SUMMARY AND SPECIFIC RECOMMENDATIONS

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1. Introduction

This is a summary of the Feasibility Study on the Aguan Valley Agricultural Development Project (Saba - Olanchito Area). The report of this Study consists of the following three volumes:

Volume I	: Main Report	(English & Spanish)
Volume II	: Appendices	(English)
Volume III	: Drawings	(English)

2. Background

2.1 Agriculture in the Republic of Honduras is the country's most important economic sector and the contribution of its production to total national commodity export accounted for 60% in 1983.

The agricultural development policies of the government have laid the basis for the self-sufficiency of basic grains, the increase of commodity export, the promotion of balanced development and the improvement of income distribution and the quality of life among farmers.

2.2 Approximately 22% of the estimated total land area with potential for agricultural development is located in the Aguan Valley and the development of this region is important for the social and economic improvement of the country such as the promotion of agrarian reform programs, the increase of agricultural production for export, the generation of new job opportunities, the rationalized distribution of population. In this context, the Lower Aguan Project has been carried out since 1970.

2.3 Considering the importance of the continuous development of the Valley, the Government of Honduras requested the Government of Japan the implementation of the Feasibility Study on the Middle Aguan Basin between Saba and Olanchito. The scope of work for the Feasibility Study was signed between the governments of Japan and Honduras and in accordance with this S/W the Japanese Government dispatched a mission to carry out the F/S between February and October, 1984.

2.4 The objective of the Feasibility Study is to evaluate the technical and economic feasibility of the development plans which include: introduction of new irrigation, drainage and road systems, improvement and consolidation of existing farm land and, development of uncultivated farm land.

3. Brief Description of the Study Area

3.1 The study area is about 21,000 ha extending to the mid-stream basin of the Aguan River between Saba and Olanchito, Department of Yoro.

3.2 The climate of the area shows a characteristic seasonal pattern with a dry period from January to May and a wet period for the remainder of the year.

In Olanchito, the mean annual rainfall is about 1,000 mm and the mean annual temperature is 26°C.

Mean monthly temperature and rainfall is set out in the table below by the meteological station in Olanchito which is located within the study area.

Month	1	2	3	4	5	6	7	8	9	10	11	12	Annual mean	Remarks
Temperature °C	23.5	24.4	25.3	27.9	30.0	28.2	27.0	26.9	27.1	26.0	24.9	24.1	25.9	1972 - 1978
Rain fall mm	48	15	39	27	50	183	115	125	129	138	122	108	1,099	"

3.3 The major rivers in the study area are the Aguan River and its tributaries, the Mame and the Jaguaca rivers. The hydrological dimensions are summarized in the following table.

River	Citchment Area	River Length	Mean Flow	Low Flow	Flood Flow	Remarks
Aguan	4,714 km^2	181 km	51.6 m^3/s	5.4 m^3/s	2,250 m^3/s	Pte.Olanchito
Aguan	7,545	289	113.5	14.8	2,950	Pte. Saba
Mame	2,069	79	25.0	3.1	810	Pte. Mame
Jaguaca	154	12	2.3	0.3	60	Pte. Jaguaca

3.4 Topography of the area consists of a plateau on the left bank, terrace plain on the right bank and diluvial plain along the Aguan River. The soil series distributed in these lands are classified into eight groups as follows:

Soil Series	Symbol	Fertility	Area (ha)	%
1. Fine Texture, Well Drained Alluvium	Ab	Medium	2,990	14
2. Aguan Clay Loam	Ag	High	6,500	31
3. Tepuesteca Loam	Te	High	780	4
4. Olanchito Sandy Loam	Ol	Medium	2,600	13
5. Ilanga Sandy Clay	Il	Medium	520	3
6. Taujica Clay Loam	Tj	Medium	1,230	6
7. Jahuaca Clay Loam	Ja	High	5,850	28
8. Fine Texture Poorly Drained Alluvium	Am	Medium	200	1

Among the aforementioned series, only Symbols Ol with gley horizon and Am with poorly drained alluvial soil present limited factors for cultivation of crops. The remaining soil series with high to medium fertility are apt for allocation to almost any kind of crops. Consequently, it can be said, from the agronomical view point that the study area has high potentiality for agricultural development.

3.5 The water quality of rivers flowing in the study area is thought to be no problem complying with the Japanese Agriculture Water standards and potable water standards.

As far as hydrogeological features of the area are concerned, the alluvium plain was confirmed to have fair aquifer reserves, i.e., the riverbed water in some part and deep groundwater in a continuous belt zone.

The volume of groundwater flow is estimated at two points of the area to be 0.0092 m^3/s and 0.0082 m^3/s, which is considered not to satisfy the requirements for the irrigation system but only for drinking water, industrial water, small-scale farming, etc.

3.6 Estimates of the areas devoted to agricultural purposes and of areas of alienated land are given in the table below. Of areas for agricultural purposes, 38% is allocated to pasture and 28% remains uncultivated. The main crops cultivated in the area are maize and beans followed by rice and oranges. Very few areas are cultivated for cassava and plantain.

	Agricultural Land				Non-Agricultural Land				Total
	Cultivated Area	No Use	Pasture	Sub total	Urban Area	Road & River	Area with Slope	Sub total	
Area (ha)	3,273	5,839	7,712	16,824	279	1,521	2,031	3,831	20,655
%	16.0	28.0	38.0	82.0	1.0	7.0	10.0	18.0	

3.7 Already 26 cooperatives with 1,012 families are settled in the study area. The total cultivated areas distributed to these cooperatives are 7,681 ha. On the other hand, 87 families of independent farmers are settled in the upper basin of the Aguan River engaging mainly in cattle farming.

3.8 The consolidation of socio-economic infrastructures has inadequately developed in the area. Furthermore, the improvement of drainage and road systems has not been attained yet. No systematic irrigation works are to be found.

3.9 There are no artificial drainage facilities except for the cross culvert of roads. There are low land areas with poor drainage between Saba and the Jaguaca River. The existing small streams are utilized as drainage canals and some areas are exposed to regular flooding.

The extent of flooding within the study area has been estimated as follows:

Return Period	1:2	1:3	1:5	1:10
Flooded Area (ha)	3,900	5,300	7,000	7,300

4. Development Concepts

4.1 The irrigation scheme has been proposed based on the 5 years return period and irrigable area of 9,100 ha. Water for irrigation will be diverted from surface water of rivers even in dry season and irrigated by furrow. Four head works have been designed on the Aguan (two), on the Mame and on the Taguaca.

Principal features of the irrigation system are as follows:

Facility	Quantiy	Remarks
Head works	4	
Siphon	1	ϕ. 1000
Pump Station	2	ϕ 350 x 2, ϕ 700 x 2
Main Canal	73,650 m	Q = 0.206 - 4.059 m^3/s I = 1/1000 - 1/2500
Secondary Canal	81,000 m	Q = 0.089 - 0.357 m^3/S I = 1/250 - 1/600

4.2 The drainage scheme has been set up taking into consideration of the utilization of existing drainage canals as far as possible. The area between Saba and the Jaguaca River where is exposed to poor drainage dense drainage canal network will be constructed. As measures for the alleviation of flooding the construction of a dyke with 1.5 -2.5 meters freeboard has been designed along the right bank of the Aguan River.

Proposed drainage facility is as follows:

Facility	Length	Remarks
Canal (Farm)	64,600 m	Q = 3.8 - 15.2 m^3/s I = 1/200 - 1/550

4.3 One main road passes the study area to link Saba with Olanchito. The development of in-farm road is insufficient except in Sector 5 (Saba - Jaguaca River).

In the road planning of the Project, one access road with effective width of 6 m has been proposed along the right bank of the Aguan River. Apart from this access road, an in-farm road with effective width of 4 m will be constructed at a density of 1 km intervals. Only the improvement works of the existing road has been considered on the left bank of the Aguan River.

Proposed roads are as featured below.

Facility	Quantity	Remarks
(Right Bank)		B = 6.0 m
Access Road	47,500 m	New : 37,150 m Repair: 10,350 m
		B = 4.0 m
In-Farm Road	120,650 m	New : 42,050 m Repair: 78,600 m
(Left Bank)		B = 5.0 m
Access Road	34,500 m	Repair: 34,500 m

4.4 With the completion of pavement works, it is expected that the highway between Saba and Olanchito would contribute greatly to the development not only for the project area but also for the surrounding areas. In this Feasibility Study, the work to evaluate the economic impacts to be brought by the implementation of pavement works has not been carried out, because the Study has been focused on the development of agriculture and livestock sectors. For reference, cost estimation is presented in Appendix J.

4.5 Land Use and Cropping Plan

(1) In irrigated Area

CROP		Cultivated Area (ha)	Yield (t/ha)	Production (t)	Price (Lps/t)	Gross Return (Lps)	Unit Cost (Lps/ha)	Total Cost (Lps)	Net Return (Lps)
MAIZE	A	(3,712) 1)	2.5	9,280	350	3,248,000	657	2,438,784	809,216
	P	(4,604)	5.0	23,020	350	8,057,000	745	3,429,980	4,627,020
RICE	A	302	2.6	785.2	460	361,192	800	241,600	119,592
	P	1,577	5.0	7,885	460	3,627,100	1,020	1,608,540	2,018,560
BEANS	A	(258)	1.1	283.8	920	261,096	500	129,000	132,096
	P	(2,573)	1.5	3,859.5	920	3,550,740	570	1,466,610	2,084,130
SOYBEAN	A	-	-	-	-	-	-	-	-
	P	(1,200)	2.5	3,000	555	1,665,000	667	800,400	864,600
CASSAVA	A	21	9	189	160	30,240	800	16,800	13,440
	P	221	20	4,420	160	707,200	2,193	484,653	222,547
TARO	A	-	-	-	-	-	-	-	-
	P	200	35	7,000	160	1,120,000	3,264	652,800	467,200
PLANTAIN	A	7	15	105	150	15,750	1,087	7,609	8,141
	P	207	35	7,245	150	1,086,750	1,687	349,209	737,541
ORANGE	A	130	25	3,250	110	357,500	1,100	143,000	214,500
	P	130	50	6,500	110	715,000	1,701	221,130	493,870
COCOA	A	-	-	-	-	-	-	-	-
	P	2,300	1.5	3,450	3,245	11,195,250	1,478	3,399,400	7,795,850
MANGO	A	-	-	-	-	-	-	-	-
	P	300	30	9,000	160	1,440,000	1,102	330,600	1,109,400
PAPAYA	A	-	-	-	-	-	-	-	-
	P	50	25	1,250	160	220,000	1,230	61,500	138,500
OTHER FRUITS	A	15	10	150	80	12,000	10	150	11,850
	P	15	12	180	80	14,400	15	225	14,175
PINEAPPLE	A	-	-	-	-	-	-	-	-
	P	400	25	10,000	360	3,600,000	2,045	818,000	2,782,000
TOMATO	A	-	-	-	-	-	-	-	-
	P	(600)	40	24,000	110	2,640,000	2,662	1,597,200	1,042,800
TOTAL	A	4,445 2)		14,043		4,285,778		2,976,943	1,308,835
	P	14,377 3)		110,809.5		39,618,440		15,220,247	24,398,193

Note: 1) Figure in Parenthesis means cultivated area for postrera season
2) Primavera season: 2,249 ha, Postrera season: 2,196 ha
3) Primavera season: 9,100 ha, Postrera season: 5,277 ha
4) A: Actual P: Plan

(2) In Non-irrigated Area

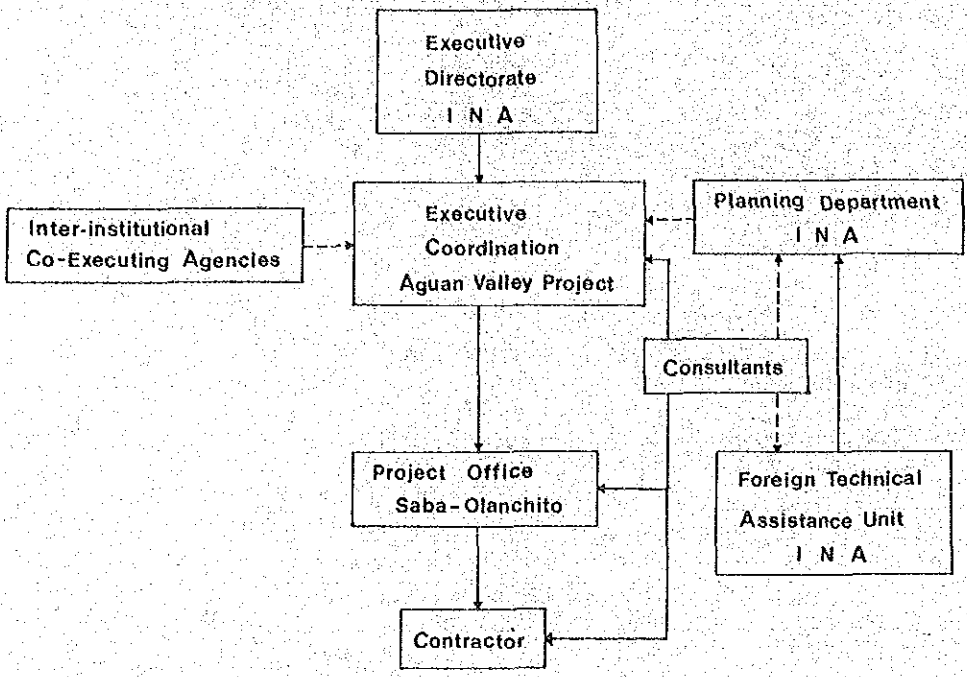
CROP		Cultivated Area (ha)	Yield (t/ha)	Production (t)	Price (Lps/t)	Gross Return (Lps)	Unit Cost (Lps/ha)	Total Cost (Lps)	Net Return (Lps)
MAIZE	A	-	-	-	-	-	-	-	-
	P	(600) 4)	3	1,800	350	630,000	671	402,600	227,400
CASSAVA	A	-	-	-	-	-	-	-	-
	P	400	9	3,600	160	576,000	800	320,000	256,000
TARO	A	-	-	-	-	-	-	-	-
	P	400	16	6,400	160	1,024,000	1,180	472,000	552,000
COCOA	A	-	-	-	-	-	-	-	-
	P	300	0.7	210	3,240	680,400	790	237,000	443,400
MANGO	A	-	-	-	-	-	-	-	-
	P	200	15	3,000	160	480,000	950	190,000	290,000
ORANGE	A	-	-	-	-	-	-	-	-
	P	2,800	25	70,000	110	7,700,000	900	2,520,000	5,180,000
PASTURE	A	7,712	6	46,272	16.6	768,115.2	20	154,240	613,875.2
	P	2,300	10	23,000	16.6	381,800	45	103,500	278,300
TOTAL	A	7,712		46,272		768,115.2		154,240	613,875.2
	P	7,000		108,010		11,472,200		4,245,100	7,227,100
GRAND TOTAL	A	12,157 5)		60,315		5,053,893.2		3,131,183	1,922,710.2
	P	21,377 6)		218,819.5		51,090,640		19,465,347	31,625,293

Note: 5) Figure in Parenthesis means cultivated area for postrera season
6) Primavera season: 9,961 ha, Postrera season: 2,196 ha
7) Primavera season: 15,800 ha, Postrera season: 5,577 ha
8) A: Actual P: Plan

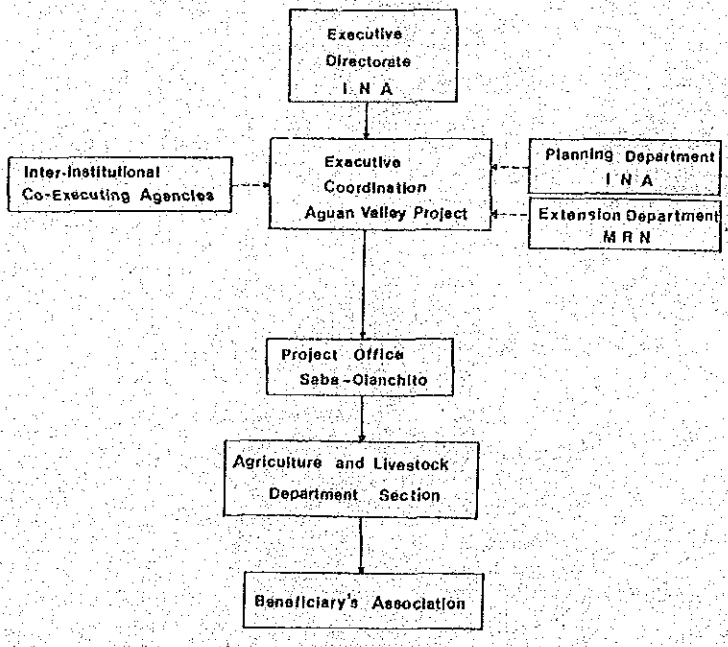
5. Project Implementation

5.1 Construction Period is to be 7 years including preparatory work period.

5.2 INA is to be the executing agency of the Project and the proposed organization chart is illustrated below.



5.3 After the commencement of the Project, INA is to work closely with MRN and other organizations concerned in order to provide farmers with the necessary extension and training.



Project Cost

Unit : 1,000 Lps

Description	F / C	L / C	Total
1. Preparatory Works	-	282.0	282.0
2. Construction Cost	47,899.8	28,367.6	76,267.4
3. O/M Equipment Cost	1,195.8	-	1,195.8
4. Administration Cost	-	1,660.0	1,660.0
5. Engineering Service	11,590.0	1,160.0	12,750.0
Sub Total	60,685.6	31,469.6	92,155.2
6. Physical Contingency	6,068.6	3,147.0	9,215.6
7. Price Escalation	16,630.9	10,849.6	27,480.5
Total	83,385.1	45,466.2	128,851.3

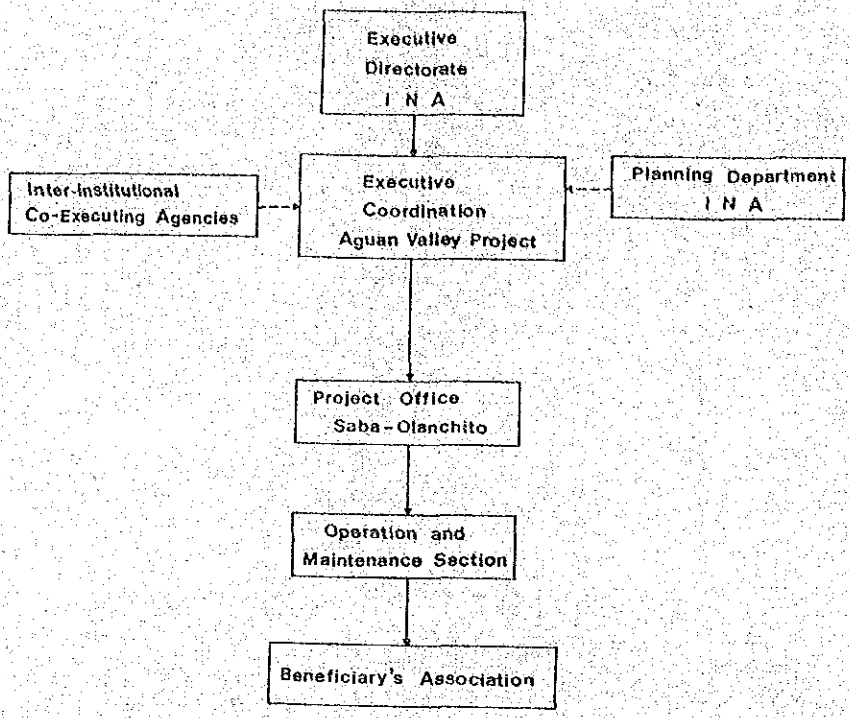
Annual Operation and Maintenance Csot

Description	Area (I)	Area (II)	Total
Maintenance Cost for Civil Work	109.7	111.1	220.8
O/M Cost of Equipment	511.0	512.5	1,023.5
Running Cost of Pump	161.2	13.4	174.6
Total	781.9	637.0	1,418.9

Replacement Cost

	Area (I)	Area (II)	Total	Remarks
Pump	1,840.2	731.9	2,572.1	Durable Period (20 years)
Gate	435.8	378.1	813.9	" (30 years)
Total	2,276.0	1,110.0	3,386.0	

5.4 The operation and maintenance in this project will include but not limited : irrigation and drainage canals, road and other irrigation facilities. Proposed organization is as set out below.



5.5 Total construction cost has been estimated to be 128,851 thousand lempiras, of which 83,385 thousand lempiras have been allocated to the foreign currency portion and 45,466 thousand lempiras to local currency. Breakdown of construction costs, annual operation and maintenance costs and replacement costs are as set out below.

5.6 The project life is 40 years including 24 months of preparatory period and 60 months construction period.

Economic internal rate of return (EIRR) of the project is estimated to be 13.00%.

5.7 Sensitivity analyses are made in respect to construction cost, gross production value and projection cost. It is found that economic returns of the project are influenced by these factors.

Factors of sensitivyty analyses	EIRR
(a) 10% increase in construction cost	12.11
(b) 10% decrease in benefit	12.02
(c) 10% increase in construction cost and 10% decrease in benefit	11.16

5.8 According to the results of financial analyses (FIRR=13.18%), it is predicated that the project will produce sufficient benefits for farmers under average farming conditions to permit the repayment of the construction costs.

6. Conclusion

As a result of the feasibility study, it has been concluded that the implementation of the Project for the agricultural development of the Aguan Valley (Saba-Olanchito area) is justified in economical, financial, technical and social aspects.

7. Specific Recommendations

7.1 Earlier Commencement of the Project

In view of the socio-economic impact of the project not only on the project area but also on the nation, a recommendation will be made for the immediate commencement of the project.

7.2 Establishment of Executing Agency

Because the project involves many aspects as mentioned before, the establishment of a new executing agency of the project like that for the lower Aguan Project office integrated with INA and other related organizations is recommended.

7.3 Construction

(1) Before the commencement of the project, prudent coordination should be carried out in respect to land acquisition of proposed sites for the construction of facilities.

(2) Taking into account the earlier generation of benefits and land acquisition of construction sites, the implementation of phased development of the project is advisable. For this purpose the project area should be classified into two areas divided by the stream of the Jaguaca River and the area between Saba and the Jaguaca River should be developed earlier.

(3) Farmers who cannot cultivate their land due to the implementation of construction works should be given priority for being employed as construction laborers.

7.4 Social Infrastructure

(1) The provision and improvement of such social infrastructures as water supply, electricity, education and public health system are essential factors for the consolidation of farmer's settlement in the project area.

(2) Water resources in the tributaries and small streams of the project area are used as drinking water for farmers. So, from the viewpoint of sanitation, existing wells should be examined.

(3) Presently the mountain areas of the Aguan River Basin have been exploited. Because forestal resources in the mountain have important effect on groundwater cultivation, soil conservation and alleviation of flood damage, it is suggested that the exploitation of mountain area should be carried out associated with afforestation program.

7.5 Project Management and Operation and Maintenance

(1) The success of the project will largely depend on the management, operation and maintenance of the project facilities. In this sense, INA has to play a leading role in coordinating related public institutions and establishment of the management organization.

(2) Main and secondary irrigation/drainage canals are to be maintained by the management and tertiary irrigation, on the other hand, canals are to be maintained by farmers.

7.6 Agricultural Support Services

(1) For successful cultivation of new crops with which farmers are not familiar, the level of agricultural support services (extension, training and research) provided by governmental organizations should be elevated. For this purpose, close coordination between the project executing agency and agricultural experimental station, research institute, extension section of INA and MRN should be indispensable.

(2) Without financial assistance, farmers cannot prepare necessary inputs for the cultivation of new crops. The executing agency has to make an arrangement with BANADESA and other credit-lending organizations to meet the farmer's requirements for this purpose.

7.7 Livestock

In order to attain further development, integrated extension service will be required; desease-prevention method should also be established. Rationalization of commercialization canal and market, improvement of existing plant, introduction of feed plant and fresh fish culture are other factors to be envisaged for their realization.

7.8 Establishment of Pilot Farm

The total project area comprises about 21,000 ha, in which crops are cultivated without application of artificial irrigation

systems. In view of future introduction of non-traditional new crops and mechanized agriculture, the establishment of pilot farm with the provision of irrigation and drainage systems and advanced crop cultivation technology in advance to the implementation of the Project will contribute to the success of the Project.

TABLE OF CONTENTS

LOCATION MAP

SUMMARY AND SPECIFIC RECOMMENDATIONS

GLOSSARY OF ABBREVIATIONS

CHAPTER 1 : INTRODUCTION 1-1

1.1 Background of the Study 1-1

1.2 Scope of the Study 1-2

CHAPTER 2 : BACKGROUND OF THE PROJECT 2-1

2.1 Introduction 2-1

2.2 National Economy 2-2

2.3 Development Strategy 2-3

2.4 Agriculture 2-7

2.5 Agrarian Reform 2-9

CHAPTER 3 : THE PRESENT SITUATION OF THE STUDY AREA 3-1

3.1 General Description of the Study Area 3-1

3.2 Climate and Hydrology 3-1

3.3 Water Quality 3-10

3.4 Hydrogeology and Groundwater 3-12

3.5 Soil 3-21

3.6 Land Use 3-28

3.7 Agricultural Production 3-29

3.8 Agarian Reform 3-43

3.9 Agro-Economy 3-52

3.10 Agricultural Market 3-56

3.11 Agricultural Infrastructures 3-67

3.12 Transport and Social Infrastructures 3-68

CHAPTER 4 : FORMULATION OF THE BASIC DEVELOPMENT CONCEPTS 4-1

4.1 Objective 4-1

4.2 Basic Development Concepts 4-1

4.3 Farm Operation Plan 4-6

4.4 Livestock 4-14

4.5 Irrigation and Drainage Plan 4-19

4.6 Land Preparation and Farm Land Development Plans 4-35

4.7 Facility Plan 4-37

4.8 Social Infrastructure Plan 4-40

CHAPTER 5 : PROJECT IMPLEMENTATION PLAN..... 5-1

5.1 Construction Program 5-1

5.2 Project Cost 5-2

5.3 Project Executing and Management Organization ... 5-4

CHAPTER 6 : PROJECT EVALUATION 6-1

6.1 Benefits 6-1

6.2 Economic Evaluation 6-2

6.3 Financial Evaluation 6-3

6.4 Socio-economic Evaluation 6-6

6.5 Evaluation of the Project 6-7

6.6 Conclusion 6-7

CHAPTER 7 : PHASED DEVELOPMENT CONCEPTS 7-1

7.1 General Considerations 7-1

7.2 Amount of Construction Works in Phased Development Concepts 7-1

7.3 Comparison of Proposals of Whole-in-one Development Plan and Phased Development Plan 7-2

CHAPTER 8 : INTEGRATION WITH THE MASTER PLAN 8-1

8.1 The Master Plan 8-1

8.2 The Integration of the Feasibility Study with the Master Plan 8-1

LIST OF FIGURES

		Page
S-1	General Plan	
S-2	Existing Land Use Map	
S-3	Soil Map	
S-4	Land Classification	
S-5	Groundwater Map	
S-6	Flood Area Map	
S-7	Land Use Plan	
3-1	Aguan River Basin	3-72
3-2	The Entire Catchment Basin of the Aguan River at Pte. Saba	3-73
3-3	Mean Monthly Rainfall for Upper Aguan (1973-1983)	3-74
3-4	Annual Rainfall and Runoff	3-75
3-5	Pattern of Mean Monthly Rainfall and Runoff	3-76
3-6	Frequency-Intensity-Duration-Curve	3-77
3-7	Pattern of Rain and Runoff from May 1980 to Apr. 1981	3-78
3-8	Pattern of Rain and Runoff from May 1982 to Apr. 1983	3-79
3-9	Investigation Point for Water Quality, Hydrogeology and Groundwater	3-80
3-10	Aguan Valley Geological Profile (A-B)	3-81
3-11	Aguan Valley Geological Profile (C-D)	3-82
3-12	Pit and Boring Point	3-83
3-13	Main Road Network in the Aguan Valley	3-84
4-1	Development Area	4-42
4-2	Rotation of Crops Within a Single 12 Month	4-43
4-3	Irrigation System (Plan 1)	4-44
4-4	Irrigation System (Plan 2)	4-45

		Page
4-5	Irrigation System (Plan 3)	4-46
4-6	Irrigation System (Plan 4)	4-47
4-7	Flow Chart of Irrigation Study	4-48
4-8	Block Model of Drainage Area	4-49
4-9	Schematic Irrigation Area	4-50
4-10	Potential Evapotranspiration	4-51
4-11	Flow Chart of Study for Drainage	4-52
4-12	Section of Dyke	4-53
4-13	Relation between Flood Discharge and Cost & Benefit	4-54
4-14	Cost and B/C	4-54
4-15	Standard Farm Lot	4-55
4-16	Farm Road Network	4-56
4-17	Section of In-farm Road	4-56
4-18	Location of Social Infrastructures	4-57
5-1 (1)	Project Implementation Schedule for Whole-in-one Development Plan	5-9
5-2 (2)	Project Implementation Schedule for Phased Development Plan	5-10

LIST OF TABLES

		Page
3-1	Rainfall Correlation Chart	3-85
3-2	Annual Rainfall and Runoff	3-86
3-3	Pattern of Mean Monthly Rainfall and Runoff	3-86
3-4	Mean Monthly Rainfall	3-87
3-5	Mean Monthly Runoff at Pte. SABA	3-88
3-6	River Flow at Pte. SABA	3-89
3-7	Maximum Mean Daily Runoff for Each Year (Pte. SABA)	3-89
3-8	Probability of Maximum Discharge	3-90
3-9	Chemical Characteristics	3-91
3-10	Soil Properties	3-92
3-11	Actual Land Use of Study Area	3-93
3-12	Cultivated Acreage of Cooperatives	3-94
3-13	Yield of Maize, Beans and Rice	3-95
3-14	Farm Management in Cooperatives	3-96
3-15	Settlers and Deserters for Each Cooperative during 1978 - 1980	3-97
3-16	Public Health Center	3-98
3-17	General Feature of Primary School in Olanchito	3-99
3-18	Registered Pupils by Grade and for Year in Rural School	3-100
4-1	Future Land Use Plan in Arable Area	4-58
4-2	Summary of Crop Net Return/ha	4-60
4-3	Staged Introduction of New Crops in Case 4	4-61
4-4	Intake Rate Test	4-62
4-5	Maximum Gross Water Requirement	4-63
4-6	River Discharge at Intake Point (in Drought)	4-64

		Page
4-7	Expected Benefit by Dyke	4-65
4-8	Benefit and Cost for the Construction of Dyke	4-66
5-1	Summary of Cost Estimation (Case 1)	5-11
5-1	Summary of Cost Estimation (Case 2)	5-12
5-2	Summary of Annual Disbursement Schedule (Case 1)	5-13
5-2	Summary of Annual Disbursement Schedule (Case 2)	5-14
6-1	Present Situation of Cultivated Area	6-8
6-2	Agricultural Income in 1984	6-9
6-3	Without Project Situation	6-10
6-4	Economic Cost	6-11
6-5	EIRR	6-12
6-6	Sensitivity Analysis (EIRR)	6-13
6-7	FIRR	6-14
6-8	Sensitivity Analysis (FIRR)	6-15
6-9	Cash Flow Case	6-16
8-1	Summary of Master Plan	8-2

CHAPTER 1 : INTRODUCTION

CHAPTER 1 INTRODUCTION

1.1 Background of the Study

In Mid-1983, according to CONSUPLANE estimates, Honduras had a population of 4.1 million, which has been growing at the very high rate of 3.5% per year.

It is estimated that about 62% of the population live in rural areas where the average growth rate is 2.4% per year, implying a strong trend in rural-urban migration.

Agriculture in the Republic of Honduras is the country's most important economic sector, accounting directly for 30% of Gross Domestic Product (GDP) and indirectly for a significant proportion of other economic activities, it provides employment for 58% of the economically active population and generates more than 80% of export economy.

In 1983, according to CONSUPLANE/UN estimates, the Aguan Valley had an estimated population of 188,000, which has been growing at an average rate of 5.6% per year since the last census in 1974.

Agriculture in the Aguan Valley is also the most important sector, although its contribution to Gross Regional Product (GRP) has fallen from 80% in 1974 to 74% in 1979 and is expected to fall further to 59% by 1985.

Approximately 22% of the estimated total land area, which has potentiality for agricultural development in Honduras, is located in the Aguan Valley and the development is very important for the social and economic improvement of the country. Therefore, the development of the Valley has been laid as one of the most important projects since 1970.

The development of the Stage I and II of the Lower Aguan Project was completed in May, 1983 with the finance from IDB, in which the Stage I development was started in 1970 and the Stage II in 1977.

In consideration of the importance of the continuous development of the Valley, the Government of Honduras requested to the Government of Japan the implementation of the Feasibility Study on the Aguan Valley Agricultural Development Project in the mid-stream area of the Valley, between Saba and Olanchito.

In response to the request of the Government of Honduras, the Government of Japan agreed upon the implementation of the Study in accordance with the relevant laws and regulations in force in Japan and in Honduras.

Accordingly, the Japan International Cooperation Agency (JICA), the official agency responsible for the implementation of technical cooperation program of the Government of Japan, dispatched the Contact Mission from July 30 to August 6, 1983 and the Pre-feasibility Study Mission from November 13 to November 27, 1983.

The Scope of Work (S/W) for the Study and Minutes of Meeting were agreed upon and signed by both parties on November 24, 1983, during the stay of the second JICA Mission in Honduras.

In accordance with the above mentioned S/W, JICA dispatched the Japanese Mission integrated with four experts to conduct the Phase I Feasibility Study in Hoduras from February 11 to March 18, 1984.

Continuously the Japanese Mission for Phase II Study consisting of twelve experts, were despatched from July 2 to October 31, 1984 to finalize the Feasibility Study in Honduras.

This Draft Final Report embodies the result of field survey in Honduras and office studies in Japan.

1.2 Scope of Study

The objectives of the Study is to formulate the project and verify its technical and economic feasibility, and to undertake on-the-job training and transfer the technology to the Honduran counterpart personnel in the course of the Study.

The scope of the Study to have been conducted are as follows:

1. Mapping

Topographic mapping of the project area on a scale of 1/5,000 with 1.0 m contour by means of an aerial photographic survey by using existing photos.

2. Feasibility Study

Field Work

A) Collection and review of the existing data of the Hydraulic Master Plan for the Aguan River Basin (hereinafter referred to as "Master Plan") and other sources related with the below information:

   a) General
      1. Meteorology
      2. Hydrology
      3. Topography
      4. Geology
      5. Soil
   b) Agriculture
   c) Agro-economy
   d) Agricultural Supporting System
   e) Infrastructure

B) Conducting the field surveys to supplement information and data mentioned above at A) for project planning, the study and analysis of these obtained through the surveys.

C) Formulation of basic development concept for the project, based on the National Development Plan.

D) Preparation for preliminary design of the Project works and provisional determination of key dimensions thereof in accordance with Honduras.

Home Office Work in Japan

A) Studying and analysing in detail the data and information obtained through the field work.

B) Finalization of the development concept for the Project.

C) Formulation of the Project

a) Cropping pattern and land use plan.

b) Estimation of crop yield, crop production and production cost.

c) Preliminary design of irrigation/drainage facilities.

d) Construction plan of Project works.

e) Implementation schedule.

f) Estimation of the Project cost.

g) Agricultural supporting services.

h) Organization for the Project during/after construction.

D) Evaluation of the Project

a) Economic evaluation by means of IRR.

b) Analysis of typical farm budget.

c) Other benefits

E) Specific Recommendations

CHAPTER 2 : BACKGROUND OF THE PROJECT

CHAPTER 2 BACKGROUND OF THE PROJECT

2.1 Introduction

This project was conceived while the national economic trends after the beginning of the 80s were marked by slow growth and rapid inflation, and the volume of some of the agricultural products from the Lower Aguan Valley project have started exceeding the processing capacity, or they seem to outrun commercial demand.

The GDP in constant price in 1981 was only 1 percent higher than that in the previous year, whereas the population growth rate in that year was estimated to 3.5 percent.

In agricultural sector, basic grains and milk were imported, whereas, such products for export as coffee, banana, sugar and meat could not fetch more foreign currency than the previous year because of the recession in the world market and heavy competitions among the producers.

This dilemma rendered the task of economic policy making of the government extremely difficult. So in the last resort, the government tends to adopt a policy designed to make use of the resources so far un-used or not fully utilized such as the land and water which this project area can provide. Two kinds of input are required to develop the potential which these natural resources have: the manpower and the capital.

The country is affluent with the raw material of the first. With appropriate training programs, they will make good farmers versed with the methods of intensive agriculture and with quality control. This is conducive to the relieving of un-employment and to the improvement toward proper distribution of labour forces in the country. The needed capital will be provided through the loan arrangement with international lending institutions or bilateral one.

In the level of regional development policy, this project shall be integrated with the frame of reference set by the Master Plan. In the agricultural sectoral level, the production policy will have to focus on the twin objectives of reducing the import of basic grains and increasing the agricultural export. Both are the efforts from opposite directions to ease payment relations with foreign countries.

The farms will be managed by several co-operatives, which will contribute to the maintenance of fair distribution of income. As has been explained, this project will, thus, be deemed to have multiple-objectives.

2.2 National Economy

2.2.1 Population

The total population shown in the previous census year of 1974 is 2,657 thousand. The annual population growth rate between 1975 and 1980 was around 3.6%. This trend went down to 3.4% after 1980 and the population in 1983 was around 4.1 million with the average population density around 36.5 per square kilometer.

Around 62% of the population are living in the rural areas and the primary sector offers about 60% of the total employment opportunity, yet the rural exodus is noticeable. (See Appendix, Table A-1.)

2.2.2 GDP

In 1983, the GDP at factor cost at current prices was US$2,676 million with a growth rate of 6.3% from the previous year. (-0.7% in real term)

Production from the primary industries contributes 30% to the total GDP. Manufacturing and construction sectors share of 22%, commerce, transport, storage and communication also 22%.

Gross Nominal Domestic Product is shown in Appendix Table A-2. Per Capita Gross Real National Product in 1983 is 274 dollars in 1966 price. (Per Capita nominal GDP in 1981 was above 700 dollar.)

2.2.3 Balance of Payment

The trade balance had been showing a chronic deficit until 1983.

But effort had been made to reduce the deficit by minimizing the import. (Export as a whole had been a standstill.) So with a continuous inflow of long term capital, though less in the amount, the deficit of overall balance of payments was reduced in 1983. Export and import of agro-product are dealt with in the Chapter 3. Table A-3 of Appendix shows the balance of payment in 1981, 82 and 83.

2.2.4 Government's Revenue and Expenditure

Table A-4 of Appendix shows the public finance realized in 1981, 82 and 83. Though current balance had been in surplus, its amount had become smaller. Whereas the capital expenditure had been increasing with increased public investment and loan repayment. The fiscal deficit had been financed by domestic as well as foreign loans.

PUBLIC DEBT

(Unit: In million of US$)

	1981	1982	1983
Total Debts	1,319.6	1,670.6	1,884.0
- Domestic Debt	402.7	552.9	626.3
- Foreign Debt	916.9	1,117.7	1,257.7

In 1983, 25.2 percent of foreign loan which the central government borrowed went to transport and communication sectors and 23.9 percent to agriculture and forestry sectors.

Debt service ratio in 1983 was 22 percent.

2.2.5 Consumer Price Index

Honduras had experienced double-digit inflation in 1979 and 1980. Since 1981, the over-all consumer price index had been declining fractionally from 9.4 to 8.9 up to 1983.

Table A-5 of Appendix shows the item-wise consumer price index between 1981 and 1983.

2.3 Development Strategy

The current five years development plan (1982-1986) has identified the following objectives.

A. Immediate objectives: Restoration of the economic and financial stability by reducing the deficit of the balance of payment and the public fiscal balance

B. Long term objectives: Diversification of various aspects of economic structure for the balanced economic growth. Special attention should be paid to the fairer income distribution, while the above mentioned objectives are to be aimed at.

2.3.1 The Measures to be Employed

(1) The improvement of the balance of payment

- Negotiate and control the quota for the export of coffee, sugar and meat, and to promote the creation of funds so that it could minimize the internal effects to be caused by the temporal oscillation in prices and quantity of demands.
- Diversify the exportable products.
- Initiate negotiation to get the external financial resources.
- Prepare strategies and programs for the reduction of external debt.
- Urge the projects with finance from foreign countries.
- Reduce the consumption of petroleum and propitiate the utilization of alternative resources of energy.

(2) The reduction of the deficit in the government's fiscal resources

- Reduce and rationalize the public expenditure.
- Improve the taxation system.
- Rationalize the expenditure of public sectors.
- Establish the functional system for the control of fuel consumption in the public sector.
- Introduce the external financial resources.

(3) The generation of new job opportunities and the raising of productivity and output in food production

- Increase the production of basic grains.
- Widen and improve the commercialization canal for the products of primary necessity.
- Maintain the control of prices for basic products.
- Accelerate the implementation of the small projects of Agrarian Reform.
- Encourage the private and federal banking system.
- Encourage the construction industry.
- Construct access roads to be connected with production areas.

(4) The modification of the productive structure and the raising of the productive capacity

- Improve the coordinative activities of government to the industrial sectors.
- Expand the financial assistance for the enterprises devoted to the production of foods and primary materials.

- Encourage the enterprises established within Agrarian Reform.
- Promote the formation and training of human resources.
- Promote the utilization of advanced technology.
- Establish the energetic auditing system in the industrial sector.

(5) The development and further utilization of natural resources

- Create the conditions for the exploitation of mineral and petroleum resources.
- Investigate natural resources.

(6) The diversification of the export capacity

- Diversify and increase the production;
- Promote export in new and traditional markets.
- Attract investors.
- Find out the assistance and advantage of international organizations.

(7) The promotion of balanced development

- Encourage the local development in order to improve the distribution of resources and, as a result, to generate new job opportunity, especially among rural population.

(8) The fulfillment of basic requirements for people

- Increase the output of foods.
- Improve the purchasing capacity and educational level
- Promote the preventive healthy programs.

(9) The improvement of the distribution of income

- Examine the taxation system.
- Register the import of extravagant goods.
- Realize policies for the investment in sectors and zone to be considered to have priority.
- Encourage social services for families of low level of income.

2.3.2 The Role of Sectors

(1) Productive Sectors

The development of the country will be based on the exploitation of agro-resources, in the primary activities of agriculture, livestock, fishery and silviculture. Also the development of agro-industry, mining, construction, and small industries will be preferred.

Special attention will be paid to the production of export-oriented goods and services and to the production and commercialization of essential goods, particularly such foods for domestic consumption as basic grains.

(2) Social Sectors

The basic policies of this sector will be oriented to the modification in the quality of governmental services actually realized and to the expansion of its coverage so that rural and marginal urban group could be benefited.

The social sectors comprising education, health, housing and environmental sanitation will be channeled to the assistance of productive sectors and with emphasis on areas where agrarian land reform will be realized.

(3) Economic Infrastructure

Energy - Emphasis will be placed on to the rationalization of consumption for the products derived from petroleum. Orderly exploitation will be required for the forestal development. It also will be promoted for the generation of hydro-electric power supply.

Transport - The construction of access roads to the production units will be promoted. This project will be proceeded with such complementary works as small irrigation and drainage systems and water supply network.

Communication - Telephone and postal systems will be expanded and improved in the areas where productive activities will be carried out or there will be strategic zones from the view point of the national defense.

2.3.3 Development Organization

In order to comply with the objectives of the Strategy it has been considered to be crucial to formulate a organization which will act as the coordination agency among concerned organizations for development.

(1) Private Sector

It is recognized that the private sector can contribute with its managerial capacity and initiative in finding out investment opportunities to the creation of new sources of job opportunities.

(2) Public Sector

Central Government:

Conducts the policy of the country in every field of economic and social activities. In this context, it will be required to rationalize the ensemble of rules and legal mechanisms and the juridical and administrative structure.

Autonomous Organizations:

Need to rationalize the assignation of its resources, simplification in the procedures and efficiency in the fulfillment of their objectives.

Public Enterprises:

Have the function to promote and regulate the country.

Local Authorities:

Will carry out its role in relation to the implementation of programs and projects designated for the fulfillment of necessities among people under their jurisdiction.

2.4 Agriculture

2.4.1 Agricultural Sector in the National Economy

Agriculture is the country's most important economic sector, accounting directly for 30% of GDP and indirectly for a significant proportion of other economic activities. It provides employment for 58% of the economically active population and generates more than 80% of export earnings. (See Appendix, Table A-6.)

2.4.2 Agricultural Products

The principal agricultural products of Honduras are banana, coffee, maiz, sugarcane, bean, etc. Among these, banana, coffee and sugarcane are export crops. In addition to these crops, cotton is also produced for export. (See Appendix, Table A-7 and A-8.)

Banana production has returned to the output levels prior to the 1974 hurricane, and of which 60 to 65% is exported. Coffee production has doubled during 1972 and 1982, mainly in response to higher prices in the export market. More than 80% of production is exported. The production of sugarcane has increased steadily at 7.5% a year.

These export crops are cultivated principally in large farms and companies. In case of banana, production and export is largely controlled by the multinational companies: United Brands in the Sula Valley and Standard Fruit Company in the Aguan River.

Meanwhile, among small farmers, subsistence agriculture is widespread and two-thirds of their crops are for household consumption. Maize, the staple diet of the rural population, is predominant among these crops, about half of their agricultural production. But the production of maize does not supply domestic requirements, and in some years Honduras has resorted to imports. (See Appendix, Table A-9.)

2.4.3 Landholding

Large farms with holdings of more than 500 hectares amount to 0.2% of the total number of farms in Honduras and hold 22% of the total farm land, while small farmers with holdings of less than 5 hectares represent 64% of the total number of farms, but they hold only about 9% of the total farm land. Also the proportion of rented land in the holdings of small farmers is high. (See Appendix, Table A-10.)

2.4.4 Under-utilization of Rural Labor

Under-utilization of rural labor is prominent. About 60% of the available man-days in small and medium farms are not utilized. The rate of under-utilization is about 63% in small farms (0-5 has) and diminishes to about 55% in farms of the 10-20 hectares group. (See Appendix, Table A-11.)

Apart from the seasonality of main crops, under-utilization of labor derives from the structural problem of small farms with too much labor and not enough land. Thus the small farmer is forced to work as hired labor in larger farms, particularly at harvest time.

Aside from the excess labor in rural areas, an undetermined number of peasants had no land. Estimate indicated that it ranged up to 120,000 families in 1974 (most likely a smaller number). They seek employment as laborers in the larger farms or migrate to the cities.

2.5 Agrarian Reform

2.5.1 Objective

The Agrarian Reform Program aims at the improvement of land utilization through the transfer of unused or under-utilized land from large landowners to landless rural families, while, at the same time, strengthening the modern entrepreneurial sector in agriculture.

2.5.2 Executive Agency - Agrarian Reform Institute

The Agrarian Reform Institute (INA), principally responsible for official institutional support of the agrarian reform, deals with land acquisition and distribution, organization and management, training and technical support of the settler groups, and with guarantees for farm credit issued by the official agricultural bank.

2.5.3 Present Condition

By 1982 the Agrarian Reform has settled 50,000 peasant families (12% of rural families) on about 210,000 hectares. About 39,000 remain in the settlements and about 11,000 families have abandoned them because they did not receive enough production land or support services or could not adapt to hard living conditions in some areas.

Since 1978, INA has concentrated its resources on the potentially most productive 9 areas, and among them the Lower Aguan Valley Project is the most important. (See Appendix, Table A-12.)

2.5.4 Agricultural Production

Rough estimates indicate that agricultural value- added in the reform sector is about 10% of the country's agricultural value-added originating in crop production. The reform sector's share of value-added varies by crops. Basic grains production is still dominant in the reform sector although significant progress is taking place with the production of African palm, banana, rice and other commercial crops. There is growing awareness that all reform groups must participate in higher earning afforded by cash crops. (See Appendix, Table A-13)

2.5.5 Problems

The problems of the agrarian reform are as follows:

INA's titling has been very slow. About 85% of the groups and 70% of the distributed land have not been titled.

CHAPTER 3 : THE PRESENT SITUATION OF THE STUDY AREA

CHAPTER 3 THE PRESENT SITUATION OF THE STUDY

3.1 General Description of the Study Area

The study area is about 21,000 hectares of national and private land, extending on the mid-stream basin of the Aguan River, located about 200 km from the capital city of Tegucigalpa in the north northeast part of the country; this area includes both banks of the Aguan River limited by the Monga River and administrative boundary of the departments of Yoro and Colon in the east and by the south road passing along the urban area of Olanchito.

3.2 Climate and Hydrology

3.2.1 Introduction

The hydrological investigations carried out for the Feasibility Study are described in this section.

The main objectives of these investigations may be summarized as follows:

(1) Defining the climate of the study area.

(2) Analysis of rainfall and discharge for irrigation and drainage scheme

Hydrological data was collected from the archives of CONSUPLANE/UN and the MRN, and was presented in the Master Plan, some of which were utilized in the Feasibility Study.

Whereas rainfall data is available for relatively long periods for a large network of stations in the Aguan basin, the collection of most of the river flow records only commenced in 1980. However, these records proved valuable in defining the general characteristics of river flow.

The study of drought rainfall and discharge was the major activities in the hydrological investigations, as estimates for 2, 3, 5 and 10 years return period were required for the irrigation plan.

The maximum peak flood for return periods of 2, 3, 5, and 10 years were estimated based on the study of the Master Plan.

1) The Aguan River Basin

The drainage basin of the Aguan River shown in Fig. 3-1 is situated in Northern Honduras, between latitude 15°25' and 16°00' N and between longitude 85°25' and 87°00' E.

The total catchment area is approximately 10,300 km^2 with the upper Aguan above Pte. Saba draining an area of about 7,545 km^2.

The Aguan Valley extends from San Lorenzo to the sea outlet at Santa Rosa, a distance of some 160 km, with a width of up to 15 km. The study area is situated in the middle of the Aguan Valley, between Saba and Olanchito, and covers approximately 21,000 ha.

The Aguan River originates above the Yoro Valley in the El Pijol Mountain Range and picks up a large number of tributaries in its 395 km meandering course to the Caribbean Sea. The Yaguala River and the Mame River are its principal tributaries, with catchment areas of 1,835 km^2 and 2,096 km^2 (2,069 km^2 above Pte. Mame), respectively.

The Mame River is in the study area, and three other tibutaries, the Uchapa River, the Uyuca River and the Jaguaca River might be utilized for irrigation plan.

The mean annual rainfall varies from about 900 mm in the upper Aguan to about 2,500 mm in the lower Aguan. The mean annual flow of the period from 1981 to 1983 in the Aguan River is about 140 m^3/s with the monthly variations reflecting the seasonal rainfall pattern.

Thus, the river is relatively low during January to April, and flood flows are most likely to take place between September and December.

3.2.2 Climate

The climate of the Aguan River Basin is dominated by the tropical easterly trade winds, which bring in moist maritime air masses. These give rise to rainfall with a strong seasonal variation associated with the migration of the Inter-Tropical Convergence Zone. Temperatures are uniformly high throughout the year. The climate of the river basin is also strongly influenced by topography; the mountain range to the north creating a rainshadow over the upper catchment.

(1) Available Data

Data on rainfall and other climatic parameters for the Aguan River Basin have been collected by the MRN, ENEE, the Standard Fruit Company and more recently by CONSUPLANE/UN. Except for rainfall data, the systematic collection of climatic data did not commence until the late 1970's. The longest continuous rainfall records are those collected by the Standard Fruit Co., at Coyoles starting from 1936. However, a systematic network of rainfall stations was not set up until the early 1970's. The advent of the CONSUPLANE/UN project for the Aguan Valley has resulted in efforts to rationalize the hydrological and meteorological station network including the setting up of a number of climatological stations.

At present, different organizations are involved in the collection of climatic data, each maintain a responsibility for the operation of their own stations. However, CONSUPLANE/UN has commenced building up an archive of data from these different sources.

In the study area, there are a few stations between Saba and Olanchito, but these stations are new and do not have data periods of sufficient length for analysis. The data from the Station of Olanchito (1972-1984), may be available for the Feasibility Study and the reason of that will be described in section 3.2.3.

(2) The Aguan Basin experiences high temperatures throughout the year with a maximum during April-May and minimum during December-January. The mean monthly temperature varies between 23°C and 30°C with little variation experienced throughout the Valley.

The Lower Valley from the coast to Saba, has a mean annual temperature of between 27°C and 28°C while above Saba, temperatures in the Valley are about 1°C lower.

The monthly temperature characteristics at these stations are summarized in the following table:

Temperatures (°C)

	Mean Monthly		Monthly Max.		Monthly Min.	
STATION	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.
Victoria	28.5	23	35	29.5	23	16
Olanchito	30	23.5	36.5	29	22.5	18
Isletas	28.5	23.5	36	29	22	18
Sinaloa	28.5	23.5	33.5	27.5	22	16

(3) Relative Humidity

The Relative Humidity (RH) in the Aguan Basin is generally high with a monthly average above 50%. The RH is at a minimum during March-May and at a maximum during October-January.

Their main characteristics may be summarized as follows:

RELATIVE HUMIDITY (%)

	MEAN	MEAN	ANNUAL
STATION	MONTHLY MAX.	MONTHLY MIN.	MEAN
Victoria	80	58	71
Olanchito	80	61	66
Sinaloa	84	76	81

(4) Wind Speed

The available data on wind speed/wind run in the Aguan Basin is sparse, but more data should become available in the future from the recently installed climate station.

The records available for Olanchito give a mean monthly wind speed varying between 31 km/day in September - December and 74 km/day from March - May. In the Master Plan, the relatively short record available for Sinaloa for the period 1980 - 1982, indicates a similar pattern of wind with a minimum in January and a maximum in May. The speeds are slightly higher than those at Olanchito, ranging between 34 km/day to 82 km/day.

(5) Isolation

Owing to the proximity of Honduras to the equator, the mean daily duration of maximum possible sunshine hours (N) varies between 11 and 13 hours, with the maximum in June and minimum in December. As would be expected, actual sunshine duration reflects the seasonal characteristics of rainfall, minimum duration occurring in the period October to December.

The data on isolation is sparse with Victoria in the Upper Aguan having the longest records (1970-81). The data available for Victoria indicates n/N varying from about 40% to nearly 70%.

A similar pattern of sunshine is shown by the records at Sinaloa for the period 1980-82 n/N varies between a maximum of about 75% in April to a minimum of about 37% in November - December. A drop in sunshine duration is also experienced in July.

(6) Evaporation

Class A pan data is available at the following stations in the catchment above Saba: Olanchito Victoria, Morazan and Las Limas. Except Olanchito, these stations are located outside the Aguan basin.

The recorded mean daily pan evaporation at these locations varies from about 3.3 mm/day to 4.5 mm/day. The highest evaporation are recorded during March - May and the lowest during November - January. The seasonal evaporation at these stations may be summarized as follows:

EVAPORATION (mm)

Station	Mar-May	June-Aug.	Sept-Nov.	Dec-Feb.	Annual
Morazan	523	424	325	293	1,565
Victoria	532	410	309	323	1,574
Olanchito	553	461	370	305	1,689
Las Limas	594	406	315	296	1,611

The evaporation at Olanchito would be typical for the study area, whereas the evaporation at other stations would be representative of the higher elevations in the upper catchment.

Although climate data are presently collected at a number of recently installed stations in the river basin, only the records at Olanchito are the sufficient length to obtain reliable estimates of the evapotranspiration needs of the reference crop (ETP).

(7) Rainfall

The mean annual rainfall varies from approximately 900 mm in the western half of the catchment to about 2,500 mm at the coast, with another high rainfall area near the southern limit where annual rainfall up to 2,000 mm is recorded. The annual rainfall distribution shows a characteristic seasonal pattern with a dry period from January to May and a wet period for the remainder of the year.

The wettest period is during September to November, when typically 35% - 40% of the annual rainfall is experienced. The driest period is during February to April with about 10% of the annual rainfall. A number of stations, particularly in the upper Aguan, exhibit a bi-model rainfall distribution with peaks in June and October.

The upper side of the study area, located between the San Juan River and Olanchito, is defined as a relatively dry zone with mean annual rainfall less than about 1,000 mm, and lower side located between Saba and the Taujica River is defined as a moist zone with mean annual rainfall in the range 1,300 - 2,000 mm.

The study area is defined as a transitional zone with mean annual rainfall in the range of 1,000 - 1,300 mm.

3.2.3 Hydrology

The hydrology described in this section was analyzed for the Feasibility Study of the study area; therefore there are some differences from the Master Plan in the applied method and content.

(1) Rainfall Analysis

1) Ten rainfall stations were chosen according to location and period of information. The correlation of the monthly data from each of these stations for the period 1973-83, with each neighboring stations, are shown in Table 3-1. These correlation coefficient range from 0.5 to 0.8 and were therefore considered unacceptable for filling in the gaps in the 1973-83 data series.

The mean monthly rainfall for the entire catchment basin of the Aguan River at Pte. Saba was calculated by the Thiessen Poligon Method as shown in Figures 3-2 and 3-3. The resulting data was correlated with the data from Olanchito and produced a relatively low correlation coefficient (0.70). But, the amount of data is not sufficient for any assessing of those results.

Nevertheless, the station of Olanchito was chosen for analysis, for the following reasons:

a) The Station of Olanchito is the nearest to the study area among the stations which possess the rainfall data for acceptance period.

b) There are no gaps in the monthly rainfall data for 1973-83 for Olanchito.

c) Considering other climatic data, only the records at Olanchito are of sufficient length to obtain reliable estimates of the evapotranspiration needs of a reference crop.

2) The annual average rainfall of 11 years (1973-83) is 1,096 mm.

The monthly distribution of rainfall is shown in Tables 3-2 and 3-3 and Figures 3-4 and 3-5. The annual rainfall was analyzed probabilistically by the Weibull Method for the drought design years, as shown in the Appendix, Fig. B-11. Based on the probability of the annual rainfall, the drought design rainfall for 2, 3, 5 and 10 years return period was estimated, as shown in Table 3-4.

The droughty design effective rainfall patterns of 2, 3, 5 and 10 years return period were estimated by the method of U.S. Bureau of Reclamation as shown in Table 3-4.

3) A rainfall intensity frequency analysis was performed in the following manner:

a) The rainfall probabilities for durations of 5, 10, 15 and 30 minutes and 1, 2, and 24 hours were analyzed by the method of Gumbel. (See Appendix, Tables B-4, B-5 and Fig. B-14.)

b) Based on these probabilities, the intensity duration frequency for 2, 3, 5, 10 and 20 years return period were shown in Appendix Table B-6 and Fig. 3-6.

c) The following three equations of rainfall intensity were formulated, and equation I (Talbot) was selected for the drainage planning.

i. $I = \frac{a}{t + b}$ (Talbot)

ii. $I = \frac{a}{T^n}$ (Sherman)

iii. $I = \frac{a}{t + b}$ (Hisano Ishiguro)

Where;
I : Rainfall Intensity (m m/hour)
t : Duration time (minute)
(See Appendix, Table B-7)

(2) River Flow Analysis

1) A series of automatic water level recorders, stage gauges and maximum stage recorders has been established by CONSUPLANE/UN. The majority of these stations were set up in 1980. The station locations are shown in Appendix, Fig. B-1 and Table B-8.

The different types of stations currently in operation may be summarized as follows:

	Aguan River	Tributaries
Automatic water recorder level	4	4
Stage recorder	4	2
Maximum stage recorder	4	2

Within the study area, the three stations at Pte. Saba, Pte. Mame and Pte. Olanchito are currently operating. In particular, the flow data at Pte. Saba is reliable with no gaps from August 1980 to December 1983. (See Appendix, Fig. B-15 thru B-18.)

The mean annual flow for three years (1981-83) at Pte. Saba was 124 m^3/s, the maximum mean daily flow was 2,020 m^3/s in November 1980 and the minimum mean daily flow was 11 m^3/s in May 1983..

2) The series Tank Model which is one of the computer models used in run-off analysis, was created using actual rainfall data at Olanchito and river flow at Pte. Saba. (See Appendix, Fig. B-19.)

The actual flow data at Pte. Saba and the synthesized flow data from this model are compared in Figs. 3-7 and 3-8.

The correlation coefficient of the average five-day runoff was 0.91. The average runoff for the recorded period was 1.53 mm/day.

The runoff data at Pte. Saba for eight years (1973-80) was synthesized by the Series Tank Model using the rainfall data at Olanchito. (See Appendix, Fig. B-20 thru B-23.)

3) The average annual runoff of the three years of actual data and eight years of synthesized data was 1.30 mm/day. The monthly runoff distribution is shown in Table 3-2 and Fig. 3-4.

The mean annual runoff was analyzed probabilistically by the Weibull Method for the drought design years. (See Appendix, Fig. B-13.)

Based on the probability of the mean annual runoff, the mean annual runoff for drought design for 2, 3, 5 and 10 years return period was estimated. The monthly runoff distribution for 2, 3, 5 and 10 years return period is shown in Table 3-3 and Fig. 3-5.

4) The stage-discharge curve for the hydrometric station at Pte. Olanchito was revised, because the curve that had been prepared by the CONSUPLANE/UN Project is doubtful. The resulting curve is valid from November of 1980 until November of 1983, with a change in the equation in May, 1981 due to an adjustment of the staff gage in the gaging station (see Appendix, Fig. B-24).

In addition, the curve is only valid for flows up to approximately 450 m^3/s. Due to lack of discharge measurements at higher flows, the behavior of the curve is unknown above this range. However, a topographic survey is planned to determine stage levels for high flows.

The average daily flows for the Aguan River at Pte. Olanchito were then calculated for the three-year period, excluding high flows above 450 m^3/s.

5) The average five-day flow was calculated for the three-year period (November 1980 - November 1983) of existing data for the Aguan River at Pte. Saba and Pte. Olanchito and the Mame River at Pte. Mame.

The five-day average flow data for Pte. Saba was then correlated with that of Pte. Olanchito and Pte. Mame. Certain flow data for Pte. Olanchito was almost equal to and in some cases greater than that for Pte. Saba. It was concluded that the Pte. Olanchito data was more doubtful because of its relatively poor and unstable gaging station, and therefore the correlation was performed after eliminating any Pte. Olanchito flow data, which was greater than 80 percent of the Pte. Saba flow for the same five-day period. The results of the flow correlations are shown as follows:

	Correlation Coefficient
Pte. Saba ----- Pte. Olanchito	0.90
Pte. Saba ----- Pte. Mame	0.87

The river discharges at Pte. Olanchito, Pte. Mame and other tributaries were estimated using the following equations:

EQUATIONS OF RIVER FLOW USING THE RUNOFF AT PTE. SABA

RF: Runoff at Pte. Saba (mm/day)

1. Pte. SABA	Drain Area A = 7545 km^2	
	$Qs = Rf \times 7545/86.4$	(M^3/s)
2. Pte. OLANCHITO	A = 4714 km^2	
	$Qo = -10.37 + 0.546 \times Qs$	($Qs > 77$ M^3/s)
	$Qo = 0.303 \times Qs^{1.07}$	($Qs > 77$ M^3/s)
3. Pte. MAME	A = 2069 km^2	
	$Qm = -11.62 + 0.323 \times Qs$	($Qs < 101$ M^3/s)
	$Qm = 0.208 \times Qs^{1.00}$	($Qs < 101$ M^3/s)
4. Pte. UCHAPA	A = 81 km^2	
	$Qu = Rf \times 81/86.4$	(M^3/s)
5. Rio JAGUACA	A = 154 km^2	
	$Qj = Rf \times 154/86.4$	(M^3/s)
6. Rio MONGA	A = 44 km^2	
	$Qm = Rf \times 44/86.4$	(M^3/s)
7. Rio UYUCA	A = 172 km^2	
	$Qu = Rf \times 172/86.4$	(M^3/s)

6) The maximum mean daily runoff for Pte. Saba was also analyzed probabilistically, utilizing the three years of actual flow data, and eight years of synthesized flow data from the Series Tank Model. The results of this analysis is shown in Table 3-7, and Appendix, Fig. B-25.

The discharge of Pte. Saba from this result was compared with that estimated from the hydrograph in the Master Plan (Appendix Fig. B-26) for five year return period.

The results as follows:

	The Tank Model	The Master Plan	Difference
The maximum mean daily flow	2,040 M^3/s	2,150 M^3/s	5.1%

These two values which were estimated from different method, were approximately equal and the flood analysis of the Master Plan is therefore considered to be reliable for the drainage plan of the Feasibility Study.

The frequency curves of the flood peaks which were analyzed in the Master Plan for Pte. Saba and Pte. Olanchito are shown in Appendix, Figs. B-27 and B-28.

The maximum mean daily flows and peak flows of 2, 3, 5 and 10 years return period for Pte Saba and Pte Olanchito are shown in Table 3-8.

The maximum mean daily flows for the tributaries were estimated using the relationship catchment area flow.

The relation of daily flow and peak flow is shown in Appendix, Fig. B-29.

The drainage system model for the Aguan River for 2, 3, 5 and 10 years return period is shown in Appendix Fig. B-30 thru B-33.

3.3 Water Quality

All land water comes from rainfall. The minerals dissolved in rainfall are very few originally but the quantities increase due to dissolution and oxidization or dioxidization in the process of flowing on the land surface or underground. Thus, land water quality reflects the difference of the time, the source and the course of flowing. Field analysis by portable water tester was carried out to know the outline of water quality in the study area.

3.3.1 River

The river water test point and its results are as Fig. 3-9 and the following table

RIVER WATER QUALTIY

No.	River Name	Date	Temp.	Conduc.	PH	NH_4	NO_3	PO_4	Cl	Fe	Remarks
			°C	μs/cm		ppm	ppm	ppm	ppm	ppm	
1	Aguan (Olanchito side)	Aug. 7	29.7	317	7.4	0.5	0.5)	0.5	8	0.3	dirty
2	Potrerillos	"	26.2	258	7.6	0.3				0.1)	
3	Mame	"	29.1	254	7.6	0.5	0.5)	0.7	8	0.3	dirty
4	Jaguaca	"	25.8	151	7.4	1.0	0.5)		6	0.2	
5	Monga	"	25.3	123	7.0	1.0	0.5)		6	0.1	
6	Uchapa	Aug. 8	23.7	88	7.6	0.3	0.5)	0.3		0.1)	
7	Uyuca	"	26.1	128	7.6	0.3	0.5)			0.1)	dirty
8	Aguan (Saba side)	Aug. 9	26.3	225	7.6	0.5	0.5)		6	0.2	

Their results are summerized as follows:

Electrical conductivities (EC) are about 100 to 300 μv/CM being less for small rivers and more for such large rivers as the Aguan and the Mame.

As electrical conductivity generally is correlated to evaporation residue (TDS), this value gives us an indicator to the contents of water quality. Consequently, the water qualities in the said area seem to be very good as a whole.

PH are 7.0 to 7.6, Cl under 10 ppm, NH4 under 1 ppm and NO_2 under 0.5 ppm. These values do not deviate from the WHO standards.

As large rivers such as the Aguan, the Mame and the Uyuca usually are dirty, these must be purified if they are used as drinking water. The up stream side of many small rivers is pure and has a comparatively stable flow. Therefore they are widely used as primary water works in many villages of the said area.

The Olanchito point of the up stream side in the Aguan River is EC of 317 μv/CM but the Saba point of the down stream side is 225 μv /CM. This difference is attributed to the dilution by many small intermediate rivers and rainfall distribution.

The PO_4 component that relates to algae generation in lake and sea is small.

3.3.2 Well

A survey of existing wells was carried out in the said area by mostly walking and their results are as shown in Fig. 3-9 and the table in the next page.

These trends are summarized as follows:

EC is from 113 μv/CM to 637 μv/CM and averages about 300 μv/CM. Accordingly, it is thought that these wells contain mostly soft water in view of the dissolved minerals and it is basically good water.

These show the trend that EC and PH are low near the highland, and increase in proportion to advancing toward alluvium plain center as Appendix Fig. C-1 indicates.

Water temperature is around 27°C, near the average temperature. There is limited evidence of iron content (Fe) which is caused by many shallow wells.

Regarding drinking water, these results conform to WHO standards due to their being from 6.2 to 7.4 in PH and 4 to 86 ppm in Cl but do not conform in three test points due to NH4 and Fe (these unqualified wells are not used at present).

EXISTING WELL WATER QUALITY

No.	Location	Depth	Temp.	Conduc.	PH	NH_4	NO_3	PO_4	Cl	Fe	Remarks
		m	°C	μ℧/cm		ppm	ppm	ppm	ppm	ppm	
1	Mendes	3.57	26.4	519	7.2	0.1)	0.5)	0.7	5	0.3	Impure
2	"	4.53	27.6	513	7.4	0.1)	0.5)		8	0.1	
3	Jalisco	4.54	27.0	382	7.2	0.1)	0.5)	0.5	8	0.1	
4	"	≈6.00	27.9	424	7.2	0.1)	0.5)	0.5	5	0.1)	
5	Barranco	4.88	26.8	334	6.6	1.0	0.5)	0.7	8	1.2	Impure, no use
6	SanFrancisco	21.22	29.0	177	7.2	0.1)	0.5)	1.0	6	0.1)	
7	"	6.36	26.6	637	7.2	1.0	0.5)	0.7	86	1.2	Impure, cattle use only
8	Rio Abajo	5.15	26.3	231	6.6	0.1)	0.5)	1.0	5	0.2	
9	Balsamo	10.95	27.6	201	6.0	1.5	0.5	2.0	6	5.0	no use
10	Nueva Lombardia	≈20.00	26.8	113	6.2		0.5)	1.0	6	0.1	
11	"	≈10.00	26.8	149	6.2	0.1	0.5)		5	0.2	
12	La Sabana	7.56	27.2	121	6.2	0.1)	0.5)	1.0	4	0.1	
13	Armenia	9.60	28.2	396	6.2	0.1)	0.5)	2.0	26	0.1	
14	Jagua Abajo	39.00	29.1	401	7.0		0.5)	0.7	15	0.1)	
15	"	8.10	29.6	121	6.4	0.1)	0.5)	2.0	6	0.1)	
16	Colonia San Rafael	4.34	29.4	124	6.2		0.5)		5	0.5	
17	Puerto Escondido	7.00	27.3	386	7.0	0.1)	0.5)	1.0	12	0.1)	
18	"	4.99	27.3	587						0.3	Impure
19	"	2.50	26.9	492	7.0		0.5)	0.7	11	1.2	
20	"	5.50	27.9	335	7.2	0.2	0.5)	0.7	5	0.5	
21	"	3.00	28.2	318	7.2	0.1)	0.5)		8	0.1)	

Note: ≈ based on hearing

3.4 Hydrogeology and Grandwater

3.4.1 General Description of the Study

As two large rivers, the Aguan and the Mame, flow in the study area, and many small rivers are developing, generally speaking it can be said that this area is favoured in water resources. But these surface waters have the variation of wet and dry seasons in a year and their use will be limited by natural cycles. In contrast, ground water is clean and exists in quantities not subject to yearly variations.

Thus, it is thought that the latter can supplement the former's weak point and so the groundwater study also will be very important.

This time, the groundwater survey was performed all over the study area together with the foundation test of proposed sites for irrigation system. The outline of these surveys are as the following and Fig. 3-9.

(1) Electric Geophysical Survey

An Electric-Geophysical Survey (ES) of 23 points was realized in the said area to know the groundwater condition, the geological section and the proposed irrigation construction foundation.

- Equipment: 3244 type (Japan Yokogawa Made)
- Details:

Survey depth	45 to 70 m
Survey method	Wenner configuration
Survey point	23

(2) Existing Well Investigation

This data was obtained by walking many places that are not accessible by car with the help of aerial photographs and topographical maps. Also we had the pumping test of two typical wells. From these data analysis, we could know the outline of the groundwater condition and its use situation.

- Existing well investigation

Well numbers (confirmed)	30 pieces
Well numbers (investigated)	22 pieces
Well depth	2.5 to 39 m
Well size	100 to 900 mm

- Pumping test: 2 pieces

(3) Some borings for the groundwater and soil mechanics were performed by a contractor and the study team.

boring numbers	Contractor	5 pieces
	Study Team	5 pieces

(4) Small river flow test

This test is thought to be important because many small rivers in the said area are being used extensively as drinking water using primary water works.

(5) Others

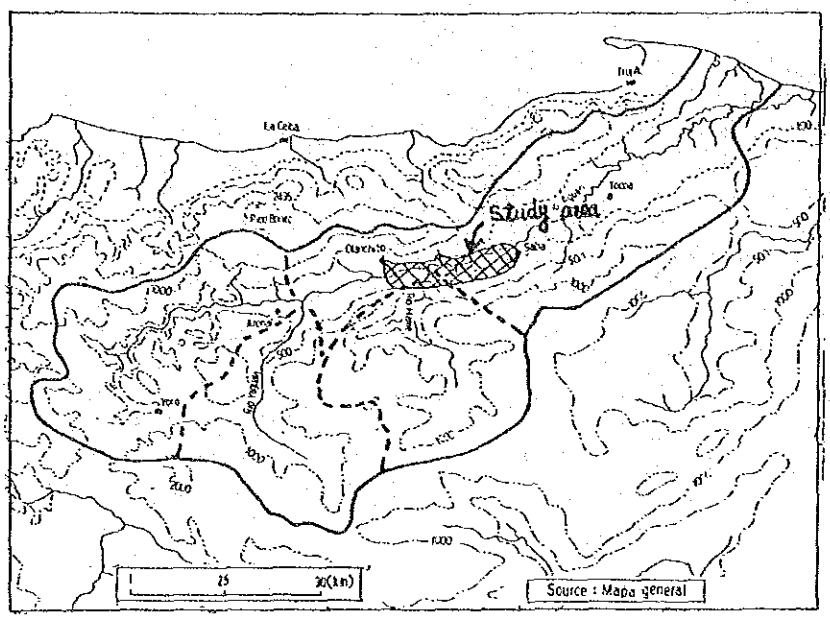
Geological exploration and aerial photographical research was carried out to know the outline of the geology and topography in the said area.

3.4.2 Topography and Hydrogeology

(1) Topography

This area is situated at the mid stream of the Aguan River about 200 km of north to northern east from Tegucigalpa of the Capital in Honduras and forms the river basin like a small corridor with a leugth of 43 km and a width of 7 km.

SURROUNDING TOPOGRAPHY



The above map shows that this area has an elevation of 150 m but both sides are surrounded by mountain ranges more than 1,000 m high. Most notable is Pico Bonito (elevation 2435 m) behind Olanchito, the highest mountain around the study area and there is a scattering of other mountains of 2,000 m high. Aguan River, flowing through the said area, is the biggest river that will be included among the several in Honduras. There are also two pretty big subsidiaries of the Yaguala River and the Mame River, but the rest are only many small rivers.

Also an extensive terrace of diluvian age exists along the Aguan River. Its area is divided between terrace and alluvial plain at close to a fifty-fifty ratio. We can also observe many meandering streams and oxbow.

Regarding geology, the paleozoic layer that is the oldest rock in the neighborhood of the said area is exposed in the highland in the opposite side of Saba City as Appendix Fig. C-2. Then, tertiary layer that is the next oldest rock is distributed extensively on both sides of the Aguan basin and forms mostly the base rock in the bottom of the said area. The following rock is the quaternary layer of the newest age and exists in the Aguan River besin; the river plain is principally composed of this rock.

Regarding the texture of these layers, the paleozoic is comprised of schists, quartzite, and gneiss mainly of matamorphic rock and is very hard because of its ancient origins. The tertiary layer is formed from Pyro-clastic rock of tuff, andesite and tuff breccia etc. and is pretty hard. The final quaternary layer comprised of diluvium and alluvium is composed from clay, sand and gravel and is loose because of its new age. This time, the quaternary basin is the main subject of the development study and there will be an investigation of its groundwater and soil mechanics concerning its development.

(2) Hydrology

In the study area, the Aguan River is meandering through the basin plain joining the Mame River in the middle stream. These flow conditions are shown in the following table.

These rivers can categorize in big rivers judging from catchment area and flow condition, and indicate that the flow of the Mame and Saba sites is stable while that of the Olanchito site is not.

RIVER REGIME

Observation site	River name	Catchment area	Flow m³/s			Regime Coefficient	Remarks
			Max.	average	Min.		
Olanchito	Aguan	4714 km²	a 1114.56	(80.70)	b 0.03	a/b 37152	
Mame	Mame	2069	254.20	(39.81)	3.82	67	
Saba	Aguan	7545	1438.00	140.27	21.70	66	

Note: 1. Based on observation data of 1982

2. ( ): There is missing in observation

In respect to tributaries, water flow was measured only one day under quiet weather condition because they are used principally as water works. The results of this observation are summarized in Appendix Fig. C-3 and the following table.

SMALL RIVER FLOW

No.	Name	Catchment km²	Date	Flow m³/s	Remarks
1	La Esperanza	20	Aug. 24	0.044	
2	Puerlo Escondido	10	"	0.035	
3	San Francisco	28	"	0.28	
4	Balsamo	6	Aug. 25	0.30	
5	"	5	"	0.10	
6	"	7.3	"	0.104	
7	Tepusteca	6	"	0.08	
8	Los Cocos	25	"	0.185	
9	Monga	41	"	0.065	
10	Uyuca	142	"	6.27	
11	Uchapa	85	Aug. 24	0.86	

Reference: Rio Jaguaca Catchment is 114 Km^2

Among them, San Francisco, Balsamo, Uyuca and Uchapa are notable for their flow. As these many small rivers are used extensively to provide drinking water from primary water works, their upstream environment and forest must be protected permanently.

(3) Hydrogeology

Hydrogeology of the said area is summarized in Appendix Fig. C-4.

The Aguan basin consists of extensive deposits of alluvium and diluvium. As these are the sediment of the new age that are transported by the Aguan River and the Mame River and are deposited thickly, there are many voids among them due to not being consolidated. Ground water fills in these voids and forms a good aquifier in gravel.

In contrast, as old rocks existing in the surrounding highland are consolidated, its groundwater potential is not considered great. Every effort is being made to certify its potential by means of extensive geophysical surveys and existing well investigation and boring.

3.4.3 Groundwater

(1) Electric Geophysical survey

Method

This is a reasonable means to know the underground geology and groundwater potentials in a river basin plain like the said area. It is a geophysical survey that measures the specific resistance by flowing an electric current into the ground at the surface of the earth and interprets the character of the earth by the amount resistance. This time, the equipment used was the 3244 type and the electrode configurations was based on Wenner method.

Analysis results

Specific resistances of unconsolidated layers like plain sediment, weathering zone and talus etc., reflect their hydrogeological character i.e. proportional to the contained water quality and inverse to the porosity. As clay has much porosity and gravel has little, the layer resistive is usually small in clay and large in gravel. In the underground study, experience indicates a good aquifer in the case of 4 to 6 times of water resistivity and the possibility of an aquifer even in 1 to 10.

Average water conductivity according to the existing well investigation in the said area is 300 $\nu\mho$/CM. (resistance 33 Ω - m) Good acquisition resistance considered to be from 130 to 200 Ωm and regular aquifer resistance is from 30 to 330 Ωm.

The analysis results of the present electric - geophysical survey are summarized in Appendix, Table C-2 and C-3. Interpretation curves are indicated in Appendix, Fig. C-5.

The terrace plain is developed by gravel to the depth of almost 10 m but changes to clay in proportion to depth.

Consequently the groundwater potentials are considered to be poor in its plain.

The alluvium plain was detected to have good aquifer of limited width but great depth and continued through the said basin.

Riverbed water of more than 10 m depth exists in a part the Aguan River basin and the Mame River but is poor in the proposed outlet works site near the Aguan bridge.

(2) Existing well investigation

1) Existing well

There are fairly shallow wells in the study area and the results of their investigation are summarized in the following table.

EXISTING WELLS

No.	Location	Depth	Casing			Water table	Yield method	Remarks
			size	type	kind			
1	Mendez	3.57 m	0.54 m	circle	concrete	1.98 m	manual	
2	"	4.53	0.75	"	"	3.05	"	
3	Jalisco	4.54	0.55	"	"	3.79	"	
4	"	* 6.00	0.70	"	"	-	hand pump	
5	Barranco	4.88	0.95	"	"	2.58	"	Washing only
5'	"	19.89	"	"	"	13.42	"	abandoned
6	San Francisco	21.22	0.17	"	steel pipe	6.89	3 turbine pump	
7	"	6.36	0.92	"	concrete	5.15	"	Cattle only
8	Rio Abajo	5.15	0.72	"	"	4.38	manual	
9	Balsamo	10.95	0.11	"	PVC	6.20	hand pump	no use
10	Nueva Lombardia	*20.00	0.09	"	"	-	"	
11	"	*10.00	"	"	"	-	"	
12	La Sabana	7.56	0.75	"	concrete	346	manual	
13	Armenia	9.60	"	"	"	3.84	"	
14	Jagua Abajo	39.00	-	"	steel pipe	-	12 Engine borehole pump	
15	"	8.10	1.30	square	concrete	5.60	manual	
16	Colonia San Rafael	4.34	0.75	circle	"	3.60	"	
17	Puerto Escondido	7.00	0.73	"	"	5.20	3 Engine turbine pump	
18	"	4.99	0.77	square	"	3.82		no use
19	"	2.50	0.55	circle	"	2.00	manual	
20	"	5.50	0.75	"	"	4.30	"	
21	"	3.00	"	"	"	2.00	"	

Note: 1 * bearing figure

2 Casing size is outside diameter.

These are shallow wells mostly of under 30 m depth except for one deep well. Dug wells of under 10 m depth amount to 16 wells and 70 percent of the total. This shows that a great majority of the existing wells are not deep.

As yield method is practiced mostly by manual and hand pump, power is used only of four points.

The water table is almost several meter deep and is smaller in the alluvium plain than in the diluvium. Appendix Fig. C-6 shows water table contour in some area scattered with wells.

The contours are changed by topography and river confluence but indicate the flow direction of groundwater and the same trend as that of main rivers, except the terrace plain.

2) Pumping test

Pumping test was performed to know the aquifer coefficient of its nearby area in two typical wells, No. 6 and No. 24. These results obtained the permeability values of 5.5×10^{-2} cm/sec and 6×10^{-1} cm/sec respectively, and the calculation details are put in the Appendix C-I.

3) Boring

The borings for groundwater investigation were performed and its results are shown in Appendix, Fig. C-7, C-8 and the following table.

Boring Outline

No.	location condition	Depth	Drill φ	Casing φ	Strainer depth	Static water level	Transmissibility	Permeability	Penetration test	Remarks
		m	mm	mm	m m	m	m²/d/m	cm/s	m tines	
1	Alluvium	15.60	85	73	8.00-11.50	0.99	15	1.54×10^{-2}	4.15 x 70 13.15 x 80 15.15 x 75	
2	"	14.30	"	"	11.00-14.00	3.41	57	4.55×10^{-2}	5.15 x 89 10.15 x 80 15.15 x 70	
3	"	5.00	"	—	—	—	—	—	—	undrillable by boulder
4	"	15.60	"	73	12.00-15.00	1.56	8	1.31×10^{-2}	5.15 x 32 10.15 x 7 15.15 x 39	
5	"	15.60	"	"	12.00-15.00	1.71	37	2.51×10^{-2}	5.15 x 21 10.15 x 71 15.15 x 23	
6	Terrace	2.80	"	—	—	—	—	—	—	undrillable by cobble
7	"	15.00	"	73	4.50-10.50	3.50	8	2.65×10^{-3}		
8	"	15.00	"	"	3.00-9.00	1.80	69	2.66×10^{-2}		
9	"	15.00	"	"	7.50-13.50	10.20	59	2.28×10^{-2}		
10	"	20.00	"	"	7.50-18.5	6.00	42	1.22×10^{-2}		
11	"	17.00	"	"	6.50-15.50	11.60	1	2.31×10^{-4}		

The above table shows that five borings were carried out in the alluvium plain and six borings in the terrace plain. According to this table the static water level is between 0.99 m and 3.41 m in the alluvium plain and between 1.80 m to 11.6 m in the terrace plain; the permeability is between 4.55×10^{-2} cm/s and 2.31×10^{-4} cm/s in the former and presents conspicuous variation in the latter.

In the course of the study, one set of boring machine was donated by the Government of Japan and with this machine six borings were performed by the Study Team followed with the technology transfer to the counterpart personnel.

4) Miscellaneous

There exists 37 deep wells on the banana plantation of Standard Fruit Co. at Coyoles. Because this plantation is located near the junction of the Aguan and the Yagula Rivers with the Agalteca River, it presents favored circumstances for the groundwater; the discharge is between 302 ℓ/min and 3,026 ℓ/min per well. This groundwater is used mainly for the washing factory of banana production.

Another 74 wells are found in the lower Aguan Project area and 27 of them are in disrepair. This may be caused by the geological conditions of the area.

3.4.4 Hydrogeological Profile

As a result of aforementioned studies, profiles of two sections (A - B and C - D) are presented as shown in Figs. 3-10 and Fig. 3-11.

The alluvium plan was confirmed to have fair aquifer reserves, i.e., the riverbed water in some part and deep groundwater in a continuous belt-zone (See, Appendix Fig. C-9). On the other hand, the diluvium plain presents less reserves without the presence of deepground water layer.

For volume of groundwater flow in Sections A-B and C-D is estimated to be 0.0092 m^3/s and 0.0082 m^3/s, respectively, the average value being 0.0087 m^3/s to cover whole the area*1) (See Appendix C-II) In addition, the available volume at the present stage was calculated to be 37,000 m^3/day as shown in Appendix C-III.. This volume does not satisfy the requirements for the irrigation system but only for drinking water, industrial water, small scale farms, etc.

3.5 Soil

3.5.1 Soil Survey

The soils survey was completed referring basically to the manual prepared by U.S. Bureau of Land Reclamation. In addition, taking into account the purpose and level of the study, existing soil maps on a scale of 1:100,000 prepared by OEA and 1:250,000 by CONSUPLANE/UN and aerial phtographies were consulted and actual vegetation and cutting face of road were studies.

In the course of the feasibility study, chemical and physical analyses of soils were conducted to determine the degree of suitability of lands and to prepare basic information for evaluating the feasibility of agricultural development of the study area. The factors basically considered in the Study include:

1) Negative components to check the growth of crops

2) Flexibility of land to adapt to improvement by fertilization

3) Planning of irrigation system

4) Necessity and degree of drainage improvement

In this sense, the aerial photography is useful for surveying the soils effectively. Summary of the aerial photography interpretation is included in Appendix, Table D-1.

Phasing		Components	
Preliminary Study	Data Collection	. Soil map	1:250,000
		. Topographic map	1:250,000, 1:50,000
		. Base information of the area	
		. Aerial photograph	
Phase I Field Work	General Reconnaissance	. Vegetation	. Sloping
	Survey on Institution for Analysis	. Chemical and Physical Analyses	
	Data Collection	. Meteorology	
Phase I Home Office Work	Topographical Understanding	. Interpretation of aerial photograph	
	Heteorological Conditions	. Temperature	. Humidity
		. precipitation	
	Formulation of Work Plan for Phase II Field Study		

Phasing		Components
Phase II	Detailed Reconnaissance	. Vegetation . topography
Field Work	Water Quality and Geology Study	. Consultation with experts
	Field observation	. Profile pit, boring and sampling
	Chemical Analysis	
	Physical Analysis	. Mechanical analysis
	Preparationof Soil Mpa	. Scale 1:25,000 (Based on topographic map of 1:5,000)
	Preparation of Land Classification Map	
	Elaboration of Interim Report (Intake rate test: refer to Irrigation Plan)	
Phase II	Elaboration of Final Report	
Home office Work		

Field observation, by boring and profile pits, was completed as summarized below. (see Fig. 3-12.)

Number of Field Observation

Profile Pit	Boring	Total
19	181	200

A total of 200 points were surveyed corresponding to one every 100 ha. Pits were approximately one meter deep and borings were more than 50 cm deep.

3.5.2 Soil Classification

In the study, soil classification was made in accordance with the soil maps in the area by Organizacion de Los Estados Americanos and CONSUPLANE/UN.

The soils are categorized generally by prevailing condition of climate, vegetation, topography and parent materials. However, in the study area, different soils are distributed mainly according to relief class, texture and drainage condition. Mechanical analysis of 28 representative soil samples was analyzed by Centro Universitario Regional Litoral Atlantico in La Ceiba.

On the basis of the results, however, these soil maps were partly revised. The soil map is attached in this report (see Fig. S-3). Soil was classified into 8 series. Soil series are summarized as follows:

(1) Fine Texture, Well Drained Alluvium (Ab)

This soil, which is observed in the river plains along the Aguan, the Mame and the Taguaca rivers, consists of fine river deposits with some organic content.

Land form is flat and drainage condition is good. Texture is sandy clay loam to loam in top soil and sandy loam to loamy sand in sub soil.

(2) Aguan Clay Loam (Ag)

The soil, both in area and quality, is one of the most important soil series. It occupies the low terrace along fine textured well drained alluvium series in a strip on both banks for almost the length of the valley. Texture of the series consists of clay loam to loam in top soil and in subsoil. Drainage condition is moderate.

(3) Tapusteca Loam (Te)

The soil occupies the highest area between the Jaguaca River and Saba. The soil is characterized by much organic matter in top and subsoil. Texture is silty clay loam to sandy loam in top and subsoil. Parent material is tuff. Drainage condition is moderate.

(4) Olanchito Sandy Loam (Ol)

The soil occupies the high terrace on both banks of the east in the area and landform is generally flat to undulating.

Therefore, it is much influenced by colluvial material from the slopes above. Texture is sandy loam to loamy sand in top and subsoil and drainage condition is moderate.

The series contains gravel on soil surface.

(5) Ilanga Sandy Clay (Il)

The soil, which occupies the high terrace in the east between the Mame river and the Jaguaca river, consists of sandy clay to sandy clay loam in top and sub soil and contain a little gravel. Landform is flat to undulating. Drainage condition is moderate to poor.

(6) Taujica Clay Loam (Tj)

The soil occupies the high terrace in the west between the Mame and Jaguaca river. Texture is silty clay loam to loam in top soil and loam in subsoil. It is distributed in flat to undulating landform. Drainage condition is moderate to poor.

(7) Jahauca Clay Loam (Ja)

The soil, which is important both in area and quality for reclamation, occupies the intermediate terrace. It is distributed in flat landform. Texture is silty clay loam to clay loam in top and sub soil. Drainage condition is moderate to poor.

(8) Fine Texture, Poorly Drained Alluvium (Am)

The soil shows hydromorphic properties and has a gley horizon within 50 cm of the surface.

Texture is silty clay loam to sandy loam in top soil and silty clay in subsoil.

It is distributed in flat landform. Drainage condition is poor.

3.5.3 Chemical Analysis

(1) Method

For soil description, a representative 100 soil samples were analyzed. Where soil samples were taken for chemical analysis, samples were obtained from both the top soil (0 - 20 cm) and sub soil (20 - 40 cm). Sampling point for chemical analysis is shown in Fig. 3-12 and number of sample is summarized as follows.

Number of Sample for Chemical Analysis

	Pit point	Boring Point	Subtotal	Total
Top soil	19	48	67	100
Sub soil	19	14	33	

* 134 (67 x 2) samples were determined pH and EC values.

Items and methods applied for the soil analysis were as follows:

1. P^H value determined in H_2O
2. Electric conductivity
3. Nitrate nitrogen (IN - KCI extraction)
4. Available phosphate (Bray and Truog methods)
5. Humus (kumada method)
6. Exchangeable potasium (Morgan method)
7. Exchangeable calcium (Morgan method)
8. Exchangeable magnesium (Morgan method)
9. Cation exchange capacity (P^H 7 N- Ammonium acetate extraction)

(2) Results

Chemical analysis of soils in the area were completed from an agricultural point of view. Results are shown in table 3-9 and Appendix Table D-2.

Judging from the results of chemical analysis, the soils in the area don't show any limited primary factor for the crop cultivation. Therefore, soils in the area are fairly good for agricultural development susceptible to fertilization.

3.5.4 Summary of Soil property

The details of the soil property in the area became clear from field observation and laboratory analysis. The suitability of the soils for agricultural uses was summarized in the study.

Properties of each soil series are given in Table 3-10.

In the fine texture, well drained alluvium, Aguan clay loam and Tepusteca loam series, a wide range of upland crops can be grown because of good to moderate drainage and high fertility. However, the fine texture well drained alluvium series is susceptible to flooding because it occupies the lowest terrace along the rivers. Olanchito sandy loam series has limited potential for crop cultivation because of gravel. Grass land can be recommended for cultivation in the area.

Drainage of Ilanga sandy clay, Taujica clay loam and Jahuaca clay loam series is moderate but partially poor. Root rotting of maize was partially observed in these areas. If adequate drainage is provided in these areas, a wide range of upland crops could be grown and yield could be increased.

Fine texture, poorly drained alluvium is severally limited for crop cultivation because of poor drainage. Soil moisture is too high to cultivate such crops as maize and beans on this soil.

3.5.5 Land Classification

The land classification was undertaken to evaluate the land capability in the study area. For this purpose, the manual prepared by the U.S. Department of Agriculture was principally consulted and its specification is as presented below.

Class I : Soils in Class I have no, or only slight, permanent limitations or risks of damage. They are very good. They methods. The soils are deep, productive, easily worked, and nearly level. They are not subject to overflow damage. However, they are subject to fertility and puddle erosion.

Class II : Class II consists of soils subject to moderate limitation in use. They are subject to moderate risk of damage. They are good soils. They can be cultivated with easily applied practices.

Class III : Soils in Class III are subject to severe limitations in use for cropland. They are subject to severe risk or damage. They are moderately good soils. They can be used regularly for crops, provided they are planted to good rotations and given proper treatment. Soils in this calss have moderately steep slopes, are subject to more severe erosion, and are inherently low in fertility.

Class IV : Class IV is composed of soils that have very severe permanent limitations or hazards if used for cropland. The soils are fairlygood. They may be cultivated occasionally if handled with good care. For the most part, they should be kept in permanent hayor sod.

Class V : Soils in class V should be kept in permanent vegetation. They should be used for pasture of forestry. They have few or no permanent limitations and not more than slight hazards. Cultivation is not feasible, however, because of wetness, stoniness, or other limitations.

Class VI : Class VI soils should be used for grazing and forestry, and may have moderate hazards when in this use. They are subject to moderate permanent limitations, and are unsuited for cultivation.

Class VII : Soils in Class VII are subject to severe permanent limitations or hazards when used for grazing or forestry. They are steep, eroded, rough, shallow, droughtly, or swamply. They are fair to poor for grazing or forestry, and must be handled with care.

Class VIII: Soils in Class VIII are rough even for woodland or grazing. They should be used for wildlife, recreation, or watershed uses.

In line with above-mentioned land classification specification, land in the study are has been classified in the following categories:

Class		Percentage
I	13,840	67
II	3,720	18
III	1,240	6
IV	1,860	9
V	n.a.	-
VI	n.a.	-
VII	n.a.	-
VIII	n.a.	-
Total	20,660	100

3.6 Land Use

3.6.1 Vegetation

The most important factors influencing the pattern of vegetation are rainfall, temperature, soil and, in detail, topographic conditions. In the Aguan Valley, the amount of rainfall varies from 2,500 mm in the coastal zone facing to the Carribean Sea, 1,600 mm at Isleta to 1,000 mm in Olanchito and 900 mm at Coyoles. As going upstream of the Aguan River, the features of a humid tropical climate appear more characteristically. The mean monthly temperature throughout the valley is between 23°C and 30°C, 36°C at the maximum and not lower than 16°C at the minimum. The monthly mean relative humidity is between 60% and 84%.

Under these climate conditions, the vegetation of the area presents the characteristic features of the tropical rain forest and judging by the vegetation in this area, there are no specific series of soils which produce different patterns of vegetation.

In the coastal zone of the Aguan Basin, mahogany trees have been cut down and next to this area oil palm is planted growing well except where badly affected by flood hazards. Large trees, such as Coroza (Palm), Chaperno, Tabascan, Madriado are flourishing and basic grains such as, maize, rice and beans are vigorous. But in the area between the Mame River and Olanchito the amount of rainfall becomes less and the cultivated areas of pastures without irrigation are increasing.

Going up the Aguan River to Coyoles, plants become extremely scarce;only Jamacuao and Tuna (Cactus) are seen prominently due to less amount of rainfall and soil texture of sandy loam. Without irrigation system, crops are scarcely to be seen in this area.

3.6.2 Present land use

There are 15,800 ha of arable land between Saba and Olanchito. Settlement of farmers in this area was consolidated in the form of cooperative and until now 26 cooperatives have been settled. The total area of these cooperatives is 7,681 ha. The main crops are maize, rice and beans as shown in Table 3-11 and Table 3-12.

Maize and beans are cultivated in two crop seasons: primavera and postrera. The primavera crops generally are sowed in June and July and harvested in October and November. The postrera crops are sowed in December and January and harvested in April and May. Rice is difficult to cultivate in the postrera season due to lack of water content in soil and rice is substituted by maize and beans.

Cassave and plantain are cultivated only for the consumption of farmers and an estimated extent of the area is 21 ha and 7 ha, respectively.

Total area of pasture in this zone is 7,712 ha. Within this area 1,394 ha are distributed for cooperatives. Only 605 heads of cow are kept in the area to produce milk. There are many pastures not cultivated due to lack of financial resourses. Improved pastures (hacienda) are found which have been established for many years.

The greatest problem is that 4,051 ha, 53% of total area of cooperatives remains uncleared. With the completion of an irrigation system this area will be cleared and used to cultivate many crops.

3.7 Agricultural Production

3.7.1 Bananas and Oil Palm

(1) Banana

Bananas are grown on a commercial scale in two estates at Coyoles and at Isletas. The total net area at Coyoles is 3,962 ha and isletas 2,030 ha. Both plantations were originally established by the Standard Fruit Company, so they are structurally similar.

The plantation at Isletas is under the control of the Empresa Asociative Campesina in Isletas (EACI). EACI was formed in 1975, from the ex-workers of the Standard Fruit Company, following that company's abandonment of the plantations. EACI has 1,118 members. The terms of a five year contract between the Standard Fruit Company and COHBANA (Banana Cooperation of Honduras) binds the company to purchase all bananas of export quality produced at Isletas. The price per box at present is Lps. 5.63.

The differences between Coyoles and Isletas plantation are reflected in average yields of 72 ton/ha at Coyoles and 43 ton/ha at Isletas respectively, and improvements have been achieved at Coyoles in irrigation drainage, fertilization and pest control. But at Isletas, soil is slightly less well-drained and rainfall is nearly double.

The irrigation systems of both plantations are fundamentally similar. Watering is chiefly used, but lately, at Coyoles a drip irrigation system was installed and shows good results, because water is used in proportion to the water requirements of the plants. The rainfall deficit at Coyoles is more serious than Isletas, and Coyoles needs all-year (300 days a year) irrigation.

Fertilizer is applied on the basis of leaf analysis, and KCl, urea and phosphate are generally used. Fertilizer is applied through the pipe of irrigation system.

The varieties of banana plant are Cavendish and Ecuatoriano. The Ecuatoriano variety has high yield and is little damaged by the wind because it is low in height.

The most common diseases are Sigatoka and Moko. Dihtance, benlate and methyl bromide are effective for these. Insecticide is not

used, but the plastic film bags for fruit are used to control insects, which transmit diseases such as Atracnosis and Ojo Bajo.

Bananas are exported every week: usually 72 thousand boxes and at least 42 thousand boxes a week. Bananas are cut at the stage of 77-84 days to export to Europe and 84 days to U.S.A.

(2) Oil Palm

The total gross area planted in Phase I, & II Lower Aguan Project is 10,500 ha. The crop requires a humid-tropical climate without a pronounced dry season. It tolerates a moist soil water regime, though it is seriously affected by water-logging and rotting of arrows occurs frequently.

Fertilizer was scarecely applied in the first three years after planting. Fertilization is given based on the results of leaf-analysis. In practice ammonium sulphate of 21% N, and potassium Chloride of 60% K_2O is recommended. In 1982, a program of fertilization was operated with good results of 65% of total area. In 1984, it is expected to rise to 80%.

Occurrence of diseases and insects is very little and insignificant. Herbicides are recommended for weed control. Cart transportation is used from the field to the plant. This costs is paid by the plant at a price of Lps. 0.38/ton. The internal transportation in the plantation is practiced by a tractor with a wagon. In practice, the cart pulled by a mule, is used economically without hurting the root system of the plants, and doesn't harden the soil much.

Imports of palm oil were some 9,500 tons in 1981; 1,900 tons in 1982.

Since the end of 1983, Honduras has sold palm oil on the international market. Principal buyers are likely to be England, Italy, Central and Latin America. In 1983, exports were 2,000 tons to England, and 1,000 tons to Nicaragua.

The price of fruits is as follows:

A) Bulk L. 130.00/ton

B) Cluster L. 127.00/ton

The price of oil in the interior market is L. 1,200.00/ton, in the international market L. 1,600.00/ton, F.O.B. at the Port of Castilla.

3.7.2 Citrus

(1) Oranges

In December 1983 the total gross area of oranges was 916 ha in the neighborhood of Sonaguera, and this is increasing due to new

planting. The Association of Citrus Cultivators of Sonaguera is established and the members are 220. In practice, only 150 members have planted oranges and the rest will plant from this year. Next year, the new plantation area planned will be 2,100 ha.

Production in the previous year ('82 - '83) was 80 million fruits. At present, production of 120 million fruits is estimated. These fruits will be purchased by the company, Griffin and Brand at price L. 165.00/ton. Griffin and Brand is a Northamerican company, which at present gives citrus cultivators help for the purpose of purchasing orange fruits.

The help consists of complete technical assistance to the established farm, and to new cultivated areas. The company offers all the necessary financial assistance from clearing of the field to harvesting the crops, including all necessary control substances to get excellent production.

When the yield of the new plantations begins, the fruits will be processed at the juice plant in San Pedro Sula. The sales price of the juice is excellent and future prospects all seem good. Orange juice will be exported to Central America and the U.S.A.

In 1983, the oranges, produced at Sonaguera, were exported to the Netherlands and some other countries and were sold in the interior market at L. 20.00 to L. 70.00 per thousand pieces.

Seed is sowed in rainy season from October to December. Control of weeds is practiced by hand. Insect injury is insignificant. The most common diseases are Comosis and Exocortis.

There is a region of 130 ha of oranges between Saba-Olanchito, adjoining the Aguan river. Fruits are for local use.

(2) Grapefruit

Since 1977, INA has assisted cooperatives to establish grapefruit plantations and the total area reached 913 ha in 1981. However, it decreased rapidly afterwards, because of decreasing exports. The total net area of grapefruits is 429 ha in 1984.

Due to poor external quality of grapefruit, only a small proportion of production has been exported to data. Non-exportable fruit has been processed into concentrate juice at the Standard Fruit Company's plant in La Ceiba, but subsequently the market for grapefruit juice declined and substantial quantities of grapefruit were buried. The quality of the juice was considered acceptable for the European market, but too acid for Central and North American taste, due to delivery of under-ripe fruits.

The packing plant which is situated at Chiripa is expected to produce 70 million boxes, which will be purchased by Griffin and Brand. Price for a box, F.O.B. at Chiripa is L. 4.20.

The most common diseases are Comosis and Exocortis. The control of Comosis is practiced by CaO and Antracol. Exocortis is controlled by applying the fertilizer including Borax.

3.7.3 Basic Grains

(1) Maize

The primavera crop is sowed in May, June or July, with the first adequate rain, and is harvested in October or November. The postrera crop is sowed in November, December or January, and is harvested in April or May. The total area of maize is 1,694 ha in primavera and 2,019 ha in postrera.

The primavera crop is harvested in rainy season, and therefore the most serious problem is the high moisture content of the grain at harvest, generally around 22%, and associated with fungus infection.

Consequently, 10% of primavera crop is not sold.

Although both IHMA stores in Olanchito and Tocoa have grain drier, they are not extensively used.

Land preparation is commonly done by tractor of INA, with a heavy harrow in excellent cooperatives, but is practiced only by slash and burn with machete in inactive cooperatives. Sowing is generally done by hand, several seeds being dropped into a small hole made by a pointed bar. The majority is farm-saved seed to grow to a height of about 2 m in period of 120 - 130 days, less in the postrera and more in the primavera. Synthetics tuxpena is occasionally grown. This is said to yield perhaps 30% more and grain is easier to separate from the cob.

Almost no fertilizer is applied to maize. A significant number of farmers apply herbicides as a supplement to hand weeding. The two popular products are 2.4D and Gramaxone.

Corn earworm and stemboarer are the most serious insects, but no pesticides are applied. The yield is obtained 1.8 - 3 ton/ha from both primavera and postrera. But yield of primavera crop is generally less than postrera as is the case in the cooperatives, as shown in Table 3-13, because of fungus diseases in humid season.

(2) Rice

Although, rice is desired by farmers to cultivate on a large scale because of good yield and high price, the total area is 302 ha only, because the seeding period is liable to delay due to the weather, and intensive labour is required for weeding, bird scaring and harvesting.

Rice is cultivated in the primavera season in this area. The seeding period is varied from May to September. Rice is rainfed

and grown on land with imperfect drainage system and the seeding period becomes late on sandy soil and early on clay soil. Harvesting time ranges from September to January.

The farm-saved seed is used by half of the cooperatives. The improved varieties CICA 6 and CICA 8 are used occasionally by advanced cooperatives. No fertilizer is applied. Herbicides, Stam LB 10 and 2.4D are used as a supplement to hand weeding. No fungicides and insecticides are applied. The yield is obtained at 2-4 ton/ha.

(3) Beans

Beans are crops of low water requirement like maize and with one time weeding, leaves of beans cover the field, saving a lot of trouble. Most beans are produced on the steep hilly slopes. Conditions during the wet season encourage fungus diseases. Consequently, postrera cultivation is more than primavera. At present, total area is 80 ha in primavera season and 178 ha in postrera season.

Beans as primavera crop are sowed in May or June and harvested in August or September; as a postrera crop they are sowed in December or January and harvested in February and March.

The most commonly used variety is the native kind of the bush-bean, San Moreno, but climbers are sometimes used to grow up the old maize stalks.

Fertilizer, herbicide, fungicide and insecticide are not applied. Yield is 1-1.5 ton/ha.

3.7.4 Other Agricultural Products

(1) Cassave and Plantains

Both cassave and plantains are the important subsistence crops and are cultivated in small patches of many household gardens. Cassave has both sweet and bitter types and yield is 20 ton/ha. Plantains are unduly affected by black Sigatoka. Yield is about 20 ton/ha. Lately the cultivated area of these products has increased.

(2) Other Fruit Trees

Ciruela, mongo, lemon, avocado, papaya, soursop and zapodilla are cultivated in many household gardens. Among these fruits the ciruela is the most prominent.

3.7.5 Agricultural Industry Products

(1) Agro-industry Products

In the study area, there are no processing plants of industrial and horticultural crops. However, lately the production of palm oil, grapefruit juice and orange juice have increased gradually due to an abundance of materials produced in lower Aguan Valley.

As the oil palm planted in lower Aguan grew rapidly, its production increases every year and Honduras, once an importer of palm oil, have become an export country. And the orange juice plant is under construction in San Pedro Sula expecting the production of new plantation at Sonaguera. Furthermore, the Standard Fruit Company is the major exporter of pineapple from their plantation at Montecristo near La Caiba. Pineapple, in addition to being exported fresh, is juiced for export as concentrate. These activities, in the neighborhood of lower Aguan, and in La Ceiba or in San Pedro Sula, would give this middle Aguan Valley good stimulation.

3.7.6 Livestock

(1) Outline

In the Republic of Honduras, cattle raising has traditionally been the most popular sector of livestock production. According to the statistics of the FAO Production Yearbook (1981), the number of livestock animals raised in the country has changed as shown in the table below.

Number of Animals Raised in Honduras

(Unit: thousand of head)

Animal	1969 - 71	1971	1980	1981
Horse	173	149	150	151
Dairy cattle	1,573	2,234	2,262	2,336
Minch cow	308	342	338	334
Swine	545	531	534	580
Sheep	3	5	5	5
Goat	18	22	22	22
Chicken	2,903	4,445	4,808	4,900

(Source: FAO Production Yearbook,Vol. 35)

As in other developing countries, in Honduras the small-scale pig and chicken farms have been rapidly increasing compared with the traditional cattle farms.

Yoro Province, where the study area is located, has the fouth largest land area of a total of 18 provinces in the country. LATINOCONSULT, S.A. (1984) estimates that the number of cattles raised in this province is 251,675, ranking the second largest share or occupying about 9.3 percent of total number of cattle in the country. The livestock, cattle raising in particular, is one of the most important sectors in Yoro Province (See Appendix , Table E-28).

The livestock (cattle raising) in the study area extends to the left bank, from Olanchito to El Juncal, and on the in right bank, from Olanchito to the Jaguaca River, of the Aguan River. A cattle breed capable of producing both milk and meat has been bred in the study area for a long time, mainly for milk production. The majority of the cattle farming is managed on large-scale farms, called "Hacienda".

In Olanchito, central part of livestock production in the middle Aguan River Basin, there is an organization of livestock farm owners called SAGO (Sociedad de Agricultores y Ganaderos Olanchito). The SAGO's data as given in table below shows the status of cattle raising in this area.

Status of Cattle Farms in the Middle Aguan River Basin

Division	Area	No. of farms for cattle raising	Total No. of cattle raised	Average No. of cattle per farm
STUDY AREA	Olanchito - El Juncal	31	5,549	178
	Olanchito - Rio Jaguaca	56	13,024	232
	(Subtotal)	(87)	(18,573)	(213)
OUTSIDE STUDY AREA	Olachito - San Lorenso	126	22,554	178
	El Okote - Alenaru	86	15,398	189
	(Subtotal)	(212)	(37,952)	(179)
TOTAL		299	56,525	189

Average land area per farm: 202 ha.
Average area of pasture per farm: 186 ha.
Max. farm area: 707 ha.
Min. farm area: 35 ha.
Average No. of cattle per farm: 189 ha.
Average No. of minch cow capable of producting milk: 51 heads
Average volume of milk obtained per head per day: 2.5 liter
Average No. of pasture divisions per farm: 15 divisions
Area of one division per farm: 13 ha.

(Source: SAGO, Memorandum, Aug. 31, 1984)

The number of cattle raised in the area mentioned in the above table occupies 22 percent of the whole Yoro Province.

Livestock (cattle raising) can be considered a very important sector in the middle Aguan River Basin.

Livestock (cattle raising) in the study area can be classified into two types of farms: a) individual farms and b) immigrant cooperative member's farms concentrating in Sector 5, between the Jaguaca River and the Monga. In case of the latter type of farm, almost all production are usually self-consumed by members of cooperatives, and the number of cattle is fewer than that of the former type of farm.

A questionnaire was conducted in respect to cattle farms with the exception of immigrant cooperative members. The survey results are summarized below and also given in Appendix, Table E-29.

1) The improvement of pasture has been unexpectedly achieved at a higher level. About 80 percent of total pasture has already been improved.

2) The study area is equipped with various kinds of pastures suitable for cattle raising, which is advantageous for rearing cattle in terms of feeding management compared with the Upper Aguan River Basin Area.

3) There are many farmers who do not belong to the SAGO.

4) The cattle farms in the study area have less experience than those in the Upper Aguan River Basin.

5) Many farmers have not been rendered any technical extension services.

6) The number of farmers who get loans from banks is less in the study area than those outside the study area.

7) Many farms are raising pigs and chickens together with cattle in the study area. Pigs are particularly popular among those farms.

8) More answers have been collected in on questionnaires from non-members of SAGO than those from SAGO's members.

In the middle Aguan River Basin, various kinds of livestock animals such as sheep, pigs, chickens and even bees, are raised besides cattle. However, most of them are for self-consumption of farmers practicing non-systematic raising methods. The breed presently practiced is mainly Criollo (native breed) or a crossbreed with Criollo and improved breeds. In addition, the prevailing raising method in the area is a ultra-extensive one with a mono-feeding of cornmeal and without measures against the prevention of diseases such as vaccinations, parasite control, etc.

In recent years, "Pig Farming Project" and "Poultry Farming Project" for rural women have been launched and implemented under the direction of MRN and financial aid from foreign countries in the Aguan River Basin. Through these projects, the interest in livestock production has been increasing among medium- and small-scale farmers.

The outline of new agriculture projects for rural women in the middle Aguan River Basin with financial aid from foreign countries are shown in Appendix, Table E-30.

(2) Cattle Breeds

The breeds of cattle currently raised in Honduras consist of F1 cross or ternary cross among Brahman, Brown Swiss, Holstein and Criollo. In addition, some farms are raising Simmental, Charolais and Santa Gertudis as Bulls. Natural insemination is common but

some large-scale farms are employing artificial insemination by applying frozen seman imported from U.S.A.

(3) Dairy Production

Due to the lack of refrigeration facilities at most farms, the cows are milked only once a day at about 4:00 a.m. every morning. The raw milk is delivered directly to the neighboring markets for sale as well as for cheese/cream producing plants located in the Aguan Valley.

The LEYDE (Leche y Derivado Compania), a milk processing company, with its base in La Ceiba, collects raw milk in the area between Saba and the Jaguaca River, and transports it to their refrigeration plant in Jutiapa. They do not collect raw milk in the upper area of the Aguan River from Olanchito. It is estimated that the volume of milk obtained is over 4 liters/head/day in the rainy season and less than 1-3 liters/head/day in the dry season, with an average of approximately 2.0 - 2.6 liters/head/day.

(4) Dairy Plant

There are three dairy plants in the upper and middle Aguan River Basin. The principal products of these plants are cheese and cream and production is carried out with technical assistance from Switzerland.

One of these plants is at El Juncal on the left bank of the Aguan River. The outline of each dairy plant in the middle Aguan River Basin is shown in Appendix, Table E-31.

(5) Pasture

As the questionnaire indicates, it is considered that about 80 percent of the pastures are the improved and pasture management is well conducted on the large-scale farms. Although soil fertilization and regular turnover plowing are not practiced, weeding is done completely by hand.

The pasture is extensively utilized for each cycle of pasturage only, and very often to do forage, hay, and silage.

The species of main grasses are shown in Appendix, Table E-32 of which the most important grasses are Guinea Grass and Merkeron. The area where the Merkeron is planted has a higher production potentiality.

Leguminosae grass has not been planted yet as a cattle feed, but Leucaena is only one plant which is presently used as a farm's fence among Leguminosae. Along the Aguan River, namely, in the right bank from Olanchito to the Jaguaca River and in the left bank from Olanchito to El Juncal, mountain slopes are well utilized for cattle raising and pasture control by burning is partly carried out.

(6) Beef Cattle production

The dual purpose of beef cattle production is conducted in the study area. Mainly, steers are grown to be sacrificed as beef cattle and feifers are used for replacement of milking cows. The growth of cattle for beef production is extremely low, and the average liveweight is 300 - 400 kg, at around 30 months after birth. The produced beef cattle, except that of the large-scale farms, are mainly delivered to La Ceiba, San Pedro Sula and Tegucigalpa by middlemen's trucks (livestock merchants). Through the two packing plants located in San Pedro Sula, some of beef is exported to U.S.A. as a boneless frozen cut meat. The reputation on beef cattles produced at the survey area, however, is not so high among the packers due to the existence of many parasites, the low meat ratio, and so on.

An approximate estimation of beef cattle productivity is given, (See Appendix, Table E-33), which is prepared through the questionnaire.

(7) Public Slaughterhouse

There are public slaughterhouses in Olanchito, Saba, El Ocote, etc., and these are mainly used for slaughtering and processing of the culling cattle and the Criollo for local consumption. As well as dairy plants, the slaughterhouses are not equipped with refrigeration facilities, so the slaughtering and processing are started at 1:00 a.m. and the products are transported to the markets at 5:00 a.m. The slaughterhouse in Olanchito, in which an average of 3 - 4 heads of cattle and 2 - 3 heads of pig are processed daily, are not well equipped with adequate machinery, environment and sanitation.

(8) Price of Livestock products

The price of each livestock products in the study area in August and September, 1984 were as follows:

Producer's Price (Ex-Farm Price)

Milk (LEYDE buying price)	0.48 Lps./litre
Milk (for local dairy plant)	0.35 Lps./litre
Beef (delivery price to retailer	0.60 Lps./lbs. (1.32 Lps./kg)
Pork (delivery price to retailer)	1.0 - 1.2 Lps./lbs. (2.2 - 2.64 Lps/kg)
Chicken Egg (non-selective and unwashed)	0.15 - 0.20 Lps./pc.

The price of milk tends to go up at 10 - 15% in dry season due to the decline in production, while the price of beef tends to go down at 10 - 20% in January and February due to the concentration of post-harvesting.

Consumer's Price at Olanchito

Beef (1st grade), frozen	2.0 Lps./lbs. (4.4 Lps.kg)
Beef (1st grade), fresh	1.8 Lps./lbs. (3.96 Lps./kg)
Pork, frozen	1.7 Lps./lbs. (3.74 Lps./kg)
Pork, fresh	1.5 Lps./lbs. (3.3 Lps./kg)
Milk (not treated)	0.4 Lps./ (3/4 litre) (0.53 Lps./litre)
Chicken Egg	0.2 Lps./pc.
Chicken Meat (frozen broiler)	1.8 Lps./lbs. (3.96 Lps./kg)
Cheese (local type)	1.3 Lps./lbs. (2.86 Lps./kg)
Cream	2.3 Lps./lbs. (0.56 Lps./kg)
Sausage (homemade)	3.9 Lps./lbs. (8.58 Lps./kg)
Fish (both freshwater and seawater fishes)	2.0 Lps./lbs. (4.4 Lps./kg)
Powdered Milk (imported, made in Holland)	6.0 Lps./450 g
Cornbeef (made in U.S.A.)	7.3 Lps./198 g
Luncheon Meat (made in U.S.A.)	7.5 Lps./395 g

Note: 1) All canned meat and dairy products are imported.

2) Broiler is produced in San Pedro Sula.

3) Frozen beef and pork are preserved in cold storages.

Comparison of Consumer's Price of Major Livestock Products in Olanchito and San Pedro Sula

(Unit: Lps.)

Products	Olanchito	San Pedro Sula
Beef (1st grade)	2.00/lbs.	2.40/lbs.
Pork	1.70/lbs.	2.40/lbs.
Chicken Meat	1.80/lbs.	1.70/lbs.
Chicken Egg	0.20/lbs.	0.15/pc.
Fish (Freshwater and seawater fishes)	2.00/lbs.	1.50/lbs.

The prices of beef and pork in Olanchito are cheaper than those in San Pedro Sula. As mentioned before, the meat produced in Olanchito comes from culling cattle and Criollo, so it cannot be concluded that producer's price is cheaper in Olanchito than those in San Pedro Sula.

(9) Outline of Livestock in Neighboring Provinces

In the neighboring provinces such as La Ceiba of Atlantida province, Trujillo of Colon Province, and San pedro Sula of Cortes Province, the modern feeding systems for cattle, pigs and chickens have started to be applied, and the special bread for each species has been introduced.

In particular, at Tumbador Ranch in Trujillo, the Beemfaster (the special hybrid for beef cattle crossbred among ¼ Short Horn ¼ Heleford and ½ American Brahman) is raised under technical guidance conducted by Florida University, U.S.A. The body weight of this breed reaches to 2,000 pounds in 24 - 30 months. The livestock production techniques have been rapidly improved as proved by the success of Embrio Transfer, etc.

(10) Marketing of Livestock Products

The marketing channel of livestock products in the middle Aguan River Basin is complicated as illustrated in Appendix, Fig. E-2. The middleman (livestock merchants and brokers), so called "Intermediario", has expanded his business to cover every site of the study area, and is dealing with all livestock products including beef cattle, steers, breeding stocks, pig, chicken egg, cheese and cream.

Some of these middlemen have their own cattle farms. It is assumed that many of them earn high profits, because they buy beef cattle at cheaper prices early in the dry season and stock them for growing further fat at their own farms. Most of these retailers come from La Ceiba, San Pedro Sula and Tegucigalpa, but some of them own the afore-mentioned large-scale farms around Olanchito.

The prices for livestock products except dairy products are negotiated and set by outer size of animals and weighing for each animal is not realized. The dealing system usually result in disadvantage for producers.

There are no standards established to estimate the quality of livestock products. Consequently, producers do not pay much attention to the quality, and tend to raise animals in the easiest way. It is envisaged that the interferences of the retailers will be much strengthened as the infrastructures in the study area will be improved in the future.

(11) Training and Extension Services

The assistance and extension services are provided by INA to the cooperative of Agrarian Reform and by M.R.N. to the existing

individual farmers who have their own land, although cooperation between these two organizations does not seem to be closely related. There is a local office of M.R.N. in Olanchito, with about 15 personnel including two veterinarians. This local office undertakes various activities such as artificial insemination of cattle, technical guidance on pasture improvement, research and prevention of animal diseases. Due to the lack of equipment, education, training, experience, etc., it does not seem that the objectives of this local office are fully accomplished.

In accordance with the results of the questionnaire survey, only 24 percent of farmers living between Olanchito and the Jaguaca River and only 4 percent of farmers living between Olanchito and EJ Juncal are receiving technical assistance.

This situation should get better with the improvement of agricultural infrastructure. The organization chart of the local office of MRN in Olanchito is shown in Appendix, Fig. E-3.

(12) Animal Disease

Presently, there is no appearance of serious animal infectious diseases such as Foot and Mouth Disease, African Swine Fever, Pseudo Rabies, as reported in South American and Caribbean Island countries. The animal diseases appeared in the study area at present include external parasites during dry seasons, impediment in breeding caused from unbalanced nutrition, and mastitis, in addition to Hemorrhagic Septicemia, Sysmptomatic Anthrax (Black-leg) which can be prevented by vaccination. At medium- and small-scale farms, they do not apply vaccination and the ultra-extensive method is done for animal raising. In this regard, the establishment of an animal disease prevention system to achieve further livestock development is required.

3.8 Agrarian Reform

3.8.1 Land Tenure

(1) National Level

Empowered by the Agrarian Reform law issued in 1975, INA has been redistributing land to the groups of land-less agricultural laborers and land-poor small farmers.

They have formed cooperatives to cultivate the land allocated to them.

The program aims at increasing productivity in the agricultural sector on the one hand, defusing the social crisis mainly caused by the population explosion on the other hand.

From the outset till 1980, about 211 thousand hectares had been re-distributed.

Through 1980, INA acquired about 60 thousand hectares of land, for which it paid about 15 million Lempiras. 9 percent was paid in cash, 60 percent of the rest in the bond of 25 years maturity with an interest of 2 percent per annum.

INA has established special task forces for issuing titledeed of the land to encourage farmers to hold them. In one poster, it reads: Peasant! Protect your family. The land you occupy is a part of your legacy. But issuing of titledeed where identification of legal ownership is involved has actually been a cumbersome and time consuming process. On the occasion of inaugural ceremony of Tocoa branch office of BANADESA, on September 9th, 1984 the President handed over a titledeed to ISLETA cooperatives of banana growers in the Lower Aguan, which settled on the land that had been abandoned by Standard Fruit Company after 1974's cyclon "Fifi".

According to the annual report of INA 1983, it acquired about the area of 19 thousand hectres in 1982, and 22.7 thousand hectares in 1983.

Table E-1 of Appendix shows how these lands were acquired. 52.5 percent were retrieved from the national land, and 44.4 percent were expropriated from the private land.

During the same year, about 19 thousand hectares of land were redistributed to 207 co-operatives with 4,930 members.

The average size of land per member is about 3.9 hectres. In the case of 1982, it was about 4.8 hectares.

Table E-2 of Appendix gives federation-wise breakdown.

In 1982, only 179 titledeed on 2,100 hectres of land were issued. In 1983, thanks to AID, INA was able to issue, 4,179 titledeeds on 22,212.7 hectres of land.

(2) The Regional level

According to the national agricultural census carried out in 1974, in the region which consists of 8 municipalities, a total area of 153 thousand hectres, mostly located in the area below the 10 percent slope line, were distributed to the 6,438 holdings. And in the statistics, the holdings are divided by four different forms of tenure. Their break is shown in the following tables.

Distribution of Land Holding According to the Forms of Tenure

(Percentage)

Tenure	No. of Holdings		Area	
	Aguan Valley	Olanchito	Aguan Valley	Olanchito
Private	19	28	41	48
Sate Land	57	49	39	35
Lease/Rent	19	14	7	3
Others	5	9	13	14
Total	100	100	100	100

Source: Censo Nacional Agropecuario, 1974

(3) Project Area

The area belongs to Olanchito municipality.

There, a total area of about 53 thousand hectares were distributed to 1,750 holdings. The area covered 26 percent of the municipality area, in which the area below 10 percent slope line is 55,331 hectares. In the same tables, above-mentioned corresponding figures of Olanchito municipality are also given.

A half of the claimed land was privately owned. Some of the biggest parcels are held by Standard Fruit Company and larger parcels are by cattle farmers.

The distribution of the holdings according to the size of parcel are shown below.

Number of Holdings and the Size of the Parcels

	-3 ha	3ha-10ha	10ha-50ha	50ha-200ha	200ha-1,000ha	1,000ha	Total
No.	565	425	529	180	49	2	1,750
Area (ha)	884	2,485	12,468	16,950	18,176	2,290	53,253

Source: Census Nacional Agropecuario, 1974

The private owners, especially the big cattle farmers are showing their anxieties expressing their concerns if their lands were adjudicated to the project in due course with the progress of the project. In those occasions, the officials from INA reiterated their official views that they are interested only in the land which will raise the productivity by the introduction of the project.

Whatever the uncertainties exist about the land tenure within the boundary of the study area, which has hampered the coming of private capital, judicial situation shall bound to be clarified sooner or later with the introduction of this project.

3.8.2 Farmer's Cooperatives

The success of increasing number of agricultural co-operatives are proofs of the fact that the agrarian reform program managed by INA has been gaining momentum. There are three major federations of co-operative; FECORAH (The Honduran Federation of Land Reform Co-operatives), ANACH (National Associations of Honduran Co-operatives) and UNC (National Union of Campesinos). The FECORAH is the oldest establishment, sponsored by INA. So, some of the member co-operatives have begun to flourish, with established cash crops perennial and annual.

There has been a problem of abandonment of land at the early stage of settlement. Then it was followed by other types of problem : reallocation of settlers, land titles and productivity.

Co-operatives were supposed to pay the cost of land which was set at 200 Lempiras per hectare at first. The terms of re-payment were soft, in installment of 20 years of maturity with no interest. Then the substantial reduction of the value of land was made by the co-operatives' request. The new price : 65 Lempiras per hectare.

In the Lower Aguan, between Saba and Corocito, Isletas and on the left bank where most of the co-operatives belong to FECORAH, they grow African palm, banana or raise cattle for cash income, and the end of the second phase of the Lower Aguan Valley Development Project has seen much improvement of the standard of living in the

part of the member farmers. With the increase of the income, co-operative can afford to have full-time administrative officer in its executive body. The result is enhancement in wielding and holding more political as well as economic power.

They have more chances of getting into the secondary industries as their credit worthiness goes up. Establishment of palm oil extraction mill is one of the examples.

Table E-3 of Appendix will give an idea how the co-operatives in the Aguan valley had developed since their inception and what they grow in their land.

As of July 1982, each member of the co-operatives had in average 12.6 hectares of adjudicated land in which he cultivated 7.2 hectares, 57 percent of the adjudicated land. In Olanchito municipality, the corresponding were 10.1 hectares, and 6.9 hectares, 68 percent.

According to the Lower Aguan Valley Development Project, the area is divided into five sectors administratively. In the end of 1983, sector 1 (between Tocoa and Saba) consists of 22 cooperatives. Sector 2 (Corocito-Tocoa) 19, Sector 3 (the left bank of the Aguan) 23, Sector 4 (ISLETA) 18 and Sector 5 (Saba-Rio Jaguaca) 15. The number of cooperatives is on the increase.

The Sector 5, which is located in the middle Aguan geographically, is included to the area which this feasibility study covers. Neither African palms nor citrus nor bananas grows in commercial scale in the Sector 5. All the cooperatives in this area grow mainly maize, and very few raise cattle, though they have land for pastures. Most of the cooperatives belong to ANACH. The details of the cooperatives in the study area is shown in Table 3-14.

In the study area, at the time when this study was carried out, there were 14 cooperatives with 765 members on the right bank of the Aguan between the Monga River and the Jaguaca River, which corresponds to most of the Sector 5.

2 cooperatives with 37 members between the Jaguaca River and the Mame, 5 cooperatives with 115 members between the Mame and El Puente. On the left bank of the river, there are 5 cooperatives with 242 members, in which one in the Sector 5. All of them have land on the right bank of the Aguan. One cooperative "El Cajon" with 27 members was being formed in the Sector 5 by the evacuees from the site where El Cajon hydroelectric power is being carried out. Three other cooperatives are now waiting for the allocation of land from INA.

In many aspects, cooperatives in the sector 5 shows quite a different characteristic than those in the rest of the area, so is the case with the Sector 5 and the rest of the sectors in the Lower Aguan Project.

The following will throw some light on these differences.

The name of the town "Olanchito" is a diminutive of Olancho, the department situated east to the Aguan Valley. People of Olancho used to cross the mountain range to come down to the valley. Now, people started coming to this valley from all the parts of the country due to INA's initative. In the Sector 5, there are only three cooperatives in which majority of the members are the natives of the area. Even the degree of majority is less than 60 percent. No cooperative consists of less than three different groups of people from the same locality, except one. There is only one cooperative which consists of three groups. In five cases, there is no single majority group. There are three cooperatives which are formed by eight or nine groups. In five cooperatives, people from the southern departments, Choluteca and Valle form majority or near-majority group. But the picture in the rest of the study area is quite different from the one mentioned above.

The natives in the area is the majority in all the eleven cooperatives. Five cooperatives are formed only by the natives. Two cooperatives made of two groups, three of three groups and one made of four groups.

The average adjudicated area to each cooperative in the Sector 5 is 453 hectares, and 7.3 hectares to each member. Corresponding figures for cooperatives in the rest of the areas are 121 hectares and 5.9 hectares. According to the INA's direction, five hectares is the standard size of the land to be adjudicated to a family. So, in all the relating statistics of the INA, the possible additional number of members to bring in to the cooperatives is mentioned along with the number of atual members.

Number of the members of the cooperatives has been changing incessantly that the regional offices of INA and MRN have charts to show the monthly changes in number. But in the Sector 5, the number has increased from the initial stage by 2.1 times, whereas in the rest of the area, it has decreased by 19 percent.

In the Sector 5, average number of members per cooperative is 62; maximum 167 and minimum 34. In the rest of the area, corresponding figures are 21, 40 and 12.

ANACH has two regional organizations in the study area to coordinate individual cooperatives and to find better access to the channel of aministration. All the cooperatives which are affiliated to ANACH automatically belong to these regional organizations. If a cooperative doesn't want to join any of the federation, it can remain as an independent cooperative like the cooperative "Carbajales".

"CARCOL", one of the regional organizations of ANACH consists of 22 cooperatives in the Sectors 1, 2, 4 and 5.

The MRN sends a coordinator for technical and credit assistance. President of this organization is a brother of the president of cooperative "21 de Abril".

The other one has an office in Olanchito. It is formed by 25 coopeatives in Olanchito municipality, above the Jaguaca River, both banks of the Aguan. The president of cooperative "Valle Aguan" has been doing the job of president of this regional organization.

3.8.3 Agricultural Supporting System

(1) Agricultural Credit

In the end of 1983, the outstanding credit of the Honduran banking system reached over a total of 1.9 billion Lempiras, an increase of 15.9 percent from the previous year.

According to the statistics of the outstanding credit of loans and discounts of the Honduran banking system at the end of three consecutive calendar years, 1981, 1982 and 1983, the sector of agriculture and animal husbandry had been getting as much loan as the industrial sector has.

In 1981, the former got 23.5 percent of the total loan and the latter, 22.2 percent; and in 1983, the former 24.3 percent, the latter 25.3 perent.

The construction and real estate sector comes the third with about 20 percent, and the commerce sector and the service come the fourth with around 13 percent. (See Appendix, Table E-4.)

In the end of 1983, loans provided by commercial banks accounted 65 percent of the overall loan, development banks around 23 percent, and the savings institutions 12 percent. This composition had not been changed much since 1981.

Most of the saving institutions' loan went to the real estate sector and the rest to the consumers'. 58 percent of the loan to the sector of agriculture and animal husbandry comes from commercial banks, the rest from the development banks. To the agricultural sub-sector, about the same volume of loans were supplied by both commercial and development banks.

To the industrial sector, about two thirds from the commercial banks, the rest from the development banks. The same composition was found in the sub-sector of animal husbandry. The reverse composition was found in the sub-division of basic grain production. (See Appendix, Table E-5.)

In the sector of agriculture and animal husbandry, which include forestry, sub-sector agriculture received a little over two thirds of the aggregate loans to the sector, about a quarter to the sub-sector of cattle farming. In the sub-sector of agriculture, 17.5 percent of the loan was given to the sub-division of basic grains, namely, maize, beans and paddy, and 68.8 percent to the five major cash crops, banana, coffee, tabacco, cotton and sugar cane. (See Appendix, Table E-6.)

BANADESA, founded in 1980, a successor of BANAFOR, is a relatively new forces to have joined the group of development banks. BANADESA has been giving long term loans to the cooperatives for the purchase of perennial plants, machinery, livestock and other agricultural inputs in the projects which INA has introduced. In these cases, INA is a supervisor of executing loans, in kind in most cases, and it acts as a guarantee.

In 1982, 98.5 percent of total number of loans given, and 72.3 percent of total value of loans went to the sector of agriculture and animal husbandry. Table E-7 and E-8 of Appendix show the detail of distribution of loans. At a glance, it is clear that the emphasis of the loans is on the cultivation of basic grains, with two exceptions of coffee and sugar cane.

For regional operation and supervision, BANADESA has its regional office in La Ceiba, and local office in Olanchito for the area in which the study area is located.

In the scene of the study area, BANADESA gave short term loans to five cooperatives for the cultivation of maize or paddy in 1983 and to three cooperatives in 1984. Sometimes, though, the money has not reached in time of need. The interest rate is 16 percent per annum, in which the half goes to the regional organization of the federation of the cooperatives.

From this year COSUDE (Swiss Corporation for Development) has started giving loans to the cooperatives in the Sector 5 for the cultivation of plantain, preparation of land and acquisition of cattle.

In the past, two cooperatives bought tractors, one each, on credit through BANAFOM. The expression of entreprenuership is laudable, but as ill luck would have it, neither of the two has utilized in economically to raise enough income out of the land. The machines are lying idle in the backyard of the house, and they are still unable to return the loans. (See Table 3-14.)

(2) Extension, Inputs and Others

Extension, input supply and tractor services are provided by either MRN or INA. The difference lies in the fact that the former mainly pays attention to the private sector, the latter to the co-operative.

The relationship between the kind of service and the organization is shown below.

Fertilizer, planting material are available through INA, MRN and BANDESA; improved seeds from MRN and chemicals and veterinary supplies are through COSACO (Livestock Producers Co-operative) and private traders.

Agro-supporting System (Except Credit Service)

	INA	MRN	BANADESA	COOP	PRIVATE
Extension	o	o			
Input supply	o	o	o	o	o
Tractor service	o	o			
Research	o			o	o

Tractor service is operated by PROMECA of MRN, whose office is located in Olanchito. INA gives service of land-clearing and land preparation for the cooperatives, but it has no tractor of its own so it has to hire it from PROMECA.

INA has a crop experimental station in Sinaloa, where, besides 70 hectares of African palm platation, they grow different plants for trial. Six crops, i.e., pineapple, cassava, taro, papaya, maracuya and plantain are tested for the diversification of crops. A cooperative which grow bananas has its own experimental farm, though the scale is nothing to compare with the one in the Standard Fruit Company.

Cooperatives which go into the palm oil extracting business start checking the quality of palm fruits, reflecting the heavily competitive market. INA and MRN, like BANADESA, have regional office in La Ceiba, and sub-station in Saba and Olanchito. INA has a center for Lower Aguan Project in Sinaloa.

(3) Other Foreign Aided Project in and Around Study Area

1) Citrus Development Corporation of Central America, whose office is in San Pedro Sula, has been a consultant to the Lower Aguan Project for citrus cultivation. It was to solve the following problems.

(i) Lack of working capital for citrus cultivation.

(ii) Lack of good management in citrus plantation.

(iii) Deficiency of marketing technique to sell the fresh citrus fruits.

(iv) Citrus processing facilities for concentrate.

(v) New seeds for better varieties.

Contrary to the two big giant fruit companies, it stays and will stay as a buyer of the fruits which co-operatives produce, and provide the producer with working capital and

give counsel on technical matters. It has identified two diseases of grapefruits, Solosis and Footrot, and sell pesticides on credit. It has just started processing plant in San Pedro Sula to produce citrus concentrate. It collects fruits from five different areas, in which Sonaguera is the one. As the distance the fruits travels are more than three hundred kilometers, the company has a plan to built a small processing unit in Sonaguera within a year to handle the citrus, meanwhile a scheme to switch gapefruits into orange is on the way.

In the study area, on the right bank of the Aguan between the Monza River and the Jaguaca River, which corresponds to the sector 5 the company is to introduce grapefruits to the 90 hectares of land, oranges (Naranja Agria to 40 hectares and Naranja Dulce to 225 hectares), according to the plan envisaged in the third stage of the Lower Aguan Project.

2) CONSUDE Project

The corporation has been working with MRN in the project named, FOMENT LECHERO. With its help, COSAGO has processed with a plan, which consists of 4 stages.

i) Establishing a milk processing plant at Santa Barbara.

ii) Establishing a milk processing plant at San Lorenzo

iii) Establishing a milk silo at San Francisco.

iv) Establishing a storage centre of milk product in Olanchito town.

At the time of the study, the second stage work has completed, and temporary storage was built in Olanchito using funds Rotativo provided by the CONSUDE.

It has started giving loans and advice to the cooperatives in the sector 5 for the cultivation of plantain, preparation of land and acquisition of cattle. The project office of the organization is located in Saba.