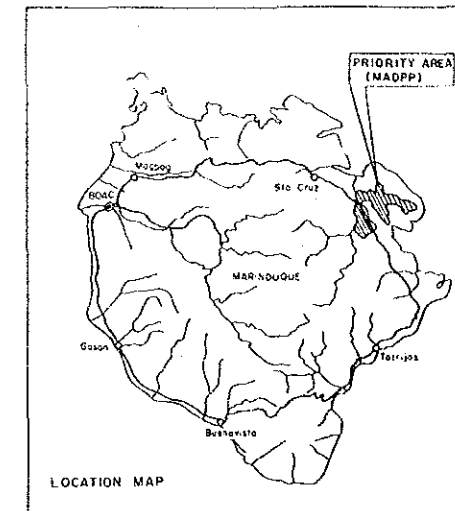
- IRRIGATION/DRAINAGE PROJECT (Existing, Proposed)
- FLOOD PROTECTION DIKE (Proposed)
- ROAD DEVELOPMENT
National Roads (Existing, Proposed)
Other Roads (Existing, Proposed)
- MUNICIPAL BOUNDARIES
- MAJOR RIVER (Proposed Dam)
- DIVERSION DAM / SPRING BOX (for Water Supply)
- MAIN PIPE (Proposed) (for Water Supply)
- PIPE LINE (Proposed) (for Village Water Supply)
- GENERATOR (Proposed)
- PRIORITY DEVELOPMENT AREA

Land Use	Present (ha)	Proposed (ha)
I. Agricultural Area		
Paddy Rice	5,400	5,650
Diversified Crops	4,020	4,300
Coconut Trees	32,470	29,550
Meadows and Others	2,810	4,000
Fruit	-	2,100
II. Forest Area		
Shrub/Grasses	24,370	7,300
Forest	5,530	21,500
III. Wetland and Others		
	5,900	6,100
Total	80,500	80,500

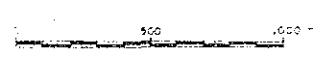
Component	Unit	Short-Term	Medium-Term	Long-Term	Total
1. Agricultural Development					
1) Research & Extension	site	13	-	-	13
2) Nurseries & Seed Bank	"	3	2	2	7
3) Demonstration Farm	"	11	12	6	29
4) Post-Harvest	"	8	8	9	25
5) Livestock Development	"	15	11	3	29
6) Farmer's Organization	"	7	16	17	40
7) Marketing & Trading	"	3	4	-	7
2. Agricultural Infrastructure Development					
1) Irrigation/Drainage	ha	1,650	680	1,340	3,670
2) Flood Protection	km	12	11	20	43
3) Rural Road	"	290	240	400	930
4) Village Water Supply	m ³ /d	2,870	-	-	2,870
3. Rural Infrastructure Development					
1) Rural Water Supply	m ³ /d	3,380	1,500	2,030	6,910
2) Hydro-Power & Generator	KW	9,000	300	600	9,900
3) Rural Electrification	km	490	150	210	850
4) Traffic System	place	245	215	400	860
5) Health & Medical Service	"	20	10	-	30
6) Education & Welfare	"	300	-	-	300
7) Communication	km	40	-	100	140
4. Aquaculture Development	ha	1	-	-	1
5. MADPP	ha	-	-	-	2
					1



PRELIMINARY LAYOUT OF MARINDUQUE AGRICULTURAL DEVELOPMENT & PROMOTION PROJECT (M.A.D.P.P.)



- LEGEND:**
- x---x--- BOUNDARY OF M.A.D.P.P.
 - - - - - IRRIGATION SERVICE AREA
 - → → PROPOSED IRRIGATION CANAL
 - - - - - PROPOSED PIPELINE (Village Water Supply)
 - — — PROPOSED RURAL ROAD
 - ▨▨▨ AGRICULTURAL DEVELOPMENT PROJECT
 - ▭ PROPOSED DAM
 - PROPOSED DIVERSION DAM



REPUBLIC OF THE PHILIPPINES	
THE INTEGRATED AGRICULTURAL DEVELOPMENT PROJECT IN MARINDUQUE	
MARINDUQUE AGRICULTURAL DEVELOPMENT & PROMOTION PROJECT (M.A.D.P.P.)	
DATE SUBMITTED: JULY 1988	SCALE: 1:50,000
DESIGNED BY:	DRAWN BY:
CHECKED BY:	APPROVED BY:
JAPANESE INTERNATIONAL COOPERATION AGENCY (JICA)	

TABLE OF CONTENTS

	<u>Page</u>
GENERAL PLAN	
PRELIMINARY LAYOUT OF MARINDUQUE AGRICULTURAL DEVELOPMENT AND PROMOTION PROJECT (MADPP)	
TABLE OF CONTENTS	
ABBREVIATION/CONVERSION TABLE/GLOSSARY	
CHAPTER 1. INTRODUCTION	1-1
1-1 Background	1-1
1-2 Priority Projects	1-2
1-3 Present Condition of the MADPP Area	1-3
1-3-1 Population, Household and Labor Force	1-3
1-3-2 Topography, Soils and Land Use	1-4
1-3-3 Farm Size and Land Tenure	1-4
1-3-4 Cropping Pattern and Crop Production	1-5
1-3-5 Livestock	1-6
1-3-6 Marketing of Farm Products	1-7
1-3-7 Farm Incomes and Expenditures	1-7
1-3-8 Farmer's Organization	1-9
1-3-9 Brackishwater Aquaculture	1-9
CHAPTER 2. PROJECT COMPONENTS OF MADPP	2-1
2-1 Agricultural Development	2-1
2-2 Agricultural Infrastructure Development	2-2
2-3 Rural Infrastructure Development	2-3
2-4 Aquaculture Development	2-3
CHAPTER 3. AGRICULTURAL DEVELOPMENT	3-1
3-1 Basic Concept of Agricultural Development	3-1
3-2 Agricultural Development Plan	3-1
3-2-1 Strengthening of Marinduque Agricultural Development Promotion Farm (MADPF)	3-1
3-2-2 Rehabilitation of Marinduque Breeding Station	3-2
3-2-3 DA Municipal Nurseries	3-2
3-2-4 Irrigated Paddy Cultivation Demonstration Farm	3-3
3-2-5 Rainfed Paddy/Diversified Crops Cultivation Demonstration Farm	3-3

	<u>Page</u>
3-3 Post-harvest	3-3
3-3-1 Post-harvest Facilities for Rice	3-3
3-3-2 Post-harvest Facilities for Corn	3-4
3-4 Farmer's Organization	3-4
3-4-1 Basic Concept for Development	3-4
3-4-2 Development Plan	3-4
3-5 Demand and Supply of Rice	3-5
3-6 Labor Requirement	3-5
 CHAPTER 4. AGRICULTURAL INFRASTRUCTURE DEVELOPMENT	 4-1
4-1 Irrigation Development	4-1
4-1-1 Present Condition	4-1
4-1-2 Basic Concept of Irrigation Development	4-4
4-1-3 Irrigation Development Plan	4-5
4-2 Rural Road Development	4-12
4-2-1 Present Condition	4-12
4-2-2 Basic Concept of Rural Road Development	4-12
4-2-3 Rural Road Development Plan	4-13
4-3 Village Water Supply Development	4-18
4-3-1 Present Condition	4-18
4-3-2 Basic Concept of Village Water Supply Development	4-18
4-3-3 Village Water Supply Development Plan	4-18
 CHAPTER 5. RURAL INFRASTRUCTURE DEVELOPMENT	 5-1
5-1 Rural Electrification Development	5-1
5-1-1 Present Condition	5-1
5-1-2 Development Plan	5-1
5-2 Traffic System Development	5-4
5-2-1 Present Condition	5-4
5-2-2 Development Plan	5-4
5-3 Education Development	5-6
5-3-1 Present Condition	5-6
5-3-2 Development Plan	5-6
 CHAPTER 6. AQUACULTURE DEVELOPMENT	 6-1
6-1 Improvement of Brackishwater Fish Culture Demonstration Farm	6-1
6-1-1 Reconstruction and Expansion of Fish Pond	6-1
6-1-2 Objectives to be Undertaken in Laboratory	6-1
6-2 Shrimp Hatchery Plant	6-2
6-3 Pilot Processing Plant and Ice Plant	6-2

	<u>Page</u>
CHAPTER 7. PROJECT COST	7-1
7-1 Estimate Condition	7-1
7-2 Project Cost	7-1
7-3 Operation and Maintenance Cost	7-1
CHAPTER 8. PROJECT IMPLEMENTATION PLAN	8-1
8-1 Implementing Agency	8-1
8-2 Implementation Schedule	8-2
8-3 Operation and Maintenance Body	8-2
CHAPTER 9. PROJECT EVALUATION	9-1
9-1 Basic Concept	9-1
9-2 Financial Analysis	9-1
9-2-1 Financial Project Cost	9-1
9-2-2 Farm Budget Analysis	9-1
9-3 Economic Analysis	9-2
9-3-1 Methodology for Economic Analysis	9-2
9-3-2 Basic Assumptions	9-2
9-3-3 Economic Cost	9-3
9-3-4 Economic Benefits	9-4
9-3-5 Sensitivity Analysis	9-7
9-4 Socio-Economic Impact	9-7
9-4-1 Improvement of Local Transportation	9-8
9-4-2 Increased Employment Opportunities	9-8
9-4-3 Improvement of Rural Life	9-8

ABBREVIATION/CONVERSION TABLE/GLOSSARY

ABBREVIATIONS

BAEcon	Bureau of Agricultural Economics
BAPA	Bureau of Power Association
BAS	Bureau of Agricultural Statistics
BAEx	Bureau of Agricultural Extension
BAT	Bureau of Air Transportation
BCGS	Bureau of Coast and Geodetic Survey
BDT	Bureau of Domestic Trade
BFT	Bureau of Foreign Trade
BIR	Bureau of Internal Revenue
BL	Bureau of Lands
BMG	Bureau of Mines and Geo-Sciences
BOI	Board of Investment
BOP	Bureau of Posts
BOS	Bureau of Soils
BSMI	Bureau of Small and Medium Scale Industries
BUTEL	Bureau of Telecommunications
CB/CBP	Central Bank of the Philippines
DA	Department of Agriculture
DAR	Department of Agrarian Reform
DBM	Department of Budget and Management
DECS	Department of Education, Culture and Sports
DENR	Department of Environmental and Natural Resources
DFA	Department of Foreign Affairs
DLG	Department of Local Government
DOF	Department of Finance
DOH	Department of Health
DOLE	Department of Labor and Employment
DOTC	Department of Transportation and Communication
DPWH	Department of Public Works and Highways
DSWD	Department of Social Welfare and Development
DTI	Department of Trade and Industry
IBRD	International Bank for Reconstruction and Development
IRRI	International Rice Research Institute
IMF	International Monetary Fund
JICA	Japan International Cooperation Agency
JSPS	Japan Society for the Promotion of Science
LBP	Land Bank of the Philippines
LWUA	Local Water Utilities Administration
MWSS	Metropolitan Waterworks and Sewerage Systems
NACIAD	National Council on Integrated Area Development

NACIDA	National Cottage Industries Development Authority
NDC	National Development Corporation
NCSO	National Census and Statistics Office
NEA	National Electrification Administration
NEDA	National Economic and Development Authority
NEPC	National Environmental Protection Council
NFA	National Food Authority
NHA	National Housing Authority
NIA	National Irrigation Administration
NIST	National Institute of Science and Technology
NLUC	National Land Use Committee
NMYC	National Manpower and Youth Council
NNC	National Nutrition Council
NPC	National Power Corporation
NPCC	National Pollution Control Commission
NRCP	National Research Council of the Philippines
NWRB	National Water Resources Board
OEA	Office of Energy Affairs
OECF	Overseas Economic Cooperation Fund
PAGASA	Philippine Atmospheric, Geophysical and Astronomical Services Administration
PCA	Philippine Coconut Authority
PCARRD	Philippine Council for Agricultural Resources Research and Development
PCCI	Philippine Chamber of Commerce and Industry
PCIERD	Philippine Council for Industry and Energy Research Development
PCCG	Presidential Commission on Good Government
PCCR	Presidential Commission on Government Reorganization
PEO	Provincial Engineering Office
PNB	Philippine National Bank
PNOC	Philippine National Oil Corporation
PPA	Philippine Ports Authority
RDC	Regional Development Council
RWDC	Rural Waterworks Development Corporation
SSS	Social Security System
TBAC	Technical Board for Agricultural Credit
UN	United Nations
UNDP	United Nations Development Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations Children's Fund
UNIDO	United Nations Industrial Development Organization
UP	University of the Philippines

CONVERSION TABLE

LENGTH

mm : millimeter(s)
 cm : centimeter(s)
 m : meter(s)
 km : kilometer(s)
 inch : inch(s) = 2.54 cm
 mile : mile(s) = 1.6093 km

AREA

sq.mm : square millimeter(s)
 sq.cm : square centimeter(s)
 sq.m : square meter(s)
 sq.km : square kilometer(s)
 ha : hectare

WEIGHT

mm.gr: milli-gram(s)
 gr : gram(s)
 kg : kilo-gram(s)
 ton : ton(s)
 once : once(s) = 28.350 gr

CAPACITY

lit : liter(s)
 cu.m : cubic meter(s)
 gallon : gallon(s) = 3.785 lit.
 MCM : million cubic meter(s)
 cavan : cavan(s) = 50 kg of palay

DISCHARGE

lps : liter(s) per second
 cms : cubic meter(s) per second
 (or m³/sec, cu.m/sec)
 cusec: cubic foot per second
 lpd : liter(s) per day

VELOCITY

mm/sec : millimeter(s) per second
 cm/sec : centimeter(s) per second
 m/sec : meter(s) per second
 km/hr : kilometer(s) per hour
 knot : knot(s) = 1.86 km/hr

sec : second(s)
 min : minute(s)
 hr : hour(s)
 Max. or max. : maximum
 Min. or min. : minimum

% : percent(s)
 No. : number
 °C : degree(s) centigrade
 Hp : horse power
 W : watt(s)

KW : kilowatt(s)
 MW : megawatt(s)
 WH : watt(s) hour
 KWH : kilowatt(s) hour
 MWH : megawatt(s) hour

EL : elevation
 MSL : mean sea level
 FWL : full water level
 HWL : high water level
 LWL : low water level

ET	:	evapotranspiration
ETcrop	:	evapotranspiration of crop
N	:	nitrogen
P	:	Phosphorus
K	:	Potassium
LV	:	local variety
LIV	:	local improved variety
HYV	:	high yielding variety
O & M	:	operation and maintenance cost
EIRR	:	economic internal rate of return
MT	:	metric ton(s)
B/C	:	benefit cost ratio
FY	:	Fiscal year (1st of January to 31st of December)
peso	:	peso(s) - US\$ 0.04587 (as of June, 1989)
\$:	dollar(s) 21.80 pesos(as of June, 1989)

GLOSSARY

Study Area	:	Area of 805 sq.km covered by the Master Plan of the Integrated Agricultural Development Project in Marinduque province
province	:	A political subdivision of a country comprising municipalities
Barangay	:	A political subdivision of province comprising Barangays
Poblacion	:	A political subdivision of a municipality comprising villages
Monsoon	:	A political center of a town
Trade wind	:	Predict wind that blows from the sea to the continent and oppositely in Winter
Tropical cyclone	:	One of three Philippines air currents, comprising from a generally easternly direction reaching the island during the period from February to April
	:	PAGASA classifies the tropical cyclone by the wind speed in center as follows:
	:	- Tropical depression; up to 17.1 m/sec (33 knot)
	:	- Tropical storm ; 17.2 (34 knot) to 32.6 m/sec (63 knot)
	:	- Typhoon ; over 32.7 m/sec (64 knot)
IR	:	High yielding variety of rice which bears varieties from IRRI
Cogon	:	A coarse grass which usually covers idle lands or abandoned clearing (<i>Imperata cylindrica</i>)
Ganta	:	A common unit of volume for rice equivalent to 2.24 kg of milled rice
Nipa	:	Heave-leafed type of palm used in hatching huts
Share tenancy	:	A practice where operators rent the land they work and pay as rent a share of the cash or crops grown
Carabao	:	The animal that most farmers used for plowing and other farming works. It is about the size of an ox and its similar to the water buffalo in other countries.
Fiesta	:	Spanish term for feast, celebrated pompously once a year to honor the patron saint.
Kaingin	:	Deforestation by shifting cultivation with slashing and burning forest/brush
Survival	:	The number who graduate/the number who enroll

CHAPTER 1. INTRODUCTION

CHAPTER 1 INTRODUCTION

1-1 Background

Since the Marinduque province has many constraint such as limited land resources, poor farming technique and farming tools, shortage of budget, etc., Marinduque is placed on the poor socio-economic conditions of the highest rate of unemployment labor in the region and the largest number of families under the poverty line. The Island is meteorologically favored for farming except typhoons, however such favorable conditions have not been utilized by farmers due to lack of facilities and countermeasures. There are many small farmers which have a little budget for farming. The Master Plan spot-lights them to increase their family income through the agricultural development. To solve the existing problems and improve such present socio-economic conditions, the Integrated Agricultural Development Plan, which contains various ideas, would be necessary to avoid the duplicate investment for the various projects.

In line with the Medium-Term Philippines Development Plan 1987-1992 and the Medium-Term Southern Tagalog Region Development Plan 1987-1992, the targets of the Master Plan for the Integrated Agricultural Development Project in Marinduque are set up (1) to attain the food self-sufficient within the Province, (2) to increase farmers' income, (3) to create/increase agro-based employment opportunities and (4) to improve social welfare. The final target of the Master Plan is to reduce the gap between the rural areas and the urban areas in the Philippines.

The target year is 2010 and development period is 20 years. The development plans proposed in the Master Plan will be divided into three stages for smooth implementation; namely, the short-term, the second-term and the long-term developments. The short-term development, aiming relatively small amount of investment and quick return would be proposed within five years by the year 1995. The medium-term development would be planned for acceleration of the development for ten

years by the year 2000, while the long-term development would be proposed by the year 2010.

The development targets are presented as follows:

- (1) Self attainment of food self-sufficient within Marinduque, especially rice and vegetables.
- (2) The population, numbers of household and farm household will reach 303,500, 56,700 and 28,800 at the target year 2010, respectively.
- (3) The Land Reform will be promoted to accomplish their target.
- (4) The employment opportunity will increase in accordance with the agricultural development in Marinduque.
- (5) The economic development target will be to level-up income level of rural families.

1-2 Priority Projects

Since the agricultural development would be proposed to early realize with comparatively small investment, the seven priority development areas are selected. Taking into consideration soil, topographic conditions, water resources, population density, the present situations of agricultural/rural infrastructures such as irrigation, roads, water supply, electrification, etc., the following areas are selected as priority development areas in Marinduque.

	<u>Name of Area</u>	<u>Municipality</u>	<u>Acreage</u>
(1)	Bagtington area	Buenavista	7.4 sq.km
(2)	Gasán area	Gasán	9.2 "
(3)	Boac area	Boac	16.4 "
(4)	Mogpog area	Mogpog	8.4 "
(5)	Sta. Cruz area	Sta. Cruz	5.2 "
(6)	Tagum-Angas area	Sta. Cruz	14.7 "
(7)	Matuyatuya area	Torrijos	6.7 "
	<u>Total</u>		<u>68.0 sq.km</u>

Among them the Tagum-Angas area having the highest potentiality of the development and the highest needs to be improved is chosen as the most immediately implementation project area. The Tagum-Angas area will play very important role not only as a core of the agricultural development in Marinduque but also as a pilot area of the agricultural development in the other remote small islands in the Philippines.

1-3 Present Condition of MADPP Area

1-3-1 Population, Household and Labor Force

Administratively, the Project Area comes under Municipality of Santa Cruz and covers nine Barangays, i.e. Angas, Matalaba, Morales, Napo, Pantayin, Tagum, Tamayo, Tawiran and Taytay. Total population of these Barangays which are partly covered by the Project Area, is estimated at 9,478 in 1989 based on the assumption of annual growth rate of 1.9% during 1980 and 1989. Population of the Project Area is estimated from the proportion of the area covered by each Barangay which is included in the Project Area. The total population in the Project Area is thus estimated at 3,693 which corresponds to 39% of the total population of the nine Barangays. (refer to Table 1-3-1)

Total household is estimated on the basis of average family size of each Barangay enumerated by the Municipality office of Santa Cruz. Total number of household in the Project Area is estimated at 633, of which 554 or about 87% are considered to be farm household. (refer to Table 1-3-1)

Average population density per sq.km in the Project Area is estimated as 251 in 1989. Among nine Barangays in the Project Area, population density is highest in Pantayin (3.86 persons per ha) and lowest in Morales (1.46 persons per ha). (refer to Table 1-3-2)

Based on the Socio-Economic Profile (1968) prepared by the Municipality of Santa Cruz, about 61% of the total population are considered as labor force, i.e. economically active population. Out of 2,252 labor force in the Project Area, about 2,116 are employed and the remaining unemployed. The said Socio-economic Profile indicates that about 59% of the employed are engaged in agricultural activities in the Project Area. (refer to Table 1-3-3)

1-3-2 Topography, Soils and Land Use

The MABPP area is located in the Municipality of Santa Cruz, and about 25 kilometers east of the capital town on Boac. The Project Area is bounded on the north by Tagum river, on the west by Tawiran river, on the south by Taytay creek and on the east by the Mompog Pass. The gross area is 1,470 ha.

Topography of the Tagum-Angas river basin has a rugged terrain with long swift flowing rivers. Due to the hilly and mountainous relief of the area, external drainage is fair to good except in some lowland areas where it is poor. Hilly land is poorly cultivated although most portions still remain idle. The lowlying area is primarily reclaimed as rainfed paddy field.

The soil is mainly derived from igneous, sedimentary and metamorphic rocks from alluvium. The lowland area consists of sand silt and clay originating from the surrounding elevated areas.

The Project Area has four distinct types of vegetations, namely: forest, grassland, cultivated crops, mangroves and swamps. The grassland area is fairly large and is found mostly in the undulating area. (refer to Table 1-3-4)

1-3-3 Farm Size and Land Tenure

Based on the statistical data of the Municipality of Santa Cruz, it is estimated that 554 farm households in the Project Area are holding

1,072 ha of agricultural land comprising 501 ha of rice land, 297 ha of coconut land, 171 ha of upland and 103 ha of grass land. Average land holding is about 1.90 ha per farm household comprising 0.90 ha of rice land, 0.53 ha of coconut land and 0.31 ha of upland and others. (refer to Table 1-3-5). Farm size of the Project Area is less than the average of the province which is estimated to be more than 2 ha.

A land tenure survey carried out by the Study Team in August 1989 showed that out of 1,541 households in the nine Barangays, 57% are land owners (full and partial owners) and 43% are tenants. (refer to Table 1-3-6). It is estimated that percentage of full and partial land owners in the Project Area is estimated to be almost the same as the above figure.

1-3-4 Cropping Pattern and Crop Production

1) Cropping Pattern

The rainfed paddy fields are prevailing in the Project Area, where paddy rice is cropped fully in the wet season and only a few areas are occupied by paddy rice in the dry season. Upland rice is grown in the upland fields which are developed in the terrace land.

Only such crops of corn, mungobean, peanut, sweet potato, cassava, etc, which are comparatively resistant crops to dryness are cropped in the Area. In the wet season, the cropped areas of these crops are estimated at about 70% of the total upland field area which exclude the area where upland rice is grown. In the dry season, the upland crops cover about 50% of upland field area and about 20% of paddy field. The other areas than the planted areas with the above crops are left as follow land. (refer to Figure 1-3-1)

2) Crops Production

The land productivity is quite low in the Project Area, depending upon the rainfall distribution under the full coverage of rainfed land.

The average yields of major crops in the Area are less than those in the Marinduque Province according to the Farm Economic Survey as shown below.

Yield of Major Crops

<u>Crop</u>	<u>Marinduque</u> <u>Province</u> (ton/ha)	<u>Project Area</u> (ton/ha)
Paddy Rice	1.6	0.8
Upland Rice	0.7	0.7
Corn	0.7	0.6
Mungobean	0.7	0.6
Sweet Potato	7.1	2.0

Source: DA and Farm Economic Survey

The yield data show a large variation among years and also among farmers. It is observed that the varied yields are caused considerably by the non-availability of moisture although the low level of the cultivation technology also affect it. Eventually, the higher land-productivity is observed in the paddy fields where plenty of water is naturally available and in the upland fields which have thick top soils with sufficient water holding capacity. This means that the land productivity could be raised easily if irrigation systems are introduced. Then, the application of the modernized farming technology is needed to level up the productivity further more.

1-3-5 Livestock

Comparatively large number of livestock are raised in the Project Area to compare with the livestock population in the other areas, although the reliable data on the livestock population are not available in the Project Area. It is estimated that one or two carabao(s) or cattle per farm are raised by about 60% of farm households, based on the farm economic survey.

And about 70% of farm households hold two to three heads of hogs and goats. About 10 to 20 head of chicken inclusive of chicks are held by almost all farm households.

1-3-6 Marketing of Farm Products

Main marketing farm product in the Project Area is coconut. Most of coconuts collected from coconut trees by the farmers are converted to copra and sold to copra buyers in Santa Cruz. Copra buyers ship the collected copra to the copra processing mills in Lucena City. Due to heavy damage caused by two typhoons in 1987, production of coconuts in Marinduque including the Project Area showed sharp decline in 1988. Although definite data are not available, it is estimated that coconut production in the Project Area was less than 100 tons in 1988 and it will take years to recover normal production.

Due to limited land resources and unavailability of irrigation water, crop productivity in the Project Area is relatively lower than other areas. Therefore, there are very few surplus of crop production to be marketed in the Project Area.

Aquaculture is one of the main income source in the Project Area. Bangus is main product and some shrimps (sugpo) are also produced. It is estimated that there exist about 500 ha of fish ponds in Marinduque, producing about 400 tons of Bangus and 1.2 tons of Sugpo. Although no definite data are available on the production of fish ponds in the Project Area, it is estimated that about 40% of total production in Marinduque are produced in and around the Project Area. Some of these products are marketed through private traders in Santa Cruz.

1-3-7 Farm Incomes and Expenditures

From the viewpoint of farmers in the Project Area, farm budget analysis has been undertaken for three typical farms, i.e. 1.0 ha rice farm (type 1), 1.0 ha rice and 1.0 ha coconut farm (type 2) and 1.0 ha

rice and 0.2 ha vegetables farm (type 3). Type 1 represents a change from rainfed rice farm to irrigated rice farm. Type 2 represents a change from a combination of coconut and rice farm to a combination of coconut, rice and intercropping farm. Type 3 represents a change from rainfed rice farm to irrigated rice and vegetables farm.

Calculation of both income and expenditures is based on the estimated input and output applied under present, "with the project" and "without the project" situations. Farm incomes may include crops, livestock, aquaculture and other job opportunities. However, for the purpose of comparison, crop income and expenditures are primarily considered in this section. Farm expenditures are based on the production cost of each crop. (refer to Tables 1-3-7 to 1-3-9)

Basic assumptions underlying the estimates of farm incomes and expenditures are as follows.

- Prices: Crops production and inputs are valued using financial prices as given in Tables 1-3-10 to 1-3-12.
- Family and hired labor: Based on the average family size of 5.8 and the labor force participation rate of 61% in the Project Area, the average number of family farm workers has been estimated at 3.5. Hired labor is assumed to be about 30% of the total labor requirement.
- Non-farm incomes: Agro-economic survey carried out by JICA Study Team in August 1989 indicates that most sample farmers are obtaining non-farm incomes with the average amount of 4,300 pesos at Barangay Tamayo. It is assumed that non-farm incomes would remain unchanged in the future.

Net farm incomes for type 1 will increase from present level of 9,760 pesos to 21,712 pesos in the future, with 222% increase. Net farm incomes for type 2 will increase from present level of 17,142 pesos to 32,467 pesos in the future, with 189% increase. Likewise, net farm incomes for type 3 will increase from present level of 16,241 pesos to 43,482 pesos in the future, with 268% increase. (refer to Tables 1-3-7 to 1-3-9). It is apparent from these figures that inclusion of vegetables cultivation would give higher level of incomes for the farmers.

1-3-8 Farmer's Organization

Farmer's Associations are organized in the six Barangays of Matalaha, Pantayin,, Tamayo, Morales, Tajum and Taytay for transmission of information/technology on farming and fishery by themselves under the guidance of DA. Although the Samahang Nayons (SNs) organized in seven Barangays of Tawiran, Matalaba, Taytay, Napo, Bagong, Sikat (Morales), Tagum and Tamayo, their activity is almost weak. Since one of the major factor of their weak activities would be the shortage of suitable persons in charge of managing the SN, the training of persons is vitally required. In the Medium-Term Philippine Development Plan (1987-1992), the establishment of PMAKB is included as one of the major components. This scheme promotes the merging and acquisition of existing Samahang Nayons. It is expected to strengthen the farmer's organization of SN for various activities like collective marketing of agricultural products, group procurement of farm inputs, group procurement, use of farm machinery, soils and land improvement.

1-3-9 Brackishwater Aquaculture

The Brackishwater Fish Culture Demonstration Farm (BFCDF) under DA exist in Tamayo, Sta. Cruz in the Project Area is operating as a core of shrimp culture in Marinduque for development shrimp culture technology. The farm has 4.7 ha culture ponds with office, dormitory and seminar hall for training local technicians.

However, due to lack of budget for the operation and improvement of the facilities including laboratory equipments and facilities, the expansion isn't achieving its purpose. Three biologists are working as staff of the farm. The laboratory has only a thermometer, PH meter and saline meter. The training course for local technicians has not started yet. The banks of the ponds are not constructed properly, therefore, it is difficult to transport materials for fish and shrimp culture along the ponds. Also many parts of the bank are collapsed due to the recent typhoons that hit the Marinduque island.

The last experimental shrimp culture carried out by the farm was resulted in the increase of production of shrimp which reached 1.2 MT/ha/crop for 120 days of breeding. This production level, however, is still lower than the production compared with other provinces used the semi-intensive method.

Table 1-3-1 Population and Household of the Project Area (1989)

Name of Barangay	Administrative Area			Project Area		
	Popula- tion	Total Household	Farm Household	Popula- tion	Total Household	Farm Household
Angas	1,021	185	162	429	78	68
Matalaba	1,021	162	142	388	62	54
Morales	605	99	87	73	12	11
Napo	1,763	296	259	688	115	101
Pantayin	654	108	94	347	57	50
Tagum	1,117	194	170	491	85	74
Tamayo	854	148	129	461	80	70
Tawiran	1,114	198	173	457	81	71
Taytay	1,329	233	204	359	63	55
<u>Total</u>	<u>9,478</u>	<u>1,623</u>	<u>1,420</u>	<u>3,693</u>	<u>633</u>	<u>554</u>

- Notes : (1) Population is assumed to grow at an annual rate of 1.9% between 1980 and 1989.
 (2) Population is assumed to be proportional to the physical area.

Source: (1) Socio-economic Profile, 1988, Municipality of Santa Cruz.
 (2) Estimate of the Study Team.

Table 1-3-2 Population Density of the Project Area

Name of Barangay	Population in 1989	Gross Area (ha)	Density (Persons/ha)
Angas	429	130	3.30
Matalaba	388	200	1.94
Morales	73	50	1.46
Napo	688	280	2.46
Pantayin	347	90	3.86
Tagum	491	180	2.73
Tamayo	461	200	2.31
Tawiran	457	160	2.86
Taytay	359	180	1.99
<u>Total</u>	<u>3,693</u>	<u>1,470</u>	<u>2.51</u>

Source: (1) Socio-economic Profile, 1988, Municipality of Santa Cruz.
 (2) Estimate of the Study Team.

Table 1-3-3 Labor Force of the Project Area, 1989

Name of Barangay	Population (1989)	Economically Active (Labor Force) (1)		Economically Inactive (2)	Working Age Population (1) + (2)
		Employed	Unemployed		
Angas	429	162	18	115	295
Matalaba	388	146	16	103	265
Morales	73	28	3	20	51
Napo	688	259	28	184	471
Pantayin	347	131	14	93	238
Tagum	491	185	20	131	336
Tamayo	461	174	19	123	316
Tawiran	457	172	19	122	313
Taytay	359	135	15	96	246
<u>Total</u>	<u>3,693</u>	<u>2,116</u>	<u>136</u>	<u>277</u>	<u>2,529</u>

Note : (1) Persons of 11 years old and over are assumed to be working age population.

Source: (1) Socio-economic Profile, 1988, Municipality of Santa Cruz.

(2) Estimate of the Study Team.

Table 1-3-4 Present Land Use

<u>I t e m</u>	<u>Area (ha)</u>
Paddy field	501
Coconut	297
Diversified crop field	171
Grass land	103
Forest	5
Others (road, river residential area)	393
<u>Total</u>	<u>1,470</u>

Table 1-3-5 Farm Size in the Project Area

unit: ha

Barangay	Rice Land	Coconut Land	Upland	Grass Land	Total (ha)	Farm H.H.	Farm Size
Angas	69	38	14	6	127	68	1.87
Matalaba	16	34	34	17	101	54	1.87
Morales	7	10	12	5	34	11	3.09
Napo	121	61	11	6	199	101	1.97
Pantayin	27	33	11	10	81	50	1.62
Tagun	86	14	30	24	154	74	2.08
Tamayo	83	9	44	24	160	70	2.29
Tawiran	55	56	6	8	125	71	1.76
Taytay	37	42	9	6	91	55	1.65
<u>Total</u>	<u>501</u>	<u>297</u>	<u>171</u>	<u>103</u>	<u>1,072</u>	<u>554</u>	<u>1.93</u>

Note : Farm Size of Rice Land, 0.90 ha; Coconut Land, 0.54ha; Upland, 0.31 ha; and Grass Land, 0.19 ha, per farm household.

Source: (1) Real Property Tax Administration Statistical Data, Santa Cruz.
(2) Estimate of the Study Team.

Table 1-3-6 Land Tenure in the Project Area
(Information from each Barangay Captain)

Name of Barangay	Household Surveyed	Landowner			Tenants
		Full	Partial	Total	
Angas	150	60	-	60	90
Buyabod 1/	120	40	-	40	80
Matalaba	184	100	19	119	65
Morales	169	70	24	94	75
Napo	280	200	30	230	50
Pantayin	108	40	-	40	68
Tagum	260	70	40	110	150
Tamayo	100	60	12	72	28
Tawiran	170	100	14	114	56
<u>Total</u>	<u>1,541</u>	<u>740</u>	<u>139</u>	<u>879</u>	<u>662</u>

Note : 1/ Buyabod is actually not included in the project area. However, it was not clear at the time of the survey whether a portion of Buyabod would be included in the project area or not.

Source: A Land Tenure Survey conducted by the Study Team, August 1989.

Table 1-3-7 Farm Financial Budgets
(1.0 ha rice farm)

unit: Pesos

	Present Condition (Rainfed)	Future without Project	Future with Project
1. <u>Gross Income</u>	<u>12,140</u>	<u>12,630</u>	<u>28,800</u>
Farm income			
Paddy, wet season	5,600	5,950	14,000
Paddy, dry season	2,240	2,380	10,500
Other income	4,300	4,300	4,300
2. <u>Expenditures</u>	<u>2,380</u>	<u>2,380</u>	<u>7,088</u>
Farming expenditures			
Paddy, wet season	1,700	1,700	4,050
Paddy, dry season	680	680	3,038
3. <u>Net Income</u>	<u>9,760</u>	<u>10,250</u>	<u>21,712</u>

Note: Other income includes non-farm/off-farm income such as wages, trade profits, remittance from relatives, etc.

Table 1-3-8 Farm Financial Budgets
(1.0 ha coconut and 1.0 ha paddy farm)

unit: Pesos

	Present Condition (Rainfed)	Future without Project	Future with Project
1. <u>Gross Income</u>	<u>21,784</u>	<u>21,891</u>	<u>43,185</u>
Farm income			
Paddy, wet season	5,600	5,950	14,000
Paddy, dry season	2,240	2,380	10,500
Copra making (1 ha)	4,455	3,600	4,950
Pulse crops ^{1/}	5,189	5,661	9,435
Other income ^{2/}	4,300	4,300	4,300
2. <u>Expenditures</u>	<u>4,642</u>	<u>4,642</u>	<u>10,718</u>
Farming expenditures			
Paddy, wet season	1,700	1,700	4,050
Paddy, dry season	680	680	3,038
Copra making (1 ha)	660	660	660
Pulse crops	1,602	1,602	2,970
3. <u>Net Income</u>	<u>17,142</u>	<u>17,249</u>	<u>32,467</u>

Notes: ^{1/} intercropping with cropping ratio of 75%.

^{2/} Other income includes non-farm/off-farm income such as wages, trade profits, remittance from relatives, etc.

Table 1-3-9 Farm Financial Budgets
(1.0 ha rice and 0.2 ha vegetables farm)

unit: Pesos

	Present Condition (Rainfed)	Future without Project	Future with Project
1. <u>Gross Income</u>	<u>19,261</u>	<u>21,878</u>	<u>51,920</u>
Farm income			
Paddy, wet season	5,600	5,950	14,000
Paddy, dry season	2,240	2,380	10,500
Vegetables (e.g. Tomato)	7,121	9,248	23,120
Other income	4,300	4,300	4,300
2. <u>Expenditures</u>	<u>3,020</u>	<u>3,020</u>	<u>8,438</u>
Farming expenditures			
Paddy, wet season	1,700	1,700	4,050
Paddy, dry season	680	680	3,038
Vegetables (e.g. Tomato)	640	640	1,350
3. <u>Net Income</u>	<u>16,241</u>	<u>18,858</u>	<u>43,482</u>

Note: Other income includes non-farm/off-farm income such as wages, trade profits, remittance from relatives, etc.

Table 1-3-10 Production Cost for Paddy, Upland and Corn
(Financial Prices)

unit: Pesos

	Paddy upland		Corn	
	Future without Project Quantity	Future with Project Amount	Future without Project Quantity	Future with Project Amount
Seeds (kg)	100	350	22	440
Fertilizers				
14-14-14 (bag)	1	325	-	-
46-0-0 (bag)	-	-	1	275
Chemical				
Insecticide (liter)	-	-	0.8	160
Human labors (man day)	14	350	15	375
Animal with operator	10	500	12	600
Base Cost for Production:		1,425		1,690
				3,225

Table 1-3-11 Production Cost for Root Crops and Coconut
(Financial Prices)

unit: Pesos

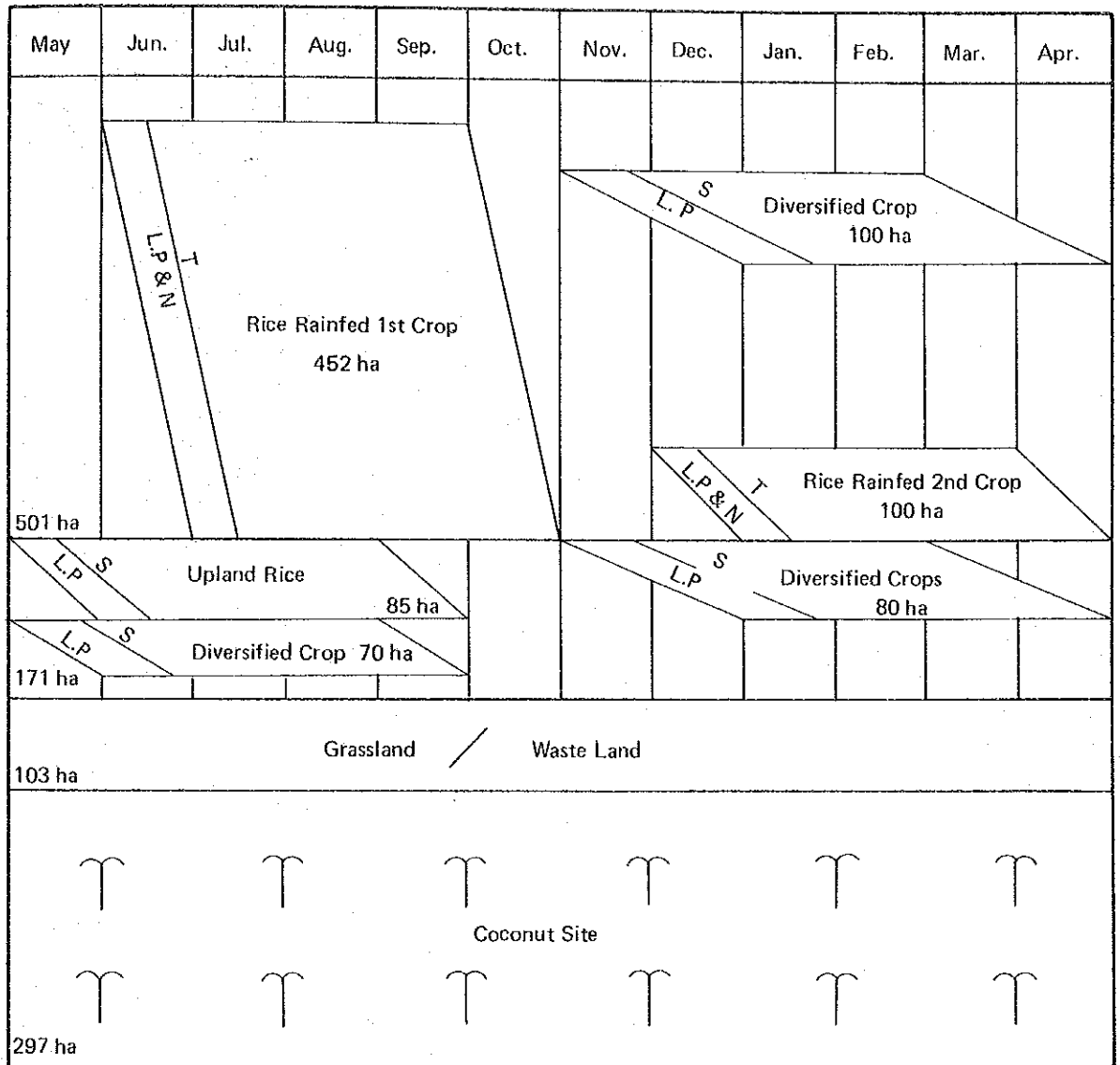
	Root Crops				Coconut			
	Future without Project Quantity	Future without Project Amount	Future with Project Quantity	Future with Project Amount	Future without Project Quantity	Future without Project Amount	Future with Project Quantity	Future with Project Amount
Seeds (kg)	-	-	-	-	-	-	-	-
Fertilizers								
14-14-14 (bag)	1	275	4	1,300	-	-	-	-
46-0-0 (bag)	-	-	-	-	-	-	-	-
0-0-60 (bag)	-	-	1.5	413	-	-	-	-
Chemical								
Insecticide (liter)	-	-	-	-	-	-	-	-
Human labors (man day)	8	200	17	425	22	550	22	550
Animal with operator	-	-	-	-	-	-	-	-
Others (miscellaneous)	-	-	-	-	-	110	-	110
Base Cost for Production:		475		2,138		660		660


Table 1-3-12 Production Cost for Vegetables and Pulse Crops
(Financial Prices)

unit: Pesos

	Vegetables		Pulse Crops	
	Future without Project Quantity	Future with Project Quantity	Future without Project Quantity	Future with Project Quantity
Seeds (kg)	0.5	0.5	22	20
Fertilizers				
14-14-14 (bag)	-	3	-	1
46-0-0 (bag)	1	2	1	2
Chemical				
Insecticide (liter)	-	2	-	2
Human labors (man day)	23	95	15	27
Animal with operator	12	14	12	14
			Amount	Amount
	1,750	1,750	352	320
	-	975	-	325
	275	550	275	550
	-	400	-	400
	575	2,375	375	675
	600	700	600	700
Base Cost for Production:	3,200	6,750	1,602	2,970

FIGURE 1--3--1 PRESENT CROPPING PATTERN



- Remarks:
-  Coconut Site
 - L. P Land Preparation
 - N Nursery
 - S Sowing
 - T Transplantation

CHAPTER 2. PROJECT COMPONENTS OF MADPP

CHAPTER 2 PROJECT COMPONENTS OF MADPP

2-1 Agricultural Development

1) Strengthening of Marinduque Agricultural Development and Promotion Farm (MADPF)

- Area: Demonstration farm with irrigation facility : 4.5 ha
- Demonstration farm without irrigation facility : 0.5 ha
- Building, road and others : 1.5 ha

Total : 6.5 ha

- Office, research room, lecture room, warehouse, working house, isolation chamber, animal shed and others with a total floor area of 1,890 sq.m.
- Experimental and training equipment
- Pest/disease observatory
- Weather observation equipment
- Farm machines and motor vehicles for all activities
- Others

2) Rehabilitation of Marinduque Breeding Station

- Office, warehouse, motor pool, pig pen and others with a total floor area of 840 sq.m.
- Animal shed for carabaos, cows, swine, goats, chickens and horses with a total floor area of 660 sq.m.
- Water supply system with deepwell
- Research and experimental equipment
- Farm equipment for pasture grass field
- Vehicles for all activities
- Others

3) DA Municipal Nurseries

- Nursery field with irrigation facility : 5,000 sq.m
- Deepwell : 1 unit
- Working house/shed : 100 sq.m
- Vehicles, equipment and others

4) Irrigated Paddy Cultivation Demonstration Farm

- Paddy field with irrigation facility : 10 ha
- Warehouse : 100 sq.m
- Farming machines, equipment and tools

- 5) Rainfed Paddy/Diversified Crops Cultivation Demonstration Farm
 - Rainfed paddy field : 2 ha
 - Warehouse : 100 sq.m
 - Farming machines, equipment and tools
- 6) Post-harvest Facilities for Rice
 - Warehouse (100 sq.m) and dry pavement (500 sq.m)
 - 1 unit of rice mill
- 7) Post-harvest Facilities for Corn
 - Warehouse (50 sq.m) and dry pavement (500 sq.m)
 - 1 unit of power corn thresher
- 8) Multi-purpose Agricultural Cooperatives (MPAC)
 - Assistance to beneficiary farmer's organization for O & M
 - One main center and eight sub-centers

2-2 Agricultural Infrastructure Development

1) Irrigation Development

- Tagum-Angas reservoir dam (Rockfill type)
 - Dam height H = 31.6 m
 - Reservoir capacity V = 2.865 MCM
- Irrigation canal
 - Main conduit L = 3.1 km
 - Main irrigation canal L = 8.8 km
 - Lateral canal L = 13.0 km
- On-farm facility A = 630 ha
- Drainage canal L = 18.9 km

2) Rural Road Development

- Rehabilitation of farm-to-market road
 - Type B L = 5.5 km
 - Type C L = 4.5 km
- Construction of farm road L = 15 km
- Construction of multi-purpose pavement : 20 pls

3) Village Water supply Development

- Ground type reservoir, V = 300 cu.m : 1 unit
- Main pipeline (G.I pipe) L = 6 km
- Distribution pipeline (G.I pipe) $\phi 6''$ L = 5 km
- $\phi 4''$ L = 6 km
- $\phi 2''$ L = 8 km
- Communal faucets : 70 pls

2-3 Rural Infrastructure Development

1) Rural Electrification Development

- Transmission line (69 KV) L = 8 km
- Distribution line (1 ϕ) L = 3 km
- Secondary line (Open secondary) L = 1.5 km

2) Traffic System Development

- Construction of waiting shed: 17 pls

3) Education Development

- Rehabilitation of elementary school: 9 classes
- Construction of school toilet: 2 pls

2-4 Aquaculture Development

1) Improvement of Brackishwater Fish Culture Demonstration Farm

- Reconstruction and expansion of fish pond A = 10 ha
- Construction of inner road L = 450 m
- Axial flow pump, generator, equipment and others

2) Construction of Shrimp Hatchery Plant

- Hatchery building A = 360 sq.m
- Hatchery tank (various size) N = 62 pcs
- Water supply facility for sea water and fresh water
- Airation system, generator and laboratory equipment
- Others

3) Pilot Processing Plant and Ice Plant

- Plant building A = 300 sq.m
- Shrimp/fish processing line : 1 line
- Horizontal plate freezer : 1 unit
- Ice making machine (10 t/d), ice store and cold store
- Others

CHAPTER 3. AGRICULTURAL DEVELOPMENT

CHAPTER 3 AGRICULTURAL DEVELOPMENT

3-1 Basic Concept of Agricultural Development

The proposed agricultural development plan consists of the following three components, namely i) development of crop production and animal husbandry, ii) institutional development of farmers' organization and agricultural supporting services and iii) development of irrigated agriculture.

The development plan of crop production and animal husbandry will be made mainly through development of adaptable production technology to the Project Area for paddy rice, upland crops of vegetables, fruits and industrial crops, and also for livestock and poultry. The institutional development includes the strengthening of agricultural supporting services on farm credit, farm inputs supply, agricultural extension, post-harvest, agro-processing and storage, marketing. The promotion in consolidation of farmers' organization is also emphasized in response to the said strengthening of agricultural supporting services. (refer to Tables 3-1-1 to 3-1-3)

3-2 Agricultural Development Plan

Successful realization of the Marinduque Agricultural Development and Promotion Project (MADPP) essentially requires to carry out the following five programs in parallel with each other.

3-2-1 Strengthening of Marinduque Agricultural Development and Promotion Farm (MADPF)

In Tagum and Angas area, the researches and experiments of new techniques for production increase for cropping of paddy and upland crops shall be carried out to be established for both the irrigated lands and rainfed lands, and the newly developed techniques shall be diffused thoroughly to the local extension workers and farmers on the practical field training.

The farms shall be established in the MADPF. The major works made through the researches and experiments are preparation of technical guidelines for crop farming, establishment of criteria on water management, etc.

For successful training, administration office, lecture rooms, laboratory are inevitably required, and audio-visual instruments and experimental/laboratory equipment are also required at reasonable extent for effective training. Tractors will be necessary for practising efficiently such works as deep plowing, ridging, etc. as well as for faming works for demonstration farm and for farmers' training. (refer to Table 3-2-1 and Figure 3-2-1)

3-2-2 Rehabilitation of Marinduque Livestock Breeding Station

Encouragement of artificial insemination and improvement of experimental pasture grasses are quite essential for increase of large size animals for their superior species in Tagum-Angas.

The necessary facilities shall be provided in addition to the existing facilities in the Marinduque Livestock Breeding Station, in Barangay Napo, and new pig-pens and warehouses shall be constructed together with improvement of the administration office. Livestock breeding shall be made for dispersal. (refer to Table 3-2-2)

3-2-3 DA Municipal Nurseries

In Tagum-Angas area, intercropping shall be introduced in the coconut plantation except irrigated land and such works will require a great number of healthy seedlings in quick and fair distribution. Consequently, DA Municipal Nurseries shall be provided for fruit-trees and industrial crops with recommended varieties. The nurseries shall be provided in Barangay Tamayo. (refer to Table 3-2-3)

3-2-4 Irrigated Paddy Cultivation Demonstration Farm

The demonstration farm shall be established to show an improved irrigation paddy cropping technology and to introduce a package of new farming techniques for paddy production increase of irrigated fields available by 540 ha in the Project Area.

The demonstration farm shall be located in the irrigated area in Barangay Taytay with acreage about 10 ha. The major facilities and equipment proposed are on-farm irrigation facilities, power-tillers, other farming equipment and implement drying yard, warehouses, etc. (refer to Table 3-2-4)

3-2-5 Rainfed Paddy/Diversified Crops Cultivation Demonstration Farm

A demonstration farm shall be provided to show improved rainfed paddy cultivation techniques for increasing production in the rainfed fields of about 57 ha available in the Project Area together with increase in production of diversified crops.

The demonstration farm shall be constructed in Barangay Napo with a scale of 2.0 ha. Major facilities/equipment required are power-tillers, various farming tools, drying yard, warehouses, etc. (refer to Table 3-2-5)

3-3 Post-harvest

3-3-1 Post-harvest Facilities for Rice

Paddy produced in the Barangays around Tawiran shall be milled with modern type of miller so as to prevent poor quality and loss in milled rice together with effective and efficient milling works.

The proposed milling plant shall be constructed in Barangay Tawiran. (refer to Table 3-3-1)

3-3-2 Post-harvest Facilities for Corn

In only one upland cropping area existing in the Marinduque, about 200 tons of corn have been harvested annually from about 20 ha of the fields.

The proposed equipment for corn post-harvest shall be established in Tawiran for effective and efficient works. (refer to Table 3-3-2)

3-4 Farmer's Organization

3-4-1 Basic Concept for Development

The farm income increase will require inevitably to do such collective works as purchase of agri-inputs, marketing services, purchase of farm machinery commonly used, crediting for farming activities, etc. For the purpose, the necessary funds shall be raised from the farmers giving consent to the purpose for making a farmer's organization.

In this case, the existing Samahang Nayons shall be merged to be one larger organization in the area, the center of which shall be a place for the headquarters and every village shall have its branch.

The organization shall provide the crop-wise study groups and try to introduce the new techniques of the said crops so as to establish the local production blocks of the specific crops. On the other hand, the grounding works of the local agriculture shall be promoted with the financial assistance by bankers.

3-4-2 Development Plan

Practically, Tawiran shall have the headquarters of the multi-purpose agricultural cooperatives (MPAC), while every village has the branch. The administrative offices, warehouses for material, etc. will be necessary. And trucks, motor cycles, balancings etc. will be required for successful services. (refer to Table 3-4-1)

3-5 Demand and Supply of Rice

Most parts of the Project area would be facilitated by gravity irrigation system mentioned in section 4-1 of Appendix II. After completion of facilities such as irrigation and drainage, farm-to-market roads, etc., under good activities of extension services to the farmers, and with good marketing system of farm inputs and outputs, rice production in the future will be increased. At the target year, supply of palay will be four times as compared to the present one, or 869 tons at present to 4,025 tons at the target year.

On the other hand, the population in the target year will also increase from 9,478 to 14,073. The consumption of rice will be decreased from 103 at present to 94 kg/year/person due to enough supply of various foods including meat, fish and vegetables. Consumption of palay will be increased from 1,638 tons at present to 2,139 tons in the target year.

Consequently, the self-sufficiency rate of palay would be from 53% at present to 188% at the target year. In case of "without project", the rate will be decreased to 40% only. (refer to Table 3-5-1 for details)

3-6 Labor Requirement

There are various agricultural development projects in the project area, such as irrigation development, Marinduque Agricultural Development and Promotion Farm, Marinduque Breeding Station, DA Municipal Nursery, Post-Harvest Facility for Rice, Post-Harvest Facility for Corn and Multi-Purpose Agricultural Cooperative. Those facilities will need some amount of labor employed for good activities. All necessary ;abpr except O & M labor for agricultural infrastructural development is estimated from 365 men at present to 2,663 men at the target year. (refer to Table 3-6-1 and Figure 3-6-1)

Table 3-1-1 Crop Production of Irrigation Area

	Present					Proposed				
	Area (ha)	Cropping Rate (%)	Cropping Area (ha)	Yield (t/ha)	Production (ton)	Area (ha)	Cropping Rate (%)	Cropping Area (ha)	Yield (t/ha)	Production (ton)
Coconut	<u>120</u>	100	120	1.0	120	<u>120</u>	100	120	1.1	132
Paddy Rice	<u>400</u>					<u>480</u>				
Irrigated	-	-	-	-	-	480	175	840	4.0	3,360
Reinfed	400	110	440	0.8	352	-	-	-	-	-
Upland	<u>60</u>					<u>150</u>				
Upland Rice		50	30	0.7	21					
Cron		50	30	0.6	18		30	45	2.0	090
Pulse/Legumes		30	20	0.6	12		25	38	1.3	50
Root Crops		15	10	2.0	20		10	15	10.0	150
Vegetable		-	-	-	-		160	240	18.0	4,320
Sub-total		<u>145</u>	<u>90</u>				<u>225</u>	<u>338</u>		

Table 3-1-2 Crop Production of Non-irrigated Area

	Present					Proposed				
	Area (ha)	Cropping Rate (%)	Cropping Area (ha)	Yield (t/ha)	Production (ton)	Area (ha)	Cropping Rate (%)	Cropping Area (ha)	Yield (t/ha)	Production (ton)
Coconut	177	100	177	1.0	177	177	100	177	1.1	195
(Fruit)	-	-	-	-	-	(30)	(100)	(30)	(7.1)	(210)
Paddy Rice										
Irrigated	-	-	-	-	-	-	-	-	-	-
Reinfed	57	80	45	0.8	36	57	120	70	2.5	190
Upland	<u>111</u>					<u>111 + 80 = 191</u>				
Upland Rice		50	55	0.7	40		40	75	0.9	70
Cron		50	55	0.6	35		40	75	1.5	119
Pulse/Legumes		30	30	0.6	20		25	47	1.1	50
Root Crops		10	10	2.0	20		10	20	10.0	200
Vegetable		-	-	-	-		<u>70</u>	<u>130</u>	10.0	1,300
Sub-total		<u>140</u>	<u>150</u>				<u>185</u>	<u>347</u>		
Forage Crop	<u>22</u>					<u>22</u>	100	22	4.0	88

Table 3-1-3 Land Use Plan

Land Use	Present (ha)	Proposed				Total
		Tawiran CIP	Tagun-Angas CIP	Other		
Paddy Field	501	60 *2 (44+10+6)	480 (400 + 80)	57	597 *2 (587)	
Diversified Crop Field	171	-	150 *1 (60+90)	111	261 (171)	
Coconut	297	20	120 (120x0.75=90)	157	297	
Grass land	103	(6)	(80)	17	17	
Forest/Bush	5	-	-	5	5	
Others (river, road residence)	393	2	40	351	393	
<u>Total</u>	<u>1,470</u>	<u>72</u>	<u>700</u>	<u>698</u>	<u>1,570</u> <u>(1,470)</u>	

Notes: *1 Inclusive intercrop coconut area of 90 ha.

*2 Inclusive intercrop coconut area of 10 ha.

Table 3-2-1 Strengthening of Marinduque Agricultural Development and Promotion Farm

1. Location: Tamayo, Sta. Cruz, Marinduque (Existing Training Center)

2. Objectives:

Field application tests on farming patterns are carried out to improve the present farm technics for paddy and other diversified crops such as corn, mungobean, etc. and to establish new farm technics for such crops as vegetables, fruits, industrial crops, etc. in cooperation with or under the supervision of DA. Based on the results of the tests, suitable farming patterns including farming techniques would be selected.

Through continuous and various field trainings on farming patterns, the extension workers, farmer leaders and other farmers would be able to adopt the new farm management technics. The new farm techniques would be transferred to the other farmers in order to increase farm income.

3. Major Activities:

- Provision of technical guidelines for crop farming
- Establishment of criteria for crop fertilization based on simple soil analysis
- Establishment of criteria on water management
- Development of rotational cropping system on diversified crops
- Farm management analysis based on field application tests by farming pattern
- Development of intercropping technology under coconut plantation

4. Acreage:

4.1 Total area:	6.5 ha.
4.2 Building and others:	1.5 ha.
4.3 Demo-farm and field application farm:	5.0 ha.
1) Coconut + upland crops (vegetables, corn, etc.)	(1.0 ha)
2) Coconut + fruit and industrial crops	(0.5 ha)
3) Coconut + forage crops	(0.5 ha)
4) Paddy	(1.0 ha)
5) Upland crops (vegetables, corn, etc.)	(1.0 ha)
6) Fruit and industrial crops	(1.0 ha)

5. Building and others

5.1 Administrative office (Existing)	(300 sq.m.)
5.2 Lecture rooms	300 sq.m.
5.3 Dormitory	300 sq.m.
5.4 Laboratory	250 sq.m.
5.5 Warehouse and research room	400 sq.m.

5.6	Farm management house (Warehouse for fertilizers, seeds, insecticides, etc. motorpool, office, etc.)	300 sq.m.
5.7	Working house of farm labors	60 sq.m.
5.8	Isolation chamber	180 sq.m.
5.9	Animal shed	100 sq.m.
	Total	(2,190 sq.m.) 1,890 sq.m.

6. Staffing

	No.
6.1 Training Farm Director	1
6.2 Administrative staff	
Division Chief	1
Administrator	1
Cashier/Accounter/Bookkeeper	1
Typist	2
Janitor	2
Driver	3
Watchman	1
Guardman	3
6.3 Training staff	
Division Chief	1
Specialist	7
Assistant Technician	8
6.4 Maintenance staff	
Division Chief	1
Mechanic	1
Electrician	1
Carpenter	1
Field worker	6
	<u>40</u>
Total	40

7. Furnitures

Desks/Chairs	25 sets
Cabinet	10
Locker	25
Typewriter	2
Fireproof safe	1

8. Vehicles

Sedan car	1
Truck	1
Micro bus	1

9. Audio Visual Instruments for Training

TV set (20")	1
Video sets	1 (incl. camera)
Movie set	1
OHP	1
Micro Computer	5
Word processor	5
Film projector	1
Copy machine	1
Typewriter	1

10. Experimental Equipment

	No.
Dryer	2 sets
Heater with thermostat	1
Refrigerator 400 l	1
Simple analyzer	1
Balance	3
Microscope	2
Irrigation facility (4.5 ha)	1
Deepwell for drinking water	1
Experimental desk	3
Exhaust facilities	1
Pest/disease observatory	1 unit
Weather observation equipment	1 unit
Others (e.g. generator)	L.S.

11. Farm Machines

Plow	5 sets
Hallow	2
Rice milling machine	1
Sheller	1
Power-tiller with attachments	2
Grass cutter	7
Power sprayer	3
Duster	3
Farming tool	L.S.
Tractor with attachments (50 Hp, 30 Hp)	2

12. Annual O & M

Farm labours	5 persons
Electric charge 1,000 kwh x 12 mos.	12,000 kwh
Gasoline 50 l x 200 day x 2 mos.	20,000 lit.
Diesel oil 100 l x 150 day x 3 mos.	45,000 lit.

Fertilizer

14:14:14	2,400 kg
S.P.	100 kg
Potash	100 kg
Urea	200 kg
Lime 1.5 ton x 6 =	900 ton

Chemical input

Fungicide

Liquid	36 l
Dust	28 kg

Insecticide

Liquid	18 l
Dust	30 kg

Table 3-2-2 Rehabilitation of Marinduque Livestock Breeding Station

1. Location: Napo, Sta. Cruz, Marinduque (Existing)
2. Objectives:
 - 1) To strengthen artificial insemination programs in order to increase the number of superior and large animals.
 - 2) To experiment on improved pasture grasses.
 - 3) To experiment and improve on breeding and raising methods on livestock.
 - 4) To experiment on breeding and raising on new species of animals to be introduced in Marinduque.
 - 5) To provide livestock hygiene services.
3. Scale: Building and pasture land (16 ha) (Existing)
4. Major facilities/equipment:
 - Rehabilitation of the peripheral fence = 10 km
 - Construction of animal shade or barn stock room

Carabao (male)	2 heads	30 sq.m.
Carabao (female)	10 heads	120 sq.m.
Cow (male)	2 heads	30 sq.m.
Cow (female)	10 heads	120 sq.m.
Swine (male)	5 heads	40 sq.m.
Swine (female)	5 heads	40 sq.m.
Goat	50 heads	30 sq.m.
Chicken	1,000 heads	200 sq.m.
Horse (for draft)	2 heads	50 sq.m.
	Total	660 sq.m.
 - Water supply system
 - Deepwell (ø4", 60m depth), submerged pump (1 unit, ø2")
 - Water supply system including water tank
 - Construction of pig pen with storage room or warehouse 240 m²
 - Improvement of the Administrative Building 100 m²
 - Motorpool 300 m²
 - Storage/Warehouse for feeds 200 m²
 - Equipment

Tractor 70 50 Hp with attachments	1 unit each
Farm tools	1 set
Portable grass cutter	5 units
Generator (2 - 5 KVA)	2 units
Container for freezer semen	7 units
	30 l x 2, 3 l x 5
A-I Instruments	10 sets
Microscope	2 units
Furniture (desk, chair, etc.)	L.S.
Generator (300 KVA)	1 unit

- Other equipment	L.S.
Pick up truck (1.0 ton)	2 units
Station wagon 4 WD	1 unit
Instrument for preventive inoculation	100 sets
Refrigerator 400 lit	3 units
Incubator (300 - 500 pcs.)	3 units
Other necessary equipment for the successful performance of A-I	L.S.
Motorcycle	5 units

5. Staffing:

5.1 Manager	1
5.2 Administrative Division	
Administrative Officer	1
Administrative Staff	1
Cashier	1
Typist	1
Janitor	1
Driver	3
Watchman	1
Guardman	3
5.3 Extension Division (A-I)	
Division Chief	1
A-I technician	3
Extension workers	3
Asst. A-I technician	3
Asst. extension workers	3
5.4 Production Division (Raising)	
Division Chief	1
Technician	3
Field worker	10
5.5 Regulatory Division	
Division Chief	1
Technician	2
Asst. technician	2
	<u>Total</u> 45

6. Annual O & M

- Labours	5 persons
- Electric charge 700 kwh x 12 mos.	9,400 kwh
- Gasoline 30 lit x 200 days x 4	24,000 lit
- Diesel oil 50 lit x 100 days x 2	10,000 lit
- Fertilizer	
S.P. 170 kg/ha x 14 ha	2,400 kg.
Urea 200 kg/ha x 25 ha	2,800 kg.
Lime 1.5 ton x 14	21 ton

Table 3-2-3 DA Municipal Nurseries

1. Location: Tamayo, Sta. Cruz, Marinduque

2. Objectives:

To increase the number of fruits and diversified crop nurseries for distribution to farmers.

3. Scale: 2,000 - 5,000 sq.m.

4. Major facilities/equipment

- Irrigation facility	1 unit
- Deepwell (4", 30 m depth)	1 unit
- Working house/shed	100 sq.m.
- Pick-up truck (1.0 ton)	2 units
- Soil fumigator	1 unit (soil injector)

5. Annual O & M

- Fertilizer (14:14:14)	250 kg.
- Lime	500 kg.
- Chemical input	
Liquid	2.5 lit
Dust	2.5 kg.
- Insecticide	
Liquid	2.5 lit
Dust	2.5 kg.
- Nursery 5 spaces x 300 pcs.	1,500 pcs.
- Soil	900 cu.m.
- Labours	2 persons

Table 3-2-4 Irrigated Paddy Cultivation Demonstration Farm

1. Location: Taytay, Sta. Cruz, Marinduque

2. Objective:

To demonstrate improve farm technics on irrigated paddy and introduce package of Technology (POT).

3. Scale:

10 ha. (one rotational block) under irrigation facilities along the main road.

4. Major facilities/equipments

- On-farm facilities such as farm road with 2.0 m width, farm ditches, farm drain*
- Power tiller and carabaos
One unit of power tiller (10 Hp) with attachments
One carabao for carabao-less farmer
- Power sprayer 2 units
- Portable power duster 2 units
- Power thresher 1 unit
- Dry pavement (by using multi-purpose pavement under the road development scheme) 500 sq.m.
- Warehouse 100 sq.m.
- Rice mill (1/2 ton/hr) 1 unit

5. Annual O & M

- Input materials:
 - Compound fertilizer (14:14:14) 4,300 kg.
 - Urea (45%) 1,300 kg.
- Input chemical
 - Fungicide
 - Liquid 60 lit
 - Dust 140 kg.
 - Insecticide
 - Liquid 80 lit
 - Dust 100 kg.
- Seed (HYV) 500 kg.

Note: *Irrigation facilities including on-farm facilities should be developed under the irrigation development scheme.

Table 3-2-5 Rainfed Paddy/Diversified Crops Cultivation Demonstration Farm

1. Location: Napo, Sta. Cruz, Marinduque
2. Objective:

To demonstrate improved farming techniques for rainfed paddy/diversified crops.
3. Scale: 2 ha. of rainfed paddy field along the main road.
4. Major facilities/equipment
 - Power tiller and carabao
 - One unit of power tiller (10 Hp) with attachment
 - One carabao for carabao-less farmer
 - Knap-sack type hand sprayer 5 units
 - Portable hand duster 5 units
 - Manual operated thresher 1 unit
 - Dry pavement (by using multi-purpose pavement under the road development scheme) 500 sq.m.
 - Warehouse 100 sq.m.
 - Rice mill (1/2 ton/hr.) 1 unit
 - Power corn thresher 1 unit
5. Annual O & M
 - Input materials
 - Compound fertilizer (14:14:14) 1,000 kg.
(215 kg. for paddy; 285 kg. for diversified crops)
 - Urea (65 + 90) 310 kg.
 - Input chemical
 - Fungicide
 - Liquid (3 + 6 lit/ha) 18 lit
 - Dust (7 + 14 kg/ha) 42 kg.
 - Insecticide
 - Liquid (4 + 8) 24 lit
 - Dust (5 + 10) 30 kg.
 - Seed (HYV) (50 + 5) 110 kg.

Table 3-3-1 Post-harvest Facilities for Rice

1. Location: Tawiran, Sta. Cruz, Marinduque
2. Objective:
To set up demonstration areas for improved rice post-harvest facilities.
3. Service Area: MADPP area
4. Scale: 100 ha.
5. Major facilities/equipment:
 - Dry pavement (by using multi-purpose pavement under the road development scheme) 500 sq.m.
 - Warehouse 100 sq.m.
 - Rice mill (1/2ton/hr.) 1 unit

Table 3-3-2 Post-harvest Facilities for Corn

1. Location: Tawiran, Sta. Cruz, Marinduque
2. Objective:
To set up demonstration areas for improved corn post-harvest facilities.
3. Scale: 50 ha.
4. Major facilities/equipment:
 - Power corn thresher 1 unit
 - Dry pavement (by using multi-purpose pavement under the road development scheme) 500 sq.m.
 - Warehouse 50 sq.m.

Table 3-4-1 Multi-Purpose Agricultural Cooperatives (MPAC)

1. Location: Main center: Tawiran
 Sub-center: Angas, Matalaba, Morales, Napo,
 Pantayin, Tagum, Tamayo, Taytay

2. Objectives:

To organize and revitalize farmers organization in Marinduque at the Barangay level through the NGO's and/or BACOD and form them into primary multi-purpose agricultural cooperatives (MPAC). These type of cooperatives will not only promote and develop agricultural cooperative production processing and marketing system but also engage in credit extension and provision of necessary services needed by the Barangay, say for example, labor needs, transportation needs, post-harvest facilities, etc.

3. Major activities:

The formation of MPAC must be initiated through the NGO's and where none are existing, through the BACOD of DA by organizing and/or revitalizing farmer's organization in the area. Farmers from three to five contiguous Barangays may organize themselves to form the MPAC, the services of which would depend on the existing needs and resources of the organization which may include all or any of the following services: credit extension, buying agricultural product, production, marketing, procurement, sale of consumer goods and provision of other services.

The BACOD will train NGO's on the over-all concept, nature, policies, types and techniques of cooperative development which they in turn will infuse into the farmers. Training for NGO leaders will be undertaken at the Marinduque Farmer's Training and demonstration Farm. The NGO's shall directly be involved in the establishment and organization of the MPAC in accordance with the guidelines made by BACOD.

For the MPAC to be more effective, aside from the main office/center, other sub-centers/offices shall be put up in other Barangay member areas to serve as warehouse/collection and/or meeting point of goods and/or services.

4. Staffing:

Main Office/Center	
Administrative Officer	1
Bookkeeper	1
Clerk	1
Warehouse helper	2
Sub-Office/Center	
Warehouseman	1
Warehouse helper	2

5. Major facilities/equipment

- Main Officer/Center		
Administrative office	50 sq.m.	
Store space	100 sq.m.	
Warehouse for materials	50 sq.m.	
Rice mill	50 sq.m.	
Warehouse for agricultural output	200 sq.m.	
Collecting/shipping place	100 sq.m.	
- Sub-Office/Branch Officer (for each sub-center)		
Administrative office	20 sq.m.	
Warehouse	100 sq.m.	
- Equipment for Main Office		
Truck (4 ton)	1 unit	
Motorcycle (100 to 125 cc)	1 unit	
Balancing (Max. 100 kg.)	5 sets	
Desk and Chair	9 sets	
Locker	2 sets	
Typewriter	5 units	
Cash register	5 units	
Power thresher	5 units	
Milling machine	1 unit	
Dryer	1 unit	
Power tiller (10 Hp)	5 units	

6. Annual O & M

 Electric charge
 Gas
 Light/Oil

Figure 3-2-1 PRELIMINARY LAYOUT OF
 MARINDUQUE AGRICULTURAL DEVELOPMENT & PROMOTION FARM
 (M. A. D. P. F.)

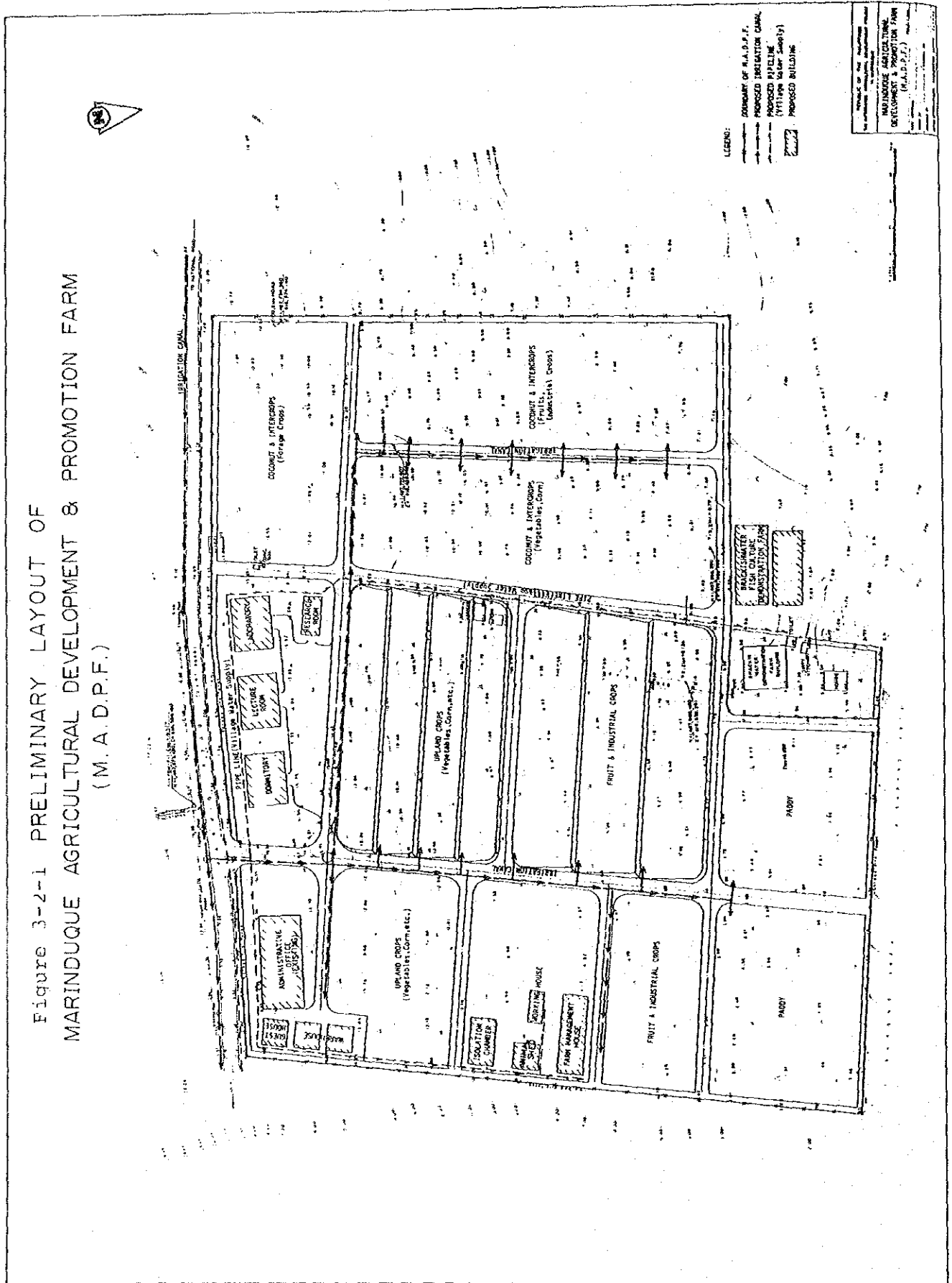


Table 3-5-1 Demand and Supply of Palay

<u>Description</u>	<u>Year</u>	
	<u>1989</u> (Present)	<u>2010</u> (with project)
1. ESTIMATED CONDITIONS		
1.1. Population	9,478	14,073
1.2. Consumption of rice per capita	103 kg/year	90 kg/year
1.3. Loss and other use	7% of Total Demand	-do-
1.4. Equivalent ratio from rice to palay	65%	65%
1.5. Yield of palay		
- Irrigated field	2.5 ton/ha	4.0 ton/ha
- Rainfed field	0.8 "	2.5 "
- Upland rice	0.7 "	0.9 "
1.6. Seed	50 kg/ha	50 kg/ha
2. DEMAND		
- Polished rice	9,478 x 103 kg = 976 ton	14,073 x 90 = 1,266 tons
- Equivalent to palay (1)	1,501 tons	1,948 tons
- Loss (2)	105 tons	136 tons
- Seed (3)	647 ha x 50 kg = 32 tons	1,090 x 50 kg = 55 tons
Total (1+2+3) (4)	1,638 tons	2,139 tons
3. SUPPLY (5)		
(refer to Table 3-1-1 & 3-1-2)	869 tons	4,025 tons
4. BALANCE (5-4) (6)		
	- 769 tons	1,886 tons
5. SELF-SUFFICIENCY RATE (5/4)		
(in case of "without project")	53%	188% (40%)

Table 3-6-1. Calculation of Required Labor Force for Agricultural Development

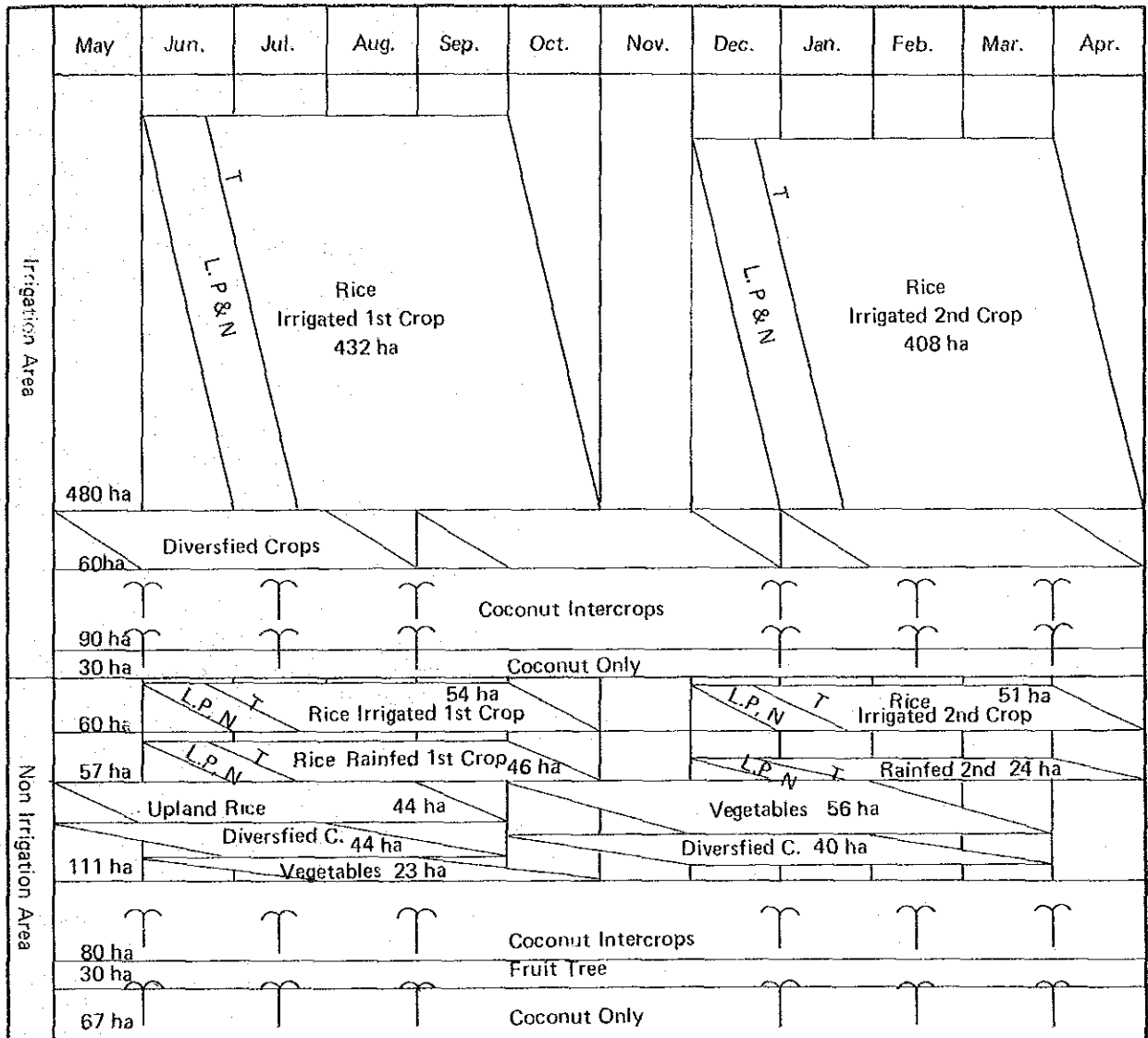
(Unit: MD)





Item	Present		Unit Req'd L. Force (MD/ha)	Unit Req'd L. Force (MD/ha)	W/ Project Cropping Area (ha)	Labor Force (MD)
	Cropping Area (ha)	Labor Force (MD)				
(Irrigation Area)						
Coconut	140	10,304	73.6	73.6	140	10,304
Irrigated Paddy	-	-	165.2	165.2	945	156,114
Rained Paddy	49	3,033	100.1	100.1	-	-
Upland Paddy	30	1,413	71.9	71.9	-	-
Corn	30	1,512	112.5	112.5	45	5,063
Pulse	20	990	89.9	89.9	38	3,416
Root Crop	10	250	55.0	55.0	15	825
Vegetables	-	-	317.0	317.0	240	76,080
Sub-total (1)		17,502				251,802
(Out of Irrigation Area)						
Coconut	157	11,555	73.6	73.6	157	11,555
Rained Paddy	45	2,786	100.1	100.1	70	7,007
Upland Paddy	55	2,591	71.9	71.9	75	5,393
Corn	55	2,772	112.5	112.5	75	8,438
Pulse/Legume	30	1,485	89.9	89.9	47	4,225
Root Crop	10	250	55.0	55.0	20	1,100
Vegetables	-	-	317.0	317.0	130	41,210
Other Fruits	22	594	40.5	40.5	22	891
Sub-total (2)		22,033				83,809
Livestock (3)		15,166 *1				33,671 *2
Total (4) (= 1+2+3)		54,701				369,282
(Equivalent to 6 hrs/MD: (5) (=4 / 6 hrs)						
Annual Labor Requirement (6) (=5 / 200 days/year)		365				2,462
(Other Labor Requirement for Proposed Agricultural Development)						
2. Marinduque Agricultural Development and Promotion Farm	-	-	-	-	-	60
17. Marinduque Breeding Station	-	-	-	-	-	58
6. DA Municipality Nursery	-	-	-	-	-	30
13. Post-harvest Facility for Rice	-	-	-	-	-	12
14. -do- for Corn	-	-	-	-	-	12
26. Multi-purpose Agriculture Cooperative	-	-	-	-	-	29
Total (7)						201
Grand Total		365				2,663

Note: *1 Present livestock Breeding farm household
 : Total farm household 554 houses
 : Assumption; 60% of farm-household have an animal.
 : Unit required labor force of 1 hr a day
 : Total working day a year is 365 days.

MD - man.day

FIGURE 3-6-1 PROPOSED CROPPING PATTERN



- Remarks:
-  Coconut Site
 -  Land Preparation
 -  Nursery
 -  Transplantation

CHAPTER 4 . AGRICULTURAL INFRASTRUCTURE DEVELOPMENT

CHAPTER 4 AGRICULTURAL INFRASTRUCTURE DEVELOPMENT

4-1 Irrigation Development

4-1-1 Present Condition

1) General

The cultivated area of MADPP are found on the lower and gentle slope and on the flat areas. The cultivated crops are coconut, upland and lowland rice, vegetables, corn and fruit trees. At present this area is predominantly cultivated with rainfed paddy. In addition, some 90 ha in the area was being irrigated by the Tambayan Pump Irrigation System but NIA had abandoned the system ten years ago due to high maintenance cost.

In this irrigation operation, paddy cropping is practiced in the rainy season, however, in the dry season due to small river discharge and lack of facilities for water impounding, cultivation is very limited.

There is one CIP, Tawiran CIP, which has 60 ha of the potential area. Aside from Tawiran CIP, the acreage of 630 ha of Tagum-Angas area in the Project Area would be converted to the irrigation area, as described below.

<u>Land Use</u>	<u>Gross Area</u> (ha)	<u>Irrigable Area</u> (ha)
Rainfed paddy field	400	400
Diversified crops field	60	60
Coconut plantation	120	90
Grass land	80	80
Road and residential area	40	-
<u>Total</u>	<u>700</u>	<u>630</u>

When an irrigation system is introduced in this area, agricultural products and farmer's income will increase, therefore, the Tagum-Angas area, water source of which is Devilla river, has high potentials for development.

2) Geology at Devilla River Sites

Two sites are considered for the Tagum-Angas dam along the Devilla river: the site-A located some 1.6 km upstream of its confluence with the Tambangan river where the water starts to flow as the Tawiran river and site-B which is about 1.5 km upstream of the site-A. No sub-surface investigation has been undertaken at the site-A while the site-B was explored by four drillholes along the dam axis with a total length of 120 m.

The river bed at the site-A has an approximate elevation of 22 m and a width of about 40 m. The slope on the right abutment varies from 15 to 20 degrees. The left abutment is steeper with slopes of about 40 to 45 degrees. The main rock types in the area are agglomerate and andesite of the Oligocene San Antonio formation. The fresh and massive agglomerate is widely exposed on the left abutment. It is well indurated and the near absence of fracturing was noted. A few meters downstream of the potential dam axis on the left abutment, a moderately to highly fractured andesite is exposed in this area, there is a marked contrast in topography with that of the area underlain by agglomerate. Apparently, the more gentle slopes and thicker overburden in this area are due in part to the fractured nature of andesite. The same condition seems to prevail on the right abutment where small outcrops of fractured andesite is limited to its southern slopes. Alluvial deposit overlying the bedrock at the river section is estimated to be in the order of three to six meters thick and consists predominantly of gravels and boulders of volcanic rocks and chert.

The site-B has a river section width of about 30 m at an elevation of approximately 37 m. It is generally rocky especially on the downstream side. Inclination of the abutments averages about 30 to 40

degrees at the left and right abutments, respectively. The rocks at and around the damsite area are essentially andesitic to basaltic volcanic flows belonging to the San Antonio formation. These rocks are classified petrographically into several rock types including andesite, andesite porphyry, porphyritic andesite, porphyritic basalt, basalt porphyry and dacite. However, since each rock type does not exhibit peculiar engineering properties, these volcanic rocks should be considered as one mass in regard to bedrock for the construction of a dam. Fresh volcanic rocks in the area are generally dense and hard. Jointings and shearing, particularly those trending prominently to the northwest with steep dips to the northeast, are rendered tight by quartz and calcite veins.

The results of previous drilling exploration at the site-B were evaluated and the different grades of bedrock were determined based on a standard classification of rock quality in the dam foundations. In general, bedrocks within the C_L-C_M class are adequate for the foundation of a fill dam type. Accordingly, the rock excavation line has been delineated and the average depth of excavation would be approximately seven meters.

In regard to engineering geological considerations, the site-B appears to be better than the site-A. For one, the average depth of excavation at the site-A would be more than seven meters although less excavation would probably be required at the left abutment along the dam axis. Also, the more intense fracturing of the andesite at the site-A, which apparently influenced the gentle slopes and deeper weathering of the bedrock, would require more extensive consolidation grouting and deeper grout curtain to reduce permeability and improve its strength as foundation materials. Further, the higher elevation and narrower river section plus the steeper slopes on the right abutment at the site-B makes it more advantageous than the site-A. (refer to Figure 4-1-1)

4-1-2 Basic Concept of Irrigation Development

1) Irrigation Planning

The Tagum-Angas CIP aims to serve irrigation water to paddy fields and diversified crop fields through a year. The dam should store the river discharge in the Devilla river having 25 sq.km of a drainage area. The annual estimated discharge is 19.66 MCM. The service area of 630 ha, which consists of 480 ha of paddy fields and 150 ha of irrigation diversified crop fields, is located at the down stream of the proposed dam. Based on the water balance by the reservoir operation, the annual water requirement for the target year is calculated at 8.1 MCM. The estimated sediment volume of 0.12 MCM is planned based on the specific sediment yield of 95 cu.m/sq.km/year, the drainage area of 25 sq.km and a life span of the dam of 50 years.

According to the results of the reservoir operation, the capacity of reservoir at the normal water surface level of 66.0 m above the mean sea level (MSL) is 2.865 MCM. The maximum capacity of 3.648 MCM at the maximum water surface level of 68.58 m above MSL and 0.119 MCM at the minimum water surface level of 46.0 m above MSL are determined. The surface areas at the maximum, normal and minimum water surface level are 35.2, 26.4 and 3.2 ha, respectively. (refer to Tables 4-1-2 and 4-1-3)

Based on the computation of the diversion water requirement presented on Table F-1-6 in the Appendix I of the other volume, the maximum water requirement considering the effective rainfall is 8.5 mm/day in June. Therefore, the unit water requirement is calculated at 1.0 lit/sec/ha for a paddy field. According to the topographic conditions of the service area, some amount of return flow would be expected for irrigation at the lower portion of the service area. The 25% of the irrigation water are assumed to be used for as a return flow. The overall irrigation efficiency, therefore, is 0.67 (= 50% ÷ (1 - 0.25)).

For the design of a canal capacity, effective rainfall is not considered. In June, the crop water requirement of 9.2 mm/day including 1.5 mm/day of percolation is applied. The diversion water requirement is calculated at 1.6 lit/sec/ha. So, for the canal design, this unit diversion water requirement is applied.

On a diversified crop field, at the average water requirement for representative crops is calculated 400 mm by the assumption of growing period of 120 days. The effective rainfall is 720 mm by the same Table F-1-6 and the average daily effective rainfall is calculated 2.0 mm/day. Therefore, the average water requirement of 1.4 mm/day is calculated as follows.

$$400 \text{ mm} - 2.0 \text{ mm/day} \times 120 \text{ days} = 160 \text{ mm}$$

$$160 \text{ mm} / 120 \text{ days} = 1.4 \text{ mm/day}$$

The irrigation efficiency is 0.5. So, the water requirement of 0.33 lit/sec/ha is applied for the diversified crop irrigation.

$$1.4 \text{ mm}/0.5 \times 10,000/86,400 = 0.33 \text{ lit/sec/ha}$$

Therefore, the total water requirement for all service area of 630 ha amounts at 530 lit/sec.

$$480 \text{ ha} / \times 1.0 \text{ lit/sec/ha} + 150 \text{ ha} \times 0.33 \text{ lit/sec/ha} = 530 \text{ lit/sec}$$

The maximum water requirement of 0.530 cu.m/sec was proposed. The proposed reservoir can also supply the 324 cu.m/day of the water for the village water supply system for the beneficiaries in the service area. In the future, the mini-hydro power plant will be able to construct by using the head and discharge for the irrigation water. (refer to Figure 4-1-2)

4-1-3 Irrigation Development Plan

There are two irrigation projects in the objective area, namely, the Tagum-Angas communal irrigation project (CIP) and the Tawiran CIP.

1) Tagum-Angas CIP

Based on the topographic map made by the JICA topo-mapping team in March, 1989, the canal alignment of the gravity irrigation system was carried out by the Team. The proposed canal length of 24.9 km, a main canal of 11.9 km and lateral irrigation canals of 13.0 km, would be contained in the project. All canal would be proposed mainly by an concrete lining canal except at some embankment portions. The operation and maintenance road with a 4 m width would be proposed on the one side of the canal and on another side of the canal a 0.5 m width dike would be designed. (refer to General Plan and Table 4-1-1)

The appurtenant structures such as drops, siphons, road crossings, canal crossings, drainage crossings, turn-outs, checks, end checks, bridges, etc. are necessary for well water management.

The on-farm facilities such as farm ditches, farm drains and small scale farm roads with a width of 2 m will be necessary for good water management. The density of those facilities will be designed by the 50 m/ha for farm ditches, one rotational irrigation block of 10 to 15 ha in average, farm drains of 30 m/ha.

2) Tawiran CIP

The Tawiran CIP is already on-going by the NIA provincial office. The project is progressed up to the end of the detail design stage as of August 1989. The construction works will be executed soon. The service area of 60 ha will be irrigated by the gravity irrigation system getting the irrigation water from the Tawiran river, which the intake point is in Barangay Makapuyat, Tawiran. The project consists of the diversion dam across the Tawiran river as an intake facility, the feeder canal from the intake facility to the service area along the right side of the river, the various appurtenant structures and on-farm facilities. Since the project will be finished within a few years, the Tawiran CIP is not including the priority development components.

Figure 4-1-2 Irrigation Network Diagram
(Tagum-Angas CIP)

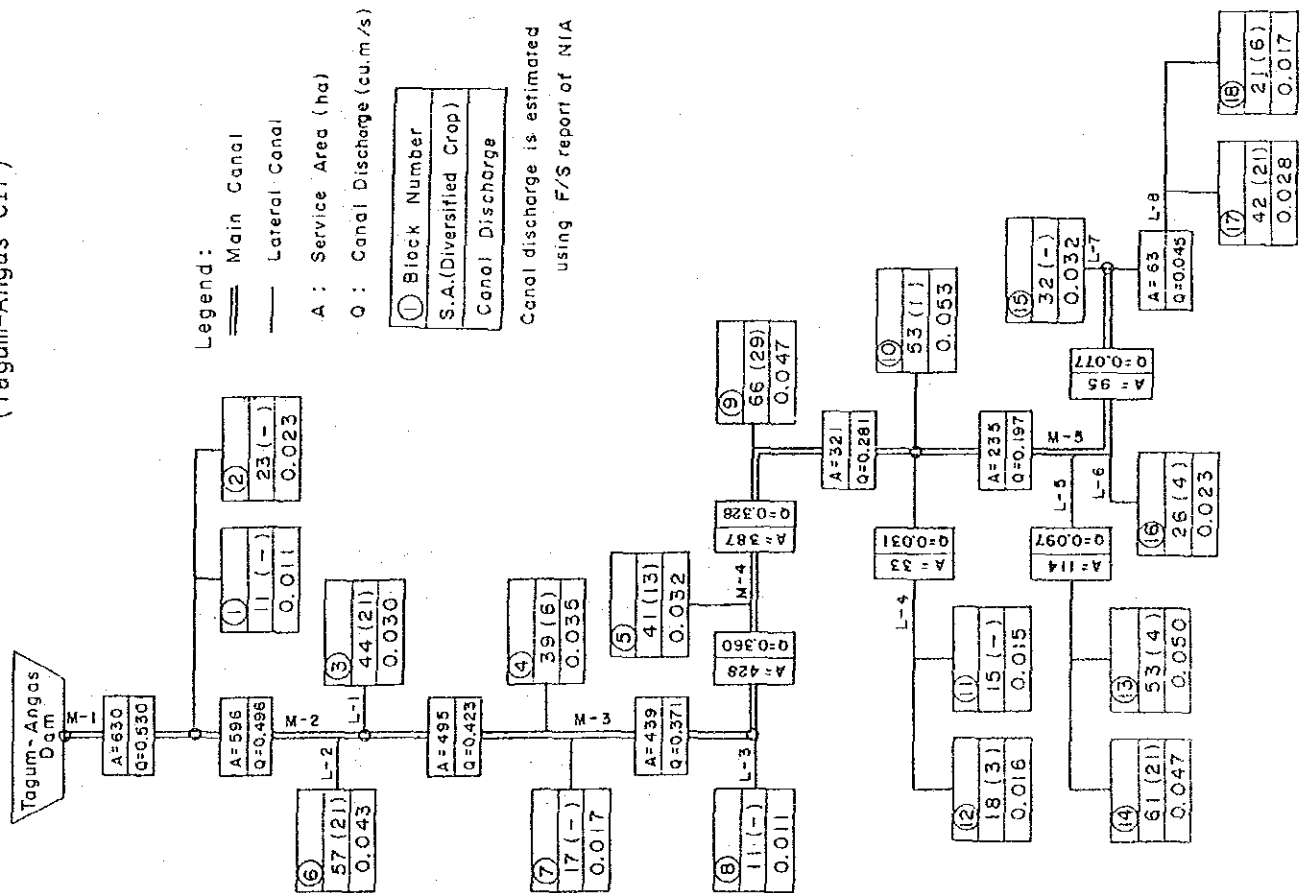


Table 4-1-1 Proposed Irrigation Program
(M.A.D.P.P)

Name of Project	Outline of Facilities	Area/ha
Tawiran CIP	Diversion (Orgee type) - H=1.8m L=45.2m Canal length - 4.6 km Main canal 2.1 km Lateral canal 2.5 km	60 ha
Tagum-Angas CIP	Intake work - Reservoir Type (Devilla river) Dam Type - Rockfill H=31.6m Reservoir capacity - 2.865 MCM Irrigation requirement - 0.53 cu.m/sec Village water supply - 324 cu.m/day Hydro power facilities - 3 x 100 KW Annual energy generation - 1.4 GWH Canal length - 24.9 km Main canal 11.9 km Lateral canal 13.0 km Farm ditch density - 50m/ha Service area for one turn-out 10-15 ha Drainage canal density - 30 m/ha Number of Farm Pond - 10	630 ha

Total 690 ha

Table 4-1-2 Water Balance of Tagum-Angas CIP

YEAR	WATER BALANCE -- TAGUM-ANGAS										W-L-LEVEL (EL-R)	
	INFLOW (MCM)	IRRIG. (MCM)	SUPPLY (MCM)	POWER (MCM)	DEMAND (MCM)	EVAPD (MCM)	SPILL (MCM)	SHORT (MCM)	C-SHORT (MCM)	ENERGY (GWH)		VOLUME (MCM)
1	18.140	7.982	0.120	6.545	14.646	0.185	2.713	0.000	0.000	0.628	0.000	39.000
2	42.840	7.982	0.120	20.653	28.755	0.141	12.890	1.215	1.215	1.354	0.596	53.000
3	27.290	7.982	0.120	13.120	21.222	0.187	7.741	0.946	0.946	1.021	2.865	66.000
4	27.830	7.982	0.120	13.081	21.183	0.137	7.751	1.381	1.381	0.918	1.951	61.923
5	27.350	7.982	0.120	12.348	20.449	0.150	6.482	0.486	0.486	0.942	2.111	62.780
6	44.920	7.982	0.120	25.043	33.145	0.255	11.521	0.000	0.000	1.883	2.865	66.000
7	28.540	7.982	0.120	15.693	23.795	0.249	4.496	0.000	0.000	1.344	2.865	66.000
8	37.370	7.982	0.120	21.538	29.639	0.255	7.477	0.000	0.000	1.482	2.865	66.000
9	58.420	7.982	0.120	23.768	31.869	0.255	26.296	0.000	0.000	1.810	2.865	66.000
10	34.380	7.982	0.120	24.953	33.054	0.254	20.072	0.000	0.000	1.876	2.865	66.000
11	36.790	7.982	0.120	18.852	26.954	0.182	15.162	0.000	0.000	1.576	2.865	66.000
12	14.330	7.982	0.120	4.681	14.582	0.246	6.592	0.000	0.000	1.516	2.865	66.000
13	28.820	7.982	0.120	15.241	17.523	0.253	5.070	0.408	0.408	0.593	2.865	66.000
14	23.810	7.982	0.120	13.924	21.728	0.528	1.856	0.000	0.000	1.243	2.865	66.000
15	32.680	7.982	0.120	20.384	28.485	0.534	3.961	0.000	0.000	1.591	2.865	66.000
16	50.130	7.982	0.120	23.403	31.505	0.250	18.375	0.000	0.000	1.785	2.865	66.000
17	35.360	7.982	0.120	24.297	32.399	0.239	22.722	0.000	0.000	1.827	2.865	66.000
18	32.280	7.982	0.120	18.365	26.466	0.248	6.399	0.000	0.000	1.490	2.865	66.000
19	34.150	7.982	0.120	14.499	22.600	0.175	10.661	0.140	0.140	1.710	2.865	66.000
20	41.180	7.982	0.120	20.149	28.250	0.249	12.681	0.000	0.000	1.591	2.865	66.000
21	37.130	7.982	0.120	19.835	27.937	0.232	8.961	0.000	0.000	1.556	2.865	66.000
22	25.380	7.982	0.120	14.388	22.490	0.197	2.693	0.000	0.000	1.173	2.865	66.000
23	24.590	7.982	0.120	14.821	22.922	0.207	1.461	0.000	0.000	1.231	2.865	66.000
24	31.180	7.982	0.120	18.986	27.087	0.251	3.842	0.000	0.000	1.330	2.865	66.000
MEAN	34.806	7.982	0.120	17.316	25.418	0.214	9.242	0.183	0.183	1.360		

Reservoir Capacity

Tagum-Angas

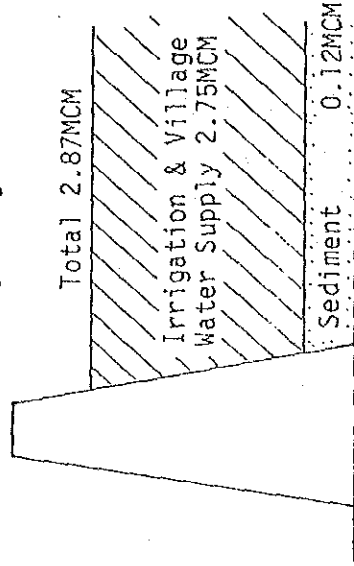


Table 4-1-3 Engineering Data of Tagum-Angas CIP

HYDROLOGICAL DATA			
Drainage Area Above Dam - sq.km		25.00	
Mean Annual Rainfall - mm		1657.00	
Mean Annual Run-off - MCM		19.66	
Inflow Design Flood - cu.m/s		381.20	
LOCATION			
Dam		Devilla River	
Type		Rookfill	
Height of Dam above Streambed - m		31.60	
Crest Elevation - m		70.60	
Crest Length - m		123.00	
Crest Width - m		8.00	
Base Width - m		140.00	
Volume of Embankment - cu.m.		131,300	
SPILLWAY			
Type		Side Channel with Chute & Flip Bucket	
Crest Width - m		40.00	
Crest Elevation - m		66.00	
Chute Width - m		10.00	
Design Capacity - cu.m/s		333.74	
DIVERSION AND OUTLET WORKS			
Type		R.C. Conduit	
Number and Size		1-2.5 m. diameter	
Control		2-0.60 m. diameter H.P. Gates	
Diversion Requirement During Construction - cu.m/s		30.20	
Irrigation Requirement - cu.m/s		0.53	
Power Requirement - cu.m/s		1.83	
Capacity at Normal Water Surface Elevation - cu.m/s		5.06	
Capacity at Minimum Water Surface Elevation		1.83	
RESERVOIR ELEVATION			
Maximum Water Surface Elevation - m		68.58	
Normal Water Surface Elevation - m		66.00	
Minimum Water Surface Elevation - m		46.00	
RESERVOIR AREA AT			
Maximum Water Surface Elevation - ha		35.20	
Normal Water Surface Elevation - ha		26.40	
Minimum Water Surface Elevation - ha		3.20	
RESERVOIR CAPACITY AT			
Maximum Water Surface Elevation - MCM		3.648	
Normal Water Surface Elevation - MCM		2.865	
Minimum Water Surface Elevation - MCM		0.119	
IRRIGABLE AREA			
Paddy (480 ha) + Deversified Crop (150 ha) =		630 (*)	
HYDRO POWER FACILITIES			
Installed Capacity - KW		300	
Number and Capacity of Units - KW		3-100	
Rated Head - m		20.90	
Maximum Head - m		26.40	
Minimum Head - m		13.40	
POWER WATERWAY			
Diameter of Penstock - m		0.35 m ϕ	
Controls		3-0.35 m ϕ Butterfly Valves	
ANNUAL ENERGY GENERATION			
Firm - CMH		0.5	
Secondary - CMH		0.9	
Total - CMH		1.4 (*)	
SWITZYARD			
		Outdoor 10.00m x 6.00	
Source: F/S Report (RIA)			
(*) JICA Study Team			

Figure 4-1-1

GEOLOGICAL CROSS SECTION
 AT SITE B (Devilta River)

Ver. & Hor. Scale = 1:1,000

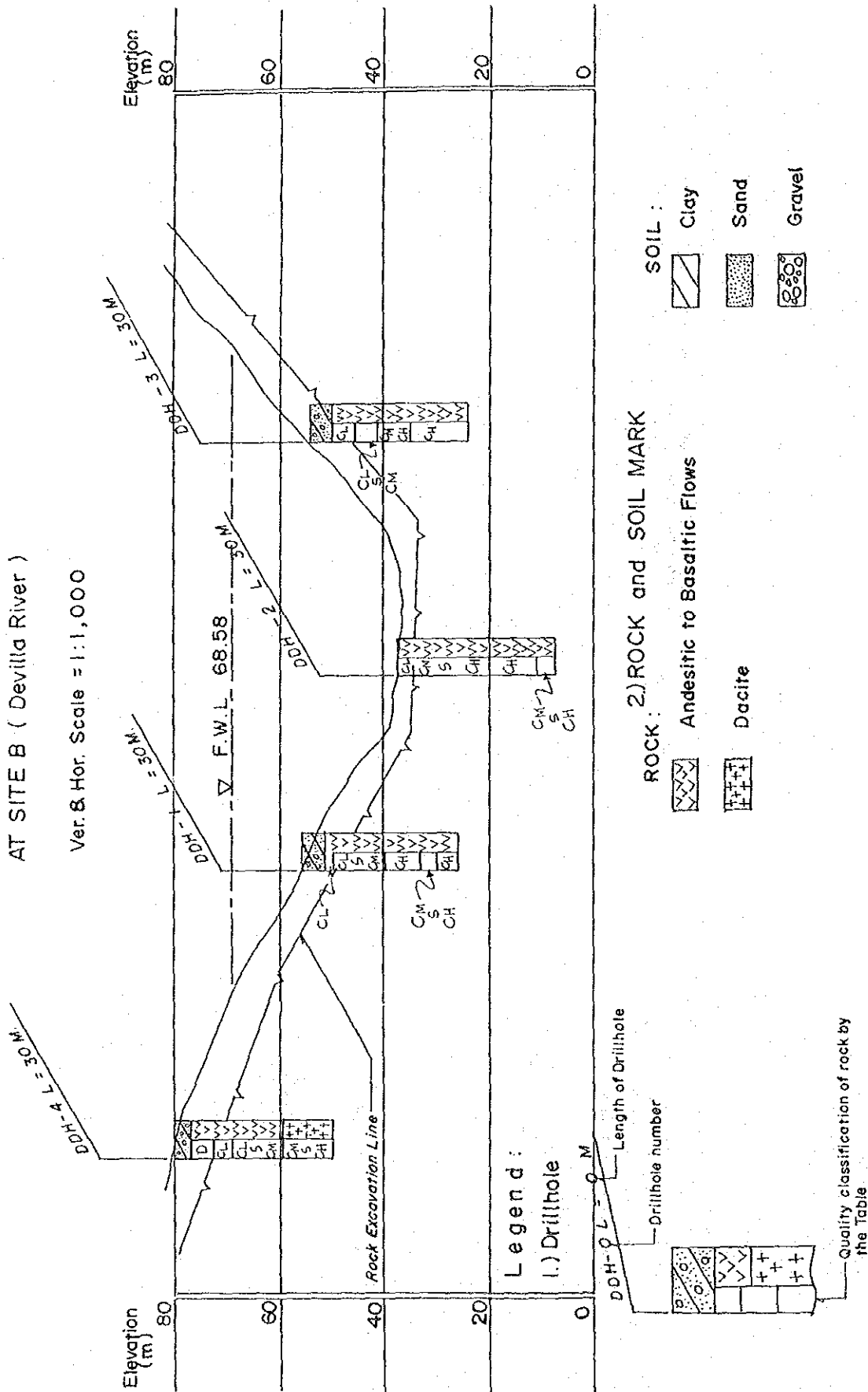
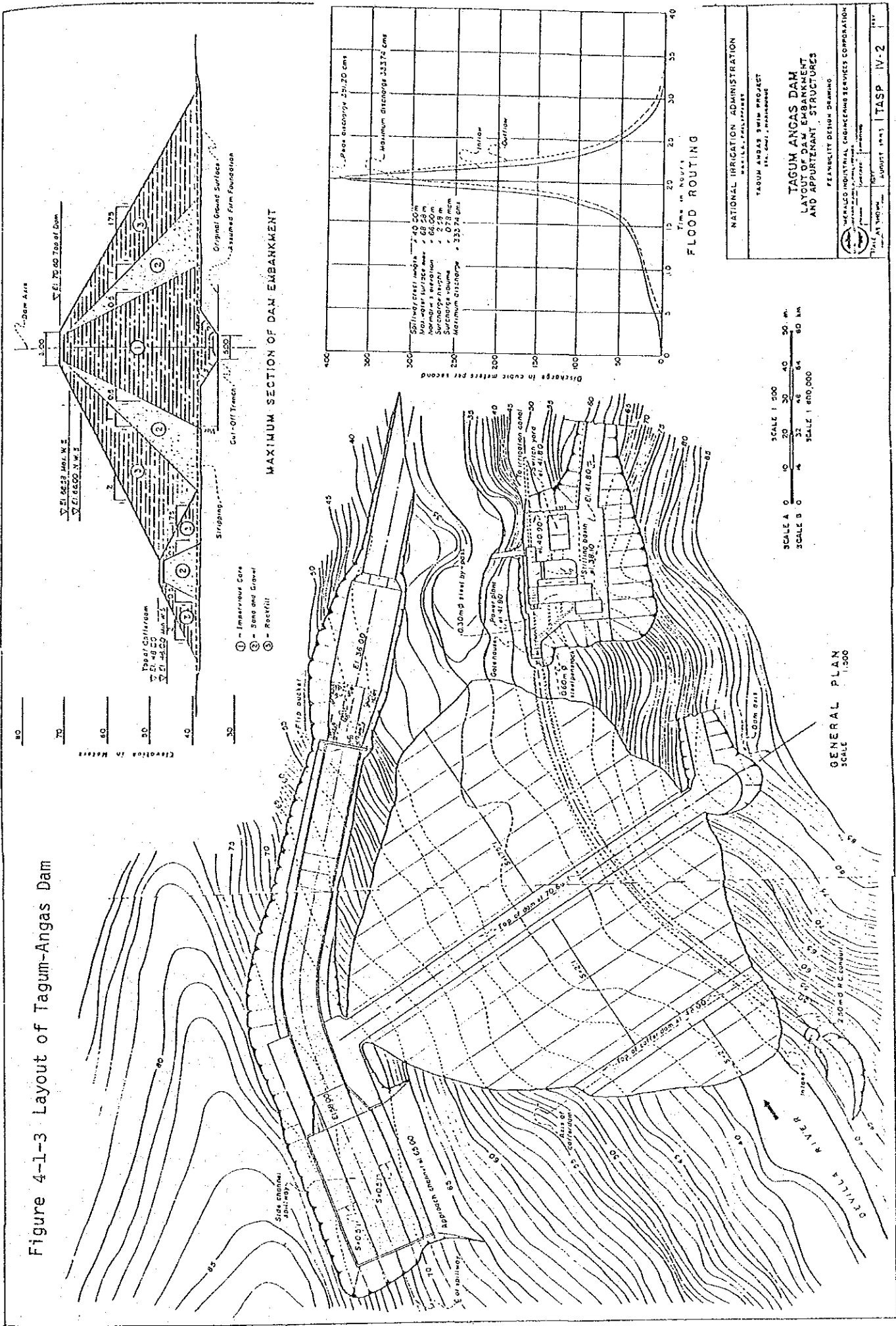


Figure 4-1-3 Layout of Tagum-Angas Dam



SCALE 1:500
SCALE 1:1000
SCALE 1:600,000

GENERAL PLAN
SCALE 1:500

NATIONAL IRRIGATION ADMINISTRATION
TAGUM-ANGAS SWIM PROJECT
M. L. PALMARES
TAGUM-ANGAS DAM
LAYOUT OF DAM EMBANKMENT
AND APPURTENANT STRUCTURES
FEASIBILITY DESIGN DRAWING
M. L. PALMARES
TAGUM-ANGAS DAM PROJECT
M. L. PALMARES
AUGUST 1963 | TASP IV-2

4-2 Rural Road Development

4-2-1 Present Condition

Existing road system in the MADPP area covers a total length of 27.80 km that have functioned as a farm-to-market road. National road as major farm-to-market road runs almost in the center of the area from north to south. Road densities are 1.89 km/sq.km of land area and 5.15 km/1,000 population which are over the provincial average. (refer to Table 4-2-1)

The conditions of the farm-to-market roads, particularly provincial and Barangay roads, are so poor due to long time absence of maintenance operations. Many sections of those roads that were originally constructed with gravel pavement have presently changed into earth road with many potholes and deep wheel tracks. Consequently such roads become so muddy in the wet season that motor vehicles could hardly pass the roads. As to the farm roads which connect between farming area and Barangays, foot trails are only found in the Area.

Problems on the present road system are summarized below.

- Poor condition of farm-to-market roads due to lack of maintenance activities, and
- Absence of farm roads in the agricultural land.

4-2-2 Basic Concept of Rural Road Development

Direct effects/merits of rural road development are savings of transportation cost and time, increase of agricultural products, and promotion of agro-industries. The most essential function of rural roads is the farm-to-market road which is particularly utilized for transportation and distribution of agricultural products and input materials. Farm roads are also necessary to support the irrigation and agriculture development scheme. Concrete pavement roads for multi-purpose use such as dry pavement for agricultural products, market area, meeting place, recreation area, playground, etc. shall be constructed in the Barangay centers.

Objectives of the rural road development are to improve accessibility between Barangays and towns so as to vitalize agricultural production, and to stimulate agriculture development as well as other infrastructure development.

4-2-3 Rural Road Development Plan

1) Development Plan

Based on the problems on the present road system and development objectives described above, rural road development plans are formulated as follows: (refer to Table 4-2-2 and Figure 4-2-1)

a) Rehabilitation of Farm-to-Market Roads

Two types of farm-to-market road are planned with a total length of 10 km. They should be all-weather road with gravel surface.

Road Type B (Equivalent to provincial road)

Napo - Pulong Parang road	:	2.0 km
Tagum - Dapdap road	:	1.9 km
Taytay - Hagimit road	:	1.6 km
<u>Sub total</u>		<u>5.5 km</u>

Road Type C (Equivalent to Barangay road)

Tawiran - Napo road	:	2.0 km
East Napo road	:	0.6 km
North Tamayo road	:	1.4 km
Angas road	:	0.5 km
<u>Sub total</u>		<u>4.5 km</u>
<u>Total</u>		<u>10.0 km</u>

b) Construction of Farm Roads

A total length of farm roads construction is 15.0 km taking account of existing road network and topographic conditions based on the irrigation and agriculture development scheme. The farm road should also be all-weather road.

c) Construction of Multi-Purpose Pavements

Multi-purpose pavements with 150 l.m long and 4.0 m wide should be provided to 20 places in the Project Area that include small Barangays.

2) Operation and Maintenance

Roads and bridges are public infrastructure to be maintained by the government. DPWH undertakes maintenance operations for national roads and Barangay roads, while PEO is responsible for provincial roads and part of Barangay roads. (refer to Figure 4-2-2)

Table 4-2-1 Existing Road Length in Tagum-Angas Area
(As of 1989)

I t e m	Tagum-Angas Area			Marinduque
	Concrete/Asphalt	Gravel	Total	
Road Length				
National Road (km)	4.45	0.55	5.00	219.18
Provincial Road (km)	3.00	12.60	15.60	183.24
Barangay Road (km)	0	7.20	7.20	140.32
Municipal Road (km)	0	0	0	135.09
<u>Total (km)</u>	<u>7.45</u>	<u>20.35</u>	<u>27.80</u>	<u>677.83</u>
Total Land Area (km ²)			14.70	959.2
Population (1,000)			5.4	205.8
Road Density				
For Land Area (km/km ²)			1.89	0.71
For Population(km/1000)			5.15	3.29

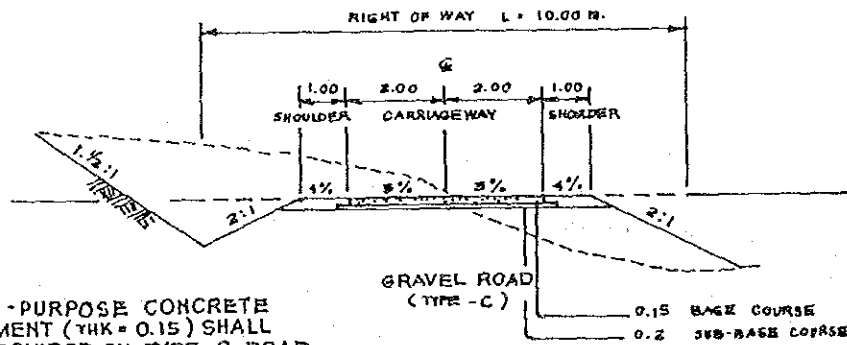
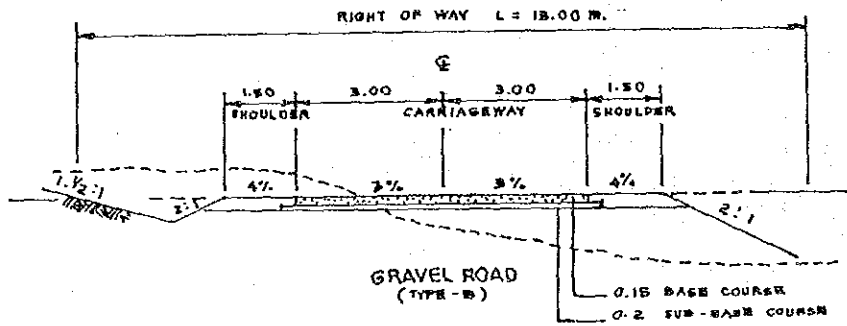
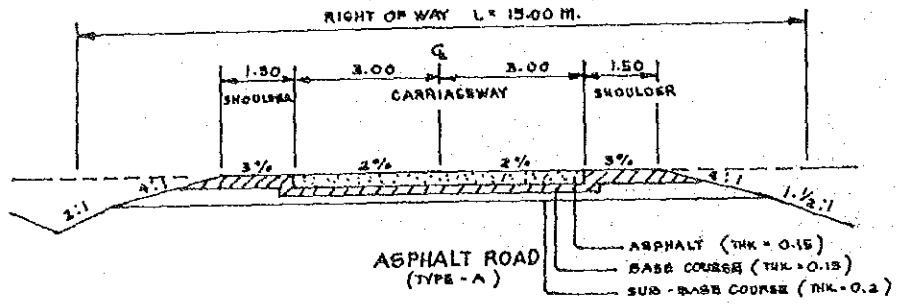
Source: DPWH, PED

Table 4-2-2 Rural Road Development Project

I t e m	Rehabilitation	Construction
1) Farm-to-Market Road		
Type A (km)	-	-
Type B (km)	5.5	-
Type C (km)	4.5	-
<u>Total (km)</u>	<u>10.0</u>	<u>0</u>
2) Farm Road		
Type D (km)	<u>0</u>	<u>15.0</u>
3) Multi-Purpose Pavement (place)	<u>0</u>	<u>20</u>

Note 1: Length of multi-purpose pavement shall be 150 l.m. per place

Figure 4-2-1 Standard Road Section



NOTE :
 MULTI-PURPOSE CONCRETE PAVEMENT (THK = 0.15) SHALL BE PROVIDED ON TYPE - C ROAD

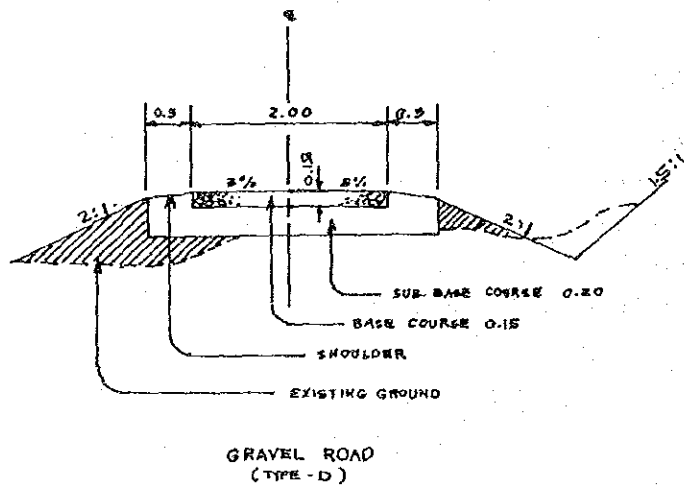
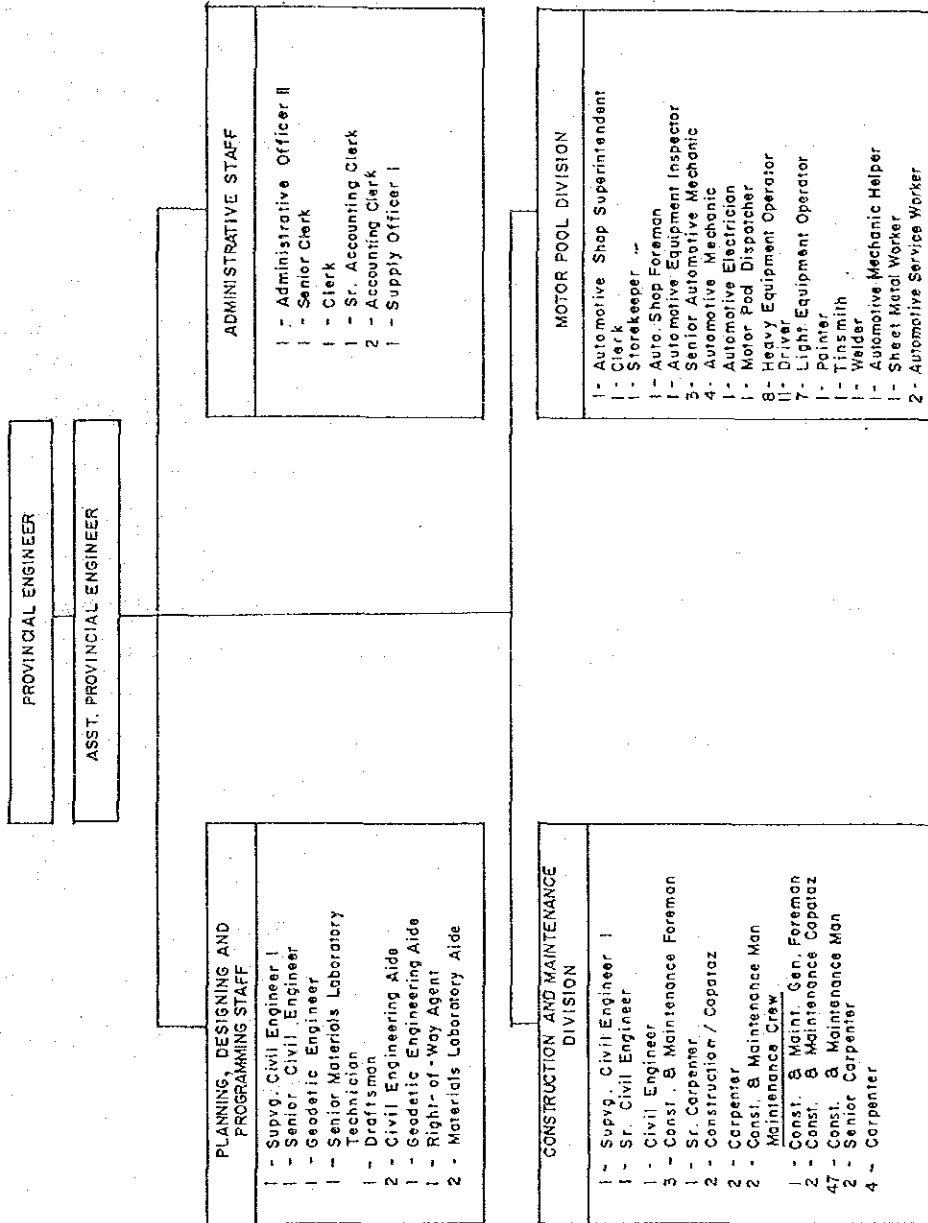


Figure 4-2-2 OFFICE OF THE PROVINCIAL ENGINEER



4-3 Village Water Supply Development

4-3-1 Present Condition

Water for domestic use in the Tagum-Angas area is generally taken from deep and shallow wells by manual pumps which are directly managed by the Barangay officials. There are 20 public wells which are composed of 15 deep wells and 5 shallow wells, and some private wells. (refer to Table 4-3-1)

Some of these wells are not functioning and confronted with inferior water quality because the water is contaminated with salt.

The total population served by public wells is approximately 2,100, which is only 38% of the population in the Tagum-Angas area. Therefore, 62% of the people in this area get water from other source such as privately-owned wells and others. Since the Tagum-Angas area is the difficult area to draw groundwater according to the geological survey, village water development is one of the strongest inhabitant's desire.

4-3-2 Basic Concept of Village Water Supply Development

Taking into consideration improvement of living environment of villages in the Project Area, it would be necessary to improve the village water supply system. Therefore, considering existing condition of water supply in the Tagum-Angas area, the village water supply system would be promoted as the Level II system, and supplied water to 70% of total population in the Area.

4-3-3 Village Water Supply Development Plan

1) General

The village water supply development plan is studied based on the following two components.

- Estimation of the water requirement.
- Preliminary design of village water system.

The scheme is composed of the farming water and rural water supply. The farming water includes water for livestock and washing farm product and farming machines.

2) Estimate of Water Requirement

a) Design Water Requirement

The water requirement is difficult from the mode of living to the form of livestock's raising. Considering water demand for domestic and livestock use, following criteria are applied for the design water requirement.

Livestock use:	Cattle -----	50 liter/head/day
	Carabao -----	50 liter/head/day
	Horse -----	45 liter/head/day
	Hogs -----	35 liter/head/day
	Goat -----	8 liter/head/day
	Chicken -----	0.6 liter/head/day
Washing use:	Truck, Tractor --	100 liter/head/day
	Plow, Hoe -----	5 liter/head/day
Domestic use:	Level II -----	60 liter/head/day

b) Water Demand

Considering trend of population and livestock, the water demand for village water supply at the year of 1955, 2000 and 2010 are as follows:

	1995		2000		2010	
	Head	cu.m/day	Head	cu.m/day	Head	cu.m/day
Livestock use:						
Cattle	510	26	560	28	670	34
Carabao	1,580	79	1,740	87	2,080	104
Horse	370	17	410	18	490	22
Hogs	3,500	123	3,850	135	4,370	153
Goat	910	7	1,010	8	1,210	10
Chicken	18,600	11	20,500	12	24,500	15
<u>Total</u>		<u>263</u>		<u>288</u>		<u>338</u>
Domestic use :	4,230	254	4,650	279	5,600	336
Others:		10		10		10
Average daily demand (q)		527		577		684
Maximum daily demand (1.3 q)		685		750		889
Maximum hourly demand (2.5 q)		1,318		1,443		1,710

3) Preliminary Design of Village Water Supply System

Gravity system which is most economical mean of village water supply would be considered as high priority. Water source would be the Tagum-Angas dam, and the facilities of the system is composed of a main pipe line, a reservoir, distribution pipe line and communal faucets. The preliminary plan of village water supply system based on the design criteria are summarized as follows:

Intake discharge:	889 cu.m/day
Water sources:	proposed Tagum-Angas dam
Facilities:	Main pipe (G.I pipe $\phi 8''$) L = 6.0 km
	Distribution pipe (G.I pipe $\phi 6''$) L = 5.0 km
	(G.I pipe $\phi 4''$) L = 6.0 km
	(G.I pipe $\phi 2''$) L = 8.0 km
	Reservoir V = 300 cu.m
	Communal faucet 70 sets

4) Organization for Operation and Maintenance

Village water supply facilities would be turned over to DPWH after implementation of the project. Afterward the facilities, the operation and maintenance would be transferred to Village Water Supply Association (VWSA) which will be established for operation and maintenance purposes.

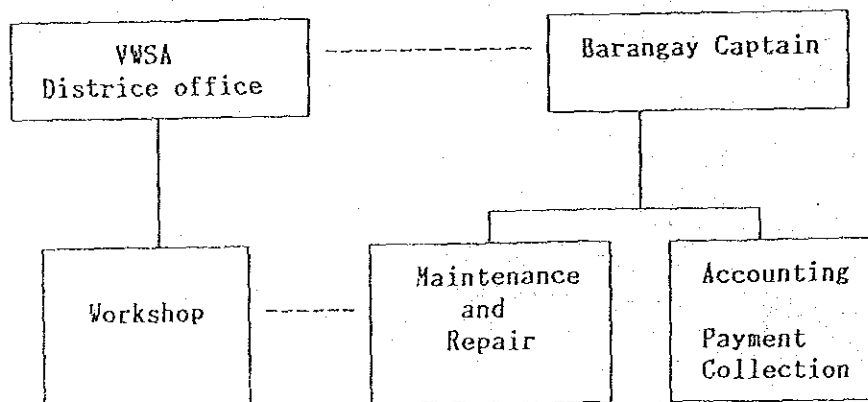
DPWH would assume the leadership of VWSA and beneficial Barangays for smooth operation and maintenance of the facilities. The operation and maintenance fee would be charged from beneficiaries in principle. The proposed organization of village water supply system is illustrated as below. (refer to Figure 4-3-1)

Table 4-3-1 List of the Existing Public Wells in Tagum-Angas Area

Location	Casing		Water LEV	CONST by	Date CONST	Status
	DIA	Depth				
Angas	4"	80'	50'	NAWASA	1962	(DW) Not Functioning
	4"	60'	40'	"	1962	(DW) "
	4"	94'	28'	DPWH	1987	(DW) Functioning
Buyabod	-	-	12'	DPWH	1984	(SW) Functioning
	5"	45'	27'	"	1987	(SW) "
Matalaba	4"	40'	10'	DPWH	1965	(DW) Functioning
	4"	60'	45'	NAWASA	1965	(DW) "
	4"	40'	10'	"	1960	(DW) "
Morales	-	-	7'	DPWH	1983	(SW) Functioning
	-	-	11'	"	1984	(SW) "
	-	-	15'	"	1985	(SW) "
Napo	5"	60'	10'	DPWH	1984	(DW) Functioning
Pantayin	4"	80'	52'	NAWASA	1965	(DW) Functioning
Tagum	6"	50'	18'	NAWASA	1962	(DW) Functioning
	4"	85'	39'	"	1962	(DW) "
	4"	94'	28'	DOWH	1987	(DW) "
Tamayo	5"	90'	75'	DPWH	1985	(DW) Functioning
	5"	20'	4'	"	1984	(SW) "
Tawiran	4"	80'	40'	PACD	1961	(DW) Functioning
	5"	60'	25'	DPWH	1984	(DW) "

Source: DPWH

Figure 4-3-1 Proposed Organization for Operation and Maintenance of Village Water Supply



CHAPTER 5. RURAL INFRASTRUCTURE DEVELOPMENT

CHAPTER 5 RURAL INFRASTRUCTURE DEVELOPMENT

5-1 Rural Electrification Development

5-1-1 Present Condition

The electric power consumed in the Tagum-Angas area is supplied by the Marinduque Electric Cooperative, Inc. (MARELCO) through the Marcopper Mining Corporation. Seven Barangays are energized. The transmission line is aligned along the national and provincial roads to connect Barangays. The average diffusion rate is 22% only, which is lower than the average rate of the province (25%). The transmission line and other related facilities are provided and electric power is supplied 24 hours a day. However, the transmission line is often closed by strong wind and heavy rain. The total length of existing transmission line in the Tagum-Angas area is about 12 km.

5-1-2 Development Plan

1) Basic Concept

Taking improvement of living environment of a rural area into consideration, it would be necessary to improve the rural electrification system. Therefore, considering the existing condition of the rural electrification in the Tagum-Angas area, optimum development plan of rural electrification would be proposed.

2) Selection of Project

Based on the development concept, the transmission line should be extended to the rural area. The average diffusion rate will be increased by 75% in 2010. (refer to Table 5-1-1)

The following rural electrification plans are proposed for development.

Objective:	To promote rural electrification and expand the energized area.		
Target household:	820 household		
Description of the program	Transmission line (69 kv)	L = 8.0 km	
	Distribution line 1 ϕ	L = 3.0 km	
	Secondary	L = 1.5 km	
Diffusion rate:	75%		

3) Electric Power Demand

The future demand of electric power on the target year 2010 is calculated based on the electric power supply plan on long-term development. And also staged power demands in 1995, 2000 are estimated. Electric power demand has been separately made for residential, small commercial, large commercial, industrial, public building, and for street light demands. The energy requirement will increase to 286 MW in 1995, 447 MW in 2000, and 761 MW in 2010. (refer to Table 5-1-1)

4) Operation and Maintenance

Proposed rural electrification facilities would be turned over to MARELCO after completion of the project. Afterward MARELCO would be in charge of operation and maintenance.

Table 5-1-1 Future Electric Power Demand

ITEM	YEAR			
	1989	1995	2000	2010
POTENCIAL CONSUMERS (Household)	804	1,000	1,100	1,340
RESIDENTIAL CONSUMERS	180	500	720	1,000
Diffusion rate (%)	22	50	65	75
KWH/consumers/month	29	25	25	30
Demand (MWH/year)	63	150	216	360
SMALL COMMERCIAL CONSUMERS	7	18	30	100
KWH/consumers/month	16	15	15	15
Demand (MWH/year)	1	3	5	18
LARGE COMMERCIAL CONSUMERS	6	14	23	50
KWH/consumers/month	140	250	250	250
Demand (MWH/year)	10	42	69	150
INDUSTRIAL CONSUMERS	-	1	1	1
MWH/consumers/month	-	3	6	9
Demand (MWH/year)	-	36	72	108
PUBLIC BUILDING CONSUMERS	2	5	8	12
KWH/consumers/month	94	145	145	145
Demand (MWH/year)	2	9	14	21
STREET LIGHT UNITS	2	6	10	20
KWH/consumers/month	57	22	22	22
Demand (MWH/year)	1	2	3	5
TOTAL DEMAND (MWH/year)	77	242	379	662
Energy losses (MWH/year)	15	44	68	99
Energy losses (%)	20	18	18	15
Energy requirement (MWH/year)	92	286	447	761
Average load (KW)	11	33	52	88
Load factor (%)	28	32	33	35
Peak demand (KW)	39	103	158	251

Source: Marinduque Electric Cooperation, Inc.
: Estimate of Study Team.

Notes : SMALL COMMERCIAL - Commercial establishments & Industrial establishment with demand up to 25 KW demand.

LARGE COMMERCIAL - Commercial establishments with more than 25 KW demand.

5-2 Traffic System Development

5-2-1 Present Condition

The traffic system in the Tagum-Angas area consists of trucks, jeepneys and tricycles in private. The jeepney is commonly used as means of transport and is operating with passenger capacity of 18 person/unit, because of the few traffic volume. The traffic volume becomes quite small after sun-set and the jeepneys hardly move around. The main transported commodities are groceries, bottled soft drinks, copra, rice and general cargoes. However, some remote areas are not served by motor vehicles due to lack of roads. Inhabitants, therefore, hike or go by horse. Since there exist only a small number of waiting sheds, it is difficult for inhabitants to catch a jeepney without exposing to rain and strong sun-shine, especially during rainy season. According to the traffic volume survey conducted by the Study Team, the traffic volume at the national road which runs through the Tagum-Angas area is about 362 vehicles/day. The existing transportation services through the Tagum-Angas area are as follows:

<u>Service Road</u>	<u>Number of Unit</u>	<u>Frequency of Trip</u>	<u>Service Hour</u>
Sta. Cruz to Torrijos	18	18	5:30 to 17:00
Sta. Cruz to Matuyatuya-Bonliw	3	3	6:00 to 17:00
Sta. Cruz to Napo-Plong Prang	3	3-6	6:00 to 17:00
Sta. Cruz to Tamayo-Alobo	4	4-6	6:00 to 17:00

5-2-2 Development Plan

1) Basic Concept

Taking into consideration increase of a number of passengers and quantities of cargoes transported by jeepneys, forecast of the future traffic volume and the proposed road development plan, it would be necessary to introduce more number of waiting sheds. The future traffic volume of the national road is shown below.

Forecast of Traffic Volume

<u>Road Section</u>	<u>1986</u>	<u>1989</u>	<u>1995</u>	<u>2000</u>	<u>2010</u>
Sta. Cruz - Torrijos	311	362	464	549	634

Note: 1. Tricycles and motor cycles are not included in the list.
2. Estimated by the arithmetical progression method.

2) Selection of Project

Based on the development concept, the waiting shed would be proposed along the national, provincial and Barangay roads at interval of one kilometer.

Objective: To improve present transport system of the Tagum-Angas area
Target population: 8,000 persons
Description: Construction of waiting shed
A = 3 m x 3 m ----- 17 units

3) Operation and Maintenance

The waiting shed would be turned over to DPWH after completion of the project.

5-3 Education Development

5-3-1 Present Condition

1) Elementary Education

There are two elementary schools in the Area, Tagum elementary school and Napo elementary school. Most education services are provided by the Marinduque Division of the Department of Education Culture and Sports (DECS). The educational facilities are inadequate and usually located at the center of Districts, which makes it inaccessible to attend school from distant Barangays, particularly in the rainy season. Some of the school buildings were damaged by past typhoons. The administration is making effort to rehabilitate and construct school houses. But the progress is slow because of the insufficiency and uncertainty of budget allocation.

2) Secondary Education

There are two damaged schools in the Barangays of Tagum and Napo. The school furnitures, tools and equipment and school supplies are insufficient. And remarkable ratio of the students are dropping out the schools due to poverty, labor needs for farming and poor school facilities.

5-3-2 Development Plan

1) Basic Concept

Taking into consideration improvement of the education system in the Tagum-Angas area, it would be necessary to carry out a plan for the consolidation of the educational facilities. Therefore considering the existing condition of the educational organization in the province, DPWH school building program would be first priority.

2) Development Strategy

The educational development plan would be proposed based on following consideration.

- The consolidation plan of the existing educational facilities should be promoted.
- The basic training of sanitation would be contemplated.

3) Selection of Project

Based on the development strategy, the educational facilities improvement projects were selected as follows:

Objective:	Improvement of educational facilities	
Description:	Rehabilitation of Tagum E/S	6 classes
	Rehabilitation of Napo E/S	3 classes
	Construction of school toilet with septic tank	2 units

4) Operation and Maintenance

Educational facilities would be turned over to Department of Health (DOH) after completion of the project. Afterward operation and maintenance of the facilities would be transferred to Department of Education, Culture and Sports (DECS). DOH would assume the leadership of them for smooth operation and maintenance of the school toilet.

