

THE REPUBLIC OF COLOMBIA

NATIONAL PLANNING DEPARTMENT (D. N. P.)
REGIONAL AUTONOMOUS CORPORATION OF QUINDIO (C. R. Q.)

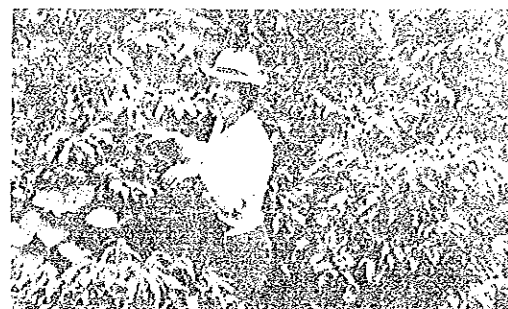
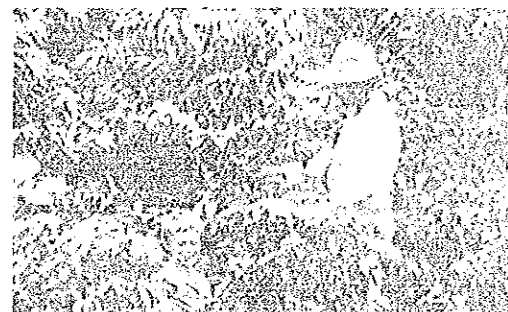
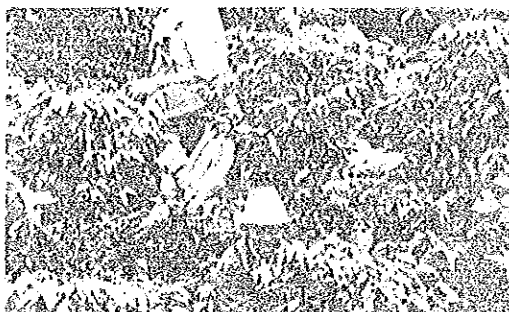
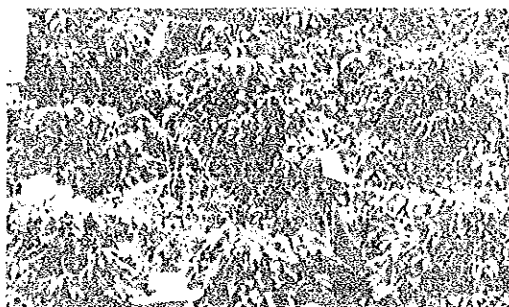


THE MASTER PLAN STUDY ON THE QUINDIO BASIN INTEGRATED AGRICULTURAL DEVELOPMENT PROJECT

FINAL REPORT

VOLUME I :
MAIN REPORT

JUNE 1988



JAPAN INTERNATIONAL COOPERATION AGENCY
(JICA)

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**NATIONAL PLANNING DEPARTMENT (D. N. P.)
REGIONAL AUTONOMOUS CORPORATION OF QUINDIO (C. R. Q.)**

**THE MASTER PLAN STUDY
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THE QUINDIO BASIN INTEGRATED
AGRICULTURAL DEVELOPMENT PROJECT**

**FINAL REPORT
VOLUME I : MAIN REPORT**

JUNE 1988

**JAPAN INTERNATIONAL COOPERATION AGENCY
(JICA)**

国際協力事業団

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PREFACE

In response to the request of the Government of the Republic of Colombia, the Government of Japan decided to conduct a Master Plan Study on the Quindio Basin Integrated Agricultural Development Project and entrusted the Study to the Japan International Cooperation Agency. The JICA sent to Colombia a study team headed by Mr. Shoji KANATSU, Pacific Consultants International, three times in the period from January 1987 to January 1988.

The team exchanged views with the officials concerned of the Government of Colombia and conducted field surveys in the whole area of the Quindio Department. After the team returned to Japan, further studies were made and the present report has been prepared.

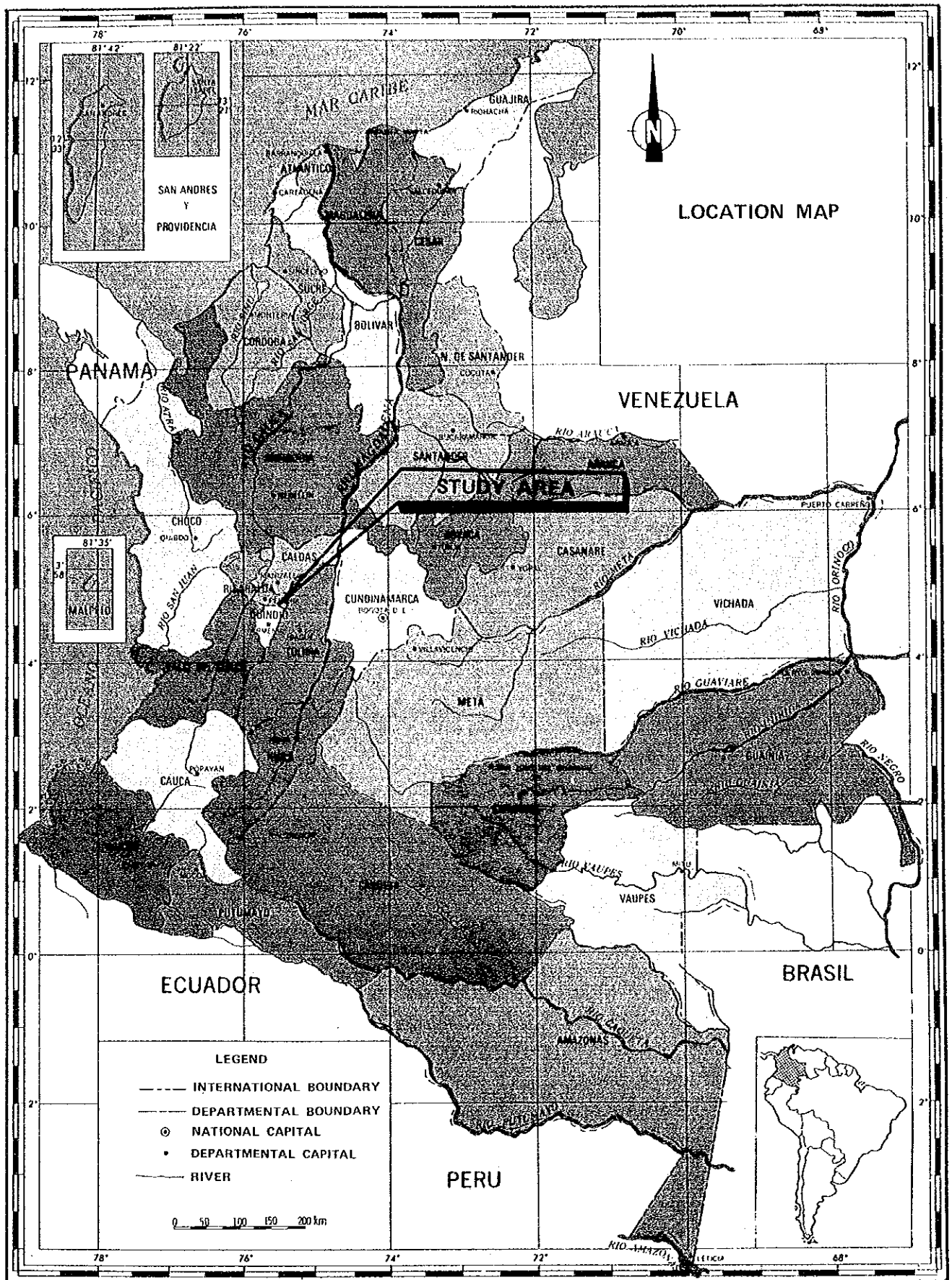
I hope that this report will serve for the development of the project and contribute to the promotion of friendly relations between the two countries.

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

June 1988

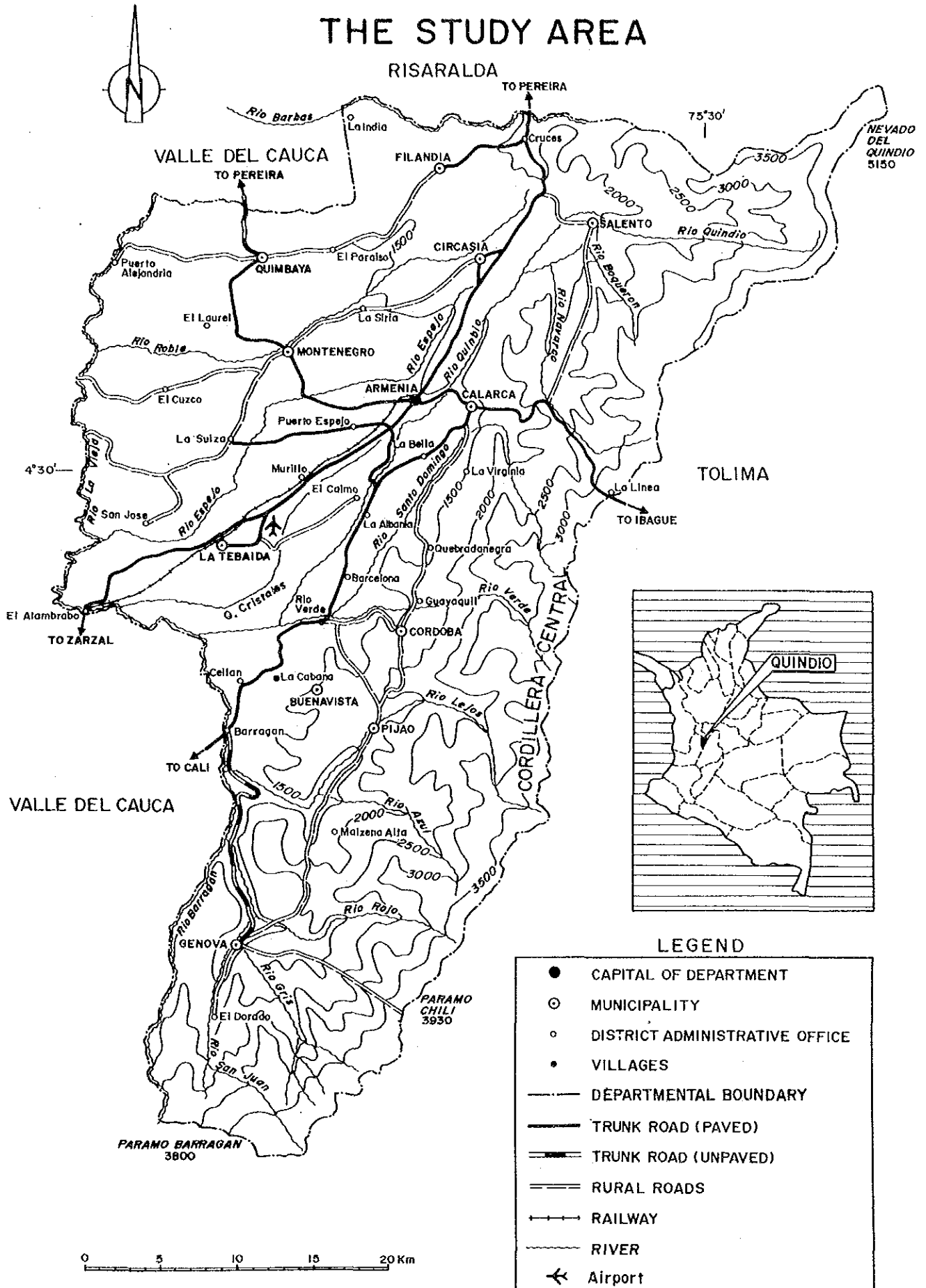


Kensuke YANAGIYA
President
Japan International Cooperation Agency



THE STUDY AREA

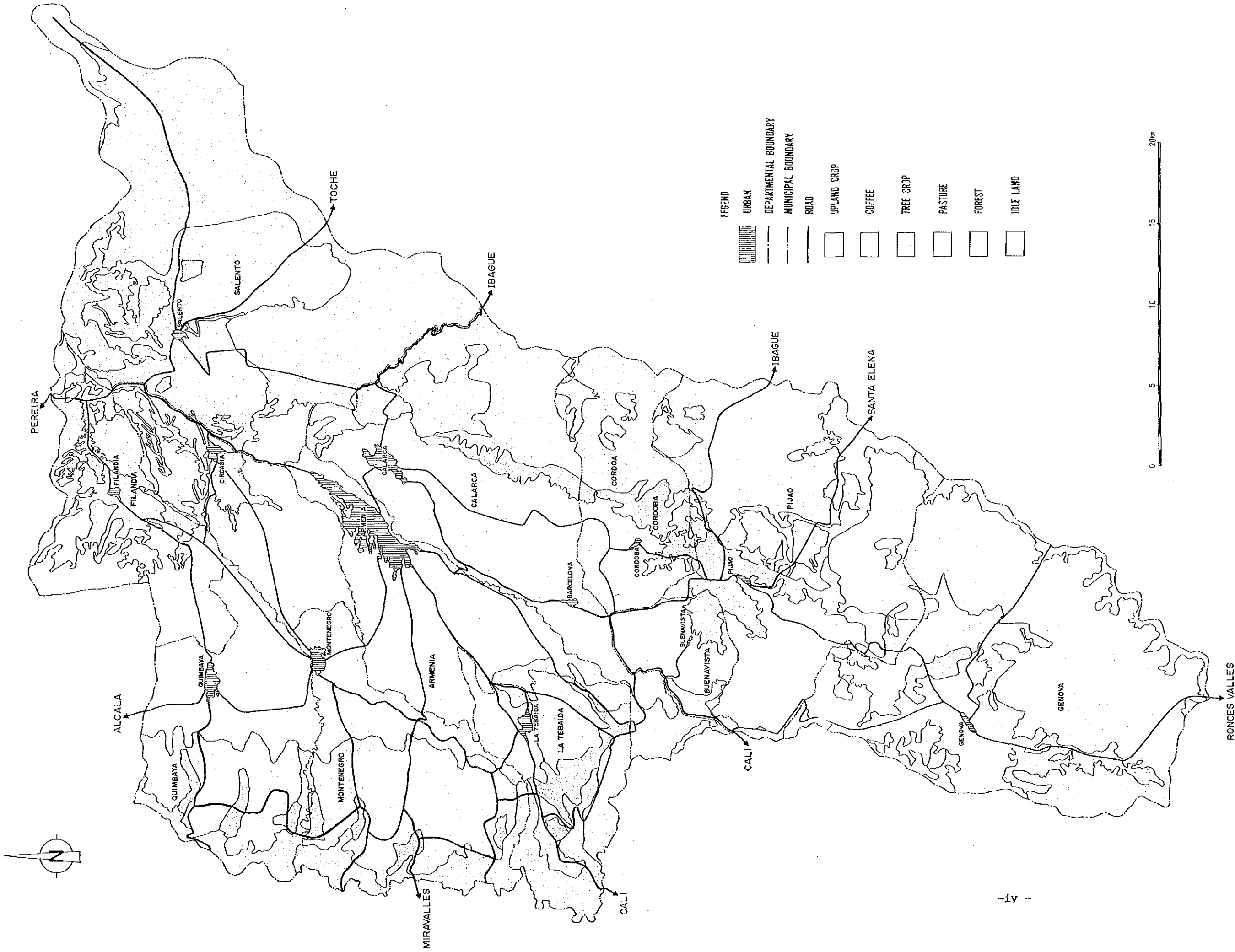
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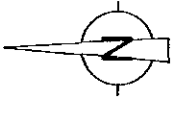
- CAPITAL OF DEPARTMENT
- MUNICIPALITY
- DISTRICT ADMINISTRATIVE OFFICE
- VILLAGES
- DEPARTMENTAL BOUNDARY
- === TRUNK ROAD (PAVED)
- TRUNK ROAD (UNPAVED)
- RURAL ROADS
- RAILWAY
- RIVER
- ✈ Airport

FUTURE LAND USE MAP

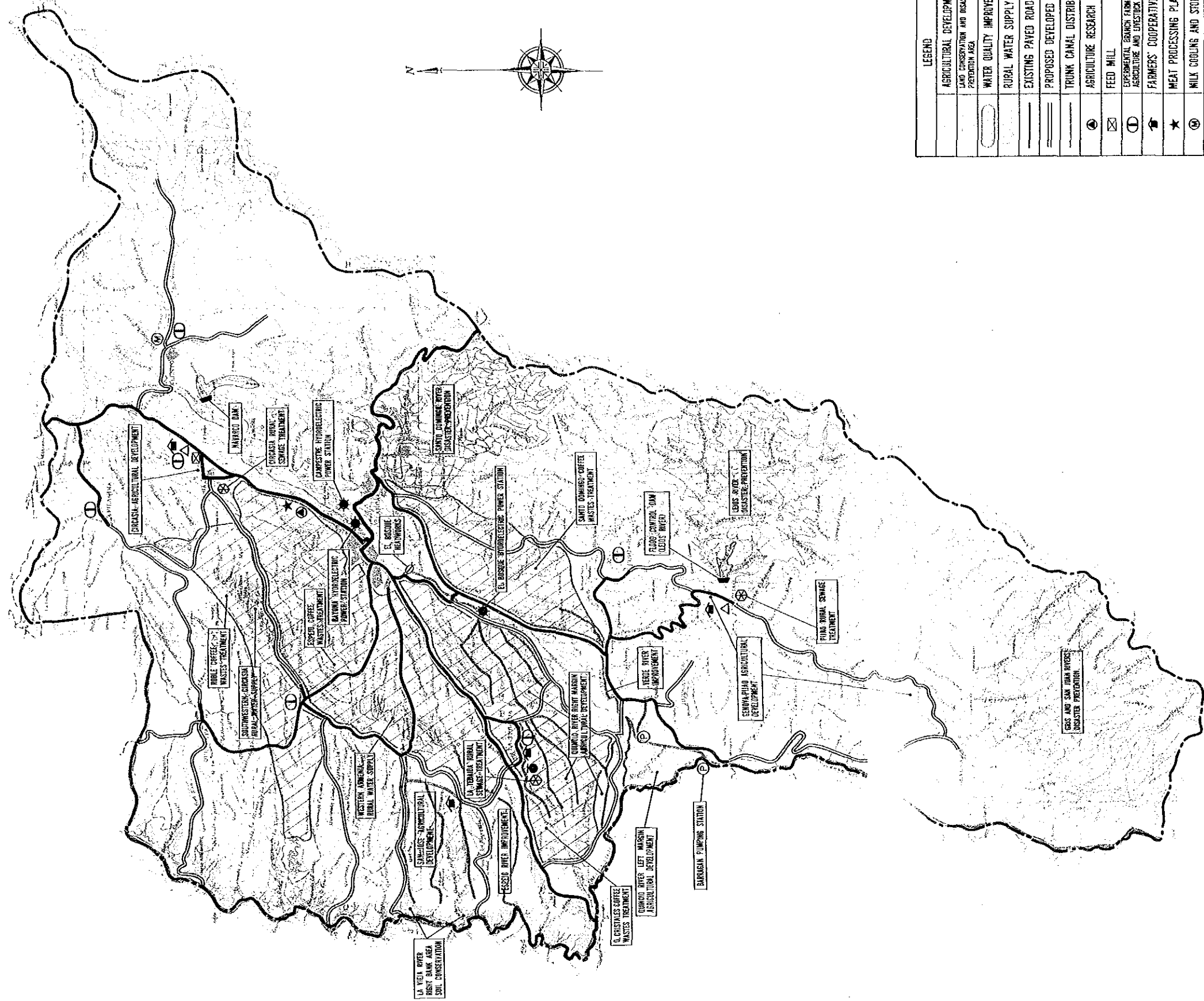


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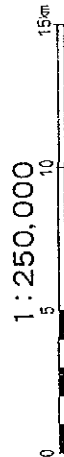
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[Dotted line]	MUNICIPAL BOUNDARY
[Solid line]	ROAD
[White box]	UPLAND CROP
[White box]	COFFEE
[White box]	TREE CROP
[White box]	PASTURE
[White box]	FOREST
[White box]	IDLE LAND



MASTER PLAN FOR INTEGRATED AGRICULTURAL DEVELOPMENT OF THE QUINDIO BASIN



LEGEND	
[Symbol]	AGRICULTURAL DEVELOPMENT AREA
[Symbol]	LAND CONSERVATION AND DISASTER PREVENTION AREA
[Symbol]	WATER QUALITY IMPROVEMENT AREA
[Symbol]	RURAL WATER SUPPLY AREA
[Symbol]	EXISTING PAVED ROAD
[Symbol]	PROPOSED DEVELOPED ROAD
[Symbol]	TRUNK CANAL DISTRIBUTION
[Symbol]	AGRICULTURE RESEARCH CENTER
[Symbol]	FEED MILL
[Symbol]	EXPERIMENTAL BRANCH FARM OR AGRICULTURE AND LIVESTOCK
[Symbol]	FARMERS' COOPERATIVE
[Symbol]	MEAT PROCESSING PLANT
[Symbol]	MILK COOLING AND STORAGE PLANT
[Symbol]	AGRO-PRODUCTS PROCESSING FACILITY
[Symbol]	SWINE BREEDING CENTER
[Symbol]	DAM
[Symbol]	HEADWORKS
[Symbol]	PUMPING STATION
[Symbol]	POWER STATION
[Symbol]	SEWAGE TREATMENT PLANT



C O N T E N T S

SUMMARY AND RECOMMENDATIONS	8- 1
CHAPTER 1 : INTRODUCTION	1- 1
1.1 BACKGROUND OF THE STUDY	1- 1
1.2 OBJECTIVES OF THE STUDY	1- 1
1.3 THE STUDY AREA	1- 2
1.4 THE SCOPE OF THE STUDY	1- 2
1.5 COMPOSITION OF REPORTS	1- 3
CHAPTER 2 : BASIC METHODOLOGY OF THE MASTER PLAN STUDY	2- 1
2.1 BASIC CONSIDERATIONS	2- 1
2.2 STUDY METHODOLOGY	2- 3
CHAPTER 3 : NATIONAL SOCIO-ECONOMIC BACKGROUND	3- 1
3.1 CHARACTERIZATION OF THE REPUBLIC OF COLOMBIA	3- 1
3.2 ECONOMIC SITUATION	3- 2
3.3 AGRICULTURAL ASPECTS	3- 5
3.4 POLITICAL AND SOCIAL SITUATION	3- 8
3.5 NATIONAL DEVELOPMENT PLAN	3- 9
3.6 QUINDIO'S POSITION IN THE COUNTRY AT A GLANCE	3-11
CHAPTER 4 : THE STUDY AREA	4- 1
4.1 PHYSICAL FEATURES	4- 1
4.1.1 Location and Topography	4- 1
4.1.2 Meteorology and Hydrology	4- 2
4.1.3 Geology and Hydrogeology	4- 4
4.1.4 Soil	4- 7
4.1.5 Water Quality	4-10
4.1.6 Water Resources	4-11
4.2 SOCIO-ECONOMIC FEATURES	4-14
4.2.1 Administrative Organization and Local Government	4-14
4.2.2 Population	4-15
4.2.3 Labour Force and Employment	4-15
4.2.4 Income Level	4-16
4.2.5 Welfare and Education	4-16
4.2.6 Regional Economic Activities	4-17
4.3 INFRASTRUCTURE	4-18
4.3.1 Transport Facilities	4-18
4.3.2 Telecommunications	4-18
4.3.3 Electric Power	4-19
4.3.4 Water Supply and Sewage Treatment Systems	4-19

4.4	AGRICULTURE	4-23
4.4.1	Land Use and Land Tenure	4-23
4.4.2	Crop Production and Cultural Practices	4-26
4.4.3	Irrigation and Drainage	4-29
4.4.4	Livestock and Inland Fishery	4-30
4.4.5	Land Conservation and Disaster Prevention	4-32
4.4.6	Farmer's Economy	4-33
4.4.7	Agricultural Markets and Prices	4-35
4.4.8	Agro-products Processing Facilities	4-41
4.4.9	Agriculture Supporting Services and Institutions	4-41
4.4.10	Development Plans and Programs in Quindio	4-43
CHAPTER 5 : DEVELOPMENT CONCEPT		5- 1
5.1	GENERAL	5- 1
5.2	POLICIES OF ADMINISTRATION AUTHORITIES FOR THE DEVELOPMENT OF AGRICULTURE IN QUINDIO	5- 3
5.3	REQUIREMENTS OF LOCAL POPULATION	5- 6
5.4	POTENTIALS AND CONSTRAINTS ON DEVELOPMENT	5- 9
5.5	FUTURE LAND USE CONCEPTS	5-11
5.6	DEVELOPMENT CONCEPT	5-15
CHAPTER 6 : FORMULATION OF THE MASTER PLAN		6- 1
6.1	DEVELOPMENT FRAMEWORK	6- 1
6.2	AGRICULTURAL DEVELOPMENT AND PROMOTION PLAN	6- 5
6.3	LAND CONSERVATION AND DISASTER PREVENTION PLAN	6-14
6.4	WATER QUALITY IMPROVEMENT PLAN	6-18
6.5	RURAL INFRASTRUCTURE PLAN	6-23
6.6	COST ESTIMATES OF THE MASTER PLAN	6-30
6.7	MASTER PLAN IMPLEMENTATION SCHEDULE	6-32
6.8	MASTER PLAN IMPLEMENTATION ORGANIZATION	6-34
6.9	JUSTIFICATION OF THE MASTER PLAN	6-35
CHAPTER 7 : HIGH-PRIORITY PROJECT I		7- 1
(QUINDIO RIVER BASIN INTEGRATED AGRICULTURAL DEVELOPMENT PROJECT)		
7.1	GENERAL	7- 1
7.2	PROJECT OBJECTIVES	7- 2
7.3	PROJECT FORMATION	7- 2
7.4	PROJECT COST	7-18
7.5	PROJECT IMPLEMENTATION SCHEDULE	7-20
7.6	PROJECT IMPLEMENTATION ORGANIZATION	7-21
7.7	PROJECT EVALUATION	7-22
7.8	FINANCIAL PROPOSAL	7-24

CHAPTER 8 : HIGH-PRIORITY PROJECT II 8- 1
(COFFEE WASTES TREATMENT PROJECT)

8.1 GENERAL 8- 1
8.2 IMPROVEMENT STRATEGY 8- 1
8.3 IMPROVEMENT TARGET 8- 2
8.4 WATER QUALITY IMPROVEMENT PROPOSAL 8- 2
8.5 TREATMENT METHOD 8- 5
8.6 IMPROVEMENT STAGE 8- 6
8.7 MODEL PLANT FOR COFFEE WASTES TREATMENT 8- 6
8.8 COFFEE WASTE TREATMENT PROJECT 8-10
8.9 COST ESTIMATES 8-11
8.10 PROJECT IMPLEMENTATION SCHEDULE 8-11
8.11 CONCLUSION 8-12

APPENDICES

A.1 SCOPE OF WORK A- 1
A.2 LIST OF CRQ PRINCIPALS AND COUNTERPART PERSONNEL A- 7
A.3 LIST OF ADVISORY COMMITTEE MEMBERS A- 8
A.4 LIST OF MISSION MEMBERS A- 9

LIST OF TABLES

Table 3.6.1	SOCIO-ECONOMIC INDEX OF THE DEPARTMENT OF QUINDIO	3-13
Table 4.1.1	SOIL CHARACTERISTICS AND DISTRIBUTION	4- 8
Table 4.4.1	ACTUAL AREA AND PROPORTION OF LAND USE BY MUNICIPALITY	4-25
Table 5.5.1	FUTURE LAND USE FORMATION BY ZONE	5-12
Table 6.6.1	COST ESTIMATES OF DEVELOPMENT PROJECTS FOR THE MASTER PLAN .	6-31
Table 7.3.1	ACTUAL AND PROJECTED LAND USE IN HIGH-PRIORITY PROJECT I ...	7- 6
Table 7.3.2	CROP PRODUCTION PLAN IN HIGH-PRIORITY PROJECT I	7- 7

LIST OF FIGURES

Fig. 2.2.1	FLOW CHART FOR THE FORMULATION OF THE MASTER PLAN	2- 4
Fig. 4.1.1	GEOLOGICAL MAP IN QUINDIO	4- 6
Fig. 4.1.2	SOIL MAP IN QUINDIO	4- 9
Fig. 4.1.3	CLASSIFICATION OF WATER QUALITY IN QUINDIO	4-12
Fig. 4.1.4	CATCHMENT AREAS OF RIVERS IN QUINDIO	4-13
Fig. 4.3.1	TRANSPORATION INFRASTRUCTURE NETWORK IN QUINDIO	4-21
Fig. 4.3.2	LOCATION OF EXISTING HYDROELECTRIC POWER STATION IN QUINDIO	4-22
Fig. 4.4.1	EXISTING LAND USE MAP IN QUINDIO	4-24
Fig. 4.4.2	DISTRIBUTION CHANNEL OF PLANTAIN	4-39
Fig. 4.4.3	DISTRIBUTION CHANNEL OF CASSAVA	4-39
Fig. 4.4.4	DISTRIBUTION CHANNEL OF ORANGE	4-40
Fig. 5.1.1	FLOW CHART FOR ELABORATION OF DEVELOPMENT CONCEPT	5- 2
Fig. 5.5.1	FUTURE LAND USE FORMATION BY ZONE	5-14
Fig. 5.6.1	SUMMARY OF DEVELOPMENT CONCEPT	5-19
Fig. 6.1.1	FUTURE LAND USE MAP (2005)	6- 4
Fig. 6.2.1	PROPOSED AGRICULTURAL DEVELOPMENT AND PROMOTION PROJECTS IN THE MASTER PLAN	6-13
Fig. 6.3.1	PROPOSED LAND CONSERVATION AND DISASTER PREVENTION PROJECTS IN THE MASTER PLAN	6-17
Fig. 6.4.1	PROPOSED WATER QUALITY IMPROVEMENT PROJECTS IN THE MASTER PLAN	6-22
Fig. 6.5.1	PROPOSED RURAL ROAD IMPROVEMENT PROJECTS IN THE MASTER PLAN	6-28
Fig. 6.5.2	PROPOSED RURAL WATER SUPPLY AND HYDROELECTRIC POWER STATION REHABILITATION PROJECTS IN THE MASTER PLAN	6-29
Fig. 6.7.1	THE MASTER PLAN IMPLEMENTATION SCHEDULE	6-33
Fig. 7.3.1	CROPPING PATTERN IN HIGH-PRIORITY PROJECT I	7- 8
Fig. 7.3.2	COMPONENT OF HIGH-PRIORITY PROJECT I	7-17
Fig. 7.5.1	PROJECT IMPLEMENTATION SCHEDULE	7-20
FIG. 8.7.1	PROPOSED COFFEE WASTES IMPROVEMENT FACILITIES	8- 9

CONTENTS OF ANNEXES

VOLUME II : ANNEXES (I)

A:	NATIONAL AND REGIONAL ECONOMY	A-1
B:	AGRO-ECONOMY AND AGRICULTURAL INSTITUTION	B-1
C:	GEOLOGY AND HYDROLOGY	C-1
D:	METEOROLOGY AND HYDROGEOLOGY	D-1
E:	SOIL	E-1
F:	LAND USE	F-1
G:	WATER QUALITY AND WATER QUALITY IMPROVEMENT	G-1
H:	AGRICULTURE AND CROP HUSBANDRY	H-1

VOLUME III : ANNEXES (II)

I:	LIVESTOCK	I-1
J:	IRRIGATION AND DRAINAGE	J-1
K:	LAND CONSERVATION AND DISASTER PREVENTION	K-1
L:	RURAL INFRASTRUCTURE	L-1
M:	WATER RESOURCES	M-1
N:	PROJECT FORMULATION	N-1
O:	PROJECT EVALUATION	O-1

ABBREVIATION

ABS	Alkyl Benzene Sulphate
Banco Cafetero	Coffee Grower's Bank
Banco Ganadero	Livestock Farmers Bank
BOD	Biochemical Oxygen Demand
Caja Agraria	Agrarian Industrial and Mining Credit Bank
CENICAFE	National Coffee Research Center
CHEC	Hydroelectric Station of Caldas
COD	Chemical Oxygen Demand
CRQ	Regional Autonomous Corporation of Quindio
DNP	National Planning Department
DO	Dissolved Oxygen
Fondo-DRI	Integrated Rural Development Fund
EIRR	Economic Internal Rate of Return
EMCOPER	Colombian Enterprise for Perishable Products
EMPO Quindio	Public Enterprise of Quindio
EPA	Public Enterprise of Armenia
EPC	Public Enterprise of Calarca
FAO	Food and Agriculture Organization of the United Nations
FEDECAFE	National Federation of Coffee Growers
FIRR	Financial Internal Rate of Return
GDP	Gross Domestic Product
GRP	Gross Regional Product
HIMAT	Colombian Institute of Hydrology, Meteorology and Land Improvement
ICA	Colombian Institute of Agriculture and Livestock
ICO	International Coffee Organization
IDEMA	Agricultural Market Institute
IGAC	National Geographic Institution
INCOMEX	Colombian External Trade Institute
INCORA	Colombian Institute of Agrarian Reform
INDERENA	Institute of Renovatable Resources
INS	National Institute of Health
JICA	Japan International Cooperation Agency
OPSA	Planning Office of Agricultural Sector
UASB	UpFlow Anaerobic Sludge Blanked Process
SENA	National Service of Apprenticeship
UNDP	United Nations Development Programme
URPA	Regional Unit of Agricultural Planning
USDA	United States Department of Agriculture

Monetary Unit

Col\$	Colombian Peso
US\$	United States Dollar
¥	Japanese Yen

Length

mm	Millimeter
cm	Centimeter
m	Meter
km	Kilometer

Weight

g	Gram
kg	Kilogram
Carga	125kg
t	Ton

Area

m ²	Square Meter
km ²	Square Kilometer
ha	Hectare

Volume

m ³	Cubic Meter
l	Liter

Others

l/s	Liter per Second
m ³ /s	Cubic Meter per Second
t/ha	Ton per Hectare
%	Percentage
°c	Centi Grade

SUMMARY AND RECOMMENDATIONS

SUMMARY AND RECOMMENDATIONS

1. SUMMARY

1.1 INTRODUCTION

Background of the Study

001 In response to the request made by the Government of the Republic of Colombia, the Government of Japan through Japan International Cooperation Agency (JICA) dispatched a mission to discuss and to enter into an agreement on the Scope of Work (S/W) for the Master Plan Study on the Quindio Basin Agricultural Development Project in July 1986.

002 In accordance with the said S/W, JICA Study Team conducted the Phase I (January-April 1987) and Phase II (July-September 1987) of the field work in Colombia. The Draft Final Report of the Study was submitted to the Government of the Republic of Colombia in January 1988. This Final Report has been elaborated in due consideration of comments and observation on the Draft Final Report presented by the Colombian Government.

Objectives of the Study

003 The objective of the present study is to formulate realistic and phased integrated agricultural development plans incorporating the necessary proposal to overcome the problems confronted by the Department of Quindio such as water pollution due to coffee waste, lack of water for various agricultural purposes in dry season, soil erosion and flooding in rainy season, etc., and to contribute to the socio-economic enhancement of the Department.

The Study Area

004 The Study area covers about 200,000 ha which comprises the whole territory of the Department of Quindio.

Scope of the Study

005 The scope of the Study is as given below:

- Phase I: Work I - Remote sensing work
- Work II - Field work in Colombia
- Phase II: Work II - Field work in Colombia
- Work III - Home Office Work in Japan

Report

006 The Final Report is composed of:

- Volume I ----- Main Report (English)
- Volume II ----- Annexes (I) (English)
- Volume III ----- Annexes (II) (English)
- Summary of the Main Report (Spanish)

1.2 BASIC METHODOLOGY OF THE MASTER PLAN STUDY

007 The present Study aims to formulate a master plan for the integrated agricultural development, and for that reason, development projects are conceived from a comprehensive viewpoint. The Study has been conducted bearing the following factors in mind.

- To make planning from the viewpoint of an integrated agricultural development;
- To place major emphasis on the expectation of local population;
- To coordinate with national and relevant regional development plans and programs;
- To formulate a feasible development project; and
- To comply with the Scope of Work.

1.3 CHARACTERIZATION OF THE REPUBLIC OF COLOMBIA

008 The Republic of Colombia is located in the northwestern corner of the Continent of South America with a national territory of about 1.14 million Km². The country is divided geographically into 5 regions - the Caribbean, Pacific, Andean, Amazon and Eastern Plain. The nation's total population, according to the census carried out in 1985, was 27.9 million, of which 3.96 million lived in Bogota. The Republic is administratively divided into a Special District of Bogota, 23 Departments, 4 Intendencies and 5 Commissariats.

Economic Situation

009 In 1986, Gross Domestic Product (GDP) at factor cost and at current prices was estimated as Col.\$6,350 billion with a rate of real growth of 5.3% compared to the previous year. The GDP per capita at current price in 1986 was estimated at Col.\$218,500, which is equivalent to US\$1,200.

010 The number of economically active population exceeded 10 million in 1985, of which 30% was employed in the agricultural sector. Unemployment rate in the 7 major cities was at 13.3% in March 1987.

011 The outstanding foreign investment amounted to US\$2,672 million at the end of 1986 and the foreign exchange reserve over the same period was US\$2,556 million. The exchange rate was Col.\$251.63 to the dollar as of September 1987.

Agricultural Sector

012 In 1985, the agricultural sector products worth Col.\$129,000 million at constant price of 1975, which represented 21.0% of the GDP. The average growth rate of the sector over the past 10 years was at 2.4% per annum which is less than that of the total GDP growth rate (3.2%). The country's principal agricultural products are: coffee, "panela" brown sugarcane, rice, sugarcane, potato, etc.

- 013 The participation of agro-products in the total exports was 68% for the year of 1984 of which the share of coffee was 51%. Apart from coffee, the other major exports were plantain and cut flower. As far as foods and agriculture-related materials are concerned, wheat, bean and barley were largely imported for the same year.

Political and Social Situations

- 014 Since the independence in 1810, the constitutional republic has been established consistently in Colombia. The present Barco Administration of the Liberal Party has been in power since August 1986.

National Development Plan

- 015 The four year socio-economic development plan (1987-1990) of the Barco Administration envisages the achievement of two targets, simultaneously: less social distortion, and consistent economic growth. The first will be carried out with a slogan "eradicate absolute poverty" and the second by the expansion of production base as well as domestic and external markets. The average annual growth rate of GDP during the Plan period is set at 5%. 4.5% of the total budget is allocated to the agriculture and livestock sector, of which 21.8% is to be financed by external loans.

The Quindio's Position in the Country

- 016 The Department of Quindio is the land of coffee galore and its agricultural sector including that of coffee production is highly ranked at national level. The level of provision of social infrastructure and services is also high. The departmental capital city of Armenia is ranked as the commercial center of the Department and traffic conjunctive point linking major cities of adjacent departments.

1.4 THE STUDY AREA

Physical Features

- 017 The Department of Quindio extends over western slope of the Central Range which is located about 180km west of Bogota and covers 1,946.7km² of area. The territory of the Department is divided topographically into two areas: eastern mountain area and western undulating alluvial fan.
- 018 The climatic conditions of Quindio varies according to the elevation. The average annual rainfall is approximately 2,000 mm and two periods of dry and wet seasons are encountered each year.
- 019 The geology of the mountain area consists mostly of Paleozoic metamorphic rocks and Cretaceous sedimentary rocks and that of the western undulating alluvial fan is composed of sedimentary rock, and volcanic rocks. Most of soils are affected by volcanic ash and about two-thirds of total soil is represented by Dystrandept.
- 020 The quality of water of major rivers is affected by urban sewage and coffee wastes discharge, and water pollution problem is increasing in these rivers. A greater portion of water resources is under-utilized, which means that there is still a considerable margin for future development.

Social and Economic Features

- 021 The Department of Quindio was founded in 1966 being separated from the "Old Caldas" Department and consists of twelve municipalities. The population of the Department and that of the capital city Armenia, as of 1985 was 378,000 and 187,000, respectively.
- 022 The economically active population reached about 138,000 in 1985, of which the agricultural sector accounted for 45% (62,500). The unemployment rate was 5.0% in 1985.
- 023 There are 18 public hospitals, 342 primary schools, 69 high schools and two universities. The literacy rate of Quindio is the second highest in the country after Valle del Cauca.

- 024 Gross Regional Product (GRP) at factor cost in 1980 was Col.\$2,128.9 million at 1970 price, with an average annual growth rate of 2.7% since 1960. Production from the agricultural sector contributed to 27.1% of the total GRP in 1980, but has been decreasing from 43% peak of 1960.

Infrastructure

- 025 Although primary road network linking major cities of other departments is adequately provided, the rural road system connecting the municipalities of the Department is still under-developed. The major transportation means are bus and taxi. One national railroad is in service between Armenia and Cali. Furthermore, two jet plane services per day are available from the Airport of Armenia (El Eden) to Bogota and viceversa.
- 026 The number of telephone connections for short distance in the urban area is: Armenia 16,680, Calarca 4,060 and the rest 4,540. In addition, sixty telephone connections for long distance are existing.
- 027 The water supply service in the Department is divided into urban water supply and rural water supply; the former is relatively well operated and maintained, while the latter is noted for poor operation and maintenance.
- 028 A greater portion of the electricity consumed in Quindio is supplied from the CHEC (Hydroelectric Station of Caldas) which amounts to 240 million kWh per year. There are six electric power plants in the Department, of which five plants with the exception of La Union are out of order at present.

Agriculture

- 029 The major land use pattern of Quindio is represented by coffee plantation, pasture and forest, which occupied 93.3% of the total land use. The average size of land holding per farmer is 8.1 ha. In terms of land tenure by size, there is a great imbalance between small and large farmers, which has been accelerating year by year.
- 030 The total cultivated area of main crops was 117,800 ha in 1984, of which coffee, plantain and cassava constituted 96.9%.

- 031 There is no organized intensive irrigation and drainage system, but there are some sprinkler irrigation systems in coffee plantations.
- 032 The livestock is characterized by the cattle breeds of both beef and dairy, but a great imbalance is observed with respect to the productivity which is caused by scale of land and animal holdings. With respect to the inland fishery, there are only a few small scale culture farms cultivating rainbow trout and tilapia fish varieties.
- 033 Two major types of the natural disaster problem in Quindio are soil erosion and flood damage - the former takes place in all over the Department and the latter is more frequently observed in the southern part.
- 034 Considerable disparity in productivity exists between coffee growers, who are rendered much supporting services by Coffee Committee, and other farmers. Nevertheless, there are some farmers who get a better income by producing crops other than coffee.
- 035 Among the agro-products produced in Quindio, coffee has an international market and plantain, cassava, orange and tomato have national markets. In the case of orange and tomato, their market systems are less organized. As for agro-product processing facilities, there are various plants and factories, such as coffee threshing factories and dairy plants, but they are small in scale and still rather under-developed.
- 036 The supporting services to farmers are provided mainly by Bureau of Agriculture of the Departmental Office and the Coffee Committee, and are supplemented by INCORA, Fondo-DRI, CAJA AGRARIA, SENA and other institutions. In relation to farmers' organization, there exist four cooperatives of coffee growers and one of producers for vegetables and fruits. About 80% of coffee growers in Quindio are associated with cooperatives.
- 037 The following development plans and programs pertaining to the agriculture and livestock sector have been formulated and some of them are being implemented now.

- Five Year Diversification Plan 1984-1989 (Coffee Committee)
- Integrated Rural Development Program (DRI-CRQ)
- Vegetable and Fruits Production Promotion Plan (Bureau of Agriculture, Departmental Office of Quindio)
- Agricultural and Livestock Development Plan 1987-1990 (Regional Agricultural and Livestock Planning Unit, Departmental Office of Quindio)

1.5 DEVELOPMENT CONCEPT

038 The present Study (Master Plan) is formulated based on a development target year of 2005. In advance to the formulation of development Projects for the Master Plan, a future land use projection without considering the development target year is prepared.

039 The future land use projection has been proposed with due consideration to physical and socio-economic conditions of the Department.

	Zone	Area (km ²)	%
1	Grazing land	79.4	4.1
2	Intensive agriculture	176.2	9.0
3	Coffee plantation	612.4	31.5
4	Integrated farming (vegetables - livestock)	101.3	5.2
5	Integrated farming (tree crops - livestock)	55.3	2.8
6	Pasture and ecological conservation	895.8	46.0
7	Environmental conservation	26.3	1.4
Total		1,946.7	100.0

The actual area used for forest, upland crop and tree crop will be expanded while pasture will be decreased. Coffee plantation area will be kept almost unchanged.

040 The development objectives of the Master Plan have been formulated after analyzing prevailing potentials and constraints on development, and in compliance with policies of national and local administrative authorities and expectations of local population. Hence the following factor are taken into consideration in the formulation of Master Plan.

- Rectification of socio-economic disparities among sub-regions
- Improvement of coffee production per unit area
- Diversification of crop production
- Better utilization of water resources
- Conservation of Natural Environment
- Enhancement of living conditions in rural area

Constraints on development and development objectives and strategies are summarized in Fig. S.1.

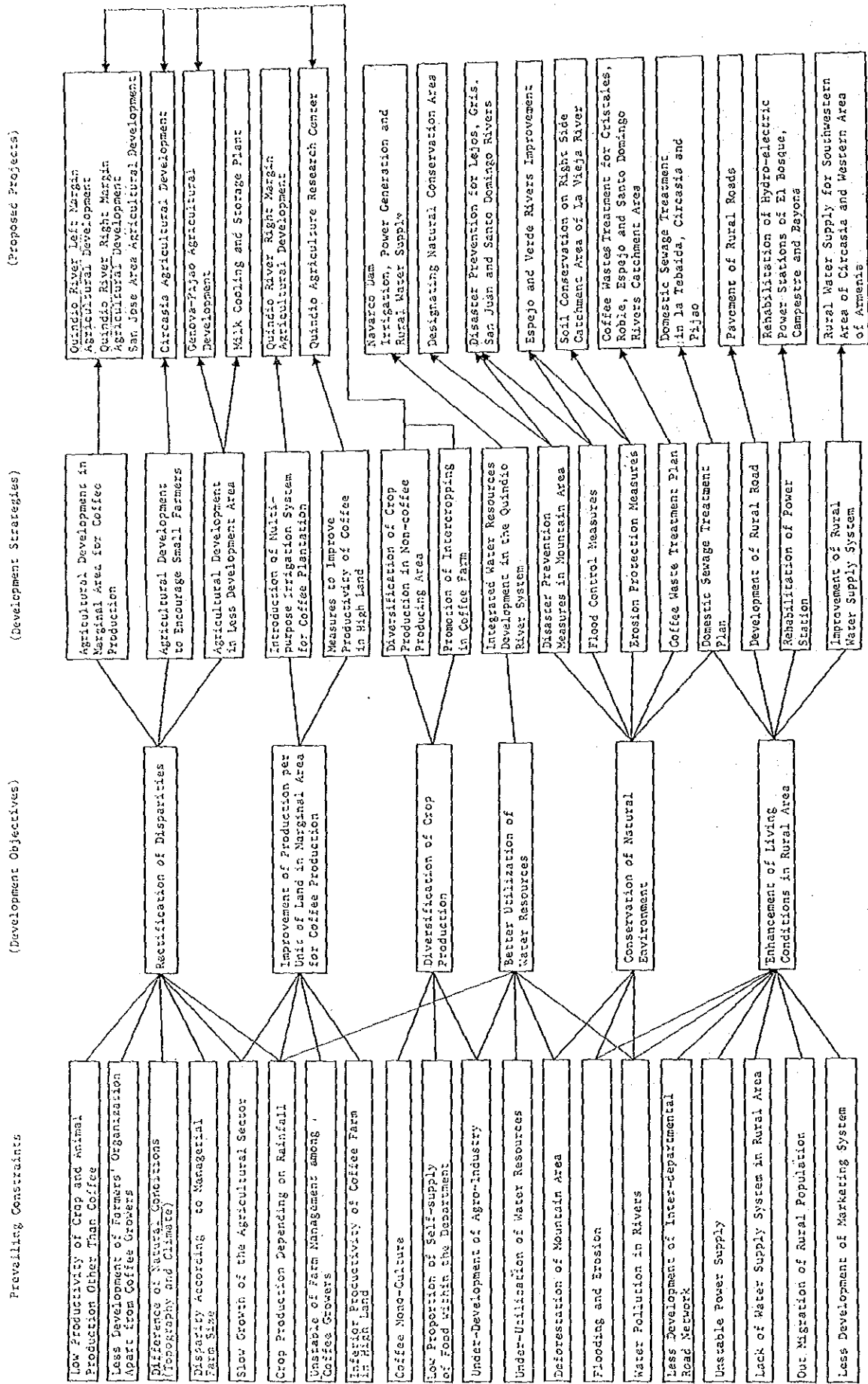


Fig. S.1 SUMMARY OF DEVELOPMENT CONCEPT

1.6 THE MASTER PLAN

Development Framework

- 041 In consideration of the effect of stabilization of local population with the proposed projects of the Master Plan, the population projection in the Department of Quindio is as summarized below.

(Unit: person)

Year	1985	1990	1995	2000	2005
Urban area	306,070	333,000	362,000	393,000	426,000
Rural area	71,790	67,000	67,000	67,000	67,000
Total	377,860	400,000	429,000	460,000	493,000

- 042 By taking into consideration the natural condition (meteorology, soil etc.) and socio-economic condition (population, market etc.) in the Department of Quindio, the output of agricultural products and their rate of self-supply within the Department in the target year (2005) is estimated as given in the following table.

(Unit: ton)

Products	1985			2005		
	Output	Consumption	Rate of Self-supply (%)	Output	Consumption	Rate of Self-supply (%)
Rice	0	14,000	0	0	16,800	0
Wheat	0	2,600	0	0	3,100	0
Coffee	104,000	1,800	*	110,900	1,900	*
Plantain	265,200	17,000	*	298,600	41,100	*
Cassava	115,000	5,800	*	116,400	12,400	*
"Panela"	2,300	25,400	9	5,600	32,100	17
Potato	2,700	9,200	29	5,700	11,700	49
Fodder Crops	5,000	18,400	27	17,200	30,400	57
Beans	600	2,800	21	5,500	3,400	*
Tomato	15,100	6,700	*	18,700	8,800	*
Other Vegetables	500	2,000	25	15,500	10,400	*
Orange	16,000	10,100	*	30,400	15,300	*
Other Fruits	1,000	3,700	27	19,300	15,600	*
Beef	2,900	11,600	25	3,500	14,000	25
Pork	300	1,100	27	900	1,200	75
Chicken	2,100	900	*	2,200	1,100	*
Fish	0	300	0	100	400	25
Milk	11,200	30,100	37	13,000	36,000	36
Egg	4,300	4,100	*	4,900	4,900	*

Note: (1) * Accomplishment of self-sufficiency

043 By taking into account the afore-mentioned projection of crops and environmental conservation, etc., the land use projection for the year of 2005 and for years beyond the target year is given below along with the existing agricultural and other land use.

Land Use Category	(Unit: km ²)					
	Present Condition		2005		Long-term (Without Target Year)	
	Area	%	Area	%	Area	%
Coffee	610.3	31.4	594.3	30.5	578.2	29.7
Upland Crops	82.5	4.2	99.8	5.1	202.0	10.4
Tree Crops	3.8	0.2	29.0	1.5	76.2	3.9
Pasture	691.9	35.5	592.6	30.5	300.0	15.4
Forest	513.2	26.4	581.9	29.9	734.7	37.8
Urban Area	16.0	0.8	21.4	1.1	27.9	1.4
Other Area	29.0	1.5	27.7	1.4	27.7	1.4
Total	1,946.7	100.0	1,946.7	100.0	1,946.7	100.0

Agricultural Development and Promotion Plan

044 In order to materialize the development concept and framework of the Master Plan, the following five areas have been identified and proposed for agricultural development represented by the improvement of necessary infrastructure (irrigation and drainage system, land reclamation, farm road network, etc.) and by introducing an intensive crop husbandry.

Area	Development Area (ha)	Development Objective
Quindio River Left Margin Area	1,500	Development of marginal area for coffee production
Quindio River Right Margin Area	5,000	Development of marginal area for coffee production and improvement of coffee production per unit of land
San Jose	3,400	Development of marginal area for coffee production
Circasia	1,600	Upgrading of small farms
Genova-Pijao	400	Upgrading of under developed area
Total	11,900	

For raising the farmer's income, integrated farming with swine farming and freshwater aquaculture is recommended in Circasia and Genova-Pijao area.

- 045 In order to overcome the various problems that the agricultural sector of the Department confronts, and in facilitating smooth implementation of agricultural development projects, it is proposed to establish a "Quindio Agriculture Research Center".
- 046 The installation of a milk cooling and storage plant is proposed in Salento where dairy cattle farming is widely conducted. The plant will be operated by collecting milk from small and medium farmers who are lacking such plant.

Land Conservation and Disaster Prevention Plan

- 047 With an eye to alleviating the progressing deforestation in mountainous areas and for maintaining the ecological balance in the project area, it is proposed to designate a total of 677.6 km² as natural conservation area. This project is designated as "Natural Conservation Area Project".
- 048 Within the afore-mentioned designated area for natural conservation, disaster prevention projects have also been formulated to mitigate the progressing environmental destruction of the three (3) catchment areas of Lejos, Gris-San Juan and Santo Domingo rivers caused by frequent flooding and soil erosion. The recommended mitigative measures for these areas consist of flood control dam, sabo dam, bank improvement, reforestation, etc.

Rivers	Catchment Area (km ²)	Purpose
Lejos	87.7	Mitigate flood damage in Pijao
Gris-San Juan	99.3	Mitigate flood damage in Genova
Santo Domingo	70.4	

- 049 As for river improvement plan, two projects have been formulated so as to recover potential river function, and to enhance soil conservation capability of hilly terrains. The protective measures to be taken comprised of widening of cross-section, bank protection, soil erosion prevention works of hilly terrain, etc. The proposed areas for improvement works are as follows.

Rivers	Improvement Area	Improvement Works
Espejo	Approx. 10 km in downstream	Widening of cross-section, slope protection
Verde	Approx. 4 km in middle stream	Bank protection

- 050 Soil conservation measures are also envisaged in area along the right bank of the Vieja River. The proposed works are gully erosion protection works, small drains, reforestation, etc.

Water Quality Improvement Plan

- 051 The water quality improvement plan is divided into two portions: coffee wastes treatment and rural sewage treatment. The former is proposed in four (4) rivers with major water pollution.

Areas	Number of Target Farms
Cristales	670
Roble	880
Santo Domingo	900
Espejo	840

- 052 On the other hand, rural sewage treatment is proposed for the following three areas that are badly affected by pollution caused by domestic sewage.

Areas	Improvement
La Tebaida	Water quality improvement in Q. Crsitaes
Circasia	Water quality improvement in Espejo and Roble rivers
Pijao	Water quality improvement in the Lejos river

Rural Infrastructure Plan

- 053 The rural infrastructure plan is composed of rural road development, mini-hydroelectric power development and rural water supply improvement projects. The rural road improvement project will be conducted with emphasis laid on the pavement of existing roads. The length of roads for improvement is as set out below:

Phase I : 113.7 km

Phase II : 144.5 km

- 054 Existing three power stations are to be rehabilitated for attaining a reliable and stable power supply within the Department. These stations were selected so as to produce higher benefits.

Power Stations	Rivers	Supervising Body
El Bosque	Quindio	EPA
Campestre	ditto	EPC
Bayona	ditto	EPC

- 055 The rural water supply projects are envisaged in southwestern Circasia which is inadequately supplied with potable water and water for miscellaneous agricultural purposes and in western Armenia where the supplied potable water quality is rather inferior.

Areas	No. of Benefited Family	Project Components
Southwestern Circasia	170	Water intake works at small streams Installation of new distribution pipe
Western Armenia	160	Deep wells Installation of new distribution pipe

Total Cost of the Master Plan

- 056 The total cost has been estimated to be approximately Col.\$75.0 billion based on the market price as of September, 1987. The total cost consists of direct construction cost, indirect cost and physical contingency and the breakdown of various cost components is presented in Table S.1.

Table S.1 Cost Estimates of Development Projects for the Master Plan

Development Projects		Unit: In million of Col.\$
		Cost
I. <u>Agricultural Development and Promotion Plan</u>		
• Quindio River Left Margin Agricultural Development	1,300	
• Quindio River Right Margin Agricultural Development	13,000	
• San Jose Agricultural Development	3,200	
• Circasia Agricultural Development	1,700	
• Genova-Pijao Agricultural Development	450	
• Quindio Agriculture Research Center	2,600	
• Salento Milk Cooling and Storage Plant	40	
Sub-total	22,290	(29.9%)
II. <u>Land Conservation and Disaster Prevention Plan</u>		
• Designating Natural Conservation Area	170	
• Lejos River Disaster Prevention	11,700	
• Gris and San Juan Rivers Disaster Prevention	6,000	
• Santo Domingo River Disaster Prevention	4,500	
• Espejo River Improvement	1,900	
• Verde River Improvement	70	
• La Vieja River Right Bank Area Soil Conservation	1,600	
Sub-total	25,940	(34.7%)
III. <u>Water Quality Improvement Plan</u>		
• Cristales Coffee Wastes Treatment	1,800	
• Roble Coffee Wastes Treatment	1,800	
• Santo Domingo Coffee Wastes Treatment	2,300	
• Espejo Coffee Wastes Treatment	1,900	
• La Tebaida Rural Sewage Treatment	2,400	
• Circasia Rural Sewage Treatment	2,900	
• Pijao Rural Sewage Treatment	1,600	
Sub-total	14,700	(19.6%)
IV. <u>Rural Infrastructure Plan</u>		
• Phase I Rural Road Improvement	4,000	
• Phase II Rural Road Improvement	5,900	
• El Bosque Hydroelectric Power Station Rehabilitation	690	
• Campestre Hydroelectric Power Station Rehabilitation	510	
• Bayona Hydroelectric Power Station Rehabilitation	710	
• Southwestern Circasia Rural Water Supply	30	
• Western Armenia Rural Water Supply	40	
Sub-total	11,880	(15.8%)
TOTAL	74,810	(100%)

Master Plan Implementation Schedule

- 057 The implementation schedule of the Master Plan is given in Fig. S.2.

Implementation Organization of Master Plan

- 058 In order to implement the Master Plan, it would be necessary to centralize the implementation agency and to make possible coordination among the various related organizations. The implementation agencies of Master plan consist of CRQ, Coffee Committee, the Departmental Office of Quindio and other concerned organs, of which CRQ is expected to play the leading role.

Implementation Benefits of Master Plan

- 059 The expected increase in agricultural output and farmer's income, and the diversification of crop production in the proposed project areas will contribute to the rectification of imbalanced productivity among the various sub-regions of the Department. Furthermore, the crop diversification plan is expected to contribute positively towards the modification of the economic structure of the Department that is too much dependent on coffee production as well, hence also enhancing the degree of self-supply of food in the Department.
- 060 Through a variety of diverse projects consisting of land conservation and disaster prevention, water quality improvement and rural infrastructure development, natural and human environments will be enhanced to encourage more private investments in agricultural processing sector, hence resulting in raising the economic potentials of the Department.
- 061 Better utilization of land by the incorporation of intensive agriculture would lead to an increase in labor opportunities in farming as well as creating new employment opportunities such as maintenance and management personnel of irrigation facilities, regular employees of farmers' organization, etc. Likewise, civil engineering works during the project construction period will create new employment opportunities for both skilled and unskilled laborers.

Fig. S-2 THE MASTER PLAN IMPLEMENTATION SCHEDULE

Development Plans and Projects	Cost (x 10 ⁶)	Year				
		1991	1995	2000	2005	
AGRICULTURAL DEVELOPMENT AND PROMOTION PLAN	Quindío River Left Margin A.D.	1,300				
	Quindío River Right Margin A.D.	13,000				
	San Jose A.D.	3,200				
	Circasia A.D.	1,700				
	Genova-Pijao A.D.	450				
	Quindío Agriculture Research Center	2,600				
	Salento Milk Cooling and Storage Plant	40				
	Designating Natural Conservation Area	170				
	Lejos River Disaster Prevention	11,700				
	Cris & San Juan Rivers Disaster Prevention	6,000				
LAND CONSERVATION AND DISASTER PREVENTION PLAN	Santo Domingo River Disaster Prevention	4,500				
	Espejo River Improvement	1,900				
	Verde River Improvement	70				
	La Vieja River Right Bank Area Soil Conservation	1,600				
	Cristales Coffee Wastes Treatment	1,800				
	Roble Coffee Wastes Treatment	1,800				
	Santo Domingo Coffee Wastes Treatment	2,300				
	Espejo Coffee Wastes Treatment	1,900				
	La Tebaida Rural Sewage Treatment	2,400				
	Circasia Rural Sewage Treatment	2,900				
WATER QUALITY IMPROVEMENT PLAN	Pijao Rural Sewage Treatment	1,600				
	Phase I Rural Road Improvement	4,000				
	Phase II Rural Road Improvement	5,900				
	El Bosque Hydroelectric Power Station R.	690				
	Campestre Hydroelectric Power Station R.	510				
	Bayona Hydroelectric Power Station R.	710				
	Southwestern Circasia Rural Water Supply	30				
	Western Armenia Rural Water Supply	40				
	RURAL INFRA-STRUCTURE PLAN					

Preparatory Stage
 Construction Stage
 A.D. = Agricultural Development
 R. = Rehabilitation

- 062 The development of more self reliant farms, along with the establishment of Quindio agriculture research center and the center's various extension services will contribute towards continuous development and propagation of agricultural and livestock farming.
- 063 Other than the above-mentioned beneficial effects, the following socio-economic benefits also could be expected to be realized.
- Enhancement of traffic and communication among community residents owing to better transport facilities due to road improvements.
 - Economic activation owing to an increase in the consumption of agricultural inputs.

1.7 HIGH-PRIORITY PROJECT I
(Quindio River Basin Integrated Agricultural Development Project)

General

064 As the possible alternative candidates in merit of evaluation for the selection of the high-priority project, the following three projects by the respective sub-region, were identified during the course of the Phase II field work.

- Lower Quindio Basin Integrated Agricultural Development Project
(Project A)

- Southern Quindio Integrated Agricultural Development Project
(Project B)

- Northern Quindio Integrated Agricultural Development Project
(Project C)

065 It was found out that the implementation of any single, individual project as the high-priority project would not meet the objectives of the project plan. It is also noted that Project A and C have a higher rate of return compared to Project B. Hence a multiple sub-project components of urgent requirement, selected mainly from Project A and C were chosen along with other relevant urgent sub-projects of Project B as the priority project and this priority project is denominated as "Quindio River Basin Integrated Agricultural Development Project." The selected sub-projects of Project B are urgent flood control and rural road development projects in the Municipalities of Pijao and Genova.

Objectives of the Project

066 The objectives of the Quindio River Basin Integrated Agricultural Development Project, identified as the high priority project are summarized as follows;

- Rectification of disparities (Upgrading of small farms and under-developed sub-regions)

- Improvement of coffee production per unit area (Intensification of the primary economic activity of the Department)

- Enhancement of the standard of living (Promotion of the development of rural infrastructure)

The present Project is composed of pertinent sub-projects so as to achieve the above-mentioned objectives, having higher urgency and necessity with promising higher economic return.

Project Formation

- 067 For the purpose of attaining the cited objectives, the Project is sub-divided into 15 number sub-projects, with four (4) number main project components, as given below.

Components of the Project

Sub-projects	Remarks
<u>Agricultural Development and Promotion Plan</u>	
1. Quindio River Left Margin Area Agricultural Development	Development of an area of 1,500 ha
2. Quindio River Right Margin Area (1) Agricultural Development	Development of an area of 2,500 ha
3. Quindio River Right Margin Area (2) Agricultural Development	Development of an area of 2,500 ha
4. Circasia Agricultural Development	Development of an area of 1,600 ha
5. Farmers' Cooperative	2 Nos.
6. Circasia Swine Breeding Center	Breeding of 400 heads
7. Agro-products Processing Facilities	3 Nos.
8. Experimental Farm	2 Nos.
<u>Land Conservation and Disaster Prevention Plan</u>	
9. Urgent Flood Control in Pijao	River bank protection
10. Urgent Flood Control in Genova	River bank protection
<u>Water Quality Improvement Plan</u>	
11. Cristales Coffee Wastes Treatment	No. of Target farm: 670
<u>Rural Infrastructure Development Plan</u>	
12. Rural Road Improvement (1)	L=93.7 km, W=9m
13. Rural Road Improvement (2)	L=20.0 km, W=5m
14. Campestre Hydroelectric Power Station Rehabilitation	Maximum output = 1,200 kw
15. Bayona Hydroelectric Power Station Rehabilitation	Maximum output = 1,350 kw

Project Cost

- 068 The total estimated cost of the Project, on the basis of market prices prevailed as of September, 1987, is Col.\$14.4 billion and the break-down of this total cost is as follows; direct construction cost of Col.\$9,600 million, indirect cost of Col.\$2,880 million, and physical contingency of Col.\$1,920 million.

Project Implementation Schedule and Organization

- 069 The total project implementation period is scheduled for 5 years, of which the initial preparatory stage, detailed design and tender evaluation covers 1.5 years and the subsequent construction stage covers 3.5 years.
- 070 The responsibility of the Project implementation agency consists of administration and supervision of the construction works and operation and management of the Project after the implementation. For attaining efficient and smooth implementaiton of the Project it is imperative to establish a Project implementation agency represented by CRQ, the leading institution, and other concerned organs.

Project Evaluation

- 071 The economic internal rate of return (EIRR) and the financial internal rate of return (FIRR) have been computed as 14.9% and 13.5%, respectively. This evaluation result suggests that the implementation of the Project is justified economically, financially and socially.

Financial Procurement Plan

- 072 The implementation of the Project requires a total cost of approximately Col.\$15.0 billion. In preparing project cost procurement plan, it is a prerequisite to divide the project cost into such categories as to be borne by farmers or farmers cooperatives, the Department or municipalities, and the Central Government. This division in cost has to be made during the course of the Feasibility Study, and besides, the division of the cost into foreign and local currency components also to be done so that the amount to be loaned by international financial institutions, and the amount to be procured locally could be separated.

1.8 HIGH PRIORITY PROJECT II
(Coffee Wastes Treatment Plan)

General

073 The rivers running through the coffee production areas in the Department of Quindio have long been polluted with coffee wastes, causing serious problem to the population of Quindio. Though the coffee wastes can be treated as far as its technical aspect is concerned, the real problem is that so far no practical treatment method introducible economically and socially has been established. In this regard, this Study examines the best available treatment method that would be most realistic to suit the country's current technical level by taking into account the regional characteristics of Quindio as well.

Improvement Strategy

074 Basically as the final target, the whole amount of generated coffee wastes would be treated, and until then, a phased out treatment program would be implemented based on the following concepts; so as to achieve gradually the final target of the treatment.

- Promotion of the water quality improvement of river catchment areas, by establishing an improvement target for each catchment area.
- Promotion of the water quality improvement in the order of high pollution load reduction effects.
- Establishment of the necessary improvement levels in accordance with the size of farms.

Improvement Targets

075 Improvement targets in receiving water have been established to meet the following beneficial usage, as follows;

<u>Purposes</u>	<u>Improvement Stream Target</u>
Potable usage	BOD: below 1ppm
Agricultural usage	BOD: below 5ppm
Industrial usage	BOD: below 10ppm

Improvement Proposals

- 076 The following legislative and institutional aspects should be considered for the effective promotion of coffee wastes treatment measures:
- Promotion of educational enlightenment on environmental conservation (by the Quindio Agriculture Research Center).
 - Study and development of treatment facilities, and establishment of management and operation systems for treatment facility.
 - Establishment of a financial support system of waste treatment.
 - Establishment of effluent standards for coffee wastes and stream standards for receiving water (rivers).
 - Provision of water-quality monitoring system in receiving water.
- 077 Evaluation was made on suitable methods for the provision of coffee wastes treatment facilities, and it is concluded that the following overall conceptual treatment systems, which can ultimately reduce discharge loads is preferable, based on the local conditions.
- Centralized treatment by a treatment plant, with collection system
 - On site treatment by individual treatment facility either of small scale or of large scale.

Treatment System

- 078 The characteristics of coffee wastes are, high load, low pH, seasonal concentration, etc. Evaluation was made on the available waste treatment methods suitable for the local conditions, and accordingly, it is concluded that UASB Treatment System is very suitable for a large volume of water, while land filtration system is suitable otherwise.

Development Stage

- 079 Considering the water demands for such beneficial uses of potable and agriculture, the provision of treatment systems has been envisaged in the following order of stages, from higher to lower priorities.

<u>Stages</u>	<u>Areas</u>
Stage I	Cristales, Roble
Stage II	Espejo, Santo Domingo
Stage III	Buenavista, Quindio, Barragan
Stage IV	Verde, Lejos, Rojo

And, the stage of development based on the size of farms, referred to as Treatment stage, has been established as follows;

<u>Treatment Stages</u>	<u>Category</u>	<u>Farm Size</u>	<u>Treatment System</u>
I	Larger farm	More than 30 ha	Individual treatment by UASB method
II	Medium farm	5 - 30 ha	Centralized treatment by UASB method
III	Small farm	Below 5 ha	Individual simple treatment by land filtration method

Model Plant for Coffee Wastes Treatment

080 Based on the assumption that Cristales area be provided with a treatment system capable of treating coffee wastes to the extent that the river water can be used for agricultural purposes (the target water quality: BOD below 5 ppm), the following 4 systems were evaluated.

<u>Systems</u>	<u>Large Farms (55)</u>	<u>Medium Farms (330)</u>	<u>Small Farms (285)</u>
A	Individual treatment	Individual treatment (330 Nos.)	Individual simple treatment
B	"	Centralized treatment by centralizing the processing of coffee berry (1 Nos.)	"
C	"	Centralized treatment with canal waste collection system (33 Nos.)	"
D	"	Centralized treatment with vacuum truck collection system (11 Nos.)	"

Note: Individual treatment for small farms is trench excavation (land filtration), and the rest are treatment facilities by the UASB system.

An evaluation of these four (4) alternative systems was carried out, accordingly, the centralized treatment system by using vacuum truck (System D) is recommended, as being realistic as well as economical because the existing facilities can be utilized. This System D covers 30 medium farms as one unit.

Coffee Wastes Treatment Project

081 Based on the model waste treatment plan for Cristales area, the following comprehensive treatment plan for the treatment of coffee wastes for the Department has been formulated. The wastes treatment plans proposed for the respective area is summarized below.

Stages	Areas	Receiving Water Quality Improvement Target (BOD)	Reduction of Load	Facilities (Nos.)		
				Individual (Large Farm)	Individual (Small Farm)	Centralized (Medium Farm)
I	Cristales Roble	5 ppm	92 %	55	285	11
		5 ppm	90 %	15	535	11
II	Espejo Santo Domingo	10 ppm	72 %	35	-	12
		5 ppm	84 %	50	-	15
III	Buenvista Quindio Barragan	5 ppm	92 %	15	260	8
		5 ppm	62 %	35	-	-
		5 ppm	92 %	10	60	4
IV	Verde Lejos Lojo	1 ppm	81 %	30	-	8
		1 ppm	78 %	50	-	12
		1 ppm	61 %	15	-	-

Note: Individual treatment system for large farms - UASB Method

Centralized treatment system for medium farms - UASB Method with vacuum truck collection.

Individual treatment system for small farms - Land Filtration Method (Trench excavation)

Cost Estimates

082 The total investment cost of coffee wastes treatment for the four areas proposed in the Master Plan is estimated as given below. This cost is composed of direct construction cost, indirect cost and physical contingency.

Areas	Cost (million of Col.\$)
Cristales	1,800
Roble	1,800
Santo Domingo	2,300
Espejo	1,900
Total	7,800

Project Implementation Schedule

083 The individual project implementation period of each of the four area is scheduled for 5 years with a staggered total project implementation period of 15 years.

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Cristales	■■■■■■■■■■	■■■■■■■■■■	■■■■■■■■■■	■■■■■■■■■■	■■■■■■■■■■										
Roble				■■■■■■■■■■	■■■■■■■■■■	■■■■■■■■■■	■■■■■■■■■■	■■■■■■■■■■							
Espejo								■■■■■■■■■■	■■■■■■■■■■	■■■■■■■■■■	■■■■■■■■■■	■■■■■■■■■■			
Santo Domingo											■■■■■■■■■■	■■■■■■■■■■	■■■■■■■■■■	■■■■■■■■■■	■■■■■■■■■■

Note : ■■■■■■■■■■ : Preparation Works (D/D, Tender Documents, etc.)
 ■■■■■■■■■■ : Construction Works

2. RECOMMENDATIONS

2.1 MASTER PLAN

084 In order for the Department of Quindio to survive as an agriculturally advanced department, it would be essential to overcome the various problems that the Department is confronting at present by improving the infrastructure for agricultural production thereby raising the productivity. To this end, the integrated agricultural development including the development of other agriculture-related sectors is an urgent issue to be addressed.

085 While implementing the Master Plan, the following factors are recommended to be given careful consideration for veering to a smooth implementation of the proposed projects.

- Most of the proposed project area for development under the present plan, are already tilled privately-owned properties. Therefore, the cooperation of the farmers would be a prerequisite for obtaining the necessary private land to install irrigation and drainage facilities, roads, etc. and also to the persuasion of farmers to shift over to modern agricultural practices. Administrative guidance should be given to the farmers so that they positively contribute towards the Project implementation from the planning stage itself.
- To realize the Master Plan and perform smooth coordination with the concerned governmental institutions, a Project steering committee consisting of personnel with clearly defined responsibility, from those concerned institutions should be established, and specifically the cooperation and close association of the Departmental Coffee Committee, the Departmental Office of Quindio and the municipality of Armenia would be essential.
- It is recommended that the implementation of the Master Plan to be carried out principally by DNP and CRQ. However, the integrated cooperation of HIMAT and other relevant authorities would also be required because this is a project of national importance.
- When the disaster prevention measures of the mountainous areas as well as the coffee wastes treatment measures are considered, the inhabitants

of the areas where such measures will be provided will not be the direct beneficiaries, but the inhabitants at down-stream. Hence it is necessary for the local inhabitants to understand the gist of the Master Plan, for which public dissemination and other relevant activities concerning the importance of environmental conservation should be performed so as for the inhabitants to have a perception on environmental issues.

- This Master Plan has been envisaged within a limited time and based on the limited data then available. Hence it is necessary to obtain more specific data during the course of the feasibility study to facilitate the detailed engineering design and then the successful implementation of the project. The necessary data to be collected should include the following;
 - Drawings showing the topography, land use, and the property boundaries of the areas to be developed under the Master Plan.
 - Data showing meteorological and hydrological conditions, and crop production.
 - Drawings showing the location of the proposed coffee treatment facilities and information on timing and volume of coffee wastes treatment.
 - Base line information on the existing water quality of all concerned rivers.
 - Socio-economic information (Evolution of population, economic activity etc.)

A continuous review of Master Plan is recommended to effectively incorporate any changes that may occur in social and economic conditions while the project is in progress.

086 Considering the fact that the Study is carried out within a limit of scope defined as the Integrated Agricultural Development, the water quality improvement plan of the Study does not take into consideration the Urban Sewage Treatment Projects in Armenia and Calarca. However, from the viewpoint of overall water quality improvement, emphasis should be placed on Urban Sewage Treatment Projects of both of these cities as well.

2.2 HIGH-PRIORITY PROJECTS

087 "The Quindio River Basin Integrated Agricultural Development Project" has been selected as a high-priority project. The project is composed of those sub-projects having specific high priorities and chosen from the various programs covered by the Master Plan; also it is well coordinated with the National Development Plan with regard to the rectification of imbalance. When considering the economic and social benefits of the Project, it would be necessary that, for the agricultural development of the Department of Quindio and in turn, the Republic of Colombia, plus as a forefront project of the Master Plan, a feasibility study should be commenced at an earliest opportunity in accordance with the present Master Plan Study.

088 "The Coffee Wastes Treatment Project," another high-priority project, will have a high social impact, but the determination of its economic benefit is difficult. Also, since there would be no direct benefits for farmers who will have treatment facilities, but will be obliged with the burden of operation, maintenance and management costs of the treatment facilities, it is anticipated that the co-operation of coffee farmers would be very difficult. Therefore, in implementing the project, financial assistance and other favorable measures by the National Coffee Federation of Coffee Growers or Coffee Committees would be essential. Although the treatment of coffee wastes at their generating source is preferable as the basic solution, considerable improvements can be achieved should each coffee grower has the slightest perception of the importance of reduction of wastes and the subsequent treatment. Coffee growers should preferably be given the following drastic guidances:

- Prohibition of disposing pulps into the river and, in turn, effective utilization of them as fertilizer.
- Covering of soil over the fertilized farmlands at the sloping areas along the rivers to prevent the run off of fertilizer.
- Provision of pulp effluent preventive measures in treatment systems.
- Prohibition of the discharge of untreated waste water into the rivers.
- Mandate of land treatment by dumping the waste solutions into trenches and pits as the minimum necessary level of treatment.

The treatment of coffee wastes is a common issue not only to the Department of Quindio but also to all other coffee production areas throughout the country. This problem could not be overlooked and should be given careful consideration, as the public perception on environmental issues would tend to enhance in future. Development of other forms of waste treatment systems that are more economical than the UASB system treatment should also be studied and encouraged as a project of national importance.

CHAPTER 1 INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Agriculture is the mainstay in the national economy of the Republic of Colombia and its productive infrastructure has been developed at the foot of the Andes where most of the country's population is concentrated. This tendency has produced various problems, which have caused stagnation in agricultural output. Under the circumstances, the Government of the Republic of Colombia laid in its Development Plan 1983 - 1986, greater emphasis on the agricultural development program aiming at realizing intensive agricultural activities.

Though the Department of Quindio is considered as a region of major agricultural production, without an integrated agricultural development program, its natural resources, an indispensable factor for the progress of agricultural sector, have been deteriorated artificially or by natural phenomena, and no appropriate land use nor farming practice matching the topographic and meteorological conditions of the Department has been established.

Based on this understanding, and with a view to relaxing the aforementioned constraints, the Colombian government desired to establish an integrated agricultural development plan covering the whole of the Department and then promote effective agricultural and livestock production. Accordingly, the Colombian government requested the Japanese government for technical assistance to implement a Master Plan Study on the Quindio Basin Agricultural Development Project (hereinafter referred to as "the Study") in July 1984. In response to this request, the Japanese government, through the Japan International Cooperation Agency (hereinafter referred to as "JICA"), dispatched a contact mission in April 1986, which was followed by an agreement to the content of the Study. Afterward, in July 1986, a preliminary study mission was dispatched to discuss and conclude the Scope of Work for the Study.

In accordance with the Scope of Work for the Study, JICA dispatched a Study Team to conduct a Master Plan Study in Colombia: the Phase I of the Field Work was carried out over a period of 3.5 months from January to April, 1987 and the Phase II of the same over 3 months from July to September, 1987.

1.2 OBJECTIVES OF THE STUDY

The Department of Quindio is located geographically in the western position of the Republic of Colombia; despite its territorial coverage of 1,947 km² is the smallest among the 23 departments of the country, it is considered an important department producing about 10% of the national coffee production that is the prop and stay of the Colombian economy. On the other hand, the Department of Quindio is at present confronted by problems that require an urgent solution of water pollution due to the processing of coffee berry, deficiency of water for agricultural and various rural uses in dry season associated with inferior level of development of its potentiality, frequent occurrence of flooding in southern

sub-region which is correlated with eroded river banks attacked by natural action of river water discharge in the rainy season. In the light of this, the present Study has the objectives to formulate an integrated agricultural development project including measures to overcome the above cited problems in the area covering a total of 200,000 ha of the Department of Quindio, and contribute toward the development of the Department.

1.3 THE STUDY AREA

The Study area covers approximately 200,000 ha corresponding to the whole of the Department of Quindio.

1.4 THE SCOPE OF THE STUDY

The Study has been conducted in two stages, Phase I and Phase II, which in turn can be divided into the following two categories.

(1) Phase I

1) Work I: Remote Sensing

2) Work II: Field Work

- Specific field survey other than remote sensing
- Preparation of the Progress Report

(2) Phase II

1) Preparatory Work in Japan

- Preparation of the Plan of Operation

2) Work II: Field Work

- Detailed field survey
- Preparation of land use plan
- Preliminary formulation of development plans by sub-region and by objective
- Preparation of the Interim Report

3) Work III: Home Office Work in Japan

- Formulation of the master plan
- Identification of high-priority projects
- Project evaluation
- Project implementation schedule
- Preparation of the Draft Final Report

1.5 COMPOSITION OF REPORTS

The Final Report of the Study consists of:

- Volume I: Main Report (English)
- Volume II: Annexes I (English)
- Volume III: Annexes II (English)
- Summary of the Main Report (Spanish)

**CHAPTER 2 BASIC METHODOLOGY OF THE MASTER
PLAN STUDY**

2.1 BASIC CONSIDERATIONS

The integrated regional agricultural development plan has objectives to design measures for the improvement of agricultural production basis and other factors so that growth of the regional, agricultural sector can be promoted. For this purpose, the Study was performed of underlying arable land use, balance of water for crop production, cropping technology, farm management system, labor force, income distribution, inputs, marketing system of products, farmers' organization, and so on.

The past experience has given a lesson that agricultural development projects which had been implemented with a sole objective of increasing agricultural output had fallen short of anticipated project result. Consequently, emphasis was laid on the formulation of an integrated regional development project, no matter whether it is rural or urban development, and the importance of integrated agricultural development has become the attention of project implementing entities. Examples of implementation for an integrated agricultural development project were increasing in developing countries.

Basic considerations on an integrated agricultural development project are generally resumed in the following manner.

- Investment in development projects shall be redistributed from industrialization and urban development purposes to rural development one so that rural/urban disparity be rectified. Nevertheless, this does not mean the disregard of the promotion of industrialization and urbanization projects but the allotment of more budgets to agricultural and rural development sectors.
- In addition to achieve production targets, a better income distribution, enhancement of social aspects and satisfying of basic human needs (BHN) shall be included in development objectives.
- The project, a measure to materialize the development policy of governmental authorities, shall be implemented with a combination of various components, namely, to aim at attaining simultaneously different objectives such as an increase in output, a growth in productivity per unit of land, generation of major job opportunities, rectification of income inequality, attainment of a better life, amelioration of welfare, etc. by implementing in a package deal such factors as economic development project represented by crop production, structural improvement project focused on agrarian reform, and non-economic (social) project consisting of education, sanitation and ecological conservation.
- Priority in selecting beneficiaries shall be given to the poorest rural population such as peasants, tenant farmers and landless farm employees.
- In the process from preparation to implementation of development projects, both central and local authorities responsible for project implementation are obliged to make their best efforts for the successful completion of projects and, at the same time, a comprehensive and continuous participation by local population shall also be envisaged.

Taking account of these considerations, as well as the Scope of the Work for the present Master Plan Study, and local characteristics of the Department of Quindio and other factors, the basic methodologies for the Master Plan Study have been presented as given below.

(1) Approach as Integrated Agricultural Development

The present Study is for an integrated agricultural development project to be elaborated for the first time in Quindio that is beyond the scope of projects which aim at no more than increasing agricultural output. Bearing said basic considerations in mind, various development components have been effectively integrated to one project that promises multiplied effects.

(2) Comprehension of Needs among Local Population

The success of a project depends on getting consensus and realizing more participation by local population. In order to obtain cooperation from the local population, the first step should be to comprehend what they consider and what they wish so that their intentions be reflected on project formulation and thus no project in absence of local population's intention should be formulated. In this regard, local concerns having been identified through the survey on farmers have been taken into account as well as sufficient meeting with local relevant authorities such as C.R.Q. and Coffee Committee have been made.

(3) Coordination with National and Regional Development Plans and Programs

The project formulation has been made referring to the development strategies for the agricultural sector of the Department of Quindio quoted in the National Development Plan and existing agricultural development plans and programs in Quindio. Emphasis has been placed on the coordination between the present Master Plan Study and National and regional development plans and programs.

(4) Formulation of Feasible Project

Master plans are likely to be elaborated irrespective of their viability for economical and technical implementation. Practical plans matching local capability in terms of financial and human resources have been designed.

(5) Compliance with the Scope of Work for the Study

A wide range of the field study covering the agricultural sector as well as other related sectors was conducted. In compliance with the Scope of the Work for the Study, the formulation of prospective projects have been made in connection with land use, agricultural development, disaster prevention and land conservation, water quality improvement and rural infrastructure.

2.2 STUDY METHODOLOGY

In elaborating the present Master Plan that has various constraints to be eased within approximately one year, the following procedure has been employed.

Step 1: Diagnosis of Prevailing Situation (Identification of Constraints for Development)

Data and information collected in the course of field work were compiled and analyzed so as to identify problems that constrain the development of the agricultural activity in the Department. This step refers to Chapter 3 - National Socio-economic Background and Chapter 4 - The Study Area.

Step 2: Preparation of Development Concepts

In preparing development concepts, constraints of the agricultural sector, policies of local authorities and requirements of local population were identified first and then goals to which the agricultural sector of the Department is addressed have been presented. Taking these goals into account, the land use proposal without incorporating the target year has been considered. Development concepts based on which the Master Plan is implemented before the target year include the incorporation of development objectives and strategies to attain these objectives. Detailed description of development concepts is given in Chapter 5.

Step 3: Formulation of the Master Plan

On the basis of the development concepts, development plans have been proposed on land use, agricultural development, soil conservation and disaster prevention, water quality improvement, and rural infrastructure. In accordance with these development plans, proposed projects ("long list") have been formulated with their investment cost and implementation schedule. Chapter 6 describes this Step in detail.

Step 4: Identification of High-Priority Projects

Of the afore-mentioned proposals presented in Step 3, high-priority projects have been identified and an economic evaluation comprising their implementation schedules at the pre-feasibility level has been made.

Chapter 7, 8 give a detailed description of this Step.

The study methodology briefly explained herewith is further summarized in the flow chart attached in the subsequent page.

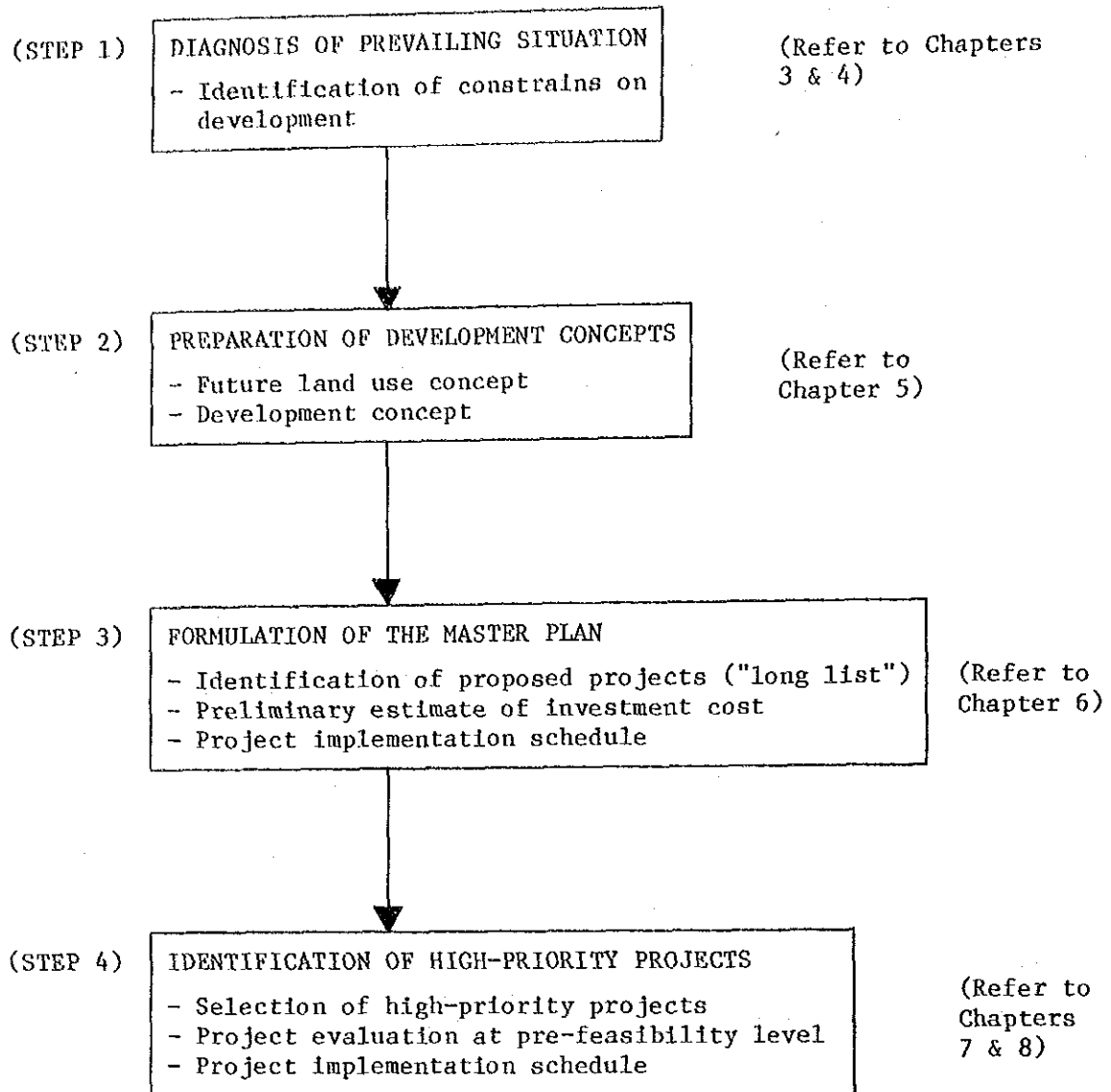


Fig. 2.2.1 FLOW CHART FOR THE FORMULATION OF THE MASTER PLAN

CHAPTER 3 NATIONAL SOCIOECONOMIC BACKGROUND

3.1 CHARACTERIZATION OF THE REPUBLIC OF COLOMBIA

The Republic of Colombia, a constitutional country to have become independent from Spain since 1810, is located in the north-western corner of the South American Continent and is stretched from 4°13' S latitude to 12°16' N latitude and from 66°51' to 79°02' W longitude. The land area of the country covers about 1.14 million km² and the number of inhabitants as of 1985 was 27.9 million. Spanish is spoken as a national language. An administrative division of the country consists of the Special District of Bogota, 23 departments, 4 intendencies, and 5 commissariats and the governor of each department is assigned by the President.

The country is divided roughly into 6 natural regions: 5 in the continent and 1 in the archipelago. On the continent, three longitudinal mountain ranges running parallel separate the country topographically into the regions of the Caribe, Pacific, Andean, Amazon and East Llano.

The geographical location of the country falls in the range of tropical zone, but the climate varies by altitude. The major portion of the nation's population is concentrated on regions of plateau in which a temperate climate dominates; with an exception of a couple of coastal cities situated in an important position in the context of the marine transport, most of major cities are found in a range of altitude 1,000 m - 3,000 m.

3.2 ECONOMIC SITUATION

3.2.1 General

1986 was an auspicious year with pronounced economic activity. Coffee, on which the country's economy has long been dependent, is sold well in foreign markets. Besides, the mining sector; crude oil, gold and coal, contributed much to a favourable balance of payments. Though a small surplus was achieved in the public finance, the rate of inflation kept soaring with increase of money supply, and the public foreign debt became heavier with its subsequent debt service increase.

3.2.2 GDP

In 1986, an estimated GDP at factor cost and at current price was Col.\$6,353.8 billion with real increase of 5.3% from the previous year. In 1985, production from the primary industry contributed 23.9% of the total GDP. Manufacturing and construction sectors combined contributed 25.4%, commerce, transport and communication, 21.8%. Private consumption consisted of about 73% of the total expenditure in GDP in 1985 with the average real growth rate of 2.1% since 1980. Per capita GDP at current price in 1986 was estimated at Col.\$218,418, which is equivalent to US\$1,200. Real annual increase rate from 1985 was 3.2%.

3.2.3 Employment

The number of the economically active population exceeded 10 million in 1985. More than 70% of them live in urban areas: it has increased by 32.8% between 1978 and 1985. 30% of them were employed in the agricultural sector, 13% in the manufacturing sector. Unemployment rate in the 7 major cities reached its highest record of 14.7% in June 1986, since then it has gone down. It was at 13.3% in March 1987.

In January 1987, the government announced plans to create about 50 thousand jobs over the next four years. 25% of the labour force is organized into 5 labour's unions.

3.2.4 Prices

Consumer prices have been rising. The index of 1986 was 325.5 (1980 = 100) with a 18.9% increase from the previous year. The government tried to minimize the fiscal deficit, and succeeded in avoiding price spiral due to the coffee boom in 1986.

3.2.5 Economic Structure and Analysis of the Input-output Table

Most economic activities are carried out by private sector, with some exceptions in mining and public utilities sectors. Bogota, Medellin and Cali have stock exchange. In 1986, stocks accounted for 1.2% of the Col.\$262.5 billion transacted in the Bogota exchange due to the inflow of government paper with high rate of return. The central and regional governments have public enterprises in such sectors as mining and manufacturing, public utilities, transport and communications and other tertiary industries. The biggest is Empresa Colombiana de Petroleros, whose annual sales in 1986 were the 48th among third world enterprises. The total amount of fixed capital of the public enterprises in 1982 was Col.\$107.95 billion.

Analysis of the input-output table of national economy valued at production in 1982 was carried out.

18.7% of value produced by the agro-livestock sector was contributed by intermediate sectors, and 81.3% by the value added.

Compensation for employees contributed 42.6% of the total value added, operating surplus contributed 57.4%, leaving the balance of indirect tax and subsidies to be negligible.

Among the intermediate sectors, manufacturing contributed most, with a rate of 8.9%.

The agro-livestock sector contributed to the sector of processed coffee at the rate of 57.5%; to meat, at 74.4%; and 28.0% to other agricultural products. The contribution of agro-livestock sector to the total intermediate sectors is 8.0%. The import coefficient of the agricultural sector was 12.1%. The demand of Col.\$1 billion in the agro-livestock sector induced new demand of Col.\$67 million in the manufacturing sector, of Col.\$36 million in the finance, of Col.\$34 million in other agro-products sector.

On the other hand, a demand of Col.\$1 billion in the processed coffee sector induced a demand of Col.\$533 million in the agro-livestock sector; the meat sector induced Col.\$688 million; and the other agro-products sector induced Col.\$292 million. The influence coefficient of the agro-livestock sector is 0.81, the second lowest; the most influential is the finance sector, the coefficient of which is 1.32.

A unit increase in final consumption induces 0.16 unit to the agro-livestock sector; a unit increase in investment induces 0.10 and a unit increase in export does 0.29.

The production activity of the agro-livestock sector depends 75.5% on consumption, 9.8% on investment and 14.5% on export.

3.2.6 Public Finance and Monetary Conditions

The fiscal situation has been greatly improved since 1984 when the deficit reached 6.8% of GDP. 1986 saw the surplus of 0.2% of GDP thanks to high coffee prices.

Tax reform bill was approved at the end of 1986. This does not directly raise revenues, but leads to promotion of savings and investments. The government also tries to minimize the deficits in public sector, and to increase the amount of transfer to local governments.

The Bank of the Republic has a function of a central bank. There are 20 private and mixed commercial banks and 4 state owned commercial banks. There are more financial institutions, some of which are owned by the state.

The government basic monetary policy instrument is the open market operation, but recently, with a sign of rapid increase of monetary base, the government took steps to increase reserve requirements.

3.2.7 Balance of Payment

According to the provisional figures, the 1986 current account was in surplus for the first time in 6 years thanks to a favourable trade balance. Besides coffee export, agro-commodities include bananas and cut flowers. Vegetables are beginning to be exported. Colombia became a crude oil exporter in 1986. Coal was exported in 1986 at a price below the cost of production. Balance of capital account was also favourable in 1986.

3.2.8 Foreign Investment Policy, Foreign Exchange Reserves and External Debts

Foreign investment in Colombia had been regulated in principle by the Andean Pact's Decision 24, but it has much been deregulated recently. The outstanding foreign investment amounted to US\$2,672 million at the end of 1986, of which 67% was from USA.

Foreign exchange reserves at the end of 1986 were US\$2,556 million. A loss of US\$381 million is anticipated for 1987. Gross external public debt at the end of 1985 reached US\$9,377 million, which raised debt service ratio to 29.2%.

3.2.9 Foreign Exchange Rate

The Colombian currency has been directly connected to the US dollar by a crawling peg system. The rate was Col.\$251.63 to the dollar as of September 4 in 1987; the rate has been declining slowly but steadily.

3.3 AGRICULTURAL ASPECTS

3.3.1 GDP and the Agricultural Sector

In 1985, according to the preliminary estimate of the Central Bank (Banco de Republica), the agricultural sector including silviculture and fishery produced Col.\$129,211 million of products at the constant price of 1975. For the last decade (1976 - 1985), the rate of growth of the sector was stagnant; the output in the period rose at as low as 2.4% per annum, which was inferior to the yearly growth rate of the GDP (3.24%). Consequently, the participation of the agricultural sector in the GDP fell down from 38% in 1950 and 29% in 1970 to 21% in 1985.

3.3.2 Land Use and Land Tenure

It is estimated that about 14.4 million ha of land in Colombia, or equivalent to 12.6% of the national territory (114 million ha) is arable for agricultural purpose, whereas land capable for pasture corresponds to 19.3 million (16.9% of the total). On the other hand, in 1985 crops harvested area and grazing or rough grazing land accounted for 3.9 million ha and 22.6 million ha, which intimates that there remains considerable margin of arable land for the expansion of agricultural production and some portion of them is actually used for grazing land due to the lack of infrastructure or other reasons.

Land tenure by size in the national level is, like in other Latin American countries, is characterized by imbalanced distribution; small and medium land owners with holding less than 10 ha represent 78.1% of the total number of properties but only 8.8% of the total rural land, while 60.8% of the rural lands is held by only 3% of the land owners with holding more than 100 ha.

3.3.3 Agricultural Output

Coffee, the mainstay of the Colombian economy, accounted for 17.3% of the total value added to crop production in 1986. The production volume for the same year was 720 thousand tons and the participation of Colombian coffee in the world market shared 15.5%.

The production of coffee has fallen down recently after having registered a maximum production in 1984. This recession in production is attributable to the acceleration in the renovation and stumping of aged plants. With an exception of 1985 in which production was badly affected by meteorological conditions, the unit yield of coffee at national level is maintained in the range of 0.75 - 0.85 ton/ha for the last six years.

Apart from coffee, following crops registered a higher contribution of value added to the total crop production: "panela" (9.3%), rice (8.6%), sugarcane (8.0%), potato (7.1%), plantain (6.0%), maize (5.0%), and cassava (4.6%).

The crops which showed a higher growth in production are: sorghum (550%), "panela" (270%), rice (260%), cacao (240%) and potato (220%). The growth of these crops is attributable to the expansion in harvested area for sorghum, cacao and potato as well as to the intensification of production per unit land for "panela" (201%) and rice (184%). On the other hand, a stagnation or recession in production has been reported for cassava, maize, soybean, wheat, and plantain. Of these crops, as for wheat and plantain, the decline in the harvested area has adversely affected the unit yield. The inactivity of production for the rest of the crops is due to combined stagnation both in harvested area and unit yield.

3.3.4 Trade in Agricultural Products

In 1986 the trade surplus of agricultural sector exceeded US\$3.4 million. This surplus owed in its great majority to coffee and if coffee is excluded from consideration, it would be reduced to as little as US\$243 thousand.

Up to 1960, the participation of coffee in total national exports was more than 90% in value terms and coffee contributed greatly to finance the government's budget. In recent years (1982 - 1985), because of the expansion of exports other than agro-products, the contribution of coffee to total national exports has reduced to around 50%. Nevertheless in 1986, coffee share was recovered to as high as 58.5%, attributable to coffee bonanza caused by the rise in price in international market which was rooted in the decline of Brazilian products.

Apart from coffee, there has been a large expansion in exportation of banana and cut flowers, and a decline in the share has taken in such exports as cotton, sugar and beef in the 1980's.

The importation of foods and agriculture-related materials and inputs accounted for 8.4% of the total imports in value terms for 1986, which was declined from 9.9% of average rate for the previous three years 1983 - 1985. A sharp drop in food and agriculture related materials and inputs both in value and volume in 1986 is attributable to the government's policy for protecting national products. With respect to individual product, the share of wheat recorded the highest with the participation of more than one-third (35.3%); subsequently, soybean oil (11.3%), animal fodder (5.7%), fish flour and powder (5.3%) and barley (4.9%) were much imported in 1986. Finally, it is worthwhile to note that the imported volume of foods has increased at an average rate of 8.5% p.a. between 1970 to 1985 that is considered a very high pace of expansion if one takes the yearly population growth rate of 2.5% (1973 - 1985) into account.

3.3.5 Labour Force

In 1984, the agricultural sector provided the greatest opportunity of employment within the country's labour market; it accounted for 33% of the total employment. As the case of contribution to the GDP, the importance of the agriculture sector reduced relatively in recent years; the participation of the sector, which registered 56% of the nation's total employment in 1951, reduced to 49% in 1964, to 35% in 1980, and to 33% in 1984, as cited above.

The projection of the SENA (National Apprenticeship Service) estimates the requirement of manpower for the agriculture sector at 2,451 thousand (27.4%) in 1987, for livestock, and 191 thousand (8%) for indirect workers.

The demand of manpower for coffee production has increased in these days, because more workers are required for new seeding and renovation of plants in the course of the improvement of varieties and for the harvesting of highly yielding plants. With regard to labour requirements for crops other than coffee, a dynamic increase has taken place for African palm and potato, cacao, while a notable decrease has occurred for cotton and cassava.

3.4 POLITICAL AND SOCIAL SITUATION

Since the establishment of the Republic of Colombia, its political scene had been dominated by the struggle between the Liberals and Conservatives for the hegemony. An arrangement was entered into for the rotation of political power in 1957 and since then it has been realized. The present Banco Administration of the Liberal Party has been in power since 1986.

In 1985, when the last census was carried out, 76% of the population lived in the urban areas. It was 46% in 1960. But the trend of rural exodus has been slowed down, partly because of the improvement in the agricultural sector.

Two distinctive social classes exist in the city; that of the employees and of the labourers, besides which there are employers. There are three in the rural area; of big farmers, small farmers and landless labourers, with migrant labourers as well. Average monthly expenditure of the city employees in May 1987 was Col.\$114,927, whereas that of labourers was Col.\$42,898. Though the government has been raising the rate of the minimum wage in accordance with that of inflation (Col.\$683/day in 1987), the amount can cover less than 50% of the cost of daily requirements. More than 50% of the family bread-earners in the major cities are getting around or less than the minimum wage.

3.5 NATIONAL DEVELOPMENT PLAN (1987 - 1990)

3.5.1 General

The four year socio-economic development plan envisions the achievement of two targets simultaneously; a less social distortion and a consistent economic growth.

The first will be carried out with a slogan "eradicate absolute poverty" under a social climate of national reconciliation. Investment will be made in the interest of bettering the physical infrastructure in rural and marginal urban areas, and of human resources.

The second will be realized by intensification of production base as well as expansion of market, domestic and external. The average annual increase rate of GDP during the plan period is set at 5% with the average increase of 5 - 6% in employment. Public investment will be focused on social overhead capital and on areas less developed and having strategical importance. Private investment is desired to increase by tax reform and more liberal foreign investment rules, which were declared at the end of 1986. The real annual increase rate of 6 - 7% in the export income is expected by the efforts of sectors in agriculture and mining, in which the value of non-traditional export goods is to be raised by 15% per annum. The domestic demand is expected to be sustained favourably by the efforts of sectors in manufacturing and construction.

The main objective of the macro-economic policy is to keep the economy growing while containing inflation. The rate of deficit of fiscal budget to the GDP is to be below 3%, and the amount of the external debt will be around US\$2 billion per annum. The budget for the total plan is given below. The net borrowing for the plan is 7.3% of the total budget, for the 52.7% of which the government seeks resources outside the country, and domestic for the rest.

TOTAL BUDGET

Unit: In million of Col.\$ at
constant price of 1987

	1987	1988	1989	1990	Total
Current revenue	1,116,026	1,206,498	1,421,373	1,445,453	5,189,350
Assets for Investment	107,126	104,407	93,814	89,511	394,858
Current Expenditure	877,684	946,497	1,095,515	1,104,117	4,023,813
Capital Formation	484,962	459,793	517,499	537,456	1,999,710
Balance	-139,494	-95,385	-97,827	-106,609	-439,315
Planned borrowing	272,128	189,271	214,205	228,404	904,008
New projects	864	27,394	40,760	49,404	118,422
(-): amortization	181,633	185,746	208,178	215,537	791,094
Net External Credit	91,359	30,919	46,787	62,271	231,336
Net Domestic Credit	48,135	64,466	51,040	44,338	207,979
TOTAL DEBT	139,494	95,385	97,827	106,609	439,315

Source: Planes y Programas de Desarrollo Económico y Social 1987 - 1990, DNP

3.5.2 Agro-Livestock Sector

The budget for the agro-livestock sector is given below. 4.5% of the total budget will go to the sector, and 21.8% of the sectoral budget is to be financed by external loans. The plan will be executed by 8 different institutions which are affiliated to the Ministry of Agriculture.

24.9% of the budget will go to the Fondo DRI, through which integrated assistance to the farmers are carried out. 22.7% will go to INCORA, which functions as a major work force of agrarian reform. ICA, the chief agency for research and technology transfer will receive 22.6%, and HIMAT, which aims at improving and preserving the quality of farmland, will get 19.8%.

The budget for the national plan for rehabilitation is included in this sector. Those areas which will not be covered by the Fond DRI will be taken care of by this provision. The amount reaches Col.\$50,293 million, and is distributed to all the institutions but EMCOPER.

AGRO-LIVESTOCK SECTOR

Unit: In million of Col.\$ at
constant price of 1987

	1987	1988	1989	1990	Total	%
ICA	14,139	14,674	16,354	16,499	61,666	22.6
INCORA	14,662	15,445	15,792	16,148	62,047	22.7
INDERENA	3,272	3,527	3,793	3,778	14,370	5.3
HIMAT	7,091	14,903	16,113	16,027	54,134	19.8
IDEMA	1,844	360	570	370	3,144	1.2
EMCOPER	121	144	132	144	541	0.2
Fondo DRI	12,062	12,165	19,288	24,446	67,961	24.9
DIRECCION SUPERIOR	1,742	2,759	2,193	2,230	8,924	3.3
TOTAL SECTOR	54,933	63,977	74,235	79,642	272,787	100

Source: Planes y Programas de Desarrollo Económico y Social 1987 - 1990, DNP

3.6 QUINDIO'S POSITION IN THE COUNTRY AT A GLANCE

The Department of Quindio with territorial extent of 1,947 km² is the smallest among the nation's 23 Departments. The capital city of Armenia enjoys a traffically important position due to its position in the so-called golden triangle of the country (Bogota - Medellin - Cali). As of 1985, the Department had a population of 378 thousand that had been growing with a rate inferior to the national average. The population of Armenia was 187 thousand, which was ranked 19th in the country and 13th in urban population alone is taken into account. Armenia has accepted inflow of immigrants from rural areas.

The agricultural sector is the most important contributor of the regional economy followed by commerce, manufacture, banking and insurance, and house rental sectors. To compare with the national level, economic structure of Quindio is featured by a major concentration on banking and insurance, agriculture, house rental and service sectors, whereas mining, electricity and gas, water supply and manufacture sectors are less important.

Besides mountain areas covered with forests, a greater portion of the departmental land consists of coffee farms and grazing land, and very little of it is occupied by farmlands cultivating crops other than coffee. The production of coffee enjoys the highest level of productivity per unit of land with 8th in planted area and 5th in output.

Table 3.6.1 summarizes the socio-economic index of Quindio with reference to the national average; the coverage of social infrastructure such as water supply and electricity ranks 2nd or 3rd at the national level (1st or 2nd if the Special District of Bogota is excluded), and literacy and university education rates are also higher than the national average, while inferior rates are registered with respect to school attendancy and house ownership (lowest in the country).

In terms of economic capacity, the Gross Regional Products (GRP) of the Department accounted for, in 1980, 0.94% of the GDP; in view of the departmental population being represented around 1.4% of the nation's total for the same year, the GRP per capita ranks below the national average. The Quindian economic contribution to the national economy has become less important in these years.

The Department of Quindio is also featured by the following social characteristics:

Quindio is the land of coffee galore. The growers enjoy high yields and quality thanks to the good soil and climate. Agriculture is more or less stagnant, the price of coffee changes by the vicissitudes of the international market situation, still, thanks to the efforts of the federation of the coffee growers for which they duly pay. The majority of the growers are pleased and satisfied with fairly good social infrastructure in general; those who are not satisfied with the rural infrastructure and can afford to do so, live in the urban area, leaving their farm affairs to a manager and a flock of seasonal labourers from other departments. They blink the change which slowly pervaded into the area as they seem to think they can cope with it without much ado.

Few industrialists are found in the Department. There used to be some: they fled as a result of civil violence just after the end of World War II when Quindio was awash with coffee boom, then they never returned.

People of Quindio once engineered the separation from the Department of Caldas to get a legal status of the department with the help of people from Risaralda. So they have talents to resort to if they need to invite entrepreneurship to the Department.

TABLE 3.6.1 SOCIO-ECONOMIC INDEX OF THE DEPARTMENT OF QUINDIO

Item		Quindio/ Colombia	Rank	National Average
Area	1,947 Km ²	0.2%	24	-
Population	377,860	1.36%	21	-
Unemployment	8.1%	-	14	9.3%
Birth rate	23.1	-	-	25.0
Fertility rate	1.9	-	-	2.0
Infant mortality	19.0	-	(Lowest) 1	-
Literacy rate	91.6%	-	3	87.8%
School attendancy	50.7%	-	12	53.1%
University education	4.5%	-	3.5	4.4%
Water supply (1)	93.6%	-	2	70.2%
Electricity (2)	96.2%	-	3	78.2%
Sewage (3)	87.2%	-	2	59.2%
(1) + (2) + (3)	84.7%	-	2	56.6%
House Ownership	54.6%	-	24	67.6%
Coffee area (a)	61,950 ha	6.1%	8	-
Area: Catura + Colombia (b)	28,891 ha	8.4%	4	-
(b)/(a)	46.6%	-	4	34.1%
Volume of Production	798,308 Carga	8.9%	5	-
Unit yield (carga/ha)	12.89	-	1	8.85

Source: CENSO 1985, URPA

PARTICIPATION OF AGRICULTURE AND MANUFACTURE IN GRP

	1960	1980	Annual growth rate (1960 - 1980)
Agriculture	42.85%(31.17%)	27.09%(22.85%)	+0.39%(13.89%)
Manufacturing	11.63%(17.34%)	12.87%(22.53%)	+3.24%(6.90%)
Total	Col.\$1,244.7 mil*	Co.1\$2,128.9 mil*	+2.27%(5.52%)
GRP/GDP	1.6%	0.94%	

Source: CENSO 1985, URPA

* 1970 price

Note: (GDP)

CHAPTER 4 THE STUDY AREA

4.1 PHYSICAL FEATURES

4.1.1 Location and Topography

(1) Location

The Department of Quindio, located geographically in the western position of the country, extends over the western slope of the Central Range and is situated at 4°04' - 44' N latitude and 75°26' - 54' W longitude. Its territory covers approximately 70 km from south to north and approximately 40 km from east to west.

(2) Topography

The topography of Quindio can be divided into the following categories: eastern mountain area and western alluvial fan and each feature is explained in the following manner:

Eastern Mountain Area: The Central Range extends from south to north and its watershed constitutes the departmental boundary with Tolima. Nevado del Quindio and other mountains higher than 4,000 m range in this category. The present mountain area extends about 10 km in width and steep slope is formed on both sides. Valleys are developed in such areas and are found in land higher than 2,500 m above sea level, while U valleys are located lower than that.

Western Alluvial Fan: This topography is formed by rivers flowing down from the eastern mountain area and lowers generally from 1,500 m to 1,100 m above sea level. Undulated land is found in this category eroded by large and small rivers. The La Vieja river passes its western extreme constituting the boundary with the Department of Valle del Cauca. The most extensive plain is extended over the confluence formed by the Quindio and Barragan rivers. Consulting with the topographic map with a scale of 1/100,000 prepared by IGAC, land areas and land elevations in the Department are given as follows:

Land Elevation	Area (km ²)	%
Lower than 1,000 m	11.0	0.6
1,000 - 1,500 m	674.1	34.6
1,500 - 2,000 m	416.5	21.4
2,000 - 2,500 m	258.6	13.3
2,500 - 3,000 m	205.8	10.6
3,000 - 3,500 m	166.5	8.5
3,500 - 4,000 m	205.5	10.5
4,000 - 4,500 m	7.4	0.4
Higher than 4,500 m	1.3	0.1
	1,946.7	100.0