THE REPUBLIC OF THE PHILIPPINES

No.

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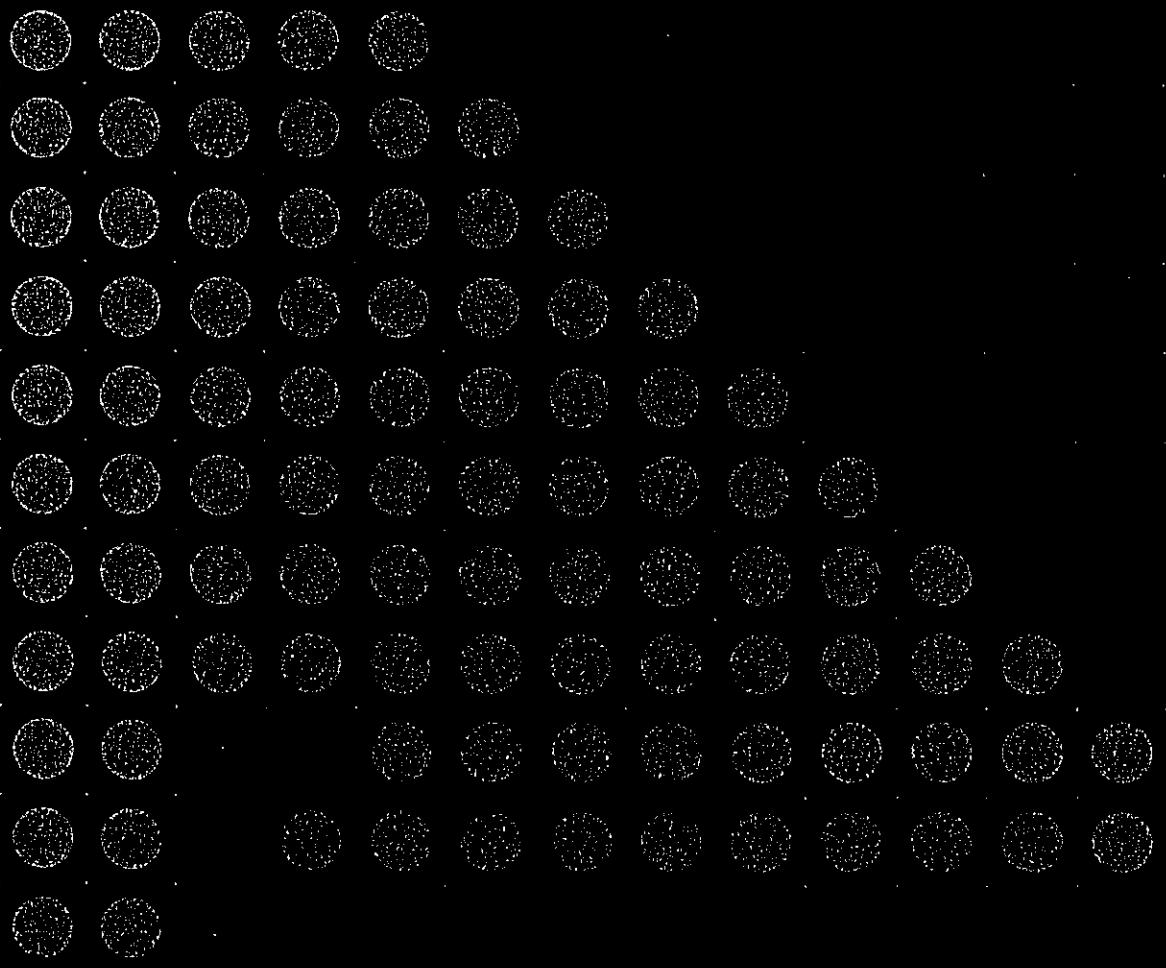
MASTER PLAN STUDY OF THE INFANTA-REAL AREA URBAN DEVELOPMENT PROJECT

TECHNICAL REPORT 4
(EVALUATION)



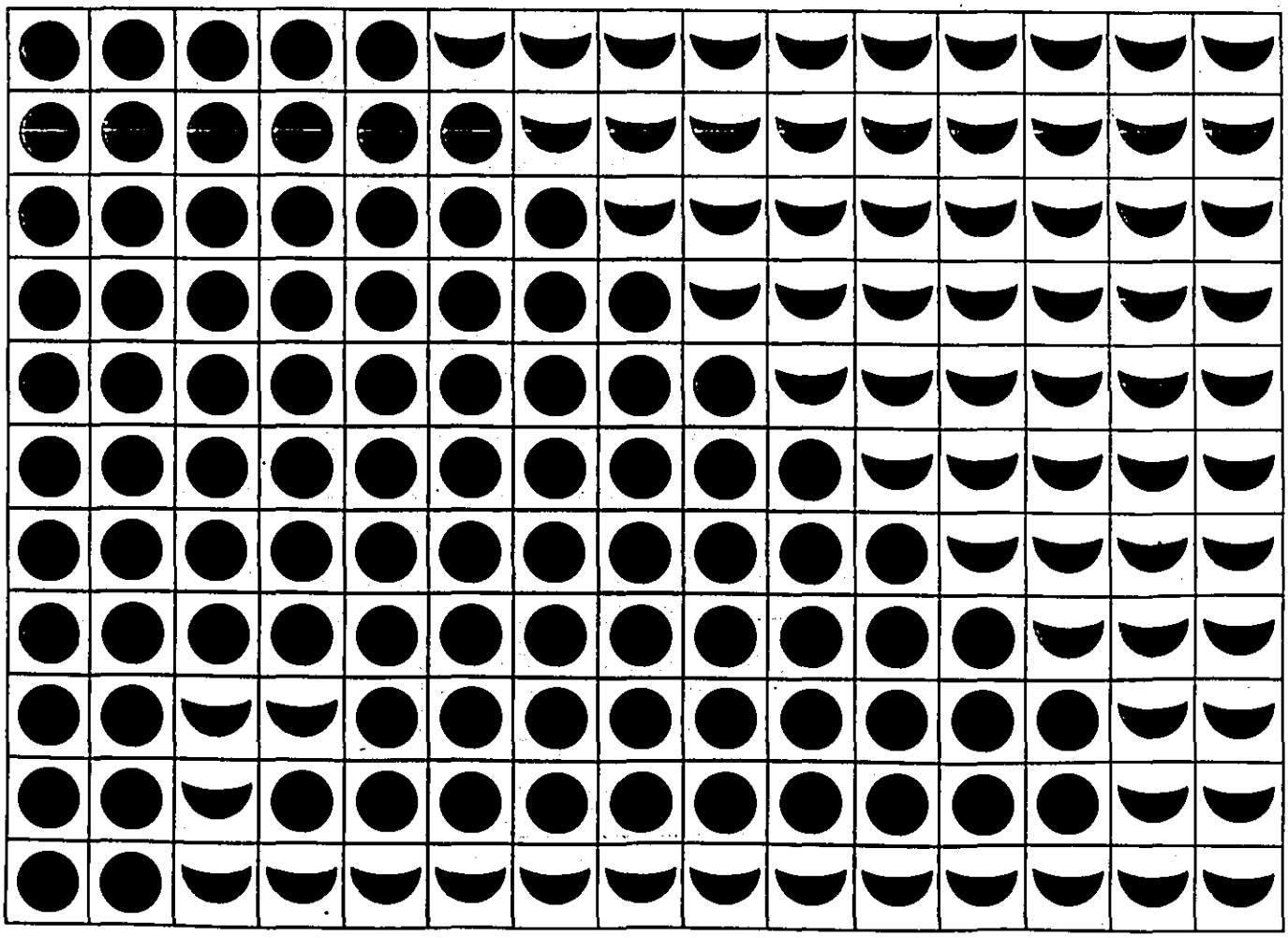
JAPAN INTERNATIONAL COOPERATION AGENCY

MARCH, 1985

THE GOVERNMENT OF
THE REPUBLIC OF THE PHILIPPINES

MASTER PLAN STUDY OF
THE INFANTA-REAL AREA URBAN DEVELOPMENT PROJECT

TECHNICAL REPORT



JAPAN INTERNATIONAL COOPERATION AGENCY

MARCH, 1985

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ABBREVIATION

AAC	Annual Allowable Cut
AADT	Average Annual Daily Traffic
BAEXT	Bureau of Agricultural Extension
BAT	Bureau of Air Transportation
BFAR	Bureau of Fisheries and Aquatic Resources
BHS	Barangay Health Station
BOL	Bureau of Land
BUTEL	Bureau of Telecommunications
EIRR	Economic Internal Rate of Return
EPZ	Export Processing Zone
FIDC	Fishery Industry Development Council
FIRR	Financial Internal Rate of Return
FRP	Fiber Reinforced Plastic
GCLA	Greater Central Luzon Area
GRDP	Gross Regional Domestic Product
HSDC	Human Settlements Development Corporation
HSRC	Human Settlements Regulatory Commission
ICT	International Container Terminal
ILIPSCO	Infanta Lighting and Power Cooperative
IPTS	Inter-Provincial Telephone System
IRM	Infanta Real Module
IRR	Internal Rate of Return
JICA	Japan International Cooperation Agency
LWUA	Local Water and Utilities Administration
MHS	Ministry of Human Settlements
MLGCD	Ministry of Local Government and Commumity Development
MMA	Metropolitan Manila Area
MNR	Ministry of Natural Rescoures
MOTC	Ministry of Transportation and Communications
MPWH	Ministry of Public Works and Highways
MWSS	Metropolitan Waterworks and Sewerage System
NACIDA	National Cottage Industries Development Authority
NAS-NEDA	National Accounts Staff, National Economic and Development Authority
NCSO	National Census and Statistics Office
NEA	National Electrification Administration
NEDA	National Economic Development Authority
NEPC	National Environmental Protection Council
NIA	National Irrigation Administration
NPC	National Power Corporation
NWRC	National Water Resources Council
PAGASA	Philippine Atmospheric Geophysical and Astronomical Service Administration
PCA	Philippine Coconut Authority
PFMA	Philippine Fish Market Authority
PICOP	Paper Industries Corporation of the Philippines
PLDT	Philippine Long Distance Telephone Company
PPA	Philippine Port Authority
PT & T	Philippine Telephone & Telegram Co.
QUEZELCO	Quezon Electric Cooperative
RCPI	Radio Communication of the Philippines
RHU	Rural Health Unit
RWDC	Rural Waterworks Development Corporation
SEAFDEC	South East Asia Fishery Development Center
WD	Water District

1. EVALUATION

1.1 An Overall Evaluation

The master plan has proposed a total of 124 projects. This impact exerted by these projects is evaluated as a whole in this section.

A model for socio-economic structure analysis has been designed and constructed to achieve the quantitative measurement of dynamic changes in IRM as a consequence of the implementation of these projects. It is also used to obtain a financial internal rate of return on the basis of analyzing the balance between the investment and cost recovery foctors (tax revenue) by systems dynamics simulation. This enables an evaluation of the following:

(i) Future development forecast;

(ii) Testing of an appropriateness of future socio-economic frameworks, as defined; and

(iii) Measurement of project implementation effects.

The model covers the entire planning area of IRM, and the projection period from 1984 to 2000.

1.1.1 Model Structure

The model consists of the following four (4) sectors:

(i) Population Sector;

(ii) Industrial Sector;

(iii) Project Sector; and

(iv) Financial Sector

The inter-relation among these sectors is shown in Fig. 1.1.1, and flow diagrams of each sector are shown in Fig. 1.1.2 to 1.1.5.

1) Population Section (See Fig. 1.1.2)

The population sector consists of projections of population and number of households by year. Each succeeding year, population is estimated by adding to or subtracting from the annual population, both natural increase and decrease (using NCSO estimated birth rate and mortality up to the year 2000), and social increase and decrease (by a mechanism using multipliers as a function of attrativeness, designated by increase of employment opportunities and by comparison of per capita GRDP with other areas).

The number of households is obtained by dividing population by the average family size of the respective years.

2) Industrial Sector (see Fig. 1.1.3)

Industrial sector consists of five (5) sub-sectors: (i) crops, livestock, and poultry; (ii) fishery and forestry; (iii) manufacturing; (iv) non-basic industry and (v) tourism. Of these, those which pertain to the subject projects are postulated, while others are estimated on the following assumptions:

(i) That existing manufacturing industry production shall increase in proportion to the previous year's population increase;

(ii) That non-basic industry production shall increase in proportion to the previous year's GRDP increase; and

(iii) That tourism shall induce tertiary industrial activities in proportion to the number of visitors.

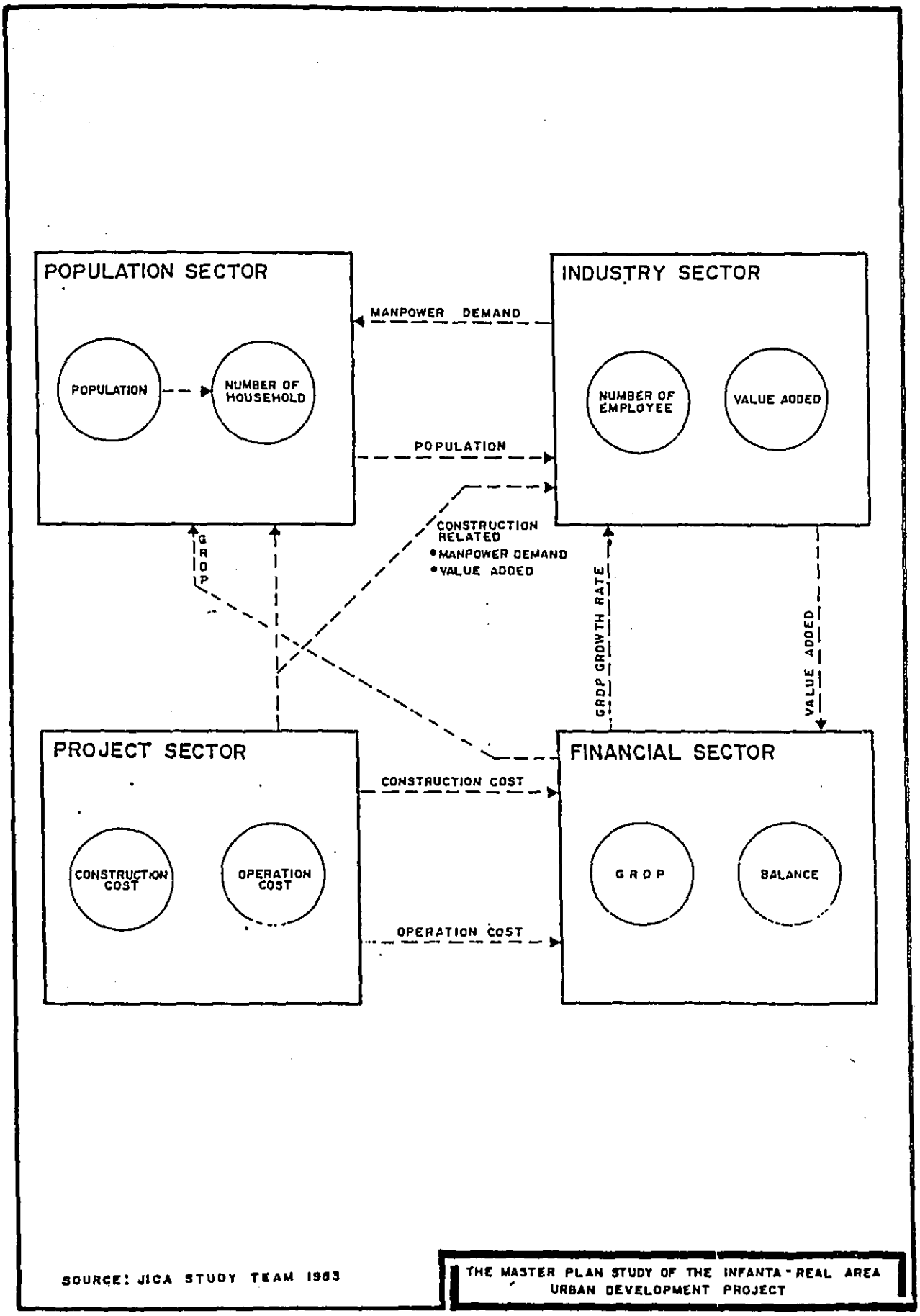
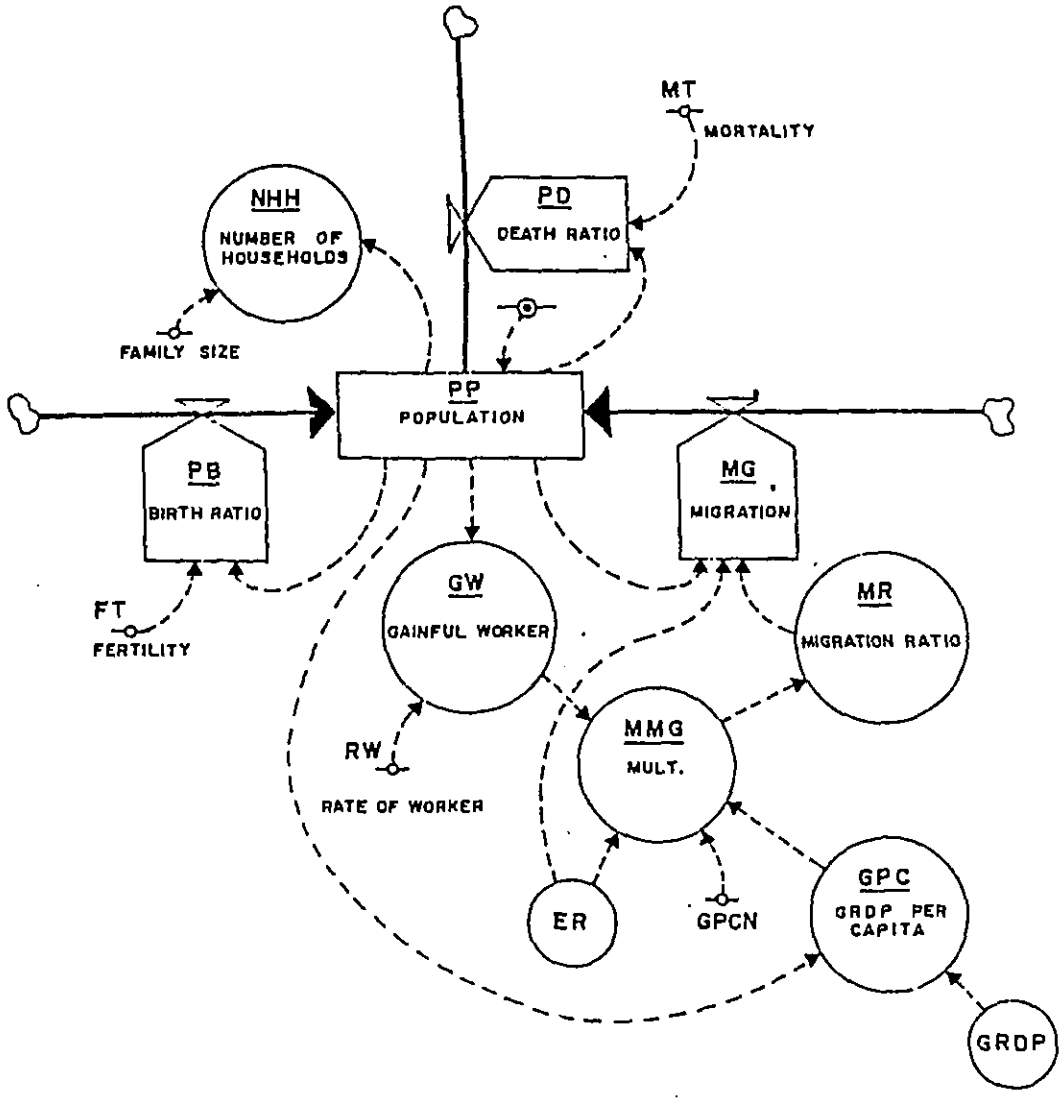


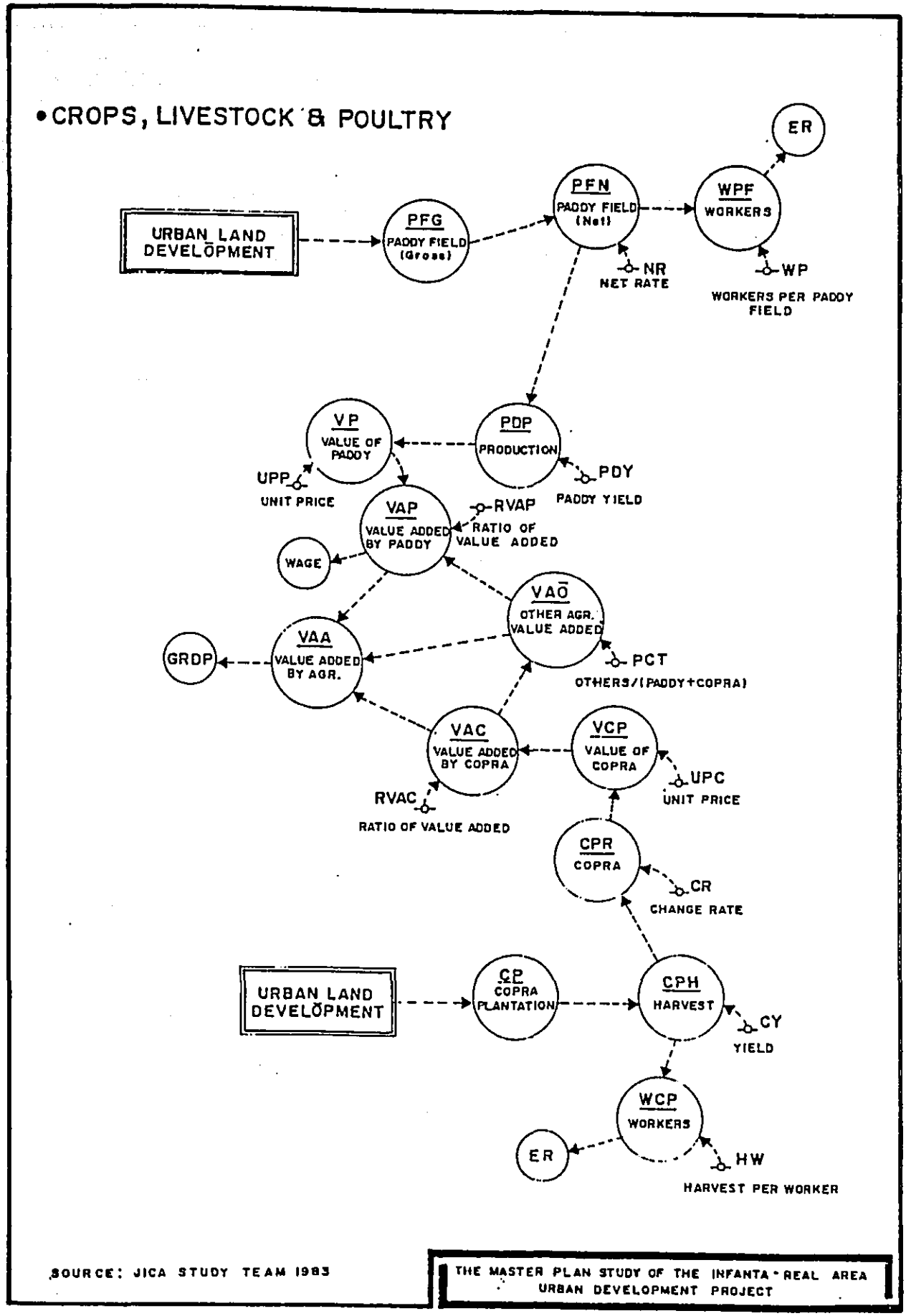
FIG. I.I.I BASIC STRUCTURE OF I.R.M AREA SOCIAL STRUCTURE MODEL



SOURCE: JICA STUDY TEAM 1983

THE MASTER PLAN STUDY OF THE INFANTA - REAL AREA URBAN DEVELOPMENT PROJECT

FIG. I.I.2 ILLUSTRATION OF POPULATION SECTOR MECHANISM



SOURCE: JICA STUDY TEAM 1983

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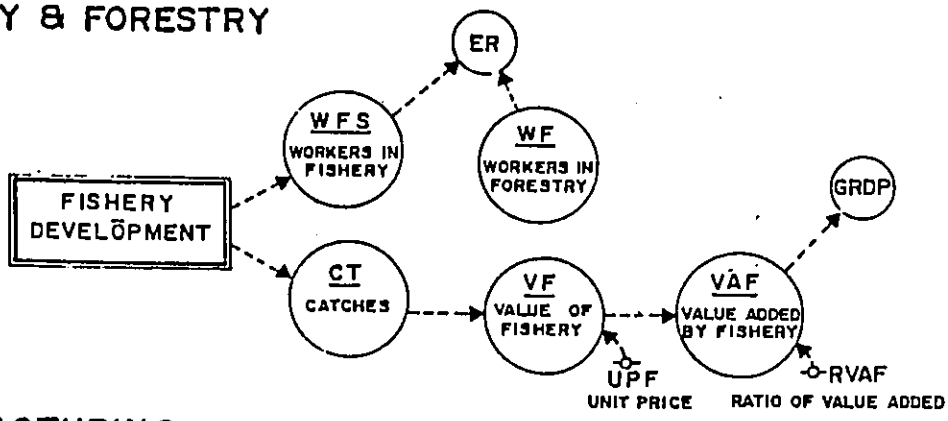
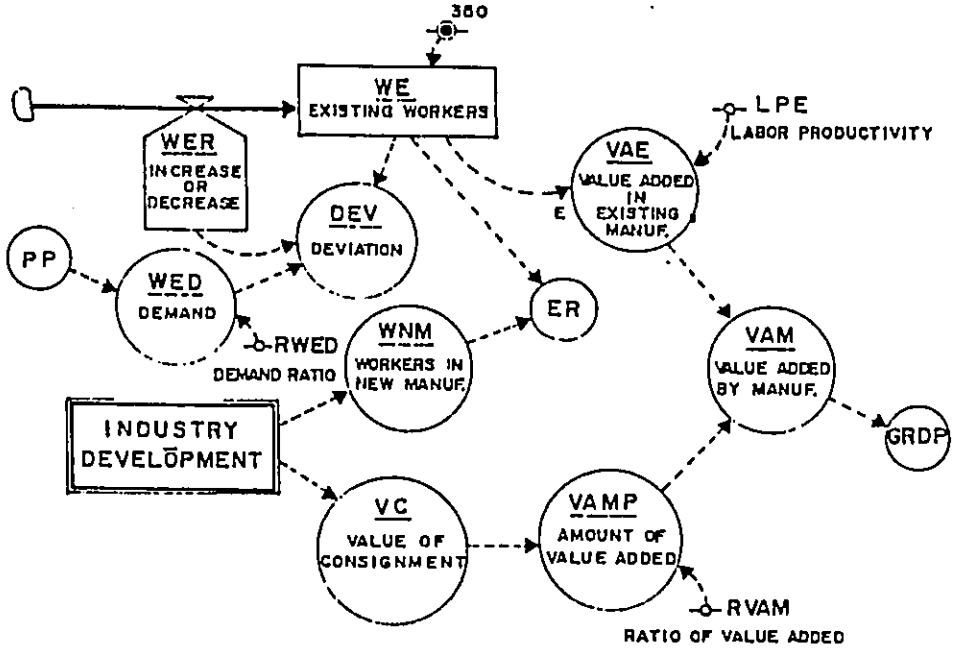
FIG. I.I.3 ILLUSTRATION OF INDUSTRIAL SECTOR MECHANISM

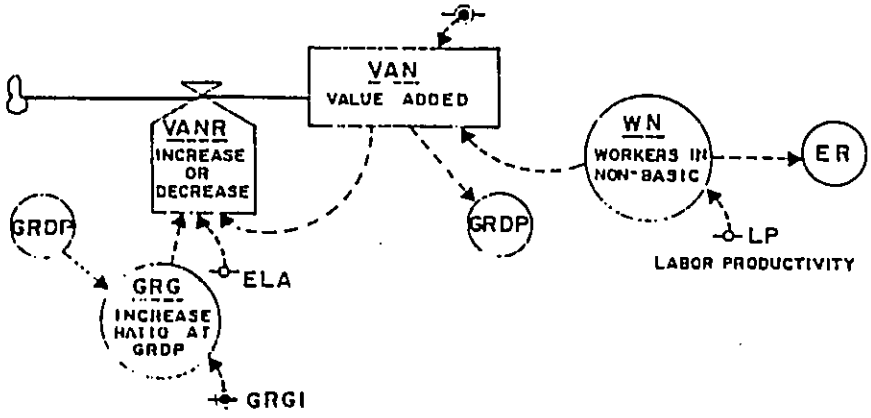
• FISHERY & FORESTRY



• MANUFACTURING



• NON-BASIC INDUSTRIAL SECTOR



SOURCE: JICA STUDY TEAM 1983

THE MASTER PLAN STUDY OF THE INFANTA - REAL AREA URBAN DEVELOPMENT PROJECT

FIG. I.I.3 ILLUSTRATION OF INDUSTRIAL SECTOR MECHANISM (CONTINUATION)

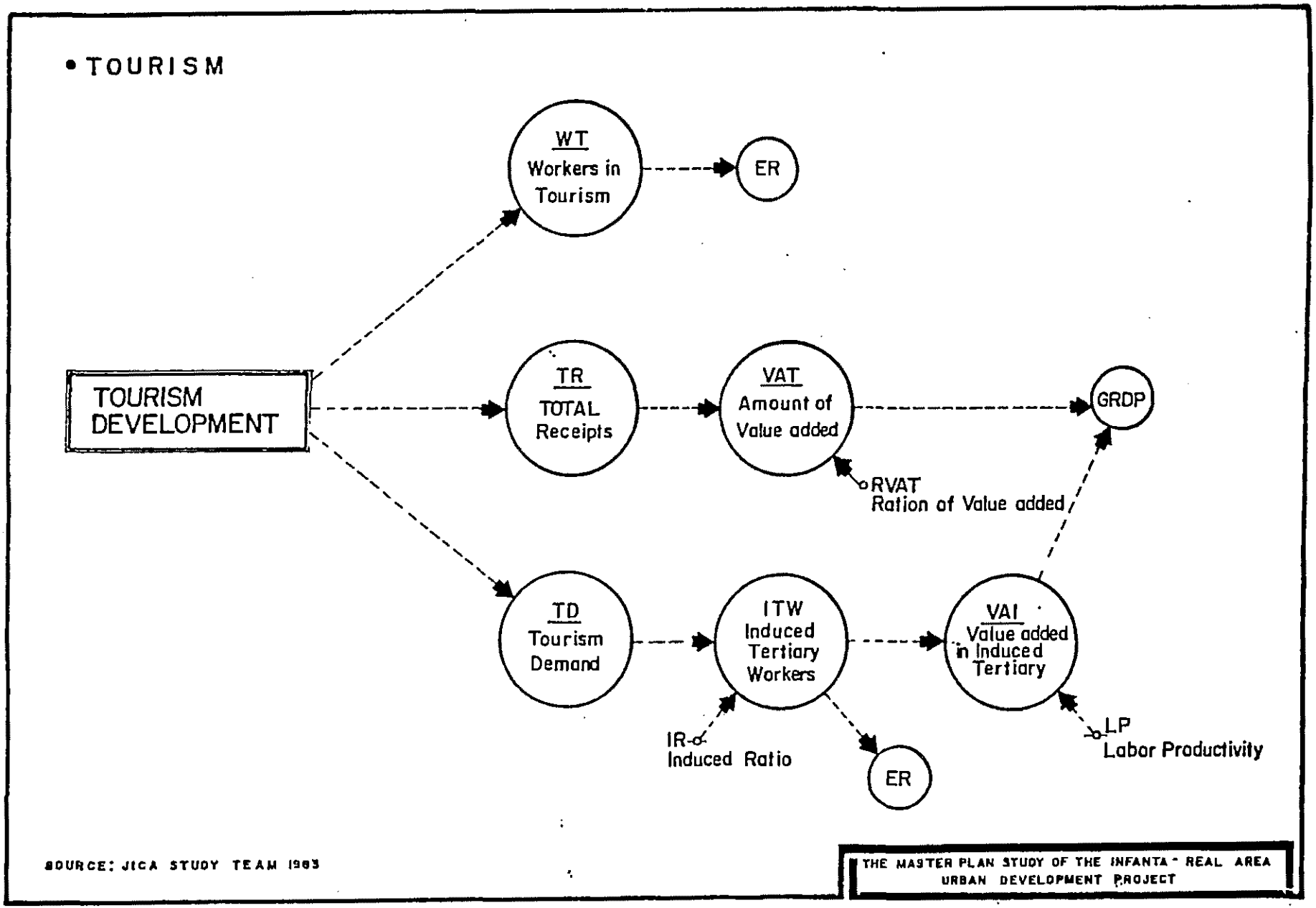


FIG. I.I.3 ILLUSTRATION OF INDUSTRIAL SECTOR MECHANISM (CONTINUATION)

3) Project Sector (see Fig. 1.1.4)

Yearly labor demand and value added by industrial sectors are estimated by taking into consideration the effects of project implementation upon the construction sector, related tertiary sector, and labor market.

4) Financial Sector (see Fig. 1.1.5)

The Financial Sector consists of computations on GRDP and public financial balance. GRDP is calculated as the total value added by all industrial sectors each year. In calculating the annual receipts and disbursements, and cumulative revenues and expenditures of the government, the cost is understood as the total construction cost and maintenance cost, while the revenue is conceived as the total tax and non-tax revenues. The income tax revenue is estimated using a ratio of its share against GRDP and total revenue is estimated based on value of income tax.

Excluded from the above calculation are the public enterprises which charge fees (tolls, charges, etc.) because disregarding such enterprises does not affect the estimation result in any way inasmuch as such enterprises are designed to break even.

1.1.2 Coefficients and Input Values

Major coefficients and input values used in this model are tabulated in Table 1.1.1.

1.1.3 Project Schedule

In order to structure and run the model, a tentative project implementation schedule has been determined. The project implementation schedule broken down by project, and by year is shown in Fig. 1.1.6.

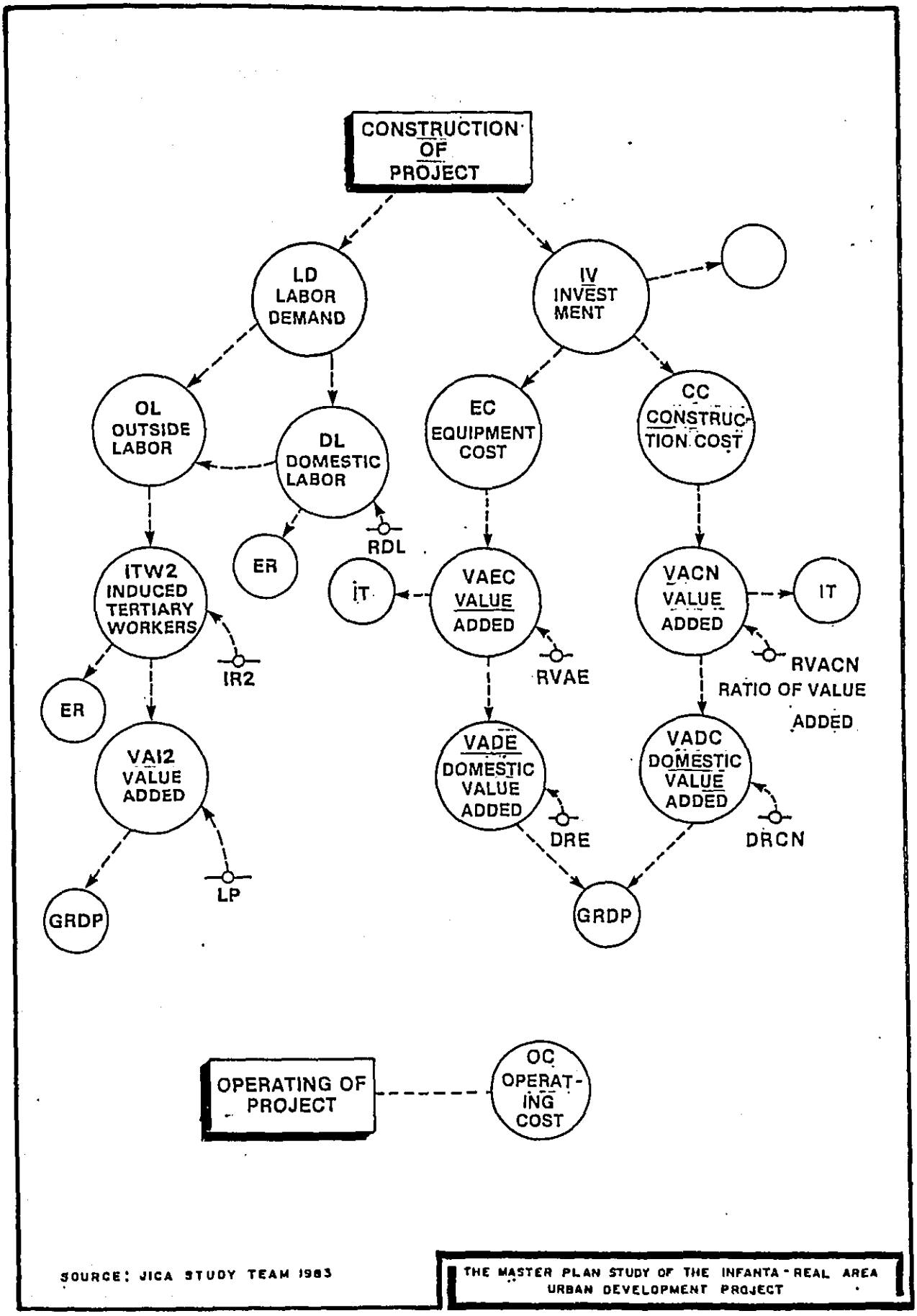


FIG. I.I.4 ILLUSTRATION OF PROJECT SECTOR MECHANISM

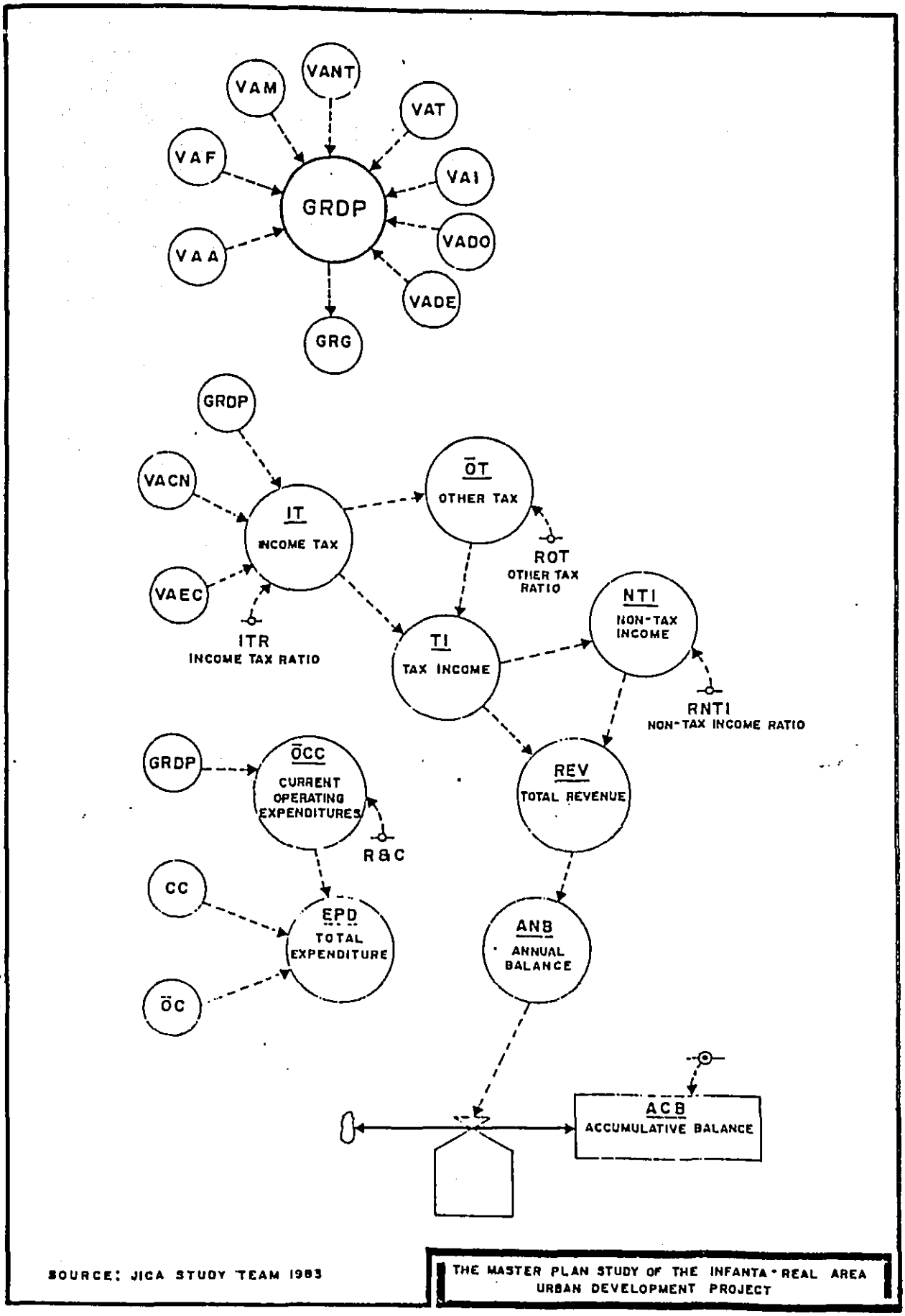


FIG. 1.1.5 ILLUSTRATION OF FINANCIAL SECTOR MECHANISM

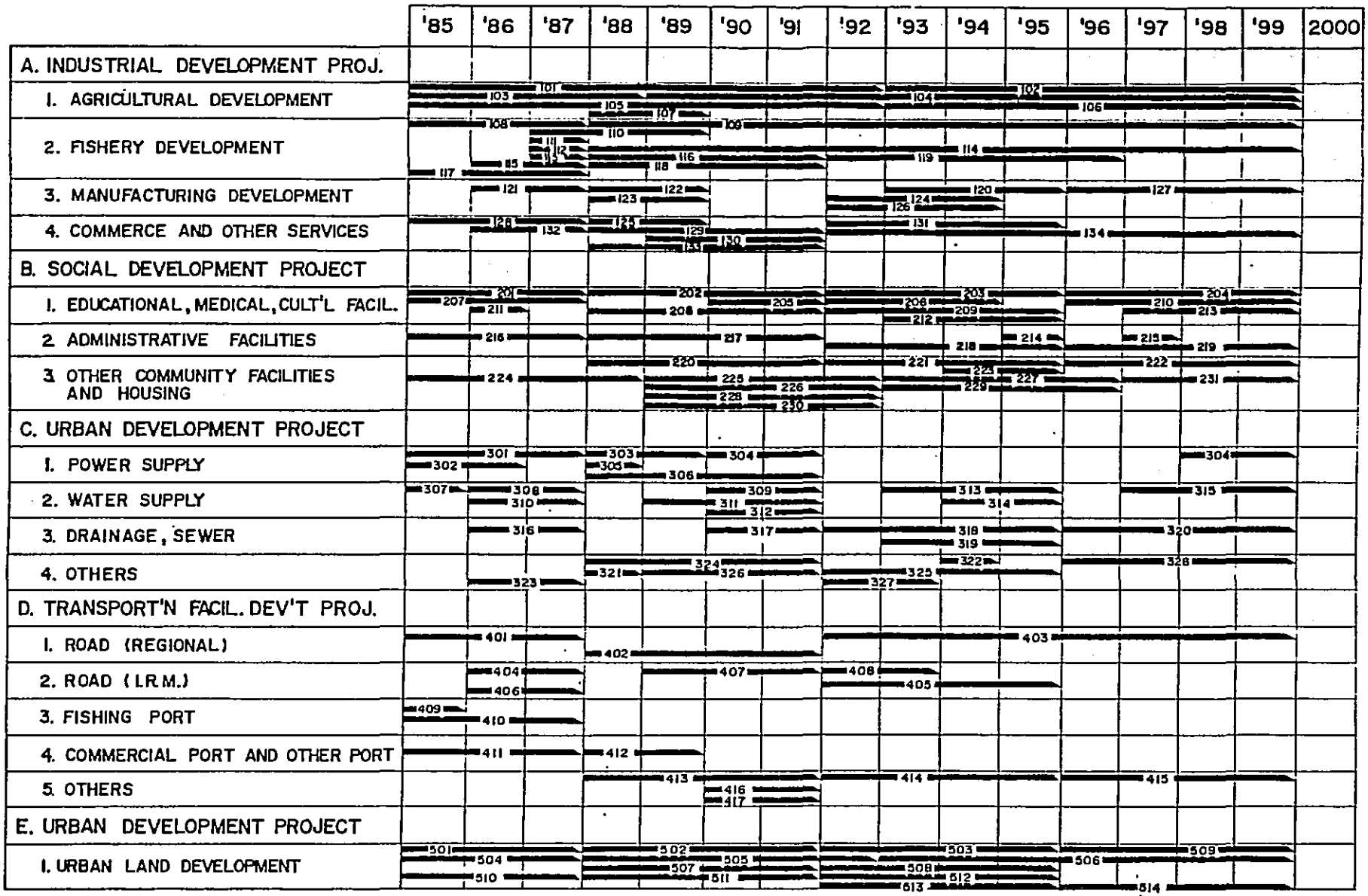


FIG. 1.1.6 PROJECT SCHEDULE

Table 1.1.1 Coefficients and Initial Values

Name of Coefficient	Value	Remarks
(1) Population Sector		
1) Birth Rate (PB), Death Rate (PD)	(%) 1980 / 1990 / 2000 Birth Rate: 3.511 / 2.560 / 1.830 Death Rate: 0.788 / 0.652 / 0.609	Based on the NCSO Projections for Region IV.
2) Ratio of Employed Persons to Total Population (RW)	(%) Ratio of Employed Persons 1983: 26.1 1992: 28.7 2000: 30.0	Obtained by applying the worker ratio (defined as the fixed ratio of employed persons to population of 15 years old and over: 42.9%) to the ratio of of population of 15 years old and over to total population, which is projected to rise gradually from 60.9% to 70% in 2000.
3) Migration Multiplier (MMG)	Labor Demand / Number of Employed persons x GRDP per capita / GRDP per capita of Region IV x 0.318	The GRDP per capita of Region IV is estimated assuming that the growth up to 1987 under the 10-year Plan for Region IV shall continue until 2000. The value 0.318 is the coefficient which makes the value of migration multiplier 1.0 when the ratio of labor demands to number of employed persons is 1.0.

Table 1.1.1 Coefficients and Initial Values (2)

Name of Coefficient	Value			Remarks
4) Migration Rate (MR)	1.5 x MMG - .3	(MMG < 1.0)		
	8.25 x MMG - 9.75	(1.0 ≦ MMG < 3.0)		
	15	(MMG ≧ 3.0)		
(2) Industrial Sector				
Agriculture Sub-Sector				
1) Paddy Field Area (PFG) Coconut Plantation Area (CP)		(ha)		Main Report (6.1.2 Land Use Plan)
		1983	1992	2000
	Paddy Field	2,819	2,682	2,565
	Coco Plantation	3,250	2,629	2,178
2) Net Paddy Cultivation Rate (NR)		(%)		Main Report (6.1.2 Land Use Plan)
	1983	1992	2000	
	80.8	87.0	92.0	

Table 1.1.1 Coefficients and Initial Values (3)

Name of Coefficient	Value	Remarks
3) Paddy Farmers per Unit of Land (WP)	Paddy Farmers per Unit of Land / Annual Growth Rate 1983: 2.02 person/ha; 1.9% 1992: 2.39 2000: 2.15; -1.25	The average number of paddy farmers per unit is estimated to increase at a rate of 1.9% per annum up to 1992 as a result of farmer increase by rice cultivation intensification, and thereafter to decrese at an annual rate of 1.25% because of the rapid advancement of mechanization
4) Palay Yield per Unit of Land (PDY)	(kg/ha) 1983: 2,375; 1992: 4,950; 2000: 10,000	Main Report (6.2 Industrial Promotion and Development Plan)
5) Unit Producer Price of Palay (UPP)	2,028 Pesos/ton (at 1984 price)	Obtained from the value and quantity of palay production in Region IV given in the Philippine Year Book 1983.
6) Coconut Yield per Unit of Land (CY)	(nuts/ha) 1983: 4,387; 1992: 6,806; 2000: 10,055	Main Report (6.2 Industrial Promotion and Development Plan)

Table 1.1.1 Coefficients and Initial Values (4)

Name of Coefficient	Value	Remarks
7) Coconut Production Per Worker (HW)	(1000 nuts/person) 1983: 15.31 — 1992: 17.45 — 2000: 19.35	The 10-year Plan (Region IV) estimates a 1.14 times improvement in labor productivity in the agricultural sector from 1983 to 1987. In view of the backwardness of IRM, it is estimated that this improvement shall be achieved by 1992, rather than by 1987. Then the improvement is predicted to continue at the same pace after 1992.
8) Coconut-Copra Conversion Ratio (CR)	4.5 coconuts = 1 kg	
9) Unit Producer Price of Coconut (UPC)	2,125 Pesos/ton	Obtained from the value and quantity of coconut production given in the Philippine Yearbook, 1983
10) Agricultural Value Added Ratio (VAA)	0.826	Estimated on the basis of the input-output table in the 1983 Philippine Statistical Yearbook

Table 1.1.1 Coefficient and Initial Values (5)

Name of Coefficient	Value	Remarks
11) Ratio of Miscellaneous Agricultural GRDP to GRDP from Palay and Coconut (PCT)	1.8	Estimated on the basis of present estimate of GRDP
Fishery and Forestry Sector		
1) Fishermen Population (WFS)		Main Report (6.2 Industrial Promotion and Development Plan)

	1983	1992	2000
Municipal Fishing		1,562	1,720
Commercial Fishing	1,230		
Fishponds		1,440	3,000
Total	1,230	3,002	4,720

2) Fish Land (CT)

(ton)

Main Report (6.2 Industrial Promotion Plan)

	1983	1992	2000
Municipal Fishing	5,150	7,470	9,040
Commercial Fishing	0	2,800	3,500
Fishpond (Prawn)	30	2,400	5,000

Table 1.1.1 Coefficients and Initial Values (6)

Name of Coefficient	Value	Remarks
3) Fishery Product Unit Price (at 1984 price) (UPF)	(pesos/kg) Municipal Fishing 11.58 Commercial Fishing 14.52 Fishponds (prawn) 100.00	Obtained from the value and quantity of fishery production given in the Philippine Yearbook, 1983, for municipal and commercial fishing, and by interview survey for prawn culture.
4) Fishery Value Added Ratio (RVAF)	0.868	Estimated on the basis of the input-output table in the 1983 Philippine Statistical Yearbook.
5) Forestry Workers (WF)	(person) 1983: 17; 1992: 137; 2000: 137	Main Report (6.2 Industrial Promotion and Development Plan)
Manufacturing Sub-Sector		
1) Population Dependent Industrial Workers Ratio to Population (RWED)	6.3 (workers per population of 1000)	The present ratio in IRM is assumed to remain unchanged.

Table 1.1.1 Coefficients and Initial Values (7)

Name of Coefficient	Value	Remarks
2) Labor Productivity (LPE)	(persons/1000 pesos) 1983: 0.0138 — 1992: 0.0138 — 2000: 0.0109	The long term prospect given in the 10-year Plan for Region IV envisages almost constant level of manufacturing labor productivity until 1987. For the present purpose, such productivity is is estimated to remain constant until 1992 and be improved at a rate of 3% annually thereafter.
3) Development Projects: Workers (WNM), Shipment Value (VC) and Value Added Ratio (RVAM)	(person, million pesos) Coconut Oil Extraction: Workers 250, Shipment Value 296.8, Value Added Ratio 0.371 Cannery: 1,800, 342.7, 0.254 Refrigeration: 170, 119.5, 0.254 Prawn Processing: 150, 215.5, 0.254 Paper & Pulp: 2,600, 453.5, 0.371	The number of workers and the value of shipment are based on 6.2 Industrial Promotion and Development Plan. The value added ratio is obtained from the input-output table in the 1983 Philippine Statistical Yearbook.
Non-Basic Industry Sub-Sector		

Table 1.1.1 Coefficient and Initial Values (8)

Name of Coefficient	Value	Remarks
1) Ratio of GRDP in 1983 to that in 1982 (GRGI)	1.079	Obtained by multiplying the average annual ratio of GRDP growth to the average annual ratio of population growth in the 10-year Plan for Region IV to that of the population growth for IRM between 1982 and 1983.
2) Ratio of Sectoral Value Added Growth to GRDP Growth (ELA)	Construction 1.044 Others 0.993	Obtained from the GRDP and sectoral value added given in the 10-year Plan for Region IV.
3) Labor Productivity (LP)	(persons/1000 pesos) 1983 / 1992 / 2000 Utility, Construction 1,043 / 0.695 / 0.528 Commercial, Financing 0.031 / 0.019 / 0.015 Transport, Communication 0.053 / 0.033 / 0.035 Service 0.310 / 0.194 / 0.146	The increases in labor productivity projected until 1987 in the 10-year Plan for Region IV is assumed to be achieved by 1992 in IRM, rather than by 1987, and shall continue at the same pace there ater.
Tourism Sub-Sector		
1) Workers (WT), Revenue (TR) and Demand (TD)	1992 / 2000 Workers (person) 800 / 1,000 Revenue (million pesos) 153 / 191.2 Demand (1,000 visitors) 117 / 146	Main Report (6.2 Industrial Promotion and Development Plan)

Table 1.1.1 Coefficients and Initial Values (9)

Name of Coefficient	Value	Remarks
3) Tertiary Industry Induction Ratio (IR)	4 persons per 1,000 visitors	The number of staying tourists (4 days stay average) and that of day tourists are projected at 53 thousand and 93 thousand, respectively. Assuming that every tourist spends 20 pesos a day, the annual total revenue can be expected to reach 6.1 million pesos. Average per capita sale of tourism workers is estimated at 10 thousand pesos annually. Thus, the number of tourism workers are predicted to be at about 600. It means that 4 tourism workers are required for every 1000 tourists.
(3) Project Sector		
1) Value Added Ratios to Construction and Equipment Value (RVAC, RVAE)	0.578, 0.371	Estimated on the basis of the input-output table in the 1983 Philippine Statistical Yearbook.
2) Local Procurement Ratios (DRCN, DRE)	50% of employment engaged in the project construction are procured inside IRM	

Table 1.1.1 Coefficients and Initial Values (10)

Name of Coefficient	Value	Remarks
(4) Financial Sub-Sector		
1) Income Tax Ratio (ITR)	2.66% of GRDP	The average ratio of income tax revenue to GDP of the Philippines between 1975 and 1980.
2) Miscellaneous Tax Ratio (ROT), Non-Tax Revenue Ratio (RNTI)	ROT: 2.2 to income tax revenue RNTI: 0.154 to total tax revenue	Both as the averages of yearly ratios from 1975 through 1980.
3) Current Operating Cost (OCC)	Personnel expenses plus maintenance expenses	The personnel expenses are expected to increase in proportion to the population growth and the yearly maintenance expenses are estimated at 5% of the accumulated amount of project investments. The initial value of the current expenditure is estimated at 8.17%, of which 55% is for personnel and 45% for maintenance, based on the average of such yearly rate for the entire Republic from 1971 through 1981.

Source: JICA Study Team

1.1.4 Estimation Result

1) Base Case

(i) Population (see Table 1.1.2 and Fig. 1.1.7)

As estimated, population shall swell from 44,000 in 1983 and 96,000 by 1992 to 158,000 by 2000, meeting the estimated population frameworks of 100,000 and 150,000 of its respective years. Cumulative natural increase and social increase from 1983 to 1992 is estimated at 11,000 persons and 40,000 persons respectively, while the same figures from 1983 to 2000 are 15,000 for natural increase and 47,000 for social increase. Immigration shall continue steadily while investments shall be active during project implementation until 1993, but as the investments shall subsequently wane, population influx shall gradually diminish.

Net natural increase shall grow gradually, the total population increase being offset by lowering birth and mortality rates (birth rate shall decrease at a greater pace). The increment of natural increase in each year, the difference between the number of births and deaths, shall maintain its level throughout the planning period at the range of 1000 persons/year to 2000 persons/year.

Accordingly, the future population increase in the area shall be affected to a large extent by the increment of social increase, a very high population growth rate of more than 10% shall be indicated during the first half of the planning period (1987-1994) in which very active project investments shall be carried out.

Table 1.1.2 Population, Household, Number of Workers and GRDP

			Number of Workers				Gross Regional Domestic Product				
Year	Population	Household	Primary	Secondary	Tertiary	Total	Primary	Secondary	Tertiary	Total	Per Capita
1983	44,423	7,862	6,779	1,016	3,786	11,582	95,314	26,001	50,116	171,431	3,859
1984	44,847	7,994	6,953	1,049	3,903	11,905	100,073	26,049	53,967	180,089	4,016
1985	45,228	8,120	7,073	6,275	3,979	17,327	104,373	52,586	59,059	216,019	4,776
1986	47,765	8,622	7,191	10,452	4,700	22,343	108,541	73,413	88,317	270,270	5,658
1987	52,607	9,565	7,445	11,310	5,752	24,507	130,392	78,170	124,165	332,728	6,325
1988	58,279	10,674	7,740	10,596	6,834	25,170	159,627	78,646	161,999	400,272	6,868
1989	63,887	11,787	8,146	13,269	7,873	29,287	178,783	133,273	203,774	515,829	8,074
1990	71,833	13,352	8,595	14,141	9,582	32,318	263,113	202,023	259,151	724,287	10,083
1991	82,828	15,511	9,088	15,446	12,543	36,987	288,725	271,705	344,596	905,025	10,927
1992	95,545	17,993	9,741	16,968	14,534	41,243	392,409	287,361	421,561	1101,331	11,527
1993	109,087	20,700	9,972	16,167	17,055	43,194	476,439	335,923	487,658	1300,019	11,917
1994	121,794	23,288	10,227	16,061	19,536	45,824	509,059	349,855	552,026	1410,940	11,585
1995	132,679	25,564	10,489	16,010	20,158	46,656	541,519	365,569	591,075	1498,162	11,292
1996	141,116	27,401	10,634	14,842	20,578	46,055	573,998	375,060	622,259	1571,317	11,135
1997	147,122	28,791	10,750	15,235	20,698	46,683	606,494	392,437	650,578	1649,510	11,212
1998	151,834	29,888	10,868	15,261	21,089	47,219	638,973	407,234	677,830	1724,037	11,355
1999	155,441	30,841	10,979	14,742	20,998	46,720	671,300	418,240	706,030	1795,570	11,551

Source: JICA Study Team

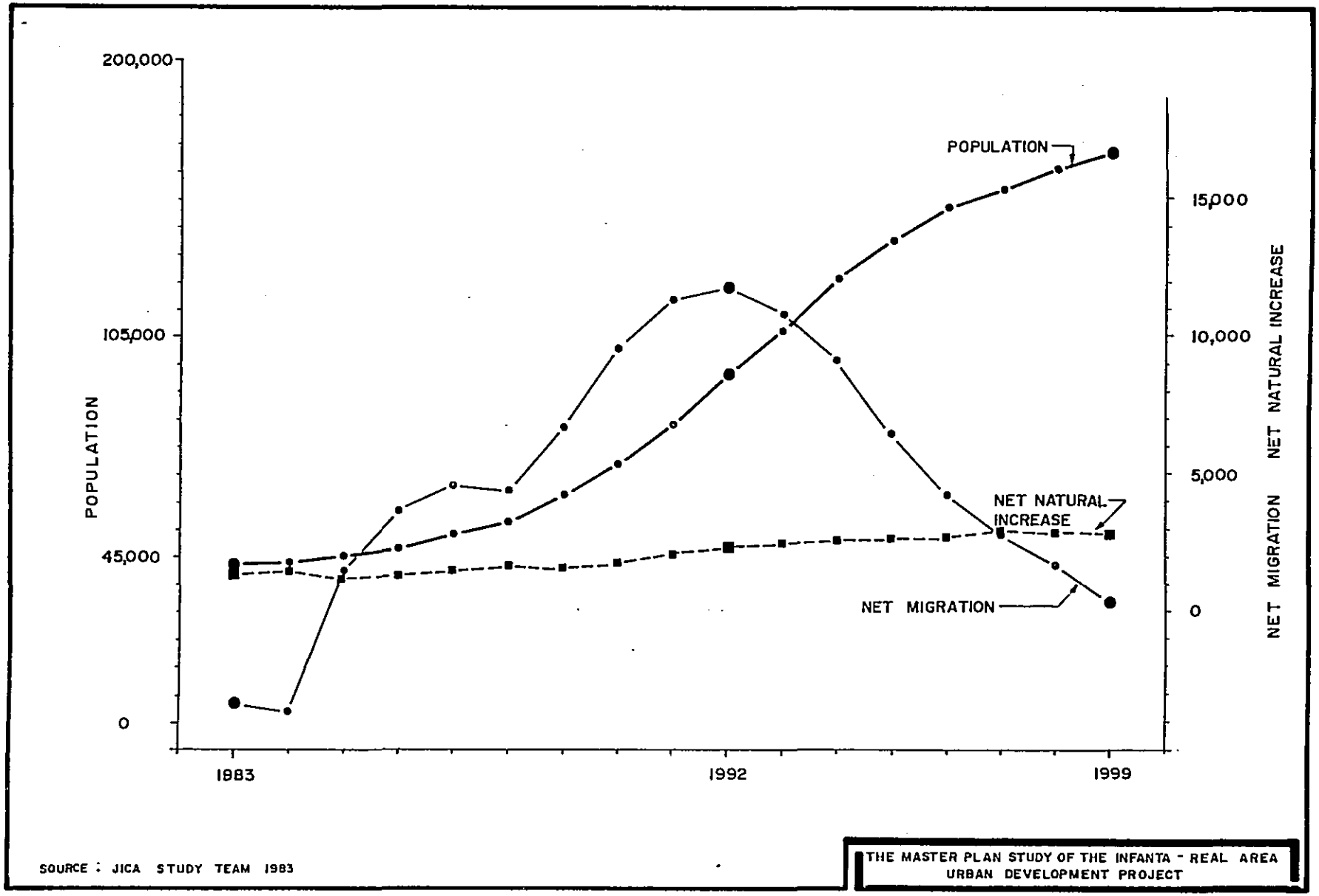


FIG. I.I.7 POPULATION , NET MIGRATION & NET NATURAL INCREASE

(2) Working Population (see Table 1.1.2 and Fig. 1.1.8)

Working population in the primary sector shall gradually increase from 6,800 to 9,700 by 1992, but afterwhich, its growth shall level off considerably. This is due to the fact that the productivity of the primary industry shall exceed the labor productivity, thus, causing the increase of its working population during the early stages of development. Therefore, an equilibrium between the growth of industrial productivity and improvement of labor productivity shall maintain their respective working populations at a steady level.

The number of workers in the secondary industrial sector which shall be largely affected by the presence of construction workers during project implementation is estimated to swell from 1,000 in 1983 to 17,000 in 1992, and then decrease to 10,600 by 2000 when all the projects shall be completed.

Working population of the tertiary industrial sector shall increase smoothly by 1994, and then level off due to the relative improvement of labor productivity.

Table 1.1.3 shows the estimated working population by sector in each year and its industrial composition. It indicates that the composition shall shift from the present rural type, with a 60% share of primary industrial workers to an urban type structure in the future with an increased ratio of the secondary and tertiary industrial workers.

(3) GRDP (see Table 1.1.2 and Fig. 1.1.9)

GRDP of IRM shall grow from 171 million pesos in 1983 to 1101 million pesos in 1992 and finally to 1998 million pesos in 2000.

GRDP per capita shall reach 11,900 pesos in 1993, level off for a short period and then shall begin its growth again to reach 12,700 pesos in 2000.

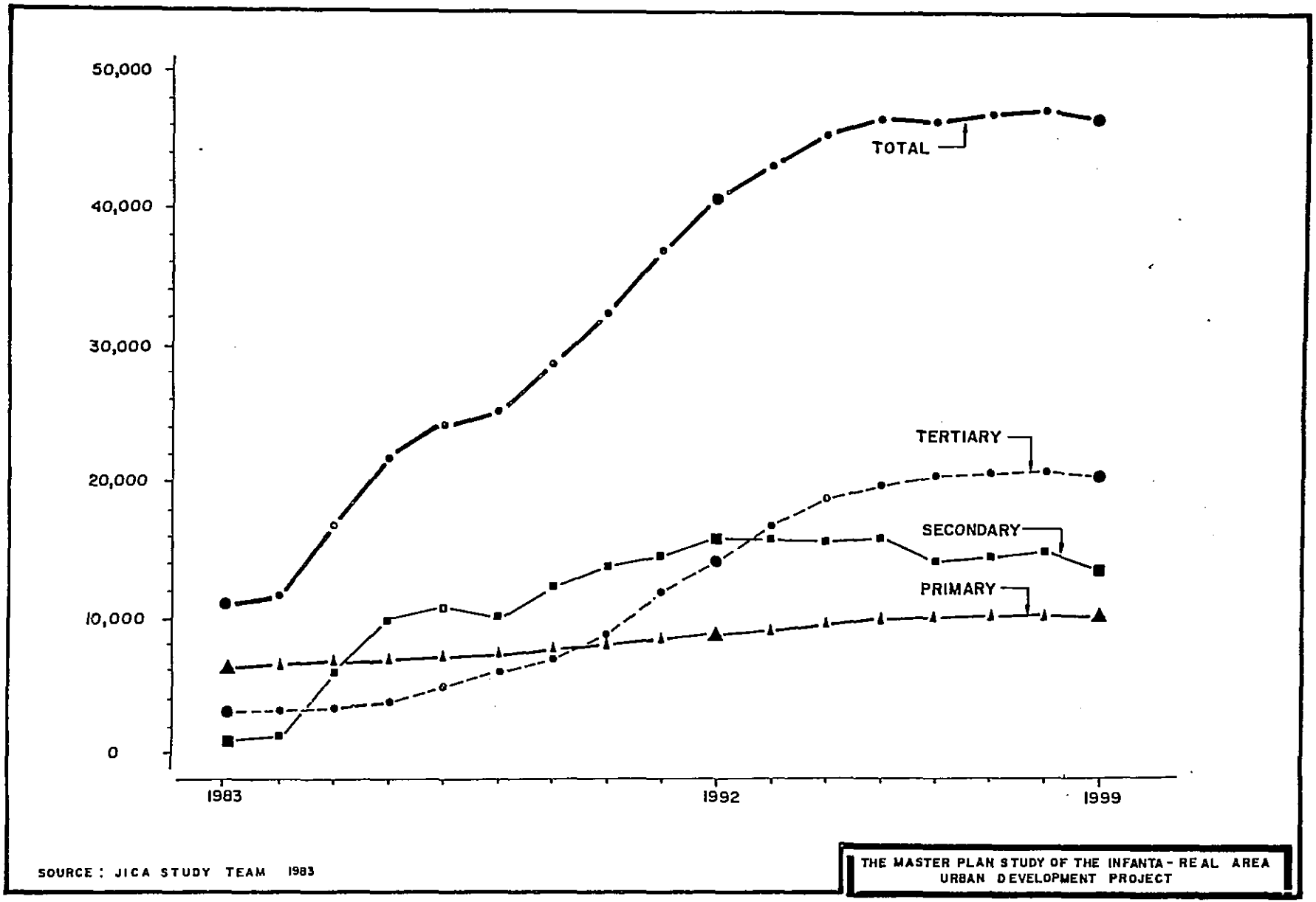


FIG. I.I.8 NUMBER OF WORKERS BY THREE INDUSTRY GROUP

Table 1.1.3 Future Number of Workers by Industrial Sector

Unit: (person; %)

	1983	1992	2000
Primary Industry	6,779 (58.5)	9,741 (33.0)	11,086 (26.1)
Agriculture	5,332 (47.8)	6,602 (22.4)	6,229 (14.7)
Fishery	1,230 (10.6)	3,002 (10.2)	4,720 (11.1)
Forestry	17 (0.1)	137 (0.5)	137 (0.3)
Secondary Industry	1,016 (8.8)	5,219 (17.7)	10,620 (25.0)
Manufacturing	350 (3.0)	2,452 (8.3)	6,019 (14.2)
Construction, Utilities	666 (5.8)	2,767 (9.4)	4,601 (10.8)
Tertiary Industry	3,786 (32.7)	14,535 (49.3)	20,787 (48.9)
Commerce, Financing	902 (7.8)	3,651 (12.4)	5,020 (11.8)
Transportation, Communication	749 (6.5)	2,609 (8.8)	3,859 (9.1)
Services	2,135 (18.4)	8,275 (28.1)	11,908 (28.0)
Total	11,581 (100.0)	29,495 (100.0)	42,493 (100.0)

Source: JICA Study Team
Note: Workers in Secondary Industry do not include project construction workers

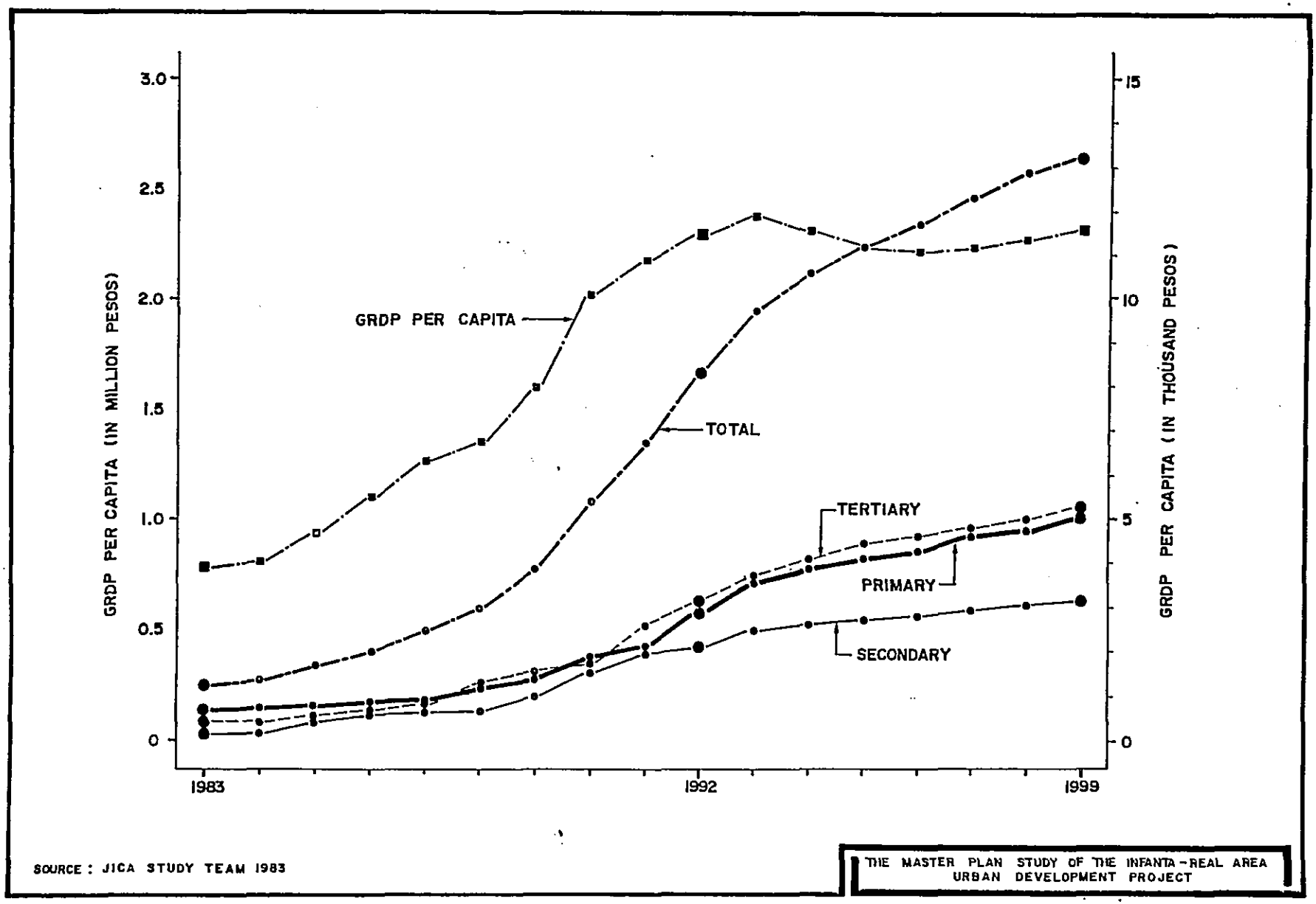


FIG. 1.1.9 GROSS REGIONAL DOMESTIC PRODUCT BY INDUSTRIAL ORIGIN

This implies that the rate of population growth shall catch up with the rate of GRDP growth in 1993 and indicates the drastic growth of GRDP in the period before 1993.

The share of the tertiary industry in the GRDP shall become the largest among other industrial sectors in 1988. Thus, the tertiary industry shall turn into a leading sector as the area becomes urbanized.

(4) Impact of Project Construction on GRDP (see Table 1.1.4 and Fig. 1.1.10)

The project construction activities shall vitalize the local industry of IRM. Consequently, the model considers such aspects as increase of employment opportunity, increase of GRDP, and induced increase of tertiary industrial workers from the project constructions.

Annual increment of GRDP caused by project constructions shall be about 29 to 68 million pesos, and its ratio in GRDP shall grow to 19% in 1986 and gradually decreasing thereafter.

As illustrated in Fig. 1.1.4, although the annual increment of GRDP caused by the project constructions shall maintain the same level throughout the planning period, its impact shall be greater during the early period because GRDP then shall be relatively small.

This indicates that at the early stages, the project construction activity shall contribute more to the vitalization of local economy that does the implementation and operation of the projects, thus, playing an important role in the take-off of the IRM economy. In this sense, the actual impact of project construction activities on GRDP growth shall be considered greater than what the figure indicates.

Table 1.1.4 Impact on GRDP by Project Construction

(in thousand pesos)

Year	(A) Labor Demand	(B) Investment	(C) Domestic Value Added	(D) GRDP	(E) (C)/(D)
1985	8,681	444,800	28,782	216,019	0.133
1986	15,445	774,900	51,373	270,270	0.190
1987	16,556	796,300	55,255	332,728	0.166
1988	14,978	823,500	50,175	400,272	0.125
1989	18,456	989,700	62,338	515,829	0.121
1990	18,369	974,300	62,334	724,287	0.086
1991	18,117	958,900	62,138	905,025	0.069
1992	19,582	955,100	67,576	1,101,331	0.061
1993	17,114	837,700	59,059	1,300,019	0.045
1994	15,814	782,100	54,572	1,410,940	0.039
1995	15,091	747,500	52,429	1,498,162	0.035
1996	12,650	758,200	44,281	1,571,317	0.028
1997	12,934	769,900	45,655	1,649,510	0.028
1998	12,627	757,500	44,572	1,724,037	0.026
1999	11,455	704,800	40,817	1,795,570	0.023

Source: JICA Study Team

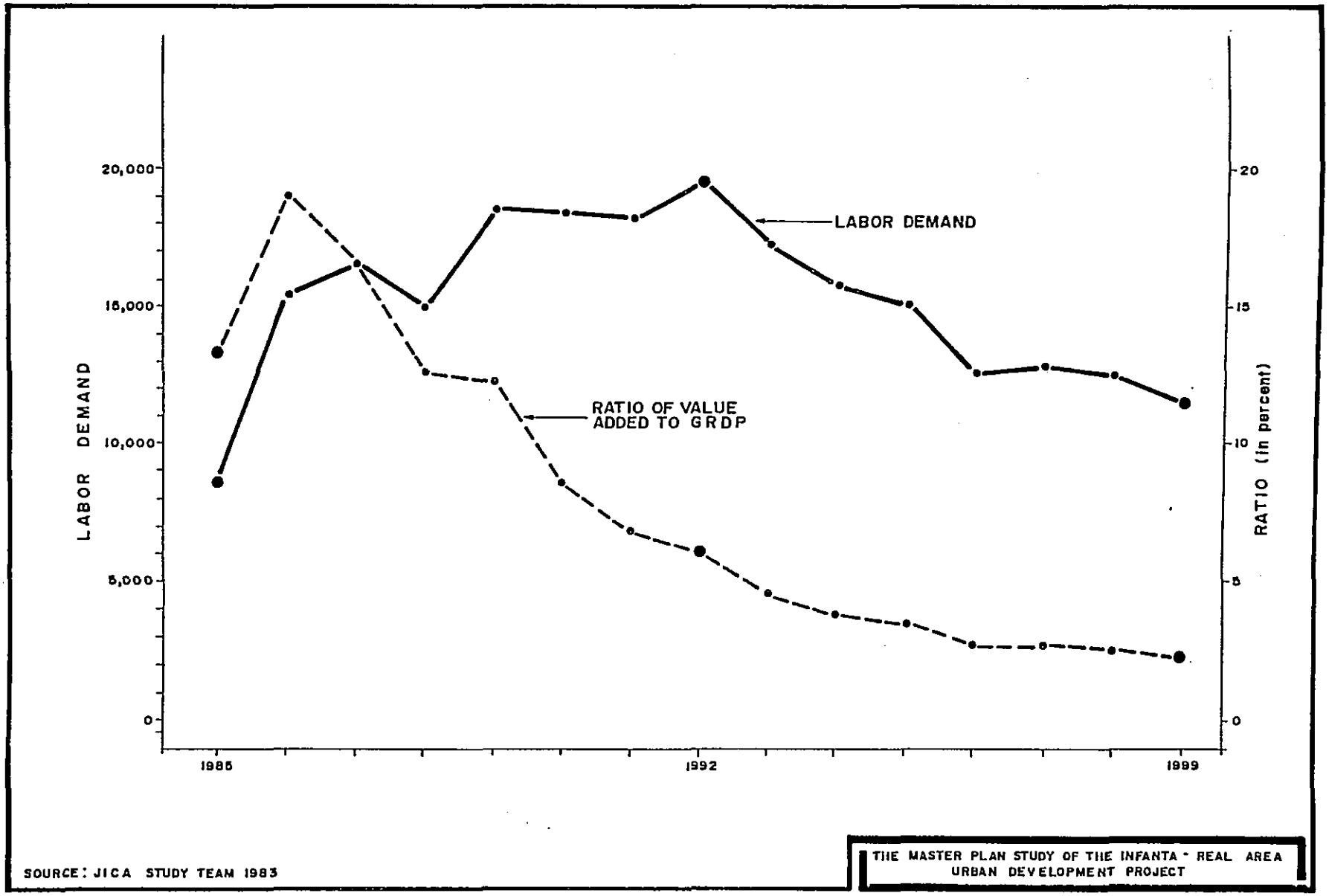


FIG. I.I.10 IMPACT ON GRDP BY PROJECT CONSTRUCTION

(5) Finance (see Table 1.1.5 and Fig. 1.1.11)

A deficit annual balance shall be experience during the first three years. However, the balance shall turn to profit affecting cumulative deficits. Thus, a surplus balance shall result in the fifteenth year. An overall financial internal rate of return shall be 20.5% assuming an inflation rate of 15%.

Therefore, the resulting analysis proves that the implementation of the master plan shall be able to achieve a satisfactory public financial balance. However, the following conditions shall have to be considered:

The model excludes from its financial analysis such publicity dependent projects which shall base its operations on collections, charges, rentals, etc., assuming the operation of those projects shall financially break even. If some of the projects were proven financially difficult, a subsidy must be introduced.

The projects excluded from the financial analysis are indicated in Table 1.1.6. The major ones are public utilities service projects (power, water, and sewer), urban land development projects, and the port development project. Financial analysis of these projects shall be necessary to confirm their financial feasibility and sound operation as a publicly financed project.

2) Sensitivity Analysis

(1) Case Setting

To measure the effects caused by changes in external conditions and by project implementation, the following assumptions were made:

Table 1.1.5 Public Income and Expenditure

(in thousand pesos)

Year	Income Tax	Other Taxes	Non-Tax Income	Total Income	Expen-diture	Annual Balance	Accumula-tive Bal.
1983	4,560	10,032	2,247	16,839	14,000	2,839	2,839
1984	4,790	10,539	2,361	17,690	14,100	3,590	6,429
1985	11,524	25,353	5,679	42,556	95,300	-52,744	-46,315
1986	17,307	38,074	8,529	63,910	291,900	-227,990	-274,305
1987	19,357	42,585	9,539	71,480	238,000	-166,520	-440,825
1988	21,170	46,573	10,432	78,175	72,000	6,175	-434,650
1989	26,440	58,167	13,029	97,636	80,100	17,536	-417,113
1990	31,819	70,001	15,680	117,500	109,600	7,900	-409,213
1991	36,434	80,155	17,955	134,544	109,400	25,144	-384,069
1992	41,853	92,076	20,625	154,554	139,600	14,954	-369,115
1993	45,585	100,286	22,464	168,335	154,000	14,335	-354,781
1994	47,778	105,113	23,545	176,436	108,900	67,536	-287,244
1995	49,641	109,211	24,463	183,316	111,300	72,014	-215,229
1996	51,303	112,866	25,282	189,450	138,800	50,650	-164,578
1997	53,543	117,796	86,386	197,725	164,500	33,225	-131, 353
1998	55,354	121,780	27,279	204,413	152,800	51,613	-79,741
1999	56,550	124,409	27,868	208,826	107,300	101,526	21,786

Source: JICA Study Team

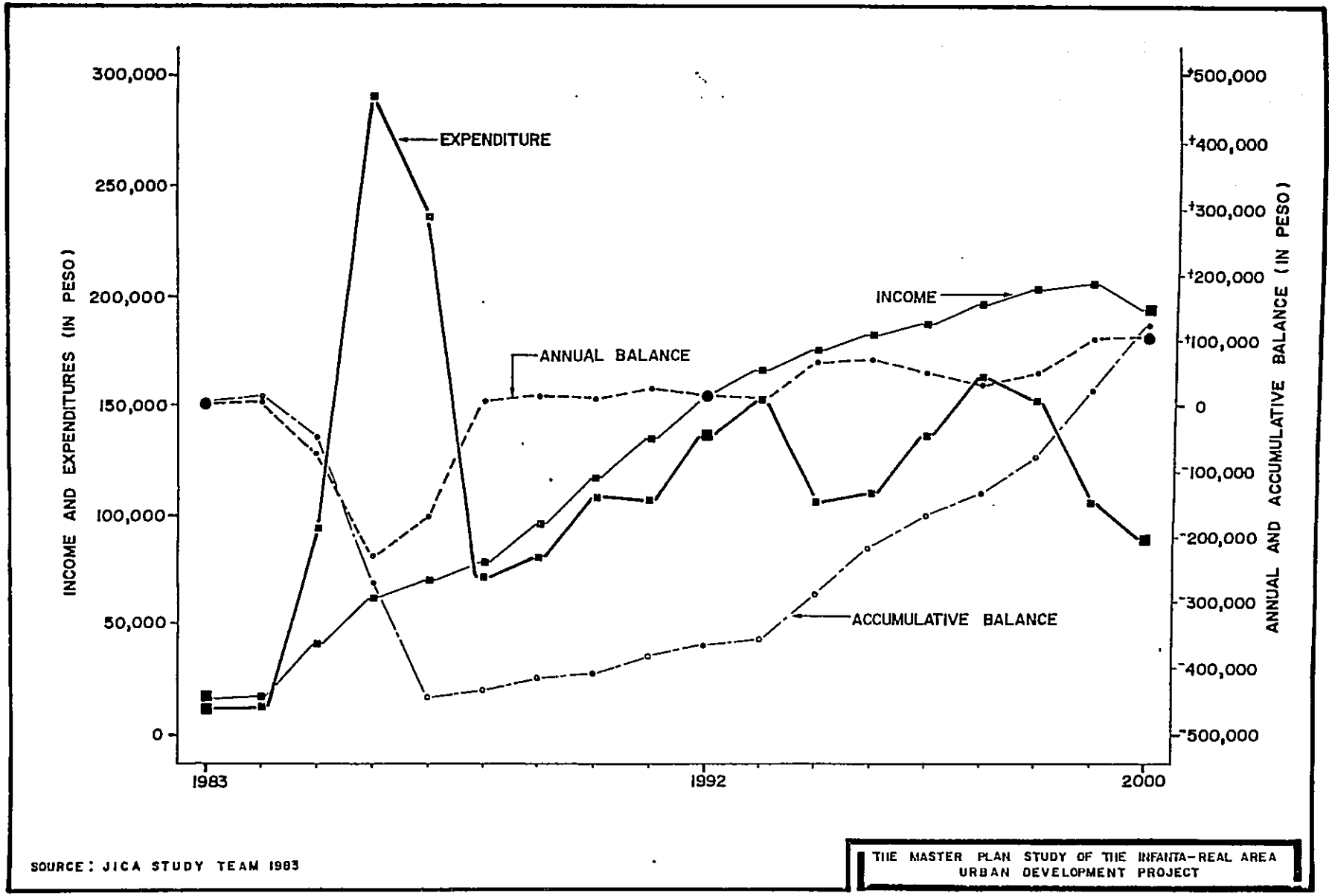


FIG. I.I.II PUBLIC INCOME AND EXPENDITURES

Table 1.1.6 Projects Discussed in the Model

Project No.	Items Discussed in the Model		
	Construction Cost	Operation Cost	Financial Bal.
101-110	O	O	O
111-112	O		
114-120	O		
121		O	O
122-131	O		
132-134	O	C	O
201-223	O		C
224-231	O		
301-306	O		
307	O		O
308-315	O		
316-318	O		O
319-328	O		
401-408	O		O
409-412	O		
413-417	O		
501-512	O		

Source: JICA Study Team

a) Changes of External Conditions

(i) Growth Rate of Outside Economy (GRDP Per Capita)

The ratio of GRDP per capita of IRM against that of the outside area, Region IV, shall work as a factor of social movement, and therefore, the change of growth rate of the outside economy shall affect the IRM's future population. Two (2) cases have been assumed for the purpose of analysis; namely, i) the growth rate of the outside economy is greater than that of the base case)from 5.9% in the base case to 8.0% in Case 1); and ii) the rate is smaller than that of the base case (from 5.9% to 4.0% in Case 2).

(ii) Construction Cost

Construction cost is increased by 20% and 40% (Cases 3 and 4 respectively). Increased construction cost shall put a burden on public financial balance; however, it shall contribute to vitalization of the local economy.

(iii) Fish Catch

The change of fish catch shall largely affect the operation of both municipal and commercial fishing, consequently affecting the shipment value and employment of the canning and cold storage industries. The decrease of fish catch by 50% from the base as is assumed in Case 5.

(iv) Agricultural Productivity

The leveling off of rice and coconut productivity after 1992 is assumed (Cases 6 and 7 respectively).

b) Effects of Project Implementation

Among the proposed projects of the master plan, the suspension of the implemention of the following projects, which seem essential to the development of local industry, are assumed for the purpose of analyzing their implementation effects:

(i) Prawn Culture Project (Case 8)

(ii) Coconut Oil Factory (Case 9)

(iii) Canning Factory (Case 10)

(iv) Cold Storage (Case 11)

(v) Prawn Processing Factory (Case 12)

(vi) Pulp-Paper Factory (Case 13)

(vii) Tourism Development Project (Case 14)

(2) Analysis Results

a) Changes of External Conditions (see Table 1.1.7):

(i) When growth role of outside economy exceeds the assumed level (Case 1)

The population shall reach 90,000 in 1992 (93.8% of the base case) and 138,000 in 2000 (87.6% of the base case). Its growth shall stagnate after 1992 as compared with the base case. Thus, by 1992 even though the population growth shall be smaller than that of the base case, the industries shall grow very rapidly during the said period, increasing employment opportunities and GRDP per capita to offset the condition of population growth. However, during the period thereafter, the growth of employment oppportunities and GRDP per capita shall stagnate, making the effect of the outside economy relatively large and causing the stagnation of population growth.

Table 1.1.7 Impact Caused by the Changes of External Conditions

Case No.	Population (person)	GRDP (1,000 Pesos)	FIRR (%)
0	95,545 (1.000) 157,787 (1.000)	1,101,331 (1.000) 1,998,355 (1.000)	20.5
1	89,599 (0.938) 138,184 (0.876)	1,100,610 (0.999) 1,983,849 (0.993)	20.7
2	101,255 (1.060) 177,870 (1.127)	1,102,014 (1.001) 2,013,038 (1.007)	20.3
3	100,391 (1.051) 162,352 (1.029)	1,121,461 (1.018) 2,006,115 (1.004)	16.7
4	105,215 (1.101) 166,891 (1.058)	1,141,596 (1.037) 2,013,851 (1.008)	13.4
5	90,836 (0.951) 145,851 (0.923)	992,429 (0.901) 1,836,898 (0.919)	18.6
6	95,531 (1.000) 155,254 (0.984)	1,101,322 (1.000) 1,920,390 (0.961)	20.8
7	95,457 (0.999) 155,373 (0.985)	1,101,271 (1.000) 1,938,431 (0.970)	20.1

Source: JICA Study Team

Note: 1. Upper Row: Value for 1992, Low Row: Value for 2000
2. Figures in parentheses are ratios to the base case
3. Characteristics of each case are as follows:

Case 1: Increase of growth rate of external economy by 2% points.
Case 2: Decrease of growth rate of external economy by 2% points
Case 3: Increase of construction cost by 20%
Case 4: Increase of construction cost by 40%
Case 5: Decrease of fish catch by 50%
Case 6: Rice productivity levels off from 1992
Case 7: Coconut productivity levels off from 1992.

(ii) When growth rate of outside economy shall be lower than assumed level (Case 2)

The population shall reach 101,000 in 1992 (106.0% of the base case) and 178,000 in 2000 (112.7% of base case), indicating a rapid increase after 1992. The population growth rate in both cases (cases 1 and 2) are higher during the period up to 1992 implying that the population growth up to 1992 shall be almost nearing its limit of growth.

On the other hand, GRDP shall not be affected. This indicates that the growth of local industries shall be materialized, focusing on the primary and secondary industries, the growth of which does not depend on population concentrations. Consequently, in order to further develop the local economy, the promotion of tertiary industries which does not depend on the project investments shall be necessary.

(iii) When construction cost is increased by 20% (Case 3)

The population shall grow larger than the base case in 2000 by 5,000 persons but GRDP shall remain almost unchanged. This means that although the impact of project construction activities shall be great during the early stages, it shall decrease its impact on GRDP at the later stages.

But on the other hand, the financial internal rate of return (FIRR) shall decrease from 20.5% of the base case to 16.7% due to the consequent increase in public expenditure.

(iv) When construction cost is increased by 40% (Case 4)

The FIRR of IRM, shall decrease more than it does in Case 3 to 13.4%. This implies a considerable difficulty in public finance because it shall be very impractical to consider that the interest rate of bank loans shall be lower than the assumed rate of inflation of 15%.

(v) When Fish Catch is decreased by 50% (Case 5)

The change of fish catch, the output of the area's leading industry, shall affect not only the fishing industry alone but also such industries as canning, cold storage and ice plants, and ultimately the tertiary industry.

Both population and GRDP shall grow up to 92% of the base case and FIRR shall decrease to 18.6% from the 20.5% of the base case.

(vi) When rice productivity is levelled-off after 1992 (Case 6)

The population shall decrease by 1.6% in 2000 and GRDP by 3.9% as compared with the base case. Therefore, the levelling-off of rice productivity shall not affect the development very much and this is due to rice productions relative decrease of contribution to GRDP in the future.

(vii) When coconut productivity is levelled-off after the year 1992 (Case 7)

Likewise, coconut productions relative decrease of contribution to GRDP has little effect because the population shall also decrease by only 1.5% and GRDP by 3.0% from the base core in 2000.

b) Effects of Project Implementation (See Table 1.1.8)

A usual method of measuring project benefits can be classified into the following two (2) methods: i) By measuring benefits when a project is implemented; and ii) By measuring losses as benefits when a project is not implemented (Fig. 1.1.12).

The latter method shall be adopted here for the measurement of benefits derived from the following major projects:

Table 1.1.8 Effect of Project Implementation

Case No.	Population (person)	GRDP (1,000 Pesos)	FIRR (%)
0	95,545 (1.000) 157,787 (1.000)	1,101,331 (1.000) 1,998,355 (1.000)	20.5
8	83,712 (0.876) 111,708 (0.708)	778,108 (0.707) 1,258,168 (0.630)	9.2
9	92,751 (0.971) 148,889 (0.944)	1,019,645 (0.926) 1,853,420 (0.927)	19.0
10	91,318 (0.956) 145,212 (0.920)	996,873 (0.905) 1,845,869 (0.924)	18.4
11	94,192 (0.986) 154,098 (0.977)	1,064,888 (0.967) 1,945,697 (0.974)	19.8
12	93,493 (0.979) 151,428 (0.960)	1,035,711 (0.940) 1,903,787 (0.953)	19.2
13	95,545 (1.000) 155,458 (0.985)	1,101,323 (1.000) 1,824,335 (0.913)	19.4
14	81,209 (0.850) 136,291 (0.864)	909,344 (0.826) 1,723,705 (0.863)	14.6

Source: JICA Study Team

Note: 1. Upper Row: Value for 1982, Lower Row: Value for 2000
2. Figures in parentheses are ratios to the base case.
3. Characteristics of each case are as follows:
Case 8: Without Implementing Prawn culture Project
Case 9: Without Implementing Coconut Oil Mill
Case 10: Without Implementing Canning Factory Project
Case 11: Without Implementing Ice Plant Project
Case 12: Without Implementing Prawn Processing Project
Case 13: Without Implementing Paper Pulp Factory Project
Case 14: Without Implementig Tourism Development Project

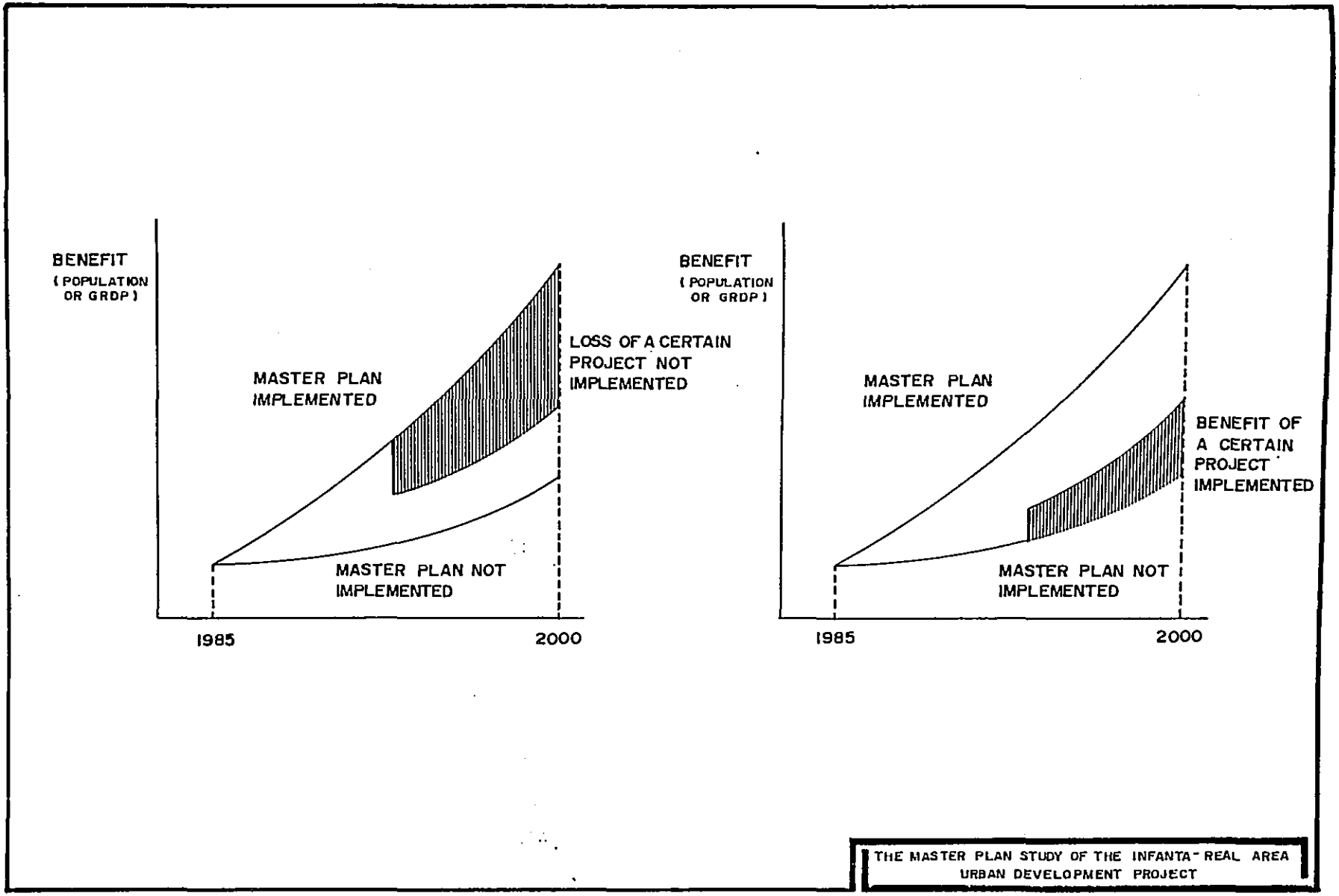


FIG. 1.1.12 METHOD OF MEASURING PROJECT BENEFIT

(i) When Prawn culture project is not implemented (Case 8)

The project has the greatest impact on both population and GRDP implying the need for it to be on the master plan. FIRR without this project shall be very low at 9.2% and as a result, a more viable version of the master plan would be necessary.

(ii) When the pulp paper factory is not constructed (Case 13)

Because of its late introduction to the IRM development, the effect of implementation shall be very small during the planning period. However, this project should play an important role in the late development of IRM. Consequently, its benefit cannot be measured thoroughly at this stage.

(iii) When tourism development is not implemented (Case 14)

This development shall have the second largest impact on population and GRDP next to prawn culture project. Likewise, without this development, a revision of the master plan would be necessary.

(iv) Other Projects

The effect of the other projects shall be minimal. However, the coconut oil and the canning factory projects, having decisively large employment and shipment values, shall have a relatively large impact on the IRM development.

1.2 Evaluation of Priority Projects

1.2.1 Project Package

The purpose of packaging the proposed projects is to accomplish a systematic and efficient facilities development program enjoying the following aspects:

i) The collective effects due to grouping of the related projects; and

ii) Efficiency in the simultaneous consideration of inter-related proposal projects.

Subject to packaging are the projects which shall be completed by 1992 taking into consideration the urgency of the projects.

Fig. 1.2.1 shows the inter-relation among projects clarified on the basis of the ISM[1] method.

In this figure, two projects which are connected with an arrow line have a cause and effect relation; namely, the project at the superior level vs the cause (or premise) of the project at the lower level connected to it by an arrow line. Therefore, the higher the project level, the higher the priority of inplementation that the project has. The following are the descriptions of the priority levels:

Note 1: ISM (Interpretive Structural Modeling)

A method which deals with complicated social problems. Patterns of inter-relation among various factors can be illustrated by multi-level diagraph in order to clarify a structure of complicated systems.

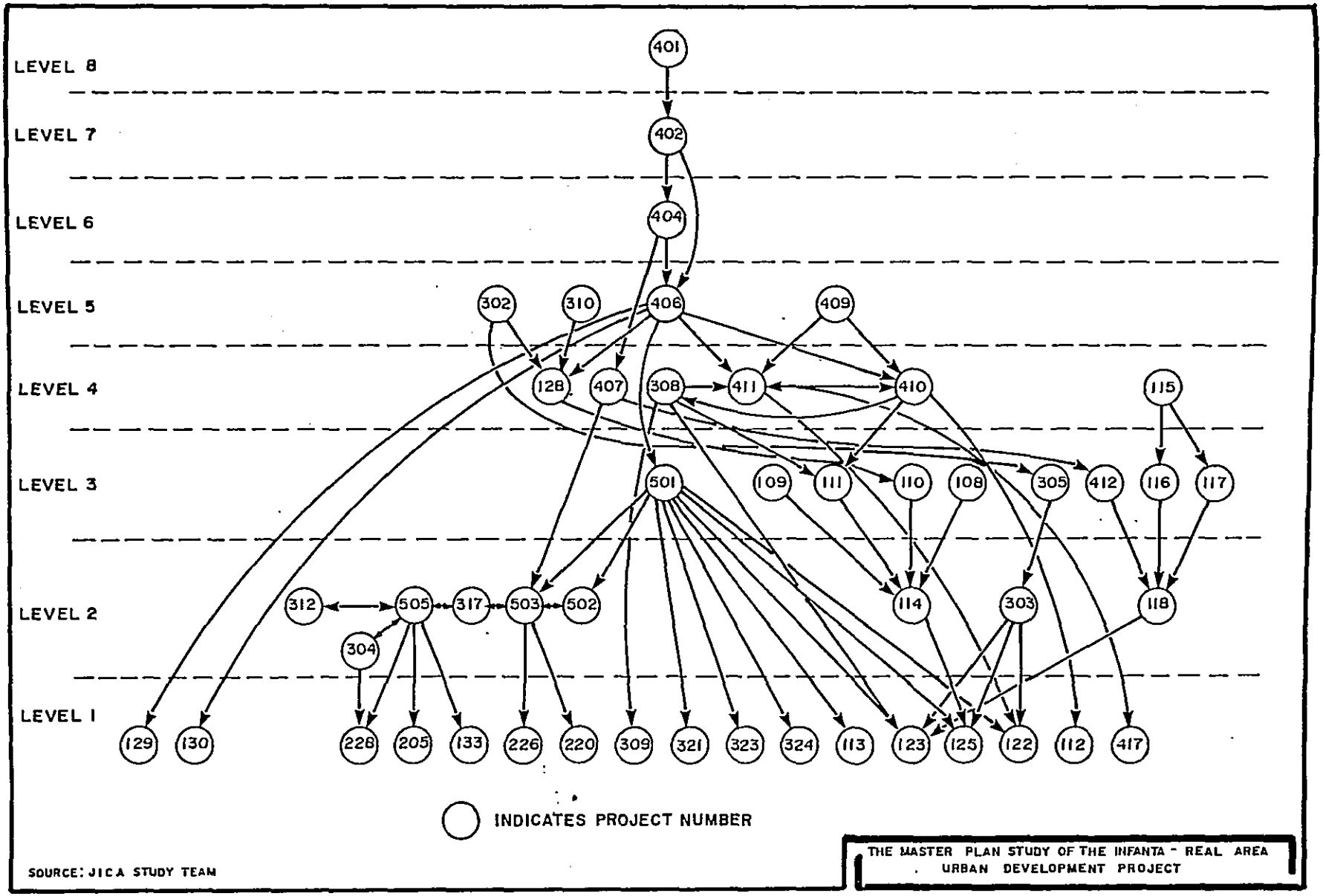


FIG. I.2.1 INTER-RELATION AMONG PROJECTS

(i) Levels 7 and 8

Infanta road improvement I and II (Project numbers 401 and 402) shall be included in this level. This improvement shall considerably shorten the travel time to MMA, thus, having a great impact on the development of local industries and, therefore, it has the highest priority of implementation.

(ii) Levels 4, 5, and 6

Infrastructure development for such industries as fishing, fishery product processing, tourism, and prawn culture, shall become the leading industries in the future IRM economy.

Specifically, these are the water supply project for the port area (project number 308), feeder road development (406), port development (409, 410, and 411), water supply project for Real industrial district (also 308). Other feeder road developments (406 and 407), power supply project for tourism development at Infanta beach area (302) water supply for the same area (310), road development (404 and 406), marine research park development (128), marine and brackish culture center (115), and feeder and urban arterial road development (404 and 407).

(iii) Level 3

This level includes such projects as the research activity for expansion of fish catch (108), fishery training program (109), fishery development center (110), upgrading of substation for the operation of fishing port and Real industrial district (305), development of fishery base port (111), land development for the distribution and processing industrial district, pilot project of prawn culturing (117), and improvement of existing minor ports for full scale operation of the prawn culture industry.

Ranking of the priority levels are based on ISM which places its emphasis on the analysis of the inter-relationship among the projects. Therefore, economic importance of each project has not been considered in ISM.

In addition to this ISM analysis, importance of each project in terms of the area's economic development has been examined (see sensitivity analysis of overall evaluation in the last section) to propose the following priority project packages:

(i) Real Port Development Project Package;

(ii) Urban Land Development Project Package;

(iii) Prawn Culture Project Package; and

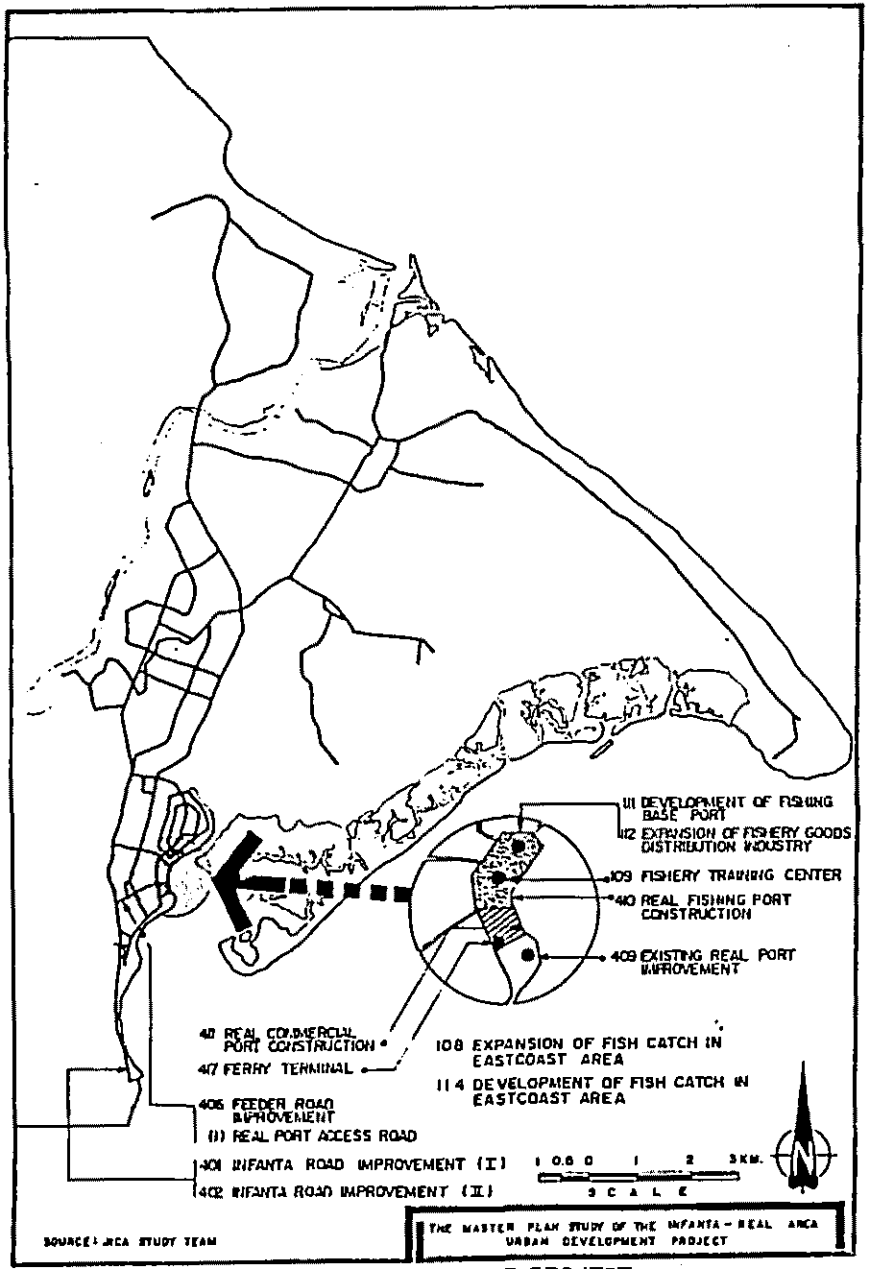
(iv) Tourism Development Project Package.

1.2.2 Economic and Financial Analysis of Project Packages

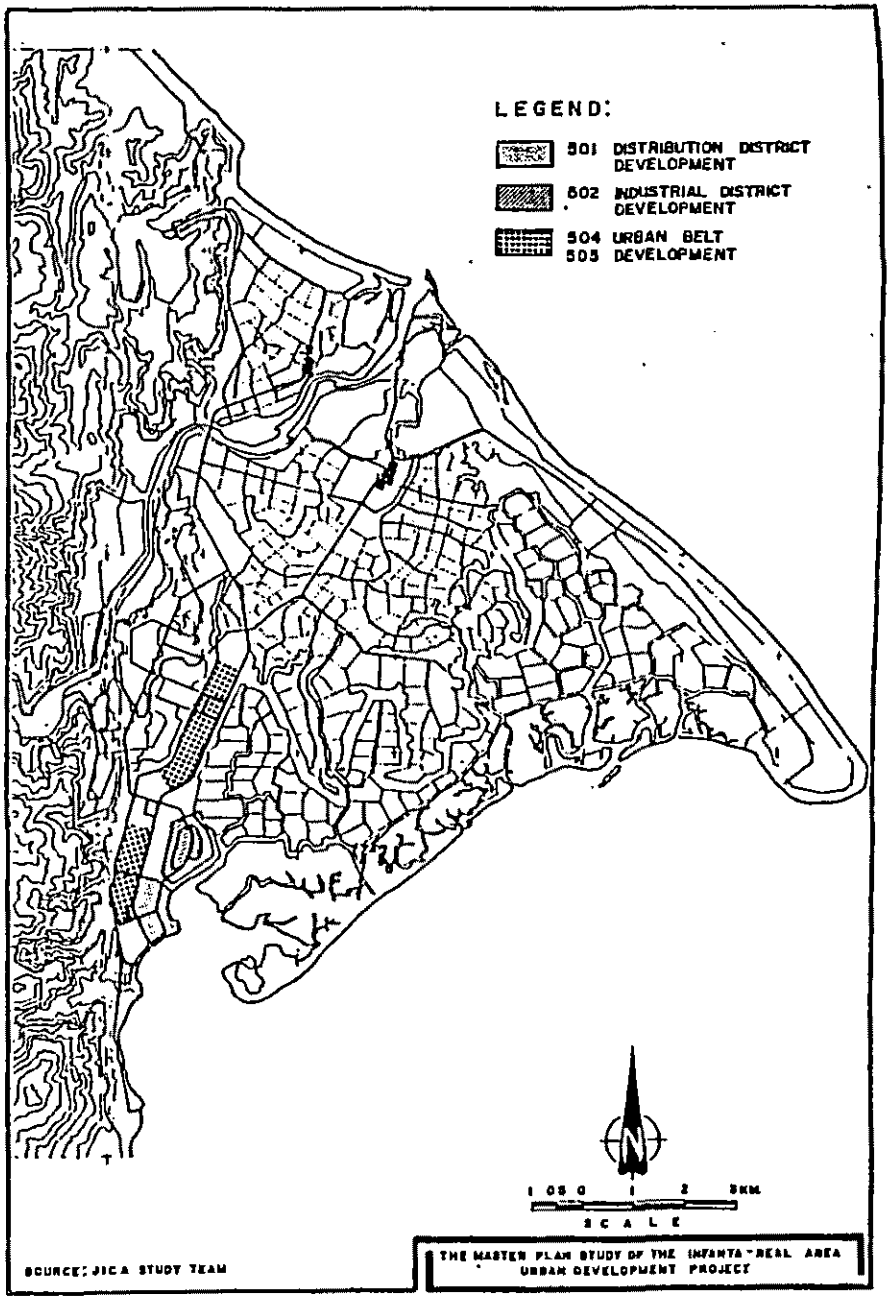
1) Basic Policies of Analysis

(i) Subject to analysis are the projects which are to be completed by 1992 and are grouped together on the basis of project packaging;

(ii) Total project life for analysis shall be the time duration up to 2000. In addition, for those projects whose project life exceed this time duration, the same shall be cut off in 2000. However, their residual value shall be considered in such cases. The project life of each package for calculating the residual value are set in Table 1.2.1, and the fixed amount method shall be used for depreciation. For the Land Development Project Package, depreciation shall not necessarily be considered since the developed land shall be sold out by 2000.

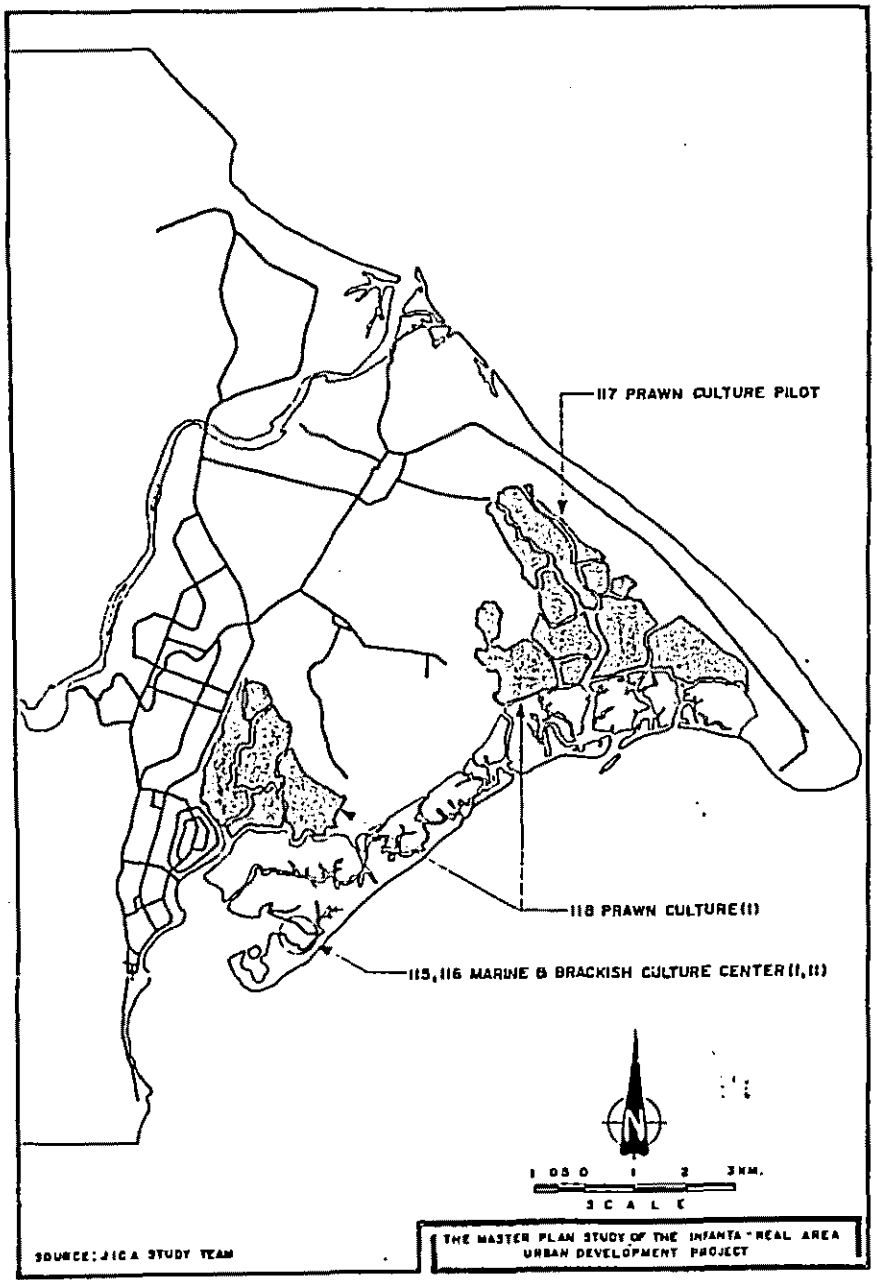


REAL PORT DEVELOPMENT PROJECT

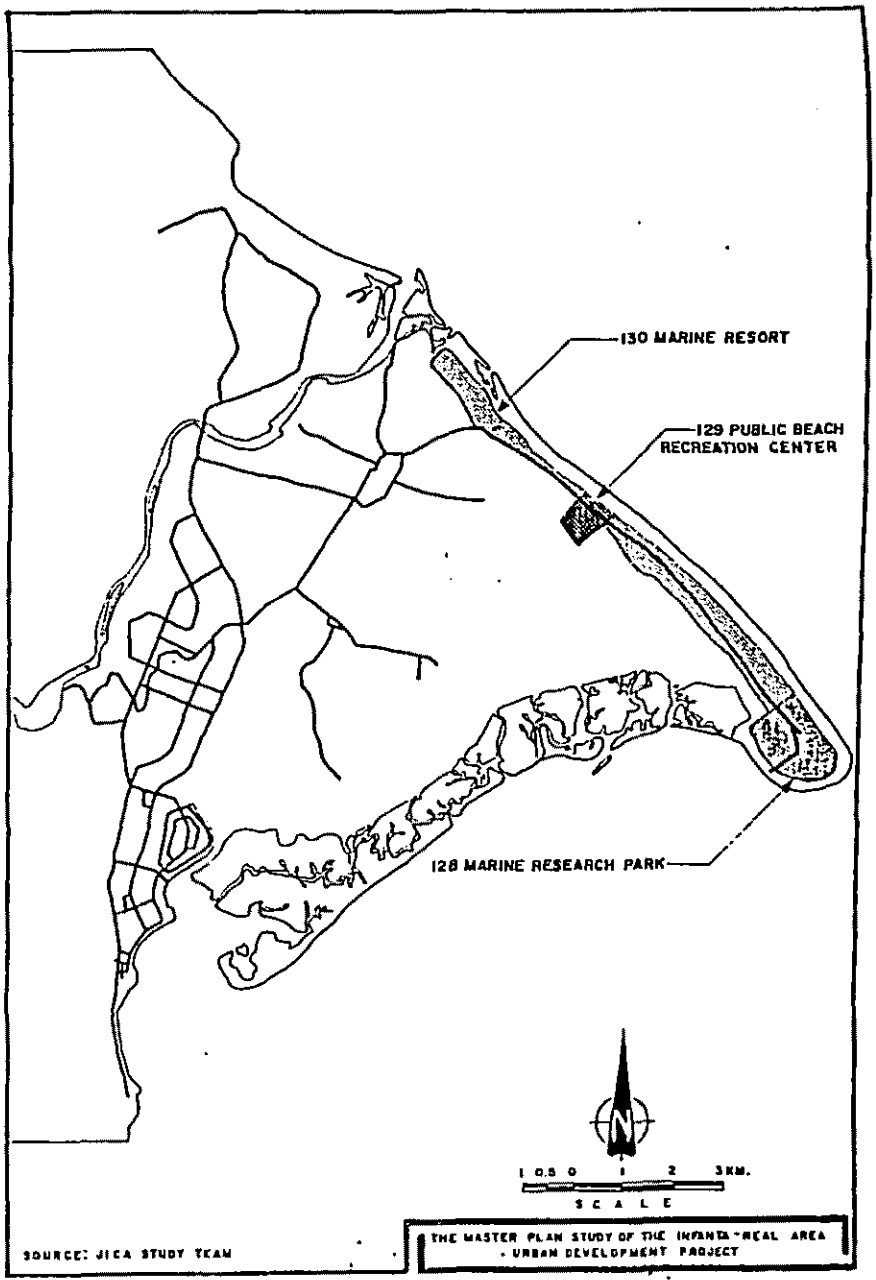


URBAN LAND DEVELOPMENT PROJECT

FIG. I.2.2 PRIORITY PROJECTS



PRAWN CULTURE DEVELOPMENT PROJECT



TOURISM DEVELOPMENT

FIG. I.2.2 PRIORITY PROJECTS

Table 1.2.1 Project Life of Project Package

Package Name	Project Life (years)
Prawn Culture Project Package	15
Real Port Development Project Package	30
Tourism Development Project Package	15
Urban Land Development Project Package	-

Source: JICA Study Team

(iii) All prices shall be set at 1984 Price levels.

(iv) The main evaluation criteria shall be an internal rate of return for each package, however, net present value and cost benefit ratio shall also be computed assuming a discount rate of 15%. However, for the Urban Land Development Project Package because the price system of other areas cannot be used here as a reference for price setting for the purpose of analysis, a price system which is financially feasible shall be established. The appropriateness of the price system shall also be examined.

(v) Financial analysis shall be done for all the packages, but economic analysis shall be applied only for the Real Port Development Project Package because of its relative importance in the National economy. The Real Port Development Project Package has two components; namely, the Port Package and the Road Package. For the financial analysis of this package, only the Port Package shall be analyzed since only this position is commercial oriented. However, both Road and Port Package shall be considered as a whole for economic analysis because the producer's surplus cannot clearly be divided between the two packages. The above discussion is summarized in Table 1.2.2.

The policies discussed above are mutual for both economic and financial analysis. The following policies are for financial analysis only:

(vi) Escalation rate shall be set at 15% from MPWH standards.

(vii) Although it is necessary to consider various taxes for analysis of operation and revenue of private enterprises, the taxes shall not be included here because the implementing and operating body cannot be determined at this stage.

On the other hand, the following are applied only for economic analysis:

Table 1.2.2 Method of Analysis by Package

Package Name	Economic Analysis	Financial Analysis
1. Prawn Culture Project Package	X	O
2. Real Port Development Project Package		
a) Port Package	O	O
b) Road Package		X
3. Tourism Development Project Package	X	O
4. Urban Land Development Project Package	X	O

Source: JICA Study Team

Note: O; Subject to Analysis
X; Not subject to Analysis

(viii) Inflation shall not be considered in economic analysis whereas it shall be considered in financial analysis.

(ix) Only direct benefits shall be considered.

(x) In economic analysis, economic cost, a cost system to measure the achievement of economic efficiency (on the assumption of free competition and free choice), is usually adopted. However, in the analysis, actual market price is used due to the following reasons: strict and detailed cost analysis is difficult at this master plan stage; and consequently, when economic cost is applied, the degree of error would become greater. Yet empirical conversion ratio is generally known as 0.8 (economic cost = actual market cost x 0.8). Thus, the difference can be estimated and analyzed in the sensitivity analyses.

2) Real Port Development Project Package

This group of projects can be divided as follows:

i) Improvement of Real Port itself and, as a subject of economic analysis, expansion of fishing port called "Port Package". For better understanding, the packages shall be described separately and later combining the two packages for evaluation as a whole:

(1) Port Package

(i) Composition of Port Package

The Port package consists of 11 projects as shown in Table 1.2.3. However, for Project 406, Feeder Road Improvement (I), only the improvement of the access road to Real Port shall be considered. The following projects are considered for economic analysis only: 108 Expansion of Fish Catch in East Coast Area, 109 Fishery Training Program, 110 Fishery Development Center, 114 Development of Fish Catch in the East Coast Area.

Table 1.2.3 Port Package Projects

Project No.	Project Name
Port and Supporting Infrastructure	
409	Existing Real Port Improvement Project
410	Real Fishing Port Construction Project
411	Real Commercial Port Construction Project
417	Ferry and Ferry Terminal Project
406 (part)*	Feeder Road Improvement (I)
Fishery and Related Industries	
111 (part)	Development of Fishery Base Port
112	Expansion of Fishery Goods Distribution Industry
108*	Expansion of Fish Catch in East Coast Area
109*	Fishery Training Program
110*	Fishery Development Center
114*	Development of Fish Catch in East Coast Area

Note*: Economic analysis only

Source: JICA Study Team

(ii) Assumptions

Necessary assumptions to analysis are tabulated in Table 1.2.4.

(iii) Cost Benefit Analysis

Cost Benefit for financial and economic analysis are shown in Table 1.2.27.

(2) Road Package

(i) Composition of Road Package

The Road Package consists of two groups of project as shown in Table 1.2.5. Since the Road Package shall not be considered for financial analysis, only the data required for economic analysis shall be prepared.

Table 1.2.5 Road Project

Project No.	Project Name
401	Infanta Road Investment (I)
402	Infanta Road Investment (II)

Source: JICA Study Team

Table 1.2.4 Precondition for Economic and Financial Analysis of Real Port Development Project Packge

Item	Preconditions

(1) Port Acitivities

1) Number of Ferry Passenger and Volume of Cargoes

Year	Number of Passengers (1000 pns)	Tonnage of Cargoes (1000 tons)			Fish Landing (100 tons)		
		Copra	Lumber	Miscellaneous	1st Class	2nd Class	3rd Class
1986	82.1	4.8	-	2.7	-	-	-
1992	137.0	13.5	37.0	20.0	16.0	8.0	24.0
2000	157.0	18.9	50.0	30.0	20.0	10.0	30.0

(2) Data for Financial Analysis

1) Investment Program

(thousand pesos at 1984 prices)

1985	1986	1987	1990	1991	Total
113, 254	148,000	208,026	3.655	3,655	476,590

Table 1.2.4 Preconditions for Economic And Financial Analysis of Real Port Development Project Package (2)

Item	Preconditions

2) Operating Cost

The values are set for the year 2000. For obtaining values for each year up to the year 2000, the following formula is used:

$$OC_i = OC_{2000} \times \sqrt{\frac{TCG_i}{TCG_{2000}}}$$

Where OC_i : Operating Cost in year i

TCG_{2000}: Total Cargoes handled at the Port in the year 2000

a. Direct Personnel Expenses

	Number of Personnel	Wages (pesos/year)	Direct Personnel Expense (1000 pesos/year)
Manager	5	50,000	250
Clerks, Engineers	15	25,000	375
Laborers	30	10,000	300
Total	50	18,500*	925

Note*: Per capita average annual wage

b. Facility Maintenance Cost — 1% of Direct Investment Cost

c. Utilities — 500 (thousand pesos per year)

d. Overhead — Equal to direct Personnel Expense

Table 1.2.4 Preconditions for Economic And Financial Analysis of Real Port Development Project Package (3)

Item	Preconditions
3) Revenue of Fishery Port	* Applied the unit prices of Navotas Fishery Port in 1984
a. Fishery Port Charge	0.06 (pesos per ton)
b. Commision for Landing	1.00 (pesos per tub)
c. Rent for Fish Market	First Class Fish 0.30 (pesos per tub) Second Class Fish 0.22 (pesos per tub) Third Class Fish 0.15 (pesos per tub)
d. Parking Charge	2.00 (pesos per vehicle)
e. Broker Royalty	0.25 (pesos per tub)
f. Sales of Fuel	1.26 (pesos per liter). The following data relating to fuel consumption are based on the weight of fishing boat:

	40 GRT	5 GRT	3 GRT
Days of Navigation	20	1	1
Ave. Daily Operating hour	12	4	4
Consumption of fuel (liter/hour)	45	8	5.5

Table 1.2.4 Preconditions for Economic and Financial Analysis of Real Port Development Project Package (4)

Item	Preconditions
g. Wharf Charge	

Gross Tonnage of Boat	GRT ≦ 10	10 < GRT ≦ 100
Unit Price (pesos)	1.00	2.00

h. Sales of Ice	58.8 (pesos/ton), Data for ice consumption are as follows:

	3GRT and 5 GRT	40 GRT
Ice Consumption (at sea)	0.5	-
Ice Consumption (on land)	0.5	0.5

i. Sales of Water	8.00 (pesos/ton), Data for water consumption are as follows

	40 GRT	5 GRT	3 GRT
Water Consumption (liter per day)	20	20	20
Number of Crew Members	18	5	4
Days of Navigation	20	1	1

Table 1.2.4 Preconditions for Economic And Financial Analysis of Real Port Development Project Package (5)

Item	Preconditions
j. Rent of Site	5.00 (pesos/m²/month)
4) Distribution Port Charge	1.5% of the value of cargo unloaded at the port
5) Ferry Facility Charge	1.5% of ferry boat fare (25 pesos per passenger)
(3) Data for Economic Analysis	
1) Investment Program	Following costs are added in the economic analysis:

(thousand pesos at 1984 prices)

1985	1986	1987	1988	1989	Total
1,536	11,753	15,921	8,185	6,626	44,021

2) Operating Cost — Following costs are added in the economic analysis:

(thousand pesos at 1984 prices)

1988	1989	1990 & after
233	233	2,945

Table I.2.4 Preconditions for Economic And Financial Analysis of Real Port Development Project Package (6)

Item	Preconditions
3) Benefit from fishery Port	Gross Sales Increase Cuased by Fish Porduction Increase $B_1 = (Q^1-Q^0)\ [r^0.P_f + (1-r^0)P_s]$ Gross Slaes Increase Caused by Freshness Gain of Products $B_2 = q^1(r^1-r^0)\ (P_f-P_s)$ Where: Q_0^1 : Production in "With Fishery Port" Case Q_1^1 : Production in "Without Fishery Port" Case r_0 : Fresh Fish Ratio in "With Fishery Port" Case r^0 : Fresh Fish Ratio in "without Fishery Port" Case P_f : Price of Fresh Fish P_s^f : Price of Non-Fresh Fish
a. Production in "Without Fishery Port" Case	Basic Conditions for calculating are as follows: 200 (ton/year)
b. Price of fish	Market Price (1984) First Class : 16 pesos/kg Second Class : 12 pesos/kg Third Class : 8 pesos/kg Prices Assumed Price of Fresh Fish : Equal to Market Price Price of Non-Fresh Fish : 30% of Market Price

Table 1.2.4 Preconditions for Economic and Financial Analysis of Real Port Development Project Package (7)

Item	Preconditions

c) Building Cost and Maintenance Cost of Fishing Boat

(thousand pesos)

	Building Cost	Annual Maintenance Cost
3 GRT Banca	50	10
5 GRT Banca	70	15
40 GRT FRP Boat	800	134

d) Operating Cost of Fishing Boat

	3 GRT	5 GRT	40 GRT
Days of Navigation	1	1	20
Number of Crew Member	4	5	18
Average Yearly Numbers of Navigation	150	150	10
Personnel Expenses per Navigation	120	150	24,000
Water Consumption			
liter	80	100	7,200
pesos	0.64	0.8	57.6
Average Daily Operating Hour	4	4	12
Fuel Consumption			
liter	22	32	10,800
pesos	138.6	201.6	68,040

Table 1.2.4 Preconditions for Economic and Financial Analysis of Real Port Development Project Package (8)

Item	Preconditions
4) Benefit from Distribution Port	
a. Savings in Passenger Transportation Cost	The passenger transportation cost of the ferry boat is 31.4 pesos per person less than that of the banca.
b. Savings in Barge Transportation Cost	The time distance between Real Port and Manila shall be shorter with the improvement of the Infanta Road. This road improvement shall result in the change of barge route from Mauban Port to Real Port. A transportation cost of 9 pesos per ton can be saved from this route. The percentage of cargo volume transferred from Mauban route to Real route is assumed at 68.4% for copra and 35.5% for lumber.
5) Benefits from Road	The benefits derived from the Infanta Road improvement are as follows: (1) Savings in the fixed vehicle operating cost; and (2) Savings in travel time of passengers and drivers.
a. Savings in Fixed Vehicle Operating Cost	

Vehicle Type	Fixed Costs (₱/hour)
Car	2.08
Bus	19.58
Jeepney	14.48
Truck under 3-ton	19.43
Truck over 3-ton	25.50

Table 1.2.4 Preconditions for Economic and Financial Analysis of Real Port Development Project Package (9)

Item	Preconditions
b. Savings in Travel Time	

Vehicle Type	Time Costs (₱/hour)
Car	40.53
Bus	214.96
Jeepney	51.66
Truck under 3-ton	18.96
Truck over 3-ton	18.96

Source: JICA Study Team

(ii) Assumptions

Necessary assumption are tabulated in Table 1.2.6.

(iii) Benefit

The following two benefits shall be considered:

i) Savings on Fixed Vehicle Cost

ii) Time Savings of Passengers and Drivers

Table 1.2.6 Preconditions for Economic Analysis of Road Package

Item	Preconditions				
(1) Traffic Volume	(vehicles per day)				
	Year	Car	Bus	Jeepney	Truck	Total
	1988	529	75	100	418	1,122
	1992	2,747	217	155	3,015	6,134
	2000	4,165	331	281	4,826	9,603
(2) Cost						
1) Investment Program	(thousand pesos at 1984 prices)				
	1985		1986	1987	Total	
	58,026		77,369	58,026	193,421	
2) Maintenance Cost	12% of total Investment Cost				

Source: JICA Study Team

There exists two reasons why the producer's surplus is not considered here. The first is that the Port Package analysis already considers the increase in fish catch as its benefit which cannot be realized without the improvement of said road. Thus, the producer's surplus has already been counted in that package. The second is that, the MPWH, in its Highway Planning Manual" is reluctant to consider producer's surplus as benefit. The assumptions for this package is the same as those tabulated in Table 1.2.4.

(iv) Cost Benefit Analysis

In summary, the cost benefit analysis of the Infanta Road Package is shown in Table 1.2.27.

(3) Economic Evaluation

The result of economic analysis of the Real Port Development Project Package is described in Table 1.2.7 and Fig. 1.2.3. The base case outputs a very high EIRR of 41%, thus, proving its high economic feasibility. Furthermore, even with doubled construction cost and decreased benefits by 40%, EIRR maintains a rate of 19.3%. Therefore, it shall be concluded that this package seems feasible even under such aggravated conditions.

Tables 1.2.8 and 1.2.9 and Fig. 1.2.4 and 1.2.5 show the results of economic analyses when the Port Package and Road Package are considered separately. Analysis of the Port Package alone, indicates a higher value than otherwise, implying its good feasibility. In addition, the analysis of the Road Package alone indicates a relatively high IRR at 26.7%. Thus, supporting the importance of its implementation.

Table 1.2.7 Result of Economic Analysis of Real Port Development Project Package

	Investment Cost (Base Case=100)	Benefit (Base Case =100)	Internal Rate of Return(%)	Net Present Value (M₱)	Benefit/ Cost Ratio
Base Case	100	100	41.0	2,034.3	4.47
Case 1	100	80	36.2	1,510.2	3.58
Case 2	100	60	30.5	986.2	2.68
Case 3	150	100	32.7	1,756.9	3.04
Case 4	150	80	28.5	1,232.8	2.43
Case 5	150	60	23.6	708.8	1.82
Case 6	200	100	27.5	1,479.5	2.30
Case 7	200	80	23.7	955.4	1.84
Case 8	200	60	19.3	431.4	1.38

Source: JICA Study Team

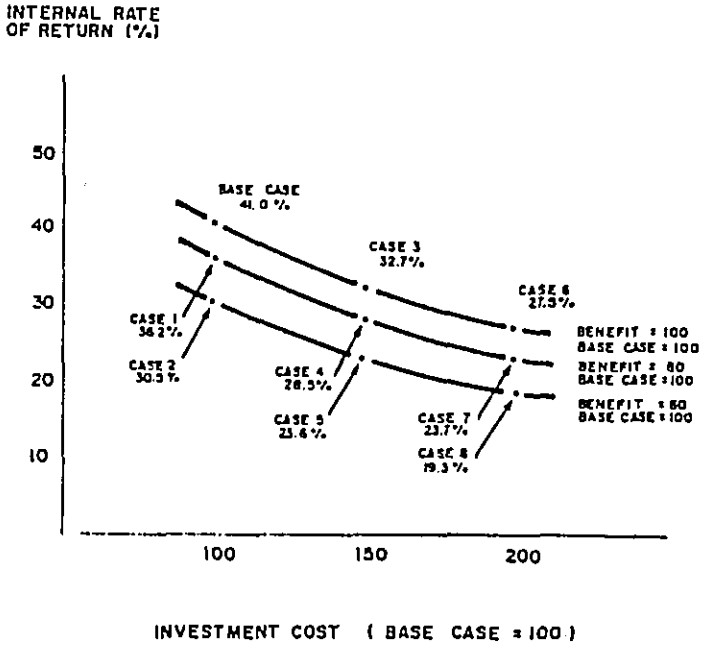


FIG. 1.2.3 ECONOMIC INTERNAL RATE OF RETURN FOR REAL PORT DEVELOPMENT PROJECT PACKAGE

Table 1.2.8 Result of Economic Analysis of Real Port Development Project (Without Road)

	Investment Cost (Base Case=100)	Benefit (Base Case =100)	Internal Rate of Return(%)	Net Present Value (MP)	Benefit/ Cost Ratio
Base Case	100	100	44.9	1,868.1	5.23
Case 1	100	80	39.7	1,406.2	4.19
Case 2	100	60	33.6	944.4	3.14
Case 3	150	100	35.9	1,658.8	3.55
Case 4	150	80	31.5	1,196.9	2.84
Case 5	150	60	26.3	735.0	2.13
Case 6	200	100	30.3	1,449.4	2.69
Case 7	200	80	26.4	987.5	2.15
Case 8	200	60	21.7	525.7	1.61

Source: JICA Study Team

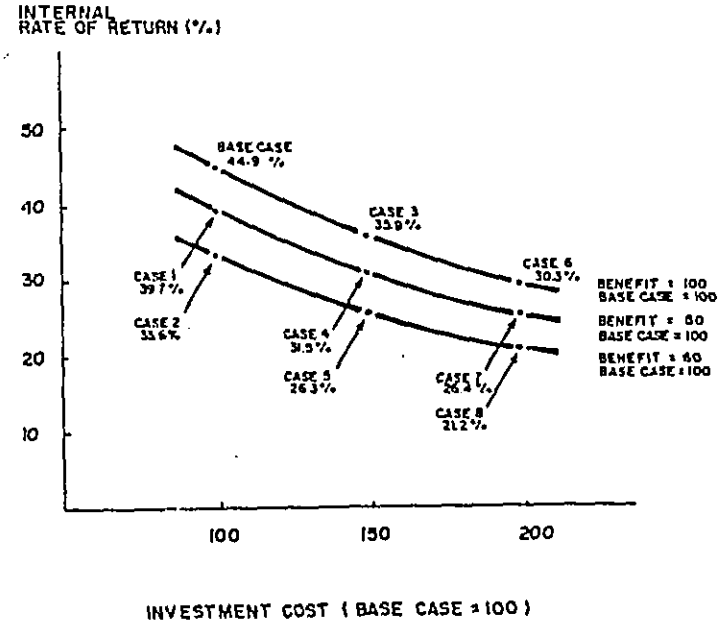


FIG. 1.2.4 ECONOMIC INTERNAL RATE OF RETURN FOR REAL PORT DEVELOPMENT PROJECT (WITHOUT ROAD)

Table 1.2.9 Result of Economic Analysis of Infanta Road Improvement Project

	Investment Cost (Base Case=100)	Benefit (Base Case =100)	Internal Rate of Return(%)	Net Present Value (MP)	Benefit/ Cost Ratio
Base Case	100	100	26.7	116.2	2.15
Case 1	100	80	22.9	104.0	1.72
Case 2	100	60	18.5	41.8	1.29
Case 3	150	100	20.3	98.1	1.46
Case 4	150	80	17.1	36.0	1.17
Case 5	150	60	13.4	-26.2	0.88
Case 6	200	100	16.3	30.1	1.11
Case 7	200	80	13.5	-32.1	0.89
Case 8	200	60	10.2	-94.2	0.66

Source: JICA Study Team

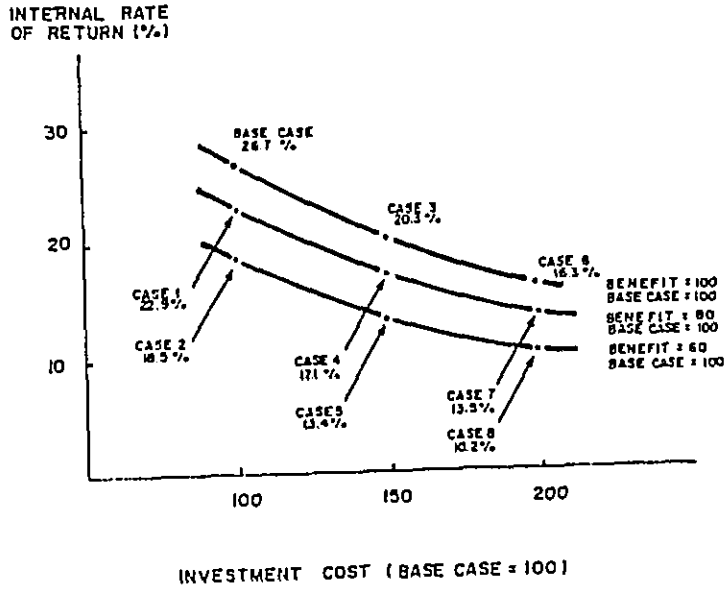


FIG. 1.2.5 ECONOMIC INTERNAL RATE OF RETURN FOR INFANTA ROAD IMPROVEMENT PROJECT

(4) Financial Evaluation

The financial analysis only considers the Port Package as explained earlier. Its FIRR at 5.7% implies difficulty in its operation. However, it should be noted that the fee set up (revenue) used here is based on that of Navotas Port which has not changed its asking rates since 1981 due to government control so that revenue increase by about 50% here can easily be justified in the future.

In such case, its FIRR would increase up to 10%, which is relatively low.

However, as proven earlier, this Real Port Development Project Package shall have a great economic impact on IRM's future development and the investment shall be evaluated as essential. In order to make its operations financially feasible such as government aid in construction and cross subsidy from other project shall be necessary.

3) Urban Land Development Project Package

(1) Outline of the Package

The master plan sets up urban land development projects which are to provide lots of housing for the increasing number of urban population, promotes basic industries and improves social services (Table 1.2.11, Fig. 1.2.2).

The area of land prepared in 1992 and 2000 totals 617.6 and 1339.7 ha respectively, and usable land at 433.2 and 889.1 ha respectively.

Table 1.2.10 Result of Financial Analysis of Real Port Development Project Package

	Investment Cost (Base Case=100)	Benefit (Base Case =100)	Internal Rate of Return(%)	Net Present Value (M₱)	Benefit/ Cost Ratio
Base Case	100	100	5.7	-279.5	0.41
Case 1	100	130	8.2	-220.4	0.54
Case 2	100	160	10.3	-161.3	0.66
Case 3	80	100	7.4	-191.9	0.51
Case 4	80	130	10.2	-132.8	0.66
Case 5	80	160	12.5	- 73.7	0.81
Case 6	60	200	9.9	-104.3	0.65
Case 7	60	130	13.0	- 45.2	0.85
Case 8	60	160	15.6	-1 3.9	1.05

Source: JICA Study Team

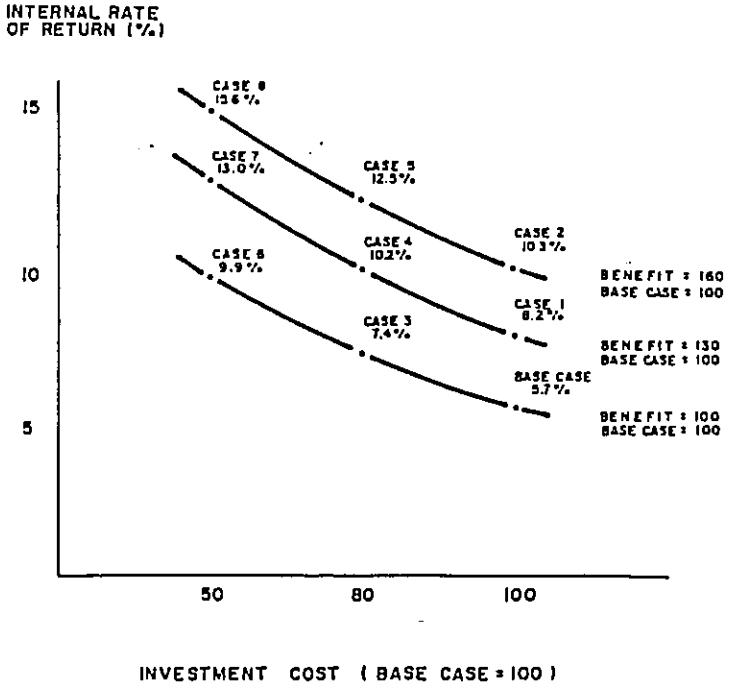


FIG. 1.2.6. FINANCIAL INTERNAL RATE OF RETURN FOR REAL PORT DEVELOPMENT PROJECT PACKAGE

Table 1.2.11 Urban Land Development Projects

Project Number	Project Name	1992	
		Development Area	Area for Sale
501	Land Development of Distribution Center District	25.6 ha.	20.5 ha.
502	Land Development of Industrial District	70.7	56.6
504, 505	Land Development of Residential District	134.2	107.4

Source: JICA Study Team

(2) Schedule of site preparation and disposition

As shown in Figs. 1.2.7 and 1.2.8, in line with the regional development strategy of IRM, site preparation and disposition shall be started in Real where such leading industries as distribution and manufacturing are to be developed. Following it are Infanta and General Nakar which shall be developed not earlier than the second phase of the development period.

(3) Cost of Land Development

(i) Labor Cost

Land development projects shall require one employee per hectar (salary is set at 20,000 pesos per person).

(ii) Overhead Expenses

This cost is equal to 100% of direct personal expenditures.

(iii) Cost of Stock Maintenance

This cost shall equal 1% of site preparation cost.

(4) Financial Analysis

(i) Methodology Analysis

Profitability of land development projects naturally depends on the selling price of lots. In this study, the selling price is computed to cover all costs of development and examined from the viewpoint of affordability of families and establishments to be located in IRM. The computation is based on the two (2) following conditions:

a) Those referred to are only projects to be completed before 1992.

PROJECT	YEAR '85 '86 '87 '88 '89 '90 '91	TOTAL CONSTRUCTION COST (M₱)
501. DISTRIBUTION DISTRICT DEVELOPMENT	Phase I 90.75 M₱ 18.75 ha. — Phase II 33.15 M₱ 6.85 ha.	97.60
502. INDUSTRIAL DISTRICT DEVELOPMENT	Phase I 96.80 M₱ 20.0 ha. — Phase II 245.39 M₱ 50.7 ha.	342.9
504-505 URBAN BELT DEVELOPMENT	Phase I 182.40 M₱ 60.0 ha. — Phase II 225.57 M₱ 74.2 ha.	407.97

FIG. I.2.7 URBAN LAND DEVELOPMENT PROJECT AND ITS CONSTRUCTION COST

PROJECT	YEAR '86 '87 '88 '89 '90 '91 '92	
501. DISTRIBUTION DISTRICT DEVELOPMENT	Phase I 15.0ha. — Phase II 5.5ha.	
502. INDUSTRIAL DISTRICT DEVELOPMENT	Phase I 16.0ha. — Phase II 40.6ha.	
504-505 URBAN BELT DEVELOPMENT	Phase I 48.0ha. — Phase II 59.4ha.	

FIG. I.2.8 MARKETING PLAN OF URBAN LAND DEVELOPMENT PROJECT

(ii) Pricing

Table 1.2.12 shows pricing to make IRR, 0% and 15%. 0% IRR implies that within the project life, revenue is expected to cover the cost for which only equity capital can make up and that deficit may amount to as much as interest of funds borrowed when equity capital is not available.

Therefore, the selling price of lots may be set higher to make IRR not less than 15% even though low interest money is available.

The selling prices of lots as mentioned above are separately calculated by project. But, taking into account all urban development projects of IRM falling into the hands of one developer, the pricing system may apply on the basis of proposed land use of the area to be developed and not the cost of each project so as to cover aggregate cost of all urban land development projects of IRM.

Selling prices which makes IRR 15% are estimated at 310 pesos/m^2 in industrial areas, 460 pesos/m^2 in residential areas and 1830 pesos/m^2 in commercial areas, provided that land values of residential areas and commercial areas are 1.5 and 6 times as much as that of industrial areas. (the ratio of land value by land use is determined by refering to that in Japan).

(iii) Lease System

Selling price of the lots developed by the above mentioned urban land development project is estimated at a range of 400 pesos to 500 pesos/m^2 depending on the level of loan interest and construction cost. The equivalent minimum rent to the estimated selling price range varies according to the interest level as shown in Table 1.2.13 (without consideration for the maintenance cost of holding land).

The rents for existing and proposed EPZs are shown in Table 1.2.14.

Table 1.2.12 Selling Price by IRR

(pesos/m²)

Project	IRR 0%	IRR 15%
501 Distribution Center District	460	620
502 Industrial District	560	610
503 & 504 Residential District	330	390

Source: JICA Study Team

Table 1.2.13 Equivalent Minimum Rent To Selling Price Corresponding To Interest Level

(in Pesos/m².month)

Interest Level (%)	Selling Price (pesos/m²)		
	400	450	500
8	2.7	3.0	3.3
10	3.3	3.8	4.2
12	4.0	4.5	5.0
15	5.0	5.6	6.3

Source: JICA Study Team

Table 1.2.14 Rents of EPZ

(in pesos/m².month)

EPZ	Rent
Operating	
Bataan	1.0
Mactan	1.5
Baguio City	2.0
Studying	
Batangas	4.5
San Fernando	
Malilipot	

Source: JICA Study Team

Considering the rather disadvantageous location of IRM, the rent shall be set a little lower than those of proposed EPZs. It means that the level of loan interest is preferably below 10% and if possible, 8%.

On the other hand, the relationship between the building cost and the equivalent minimum floor rent fluctuates depending on the interest level as shown in Table 1.2.15.

The floor rent for studying EPZs are 20 pesos/m^2/month for factories and 45 pesos/m^2/month for commercial facilities. Table 1.2.15 shows that it is necessary to get the interest level below 8% and the building cost below 3000 pesos/m^2 in order to set the floor rent at a level of 20 pesos/m^2/month.

The future ability of the middle class in IRM to pay house rent is estimated between 1,200 and 1,500 pesos/month which is 10% of monthly family income between 4000 and 5000 pesos/month. The minimum rent for a house of 50 m^2 floor area on a lot of 100 m^2 shall be at 1,270 pesos/month which is included in the ability to pay range with a building unit cost of 3000 pesos/m^2 and a land price of 400 pesos/m^2 on the condition that it is constructed using a soft-loan of 8% interest.

If it is considered that the collection of such uniform rent is difficult especially at the early stage of development, the escalating rent system is worth introducing. For example, the initial rent can be set at a level of 60 to 70% of the uniform rent with an escalation rate of 3% per annum and a loan interest rate of 8 to 10%.

(5) Conclusion

The urban land development project in IRM shall become feasible by carrying out the following measures:

(i) Price setting responding to affordability and forbearance of land and facility users;

Table 1.2.15 Equivalent Minimum Floor Rent to Building Cost Corresponding to Interest Level

Interest Level (%)	Building Cost (pesos/m²)		
	3,000	4,000	5,000
8	20	27	33
10	24	32	40
12	29	38	48
15	35	47	58

Source: JICA Study Team

(ii) Procurement of soft term loans with interest levels of less than 8%;

(iii) Minimizing land development and facilities construction cost; and

(iv) Introduction of the escalating rent system.

4) Prawn Culture Development Project Package

(1) Outline of the Package

(i) Current condition of aqua culture.

There has been developed around 900 ha of fishponds in mangrove swamp area, mainly devoted to the sabahi product and partially to prawn culture which are not fully developed due to shortage of prawn fry.

(ii) Outline of the Project

Prawn culture development projects consist of 4 components as follows:

Phase I: Prawn culture pilot projects shall develop 300 ha of fish ponds for 3 years (1985-1987) reconstructing existing fish ponds and adding the necessary equipment so that primitively managed fishponds are converted into intensively or semi-intensively managed fish ponds.

The marine brackish center should be constructed and its operation started in order to provide prawn fry for the prawn culture development stated above.

Second Phase: The fish pond developed in the First Phase should subsequently be expanded by 900 ha for the next coming 4 years (1988-1991).

The marine brackish center shall also be expanded to meet the demand of prawn fry which shall be increased by the expansion project of fish ponds. The sizes of prawn culture ponds and the marine brackish center to be developed are shown in Table 1.2.16

Table 1.2.16 Prawn Culture Pond and Hatchery Center

	Construction Period	The Area of Prawn Culture Ponds(ha)	The Amount of Production of prawn frys in the center (1000 pesos)
Prawn Culture Pilot Project			
Phase I Stage (I)	1985-1986	200	27,200
Stage (II)	1987	100	13,600
Phase II Stage (I)	1988-1989	450	61,200
Stage (II)	1990-1991	450	61,200
Total		1,200	163,200

Source: JICA Study Team

Remark: The amount of prawn fry production shown on the table shall be required for the production of prawn in the developed fish pond in year 2000.

Table 1.2.17 Prawn Culture Project Package

Project No.	Project Name
115	Marine and Brackish Culture Center (I)
116	Marine and Brackish Culture Center (II)
117	Prawn Culture Pilot Project
118	Prawn Culture Pilot Project (I) Expansion

Source: JICA Study Team

(2) Investment Program

The investment requirement for this project amounts to around 269 m pesos (at 1984 prices) which is divided by year as shown in Table 1.2.18.

(3) Annual Operation Expenses

(i) Prawn Culture Pond

Item and amount necessary expenses for the operation of 1 hectare of prawn culture pond are tabulated in Table 1.2.19 (1984 price levels).

The annual operational expenses in the table are calculated assuming a 100% productivity rate (namely a yield of 3333 kgs per hectare).

Annual operational expenses of each year shall be estimated assuming the following relationship existing between the operational expense rate and the productivity rate of each year throughout the total project period:

$$\text{Operational Expense Rate} = (\text{Productivity Rate})^{1/2}$$

Table I.2.18 Investment Program of Prawn Culture Project Package

(₱1000, 1984 price)

Year	Amount of Investment
1985	11,040
1986	19,820
1987	16,140
1988	62,200
1989	62,200
1990	62,200
1991	62,000
Total	295,800

Source: JICA Study Team

Table 1.2.19 Cost Items And Amount of Expenses Per 1 ha. Prawn Culture Pond

Cost Item	Amount of Cost (₱)/Year	Remarks
1. Preparatory Cost	5,200	fertilizing fish pond/getting rid of harmful species of fish
2. Feed Cost	57,200	Purchasing feed
3. Harvesting Cost	2,000	Labor cost for catching/packaging prawn
4. Utility Cost	29,500	Mainly cost of electric for pumping
5. Maintenance Cost	1,000	Maintenance of pond and machines
6. Salary	12,000	Salary of personnel
Total	106,900	

Source: JICA Study Team

(ii) Hatchery Center

Expense items and corresponding amounts for a unit facility (production capacity of 600,000 prawn) are tabulated in Fig. 1.2.20 frys (1984 price levels). A method of estimating the operational expense of each year is same as the method applied for the prawn culture pond.

(4) Production and Revenue Estimates

(i) Estimate of Prawn Production

A target annual yield of 3333 kgs per hectare in the year 2000 is assumed and this figure is set as 100% productivity.

The productivity in 1987 when the partial operation of the prawn culture pilot project shall commence, shall be set at 35% (1167 kgs/ha[1]) and it shall increase by 5% each year up to 2000.

(ii) Estimate of Prawn Fry Production

The required number of fry from the prawn culture project shall be estimated by the following equation:

Note 1: Productivity of extensive prawn culturing at present is 200 to 400 kgs/ha and with semi-intensive experimental culturing, 1000-300 kg/ha.

Table 1.2.20 Cost Items and Amount of Expenses per unit of Facility of Hatchery Center

Cost Item	Amount	Remarks
1. Personnel Salary	35,800	Salary of Employee
2. Facility Maintenance	12,000	Maintenance and repair cost of facilities
3. Feeds and Others	36,000	Feeds and necessary equipments
4. Parent Prawn Purchase	60,000	
5. Utilities	7,000	Power, Water
Total	150,800	

Source: JICA Study Team

$$\text{Number of Prawn Fry} = \frac{\text{Total Prawn Production(kg)x100}}{\text{Ave. Wt. of Prawn}^{1} \times \text{survival ratio of fry}^{2}}$$

(iii) Revenue Estimate

The revenue shall be estimated assuming an average prawn at 35 grams is priced at 100 pesos/kg.

(5) Cost Benefit Analysis

A cost benefit analysis is shown in Table 1.2.27.

(6) Result of Financial Analysis and its Evaluation

The results of analysis on the basis of the above discussed premises are tabulated in Table 1.2.21 and Fig. 1.2.9. An FIRR of the base case is computed at a very high rate of 53.6% implying its rigid financial feasibility. When construction investment and revenue are changed for sensitivity analysis, the change of revenue particularly, shall largely affect its profitability. Thus, if the revenue is decreased to 60% of that of the base case, the FIRR shall go down to 18.7% which indicates the financial difficulty in Project operation. However, even with a doubled construction cost, it shall only lower the FIRR to 35.2% which can still be considered as profitable.

Note: 1 Average weight shall be 35 gms

2 70% is used based on SEAFDEC data.

Table I.2.21 Result of Financial Analysis Of Prawn Culture Development Project

	Investment Cost (Base Case=100)	Benefit (Base Case =100)	Internal Rate of Return(%)	Net Present Value (M₱)	Benefit/ Cost Ratio
Base Case	100	100	53.6	1,390.2	1.75
Case 1	100	80	38.5	740.0	1.40
Case 2	100	60	18.7	89.9	1.05
Case 3	150	100	42.1	1,251.6	1.63
Case 4	150	80	30.0	601.4	1.30
Case 5	150	60	13.4	-43.7	0.98
Case 6	200	100	35.2	1,113.0	1.52
Case 7	200	80	24.7	462.9	1.22
Case 8	200	60	10.0	-187.3	0.91

Source: JICA Study Team

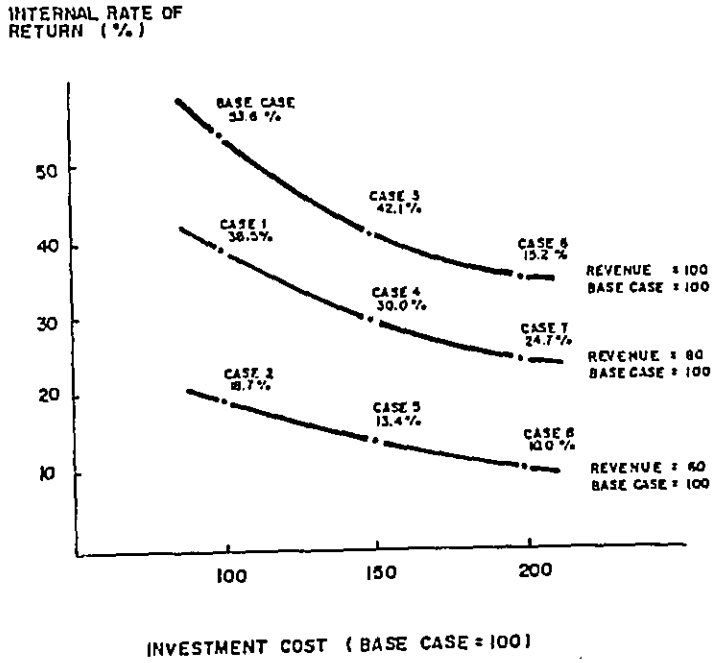


FIG. I.2.9 FINANCIAL INTERNAL RATE OF RETURN FOR PRAWN CULTURE PROJECT PACKAGE

Consequently, it shall be concluded that this package on conversion of mangrove swamp areas of IRM into prawn culture ponds and consequent operations of prawn culturing shall be financially profitably, provided that: (i) there is no large fluctuation in construction cost; and (ii) at least 70% of the estimated production and revenue, namely sales price shall be maintained.

5) Tourism Development Project Package

As stated before, only the financial analysis shall be carried out for the package.

a) Composition of package

This package is composed of a group of three projects as shown in Table 1.2.22.

b) Investment Program

The total construction investment shall amount to 1.097 million pesos (at 1984 price levels). The investment program is shown in Table 1.2.23.

c) Cost Estimates

The required cost of its operation shall be classified as:

(i) Personnnel expenses for operation of tourist facilities

The personnel expenses discussed here is the required salary of employees who are directly involved in the management and operation of tourist industries. Total annual salary required number of employees and average annual salary by employment class are tabulated in Table 1.2.24.

The figures in the table are computer on the basis of projected number of tourist in 2000.

Table 1.2.22 Tourism Development Project Package

Project No.	Project Name
128	Marine Research Park
129	Public Beach Recreation Center
130	Infanta Marine Resort

Source: JICA Study Team

Table 1.2.23 Tourism Development Investment Program

(1,000 pesos at 1984 prices

Year	Amount of Investment
1985	137,400
1986	183,200
1987	137,400
1988	134,750
1989	164,630
1990	174,590
1991	164,630
Total	1,096,600

Source: JICA Study Team

Table 1.2.24 Personnel Expenses

	Persons	Average Annual Salary(₱)	Total Personnel Expenses (P1,000)
Manager Class	32	50,000	1,500
Clerical, Engineer	168	25,000	4,200
Laborer	600	10,000	6,000
total	800	14,750*	11,800

Source: JICA Study Team

Note: Average Annual Salary of allEmployees

(ii) Operational Expenses

Operational expenses here includes all the necessary expenses besides perscnnel expenses such as maintenance costs facilities, expenses of facilities operations and logistic costs of facilities operation.

The operational expenses are estimated at 2% of the total facility construction costs.

Personnel expenses and operational expenses of each year by facility shall be computed by multiplying the required personnel expenses and oeprational expenses by facility in 2000 by the square root of the facility occupancy rate for each year. The facility occupany rate here is defined as the ratio of the number of tourists per facility in each year by the projected number of tourists per facility in 2000.

d) Revenue Estimates

(a) Projection of number of tourists

The following assumption are considered:

(i) Famy-Real section of Infanta Road shall be improved by 1986.

(ii) Beaches and related bathing facilities for day time visitors shall be developed between 1988 through 1991.

(iii) Hotel facilities shall be constructed; 300 rooms by 1987 and 400 rooms by 1991.

(iv) Projection of tourists after the completion of all facilities shall be: day time (short stay) visitors at 93000 persons and overnight (long stay visitors) 175,200 persons.

(b) Projections of Day Time (Short stay) Visitors

(i) The improvement of Infanta Road shall encourage people to the area so that a new beach resort area shall be developed with daily trips from MMA (1987 - 10% of target number of tourists, 1988 - 20%).

(ii) As facilities shall be developed, the number of day time visitors shall gradually increase (1989-30%, 1990-40%, 1991-50%).

(iii) When all the facilities are completed and bus package tours promoted, the number of day time visitors shall drastically increase (1992 - 75% of target number of tourists, 1993 and after 100%).

(c) Projections of overnight visitors (long stay)

(i) Growth in the number of tourists shall largely depend in the sales promotion effort. However, assuming the majority of overnight visitors shall come by package group tours (dominantly from Japan), an unknown resort shall presumably have a difficult time in attracting tourists.

(ii) According to the above mentioned views, the increase rate of tourists shall be estimated conservatively.

(iii) An occupancy rate in the following year (1988) after the construction of the initial facilities shall be 20%.

(iv) Therefore, the rate shall increase by 20% each year (1989-40%, 1990-60%)

(v) An occupancy rate of 60% shall be maintained after 1990.

(d) Revenue

The composition of day time visitors being considered here are those residents of MMA from the upper and middle income brackets. In particular, these are families whose household head earns an income of about 110,000 pesos/month and above and those single persons with an income of 3,000 pesos/month.

Based on the results of interviews on these income groups, an average of 100 pesos/person/day of local sales can be expected. This amount equals the average amount spent on other beach resorts, and including the tourist bus fare (a round trip of 80 pesos based on existing bus fares of 30 pesos for one way), it shall still be within the range of their budget or their "willingness to pay". A majority of overnight visitors shall presumably be from abroad, and average sales is estimated at 800 pesos/person/day, including 500 pesos for lodging, 200 pesos for food and the rest for souvenirs and other items.

The total annual revenue shall be obtained by multiplying the projected number of visitors in each year by the above mentioned unit sales (Table 1.2.25).

e) Result of Financial Analysis and its Evaluation

To summarize all the discussions above, the cost benefit analysis of this package is tabulated in table 1.2.27, and the result of the financial analysis is shown in Table 1.2.26 and Fig. 1.2.10.

The FIRR is computed at 18.2% which is relatively low for operating the package on the basis of loans from commercial banks.

The result of the sensitivity analysis indicates that a change of construction cost and revenue shall affect its financial feasibility to a considerable extent.

Table I.2.25 Tourism Development
Yearly Revenue

	1987	1988	1989	1990	1991	1992	1993 & After
Day Tourist							
(1000 persons)	9.3	18.6	27.9	37.2	46.5	69.8	93.0
(1000 pesos)	930	1,860	2,790	3,720	4,650	6,980	9,300
Staying Tourist							
(1000 persons stays)		43.8	87.6	131.4	131.4	175.2	175.2
(1000 pesos)		35,040	70,090	105,120	105,120	140,160	140,160
Total							
(1000 persons)	9.3	62.4	115.3	168.6	177.9	245.0	268.2
(1000 pesos)	930	36,900	72,870	108,940	109,770	147,140	149,450

Source: JICA Study Team

Table 1.2.26 Result of Financial Analysis Of Tourism Development Project

	Investment Cost (Base Case=100)	Benefit (Base Case =100)	Internal Rate of Return(%)	Net Present Value (M₱)	Benefit/ Cost Ratio
Base Case	100	100	18.2	229.7	1.16
Case 1	100	80	13.4	-104.8	0.93
Case 2	100	60	7.5	-439.2	0.70
Case 3	120	100	15.3	20.8	1.01
Case 4	120	80	10.8	-313.6	.0.81
Case 5	120	60	5.3	-648.1	0.61
Case 6	140	100	12.9	-188.1	0.90
Case 7	140	80	8.7	522.5	0.72
Case 8	140	60	3.5	-856.9	0.54

Source: JICA Study Team

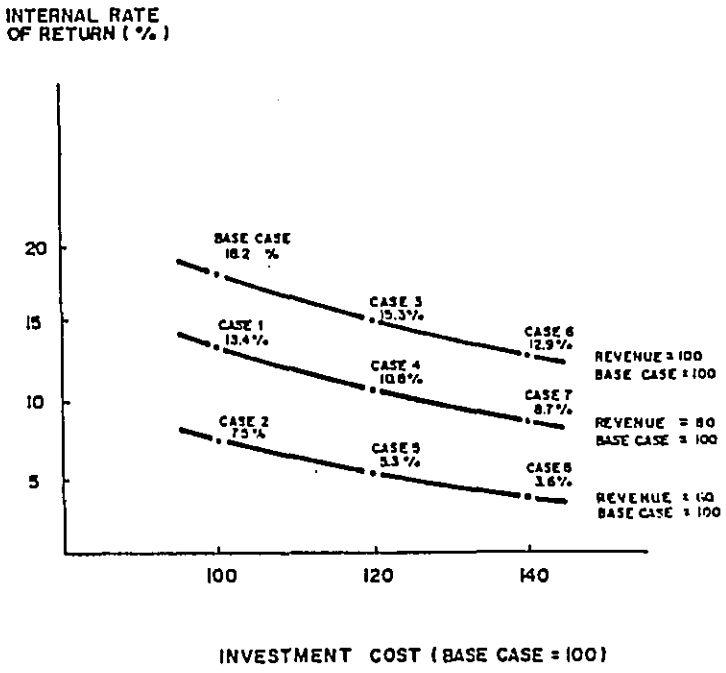


FIG. 1.2.10 FINANCIAL INTERNAL RATE OF RETURN FOR TOURISM DEVELOPMENT PROJECT PACKAGE

Table I.2.27 Cost-Benefit Stream by Project

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Real Port Package (Economic Analysis)																
Cost	114,790	160,211	342,090	11,519	10,125	10,061	10,315	7,080	7,125	7,166	7,207	7,247	7,293	7,334	7,379	7,402
Construction	114,790	159,753	341,559	8,185	6,626	3,655	3,655									
Operation		458	531	3,334	3,499	6,406	6,660	7,080	7,125	7,166	7,207	7,247	7,293	7,334	7,379	7,402
Benefit		1,101	23,928	98,316	143,741	300,585	422,192	841,992	964,576	1004,765	1056,454	1096,314	1150,934	1192,748	1245,001	1288,650
Fishing Port			22,432	96,636	142,227	298,727	419,662	838,705	961,189	1001,276	1052,858	1092,611	1147,120	1188,824	1240,960	1284,515
Savings on Passenger Transportation Cost		1,071	1,335	448	1,238	1,529	2,129	2,795	2,870	2,945	3,024	3,102	3,181	3,259	3,341	3,423
Savings on Barge		30	37	87	139	126	159	201	211	222	234	245	258	271	285	276
Road Benefit			124	145	171	203	242	291	306	322	338	356	375	394	415	436
Real Port Package (Financial Analysis)																
Expenditure	113,254	148,458	208,557	1,964	2,129	5,979	6,233	2,998	3,043	3,084	3,125	3,165	3,211	3,252	3,297	3,320
Construction	113,254	148,000	208,026			3,655	3,655									
Operation		458	531	1,964	2,129	2,324	2,578	2,998	3,043	3,084	3,125	3,165	3,211	3,252	3,297	3,320
Revenue		90	134	4,556	5,653	7,256	9,990	16,857	17,418	17,800	18,294	18,783	19,221	19,768	20,316	20,862
Fishing Port			20	4,131	5,107	6,558	9,085	15,678	16,191	16,520	16,959	17,392	17,769	18,255	18,739	19,232
Commercial Port		59	80	396	513	662	862	1,128	1,175	1,227	1,281	1,336	1,396	1,456	1,519	1,571
Ferry		31	34	29	33	36	43	51	52	53	54	55	56	57	58	59
Infanta Road Package																
Cost	58,026	77,369	58,026	2,321	2,321	2,321	2,321	2,321	2,321	2,321	2,321	2,321	2,321	2,321	2,321	2,321
Construction	58,026	77,369	58,026													
Maintenance				2,321	2,321	2,321	2,321	2,321	2,321	2,321	2,321	2,321	2,321	2,321	2,321	2,321
Benefit				22,920	33,093	46,441	78,252	107,286	113,454	119,893	126,765	134,027	141,762	149,846	158,428	167,516
Savings on Fixed Vehicle Operation				4,431	6,751	10,449	22,551	25,837	27,397	29,035	30,787	32,636	34,610	36,690	38,893	41,238
Time Saving Benefit				18,489	26,342	37,992	55,301	81,449	86,057	90,858	95,978	101,391	107,152	113,156	119,535	126,278
Prawn Culture Package																
Expenditure	11,040	19,820	32,833	88,968	90,592	137,019	140,671	131,137	136,492	141,645	146,616	151,424	156,084	160,610	165,011	169,298
Construction	11,040	19,820	16,140	62,200	62,200	62,200	62,200									
Operation			16,693	26,768	28,392	74,819	78,471	131,137	136,492	141,645	146,616	151,424	156,084	160,610	165,011	169,298
Revenue			23,333	40,000	45,000	125,000	137,500	240,000	260,000	280,000	300,000	320,000	340,000	360,000	380,000	400,000
Tourism Development Package																
Expenditure	137,400	183,200	141,484	150,265	186,004	200,529	193,254	32,762	33,732	33,732	33,732	33,732	33,732	33,732	33,732	33,732
Construction	137,400	183,200	137,400	134,750	164,630	174,590	164,630									
Operation			4,084	15,515	21,374	25,939	28,624	32,762	33,732	33,732	33,732	33,732	33,732	33,732	33,732	33,732
Revenue			930	36,900	72,870	108,840	109,770	147,140	149,460	149,460	149,460	149,460	149,460	149,460	149,460	149,460

Source: JICA Study Team

2. MANGROVE SWAMP DEVELOPMENT IMPACT ANALYSIS

2.1 Purpose and Method

2.1.1 Purpose

In view that, of the Infanta-Real Urban Development Plan (hereinafter, "Plan"), that which shall cause an immense change to the nature shall be the mangrove swamp development project, an environment analysis has been achieved for the purpose of ascertaining that the natural environment shall be protected from excessive development when mangrove swamps would be converted into prawn culture ponds, as well as from excessive contamination when the culture pond development would result in a water quality change.

2.1.2 Method

This environment evaluation has been accomplished through the exploratory survey of the swamp and the analysis of the survey findings.

1) Field Survey

(i) Mangroves

With the cooperation of the National Mangrove Committee (NMC), the species of the mangrove were identified, the number of mangrove trees was counted, and the form of vegetational distribution was observed in the 5-meter square plot which was selected as that which showed a representative scenery of each of the eight locations shown in Figure 2.1.1.

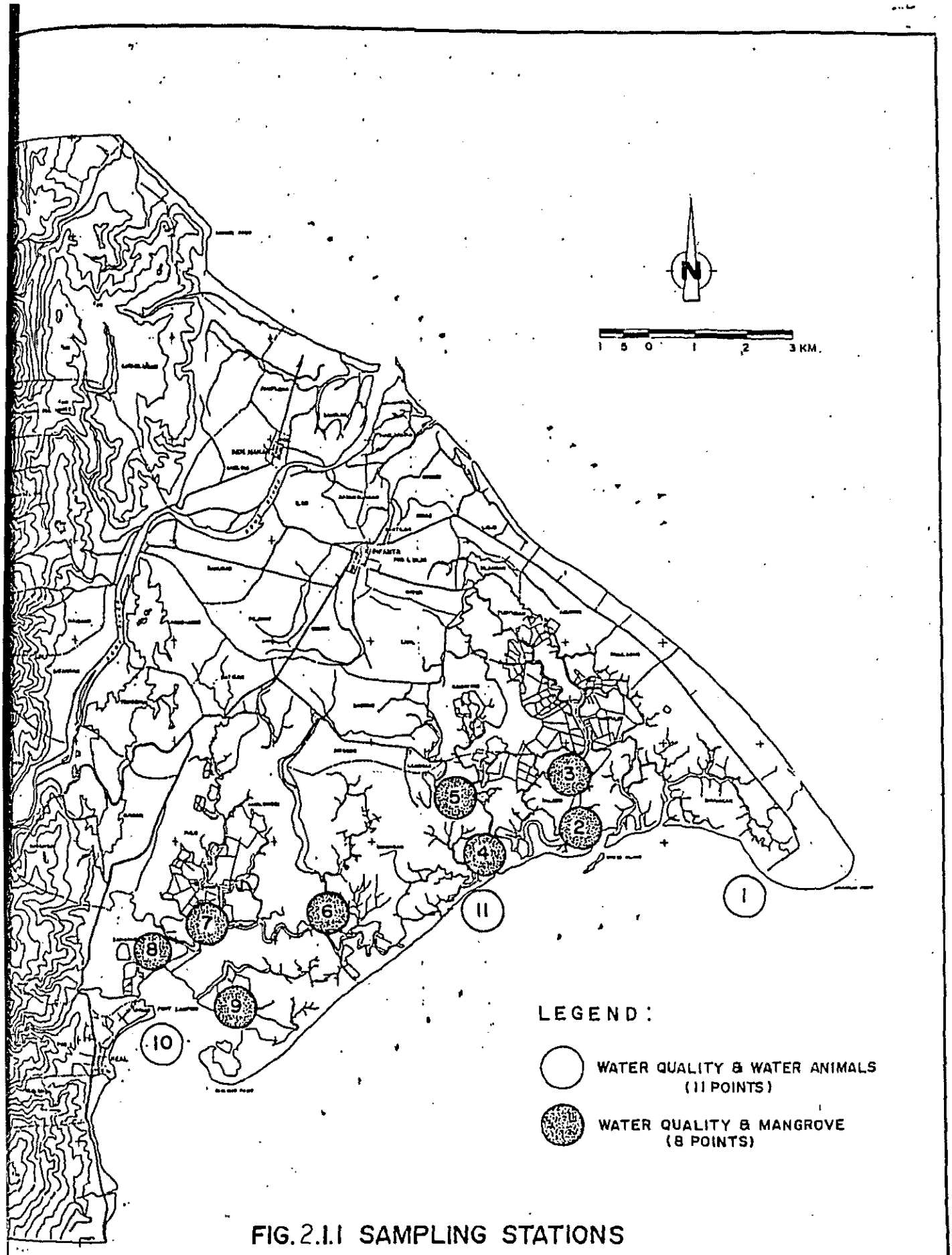


FIG. 2.1.1 SAMPLING STATIONS

THE MASTER PLAN STUDY OF THE INFANTA - REAL AREA URBAN DEVELOPMENT PROJECT

(ii) Water

Water temperature, water depth, chlorine content, dissolved oxygen (DO) and chemical oxygen demand (COD) were measured and a sample of surface water (-0.5 meters) was collected at the eleven (11) locations shown in Figure 2.1.1. The samples were sent to the Laguna Lake Development Authority (LLDA) for analysis.

(iii) Aqua Life

At the eleven (11) locations shown in Figure 2.1.1, aqua life was collected by trawling a larvae net (45-centimeter diameter with XX13 net screen) near the surface at the speed of about two (2) knots for five (5) minutes. The catch was fixed in 5% neutral formalin solution and sent also to LLDA for microscopic identification of species and the determinaion of the variety.

(2) Survey Period

First Survey: June 4 -6, 1984
Second Survey: June 14 - 18, 1984

2) Analysis

(1) Facts Finding

The current status of, or the facts as they exist about, the environmental resources and quality were comprehended with regard to the mangroves, water, and aqua life through field surveys, the research of available materials, and the analyses of the collected samples.

(2) Prediction

The prediction of environmental changes to be brought about by the project implementation has been done as follows:

(i) Mangroves

The ecological significance of the mangrove area to be lost by the development and the impact of its loss upon surrounding mangrove areas were quantitatively estimated and evaluated.

(ii) Water

A water pollution simulation was constructed and used for the quantitative estimation and evaluation of change in water quality that might be caused by the project implementation.

2.2 Present Status

2.2.1 Mangroves

1) Field Survey Findings

The number of mangroves in each plot is shown in Figure 2.2.1 and Table 2.2.1, their distribution characteristics in each plot are shown in Table 2.2.2, and such characteristics of each species are shown in Table 2.2.3.

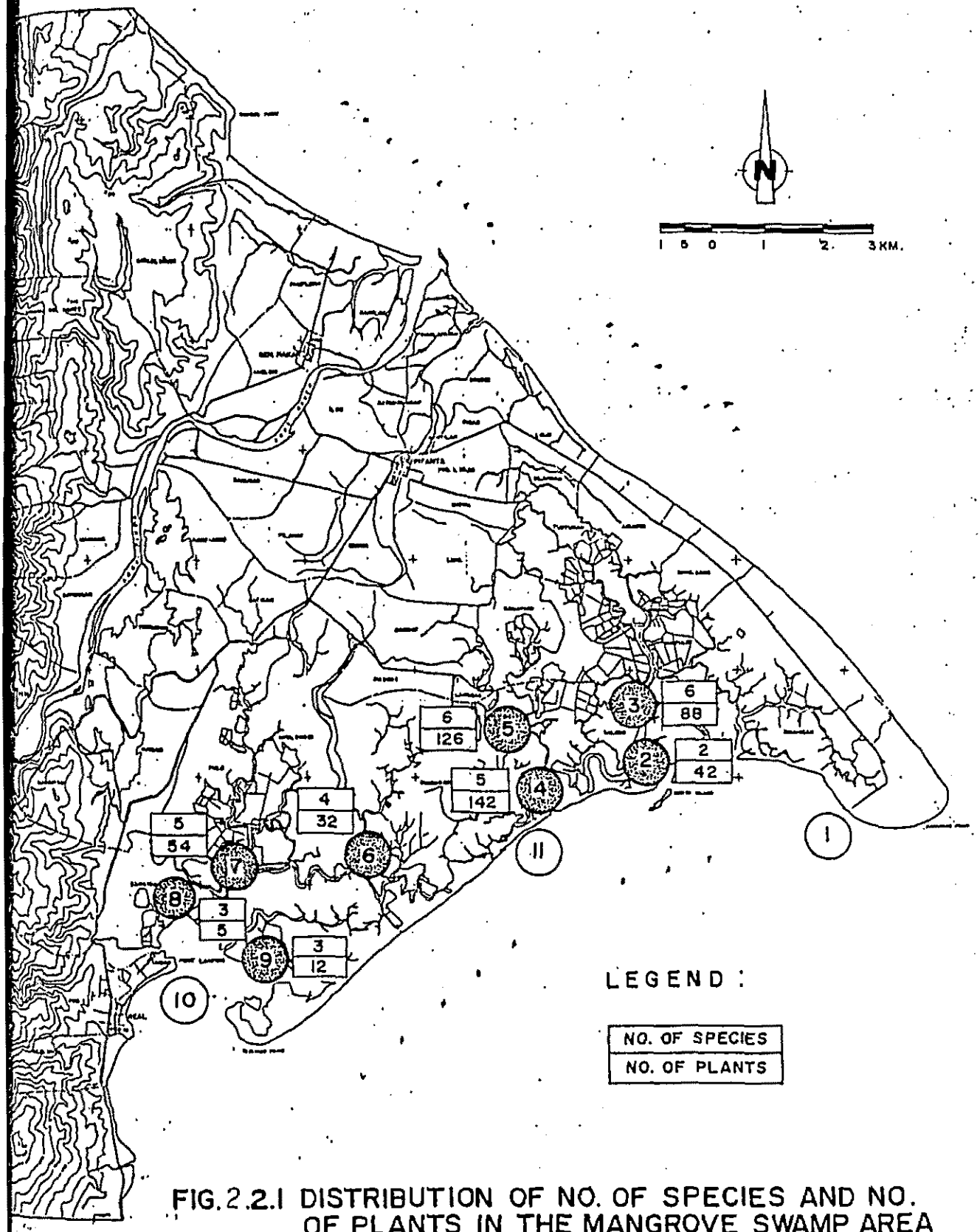


FIG. 2.2.1 DISTRIBUTION OF NO. OF SPECIES AND NO. OF PLANTS IN THE MANGROVE SWAMP AREA

THE MASTER PLAN STUDY OF THE INFANTA - REAL AREA URBAN DEVELOPMENT PROJECT

Table 2.2.1 Summary of the Genus and Individuals Per Genus for the Eight (8) Sampling Plots

GENUS	QUADRAT 2	QUADRAT 3	QUADRAT 4	QUADRAT 5	QUADRAT 6	QUADRAT 7	QUADRAT 8	QUADRAT 9	TOTAL
Rhizophora spp.	12	1	3	1		13		8	38
Brugiera spp.		22	2	27			1		52
Avicennia spp.		3	4	5	3	1	3	3	22
Ceriops spp.	30	27	128	67	1	38			291
Sonneratia spp.							1	1	2
Lumnitzera spp.						1			1
Aegiceras spp.		34	5	23	6				68
Xylocarpus spp.		1		3		1			5
Scyphiphora spp.					22				22
TOTAL	42	88	142	126	32	54	5	12	501

Source: JICA STUDY TEAM

Table 2.2.2 Summarized Characteristics of Quadrants Nos. 2 - 9

Parameters	Q 2	U 3	A 4	D 5	R 6	A 7	T 8	S 9	TOTAL/MEAN MODE/MX
Total No. of Plants	42	88	142	126	32	54	5	12	501
Density (plant/m^2)	1.68	3.52	5.68	5.04	1.28	2.16	0.20	0.48	2.51
Most Abundant Genus	Cer.	Aeg.	Cer.	Cer.	Scy.	Cer.	Avi.	Avi.	Ceriops
Average Ht. (m.)	0.40	1.42	0.53	0.54	0.54	1.00	1.20	1.90	0.94
Tallest Ht. (m.)	2.5	10.0	2.5	7.5	1.5	3.5	2.2	3.5	10.0
Genus of the Tallest Trees	Rhi.	Avi.	Avi.	Avi.	Avi.	Rhi.	Son.	Rhi.	Avi.
Soil Type	L	C-L	C-S	C-L	S-Si -L	S-L	S	S	S-Si-C-L

Legend:

Cer. - Ceriops; Aeg. - Aegiceras; Scy. - Scyphiphora;
Avi. - Avicennia; Rhi. - Rhizophora; Son. - Sonneratia;
L - Loam; C - Clay; S - Sand; Si - Silt

Table 2.2.3 Botanical Characteristics of Mangrove Genus Basing from the Accumulated Data Taken from Quadrant Nos. 2 - 9

SPECIES	Density (plant/ha)	Frequency (%)	Crown Cover (m^2/ha)	Relative Density (%)	Relative Frequency (%)	Relative Crown Cover (%)
Rhizophora	1,900	75.00	596.5	7.58	17.65	22.58
Bruguiera	2,600	50.00	279.5	10.38	11.76	10.58
Avicennia	1,100	87.50	632.5	4.39	20.59	23.94
Ceriops	14,550	75.00	720.00	58.10	17.65	27.26
Sonneratia	100	25.00	47.5	0.40	5.88	1.80
Lumnitzera	50	12.50	11.5	0.19	2.94	0.44
Aegiceras	3,400	50.00	283.5	13.57	11.76	10.73
Xylocarpus	250	37.50	27.5	0.99	8.82	1.04
Scyphiphora	1,100	12.50	43.0	4.39	2.94	1.63
TOTAL	25,050	425.00	2,641.5	99.99	99.99	100.00

Formula:

$$\text{Density} = \frac{\text{Total No. of Plants}}{\text{Total Area Sampled}} \times \text{one hectare}$$

$$\text{Relative Density} = \frac{\text{Density of Genus}}{\text{Density of all Genera}} \times 100$$

$$\text{Frequency} = \frac{\text{No. of Quadrant a Genus Occured}}{\text{Total No. of Quadrant}} \times 100$$

$$\text{Relative Frequency} = \frac{\text{Frequency of One Genus}}{\text{Total Frequency of all Genera}} \times 100$$

$$\text{Crown Cover} = \frac{\text{Total Crown Cover of the Genus}}{} \times \text{one hectare}$$

$$\text{Relative Crown Cover} = \frac{\text{Crown Cover of Genus}}{\text{Total Crown Cover of all Genera}} \times 100$$

(1) Number of Species

The variety of mangroves (identified down to genus) found in the survey slots counted a total of nine genera shown in Table 2.2.2. The highest frequency of appearance was noted of Avicennia, found in seven of the total eight (8) plots. Trees of this genus can grow in a wide variety of surface soil from loamy to sand with a strong adaptability to environment.

The next was Phizophora and Ceriops, found in six (6) out of the eight (8) slots. The rare ones were Lumnitzera and Scyphiphora, which were found only in one slot. The variety was small in coastal area where the surface soil is sandy, while the variety was large in inland swamps. The variety observed while moving from one survey slot to another is believed to have been the seven families, nine genera, and 18 species shown in Table 2.2.4.

(2) Frequency

The total number of mangrove trees found in all plots was 501, and the average density was estimated as 25,050 trees per hectare.

By species, the most frequently appeared was Ceriops, which counted 14,550 trees per hectare, or accounted for 58.1% of all trees of all species. The high frequency of appearance of this species can be explained by its fruitfullness and high survival rate at the sprouting time, as reflected by the fact that each adult tree was seen surrounded by seedling, which made the density of this species heavier. The frequency of other species was low and their respective density and composition ratio to total trees were 3,4000 trees per hectare and 13.6% for Aegiceras, 2,600 trees per hectare and 10.4% for Bruguiera, and 1,900 trees per hectare and 7.6% for Rhisophora.

Table 2.2.4 Mangrove Species* Growing in Infanta-Real Mangrove Areas.

	SPECIES	GENUS	FAMILY
1.	Rhizophora apiculata	Rhizophora	Rhizophoracea
2.	Rhizophora mucronata	Rhizophora	Rhizophoracea
3.	Bruguiera gymnorrhiza	Bruguiera	Rhizophoracea
4.	Bruguiera sexangula	Bruguiera	Rhizophoracea
5.	Bruguiera parviflora	Bruguiera	Rhizophoracea
6.	Ceriops tagal	Ceriops	Rhizophoracea
7.	Ceriops decandra	Ceriops	Rhizophoracea
8.	Avicennia officinalis	Avicennia	Aviceniacea
9.	Avicennia marina	Avicennia	Aviceniacea
10.	Sonneratia alba	Sonneratia	Sonneratiaceae
11.	Sonneratia caseolaris	Sonneratia	Sonneratiaceae
12.	Lumnitzera racemosa	Lumnitzera	Combretaceae
13.	Lumnitzera littorea	Lumnitzera	Combretaceae
14.	Aegiceras floridum	Aegiceras	Myrsinaceae
15.	Aegiceras corniculatum	Aegiceras	Myrsinaceae
16.	Xylocarpus granatum	Xylocarpus	Meliaceae
17.	Xylocarpus mollucensis	Xylocarpus	Meliaceae
18.	Scyphiphora hydrophyllacea	Scyphiphora	Euphorbiaceae

*The species were observed during the survey but not recorded in the field notes.

As for their crown cover, the cover ratio for all survey plots was 2,642 square meters per hectare. The highest value of 720 square meters per hectare (composition ratio, 27.3%) was shown by Ceriops, followed by 632.5 square meters per hectare (composition, 23.9%) of Avicennia, which had a large crown, and 596.5 square meters per hectare (composition, 22.6%) of Rhizophora. Although with a high density, Aegiceras, whose crown was small, showed a small crown cover of 283.5 square meters per hectare (composition, 10.7%).

(3) Tree Height

The average tree height in all plots was 0.94 meters. Tall trees mostly belonged to the genus of Avicennia, the tallest being the 10-meter medium tree. This was because this genus is unfit for firewood, for making charcoal, or for construction material, because it contains much ash and is easily broken, while Rhizophora and Bruguiera are fit for such purposes and are often cut down.

(4) General Condition

The mangroves were observed as generally healthy. In comparison with premeval mangrove forests (such as one in Palawan Island), the observed mangrove trees were generally short regardless of the species. The traces of felling were found ubiquitous, evidencing human interventions and the nature of these mangrove forests as a secondary forest.

(5) Geographical Difference

Of all the survey plots, those located on the delta in Lamon Bay (Stations 8 and 9) showed a vegetation quite different from others. At these stations, only about three species were observed and density ranged only from 0.2 to

0.5 trees per square meters, or about one-tenths the densities at other stations. Moreover, almost no seedlings were seen. This was much because of the topography. While mangroves prefer a muddy soil, the surface soil at these stations was sand with low level of nutrient salt and, under the influence of waves, the sand bottom could easily change, making it difficult for seed to root and sprout.

(6) Mangroves Around Culture Ponds

From the field survey, it was concluded that the development of culture ponds will cause no harmful effect on neighbouring mangroves. In the Philippines, it is required that, when a culture pond is to be developed in mangroves swamp, a distance of at least 20 meters must be retained between the pond embankment and a nearby creek. In fact, mangrove trees in these buffer zones were found healthy and showed no detrimental effect of development, probably partly because the present level of extensive culture results in supplying, in its waste water, and amount of nutrient salt to help the mangrove vegetation. Residual feed used in ponds is also believed to help the vegetation. The only detrimental effect of culture pond development in mangrove swamp, if at least one has to be mentioned, will be the need of cutting the trees down.

(7) Additional Comments

The field survey revealed the existence of no rare species or no forest with a sufficient value for preservation in the mangrove swamps. Their botanical characteristics were of the structure and scale normally found in the Philippines.

2) General Condition

A vegetation distribution map of the entire mangrove swamp area has been made, using aerophotographs.

(1) Vegetation Distribution Map

The vegetation distribution map was made based on the topographical map at the scale of 1:50,000 obtained from the Bureau of Coast and Geodetic Survey (BCGS) and the aerophotographs taken in 1878 from the National Resources Management Center (NRMC). The mangrove swamp was classified into the areas of fishpond, nipa, mangrove dense stand, mangrove sparse stand, and logged-over, and the areal size of each was calculated by dot-grid method. Mangrove tree density was judged from the size of open space between crowns as appeared on the aerophotographs, and where the space was wide was classified sparse stand and where it was narrow was classified dense stand. The vegetation map, thus prepared, is presented in Figure 2.2.2.

(2) Swamp Structure

The area by vegetation structure of the mangrove swamps south of Infanta Road, where the swamps are most developed, is shown in Table 2.2.5.

Mangrove swamps cover a total area of 3,230.5 hectares, which is nearly half (47.4%), the entire land area. The breakdown of this swamp area is as follows: 857.0 hectares (or 12.6%) was mangrove, dense stand; 847.0 hectares (12.4%) was mangrove, sparse stand; 119.5 hectares (1.6%) was logged-over; 707.0 hectares (10.4%) was fishpond; and 700.0 hectares (10.3%) was nipa. The total mangrove area (dense and sparse stands) was 1,704 hectares,

Table 2.2.5 Status, Land Uses and Hectarege of Mangrove and Adjacent areas in Infanta and Real, Quezon.

CLASSFICATION	AREA*(Ha.)	IL	TT
(Mangrove Swamp)			
Mangrove, Dense Stand	857.0	26.5	12.6
Mangrove, Sparse Stand	847.0	26.2	12.4
Logged-Over	119.5	3.7	1.6
Fishpond	707.0	21.9	10.4
Nipa	700.0	21.7	10.3
Sub-Total	1,594.00	1.0	47.4
(Others)			
Rice Paddy	1,594.00	44.5	23.4
Coconut	1,610.00	45.0	23.6
Woods-Brushwoods	360.00	10.0	5.3
Grassland	17.0	0.5	0.2
Sub-Total	3,581.0	100	52.6
Grand Total	6,811.5		100

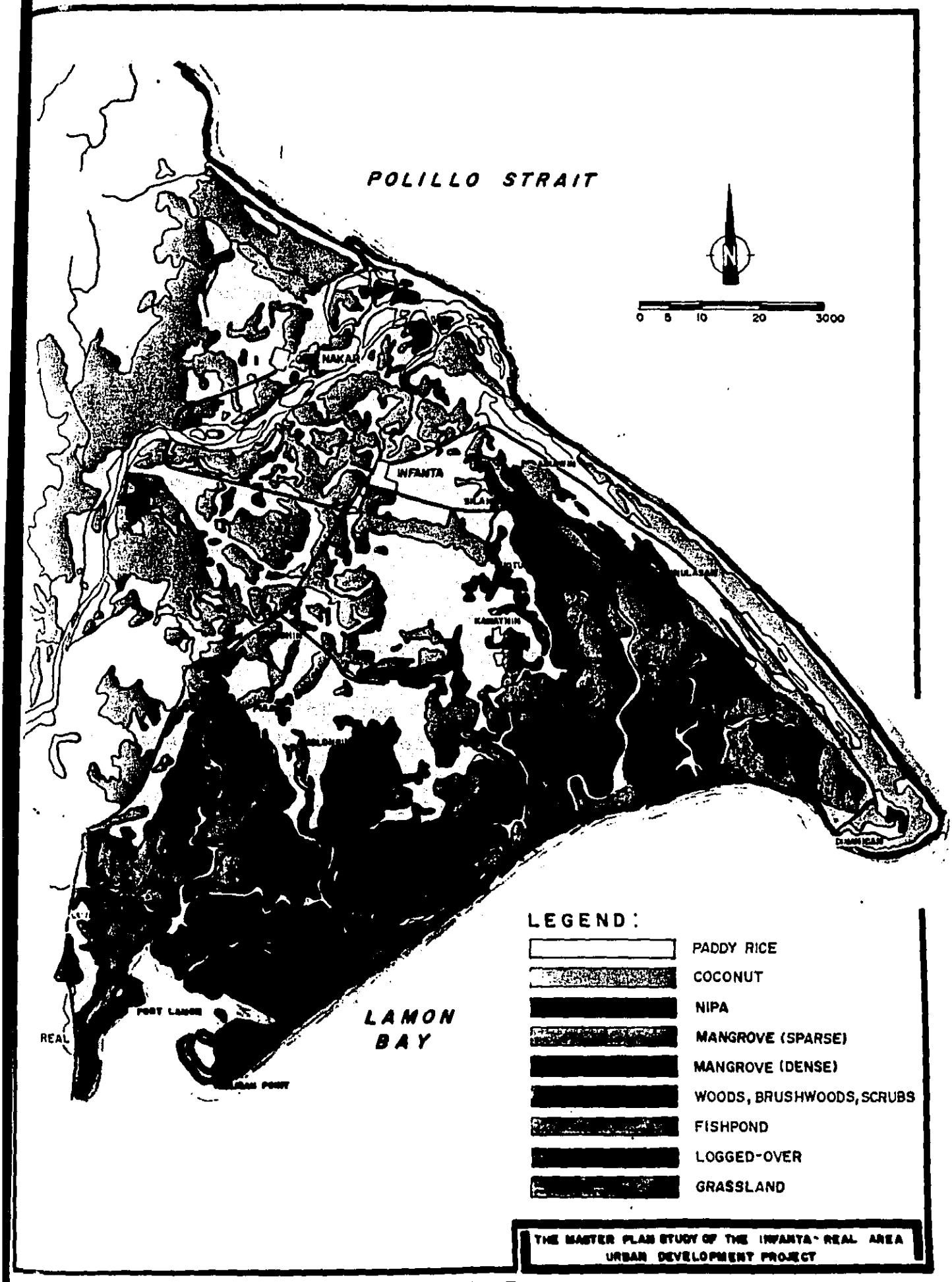


FIG. 2.2.2 VEGETATION OF MANGROVE AREA AND SURROUNDINGS

or 53% of mangrove swamp area, and 25% of the entire land area. Assuming an average density of 3.2 trees per square meter (the average of the densities at Stations 2 through 7 in Table 2.2.2) for the dense stand and that 0.34 trees per square meter (the average of those of Stations 8 and 9, same Table) for the sparse stand, the total number of mangrove trees is estimated as

Approximately	27,420,000 in dense stand area
Approximately	3,880,000 in sparse stand area
Total	30,300,000

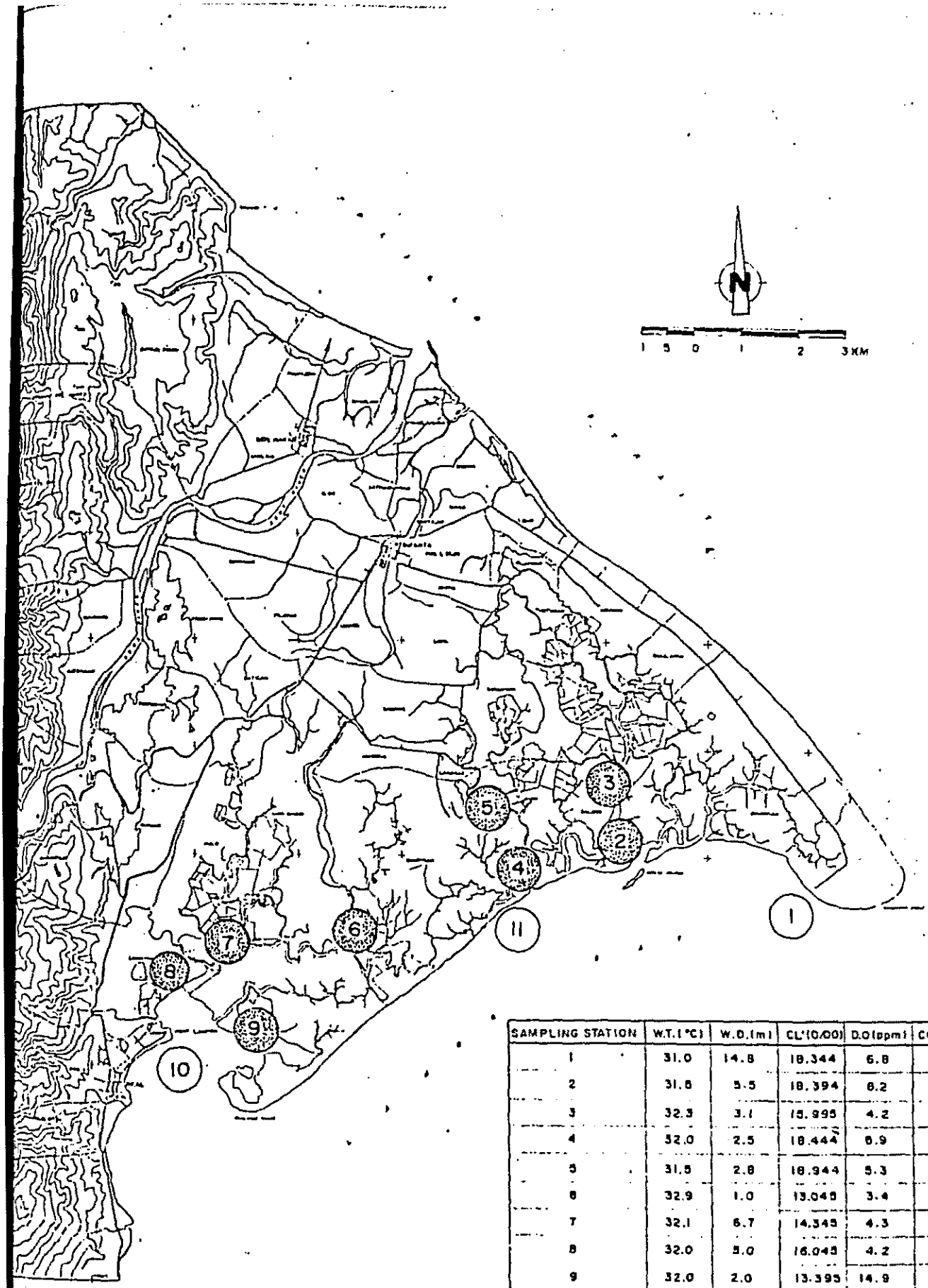
Many dense stand areas and sparse stand areas are found distributed in the inland canal area. The logged-over areas are mostly found near fishponds or paddies, suggesting that mangrove trees were cleared for making them. Fishponds, both in operation and under construction, cover a total area of 707.0 hectares, which accounts for about 21.9% of the overall mangrove swamp area. Most of the fishponds are located in Infanta.

The species of nipa found was Nipa fruitcans. It is estimated that about 30% of the nipa area has since been converted to fishpond, and the distribution of nipa area is gradually shifting toward inland.

2.2.2 Water

1) Survey Findings

The result of analysis of water samples obtained at the field survey is presented in Figure 2.2.3 and Table 2.2.6. The value of COD, as revealed, was about 100 times the value found in the coastal waters of Japan, probably because of difference in the assay method, and, therefore,



SAMPLING STATION	W.T.(°C)	W.D.(m)	CL'(0/00)	D.O(ppm)	COD(ppm)
1	31.0	14.8	18.344	6.8	317
2	31.8	5.5	18.394	8.2	264
3	32.3	3.1	15.995	4.2	475
4	32.0	2.5	18.444	6.9	330
5	31.5	2.8	18.944	5.3	554
6	32.9	1.0	13.045	3.4	436
7	32.1	6.7	14.345	4.3	515
8	32.0	5.0	16.045	4.2	594
9	32.0	2.0	13.395	14.9	330
10	31.2	3.9	18.344	4.4	396
11	32.0	2.5	19.044	4.5	594

THE MASTER PLAN STUDY OF THE INFANTA · REAL AREA URBAN DEVELOPMENT PROJECT

FIG. 2.2.3 RESULTS OF WATER QUALITY

Table 2.2.6 Water Quality

Station	(°c)	(m)	Cl' (0/00)	DO ppm	COD (ppm)
St. 1	31.0	14.8	18,344	6.8	317
2	31.5	5.5	18,394	6.2	264
3	32.3	3.1	15,995	4.2	475
4	32.0	2.5	18,444	5.9	330
5	31.5	2.8	18,944	5.3	544
6	32.9	1.0	13,045	3.4	436
7	32.1	6.7	14,345	4.3	515
8	32.0	5.0	16,045	4.2	594
9	32.0	2.0	13,395	14.9	330
10	31.2	3.9	18,344	4.4	396
11	32.0	2.5	19,044	4.5	594

is regarded for evaluation. Also the abnormal values of chlorine content found at Station 5 and of DO at Station 9 are disregarded.

(1) Water Temperature

Throughout the mangrove swamps, water temperature generally ranged between 30° to 32°C, with the maximum of 32.9°C being measured at Station 6, deep into the canal area.

(2) Water Depth

Water depth varied from the water system to another and from the station to another, but a depth of about three meters was found even deep into the canal area. On the days of survey, the tide was generally on the ebb in the morning and was on the flow in the afternoon (see Figure 2.2.4 for the tide levels) in Legaspi Port in the different hours of those days.

(3) Chlorine Content

The highest chlorine content of 19.044% was observed in the coastal area, and the content declined toward inland area. The lowest content of 13.045% (in rising tide) was shown at Station 6, about three kilometers upstream of Ticlang River.

(4) Dissolved Oxygen

DO ranged from 3.4 to 6.2 milligrams per liter in the coastal area and declined toward inland area. It was 4.4 milligrams per liter in the vicinity of Lamon Port.

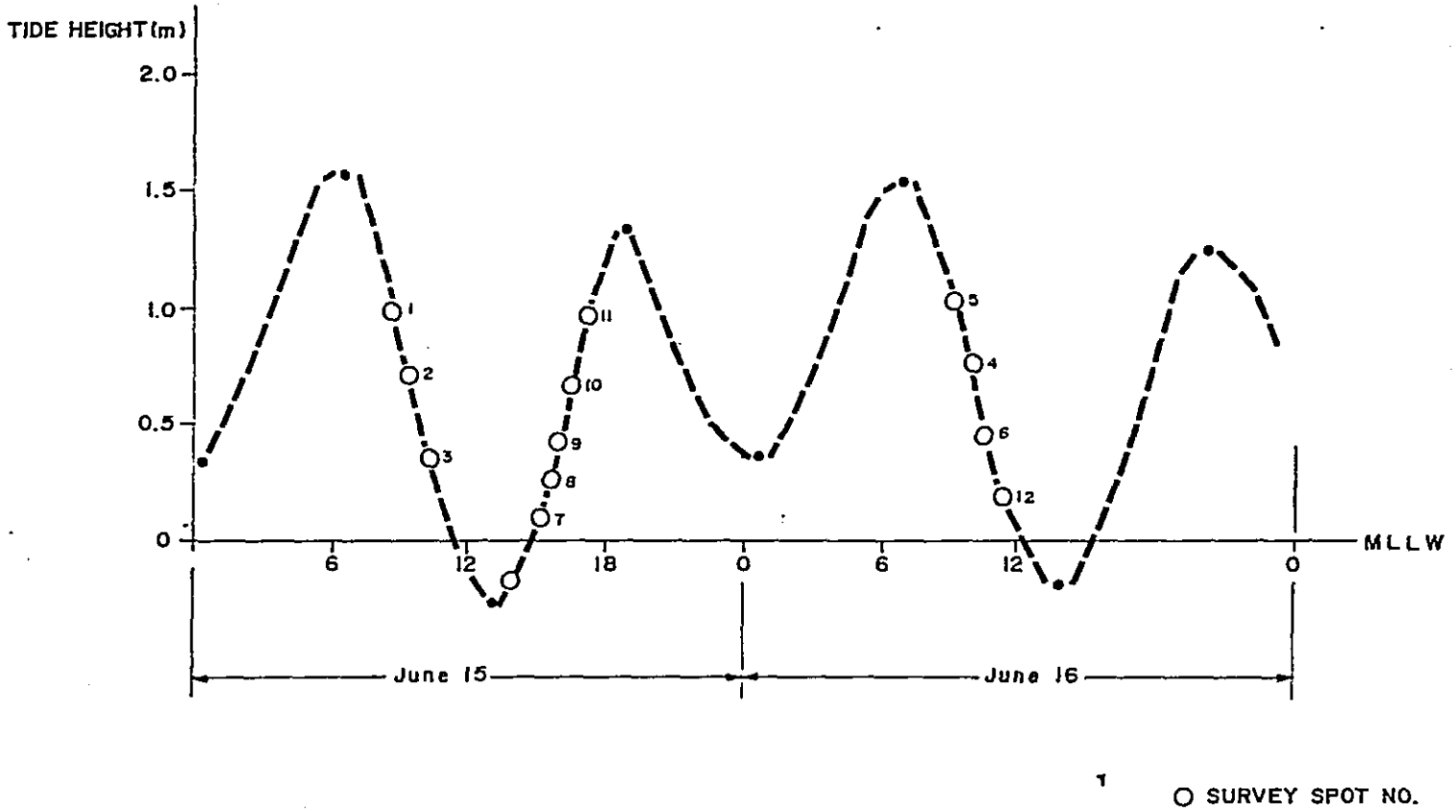


FIG. 2.2.4 TIDE AMPLITUDE OF SURVEY DAYS AT LEGASPI PORT

2) Environmental Standard for Water

Water is classified into plain water, underground water, sea water, and estuarine water by the Filipino Environmental Standard, which further classifies each category into classes of use and stipulated quality parameters and their specifications for each such class. According to this Standard, the swamp water belongs to the SC class (for the culture or nursing of fish and other aqua life) of sea water or estuarine water. Of the parameters surveyed, the water temperature and DO are stipulated for said class by the Standard as follows:

(i) Water Temperature

The maximum rise above natural temperature shall not exceed 3°C outside the mixing zone as determined by the Commission.

(ii) DO... At least 5 milligrams per liter

The water temperature which was measured near the surface cannot be judged by said Standard. The DO specification of the Standard was not satisfied at six stations. The water systems in the vicinity of Lamon Port are particularly far from satisfying the Standard. From the observation during the field survey, however, it is believed that all the water systems satisfied the water clarity standard of at least 1.0 meter visibility.

2.2.3 Aqua Life

1) Survey Findings

Field Survey findings about aqua life are presented in Table 2.2.7. The bottle which contained the sample taken at Station 6 was broken in transit and, therefore, no data is reported for this Station.

(1) Species

A total of 25 different species were found at 10 locations, of which the location showed the highest variety was Station 11 with sixteen (16) species. The species abundantly found at all stations are Nauplius stage and Zoea stage of Pseudodiaptomus sp. Myoidacea order.

The larvae of prawns and crabs, which are useful for fishery purposes, were not found, because the larvae net was trawled through the center of canal.

(2) Density

Density, in terms of the number of individual living beings found by trawling the net for five (5) Minutes (at the speed of about two knots) varied greatly from station to station, but the density is somewhat high in the water systems near Lamon Port. Very low densities were found at Stations 1, 2, and 3.

Table 2.2.7 Result of Biological Analysis (1)

Organisms Identified (#)		IRM 1	IRM 2	IRM 3	IRM 4	IRM 5	IRM 6	IRM 7	IRM 8	IRM 9	IRM 10	IRM 11
Class Crustacea												
Order Copepoda												
Nauplius stage	29			2		1			2	18	2	3
1. Cyclopoidea												
Microcyclop	25				1	21						1
Copilia (larval stage)	1										1	
2. Calanoidea												
Pseudodiaptomus sp_1	969		4	6	41	133		302	27	61	172	222
Pseudodiaptomus sp_2	79					45			1	13	10	10
Euchaeta	11					11						
3. Harpacticoida												
Canthocamptus	4					1				3		
Microsetella	2				1							1
Order Cladocera												
Bosmina	2					1				1		
Order Mysidacea												
Nauplius stage	687			8	20	1		621	21	9	5	1
Zoea stage	1993				153	17		1034	262	316	94	116
Post larval stage of Neomysis	70							5	21	23	12	9
Order Euphausiacea												
furcilia stage	76				15							61
Order Decapoda												
Lucifer	69										34	35
Porcellanidae (larva)	4											4
Paguridae (post larvae)	13										9	4
Palaememenidae (post larvae)	24									2	12	10
Order Ostracoda												
Cypricercus	2			1		1						
Order Cirripedia												
Balanus (nauplius stage)	13							7	4	2		
Cyprid larva	7								1	2	2	2

Table 2.2.7 Result of Biological Analysis (2)

Others										
Rotifera										
Brachionus	1					1				
Echinodermata (planktonic stage)										
Pluteus stage	11					3		3	5	
Ophiopluteus stage	3							1	1	1
Annelida										
Dero	2							2		
Coelenterata (planktonic stage)										
Obelia	1									1
TOTAL		4	17	231	232	1973	339	456	359	481

Remarks: No data on the total volume of sample filtered was provided so that organisms identified are reported as per number instead of #/m.

Some organisms were identified up to family level only because they are undergoing different metamorphic stages thus taxonomic features are not yet well developed.

2) Observation

During the field survey, people were seen all over the place to catch baby prawns with a net, either walking or using a canoe, in mangrove swamps on both sides of the canal, which suggests that the swamps are valuable nursery for aqua life. This is also reflected by the fact that many of the aqua life collected during the field survey were very young. Likewise, a pair of men were often seen walking along the coastal line (particularly from near Lamon Port to Tacligan Port), trawling a net to catch milkfish fingerlings, which suggests that the immediately coastal waters are also valuable nursery for fishery resources.

2.3 Loss of Mangrove Swamp

The mangrove swamp to disappear upon the start of the prawn culture development is reviewed.

1) Magnitude

The magnitude of the mangrove swamp to be lost by the implementation of prawn culture project is estimated first in terms of the areal size of the swamp. By the present land use (see Figure 2.3.1 and Table 2.3.1), the area demanded by the project will consist of 580 hectares (34% of pre-development area) of mangrove area (both dense and sparse stands), 48.7 hectares (69% of same) of fishpond area, 288.5 hectares (41% of same) of nipa area, 47 hectares (39% of same) of logged-over area, for a total of 1,403 hectares, which account for nearly all (93%) of the development land area.

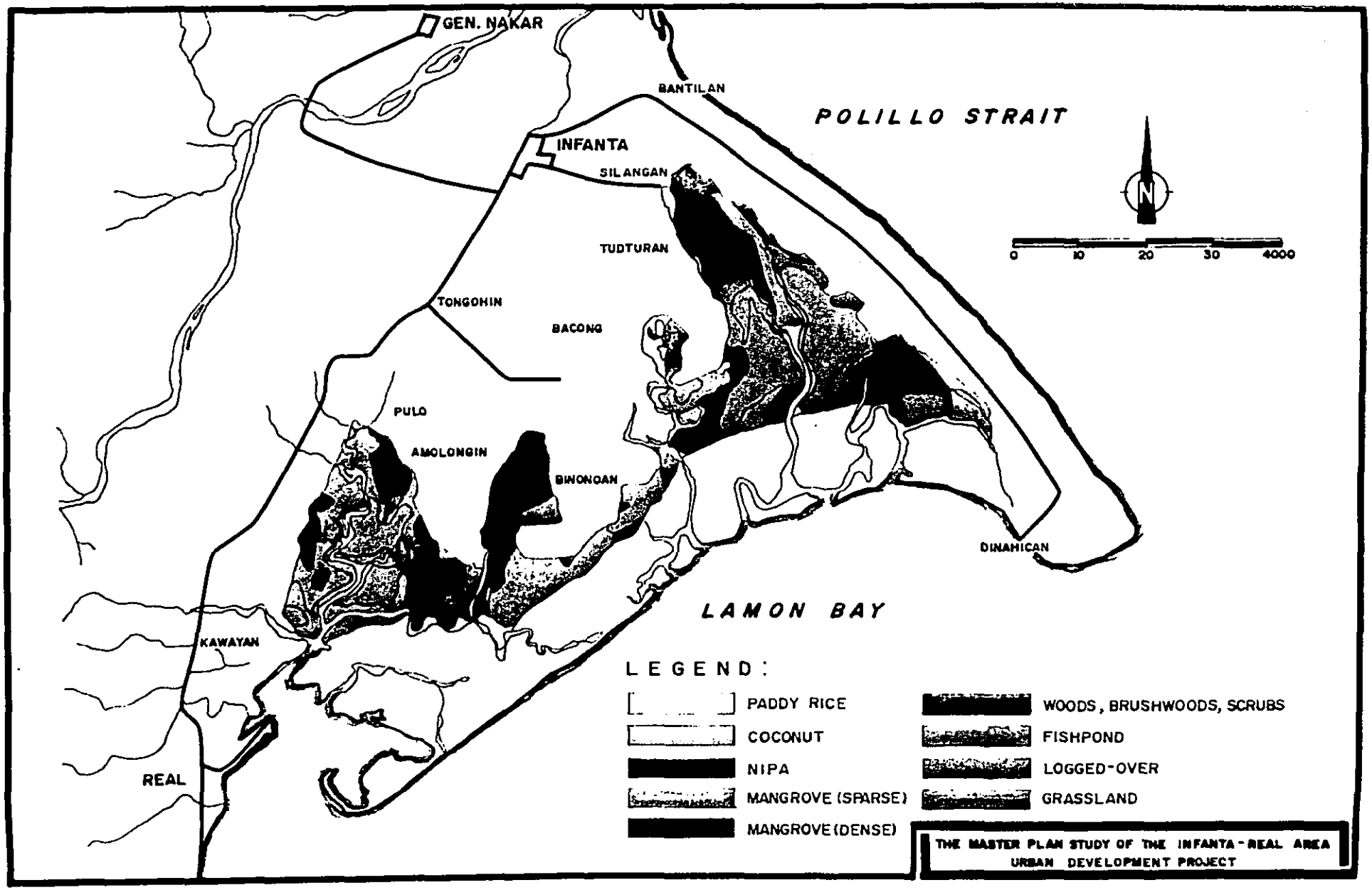


FIG. 2.3.1 STATUS OF PROPOSED FISHPOND DEVELOPMENT AREA

Table 2.3.1 Status Land Uses and Hectarage of Areas Included in the Proposed Fishpond Development of IRM Project

CLASSIFICATION	AREA	AREA	(%)
(Mangrove Swamp)			
Fishpond	707	487.5	69%
Nipa	700	288.5	41%
Mangrove, Sparse Stand	847	373.0	44%
Mangrove, Dense Stand	857	207.0	24%
Logged-Over	119.5	47.0	39%
(Others)			
Rice Paddy	1,594.0	24.0	2%
Coconut	1,610.0	11.0	1%
Woods-Brushwood	360	44.0	12%
Grassland	17.0	16.5	97%
TOTAL	6,811.5	1,677.2	

At the average tree density of 3.2 and 0.34 per square meter for dense and sparse stands, respectively (see under 2.2.1, 2)), the number of mangrove trees to be lost as a result of development is estimated at

In dense stand area.....	6,620,000
In sparse stand area.....	1,270,000
total	7,890,000

2) Impact

Mangroves have the following benefits, which will be lost by the project implementation:

(1) Direct Benefits

(i) Construction Materials

Many species of mangrove trees are hard and have a high water resistency and, therefore, often used as construction materials. Particularly excellent species is Bruguiera gymnorrhiga.

(ii) Fuel

Many species are often used as handy and easily available firewood. Ceriops is the genus which is particularly well used for this purpose.

(iii) Miscellaneous

The bark of certain species of Phizophoraceace, particularly that of Rhizophora genus, is used for leather tanning and as the raw material of orange-brown dyes.

(2) Indirect Benefits

(i) Soil Protection

Mangroves, which grow on the edge of water, have the effect of protecting coastal soil from erosion and corrosion by wind and waves.

(ii) Water Purification

Mangroves have the effect of purifying water through its capability of absorbing and assimilating nutrient salt.

(iii) Ecology Preservation

With its water retention, sunlight absorption and high density vegetation, mangrove swamp constitute an ecology of itself, called the mangrove ecology, which offers a fine nursery of larvae and a fine habitat for birds and animals.

(iv) Scenery

Mangroves often form a beautiful zonation as an important tourism resource.

It is undeniable that the above benefits will be lost by the clearing of mangroves for the conversion of swamps culture ponds. However, the detrimental effect will be limited in view of the following:

(i) The area to be lost contains no rare species of mangrove or no important mangrove forest, while the structure and scenery of the forest to be lost are very common in the Philippines.

(ii) The presence of any rare or valuable animals or plants in the area to be cleared has never been reported.

(iii) The subject swamp area do not fall under either "wilderness area" provided for by Presidential Proclamation No. 2151, whose purpose is the preservation and conservation of mangrove forests, or the "mangrove swamp forest reverses", provided for by Presidential Proclamation No. 2152.

(iv) A mangrove belt of at least 20 meters will be established between a prawn culture pond embankment and a river or major canal in accordance with the provision of Section 16 (8) of Presidential Decree No. 705.

(v) A creek development is designed so as not to hinder connection with and water exchange with rivers, and, therefore, will not lead to the devastation of larvae nursery or animal/bird habitat.

(vi) A very viable water activity will be retained in the buffer mangrove belt because the effect of COD load of waste water from culture ponds will be extremely small on the swamp water, as shown in the next section. This is well supported by the observation, during the field survey, of no abnormality with mangroves in the vicinity of fishponds and by the fact that mangroves are inherrently very fruitful, and grow fast with a wide range of environmental adaptation.

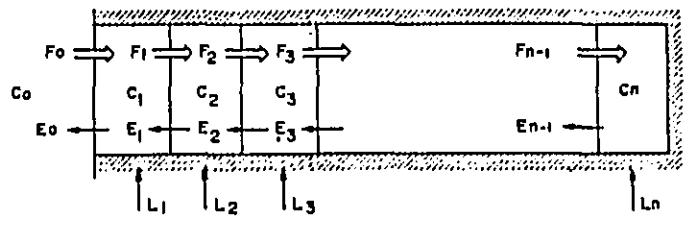
(vii) Scenery as seen from canal side will change little, inasmuch as culture ponds will be shielded by the buffer mangrove belt and because there will be no high-rises to distract the harmony of the scenery.

2.4 Impact on Water

In order to assess the impact of feed residue from prawn culture activity upon the quality of water, a simulation model has been constructed and used for the prediction of COD value as the indicator of such impact.

1) Model

The Model conceives of a dispersion area whose left end is open and the right end is closed, as shown by the figure below. The inside of this area is divided into number of sections, and it is assumed that the fluid of the medium flows cyclically in and out through the left opening. This is in simulation of a narrow bay at whose mouth sea water comes in and out by the rise and fall of tide.



When the fluid with concentration C_0 flows in at the flux F_0 and flows out at the flux E_0, alternately, and designating the concentration in section i in the m-th cycle as C_i^m, the substance load quantity during one cycle as L_i, average volume as V_i, and the flux and reflux of the medium fluid which flow to and from section i and section i+1, alternately as F_i and E_i, respectively, then because the product of multiplication of concentration difference between m-th cycle and m-th - 1 cycle in each section and the volume is equal to the quantity of substance flux and reflux during one cycle, the following equations are sustained:

$$\left.\begin{aligned}
V_1(C_1^m - C_1^{m-1}) &= F_0C_0+E_1C_2^{m-1}+L_1-(F_1+E_0)\,C_1^{m-1}\\
V_2(C_2^m-C_2^{m-1}) &= F_1C_1^{m-1}+E_2C_2^{m-1}+L_2-(F_2+E_1)\,C_2^{m-1}\\
&\vdots\qquad\qquad\qquad\qquad\vdots\\
V_i(C_i^m - C_i^{m-1}) &= F_{i-1}C_{i-1}^{m-1}+E_iC_i^{m-1}+L_i-(F_i+E_{i-1})\,C_i^{m-1}\\
&\vdots\qquad\qquad\qquad\qquad\vdots\\
V_n(C_n^m-C_n^{m-1}) &= F_{n-1}C_{n-1}^{m-1}+L_n-E_{n-1}C_n^{n-1}
\end{aligned}\right\} \quad (1)$$

In constant situation,

$$C_i^m = C_i^m - 1$$

and, therefore, the left side of each of the above equation becomes zero, and the final concentration C_i in each section (although concentration changes during each cycle, concentration at a particular point in time during the cycle is the same as concentration during other cycle. Here C_i^m is written C_i) will be

$$
\begin{aligned}
&(F_1 + E_0)C_1 - E_1C_2 = F_0C_0 + L_1 \\
&- F_1C_1 + (F_2 + E_1)C_2 - E_2C_3 = L_2 \\
&\quad\vdots \qquad\qquad\qquad \vdots \\
&- F_{i-1}C_{i-1} + (F_i + E_{i-1})C_i - E_iC_{i+1} = L_i \\
&\quad\vdots \qquad\qquad\qquad \vdots \\
&- F_{n-1}C_{n-1} + E_{n-1}C_n = L_n
\end{aligned}
\qquad \text{(2)}
$$

So, if the values of quantity of flow of the medium liquid in each section, F_i, E_i, and the substance load quantity L_i are known, the concentration C_i in each section after infinite repetition can be obtained by solving the simultaneous linear equation (2).

If the dispersion area is complicatedly branched rather than the narrow unidimensional one which is conceived of here, the concentration in each section can be calculated as long as the flux quantity of the fluid is clearly known.

2) Parameters

The input data used in the calculation are shown in Table 2.4.1.

(1) Canal Zoning

The zoning of the canal is as shown in Figures 2.4.1 and 2.4.2.

(2) Section Area

Sectional area = canal length X canal width

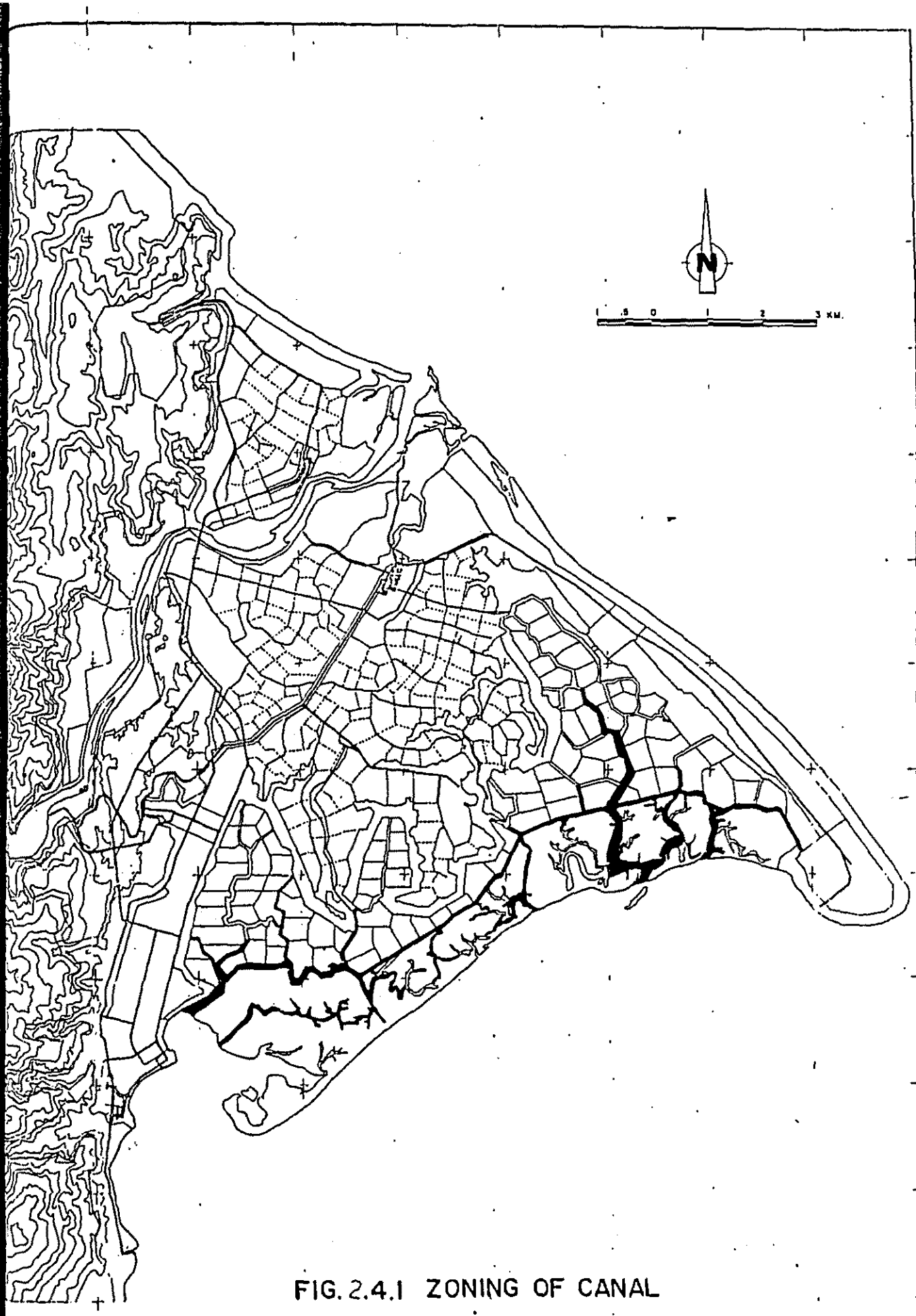


FIG. 2.4.1 ZONING OF CANAL

THE MASTER PLAN STUDY OF THE INFANTA - REAL AREA URBAN DEVELOPMENT PROJECT

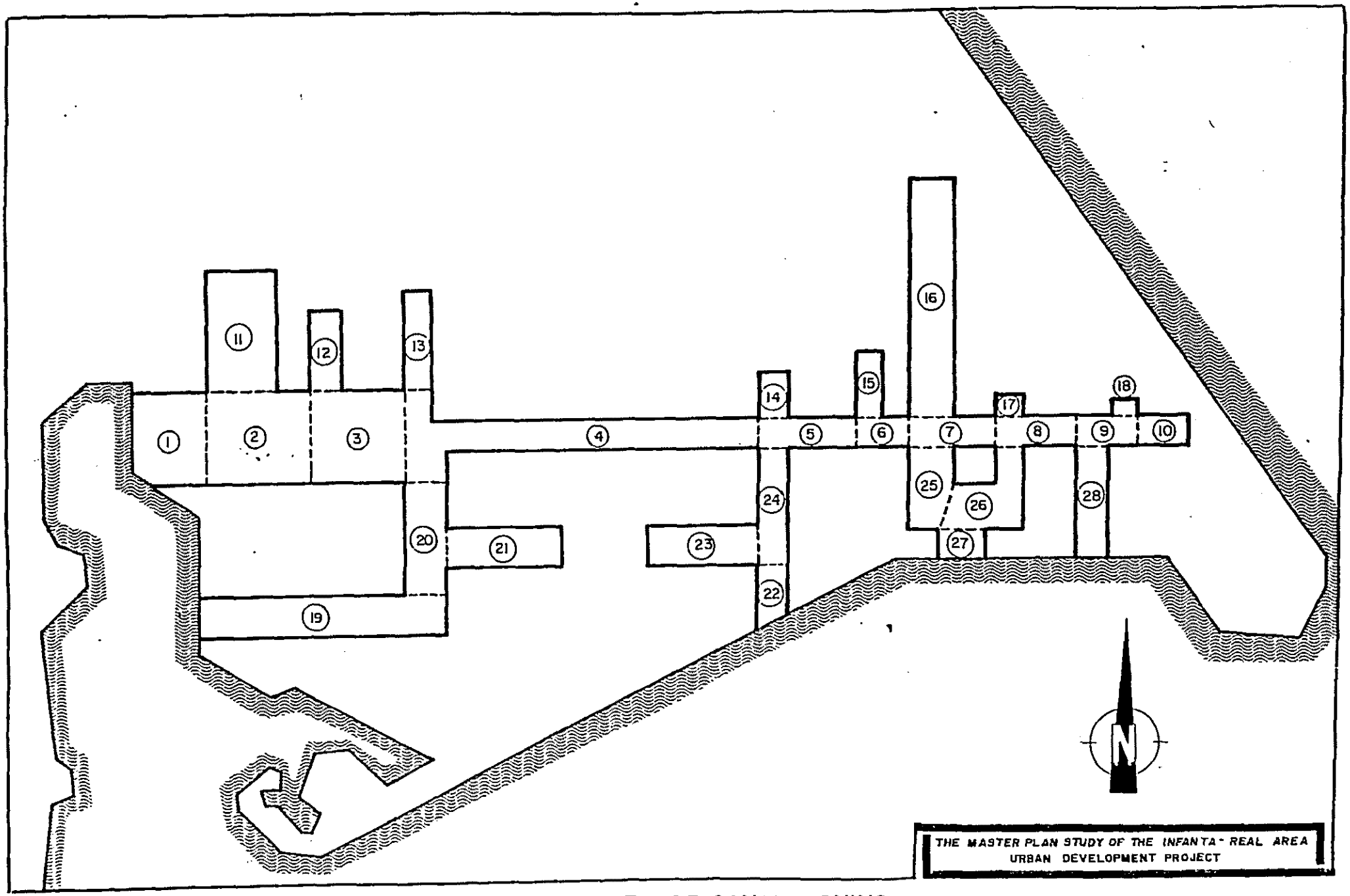


FIG. 2.4.2 MODEL OF CANAL ZONING

Table 2.4.1 Sectional Input Data

Zone No.	Canal Leng. (km)	Canal Width (m)	Area (x1000m^3)	Hinterland Area (ha)	Inflow Pollutant (kl/12h)	Inflow Pure Water (x1000^3/12h)
1	1.0	120	120.0	0	0	0
2	1.2	120	144.0	0	0	0
3	1.2	120	144.0	0	0	0
4	3.9	30	117.0	0	0	0
5	1.1	30	33.0	0	0	0
6	0.4	30	12.0	0	0	0
7	1.1	30	33.0	0	0	0
8	0.9	30	27.0	0	0	0
9	1.0	30	30.0	0	0	0
10	1.0	30	30.0	0	0	0
11	1.4	100	140.0	300	139	34.0
12	0.8	25	20.0	100	46	11.3
13	1.1	30	33.0	200	93	22.6
14	0.5	25	12.5	100	46	11.3
15	0.7	25	17.5	100	46	11.6
16	2.3	70	161.0	600	278	68.0
17	0.7	35	24.5	50	23	5.6
18	0.2	25	5.0	50	23	5.6
19	5.6	40	224.0	0	0	0
20	0.6	15	9.0	0	0	0
21	1.0	25	25.0	0	0	0
22	1.0	40	40.0	0	0	0
23	1.0	25	25.0	0	0	0
24	0.6	40	24.0	0	0	0
25	0.7	85	59.5	0	0	0
26	1.0	40	40.0	0	0	0
27	0.1	220	22.0	0	0	0
28	1.0	40	40.0	0	0	0
TOTAL				1,500	694	1,700

	Trunk Canal	Feeder Canal
Newly Developed Section	30 m	25 m
Existing Section	existing width	

(3) Inflow Load

Assumption 1: That approximately 10% of feed is exhausted into canal water as residue (as estimated from the experimentation result on young yellowtail), and the quantity of this feed residue is understood as the COD load.

Assumption 2: That the quantity of feed given equals the quantity of production, that is the feed-prawn conversion ratio of 1.0 is assumed.

(i) Production Quantity

The production of 5,000 tons per 1,500 hectares per year with 360 operational days per year is assumed. In other words, a daily production of 9.26 kilograms per hectare is assumed.

(ii) Feed Quantity

Feed quantity = production quantity x 1.0
= 9.26 Kg/Ha./Day

(iii) COD Load

Load = Feed quantity x 0.1 = 0.926 Kg/Ha./Day
Load inflow = Load x Feeding Area
= Load x areal size of the hinterland of the point of each load input

(4) Plain Water Influx

Of the water demand estimated for the year 2000, it is assumed that 50% of irrigation water will flow into canals. The total water discharge volume is distributed by the ratio of area.

Water Demand (Year 2000)

Item	Volume (m /sec)
Domestic	0.278
Commercial	0.374
Industrial	0.828
Irrigation	7.900

(5) Boundary COD Concentration

Two (2) possible cases have been conceived of as follows:

Case 1: A concentration of 3 ppm is assumed for Real Port and 2 ppm for all other boundaries.

Case 2: A concentration of 2 ppm is assumed for all boundaries.

(6) Tidal Amplitude

The following three (3) cases have been thought of in view of the tidal level in Legaspi Port and of the 1984 Tidal Level Table:

Case 1: Spring tide ..... 2.0 meters
Case 2: Medium tide ..... 1.5 meters
Case 3: Neap tide ..... 0.5 meters

3) Calculation Result

The calculation result (shown in Table 2.4.2) indicates that the effect of COD load from prawn culture ponds on canal water is believed to be extremely limited.

In the east-west trunk canal, the concentration rises toward east (Sections 1 through 10) and reaches the maximum in the branch canal in the deepest east (Section 18), in all of the six cases used for calculation. The maximum value of 5.4 ppm is shown in Case 3, which assumes the worst situation, and this concentration is about double the boundary concentrations. This would be the quality of water which is well within the "maximum concentration causing no unpleasant feeling in the people's daily living (including taking a walk on shore, etc.)" as defined for sea water class C by the Japanese Environmental Standard for Water. The calculated concentration level will be so low that prawns and crabs, as well as fishes, which live in the canals will not be affected and that even larvae will be affected only very slightly.

Table 2.4.2 COD DENSITY
(Simulation Results)

Zone	1	2	3	4	5	6
1	3.0	3.1	3.2	2.1	2.1	2.4
2	3.1	3.1	3.4	2.2	2.3	2.8
3	3.1	3.1	3.6	2.3	2.4	3.1
4	3.1	3.1	3.7	2.4	2.6	3.4
5	2.8	3.0	3.7	2.6	2.7	3.7
6	2.9	3.0	3.8	2.7	2.9	3.8
7	2.8	3.0	3.9	2.8	3.0	3.9
8	2.6	2.7	3.4	2.5	2.7	3.4
9	2.4	2.5	3.0	2.4	2.5	3.0
10	2.4	2.5	3.0	2.4	2.5	3.0
11	3.2	3.3	3.7	2.4	2.6	3.4
12	3.4	3.5	4.1	2.8	3.0	4.2
13	3.4	3.6	4.3	3.0	3.3	4.4
14	3.4	3.6	4.3	3.2	3.5	4.4
15	3.2	3.5	4.0	3.1	3.4	4.0
16	3.1	3.3	4.1	3.1	3.3	4.1
17	2.8	2.9	3.7	2.7	2.9	3.7
18	3.4	3.7	5.4	3.3	3.7	5.4
19	3.0	3.0	3.0	2.0	2.0	2.1
20	3.0	3.0	3.3	2.1	2.2	2.5
21	3.0	3.0	3.3	2.1	2.2	2.5
22	2.2	2.0	2.6	2.1	2.2	2.6
23	2.5	2.5	3.2	2.3	2.4	3.1
24	2.5	2.5	3.2	2.3	2.4	3.1
25	2.6	2.7	3.6	2.6	2.7	3.6
26	2.4	2.5	3.2	2.4	2.5	3.2
27	2.2	2.3	2.7	2.2	2.2	2.7
28	2.1	2.2	2.4	2.1	2.2	2.4

2.5 Total Assessment

2.5.1 Measures for Environment Preservation

The policies and measures for environment preservation which have been considered at various steps of planning are as follows:

(1) Suitability Assessment

In assessing the land use suitability of the planning area, the policy of nature preservation, together with the policies of agricultural and industrial development has been formulated.

In order to preserve the existing topography and natural environment, the following measures shall be needed:

(i) Seashore Preservation;

(ii) Mangrove Swamp Preservation;

(iii) Mountainous Preservation.

(2) Basic Development/Preservation Policy

Based on the above policies, the following policies have been prepared as the basic development/preservation for the whole development:

(i) The plains of Infanta and the flat land of General Nakar shall be developed/preserved as an agriculture promotion area;

(ii) Urban development shall be actively promoted in districts along Infanta Road rather than those of (i) above;

(iii) The coastal, swamp and hilly areas shall be preserved; however:

i) The recreational, tourism, fishing and activities utilizing resources shall be allowed but not to the extent of damaging the natural environment; and

ii) That particularly in the parts of nature preservation area where urban development is strongly needed, urban development shall be achieved while maintaining harmony with the natural environment.

(3) Land Use Planning

In the land use plan, the agriculture and forestry land shall be preserved as productive greens while the coastal area, the swamps and the hills shall be preserved as the natural environment preservation area.

Consequently, the following three (3) zones shall be created in the natural environment preservation area for maintaining harmony between preservation and development:

(i) Preservation Greens

Nature shall be left untouched (in terms of topography, land, green, scenery, etc.), and shall be designated as one of the following:

(a) coastal preservation greens (200 meters width strip on coast);

(b) swamp preservation green (100 to 200 meters width strip on the fringe of the swamp or 500 meters width (200 to 300 meters width strip of slop along on the fringe of the hill land); and

(d) Agos River Strip of 100 to 200 meters width.

(ii) Natural Environment Preservation Area (Scenic Zone)

Recreational and other development shall be allowed but not to the extent of damaging nature. Developable areas shall be controlled, and development work shall be required to accompany the restoration of greens and nature. The Seaside recreation zone in the coastal preservation area, the scenic housing zone, and hill institutional area shall fall under this category.

(iii) Park Area

Facilities and buildings to support the utilization of the nature for seaports, recreations, scientific research, and other purposes must be concentratedly located rather than scattered because these could destroy nature. Land for such facilities shall be secured in coastal parts of Dinahican, Abiwain and Catablingan.

(4) Project Formulation

At the stage of project formulation, the degree of concern, and measures for environmental preservation of each project varies depending on the characteristics and functions of each project. However, all the projects have been formulated based on the measures and policies explained from (1) to (3) above. In principle, therefore, adequate measures and concern for the environment preservation are considered and included in each project of the IRM Urban Development.

2.5.2 Forecast of Impact

After forecasting various impacts of the development which have been formulated on the basis of aforementioned discussions in 2.5.1, the following impacts are then classified:

(i) Diminutive Mangrove Area and its Impact

The diminution of the mangrove area (1500 ha) due to the promotion of prawn culture projects would decrease the value of mangrove such as its direct use i.e., construction material, and fuel; and indirect, i.e., soil erosion protection, water purification, preservation of eco-system, scenic landscape, etc. Therefore, no positive impact in the diminution of mangrove shall be expected. However, its negative impact to the area's natural environment shall be considered minimal due to the following reasons:

i) There is no previous species and vegetations of mangrove in the diminutive area, and its composition and landscape are common in the Philippines both in size and structure;

ii) There is no previous animal or plant species reported to exist in the area;

iii) The subject mangrove area does not fall under either "Wilderness Area" (Proclamation No. 2151 for preservation and conservation of mangrove forest) or "Mangrove Swamp Forest Preserves" (Proclamation No. 2152).

iv) Based on the regulations in P.D. 705 (Sec. 16.(8)), at least 20 meters buffer mangrove zone shall be prepared between the embankment (main dikes) of the culture pond and river/drainage channel.

v) The channel shall be designed so as to conform to the water flow and exchange of the rivers. Therefore, extreme demolition of the living environment for fly and larvae due to cutting and disappearance of water systems.

vi) The buffer mangrove zones shall be able to maintain their vital activities due to the fact, as clarified in the next section, that the COD load discharged from the prawn culture pond shall not heavily affect the water quality. This was proven based on the observation from the field survey that the mangrove near the existing fish ponds maintain their vital activities; and also based on the mangrove's ecological characteristics of high adaptability to its environment, its prolific and fast growth.

vii) Scenery from the channel side shall not change because of the buffer mangrove zone covering the culture ponds, and that there are no high rise building structures which tend to give negative impact to the area's natural landscape.

(ii) Change and Impact on Water Quality

Impact on water quality of surrounding channels to be polluted by feeding dregs of the prawn culture projects has been analyzed using a simulation model (linear box) with COD as the indicator under the following assumptions:

(1) COD Load = (Feeding Load) X 0.1 (Equals dregs of Feeding

(2) Fresh Water Inflow = (Irrigation Water Volume) X 0.5 (Equals reaching coefficient)

Six (6) simulation cases were conducted for different boundary concentration and tidal levels. Every case showed the same tendency that the concentration of COD increases as the area goes from west to east along the main east-west channel and reaches its maximum value at the deepest tributary from the sea.

The maximum COD value among the six (6) cases was that of Case 3 with the worst conditions, which was 5.4 ppm. This value is only twice as that of the outside sea water, and fall under the category "Open Sea Grade C" of the Japanese Water Quality Environment Standard defined as "sufficient level which shall not cause a nuisance to daily living (like walking on the beach)". Moreover, this COD value level shall not cause any negative effect on the area's aquatic animals such as fish, crab, prawn, and their fly and larvae. Therefore, in consideration of the above discussions, the impact on the water quality by the COD load from the prawn culture projects shall be considered at a minimal level.

(iii) Others

The assessment matrix was formulated by each project with various enviroment impact assessment items. Then qualitative analysis was conducted using geographical area, duration, and strength of impact as criteria. Based on the overall assessment, with the exceptions of (i), (ii) discussions, and the transition to urban environment of the urban development projects, the impact to the area's natural environment shall be at a minimal level.

2.5.3 Conclusion

Taking all the analyses and assessment into consideration, it has been clarified that the IRM Urban Development has been planned based on the appropriate policies and measures for the environment preservation at its various planning stages. Consequently, at the end of its implementation stage, its impact against the area's natural environment shall be at a minimal level.

Therefore, the implementation of the development plan shall cause, in the standpoint view of environment assessment, no critical negative impact on the area's environment.