

# 3

## **PLANNING GOALS AND DEVELOPMENT POLICIES**



## 3.1 Appropriate Urban Image

The goal of the IRM urban development is to establish the "Model Urban Center for Agro-Forestry and Marine Product Industries" which may be a practical model of urban development in the Philippines for the 21st century by integrating the rural and urban settings. This new city shall be the urban center having the northern part of Luzon Island, eastern coastal region, including Polilio Islands, and Pacific waters within its area of influence. It shall serve as a base for the concentration and distribution of people, goods, money, and information between the region and other external areas.

At present, the cities in GCLA functioning as urban centers with agro-forestry characteristics are Lucena City, the Provincial Capital of Quezon, and Batangas City, the Provincial Capital of Batangas. These two (2) cities are located along the coast and provide a landing place for surface fishing, as well as a service base for their surrounding areas. However, Lucena City has the characteristic of a relatively extensive life base while Batangas City has the profile of a physical distribution base and industrial city.

"A Model Urban Center for Agro-Forestry and Marine Product Industries", the goal of IRM is to adopt the roles played by these two (2) cities in the south-western part of Luzon Island in its sphere in the Eastern Coastal Region. It shall have the characteristics of both cities.

The economic base and social image of IRM and the characteristics of city formation are summarized as follows:

- (i) Improvement in productivity by applying the most up-to-date technology to agriculture, forestry, fisheries, and especially rice culture, coconut production, surface fishing, and aquaculture.
- (ii) Building-up of an industrial complex through simultaneous development of agriculture, forestry, and fisheries related research institutions, distribution related industry and processing industry.
- (iii) Establishment of the first resort area for Filipinos in the East Coast of Luzon Island.
- (iv) Environmental harmony in terms of urban and agricultural land use and water utilization.
- (v) Creation of a social system where rural and urban societies are fused.
- (vi) Creation of a new culture based on the historical and traditional features of the northern area of Quezon Province.
- (vii) Formation of a central city with an extensive biosphere by combining with a new regional administration system.
- (viii) Promotion of its self-developing ability.

## 3.2 Development Policies and Procedures

To establish a new city in a presently undeveloped area, it is necessary to call for some socio-economic project aimed at triggering a population concentration in that area by utilizing its locational conditions and development potentials to develop the related industries with the improvement of transport and communication networks, and to promote the improvement of the town area and urban facilities corresponding to the growth of population.

From the development potentials of IRM, as the leading projects with prime urban development are agro-forestry and fishing distribution and processing industries complex, pulp and paper milling industry, and tourism development, and as preconditions, therefore, the improvement of transport facilities like roads and ports shall be considered.

Taking into account the given situation in this area with regard to availability of resources and time frame, it is considered to be most realistic and strategic that the complex of agro-fishery processing industry and distribution industry is established first as the leading project, together with the development of the tourism industry. Then, the new potential for industrial development shall follow through the process of urban development.

Setting the goal for the realization of "Model Urban Center for Agro-Forestry and Marine Product Industries" as target of IRM in year 2000, the procedure for achieving that goal are as follows:

- (i) Improve the basic conditions by 1987, end of present five year plan;
- (ii) Form an initial image of a self-supporting city during the next five year plan, 1988-1992; and
- (iii) Raise the function of the urban center during the period until 2000.

### First Phase (Base Preparation Period)

The main targets of this period are the formation of a developing core by improvement of roads, ports, fishing ports, and port town (industry, distribution and housing), the technical and enterprising demonstration of productivity raising in agro-fishery industries, and the invitation of agro-fishery product processing industries. In addition, arrangement of temporary telecommunications network, basic distribution facilities (cold storage, ice plant, etc) and tourism bases shall be objectives. In social work, publicity and hearings are important for obtaining the consensus of the population regarding the future image of IRM.

For that reason, it shall be required to determine the development scale and project contents in relation to the development core as soon as possible

in the initial period by conducting feasibility studies. This way, the project can start and proposals/recommendations shall be ready by the end of the period.

### Second Phase (Take-Off Period)

In this stage, on the basis of the base preparations, the promotion of agro-fishery production, establishment and operation of processing industries, consolidation of distribution related industries, and development of beach recreation facilities shall be carried out. To cope with the quick growth of urban population and mobility increase, the development of new housing zones, improvement of principal roads in city, improvement of public transportation and improvement of supply and disposal systems in major town areas are necessary.

In order to harness the social mobilization due to rapid urbanization (change in land use, water surface use, in-migration, tourists, and construction workers, consumption increase, etc.) for the formation of a self-supporting city, clear directions shall be shown and necessary systematic measures and improvement of major facilities are to be implemented in relation to environmental control, harmonization of the different classes of population, systematic consolidation of urban facilities, and adequate correspondence of administration to needs of population.

### Third Phase (Advancement Period)

In the economic-industrial viewpoint with consolidation of leading industries, the introduction of new industries is required. At the present stage, pulp/paper industry may be presumed but it is necessary to choose the most suitable one in accordance with the growing process of IRM and the socio-economic trend from the present.

The improvement of the central commercial zone shall occur during this Period to enhance the commercial function adequate for an urban center.

It shall also be required to develop new housing zones, redevelop old towns, and enlarge the capacity of supply and disposal facilities to cope with the population growth and increase of urban activities.

At the same time, all other urban facilities shall respond proportionately to this growth.

# 4

## DEFINITION OF SOCIO - ECONOMIC FRAMEWORK



# 4.1 Target Population

## 4.1.1 Forecast of Population Trends

The population of IRM was 44,420 persons as of December, 1983, which accounted for 3/4 of the total population of the three (3) municipalities including the mountain area. The comparison of shares in the population of the IRM between 1975 and 1980 against the total population of the three (3) municipalities, according to the census, reveals some increase from 75% to 76.8%. The increase is attributed to the excess inflow of population into the IRM from the mountain area as mentioned in Chapter 2. The IRM population tend to migrate to Metro Manila and other urban areas, showing a pattern of population outflows to urban areas in search of education and job opportunities on the part of the male population, and subsequent outflow of the female population going after the males for marriage.

The overall population trend of the Philippines shows a sharp decline in birth rate due to the population control program. According to the forecast by NCSO, the reproduction rate shall drop down to one (1) or so on the national average by the year 2000. Based on past data of the decline in birth rate and trends of population distribution among municipalities, NCSO forecasts that the total population of the three (3) municipalities would become 80,000 or so by the year 2000.

Estimates of future populations according to the trends mentioned in the foregoing are as listed in Table 4.1.1.

**Table 4.1.1 FUTURE POPULATION OF IRM BY TREND**

	(Person, %)		
	1983	1992	2000
0-14 years	17,370 (39.1)	19,800 (35.6)	19,090 (29.7)
15-64 years	25,720 (57.9)	33,420 (60.1)	41,510 (64.6)
65 yrs. & over	1,330 ( 3.0)	2,390 ( 4.3)	3,660 ( 5.7)
Total	44,420(100.0)	55,610(100.0)	64,260(100.0)

Source: Estimated by JICA Study Team

According to the estimates on the table, the future population in IRM would roughly be 56,000 by 1992, and 64,000 or so by 2000, accounting for approximately 80% of the total population of the three municipalities. As for the age structure, the childhood population shall show a sharp decline because of the outflow of the young and the reduced birth rate, with a net reduction in the 1990s.

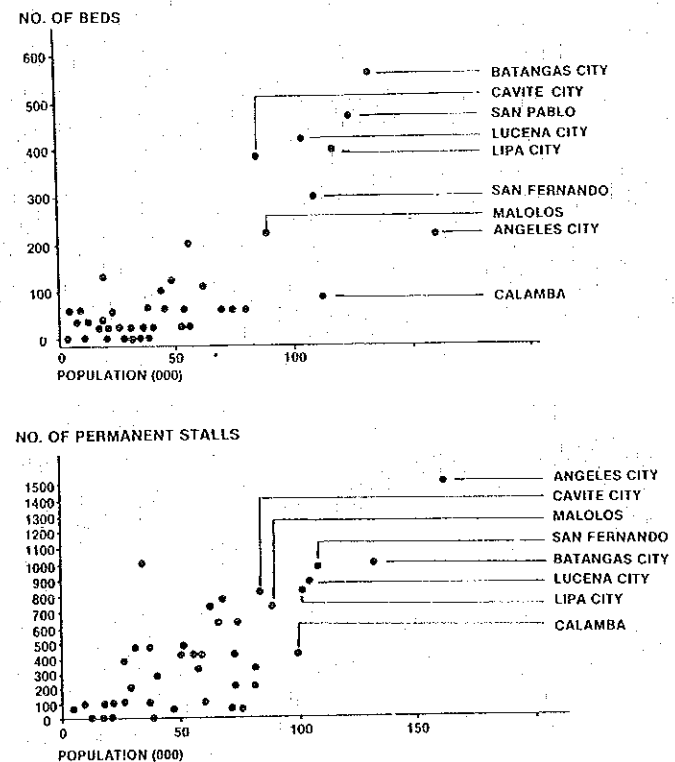
The elderly population, on the other hand, shall have a dramatic threefold increase by the year 2000 compared with the present.

## 4.1.2 Population Size in Urban Centers

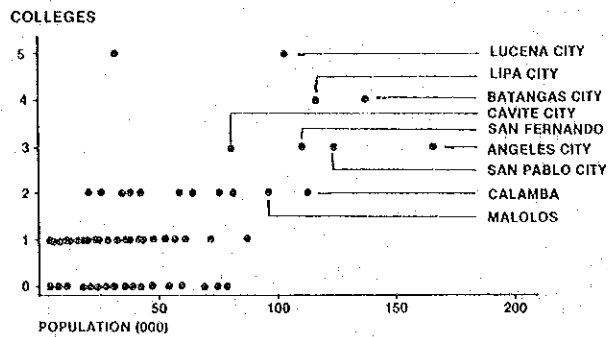
In the Comprehensive Human Settlements Plan of the Ministry of Human Settlements, the scale of cities in the year 2000 is specified as 250,000 persons to 1,000,000 persons for each regional center and a sub-center of 20,000 to 80,000 persons for each primary and secondary urban center. In GCLA, Metro Manila holds the designation of a regional center under which seven (7) cities are designated as urban centers.

"Urban Center" refers to a self-contained and self-sustained community which must be capable of providing not only employment opportunities for urban type industries but also opportunities for purchasing daily necessities, high level education, and other social services including medical and cultural services of high quality for residents in the area concerned. In order to do so, population of a certain size to back up such functions is required.

The current relationship between the size of urban population and urban services shows that the degree of sufficiency of urban facilities shall increase rapidly when the population exceeds 100,000 persons or so. This means that each city with a population of 100,000 or more is providing a higher level of urban services supported by its particular economic foundation with sufficient functions to serve as an urban center (Fig. 4.1.1).



**FIG. 4.1.1 NUCLEUS FACILITIES/POPULATION SIZE**



Of the seven cities in GCLA mentioned above, the four cities of Batangas, San Pablo, Lipa, and Lucena have populations in excess of 100,000 persons. These cities, except Lipa, are capitals of their respective provinces, with centralized administrative functions. Although rural areas are also included in the administrative region of such a city, it is obvious that a concentrated population of at least 100,000 is required in the urban areas.

Therefore, in order for a city to function as an urban center, the accumulation of roughly 100,000 persons is necessary for the size of the urban population.

### 4.1.3 Planned Target Population

The four cities which are already advanced urban centers had each population in excess of 100,000 in 1980. These cities have been continuing their growths, and the population of each city is expected to reach 200,000 or so by 2000 approaching the size of a regional sub-center (see Fig. 4.1.2).

Taking account of such situations, IRM must have a population of at least 100,000 in order to function as the urban center in the east coast with a more rapid pace of growth than those of advanced cities around it. In other words, IRM must assume a similar role as Lucena in the northern part of the province. Lucena is playing its role as an urban center in the southern part of the same province so that IRM and Lucena may coexist in the said province ensuring each position as an urban center.

The process of growth for IRM in comparison to the advanced urban centers is as follows:

(i) First of all, efforts shall be made to increase the population to the present size of 100,000 held by the advanced cities by the target year of 1992. At this point, the populations of each advanced city shall reach the scale of 150,000, but the relative difference in population size shall be reduced from the present level of 1/2 to 2/3 with a sufficient absolute scale of population capable of supporting a high degree of service facilities.

(ii) the next step shall be to increase the population to 150,000 by the year 2000. This is the same size of population to be at-

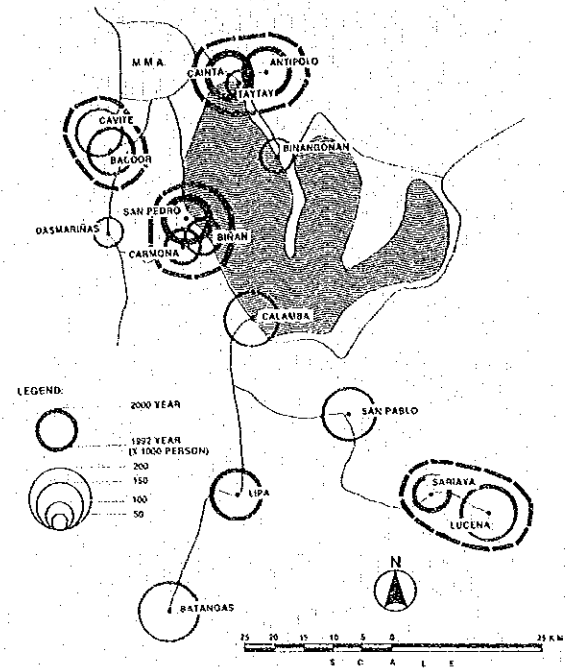


FIG. 4.1.2 PROJECTED POPULATION OF REGION IV

tained by the advanced cities in 1992, a stage at which functions of an urban center would be stabilized and reinforced with some of the functions of a regional center beginning to take concrete forms.

The population size of 150,000 is slightly in excess of the current population of Batangas (144,000). Batangas City is a port city in which textile and petrochemical industries have been developed. At the same time, it prospers as a base for sightseeing tours to nearby islands including the Mindoro Island. In terms of targets set for IRM, functions of a harbor and fishing port may play a key factor to develop agriculture and fishery industries as well as allied industries to process such products. Furthermore, the introduction of new industries shall also be attempted to at least surpass the present level of Batangas by the year 2000 (Fig. 4.1.3).

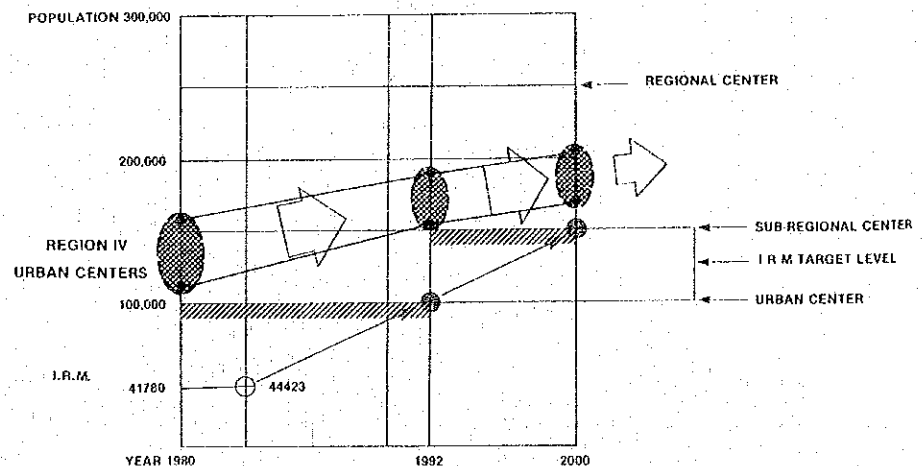


FIG. 4.1.3 TARGET POPULATION OF I.R.M.



As mentioned above, setting population targets of 100,000 by 1992 and 150,000 by 2000 means that the increase of 45,000 persons by 1992 and the increase of 85,000 persons by 2000 are expected over the trend projections listed on Table 4.1.2. This necessitates the prevention of the outflow of the young age group to areas outside of the region as seen in the past, the promotion of a "home-coming" movement for people already out of the region, and the inflow of population from mountain areas of the three (3) municipalities out of commutable distances, as well as from the Polillo Islands or the southern part of the province, etc. Management and engineering staff from certain companies to be stationed in the region may also contribute to the population increase, though the number may be insignificant.

It is expected that the age structure in the future shall have a higher ratio for the productive age group and a smaller ratio for the elderly than those predicted by trend (Table 4.1.2).

**Table 4.1.2 FUTURE PLANNED POPULATION OF IRM BY AGE GROUP**

	(Person, %)		
	1983	1992	2000
0-14 years	17,370 (39.1)	32,700 (32.7)	40,650 (27.1)
15-64 years	25,720 (57.9)	64,200 (64.2)	103,950 (69.3)
65 yrs. & over	1,330 ( 3.0)	3,100 ( 3.1)	5,400 ( 3.6)
<b>Total</b>	<b>44,420 (100.0)</b>	<b>100,000 (100.0)</b>	<b>150,000(100.0)</b>

Source: JICA Study Team

## 4.2 Future Population of Gainful Workers

### 4.2.1 Proper Industrial Structure for Agro-forestry and Marine Industry Model City

A model city for agro-forestry and marine industries is aimed to accumulate the tertiary sector industries as an urban center, through balanced development of the primary and secondary industrial sectors. The balance of about 50% for the primary and secondary sectors as basic industries, and the remaining half for the tertiary sector as the service industry with 50-50% share between the primary and secondary sectors could be used to attain this goal.

Fig. 4.2.1 shows industrial structure of IRM, Lucena, Batangas, and Metro Manila, and the scope of the industrial structure expected of the model city.

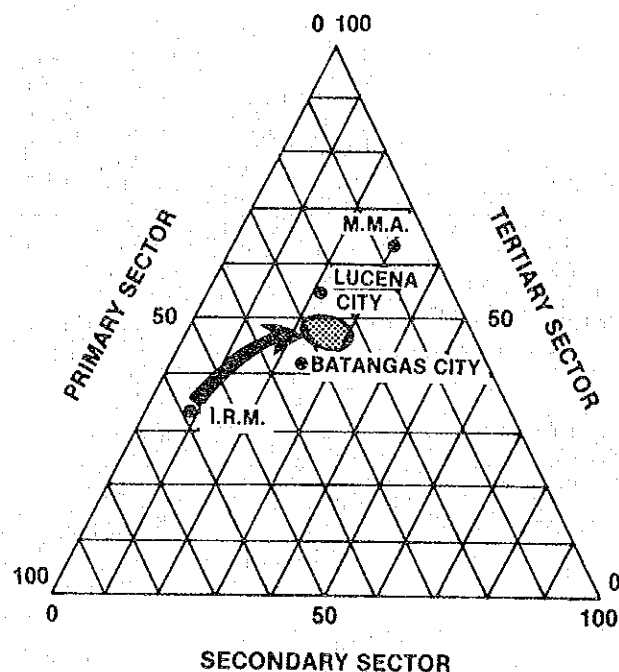


FIG. 4.2.1 TARGET RANGE OF INDUSTRIAL COMPOSITION FOR AGRO-FISHERY INDUSTRIAL MODEL CITY

### 4.2.2 Planned Gainful Worker Population of IRM Classified by Industrial Sectors

The future population of gainful workers of IRM is so planned to maintain the current ratio of the gainful workers against the total population of 15 years or more with planned ratios of 26% for the primary sector, 25% for the secondary sector, and 40% for the tertiary sector in the year 2000 for the industrial structure based on the combined ratios of Lucena and Langas while taking account of the characteristic features of this region (Table 4.2.2).

The number of gainful workers of tertiary sector at that time is expected to reach 0.147 persons per capita, approaching the level of 0.151 person per capita, equivalent to the combined ratio of gainful workers of both Lucena and Batangas as of 1980. The aspect as an agro-forestry and marine city shall remain in 1992, but the accumulation of the tertiary sector per capita shall approach the level of 0.136 persons held currently by Batangas (Table 4.2.1.).

Table 4.2.1 FUTURE GAINFUL WORKERS OF IRM BY INDUSTRIAL SECTOR

	(Person, %)		
	1983	1992	2000
Primary Sector	6,788 (58.5)	9,600 (0.334)	11,700 (26.0)
Secondary Sector	1,022 ( 8.8)	5,500 (0.192)	11,200 (25.0)
Tertiary Sector	3,786 (32.6)	13,600 (0.474)	22,100 (49.0)
<b>Total</b>	<b>11,596 (100.0)</b>	<b>28,700 (100.0)</b>	<b>45,000(100.0)</b>

Source: JICA Study Team

## 4.3 Planned Target GRDP

### 4.3.1 Forecast of GRDP per Capita in Region IV

The current GRDP per capita in Region IV is assumed to be 10,200 pesos. According to the data given in the "Ten-Year Development Plan, 1978-1987", "Regional Development: Issues and Strategies" (NEDA, 1978), etc., the future GRDP per capita in Region IV is expected to attain the level of about 16,000 pesos/person in 1992, and about 23,000 pesos/person in 2000.

The average GRDP in Region IV shall depend in many respects on the advanced region in the west where the economic level is extremely high with the concentration of population exceeding half of the total.

Quezon Province, in which IRM is located, has a relatively low income level with the estimated GRDP of 70% of the average of Region IV. Therefore, the GRDP should reach the level of 11,200 pesos/person by 1992, and 16,000 pesos/person in 2000, if Quezon Province grows at the same pace as the average of Region IV (Table 4.3.1).

Table 4.3.1 FUTURE GRDP PER CAPITA OF REGION IV

Year	(in peso)	
	GRDP per Capita	Growth Rate (%)
1983	10,200	5.13
1992	16,000	
2000	22,900	

Source: Estimated by JICA Study Team based on the documents by NEDA

### 4.3.2 Target GRDP of IRM

The GRDP per capita of IRM is presently about 3,900 pesos/person, less than 40% of 10,200 pesos/person, which is assumed to be the average level of Region IV. In order to reach the level of an independent city with the population of 100,000 by 1992, opportunities to gain relatively high incomes that may encourage the new inflow and to prevent the outflow of population shall be necessary. This indicates the necessity to ensure a higher pace of income increase than the average of Region IV or that of Quezon Province.

Quezon Province is at present divided into the following levels: the high income level urban area at the South of the Province centered on Lucena City; and the low income level rural area at the north of the Province.

A target for IRM to become an urban center of the northern area with a medium income level by 1992 is set. The target GRDP/capita shall be set at 11,200 pesos, an estimated average GRDP/capita of Quezon Province in the same year.

In order to achieve this level, GRDP per capita should increase at a rate of 12.4% and population to reach 100,000 at a rate the 9.4%. The same relationship can be observed between the two (2) rates of Region IV for the period 1983 to 1992.

After 1992 up to the year 2000, a GRDP per capita shall grow at the same rate as Quezon Province to reach 16,000 pesos (Table 4.3.2).

Table 4.3.2 FUTURE GRDP PER CAPITA AND GRDP OF IRM

	1983	1992	2000
Population (in thousand)	44.4	100.0	150.0
GRDP per Capita (in peso)	3,860	11,360	22,400
GRDP (in million pesos)	171.4	1,120.0	2,400.0

Source: JICA Study Team



**5**

**STRUCTURE PLAN**



# 5.1 Basic Policies for Development, Improvement and Preservations

## 5.1.1 Evaluation of Land and Transportation Conditions

For purposes of evaluation, the region has been divided into nine (9) areas with similar land and location conditions (Fig. 5.1.1). These nine (9) divisions were then evaluated from the following three (3) points of view:

### Agricultural Development

Suitability of an agricultural land has been assessed chiefly with regard to rice cultivation. Suitability is judged from the soil, slope, water, drainage, and scale of existing accumulation and future expansion (Table 5.1.1). The results of an overall evaluation are as follows: District 7 in Infanta, which is the central part of the Agos River Irrigation System, is the most suitable as an agricultural land; Districts 1, 4, and 5 in the Agos River basin need flood control measures, but shall be more suitable than other zones in the future; and District 9 has little possibilities of being developed as one of the major farming zones in the project area.

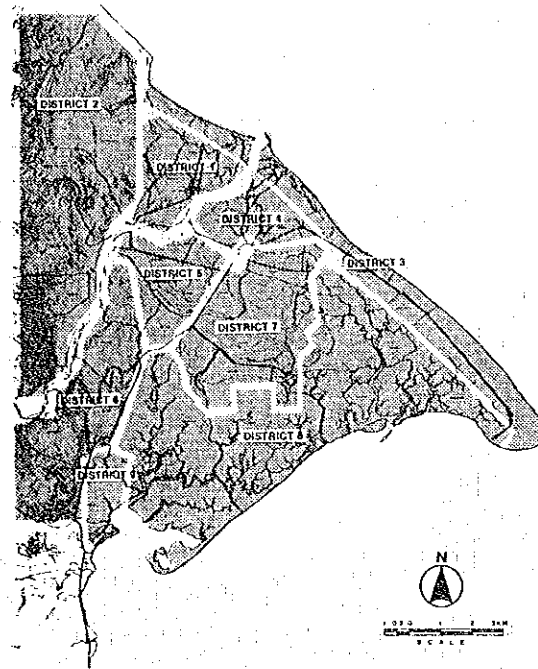


FIG. 5.1.1 ZONING BY EXISTING LAND CHARACTERISTICS

### Urban Development

The suitable land for urban development is concentrated along Infanta Road. Zones 4, 5 and 7, which is productive agricultural land as well,

Table 5.1.1 LAND ASSESSMENT FOR AGRICULTURAL DEVELOPMENT

Items	Zone Number									Assessment
	1	2	3	4	5	6	7	8	9	
Soil	○	△	△	○	○	△	○	△	○	The soil of Zones 1, 4, 5, 7, and 9 (flat land in General Nakar plains of Infanta) is quingua silt-loam and is most suitable to rice cultivation. Zones 2, 3 and 6 in coastal area has Buguey loamy sand/ Antipolo sandy clay more suitable to coconut than to rice.
Slope	○	x	○	○	○	x	○	○	○	All zones but 2 and 6 and the hills of Infanta and General Nakar are suitable to rice cultivation.
Water Supply for Farms	○	x	x	○	●	x	●	x	△	Flat land in Infanta is irrigated under the Agos River Irrigation System, which will be further enhanced in the future. Zones 1 and 4 are adjacent to Agos River from which they can be irrigated. Since Zone 9 in Real has no major river, water supply will be limited.
Flood Drainage	x	○	x	x	○	○	○	x	△	Zones 1 and 4 are the flooding area of Agos River and are affected by high tide. They are flat land and have a poor drainage. Zone 3 faces the coast and is exposed to high tide and salt damage. Zone 9 is relatively a low flat land and drainage is not so good.
Scale (Accumulative)	○	○	x	○	○	○	●	○	△	Zone 7 is covered by the existing large scale irrigation system. Zones 1, 4 and 5 have no less than areas that can be developed as agricultural zone. Zone 9 is for a small scale and has little possibility for future physical expansion.
Evaluation	○	x	x	○	○	x	●	x	△	Zones 2 and 6 are unsuitable to rice in view of the slope water supply. Zone 3 is not for a large scale agricultural development in view of soil, water and the effect of the sea. Zone 9 is otherwise suitable but has little possibility of being developed as a major farming area in the study area.

**Table 5.1.2 ASSESSMENT FOR URBAN DEVELOPMENT**

Items	Zone Number									Assessment
	1	2	3	4	5	6	7	8	9	
Ground	△	●	X	△	△	●	△	X	△	Zones 3 and 9 have unsuitable ground. Zones 1, 4, 5, 7, and 9 are not suitable, but the soil is alluvial with not so high bearing strength. Zones 2 and 9 have a stable rock bed. Urban development costs more in Zone 2 and 6 than in others Zones account for the land slope conditions.
	○	△	○	○	○	△	●	○	○	
Drainage	X	●	△	X	△	●	○	X	△	Zones 1 and 4 are Agos River flood area, and Zone 8 is swamp area.
Traffic Condition	X	X	△	△	○	●	○	X	○	General Nakar is inconveniently served by transportation. Zones 3 and 8 are further away from Infanta Road. Zones 5, 6, 7 and 9 are by Infanta Road and conveniently served, while Zone 9 is the closest to the Port. Zone 6 is the center of the area with equal distances from the centers of the three municipalities.
Urban Service	X	X	△	△	○	△	○	X	△	Power supply is good along Infanta Road. Zones 5 and 7 are close to Poblacion and have a good access to urban services.
Evaluation	X	X	X	○	○	○	○	X	○	Suitable are Zones 5, 6, 7 and 9 along Infanta Road. In view of proximity to a Poblacion, Zones 5, 7 and 9 are desirable.

Zone 6 which is located in a strategic point of transportation, and Zone 9 which is closest to Real Port have been selected as the suitable land for urban development. Suitability of each district in IRM is examined for complex urban development of each component in view of ground condition, slope/drainage conditions, transportation conditions, and urban facility service conditions (Table 5.1.2).

### Environmental Preservation

In order to conserve the existing topography and natural environment, preservation measures are needed in the following areas:

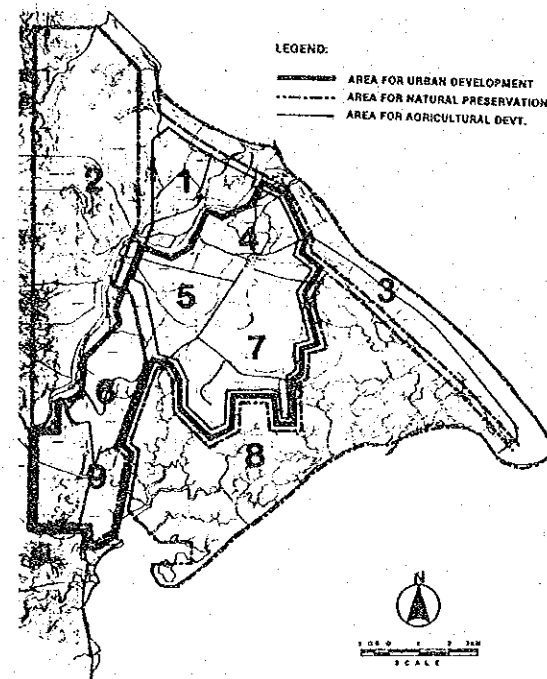
- (a) Seashore Preservation
- (b) Swamp Preservation

Swamps function as a buffer belt between the sea and land, and support ecology in IRM (protection of farm land from salt and tidal damage and protection of sand from being washed away).

- (c) Mountainous Preservation

The slash and burn, farming and timber felling engaged in for years have resulted in erosion of the Sierra Madre. The natural environment of the mountains should be preserved. This natural environment is to be utilized as important resources for outdoor recreational activities and tourism development.

Lands (or districts) suitable for agriculture, urban development or natural preservation abound in IRM. Some districts have overlapping and contradicting suitabilities such as suitability for agriculture as well as suitability for urban development for a single district, etc. (See Fig. 5.1.2).



**FIG. 5.1.2 SUITABLE AREAS FOR URBAN/AGRICULTURAL DEVELOPMENT & NATURAL PRESERVATION**

### 5.1.2 Urban Development Patterns

#### Even Growth Center

Urban development patterns which indicate arrangement/distribution of industrial, population, and urban functions are considered aside from the above suitability assessment. Basically, the following three (3) alternative patterns are possible:

The three (3) municipalities are expanded around their existing downtown areas so that they shall equally share future population and urban functions (as far as their physical capacities shall allow);



## Concentrated Growth Center

Future population and urban functions shall be concentrated in Infanta which presently has the largest flat land area and, therefore, can be developed into a large urban area.

## Dispersed Growth

Each urban function is distributed to the most suitable available site according to the function characteristics.

The pros and cons of these three (3) basic patterns are summarized in Table 5.1.3 in view of which, the urban development pattern is determined as follows:

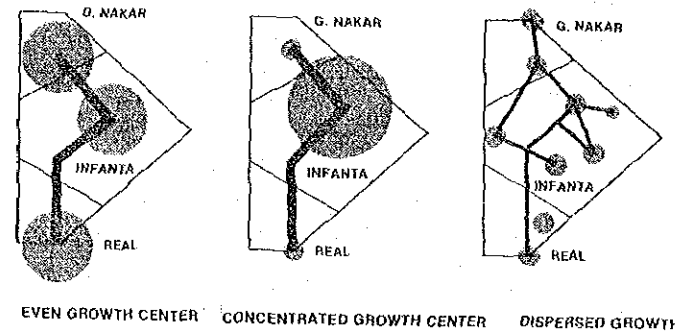


FIG. 5.1.3 URBAN DEVELOPMENT PATTERN

Table 5.1.3 ADVANTAGE/DISADVANTAGE OF URBAN DEVELOPMENT PATTERN

Development Pattern	Advantage	Disadvantage
I. Even Growth Center	<ol style="list-style-type: none"> <li>1. Well balanced development between three municipalities with equally-shared burden (cost) of urban development</li> <li>2. Size and extent of built-up area constructed shall be moderate throughout the three municipalities</li> </ol>	<ol style="list-style-type: none"> <li>1. Same goal on three municipalities incurs greatest burden on General Nakar which now has low level of infrastructure service and urban functions.</li> <li>2. *Rapid improvement of central districts shall be needed throughout the three municipalities to cope with concentrated urban functions.</li> <li>3. Real and General Nakar shall be overconcentrated with population and urban function in view of the physical constraint of a few flat land areas.</li> </ol>
II. Concentrated Growth Center	<ol style="list-style-type: none"> <li>1. Infanta can exert social economic power as a large scale city on account of high concentrated/accumulation of manpower and urban function</li> <li>2. High concentration of urban functions (on one spot) help the city create urbanity and high quality urban space (atmosphere)</li> <li>3. Increased efficiency of urban development in Infanta, while mitigating pressure and burden of urbanization on Real and General Nakar.</li> </ol>	<ol style="list-style-type: none"> <li>1. Disparity in urban development becomes bigger between the three municipalities, while imposing a great burden on Infanta</li> <li>2. Over concentration may incur in urban problems</li> </ol>
III. Dispersed Growth Center	<ol style="list-style-type: none"> <li>1. Shall be able to cope with urban development according to different situations (anytime, any place)</li> <li>2. Every district in IRM shares a variety of urban function.</li> <li>3. Alleviates the burden and pressure on the existing built-up area.</li> </ol>	<ol style="list-style-type: none"> <li>1. Difficult to created an integrated cohesive built-up area instead of dispersed patches of built-up areas.</li> <li>2. Inefficiency in urban development caused by scattered low density built-up areas.</li> <li>3. Inefficiency in land use because of unordered urban sprawl.</li> </ol>

\*In existing built-up areas of the three municipalities, street improvement were made in a grid pattern. But the street are too narrow to cope with motor vehicle traffic in the central districts, caused by future urban development. And also, lots for building in the central districts are too small to accommodate future urban functions (commercial buildings, offices, etc.)

Source: JICA Study Team 1983

(i) That the scale and speed of expansion of the existing downtown shall be normalized in pace with the gradual improvement of the central parts (an excessive burden shall not be placed on the existing downtowns as in the case of Basic Patterns I and II).

(ii) That new urban facilities and additional population shall be concentrated into one unified downtown area (and not distributed as in the case of Basic Pattern III).

(iii) That this new downtown shall be located centrally among the three (3) municipalities so it shall be, in fact, the center of the 150,000 population city with a high quality urban space.

### 5.1.3 Basic Policies for Development, Improvement and Preservation

In view of land suitability to the development or preservation, and the urban development pattern discussed in 5.1.2, the basic policy for development and preservation of IRM is set forth as follows:

(i) The plains of Infanta and the flat land of General Nakar shall be developed/preserved as an agricultural promotion area. Therefore, urban development in these areas shall be encouraged only in the limited areas of the existing downtown, and the area along Infanta Road;

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

(iii) The coastal, swamp, and hilly areas shall be preserved provided, however, of the following: that recreational, tourism, fishery, and activities utilizing resources shall be allowed to the extent of not damaging the natural environment; and that particularly in the portions of nature preservation areas where urban development is strongly needed, urban development shall be achieved while maintaining harmony with the natural environment.

## 5.2 Definition of Future Urban Structure

Based on the basic policies for development, improvement and preservation as described above, a new urban structure to meet the needs of a population of 150,000 was considered and defined as follows:

### 5.2.1 Basic Policies and Targets

An "urban structure" refers to a comprehensive, organic, and structural arrangement of industrial and social spaces within a natural surrounding. The basic policies and targets for achieving the urban structure of IRM, are defined below.

### Formation Appropriate to the Natural Surroundings

As described above, urban development in IRM is to be carried out in harmony with the preservation of the natural environment. For this reason, the urban structure which is to be defined here must conform to the program aimed at preserving the natural surroundings of the region.

### Formation Which Consolidates and Integrates the Regional Society

A city must be constructed to strongly bind together the widely dispersed development spots, the city with agricultural villages or the three municipalities which constitutes the planning region.

### Formation Which Systematizes Industry

To achieve described results in IRM, development of industry must be carried out along a uniform route. This shall be necessary in order to systematize such industries in space and time so as to create an urban structure tied to urban development.

### 5.2.2 Establishment of Urban Structure

#### Comprehensive Basic Composition

An analysis of the most appropriate new urban structure for IRM based on policies relating to development, improvement, preservation, and the establishment of the urban structure is shown in Fig. 5.2.1.

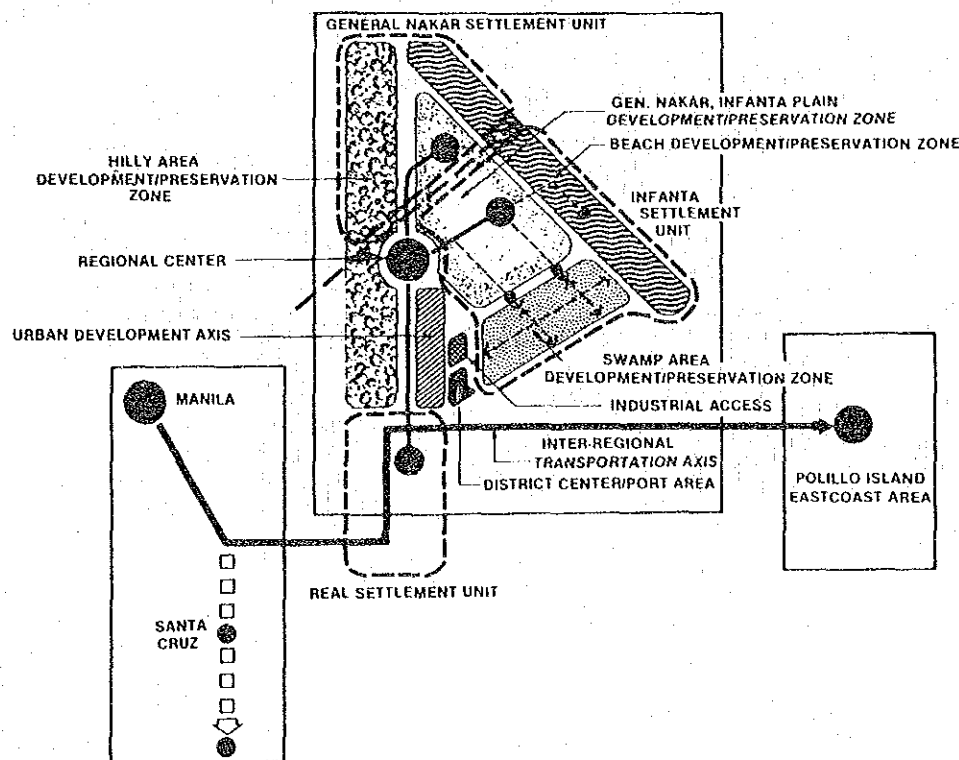


FIG. 5.2.1 ESTABLISHMENT OF FUTURE URBAN STRUCTURE

The basic composition of this urban structure is described below:

(i) The interregional transport axis shall be formed by connecting the area to the west of the Sierra Madre range (including MMA) with the east coast region by land through Infanta Real, and sea through the port of Real.

(ii) Within the district being planned, three (3) municipal sub-centers and one regional center should be formed and an urban transportation axis should be established joining these various sub-centers and center in order to form the main framework of the urban structure of the area.

(iii) Along the inter-regional transport axis, a belt should be formed which contains a concentration of intensive industrial and urban facilities in order to serve as the axis of urban development in the region.

(iv) The overall natural environment of the planning district shall be maintained through the establishment of four (4) environmental preservation zones (hill zone, General Nakar-Infanta-Real plain zone, coastal zone, swamp zone) in which natural resource development shall be undertaken with full consideration given to preserving the natural environment.

## Basic Land Use Structure

The land use structure shall be formed using the following social and natural spatial systems as the framework:

### 1) Social Spatial System

The regional center shall function as the center of the east coast area and the three municipalities district with respect to the social aspect. The existing central districts of each municipality shall function as a sub-center of the regional center.

### 2) Natural Spatial System

A natural spatial system shall exist in the form of coastal, swamp, and hill natural zones around the perimeter of the General Nakar-Infanta agricultural plain at the center of the planning region functioning as a protective buffer for the plain. It shall be necessary to undertake development and preservation of the natural environment in accordance with the natural characteristics of each zone.

The planning region has been divided into areas for natural land use and for urban land use. In principle, the four (4) natural zones have been earmarked for natural land use. Urban land use has been restricted to the central areas of the existing three (3) municipalities, the regional center, and the axis of urban development, as described below:

(i) In addition to serving as the center of city life for their respective municipalities, the central areas of the existing three (3) municipalities shall be designated for land use providing services to the natural environment.

(ii) The regional center to be developed on Infanta Road at a point equidistant from the centers of the three municipalities shall be designated for land use with daily living service functions to accommodate a regional population of 25,000 inhabitants by the year 2000.

(iii) The urban development axis along Infanta Road lies between the regional center and the interregional transport axis has a high potential for development. This axis shall be designated for IRM's major urban industries, urban services, and residences for workers in these industries.

## Basic Structure of Industrial Layout

The urban development policy and procedure as established in Chapter 3.2 call for the following steps taking advantage of the formation of the inter-regional transport axis which connects the east coast region with the MMA region: natural resources development and related industrial development; development of distribution and processing industries designed to add value to and realize the smooth operation of this natural resources development; and development of urban service industries based on these key industries. These various steps shall be placed into the urban structure according to the following basic plan:

### 1) Natural Resources Development and Development of Related Industries

Within the planning region, development of a fishing industry shall be undertaken on the Pacific Coast and coconut production shall be increased in the eastern coastal region including Polillo Island. The following industries shall also be developed in this region in harmony with the natural ecological system as part of the natural land use plan described earlier:

(i) In the General Nakar-Infanta Plain, which fills the majority area of the plain within the planning region, rice paddy cultivation, and other agricultural industries shall be intensified and improved.

(ii) Within the swamp zone, an intensive marine products cultivation industry shall be promoted which makes the most of the natural conditions of the area.

(iii) In the coastal zone, which consists primarily of sand beaches, a tourist resort industry shall be developed.

(iv) In the hill zone, forestry development shall be promoted (to provide part of the raw materials for the future paper/pulp factories), and tourist facilities shall be developed in harmony with the natural environment.

## 2) Development of Distribution and Processing Industries to Add Value and Ensure Smooth Development of Natural Resources

In addition to building up the distribution industry to handle the collection and shipment of fish catches from the Pacific and agricultural products (primarily coconuts) from the eastern coastal region, processing industries for these products, and artificially cultivated marine products shall be developed on the urban development axis as described below.

(i) To serve as the fishing industry for the Pacific region, wholesale markets, ice manufacture, freezing and refrigeration, warehouse industries, and related repair industries shall be promoted as part of the fishing ports.

(ii) As a processing base for agricultural and marine products, distribution and processing industries such as shrimp processing, canning, coconut oil extraction, etc., shall be developed.

## 3) Development of Urban Service Industries

With the industries outlined in 1) and 2) above as key industries, the following urban service industries shall be developed:

(i) Service industries relating to daily life shall be developed in a commercial district having advanced service capabilities in the regional center, in addition to the existing central districts.

(ii) Service industries relating to business establishments shall be developed in conjunction with the above fishing and processing bases.

## Basic Structure of Transportation System

The transportation system shall be comprised of the interregional transportation, and urban transportation systems described below:

### 1) Inter-Regional Transportation System

The comprehensive transportation for the eastern region (Rizal, Laguna and Quezon Provinces) shall consist of the following three components:

(i) An interregional trunk road running north-south through the three provinces and connecting them with Manila.

(ii) Feeder roads connecting the east coast cities with this interregional trunk road.

(iii) Ports for marine transportation in the east coast region and the Pacific offshore areas.

Within this interregional transportation system, a fishing port to be improved and newly constructed on Lamon Bay at IRM shall form the base of marine transport for the northern part of the east coast region. This port shall tie the three (3) eastern provinces with Manila via Infanta Road which, as described above, shall act as a feeder route. This way, the first transportation and transport breakthrough to the east coast of Luzon shall be completed (interregional transport axis).

## 2) Urban Transportation System

The urban transportation system shall form a transportation network capable of accommodating the needs arising from the transformation of the region's traditional agricultural village structure to a new urban structure.

### (a) Inter-city Inland Transportation System

A shift shall be made from the existing municipal transportation pattern which primarily covers the centers of each of the three municipalities separately to a pattern of inter-municipal transportation centered on the main regional center. For this purpose, three urban trunk roads shall be constructed radially from the regional center toward the central districts of the three municipalities to form the axis of urban transportation, and feeder routes shall be added to serve the coastal, swamp, and hill zones and, thereby, comprise an urban transportation network for the entire region.

### (b) Urban Marine Transportation System

In order to meet the requirement of coastal banca transport, marine recreational transport, and transport of marine products in the swamp zone, a trunk water route shall serve as an axis across the length of the swamp zone, with feeder routes consisting of improved existing water routes. Transportation nodes shall also be created at interconnecting points with the above inland transportation system in order to form a systematic marine transport system in the urban area.

## Basic Structure of Urban Facilities

In order to achieve an appropriate distribution of demand within the region for urban facilities consisting of public utilities and social service facilities, population and industry shall be properly distributed within the determined urban structure. This is to permit the use of local resources such as hydroelectric power and ground water, resources which are seen to be adequate as long as demand is not overly concentrated.

### 1) Public Utilities

Urban public utilities consisting of water, electricity, telegraph, telephone and sewer facilities shall initially be constructed as separate and independent closed systems in each district meeting the specific demand of the district. Later, as urban development takes place, a more economical and unified system shall be completed to link these various facilities when greater capacity and quality are demanded in the system. In this way, the public utilities system can be gradually and rationally constructed.

The water supply system shall include five (5) divisions within the planning area in accordance with urban development distribution. Water resource development shall be carried out on available groundwater in or near each water supply district while maintaining a proper balance with the need for agricultural water derived mainly from surface water. As quantitative and qualitative water demands dictate, water shall be taken from the Agos River and treated at a central purification facility, after which it shall be distributed to each district through a comprehensive network.

Regarding electric power supply, the transmission system from the Luzon Grid and the distribution system within the region are both nearly completed. These systems form the base of the power supply system for the region. However, as demand in the region expands in the future, development of local power through small hydroelectric power plants, etc., improvement in transmission and substation facilities for the Luzon Grid, and fortification of the regional power distribution network shall be carried out.

As for communication, during the early stages of implementation, simple telegraph and telephone facilities shall be built in central Infanta which serves as the existing center of IRM, and in the new central district of Real where development is to be concentrated during the early phases of the project. By the year 2000, however, plans call for the formation of a comprehensive telex network and telephone network having (one) 1 central exchange office and three (3) sub-exchanges which, together, can cover the entire city centers and the main development bases.

For the sewer facilities, a closed branch-type drainage system is planned for each central district. However, during the first half of the planning period, drainage shall be carried out either by each district undergoing land preparation or by individual properties doing so.

## 2) Social Service Facilities

Social service facilities serve an extremely important function in terms of integrating and connecting the regional, urban, and agricultural village societies. The allocation of these facilities within the new urban structure is planned as follows:

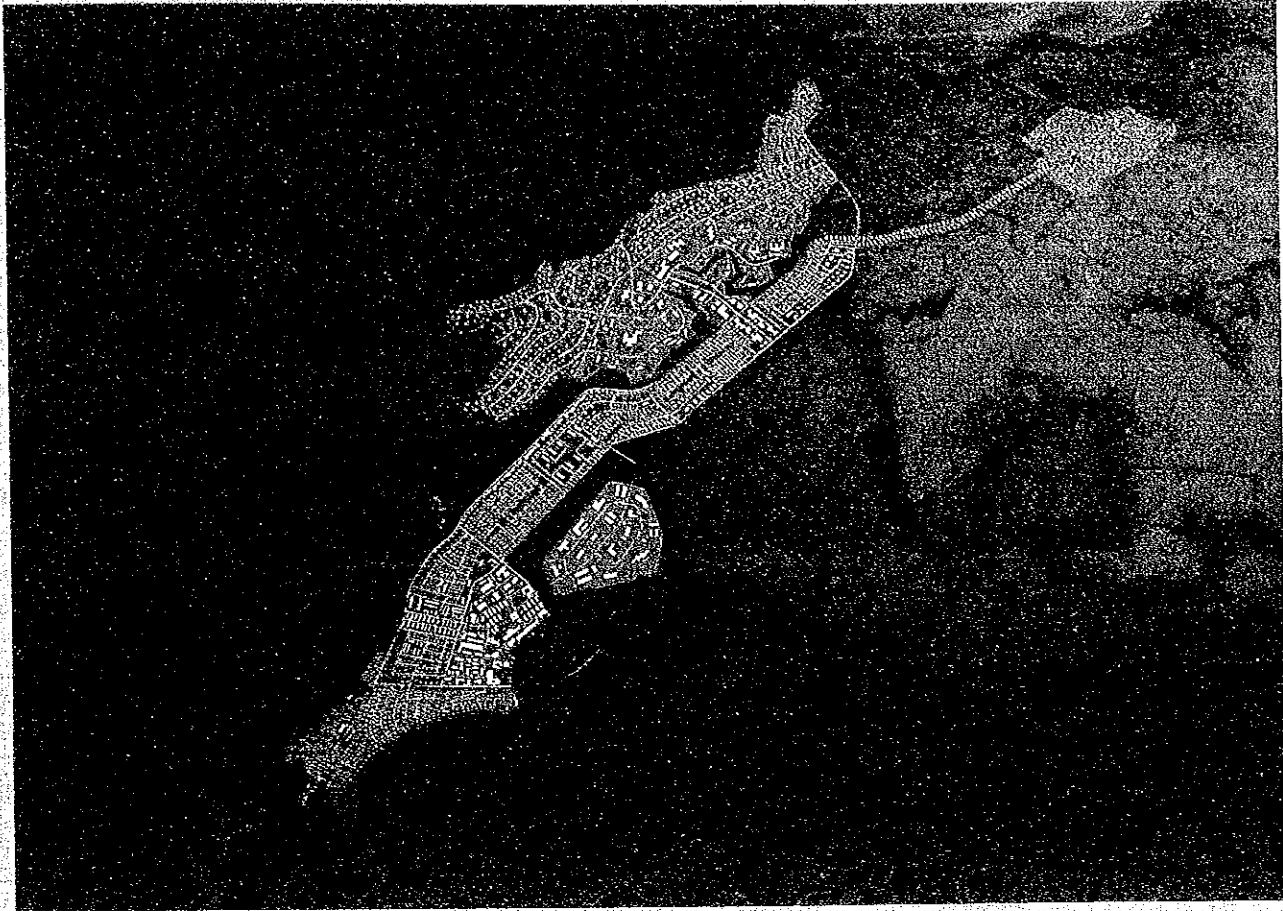
(i) The coastal region in the north of Quezon Province, which includes the three municipalities and Polillo Island, is isolated away from the provincial capital of Lucena, the base of social services. Accordingly, a new social service district shall be created within the urban structure capable of providing social services to residents in the east coast region.

(ii) The regional center offering the above described high-level services shall be located at the center of the region. From this center, social services of all kinds shall be provided to the residents of the planning district and, based around this center, the integration and connection of the three municipalities shall be planned.

(iii) Expansion of social service facilities shall also be carried

out within the existing center of the three (3) municipalities. This shall aim to unify the municipal communities through the provision of everyday conveniences, based on the traditional customs of the residents.

(iv) Fundamental facilities which are specially needed by residents shall be provided at the barangay centers, and strengthening of the basic social group shall be carried out at the barangay level.



# 6

## **FORMULATION OF MASTER PLAN**





# 6.1 Urban Development Plan

The Urban Development Project, consisting of the Land Use Plan, the Transportation Plan, and the Utilities Plan has been prepared in order to accommodate the future target population and working people of IRM based on the Structure Plan described earlier.

## 6.1.1 Basic Policies of the Urban Development

The basic characteristics of IRM's urban development can be expressed by the following two points:

(i) Since a certain accumulation of urbanization exists in the designated area, the Project implies neither the development of a city from scratch nor the spontaneous development of an existing city which has certain urban accumulations and the capacity for self control. The Project, therefore, shall have the character of both types of development. This shall pose a difficult problem since a completely new physical development system cannot be applied at the beginning and also because the formation of a new city cannot be conducted while controlling the past and present autonomous trends.

(ii) Unlike an ordinary city where the urban areas are spread around the commercial and business centers, the proposed new city shall be multi-centered or of the decentralized type, as shown by the Structure Plan, in view of its relationship with agricultural land and the protection of the natural environment. This shall make the control of land use and the realization of a simplified, as well as a more efficient infrastructure, more difficult to achieve.

In view of the above mentioned difficulties for proceeding with urban development, the basic policies of the Urban Development Project have been set out as described below:

(i) As shall be later described in the section on the Phase Development Program, the urban development of IRM has been divided into three (3) periods, i.e., the Base Preparation Period, the Take-Off Period, and the Advancement Period. Appropriate systems for land use and the preparation of infrastructure are employed for each period. Therefore, IRM cities in 2000 shall be planned in a manner where phased development of these periods can be achieved.

(ii) Special ranking in urban development, corresponding to the phased development mentioned above, is especially important for decentralized urban areas. Unless these rankings are made clear, the development shall progress in a disorderly manner causing confusion in land use, destruction of the environment and natural resources, and confusion and inefficiency in the infrastructure.

It shall, therefore, be necessary to formulate a land use system and to prepare the required infrastructure based on the special development ranking in response to the previously mentioned phased development. To be more precise, at the beginning of the Project, the Real Distribution District shall be the center of development activities while the existing city structure is relied upon and in the later period of the Project, the Regional Center shall be dealt with.

## 6.1.2 Land Use Plan

Under the Master Plan, the Land Use Plan stipulates that areas of certain sizes and their respective major uses shall be decided based on the development concepts for land use and urban areas. (The detailed use of each area shall be designated by the Development Plan for the respective area.)

### Basic Policies of the Plan

The following two (2) points described the basic policies which shall decide the size of the area, boundaries, and major use:

#### 1) Intensive Land Use

Because of the necessity to conserve agricultural land and protect the natural environment, the usable amount of urbanizable land in the Project areas is quite limited. The demand for land should, therefore, be dealt with by intensively utilizing the available area for development. (Land use intensity shall, thus, become higher than those in naturally developed cities.)

Conservation of the natural environment should be secured in a general perspective by not dividing agricultural and natural preservation areas into parcels but by keeping them as large blocks while development efforts of appropriate intensity shall be applied in several other areas.

Furthermore, the intensive type of urban development is advantageous in the provision of both a highly urbanized space with isolated village areas, and the improvement of the efficiency of urban facilities by concentrating on the development of smaller areas.

#### 2) Specialization and Compounding of Land Use

A total land use system shall be formed by combining districts which have been designated for special uses, and districts of compound uses.

The Resort and Recreation Center and the Regional Center district (commercial and public utility area) mentioned earlier should be made into specialized districts in view of the anticipated merits of integrating business facilities of the same fields and also in view of the construction of an urban environment with notable characteristics (these districts shall compose the urban image of IRM).

In addition, an attempt should be made to separate areas such as the sites of plants which cause environmental pollution, etc., and which cannot co-exist with other places of use, and to integrate them into specially designated areas.

Compact, as well as compound urban areas shall be developed for purposes other than those mentioned above which shall benefit from co-existence. Economic and social activities shall be vitalized, thus, creating the bustle of city life.

Furthermore, in order to carry out the phased development and special rankings shown in the basic policies of urban development, a plan to form an effective land use shall be necessary. Compound urban districts with centralized city functions shall be developed in certain areas at the beginning of the Project and specialized urban areas of major land use types shall be developed in the later period of the Project.

At the beginning of the Project, the population in each city is expected to be small. Should they be located in accordance with the zoning of future land use, the result shall be as follows: (i) Land use shall be from the beginning of the Project resulting in the need for the infrastructure to be developed over a wide area; and (ii) the distance between developed areas shall be too far to be convenient.

A land use strategy shall, therefore, be adopted. Urban functions shall be compounded to a certain extent at the beginning of the Project in order to form cores of urban development by creating coherent as well as compact areas. Using these cores as leverage for the next phase of urban development, new urban districts of specialized functions shall be developed in accordance with the enlarged demand for these functions. Figure 6.1.1 shows these development patterns. The Real Distribution District, which shall be described later, must be developed first of all as the core of urban development.

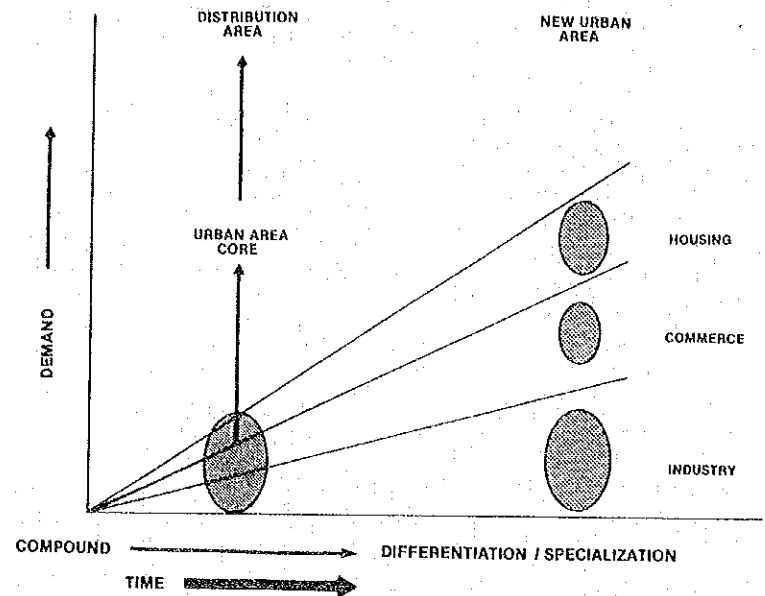


FIG. 6.1.1 STRATEGIC TRANSITION OF LAND USE

## Basic Concept of Land Use Distribution

### 1) Development Concept for Urban Land Use

The following development concept is summarized as shown in Fig. 6.1.2, based on the Structure Plan:

#### (a) Regional Center Development

The Regional Center District shall consist of the Commercial District where the various commercial and social industries shall be located, the public social service district, and the Low Density Residential which shall constitute a representative high quality residential district of the Project area.

#### (b) Central District Development of the Three Municipalities.

Relatively high density and compound urban areas shall have a compact development in order to accommodate the town centers, i.e., the Commercial Service District, sites for public utilities, and the existing residential areas, and also to respond to the gradual growth of the urban population in these towns.

#### (c) Infanta Real Urban Belt Development

This is a medium density compound urban area which shall be formed along with the Infanta Road from the Central Real District to the Regional Center District. It shall constitute the dominant venue to accommodate most of the population. Various service businesses, etc. which shall develop in accordance with the population growth, shall be compounded in the area.

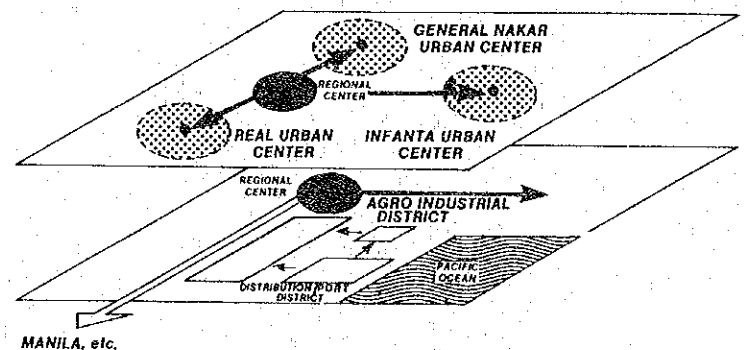


FIG. 6.1.2 URBAN DEVELOPMENT CONCEPT

(d) Distribution Center District Development

Various businesses such as distribution (wholesale and retail markets, cold storage warehouses), services related to the distribution businesses, cargo and passenger transportation, finance and insurance, real estate, sight-seeing and sales/service business for people working at the harbour shall be developed as a complex. This complex, together with the fishing port and general port facilities, comprise the Distribution Center District which shall constitute the transport node of the Regional Transport Axis connecting the east coast area and MMA.

Since this distribution center has to function as the core of urban development preventing scattered urban development at the beginning of the IRM Project, this can also accommodate first phase manufacturing industrial development as described below.

(e) Agro-Fishery Processing District Development

The agro-fishery processing industries shall be developed as the processing base for agricultural and fishery products of the east coast area.

The First Phase development of these industries shall be located in the distribution center, but after which industrial estate next to the center shall be consolidated for further development of agro-fishery processing industries.

2) Development and Conservation Concepts of Land Use for Agriculture and Natural Preservation

Development shall be carried out causing no damage to the eco-system as a whole by the clear designation of the preservation areas, i.e., (i) the natural environment shall be completely protected; (ii) the land shall be intensively used for agriculture or fishery; (iii) a certain amount of development shall be carried out while taking into account the conservation of the natural environment, and (iv) development shall be intensively carried out (Fig. 6.1.3).

(a) Preservation Green Stripe

This is a stripe wherein current natural environment shall be preserved as green areas. Lands of distinguished feature like coastal line, rivers, hillside, etc., which are vulnerable to erosion and pollution are preserved as Green stripe to become anchor of nature preserved in its totality.

(b) Productive Land

This is an area where agricultural or fishery development shall be intensively carried out under the natural conditions of the area. Industries using natural resources, as described in the previous Chapter, shall be actively developed. This productive land shall be protected by the preserved green areas of land above.

(c) Environmental Preservation District

In this district, tourism, recreation, and other related activities shall be carried out within limits, while preserving the natural environment.

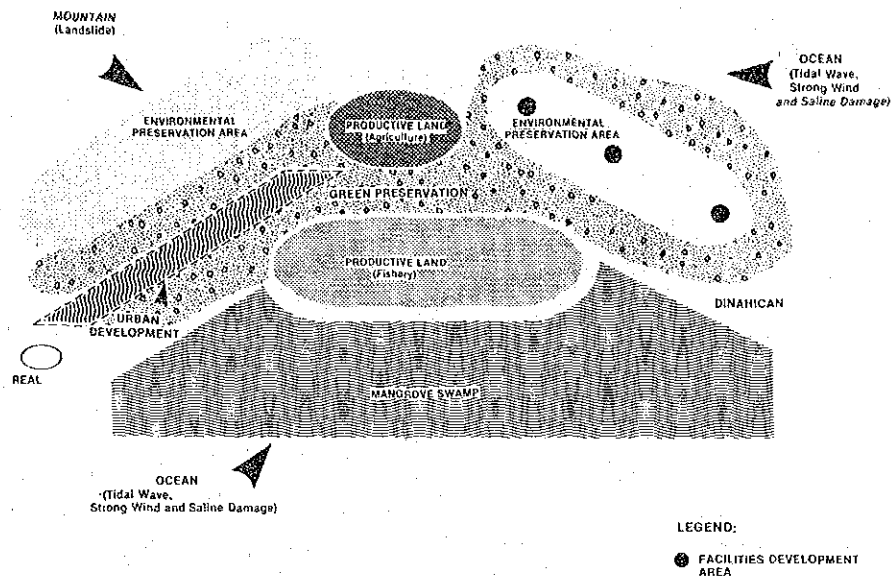


FIG. 6.1.3 NATURAL PRESERVATION/DEVELOPMENT CONCEPT

(d) Facilities Development Area

Various kinds of utilities and structures shall be necessary when the natural environment is to be used for purposes of recreation, sports and research, and academic activities. There is a danger, however, of these facilities being ill planned and dispersed all over the area, thus, destroying the natural environment. This Facilities Development Area, therefore, shall collectively accommodate these facilities in order to avoid such danger.

Land Use Plan

The Land Use Plan has been prepared in order to achieve the development concepts described above (Fig. 6.1.4). Table 6.1.1 shows the composition of land based on the Plan.

1) Urban Land Use

The expected population and employment are distributed to the districts designated as urban land development areas and land areas for the respective land uses are calculated (Tables 6.1.2 and 6.1.3). According to the results of this calculation, the total urban area shall be 713.8 ha in 1992 and shall double to 1,444.3 ha in the year 2000.

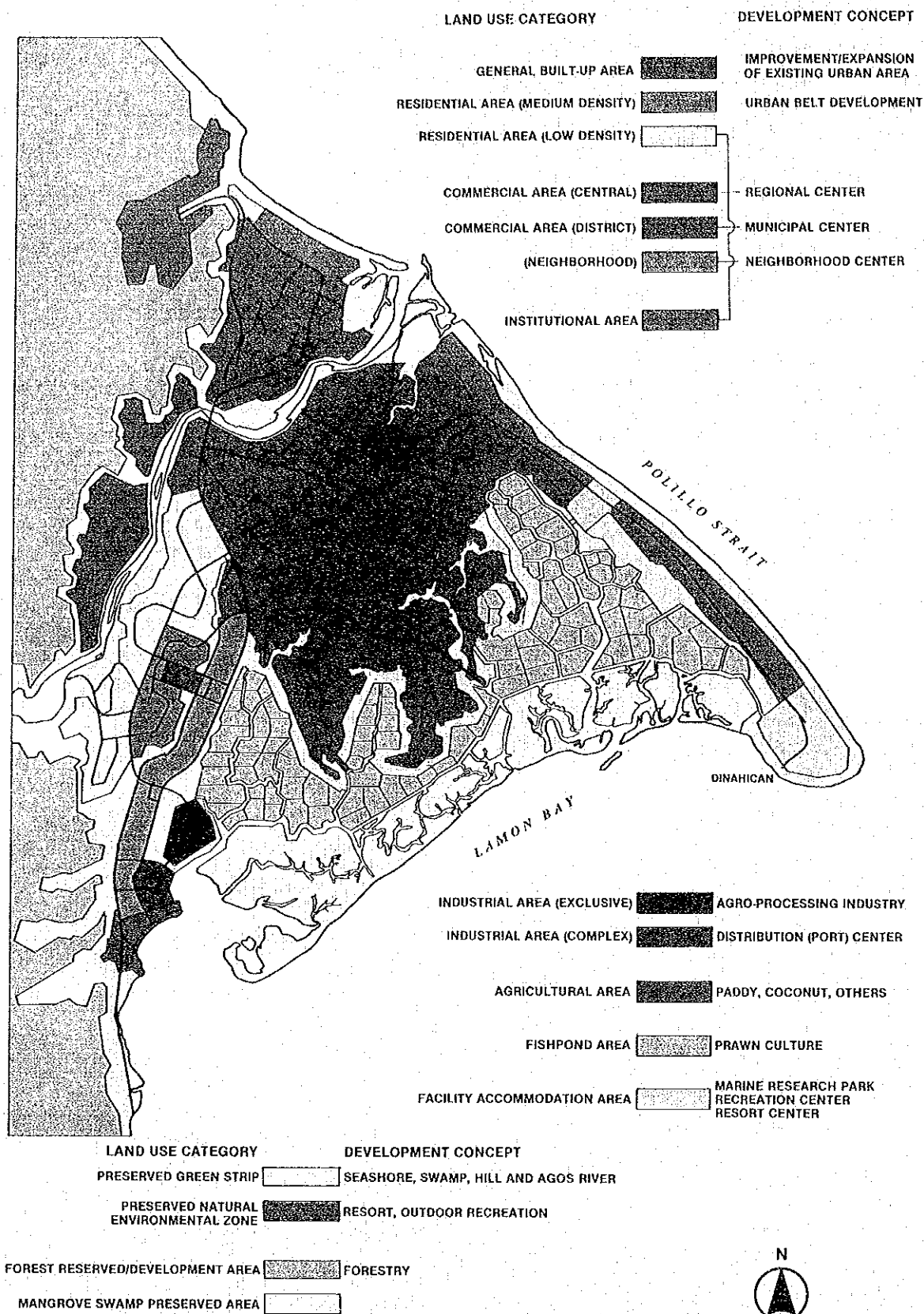
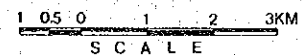


FIG. 6.1.4 PROPOSED LAND USE (YEAR 2000)



**Table 6.1.1 PROPOSED LAND USE AREA**

Classification	Land Area (ha)	(%)
Urban Land Use	1,444.3	9.5
General built-up area (including commercial/industrial)	313.7	2.1
Residential Area (Medium Density)	245.2	1.6
Residential Area (Low Density)	525.1	3.4
Commercial Area (Central)	28.2	0.2
Institutional	206.3	1.3
Industrial Area (Exclusive)	70.2	0.5
Industrial Area (Complex)	55.6	0.4
Natural / Agricultural Land Use	13,822.6	90.5
Agriculture Area	3,895.5	25.5
Fishpond Area	1,677.2	11.0
Preserved Greenstrip	2,968.4	19.4
Preserved Natural Environmental Zone-Resort / Outdoor Recreation Area	740.0	4.8
Preserved Mangrove Area	1,381.5	9.0
Forest Area	2,816.9	18.5
Facility Accommodation Area	255.6	1.7
Others	87.5	0.6
<b>Total</b>	<b>15,266.9</b>	<b>100.0</b>

Source: JICA Study Team

(a) Residential Land Use

The target population (100,000 in 1992 and 150,000 in 2000) is categorized the urban population and the suburban population in their respective areas as follows:

(i) The suburban area shall absorb rural population which is estimated to increase at the growth rate of the past decade and 72.5% of the family members (8,700 in year 1992, 13,300 in year 2000) of the people working for prawn culture and tourism development taking place in the rural area (72.5% is the current population ratio of those living in rural area).

(ii) The urban area shall absorb the population increase mainly due to urban industries (Table 6.1.4). Based on this figure, the urban population shall be 55,000 in 1992 and 94,000 in 2000. In 1989, the suburban population shall equal the urban population (urbanization ratio: 50%).

The distribution of urban population is planned in the following manner:

(i) Since the old urban areas cannot bear the heavy burden of a large population due to their weak urban bases and since the excellent agricultural land around them should be preserved, the urban population in these areas should be maintained at appropriate levels. Based on an examination of these conditions, the target population for Infanta, Real, and General Nakar have been put at 20,000, 10,000, and 5,000 respectively.

(ii) With regard to the new urban areas, based on an examination of the desirable population density and usable land area for each district, the target population for the Infanta Real Urban Belt, the residential district of the Regional Center and the Distribution Center District have been placed at 36,000, 21,000, and 2,000 respectively. According to this plan of distribution, the Infanta Real Urban Belt shall become the

**Table 6.1.2 LAND DEMAND, YEAR 2000**

	Existing Central Area (Sub-Center)			Regional Center			Distribution Dist.	Industrial Dist.	Urban belt Dist.	Suburb (Non-Urbanized Area)	Total (Urbanized Area)
	Infanta	Real	Gen. Nakar	Residential Area	Commercial Area	Institutional Area					
<b>Residential</b>											
Population (Person)	20,000	10,000	5,000	21,000	0	0	2,000	0	36,000	56,000	99,000
Population Density (person/ha)	200	240	150	80	—	—	210	—	240	—	—
Land Area (ha)	100.0	41.7	33.3	261.5	—	—	8.3	—	150	—	595.8
<b>Industrial</b>											
Workers (person)	422	81	0	0	0	0	269	2,370	0	(2,600)	5,985
Density (person/ha)	50	50	—	—	—	—	50	35	—	243	—
Land Area (ha)	10.1	3.7	5.2	—	—	—	5.4	67.7	—	—	83.1
<b>Commercial Service</b>											
Workers (Person)	1,530	560	780	Included in right figure	2,120	—	740	—	1,390	2,170	7,110
Density (person/ha)	150	150	150	—	100	—	180	—	150	—	—
Land Area (ha)	10.1	3.7	5.2	—	21.2	—	4.1	—	9.3	—	53.6
<b>Utilities</b>											
Area Ratio (%)	15	15	15	5	5	55	15	5	15	—	—
Land Area (ha)	27.3	10.8	8.9	26.3	1.4	113.5	5.3	4.5	36.8	—	234.8
<b>Road Transportation Facilities</b>											
Area Ratio (%)	15	15	15	15	15	5	30	15	15	—	—
Land Area (ha)	27.2	10.8	8.9	25.3	4.2	10.3	10.7	13.5	26.8	—	148.8
<b>Green Vacant Land</b>											
Area Ratio (%)	5	5	5	40	5	40	5	5	5	—	—
Land Area (ha)	9.1	3.6	3.0	210	1.4	82.5	1.8	4.5	12.3	—	328.2
<b>Total</b>	<b>182.2</b>	<b>92.2</b>	<b>59.3</b>	<b>525.9</b>	<b>88.2</b>	<b>206.3</b>	<b>35.5</b>	<b>90.2</b>	<b>245.2</b>	<b>—</b>	<b>1,444.3</b>

Source: JICA Study Team

Table 6.1.3 LAND DEMAND, YEAR 1992

	Existing Central Area (Sub Center)			Regional Center					Suburb (Non- Urban- ized Area)	Total (Urban- ized Area)	
	Infanta	Real	Gen. Nakar	Residen- tial Area	Commer- cial Area	Institu- tional Area	Distri- bution Dist.	Indus- trial Dist.			Urban Belt Dist.
Residential											
Population (Person)	15,000	10,000	1,000	7,000	—	—	2,000	—	20,000	45,000	55,000
Population Density (person/ha)	200	240	150	80	—	—	240	—	240	—	—
Land Area (ha)	75.0	41.7	6.7	87.5	—	—	8.3	—	83.3	—	302.5
Industrial											
Workers (person)	282	61	—	—	—	—	114	1,860	—	243	2,317
Density (person/ha)	50	50	—	—	—	—	50	35	—	—	—
Land Area (ha)	5.5	1.2	—	—	—	—	2.3	53.1	—	—	63.2
Commercial Service											
Workers (Person)	1,180	550	160	Included	1,330	—	560	—	600	1,700	4,380
Density (person/ha)	150	150	150	in right	100	—	180	—	150	—	—
Land Area (ha)	7.9	3.7	1.1	figure	13.2	—	3.1	—	4.0	—	33.1
Utilities											
Area Ratio (%)	15	15	15	5	5	55	15	5	15	—	—
Land Area (ha)	20.4	10.8	1.8	8.8	0.9	37.8	4.1	3.5	20.1	—	108.2
Road Transportation											
Area Ratio (%)	15	15	15	5	15	5	30	15	15	—	—
Land Area (ha)	20.4	10.8	1.8	8.8	2.7	3.5	8.2	10.6	20.1	—	86.8
Green Vacant Land											
Area Ratio (%)	5	5	5	40	5	40	5	5	5	—	—
Land Area (ha)	6.8	3.6	0.6	70.0	0.9	27.5	1.4	3.5	6.7	—	121.0
<b>Total</b>	<b>136.1</b>	<b>71.8</b>	<b>12.0</b>	<b>175.1</b>	<b>17.8</b>	<b>68.1</b>	<b>27.4</b>	<b>70.7</b>	<b>131.7</b>		<b>713.8</b>

Source: JICA Study Team

Table 6.1.4 FORECAST OF URBAN POPULATION

	Person		
	1983	1992	2000
Target IRM Population	44,423	100,000	150,000
Suburban Population			
(Trend)	32,226	39,000	46,000
(Increment by Dev.)		6,000	10,000
Total	32,226	45,000	56,000
Urban Population	12,197*	55,000	94,000

Note: \*Ungos is included because it is conurbated to Real Poblacion

Source: JICA Study Team

dominant venue to absorb the increased population since it shall occupy 38.3% of the total urban population.

(iii) The possible process of development is as follows:

i) Since the development of industries shall start from the Distribution Center and Agro-Fishery Processing, the related population for these industries shall be mainly absorbed by the Infanta Real Urban Belt (20,000 in year 1992; target completion ratio: 58%) and supplementarily by the Real urban area (10,000 in year 1992 target completion: 100%). Meanwhile, the Infanta urban area, and the existing Regional center shall absorb some of the population (15,000 in year 1992) due to its local importance.

ii) In accordance with the progress of the development over the entire area, with the maturing of the city industries, the vacancies in the residential district of the new Regional Center (21,000 in 2000), and in the Infanta Urban Belt (36,000 in 2000), shall be filled (Table 6.1.5).

Table 6.1.5 REPLENISHMENT RATIO OF URBAN POPULATION

	Existing Central Area (Sub Center)			Regional Center					Total Urban Area	
	Infanta	Real	Gen. Nakar	Residen- tial Area	Commer- cial Area	Institu- tional Area	Distri- bution Dist.	Indus- trial Dist.		Urban Belt Dist.
Replenishment Ratio of 1992 Urban Population Against 2000 Target Urban Population	75%	100%	20%	33%	—	—	100%	—	56%	58%

## (Residential Land)

By referring to the present values (202 persons/ha for Infanta, 416 persons/ha for Real and 145 persons/ha for General Nakar), the net population density of residential land is given as follows:

### (i) Sub-Centers

Due to limited urban land, the residential districts shall be of a consolidated and compact type. Population density in Infanta urban area shall maintain as high as it is now. The degree of intensity is slightly raised in Real (240 persons/ha) because the usable area is small due to its locational constraints between the sea and mountains. At General Nakar, a relatively low density of 150 persons/ha is given, taking into account the smaller population.

### (ii) New Urban Areas

The area along Infanta Road is expected to have a high land requirement for residential purposes. Since the usable area, however, is limited, a relatively high density of 240 persons/ha is planned.

With regard to the residential district of the Regional Center, the land use ratio shall be controlled at 60% and a population density of as low as 80% persons/ha is planned due to its location at the hill area, which is also a preservation area.

As described in the Land Requirement Plan, Barangay Ungos shall be integrated into the Distribution Center District. Some 2,000 people are currently living in Ungos and this number is expected to decline in accordance with the gradual transformation of land use at Ungos.

A small residential area shall be developed in the new Distribution Center District in order to bring homes and places of work close together (especially at the beginning of the Project). The Distribution Center District shall, therefore, accommodate some 2,000 people for its total population including the new residents mentioned above. A population density of 240 persons/ha is expected for this residential area as another intensively populated urban area.

Tables 6.1.2 and 6.1.3 show the required residential land area in each district/area based on the respective planned population densities. The total project area shall be 302.5 ha (1992) and 595.8 ha (2000).

Based on these requirements, the residential areas are categorized as follows:

### (i) General Residential Areas

In the existing urban centers and diversified residential areas with various housing types shall be developed.

### (ii) Medium Density Residential Areas

The area along the Infanta Road shall be developed as a medium density residential area where cheap residential land shall be supplied to city workers in the form of social/economic housing.

### (iii) Low Density Residential Area

A low density residential area (the scenic residential area) shall be developed in the residential district located in the hill area of the Regional Center. Residential land in a rich natural environment shall be put on the open market for housing.

## (b) Industrial Land Use

### (Distribution of Workers for the Manufacturing Industry)

The number of workers in the manufacturing industry is predicted to be 2,560 in 1992 and 5,985 in 2000 based on the Industrial Development Plan for the IRM district (Table 6.1.6).

These workers shall be distributed to each development district as described below (Table 6.1.7):

The population responsive types of industries shall be located in the Infanta urban area, the Distribution Center District, and the Real urban area which are the focusing points of the population distribution with high convenience of transportation in IRM. Workers for these industries shall be distributed to these areas in proportion to the respective population size. (The population in these areas are as follows: (1) 58,900 in 1992 and 78,500 in 2000 for the Infanta urban area including suburban areas and General Nakar; (2) 29,000 in 1992 and 59,000 in 2000 for the Distribution Center District including the Infanta Real Urban Belt and the Regional Center; and (3) 12,100 in 1992 and 12,500 in 2000 for the Real urban area including suburban areas.)

Based on this plan, the requirement for population responsive types of industries is the highest in the Infanta urban area (350 persons in 2000), and the location of urban service industries should be considered. The same types of industries should also be considered for the Distribution Center District.

In view of the convenience to nearby inhabitants offered by most of these population responsive types of industries as well as the fact that they shall not cause any environmental pollution, they should be located in the general urban areas together with the other types of land uses.

As for Agro-Fishery processing industries, the first phase development should be accommodated in the distribution center and subsequent phase development in the Industrial District. Altogether, 2,370 workers in 2000 are assumed.

Pulp and paper mills shall be separated from the Industrial District as their building requires special conditions. Therefore, they shall be located at appropriate sites near the mouth of the Agos River (the number of workers in 2000 shall be 2,600).

## (Industrial Land Requirement)

The area of the industrial site in each district is calculated on the basis of the worker distribution described above (Tables 6.1.2 and 6.1.3).

The calculation of the industrial area for the population responsive industries is made based on the given average worker density (number of workers/site area) of 50 persons/ha where middle and small size plants are assumed. The results of the calculation are 8.4 ha for Infanta Central, 1.6 ha for Real Central, and 5.4 ha for the Distribution Center District totalling 15.4 ha (in 2000). These areas include the sites of existing plants.

As the average worker density for agro-fishery processing industries mainly consisting of food processing industries is considered to be approximately 35 persons/ha, the required area shall be 67.7 ha (in 2000).

Although 51.7 ha of land shall be required for 2,700 workers in the pulp paper industry (2000), the area shall be extended up to 110 ha when the Project after the year 2000 is completed.

Based on the above requirements, the following Industrial Land Plan has been prepared:

### (i) General Industrial Area

Urban service industries (population responsive industries) such as various repair shops and food processing plants shall be allowed to operate in the general urban areas (Infanta and Real) under certain anti-pollution regulations. Their location in the urban area, therefore, has not been particularly designated.

**Table 6.1.6 WORKERS IN MANUFACTURING INDUSTRY**

	Person		
	1983	1992	2000
Existing Manufacturers	350	350	350
Newly Established Population Responsive Manufacturers	—	350	665
Agro-Fishery Industries	—	1,860	2,370
Pulp-Paper Manufacturers	—	—	2,600
<b>Total</b>	<b>350</b>	<b>2,560</b>	<b>5,985</b>

Source: JICA Study Team

**Table 6.1.7 DISTRIBUTION OF MANUFACTURING WORKERS**

Year	Industrial Classification	Person					Total
		Infanta Central Urban Area	Real Central Urban Area	Distribution District	Industrial District	Other Suburb	
1992	Existing Manufacturers	72	21	14	0	243	350
	Newly Established Population Responsive Manufacturers	210	40	100	0	0	350
	Agro-fishery Industries	0	0	0	1,860	0	1,860
	<b>Total</b>	<b>282</b>	<b>61</b>	<b>114</b>	<b>1,860</b>	<b>243</b>	<b>2,560</b>
2000	Existing Manufacturers	72	21	14	0	243	350
	Newly Established Population Responsive Manufacturers	350	60	255	0	0	665
	Agro-fishery Industries	0	0	0	2,370	0	2,370
	Pulp-Paper Manufacturers	0	0	0	0	2,600	2,600
	<b>Total</b>	<b>422</b>	<b>81</b>	<b>269</b>	<b>2,370</b>	<b>2,843</b>	<b>5,985</b>

Source: JICA Study Team

(ii) Complex Industrial Area

The above mentioned urban service industries shall be located in the Distribution Center District which in turn shall be located at the hinterlands of Port Real. Since these are light industries which can co-exist with other types of land uses, the entire Distribution Center District is designated as a complex industrial area including warehouses. As described before, the first phase development of agro-fishery processing industries should be located in this district.

In addition, Barangay Ungos where the present port is located shall also be included in the Complex Industrial Area owing to the fact that some industries already exist there in close relation to the port function. In addition, the transformation of land use shall gradually progress due to the large influence of the new port facilities as well as distribution facilities next to it.

(iii) Exclusive Industrial Area

To accommodate agro-fishery processing industries spilling over the distribution center district, industrial estate should be consolidated next to the center. This shall be designated as the Exclusive Industrial Area.

(c) Commercial and Service Land Uses

(Distribution of Workers)

The number of workers in the tertiary industry has been estimated based on their ratio as in the case of Lucena and Batangas (Table 6.1.8). The distribution of workers to each development district is described below (Tables 6.1.9 and 6.1.10).

(i) First, retailers are divided into those of the Central Commercial Areas and those of the Neighboring Commercial Areas. The ratio of the workers at the central commercial areas is given as the ratio of large retail workers of Region IV to the total number of retail workers. The reason is that these large retailers must be located at the commercial centers of the areas in order to secure a large number of customers. The central commercial businesses shall be located at the center of the existing sub-centers (Infanta, Real, and General Nakar) and the Regional Center and the prospective number of workers shall be distributed in accordance with the population of the respective areas. The Regional Center includes the Polillo Islands and also covers these three (3) existing municipalities in view of providing additional commercial services to them by overlapping the existing commercial centers of these towns.

Since neighboring commercial businesses shall be considered as the nearby stores, they shall be distributed in proportion to the respective populations of each area.

**Table 6.1.8 WORKERS IN TERTIARY INDUSTRY**

	Person		
	1983	1992	2000
Commerce Total	842	3,600	5,500
Retail	—	3,300	5,000
Wholesale	—	300	500
Transport/Communication	751	2,800	4,200
Finance/Insurance	61	1,000	1,600
Social/Domestic Serv.	2,137	6,900	10,100
<b>Tertiary Industry Total</b>	<b>3,791</b>	<b>14,300</b>	<b>21,400</b>

Source: JICA Study Team



Table 6.1.9 DISTRIBUTION OF TERTIARY INDUSTRY WORKERS (1992)

	Person								
	Existing Central Area			Regional Center	Distribution District	Urban-Belt Dist.	Suburb		
	Infanta	Real	Gen. Nakar				Infanta	Real	Gen. Nakar
Retail									
Central	120	50	40	490	0	0	0	0	0
Neighborhood	390	260	30	180	50	520	950	50	160
Wholesale	100	20	10	50	110	0	0	0	0
Finance/Insurance	340	80	50	160	380	0	0	0	0
Private Services									
Central	50	20	20	210	0	0	0	0	0
Neighborhood	180	120	10	240	20	80	440	30	70
<b>Total</b>	<b>1,180</b>	<b>550</b>	<b>160</b>	<b>1,330</b>	<b>560</b>	<b>600</b>	<b>1,390</b>	<b>80</b>	<b>230</b>

Source: JICA Study Team

Table 6.1.10 DISTRIBUTION OF COMMERCIAL SERVICE WORKERS(2000) Person

	Person								
	Existing Central Area			Regional Center	Distribution District	Urban-Belt Dist.	Suburb		
	Infanta	Real	Gen. Nakar				Infanta	Real	Gen. Nakar
Retail									
Central	170	50	60	720	0	0	0	0	0
Neighborhood	530	270	130	560	50	960	1,230	70	200
Wholesale	120	20	120	70	160	0	0	0	0
Finance/Insurance	390	80	390	230	510	0	0	0	0
Private Services									
Central	70	20	20	290	0	0	0	0	0
Neighborhood	240	120	60	250	20	430	550	30	90
<b>Total</b>	<b>1,520</b>	<b>560</b>	<b>780</b>	<b>2,120</b>	<b>740</b>	<b>1,390</b>	<b>1,780</b>	<b>100</b>	<b>290</b>

Source: JICA Study Team

(ii) Personal service business shall be made up of those businesses which remain after public businesses and personal services are subtracted from social/personal services (Table 6.1.8). The number of workers in this sector is estimated based on the number of private service workers per 1,000 at GCLA (14.59 persons/1000). These shall be 1,500 and 2,200 for the years 1992 and 2000 respectively.

They shall also be divided into those in the Central Commercial Areas and those in the Neighboring Commercial Areas. Their distribution shall be based on the amount of population in each area or district.

(iii) Since wholesale, finance, and insurance businesses mainly constitute office service, they shall be distributed to the centers of each area based on the number of workers (industrial, retailing, and private services) in each respective area. In other words, they shall be located at the existing centers of the three (3) municipalities and the Regional Center. They shall also be located in the Distribution Center District as their business operations shall eventually be necessary in relation to the port distribution businesses and the processing industries in the District.

The main characteristics of the distribution results described above are summarized as follows:

- (i) The Regional Center shall have the largest accumulation of commercial and servicing industries (in 2000). In 1992, however, it shall barely exceed the size of the Infanta urban area.
- (ii) Although Infanta shall have a controlled urban population, there shall be a strong demand for the Infanta urban center as it shall constitute the commercial and service center for the Infanta and General Nakar suburban areas.
- (iii) The demand for neighboring commercial businesses shall be large at the Infanta Real Urban Belt in proportion to the size of the respective urban population.
- (iv) Commercial and service industries shall achieve the size of a proper commercial center in the Distribution Center District.
- (v) No large growth is expected in the Real urban center as it shares the market with the commercial center of the Distribution Center District (in 1992, its size shall equal that of the Distribution Center District).

#### (Commercial Land Requirement)

Based on the average net densities of the commercial and service industry in the Philippines and also in the planned districts, 150 persons/persons/ha, 100 persons/ha and 180 persons/ha are given for the existing urban centers (sub-centers) and the Infanta Real Urban Belt, the Regional Center and the Distribution Center District respectively. Using these figures, the land requirement for commercial and service industries can be calculated (Tables 6.1.2 and 6.1.3). The total area shall be 33.1 ha and 53.6 ha in 1992 and 2000 respectively.

Based on the calculation results described above, the Commercial Areas Development Plan has been prepared as follows:

#### (i) Neighboring Commercial Areas

The urban areas extend beyond a walking distance (400-500 m) at the Infanta Real Urban Belt and the residential district of the Regional Center. Neighboring commercial areas, therefore, selling general goods shall be developed in these urban areas.

#### (ii) Local Commercial Areas

As mentioned previously, the commercial areas in the existing urban centers of the three municipalities shall act as neighboring commercial areas for the urban population.

They shall also act as the commercial centers for each municipality or district. The existing urban centers shall, therefore, be developed as local commercial areas where neighboring and central commercial activities are mixed using the existing shopping arcades as the cores.

#### (iii) Port Commercial and Business

The areas for distribution related to commercial and service industries and their business functions (office work) shall be developed in the Distribution Center District in order to promote their growth. As described in the Industrial Land Plan, these areas shall be designated as Complex Industrial Areas because they shall be developed as complexes with distribution and light industries.

#### (iv) Central Commercial Area

The central commercial area shall be developed in the Regional Center to accommodate commercial and service industries serving the east coast area and the three (3) municipalities. It shall be developed as a modern commercial center with a lot of integrated open space (parks, green tracts

of land, car parks, etc.). As mentioned earlier, the employment density shall be kept low as a result of this.

#### (d) Institutional Land Use

Public spaces include social service facilities (educational, medical, cultural, and administrative services), transport facilities (roads, ports and harbours, transport terminals and public car parks, etc.), parks and other public utilities (power substations, water treatment plant and sewage plant, etc.). These spaces are planned in the following manner (Table 6.1.11):

(i) Public spaces shall be secured based on the following composition in places other than the specialized districts (Regional Center, Distribution Center District and Agro-Fishery Processing Districts):

i) With reference to the development criteria for social service facilities in the Philippines (3.0 ha/10,000 persons for primary schools, 3.0 ha/20,000 persons for secondary schools and 1 facility/5,000 persons for BHS. In the case of a park, 3.5 - 9% of the land should be provided), 15% of each district's total land area should be provided for public facilities.

Table 6.1.11 LAND REQUIREMENT FOR INSTITUTIONAL FACILITIES

	Existing Built-Up Area			New Built-Up Area		
	G. Nakar	Infanta	Real	Infanta (Regional Center)	Real (Distribution Center)	
<b>I. Population Responsive Facilities</b>						
1. Education	3.0	8.0	8.0	33.5	13	
2. Medical	0	1.0	0	5.0	2.5	
3. Administrative	1.0	1.0	1.0	8.0	3.0	
4. Park	2	2	2	0	2	
5. Power Water Supply	2.5	2.5	2.5	9.0	2.5	
<b>II. Facilities Serving Broader Area</b>						
1. Education (University, etc.)	0	0	0	19.0	14.0	
2. Medical (Hospital)	0	0	0	10.0		
3. Administrative	0	0	0	6.0		
4. Culture	0	0	0	3.0		
5. Park				20.0		
Existing Facilities	4.5	11.5	5.0	—	—	
<b>Total</b>	<b>13.0</b>	<b>26.0</b>	<b>18.5</b>	<b>113.5</b>	<b>37.0</b>	<b>208.0</b>

Source: JICA Study Team

ii) Land for roads should be 15% of the total in view of the progress of motorization in the future.

iii) Parks, open spaces and unused land (slopes, rivers, etc.) should be 5% of the total.

(ii) Since the residential district and the public utility district of the Regional Center shall be located in the hilly area, which is also an environmental preservation area, development shall be carried out at 60% of the total area, leaving 40% intact (for public spaces).

Since the required land for social service facilities located in the public utility district of the Regional center is 113.5 ha (Tables 6.1.2 and 6.1.3), the area of the public utility district of the Regional Center shall become 206.3 ha on the basis of the 5% requirement for roads and transport facilities (in terms of the actual developed area, this is 8.3% / 5% § 60%).

A general hospital, university, and cultural center, etc., should be distributed in the Regional Center in relation to the improvement plan of the medical, educational, and cultural levels of the East Coast area. These facilities should be developed to integrate with the surrounding landscape in order to prepare the natural environment.

(iii) Since land for port facilities shall be necessary in the Distribution Center District, land for road and traffic facilities shall cover 30% of the district area.

(iv) Land for public utilities shall cover only 5% of Agro-Forestry Processing District since this district does not require social service facilities.

## 2) Natural Preservation Land Use

Based on the development concepts of the Natural Preservation Areas described earlier, the following should be designated: (i) Preservation Green Belts; (ii) Productive Land; (iii) Environmental Preservation Areas; and (4) Facilities Development Area (Fig. 6.1.5).

### (Preservation Green Stripe)

This designation is given to areas where topographical inflexion occurs or land use patterns change in order to prevent topographic destruction as well as provide a buffer zone against any undesirable influence between different types of land use adjacent to one another.

#### (i) Coastal Preservation Green Stripe

This consists of a coastal line with a sandy beach and coconut trees of 200 m in width and 22 km in length preserved by the prevention of soil erosion caused by currents and waves.

#### (ii) Swamp Preservation Green Stripe

This green belt is designated along the swamp boundary 100 - 200 m in width and 21 km in length to protect the swamp environment surrounding the fish ponds and also to protect the agricultural land from damage caused by sea water, high tides, sediment discharge, etc.

In places where the swamp faces the sea, a green belt of about 500 m in width and 18 km in length shall be designated to preserved the mangroves areas. It is hoped that this measure shall achieve the following: (i) protect the area from damage by sea water, high tides, and sediment discharge; (ii) promote the natural purification of sewage from the culture ponds; and (iii) conserve the landscape and natural environment.

#### (iii) Hill Area Preservation Green Stripe

An area of 200 to 300 m in width and 44 km in length on the slope adjoining the flat land shall be designated as a green strip in order to prevent

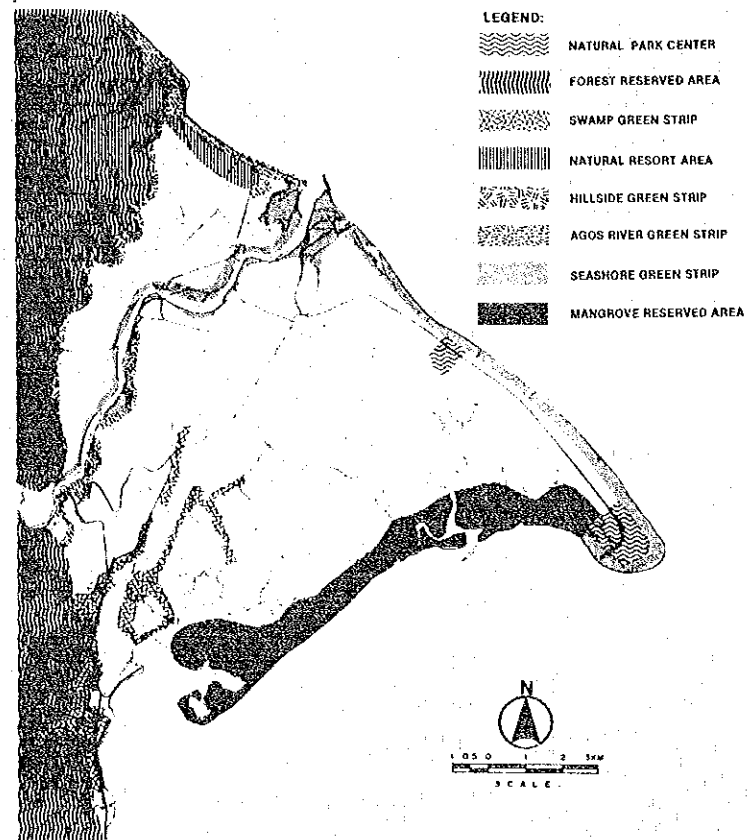


FIG. 6.1.5 ZONE OF NATURAL ENVIRONMENTAL PROTECTION & PRESERVED GREEN STRIP

sediment discharge and erosion of the hill areas belonging to the Sierra Madre mountain range.

#### (iv) Agos River Bank Preservation Green Belts

The areas along both river banks of the Agos River shall be designated green stripes to conserve the Agos River system.

### (Productive Green Tracts of Land)

#### (i) Agricultural Land

Agricultural land shall be distributed in the manner based on the Agriculture Promotion Plan given in Section 2.1, Chapter 6.

Some 2,500 ha of land shall be secured for the cultivation of rice on the Infanta and General Nakar plan in order to achieve a self reliant rice supply. (Extensive growth of the Infanta urban area is, therefore, suppressed and urban development is limited to the area along the Infanta Road and the hill areas.)

The plain's arable land shall be readjusted to develop intensive paddy fields in order to increase rice production.

Rice fields shall increase to 2,565 ha due to conversion from coconut cultivation to rice cultivation based on the completion of irrigation systems, and also due to the abandonment of rice fields as a result of urban development. As the ratio of used land shall be improved to 92% (currently 82%), the rice fields shall reach 2,360 ha (in 2000).

The smaller coconut forests shall be transformed to paddy rice fields. The coconut plantations, however, shall be developed into intensively replanted coconut forests and the introduction of new varieties shall be introduced.

The land area for coconut forests shall be reduced by 1,000 ha totalling 2,178 ha due to its conversion to paddy rice fields and abandonment as a result of urban development.

(ii) Forest Land

Although part of the hill area shall be developed for residential as well as recreational purposes it shall still be, in principle, a forest preservation area. The mountainous areas of the three (3) municipalities shall be developed as reforestation areas in preparation for the pulp paper mills to be built in the future. The hill area shall make up a part of this reforestation area and an experimental Reforestation Pilot Project shall be carried out over an area of 70 ha.

(iii) Fishery Site

The fishery site shall be located in the following manner based on the Fishery Promotion Plan given in Section 2.2, Chapter 6.

The target productivity is given at 60% for 1992 and 100% for 2000 while the area to be developed is 900 ha for 1992 and 1,500 ha for 2000.

The development policies for the fishery site where square fish ponds are lined up regularly are as follows:

(i) Intensive as well as high density fish ponds shall be developed and the existing fish ponds shall be redeveloped in the area sandwiched by swamp preservation Green Stripes as stated before.

(ii) Fundamental channel development and readjustment of the fishponds, including the existing fish ponds and unused land shall be carried out for effective land use and smooth operation of fish cultivation.

(iii) Channel development is aimed at effectively utilizing the land by making small meandering channels straight and by integrating many small creeks. The realization of an effective transportation and water supply system within the fish cultivation complex and a water system are attempted by the development of channels to traverse the various small rivers.

(Environmental Preservation Areas)

The environmental preservation areas, where housing, industrial, and tourism development are carried out without adversely affecting the natural environment shall be designated as follows:

The development areas in these districts shall be regulated and positive measures shall be implemented to reinforce the natural beauty of the land during and after development:

(i) Coastal Recreation Area

This area is designated along the Coastal Preservation Green Stripe previously mentioned. Accommodation and outdoor recreation and sports facilities shall be provided based on the Tourism Promotion Plan described in Section 2.4, Chapter 6.

The natural environment is an important resource for tourism and the development must, therefore, be carried out while the natural environment is preserved (mainly coconut forests) in this area.

(ii) Hill Recreation Area

The hill areas of General Nakar shall be developed as a recreation area linked to the coastal area mentioned above. Harmonious development is also necessary here in order to conserve the natural environment.

(iii) Hill Scenic Area

The Regional Center, located in the hill area, shall be developed not only for the prevention of disasters but also to provide the urban areas with plenty of greenery representing the beauty of the East Coast. It is, therefore, designated as an environmental preservation area. The area to be developed shall be controlled at 60% of the total land, as described earlier, and a number of regulations shall be enforced to maintain and improve the environment.

(Facilities Development Area)

Facilities for research, academic, sports, leisure, and tourism purposes shall be developed in the following manner in relation to the Coastal Recreation Area. The development shall be based on the Tourism Promotion Plan described in Section 2.4, Chapter 6.

(i) Dinahican Marine Research Park District

As shown in the Tourism Promotion Plan, a fishery research institute, academic and cultural facilities, hotel accommodations, and sports facilities shall be concentrated in this district, 28.3 ha in size.

(ii) Public Beach Resort District

As part of the comprehensive tourism development plan for the coastal area, a recreation center consisting of a beach leisure center and an amusement center shall be provided halfway along the Infanta coast with an area of 46 ha.

## Urban Land Development Plan

It is a planning practice to formulate a development plan of an area covering convenient design periods. Likewise, in IRM urban development, the entire development plan shall be scheduled in the following two (2) periods: (i) Priority Development Period (1984-1992); and (ii) Long Term Planning Period (1993-2000).

However, all land development activities cannot be accomplished simultaneously. In conformity with the scarcity of resources, and with respect to the normally gradual process of urban evolution, the Priority Development Period shall further be divided into two (2) phases. These phases must be designed to respond in harmony with the said process of urban evolution. The first phase shall initiate selected industrial development projects and provide the compact urban land to accommodate the immediate population increase expected to propel the IRM economy. A second phase shall support and nurture this fledgling economy with more intensive development projects to fuel initial development efforts and achieve the image envisioned for the year 1992.

According to the above discussions, the following outline of urban land development shall be proposed (Fig. 6.1.6):

(a) Construction of Urban Core

As stated above, an urban core and an urban area which includes the Real Port development as its major component shall be developed in the early period of the IRM Development of the IRM Development in order to accommodate such industries as distribution, commerce/services, and agro-fishery processing manufacturing which shall initiate the IRM urban development. This urban core should also be constructed with necessary infrastructure services (power, water, road, etc.). Without this initial urban land development, no such industries shall be induced. Otherwise, they shall likely be located on the perimeter of existing urban areas where the essential infrastructure services seem inadequate, thus, causing sporadic and chaotic land use to take place in IRM.

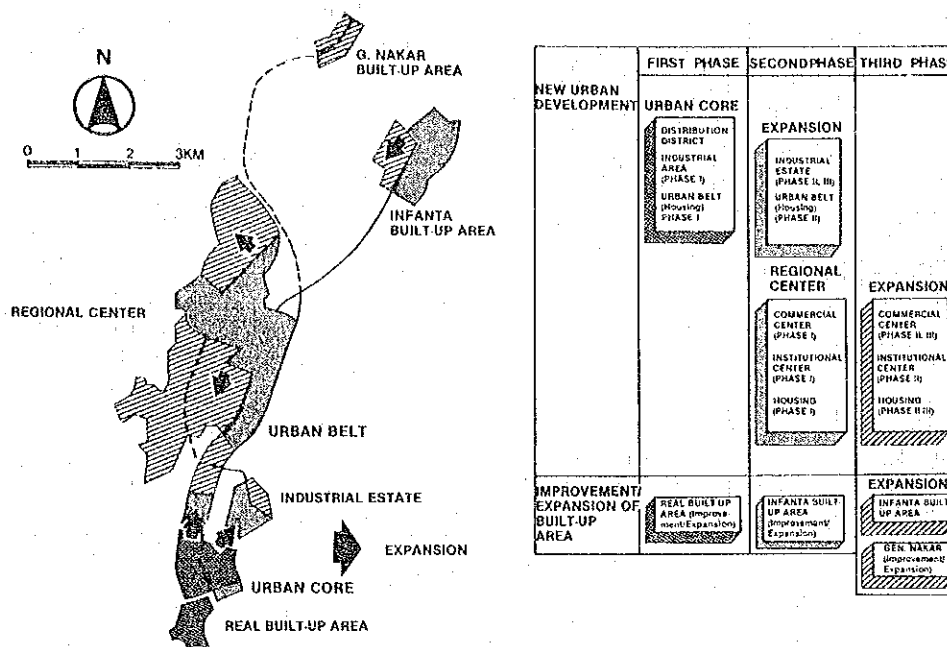


FIG. 6.1.6 EXPANSION OF URBAN DEVELOPMENT

(b) Construction of Central Urban District for Establishment of New Urban Structure

After a self-supporting urban growth is initiated on the basis of the above urban core, a tremendous increase of both population and industrial activities shall be expected to take place in IRM. In order to respond to this drastic change of society, a new central urban district should be developed at the regional center, thereby, transforming the existing urban structure into an appropriate composition with which the population of 150,000 can be accommodated by 2000, one which shall be able to accommodate the population of 100,000 to 150,000 by 2000. At the same time, said urban core shall be expanded to play a part of this transition.

(c) Establishment of Urban Structure

The development discussed in (i) and (ii) above are the two (2) phases of the Priority Development Period. After this development, an integrated urban structure shall be established during the Long Term Planning Period, facilitating further expansion of the future urban areas in IRM.

Such major components as the urban core of Real Port area, the Regional Center, residential area development along Infanta Road, and the development of General Nakar Central Urban Area shall be completed during this period. Thus, an establishment of a structure which shall be able to orchestrate those development components as one integrated urban development shall be essential in view of efficient economic as well as physical development of IRM in the future.

(d) Major Districts Development Scheme

The development concepts of major districts are shown here as tentative

models in order that the Land Use Concepts mentioned earlier may be understood. The District Development Plans and the designation of land use based on these Plans should be carried out in the future with an understanding of the detailed conditions (topography, geology and propriety land rights, etc.) while using these models as the starting points.

The following three (3) districts have been listed as the major districts because they constitute important components in the IRM Urban Development Project.

(i) **Urban Core:** Since the fishery and distribution bases shall be the backbone of economic and industrial development in IRM, it is strongly required that an efficient Urban Core is created wherein these bases are well integrated with related industries, urban facilities, and housing, etc.

(ii) **Marine Research Park:** Apart from being a main component in the promotion of tourism for the vitalization of the Region's economy, this Park is also important for the promotion of the entire urban development as it plays a symbolic role as a main environmental component for IRM.

(iii) **Regional Center:** The development of the new Regional Center is indispensable to IRM. A city of 150,000 inhabitants, not only functions wholly in order to form an urban society, but also to achieve the Project goal of presenting itself as an urban center for as wide an area as the East Coast.

1) IRM Urban Core Development

(a) Objectives

In order to trigger the IRM Urban Development, an urban core shall be established to become the base for an autonomous growth of IRM.

(b) Location

This urban core which is flanked by Infanta Road and the New Real Port covers an area of around 100 ha. containing the Distribution Center and 60 ha. residential area of first phase Urban Belt Development (Fig. 6.1.6).

(c) Development Concept

In parallel with the improvement of the conditions for interregional transport (Infanta Road and Real New Port), a vital factor of the IRM development, urban land development shall be carried out to create a center for natural resources and industrial developments which consists of the following components (see Fig. 6.1.7 conceptual linkage among the development components of urban core):

(i) Distribution/Fishery Base of the East Coast Region

Distribution Industries (fish market, cold/freezing storage, etc.), and Related Service Industries (repair factories, ice plant, etc.) shall be promoted to activate and support natural resources exploitation, marine transportation, and fishing in the east coast region.

(ii) Natural Resources Development/Promotion Center

Marine Brackish Culture Center (produce and deliver prawn fry, and market cultured prawn) shall be constructed aiming at promoting prawn culture industry in the swamp area.

(iii) Development of Agro-Fishery Processing Industry

The first phase of development of processing manufacturing industries shall commence in connection with the natural resource development mentioned above.

(iv) Port Commercial/Business Center

Commercial/service industries and business activities (like trading) shall be introduced in accordance with development in the port area of industries such as distribution industries and manufacturing industries as stated above.

(v) Model Housing Development Area

A model housing development shall be created in the core where variety of different housing types shall be provided for the families of workers in the core as well as for other increased urban population.

(d) Land Use Scheme

The above mentioned Redevelopment Concepts are translated into the land use scheme of the 100 ha. area of urban core (Fig. 6.1.8) in accordance with the major zoning of development components which shall accommodate the facilities/industries listed in Table 6.1.12.

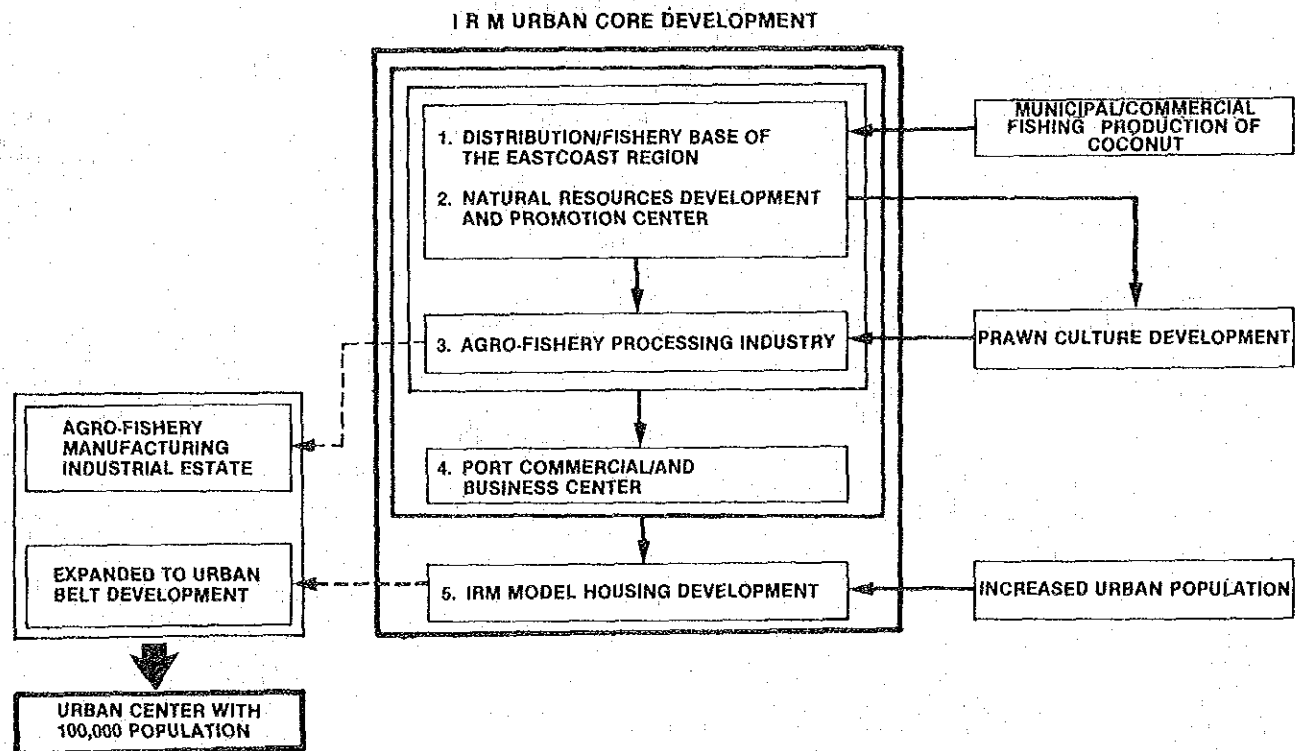


FIG. 6.1.7 CONCEPTUAL LINKAGE AMONG THE DEV'T COMPONENTS OF URBAN CORE

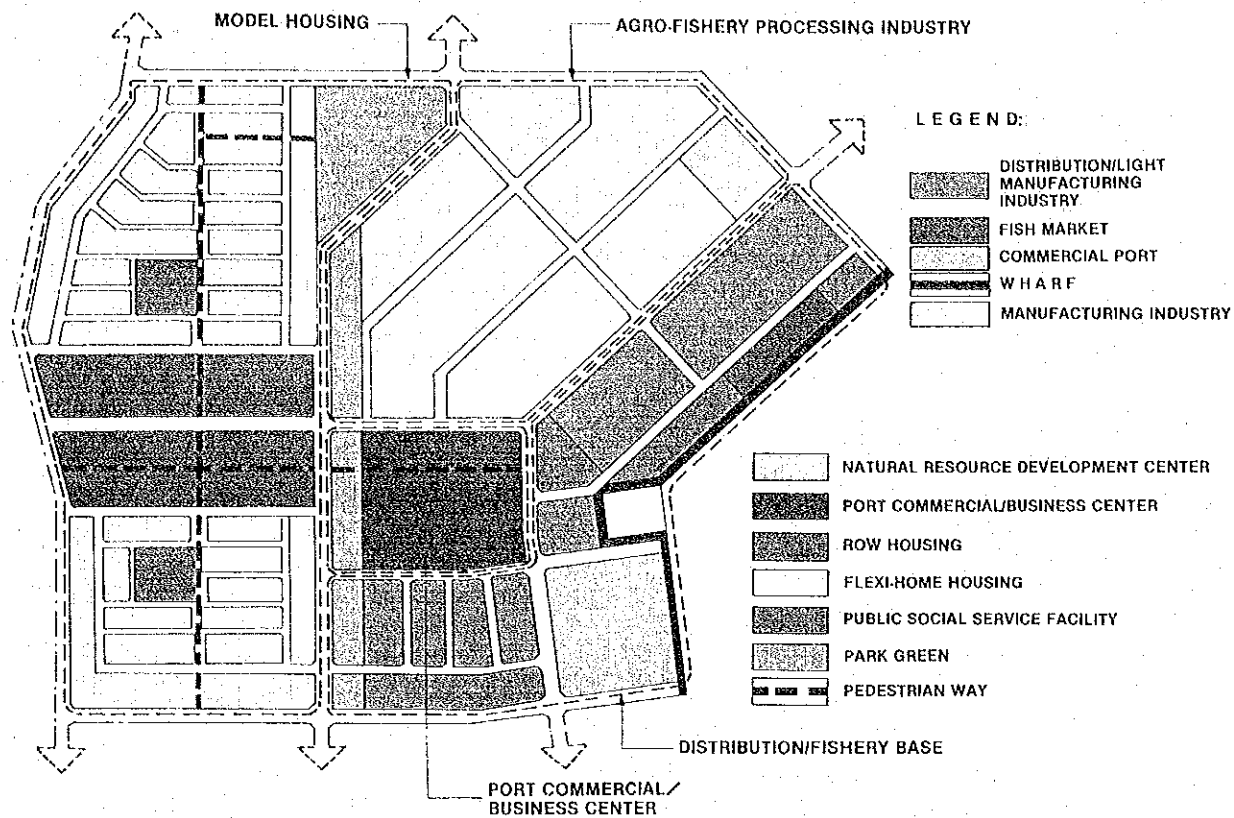
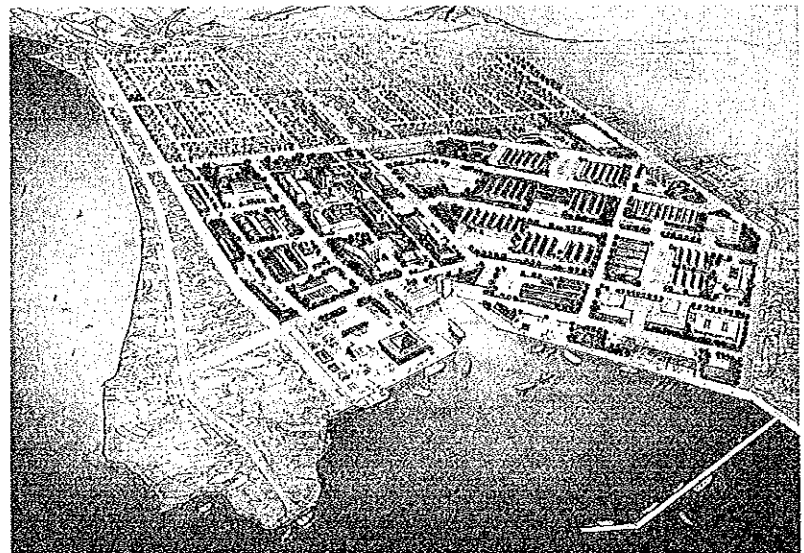


FIG. 6.1.8 LAND USE SCHEME OF URBAN CORE

Table 6.1.12 FACILITIES/INDUSTRIES TO BE LOCATED IN THE URBAN CORE

Zoning	Facilities/Industries
Distribution/ Fishery Base  21.5 has.	<ul style="list-style-type: none"> <li>• Port facilities (quay, loading/unloading facilities, stockpile yard, fish net drying yard, office, gas/water station, slipway, fish market, etc.)</li> <li>• Fishing distribution industries (wholesale, cold/freezing storage, etc.)</li> <li>• Service manufacturing industries (repair shops of fishing net, boat and boat equipment, engine, ice plant, etc.)</li> <li>• Transportation node facilities (ferry terminal, parking lot, truck terminal, etc.)</li> </ul>
Agro-fishery Processing Manufacturing Industries  20.0 has.	<ul style="list-style-type: none"> <li>• Fishery processing factories (prawn, tuna, etc.)</li> <li>• Agro-processing factories (coconuts, etc.)</li> <li>• Natural resources development center (Marine brackish culture center)</li> </ul>
Port Commercial Business Center  4.1 has.	<ul style="list-style-type: none"> <li>• Retail store (general merchandize, commodity related port activities, etc.)</li> <li>• Service industries (lodging, restaurants, tourist shops, personal services, leisure recreation facilities)</li> <li>• Business Office (finance, insurance, trade communication, etc.)</li> </ul>
Model Housing Development  50-60 has.	<ul style="list-style-type: none"> <li>• Row housing, flexi-home, low cost housing.</li> </ul>



## 2) Marine Research Park

### (a) Development Purpose

The marine research park shall be built as a leading core for the development of the peninsula stretching from Santa Monica to Dinahican into a major resort and recreation area in Luzon Island.

### (b) Location and Area

It shall be located at the tip of the peninsula, and shall consist of 28.3 ha. of land surrounded by a sandy beach and the coastal preservation green belt of 100 m in width.

### (c) Development Concept

The park shall have complex functions i.e., (i) it will be a base for water recreation activities in a natural environment, (ii) it shall form a convenient base for resort recreation points spread over the peninsula; and (iii) it shall be a base for water recreation activities.

Fig. 6.1.9 shows the development concept of the park. The main facilities shall be distributed as follows:

#### (i) Accommodation

Accommodation shall be provided at the center of the park district. Hotel-type as well as cottage-type accommodation shall be introduced to express the character of resort facilities. The hotel shall also be used to ac-

commodate visitors to the Research Institute, and shall be equipped with a convention hall and an exhibition hall, etc.

#### (ii) Research Facilities (Fishery Center)

A marine research center which shall be a show piece of IRM shall be invited to open here.

#### (iii) Out-door Recreation Facilities

Although the beach shall be the main recreation facility places for out-door sports (tennis, riding and golf, etc.), and recreation (picnic areas, etc.) shall also be introduced.

#### (iv) Anchorage Facilities

Anchorage facilities for boats at the fish ponds in the swamp area, water tours to the natural mangrove forests, and water sports (yachting, fishing, etc.) shall be developed.

## 3) Regional Center

### (a) Development Purpose

The creation of a rich urban environment, the improvement of convenience for the inhabitants, and the systematization of land use shall be promoted by the creation of an urban core where these social service and commercial facilities serving the entire IRM as well as wider areas beyond the IRM in particular are gathered together.

### (b) Location and Area

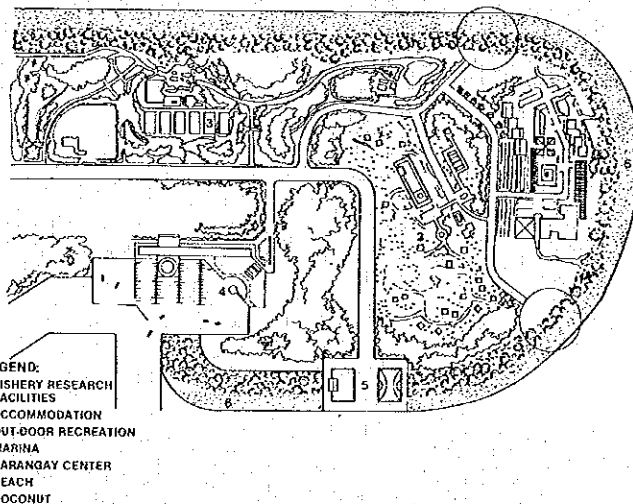
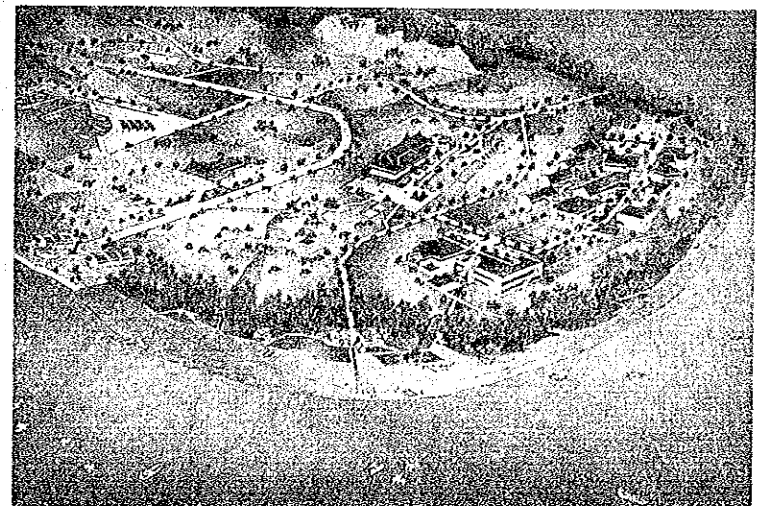


FIG. 6.1.9 DEVELOPMENT SCHEME OF MARINE RESEARCH PARK





The Regional Center shall be located at portions of the hill area with the same distance from the three (3) municipal centers (at the center of the Project Area). A medium-density residential area along the Infanta Road and a low-density residential area on the hill are planned to the east and west of the center area respectively.

A transportation service for the Regional Center shall be provided by the Infanta Road which constitutes the eastern boundary of the center and Marcos Road which runs through the central area.

(c) Development Concept

The following facilities shall be provided for each zone in the Regional Center:

- (i) Education and Cultural Zone  
(university, high school, regional library, cultural, etc.)
- (ii) Medical Zone  
(general hospital, RHU, etc.)
- (iii) Administrative Zone  
(central post office, central administrative center, Infanta offices of various institutions, regional court, etc.)
- (iv) Commercial Zone  
(retail stores, markets, entertainment facilities, telex, telegraph offices, telephone exchange, radio stations, etc.)
- (v) Civic Park and Sports Facilities

The distribution of these zones shall be that while the institutional facilities are located in the hill area to form an entity with the park area, the commercial axis shall be set up to enter this park area from the lower land (Infanta Road side) towards the hill area (Fig. 6.1.10).

In addition, this commercial axis shall be set up so that is related to the neighbouring commercial section in the medium density urban area along the Infanta Road and runs through the low-density residential section in the hill areas.

A schematic diagram of the facilities in the Regional Center is shown in Fig. 6.1.11.

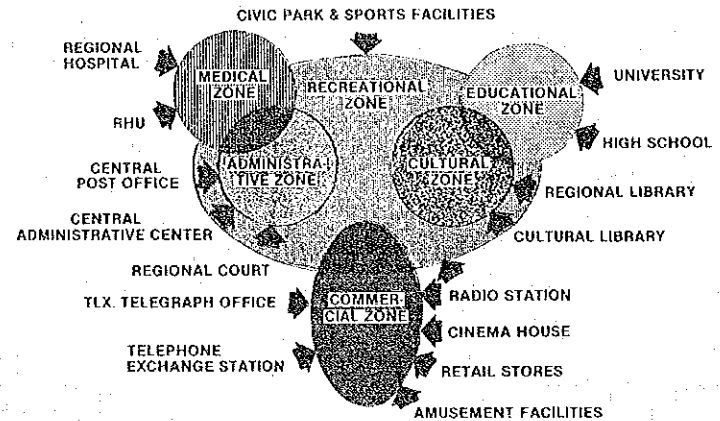


FIG. 6.1.10 MAJOR ZONING OF REGIONAL CENTER

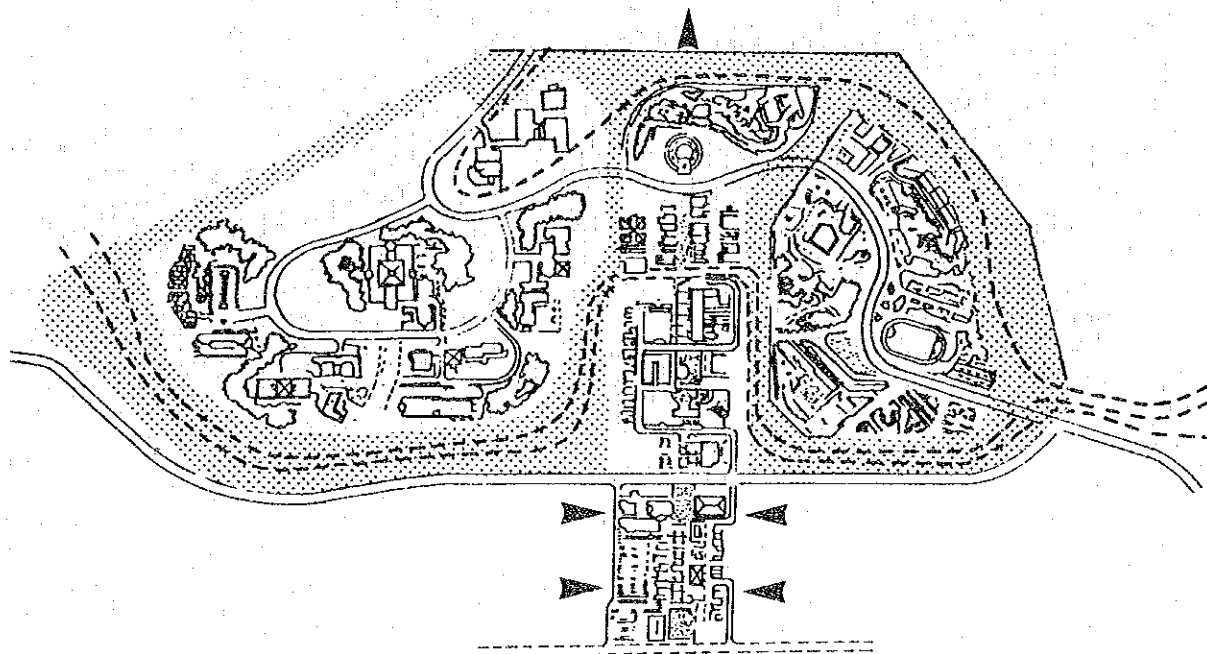
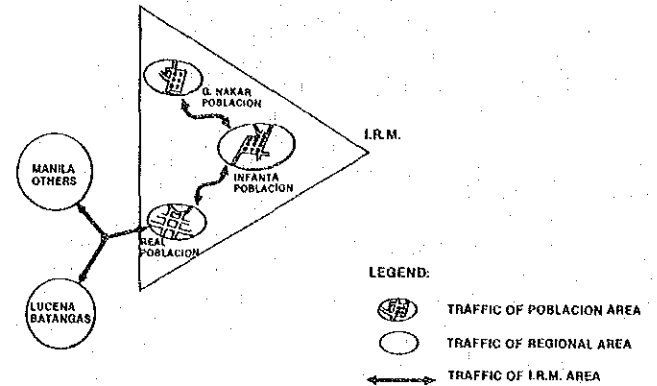


FIG. 6.1.11 REGIONAL CENTER DEVELOPMENT PLAN

### 6.1.3 Transportation Plan

#### Road Transport Plan

The road transportation system is to be composed of the broad inter-regional transport system and the urban transport system. The former is designed to link the IRM transportation system with those of Manila and the eastern Region (Rizal, Laguna, and Quezon Provinces). The latter shall form the comprehensive transportation system within the planning region (Fig. 6.1.12).



#### 1) Inter-Regional Transport Axis

The purpose of the interregional transport axis is to provide a trunk road for the eastern corridor axis in order to connect the west coast area centering on MMA and the Pacific east coast area. By using the Manila East Road which runs between Manila and Famy as the axis of the eastern growth corridor, and the Infanta Road running between Famy and Infanta, the east-west axis can be secured. The formation of this axis, however, requires that these roads be improved to the highest level so that travel time standards could be achieved.

FIG. 6.1.12 TRANSPORTATION SYSTEM OF PLANNING AREA

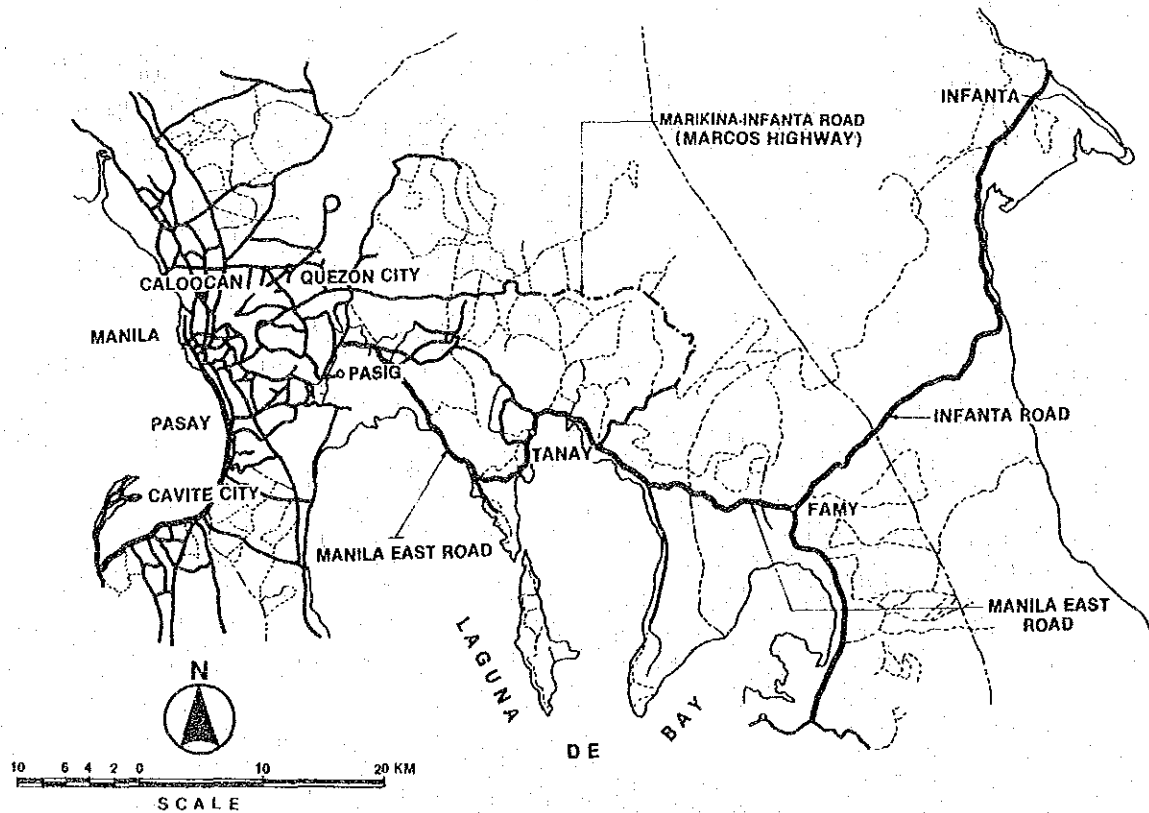


FIG. 6.1.13 REGIONAL ROAD NETWORK (M.M.A.-INFANTA)

In addition, this eastern corridor axis connects three (3) provinces, i.e., Rizal, Laguna, and Quezon by joining the north-south axis of the Manila East Road running from Famy to Lucena via Sta Cruz. Accordingly, the possibility of the development of the eastern underdeveloped area is increased due to the strengthening of the eastern corridor axis (Fig. 6.1.13).

The Marikina-Infanta Road (Marcos Highway), stretching for some 130 km from Marikina in Rizal to Infanta in Quezon has been planned by MPWH in order to promote the development of the hill areas in Rizal Provinces, and to act as a by-pass for the Manila East Road.

Although the construction of the Marikina-Infanta Road started in 1974, only about 38 km from the beginning of route have been completed so far due to the slow progress of related developments, and the difficulty of construction in the mountain areas. The plan has now been revised to reduce the scope of the original plan. According to the revised plan, a substitute road strating from the Module II District of the Lungsod Silangan Development Project and connecting with the Manila East Road at Tanay via the existing road is now under consideration.

If this plan is put into practice, the eastern growth corridor connecting MMA and the east coast shall in effect be the Manila East Road and the Infanta Road. The Infanta Road connecting Famy and Infanta would have to bear both traffic between MMA and IRM and between IRM, Santa Cruz, and Lucena, etc. in southern Quezon. Road improvement for the Infanta Road shall, therefore, become a necessity in order to meet this large volume of traffic.

When transport activities between IRM and other areas become vitalized by the road improvement, a traffic volume of 6,200 vehicles/day and 9,600 vehicles for the Infanta Road shall be estimated in years 1992 and 2000 respectively (Table 6.1.13).

Sections of the road which currently show a traffic volume of 9,100-10,000 vehicles/day in the GCLA area are the sections between Carmona (10,000 vehicles/day) of the Manila South Road, between Tarlac and Paniqui (9,199 vehicles/day) of the Manila North Road, and between the Ibaan Junction and Batangas (10,750 vehicles/day) of the Batangas Road.

In comparison with other roads, therefore, the volume of traffic on the Infanta Road shall correspond to cities with a population of 120,000-180,000 such as Calamba (pop. 121,000), Tarlac (pop. 176,000) and Batangas (pop. 144,000), all of which are important cities within a 100 km radius of Manila.

Since traffic to Manila shall occupy 78% of the entire volume in year 2000, it can be said that traffic on the Infanta Road shall be Manila-oriented. The most effective way to deal with such future increase in traffic, both in quantity and quality, shall be to improve the 40.8 km Infanta Road, the only road currently connecting the east coast area.

The planned contents of improvement of the Infanta Road include at least two (2) traffic lanes and the upgrading to a high standard road, paved throughout, so as to secure a reliable regular traffic or to achieve time reduction.

These targets have been decided for the Infanta Road in order to maintain the steady flow of goods such as fresh food generated by the industrial development in IRM, and the flow of passengers over a wide area since the Road shall act as the area's growth corridor.

Concrete planned items are the widening of the current single lane section, the improvement of road alignment which is currently of a low standard, the repair of old bridges, the provision of water drainage at the roadsides, and the provision of traffic safety facilities such as quadrails, curve mirrors, etc. (Fig. 6.1.14).

Table 6.1.13 FUTURE TRAFFIC VOLUME OF INFANTA ROAD

		(Vehicle AADT)	
Direction	Kind of Vehicles	1992	2000
To Manila	Cars	2,264	3,349
	Buses	199	304
	Jeepneys	0	0
	Trucks	2,411	3,863
	Total	4,874	7,516
To Lucena & Others*	Cars	483	885
	Buses	18	27
	Jeepneys	155	281
	Trucks	604	963
	Total	1,260	2,087
Total	Cars	2,747	4,165
	Buses	217	531
	Jeepneys	155	281
	Trucks	5,015	4,286
	Total	6,134	9,603

Source: JICA Study Team

Note\*: Interview Survey Limited to passengers on outgoing buses.

(a) Road Widening and Alignment

(i) Widening of the single lane section between Binangan Point and Lumber Camp.

(ii) Improvement of road alignment and its geometrical design particularly in view of it being a trunk road for large vehicles (Fig. 6.1.15 and Table 6.1.14).

(b) Bridge Repair

Replacement of timber bridges and dilapidated truss bridges (totalling 7) with RC concrete bridges.

(c) Paving

Asphalt-concrete paving shall be used to bring about a reduction in transportation time, and also in view of the high humidity in the mountain areas (Fig. 6.1.16).

(d) Drainage Facilities

For road maintenance and traffic safety, drainage facilities such as side ditches (U-shaped ditches), and pipe culverts, etc., shall be provided along the entire road since rainfall in the area is not excessive.

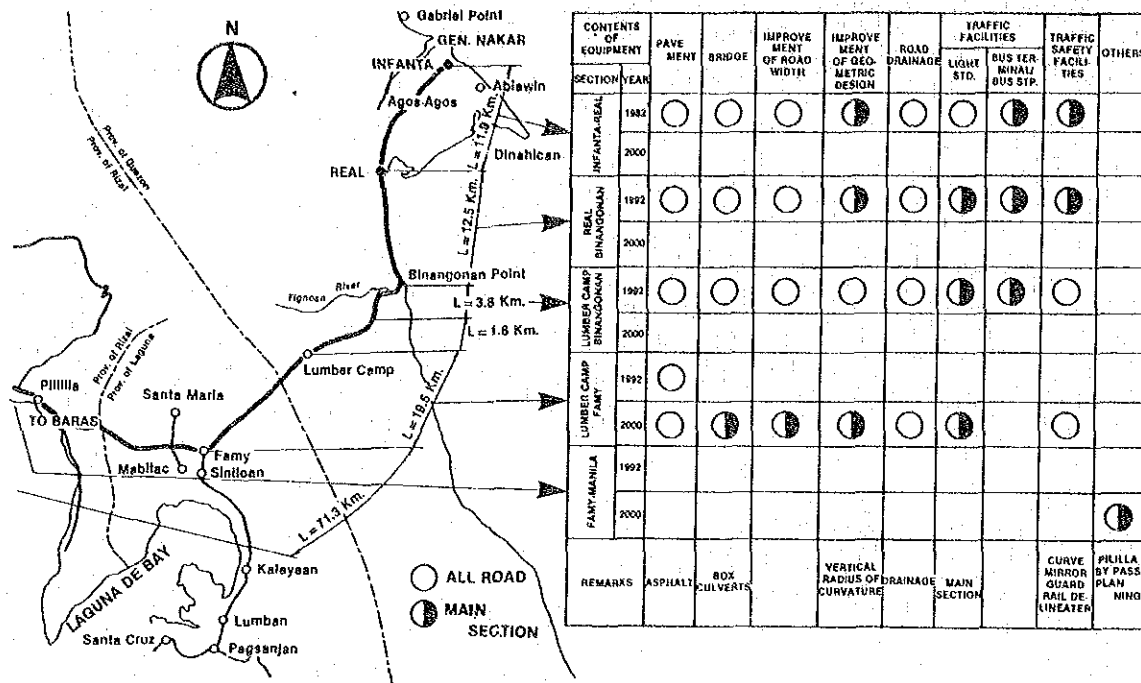


FIG. 6.1.14 ROAD IMPROVEMENT PLAN (INFANTA ROAD)

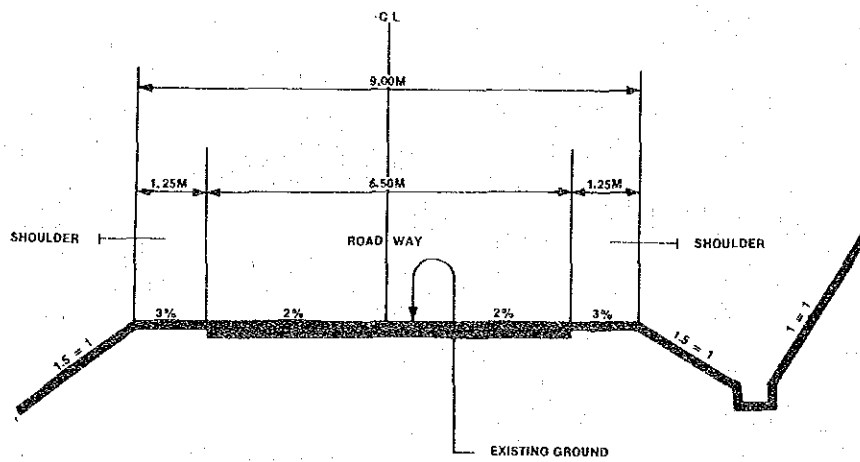
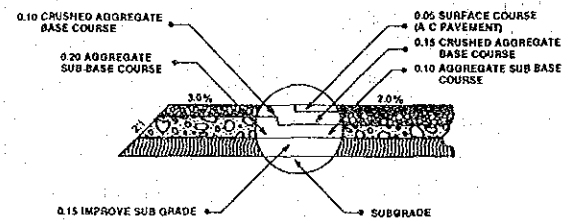


FIG. 6.1.15 TYPICAL CROSS SECTION

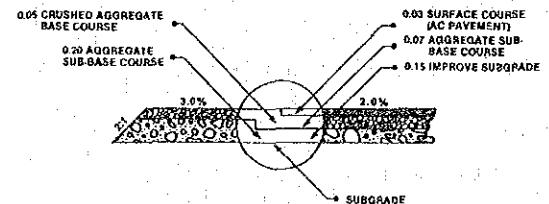
Table 6.1.14 GEOMETRIC DESIGN STANDARD (BINANGONAN-LUMBER CAMP)

Design Elements		Standards
Design Speed	km/hr	40
Width of Road	m	9.0
Minimum Horizontal Radius	m	50
Minimum Gradient	%	10
Critical Length of Grade	m	140
Minimum Superelevation	%	8
Min. Length of Vertical Curve	m	40

Source: JICA Study Team



STANDARD PAVEMENT SECTION



PLAIN PAVEMENT SECTION

FIG. 6.1.16 STANDARD CROSS-SECT. OF ASPHALT PAVEMENT

(a) Traffic Safety Facilities

Curve mirrors, guardrails, delineators, markings, road lighting, etc., shall mainly be provided at road sections in the mountainous area.

The Manila East Road shall become a bottle-neck if the volume of traffic increases in the future as it runs through the major cities located on the northern coast of Laguna de Bay where traffic is mixed with city traffic.

Although by-passes have been constructed for some of these major cities in order to divert the volume of traffic, there are no by-passes in Piliia, Baras, etc., in Laguna Province. In view of the future traffic volume of these areas, the construction of by-passes shall, therefore, be necessary.

By improving the present Infanta Road as described above, it shall be possible to achieve the objective of connection, thereby, travelling to or from IRM and MMA within three (3) hours resulting in an increase of trips in and around IRM.

2) Urban Transport System

The urban transport system shall be based on the Urban Road Network Plan, and the Urban Public Transport Plan. The system shall provide transportation services that properly respond to changes in the transport system from a motor bike oriented transport system based on the existing agriculture oriented structure of the project area using tricycles as the main vehicle to a four wheel car oriented transport system based on the urbanized structure of the area.

The future traffic volume of major arterial road in Infanta are estimated based on the area's development proposed by the Master Plan.

The results of the estimates show that Infanta Road (Real-Infanta) shall accommodate 5,300 vehicles/day and 8,400 vehicles/day in year 2000.

Dinahican Road (Infanta Central Urban Area-Dinahican) shall have 9300 vehicles/day in 1992 and 1,160 vehicles/day in 2000; and Binugao Road (Infanta New Urban Area-General Nakar) shall have 1,600 vehicles/day in 2000.

The purpose of urban road network development is to effect the smooth as well as safe transportation of goods and people. It shall, therefore, be necessary to provide urban trunk roads which correspond to the daily traffic pattern around the Regional Center and the industrial traffic pattern expected along the Infanta Road.

Feeder roads shall then be provided from these trunk roads to the swamp district, the coastal district, etc., inducing more trip improvements (Fig. 6.1.17).

The existing street network in the Infanta urban area should be upgraded to a vehicle oriented road network eliminating through traffic under this system. A circumferential road shall be developed to respond to the expansion of the urban area.

With Infanta Road as the major artery, other arterial roads shall be proposed to form urban road network connecting the regional center, Infanta, and Real new urban area, and the existing central districts, with each other. It shall also include feeder road development, industrial access to Real Port, Silanga, Langas, and Dinahican transport node of Infanta (Fig. 6.1.18).

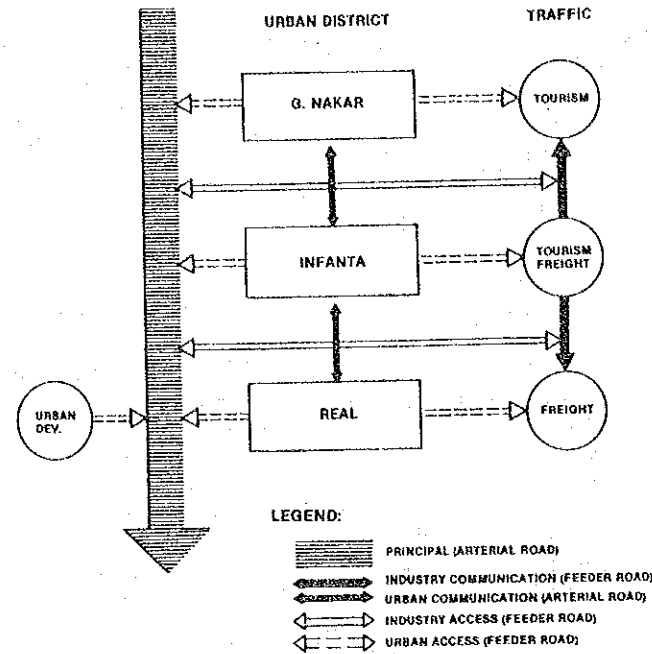


FIG. 6.1.17 URBAN TRANSPORTATION NETWORK

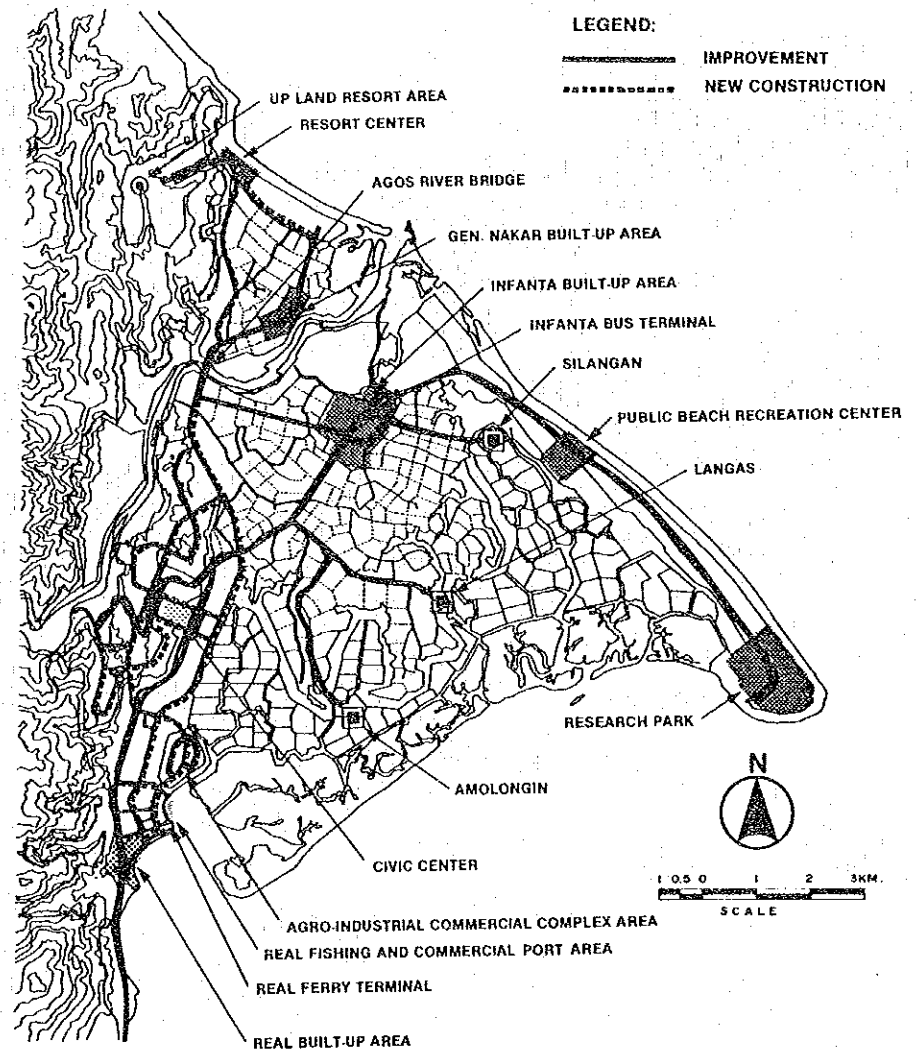


FIG. 6.1.18 ROAD NETWORK PLAN OF IRM

As for the geometric design standards of the urban road network, the urban arteries shall be designed with high standard, two-lane width roads, thus, accommodating various traffic ranging from trailer trucks, regular vehicles, and pedestrians. Auxiliary facilities such as drainage and lighting shall also be provided. On the other hand, the feeder road development shall place its emphasis on smooth mobilization freight traffic and on its service road functions for the settlement. Therefore, it shall be designed for the safety of everyday local traffic and the accommodation of freight traffic (Fig. 6.1.19).

By this road improvement work, the existing road network (aggregate road length: 226 km, road ratio: 0.8%, paved road ratio: 3%) shall reach a new level with an aggregate road length, road ratio and paved road ratio of 259 km, 1.0%, 28% respectively.

When this road condition is compared to cities with a population of 100,000-150,000 such as Lucena, Lipa, San Pablo, and Batangas, the road ratio is lower as shown in Table 6.1.15. This is because 54% of the road length shall still consists of the narrow Batangas Road and because development efforts shall be concentrated on provincial roads and other high-ranking roads.

The improvement and the functional differentiation of public transport are as follows: (i) The expansion of bus routes to meet the increased traffic

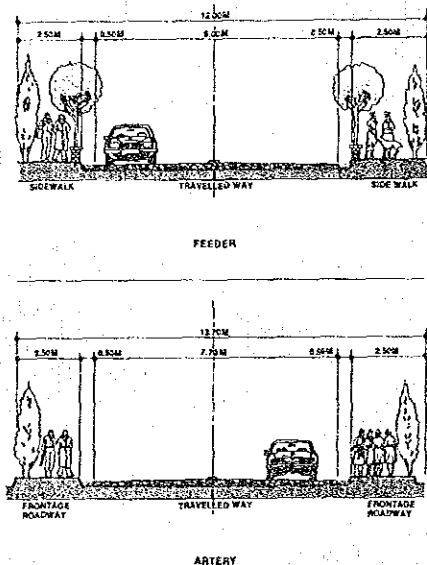


FIG. 6.1.19 STANDARD CROSS-SECTION OF INTER-URBAN ROAD

Table 6.1.15 INVENTORY OF ROADS BY CITIES WITH POPULATION OF 100 THOUSAND AND OVER

	a Land Area (km <sup>2</sup> )	b Road Length (km)	c Road Area (km <sup>2</sup> )	d Pavement Road Length (km)	c/a Rate of Road (%)	d/b Rate of Pavement (%)
Batangas	283.0	223	1,252.3	103	0.44	46.2
Lipa	209.4	216	1,166.4	82	0.56	38.0
San Pablo	214.0	138	767.6	84	0.36	60.9
Lucena	68.5	75	432.8	39	0.63	52.0
Total	774.9	652	3,619.1	308	0.47	47.2

Source: MPWH

connections with outside areas such as Manila, etc., the improvement of the bus terminal in Infanta, and the improvement of bus stops in Real; and (ii) the change of the major public transport mode from tricycle transport to jeepney transport as a measure to respond to the widened daily activities of the inhabitants (commuting, schooling, shopping, etc.) in the area.

## Port Development Plan

The Port Real Development plan shall be executed at Lampon Bay in view of the accumulation of agro-fishery resources in the Pacific area, and the development of a direct distribution route of goods to Manila. This Port Development Plan shall enable the port to serve both as a fishing and a commercial port (Fig. 6.1.20).

The conditions which have prompted the port development of IRM at Real are as follows:

- (i) It already has some of the functions to act as a port, and it shall be able to become a strong distribution base due to its proximity to the Polillo Islands where a large volume of goods distribution is anticipated.
- (ii) Fishery workers are concentrated in Real.
- (iii) There is easy access to trunk roads for goods being transported by land.
- (iv) The natural conditions are suitable.
- (v) Functionally speaking, it can also handle products for the aqua culture industry in Infanta's swamp areas as well as be a base for ocean fishing.
- (vi) With the agro-forestry processing plants located in its hinterland, it offers its much needed support to these industries.
- (vii) Extensive services for passengers travelling from the Polillo Islands to Manila and vice-versa.

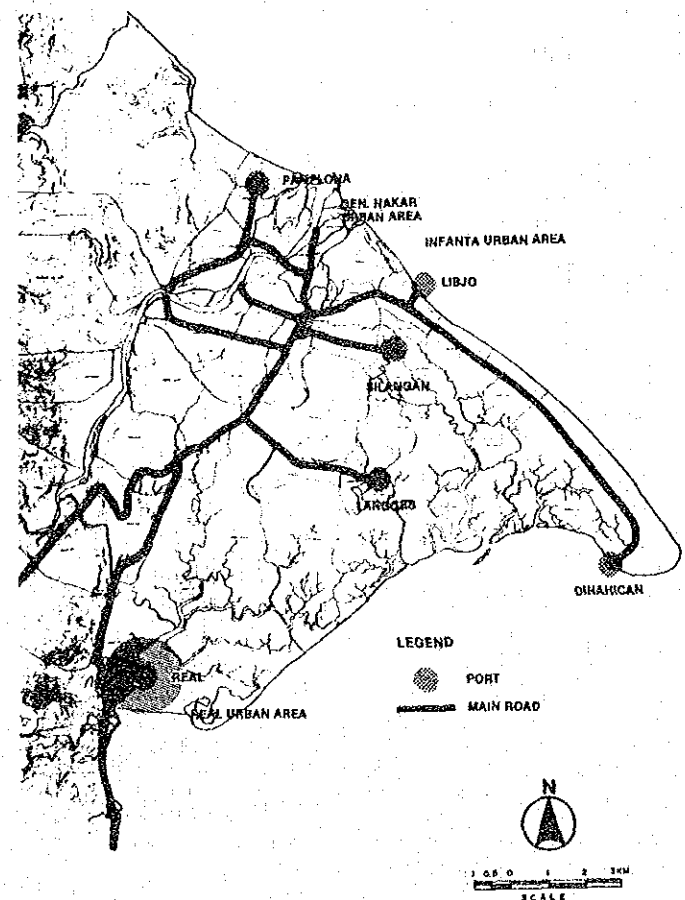


FIG. 6.1.20 LOCATION OF NEW REAL PORT

## 1) Fishing Port Quay Development Plan

Development of the fishing port quay has been planned to enable the unloading of 65,000 tons of catches, based on the Ocean Fishing Plan, as part of the Industrial Promotion and Development Plan described in Chapter 6.2.

The fishing port shall possess the following functions (Fig. 6.1.21):

- (i) With regard to fishing boats, banca type boats as well as 40-ton class boats, should be catered to.
- (ii) Apart from the base function for ocean fishing, it should also provide a place for product handling for the aqua culture industry of Infanta's swamp areas.
- (iii) Port facilities for conventional banca type boats are integrated in the plan.
- (iv) Fishing industry related facilities such as fish market, freezing and cold storages, and oil/water supply facilities are integrated as part of the Fishery Base Development Plan.
- (v) Marine Product Processing factory such as prawn processing factory, and canning factory, etc., should be provided in order to make complete production possible.

Concrete provisions shall be made as follows (Fig. 6.1.22):

- (i) Quays: Aggregate length of 500 m (including piers for unloading, preparatory work, and resting);

- (ii) Dredging: Maximum depth -3.5 m;
- (iii) Breakwater: Lampon Bay, aggregate length of 500 m;
- (iv) Reclamation and Land Preparation: Inclusive of the related road development; and
- (v) River Improvement: Replacement work for two (2) creeks;

## 2) Commercial Port Quay Side Development Plan

The port of Real is located at a strategic and central point of the east coast region of Luzon Island, being equally apart from Aparri and Legaspi, the existing major ports of the east coast region.

In addition to the above fact, its proximity to MMA shall give IRM a possible role of distribution of domestic marine transport.

In addition to the functions of fishing port to respond to the fishery resource development as discussed in the last section, the function of the commercial port to handle passengers, primary industrial products such as coconuts and lumber, manufacturing products, general merchandise which are collected and distributed among the area of the east coast region shall be proposed for the Real Port development.

The planned commercial port shall have the following functions:

- (i) It should have handling capability of the following: i) 27,000 tons/year for agricultural products, mainly consisting of coconuts; ii) 5,00 tons/year for industrial goods, mainly consisting of timber; and iii) 30,000 tons/year for distribution goods (daily necessities), totalling 107,000 tons/year (Table 6.1.16).

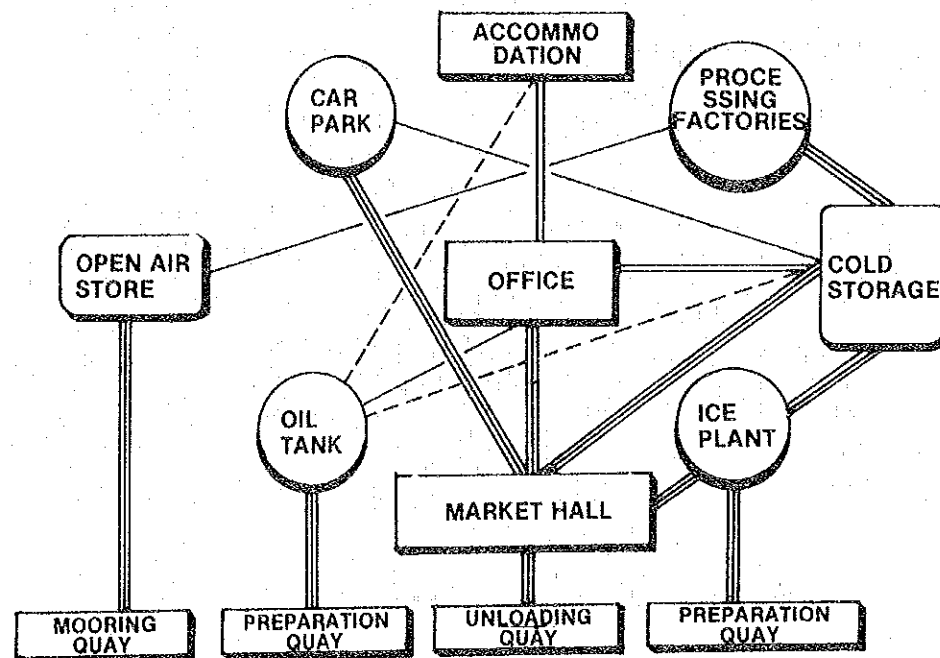


FIG. 6.1.21 INTER-RELATIONSHIP DIAGRAM AMONG FISHING PORT FACILITIES

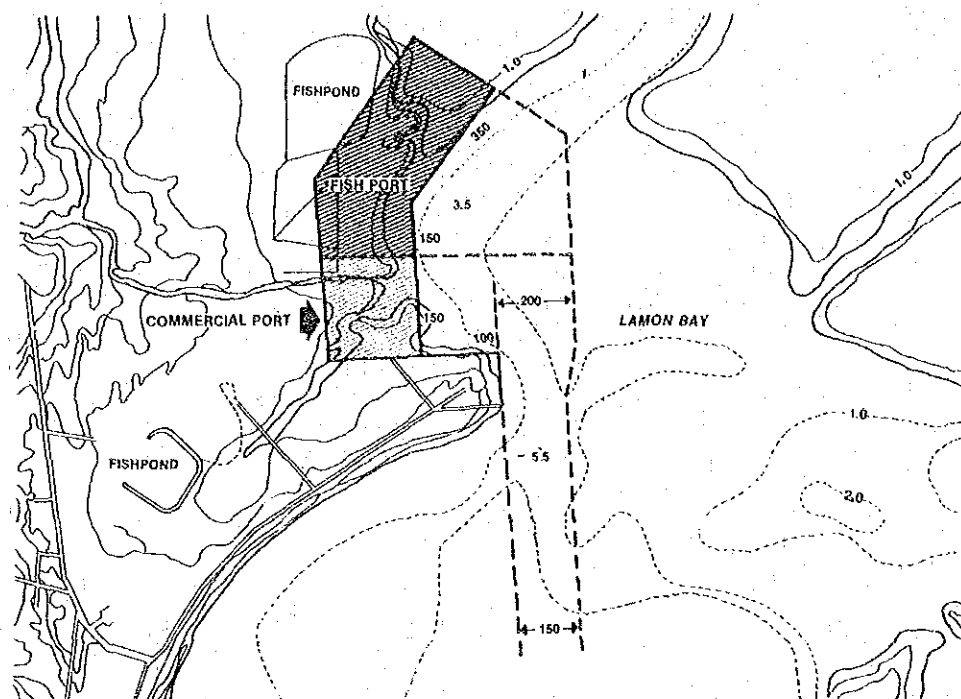


FIG. 6.1.22 DEVELOPMENT PLAN OF REAL PORT

Table 6.1.16 PROJECTION OF HANDLING CARGO IN REAL PORT

	(ton, person)	
	1992	2000
Catches and Fishing Goods	52,000	65,000
Agricultural Products and Inputs	18,000	27,000
Manufacturing Products and Materials	37,000	50,000
Commodities	20,000	30,000
Ferry Passengers	210,000	230,000
<b>Total</b>		
Cargoes	127,000	172,000
Passengers	210,000	230,000

Source: JICA Study Team

(ii) Provisions should be made to allow a maximum of 1,500 tons class cargo boat to enter the port.

(iii) Provisions should be made to allow a 50 ton ferry boat to enter the port for an estimated ferry passengers of 230,000

persons/year from the Polillo Islands. Ground facilities catering to these passengers should also be provided.

(iv) Landing and open air storage areas for cargoes should be provided.

(v) It should have a unified function with the industrial area producing coconut oil, etc.

(vi) With regard to water/oil supply facilities and repair shops, etc., they should also serve the fishing port.

Concrete provisions to be made are as follows:

(i) Quays: Cargo Pier 2 berths 200 m  
Ferry Pier 1 berth 50 m

(ii) Dredging: Maximum depth -5.5 m

(iii) Reclamation and Land Preparation:  
Inclusive of the related road development.

(iv) Open air storage and places for landing.

(v) Ferry terminal: A bus terminal shall adjoin the ferry terminal to improve the transfer service of ferry passengers.

Apart from these major ports, port improvement work shall be carried out on important traffic bases such as Langas and Silangan in order to facilitate coastal transport by bancas, transport for marine recreation, and transport to and from the fish ponds in the swamp district. Appropriate facilities such as quays, landing yard, open air storage, car parks, etc., should be provided based on these area's local requirements (Figs. 6.1.23 and 6.1.24).



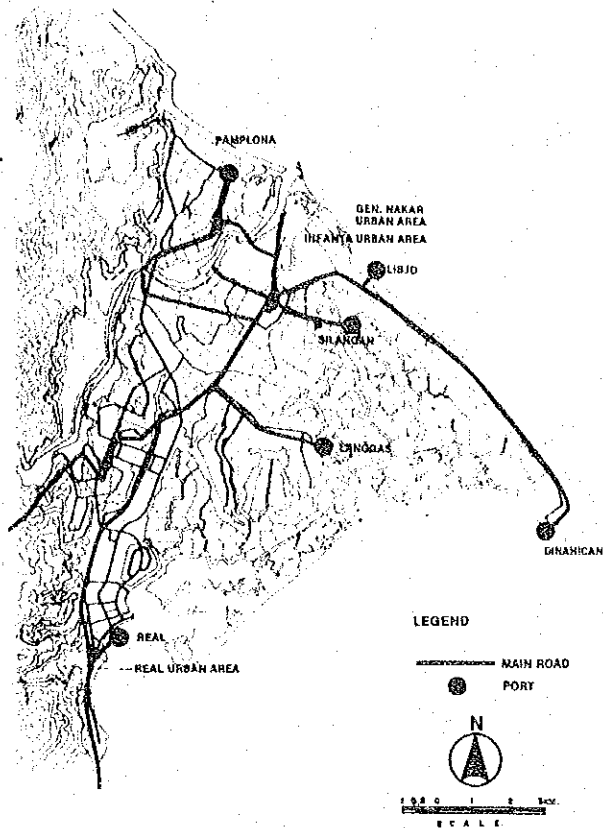


FIG. 6.1.23 LOCATION OF PORT DEV'T

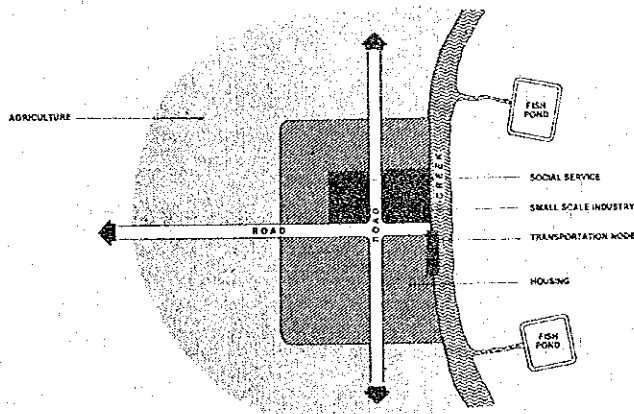


FIG. 6.1.24 DEVELOPMENT SCHEME OF LANGGAS, SILANGAN PORT

## 6.1.4 Public Utilities Plan

### Basic Policy and Target

The sectors which are dealt with in this Public Utilities Plan are water

supply, power supply, telecommunication, drainage, and solid waste disposal.

These functions are indispensable, and shall be the basis of urban area development for the industrial development and improvement of the people's living standard. In addition, the planned development of these functions are feasible. Therefore, the development of these utilities shall occupy along with the transportation facilities development a very important position in the IRM development.

To formulate the development plans, the following points shall be taken into consideration:

- (i) Philippine standards of utilities development;
- (ii) Development corresponding to the steps of urban development;
- (iii) Importance of public utilities in industrial development;
- (iv) Low cost facilities development, alleviating the financial burden; and
- (v) Alleviation of negative environmental impact of development.

The concrete strategies shall be as follows:

- (i) During the initial period of the urban development, emphasis shall be placed on the development of public utilities and other services to support the industrial development within limited areas;
- (ii) During the growth period of industry and population, the focus shall be set on the development of public utilities and other services to serve the whole urbanized area, which shall be growing considerably due to the area's industrialization; and
- (iii) Approaching the year 2000, during the period when the service demand expands quantitatively and changes qualitatively, an integrated system of each public utility to serve IRM as one unified city shall be established that a city with a population of 150,000 is supposed to have.

### Water Supply Plan

#### 1) Water Resources: Quantity and Distribution

##### (a) Surface Water

Rivers in and around IRM are summarized in Table 6.1.17.

According to Table 6.1.17, the average quantity of water directly obtainable by natural intake is from Agos River, the only large river in IRM during dry months with about 20 cubic meters per second (to ten year probability). Assuming 70% of which is available, the amount of available water during the dry period shall be 14 cubic meters. The total quantity of water available from all other rivers is about 15% of said quantity.

The yearly discharge patterns of Agos, Kiloloron, and Kinaliman Rivers show that drought season occurs from March to August (Figs. 6.1.25, 6.1.26, 6.1.27);

Table 6.1.17 DISCHARGE OF RIVERS

		Drainage Area (km <sup>2</sup> )	Annual Mean Discharge (m <sup>3</sup> /s)	Dry Monthly Mean Discharge (m <sup>3</sup> /s)	(Driest Year)	
					Driest Discharge (m <sup>3</sup> /s)	Annual Volume (m <sup>3</sup> )
Gen. Nakar	Ioden River	—	0.5	0.1	—	1.58x10 <sup>7</sup>
	Binoan River	—	0.5	0.1	—	1.58x10 <sup>7</sup>
Infanta	Agos River	879.0	116.6	20.0	—	3.68x10 <sup>7</sup>
Real	Kinaliman River	6.0	1.2	0.3	0.2	3.98x10 <sup>7</sup>
	Kiloloron River	8.6	1.3	0.3	0.2	4.10x10 <sup>7</sup>
	Kawayan River	1.6	0.05	0.01	—	1.58x10 <sup>6</sup>
	Balibaguhin River	1.8	0.05	0.01	—	1.58x10 <sup>6</sup>
	Tignoan River	—	2.5	0.5	—	7.88x10 <sup>7</sup>
Total			122.7	21.32		

Source: NWRC and NEA

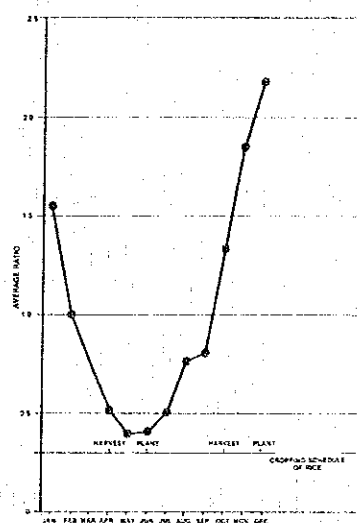


FIG. 6.1.25 DISCHARGE PATTERN OF AGOS RIVER

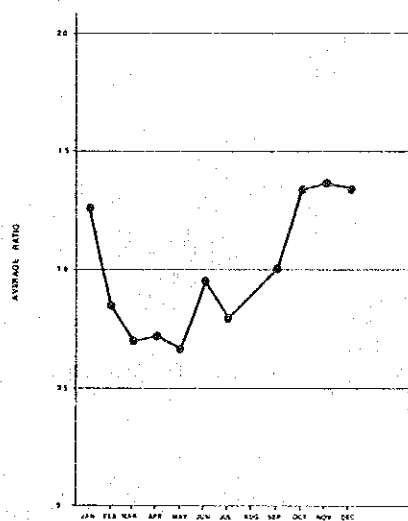


FIG. 6.1.26 DISCHARGE PATTERN OF KINANLIMAN RIVER

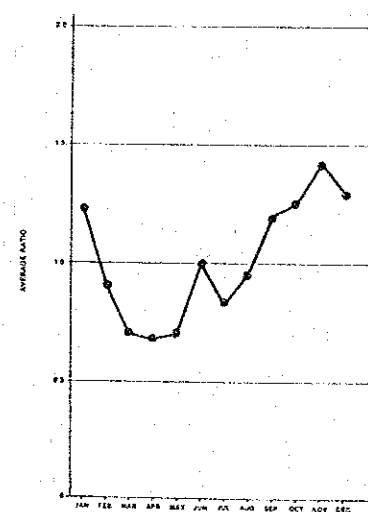


FIG. 6.1.27 DISCHARGE PATTERN OF KILOLORON RIVER

(b) Underground Water

The underground water reserve of the three municipalities is calculated by NWRC and presented in Table 6.1.18.

The true quantity of obtainable underground water cannot be known without detailed pumping test, but the possibility of a large scale utilization of underground water is not suggested by the present underground water level, and the volume now being pumped. In particular, the quantity obtained from deep wells in Real Poblacion is limited. For purposes of planning, the data in Infanta amounting to 950 liters per second (of which 43 liters per second is from deep wells) is used as the upper limit of available underground water.

Table 6.1.18 AVAILABLE GROUND WATER

Municipality	Inflow			Ave. Capacity/ Well	
	SW Area	DW Area	Total	SW	DW
Gen. Nakar	249	383	632	0.43	7.6
Infanta	907	43	950	0.43	7.6
Real	—	134	134	—	4.0
Total	1,156	560	1,716	liter/sec	

Source: NWRC

## 2) Future Water Demand

Future demand is estimated for the following: (i) domestic-use water; (ii) commercial-use water; (iii) industrial-use water; and (iv) agricultural-use water.

### (a) Unit Demand

The average demand for domestic use water per capita per day as calculated by LWUA is used. Also the average demand for commercial and industrial water per connection as calculated by LWUA is used (see Table 6.1.19).

The water demand of each project as estimated by industrial experts is used. Agricultural water demand is estimated by multiplying the average quantity of irrigation water, presently needed per hectare of rice paddy, by the total paddy area as estimated in accordance with the existing data of NIA and the future rice paddy expansion program.

### (b) Demand Estimate

The future water demand as estimated using the above mentioned unit demand values is shown by sector in Table 6.1.20.

## 3) Future Supply-Demand Balance

Based on the water resources and the result of the demand estimate, the supply-demand balance by water source in the future shall be examined in this section.

### (a) Impact of MWSS Project on the Discharge of Agos River

When mentioning the future balance of the area's water supply-demand, it shall be necessary to consider the influence of Metropolitan Water Supply (MWS) III Project upon the downstream discharge of the Agos River.

The main component of the MWS IV Project in the construction of reservoir dams at the Kaliwa and Kanan Rivers (branches of Agos River). However, only Kaliwa River dam (Laiban Dam), the schedule of which has been confirmed (1991 completion), is taken into consideration.

The discharge area of the Kaliwa River occupies 30 percent of the total discharge area of the Agos River. Therefore, assuming discharge downstream at the IRM area shall be about 14 m<sup>3</sup>/sec during the dry period of the driest year (10 year probability), with 70% availability, about 9.8 m<sup>3</sup>/sec can be used for the IRM area.

The total water demand of the IRM area including the agricultural usage in year 2000 is estimated at 9.48 m<sup>3</sup>/sec. So it can be said that the water demand of the area can be satisfied only by the discharge of the Agos River.

On the other hand, there are many uncertain factors involved in the construction at Kanan River. However, even though the dam will be constructed, the planning adjustment for the IRM area with the implementing agency, MWSS, shall be done by the planning body.

### (b) Relation between Ground Water Resources and the Future Water Demand

Examining the balance of the available ground water and urban water demand in year 2000, with an exception of the pulp water which only by itself shall exceed the limit of ground water availability, the upper limit is 0.95 m<sup>3</sup>/sec while the estimated demand of urban water use (excluding agriculture) shall be 0.779 m<sup>3</sup>/sec as shown in Table 6.1.20.

Therefore, the urban water demand in 2000 can be met sufficiently with the ground water alone.

Table 6.1.19 STANDARD WATER DEMAND BY SECTOR

Year	Domestic (per capita) (l/day)	Commercial (per connection) (m <sup>3</sup> /day)	Industrial (per connection) (m <sup>3</sup> /day)
1983	130	1.00	3.0
1992	145	1.30	4.5
2000	160	1.60	6.0

Source: LUWA

Table 6.1.20 FUTURE WATER DEMAND

Sector	(m <sup>3</sup> sec)		
	1983	1992	2000
I. Domestic	0.068	0.168	0.278
II. Commercial General	0.008	0.039	0.111
Tourism	—	0.240	0.263
III. Industrial General	0.001	0.009	0.022
Fishery	—	0.058	0.072
Pulp	—	—	0.701
Coconut	—	0.021	0.033
Sub-Total (Urban)	0.077	0.535	1.480
IV. Agricultural (Agos River only)	6.900	7.430	7.900
IRM Total	6.977	7.965	9.380

Source: JICA Study Team

#### 4) Water Supply Plan

##### (a) Policy of Water Supply

The available system of water supply in the area can be classified as shown in Table 6.1.21.

The difficulty of the development will increase with construction cost on the systems as 1 - 2 - 3 - 4 - 5.

The future water supply of IRM area shall be provided through the combination of the above systems. However, such system development is to respond to the steps of urban development.

The following basic policy of the development shall be proposed.

(i) Considering the availability, both the surface and ground water shall be able to meet the demand of urban water use in 2000, although during the planning period, the water supply of the area shall depend on the low cost ground water system as much as possible.

(ii) The basic water supply districts shall be delineated and in each district a water supply system shall be developed utilizing the easily available water source (in most cases, the ground water source).

(iii) During the planning period, each basic district shall be supplied by a respective independent system (combination of system 1 through 4). After the year 2000, when the total demand of urban use nearly reaches near the upper limit of ground water availability, an integrated water supply system with Agos River as water source, shall be developed to join each district and serve the IRM area as a whole.

(iv) Basically, the water supply by the systems 3 and 4 shall be limited to the urbanized area. However, even in the suburban areas, a simplified piped water system (such as a community faucet) shall be disseminated as much as possible in order to increase the convenience and amenity of urban living.

The service population by the piped water system within the urbanized area, shall be about 70% of its total population.

**Table 6.1.21 AVAILABLE WATER SUPPLY SYSTEM**

System	Characteristics
System 1 Individual Household Well	Can be developed easily but not suitable for urban living.
System 2 Communal Faucet	Low cost but in the same way as above, unsuitable for urban living. With pumping facility, small-scale piped system is possible.
System 3 Piped Water Supply System (ground water source, responding to each district level demand)	Little treatment cost, smaller construction costs than surface water system, relatively low stability of water source and small availability of water.
System 4 Piped Water Supply System (Surface water source)	High construction cost but stable water source, large scale possible, possible to respond to large demand and flexibility of expansion, especially large merit when water source is nearby.
System 5 Integrated Water Supply system (surface water source responding to the IRM's total water demand)	Large construction cost, only possible when the demand is very large, stable and planned supply is possible

Source: JICA Study Team

##### (b) Basic Water Supply District

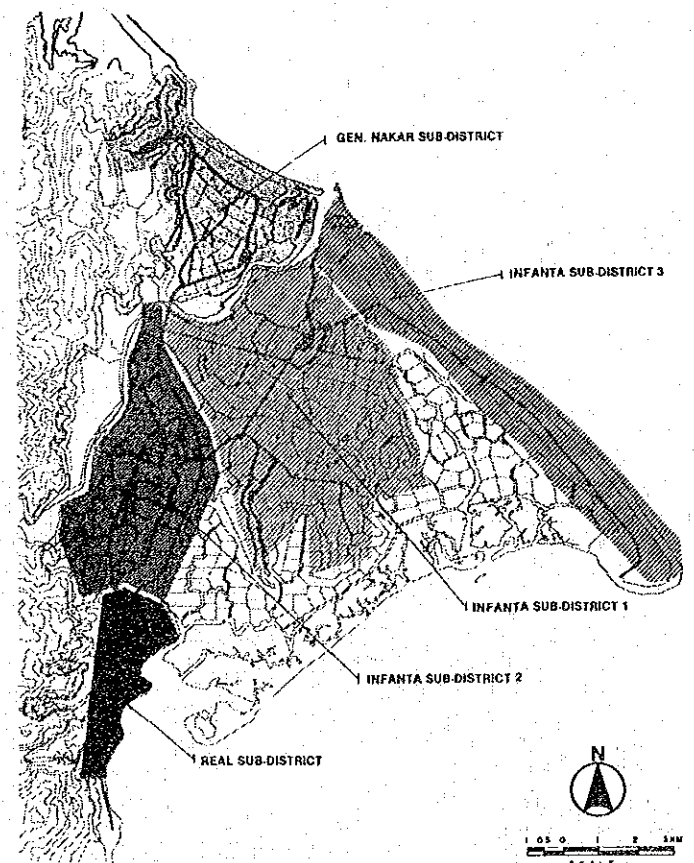
The development of water supply system shall be done by five basic districts as shown in Table 6.1.22 and Fig. 6.1.28, taking into account the following: i) uniformity as administrative entity and as basic settlement unit, and ii) development stage of each district, into consideration.

**Table 6.1.22 BASIC WATER SUPPLY DISTRICTS**

District	Component	Demand* (m <sup>3</sup> /sec)
Gen. Nakar District	Urbanized Area, Resort Area, Pulp Suburb	0.827
Infanta District 1	Central Urban Area, Suburb (Agriculture, Swamp)	0.122
Infanta District 2	New Urban Area	0.157
Infanta District 3	Resort Area, Settlement along Poblacion to Dinahican	0.175
Real District	Central and New Urban Area, Port, Industry District, Suburb	0.199
<b>Total</b>		<b>1.480</b>

\*: Without Irrigation

Source: JICA Study Team



**FIG. 6.1.28 WATER SUPPLY SUB-DISTRICTS**

(c) Water Supply Plan

Based on the basic policy and the water demand responding to the urban growth, the development plan shall be proposed as illustrated in Figs. 6.1.29, 6.1.30.

(d) Development Project

The essential water supply facilities development projects, which are necessary to materialize the formulated water supply plan, shall be classified into the following nine (9) projects.

(i) Ground Water Study

Study for estimating availability of ground water by conducting test-boring, pump-up test, electric prospecting, etc.

(ii) Real New Water Supply (Phase I)

Construction of a new water supply system for the Real Port area and the manufacturing area, acquires supply from Kamayan and Balibaguin Rivers in the vicinity of the Real Poblacion. When constructed, it shall be serving a reserved land for the facility expansion considering the future growth of Real New Urban area and industrial area.

(iii) Real New Water Supply (Phase II)

The second phase of the above project, the subject service area, shall be the entire New and Central Real Urban areas. The source shall be the less expensive ground water made available by drilling of a deep well in either Real or Infanta in the proximity of the Real poblacion. The system shall be connected with the old system.

(iv) Infanta Water Supply (District 3)

Construction of a water supply system to supply water mainly for the Marine Research Park and the settlement/facilities along the road. Drilling of a deep well and water distribution main development.

(v) Infanta Water Supply (District 1)

Rehabilitation and expansion of the existing water supply system of Infanta. A new water source shall be attained by drilling a deep well. The service area shall be the whole urban area.

(vi) Infanta Water Supply (District 2 - Phase I)

Construction of a water supply system for a part of the Regional Center (commercial and residential areas). The water source shall be secured by drilling a deep well.

(vii) Infanta Water Supply (District 2 - Phase II)

The second phase of the above project is a construction of a water supply system which shall cover the entire Infanta New Urban Area including the Regional Center, the Commercial District, and the Residential areas. The water shall be taken from the Agos River by constructing intake and pump-up facilities. This system will be a core of the Integrated Water Supply System.

(viii) General Nakar Water Supply

Construction of a water supply system for the urban area of General Nakar. (Ground water source-deep well)

(ix) IRM Integrated Water Supply System (Phase I)

Phase I shall consist of constructing an integrated water supply system for the whole IRM area by expanding intake, transmission, treatment facilities of the system of the Infanta New Urban area.

(In Phase II, an integrated system shall be completed by connecting each water district with a transmission main)

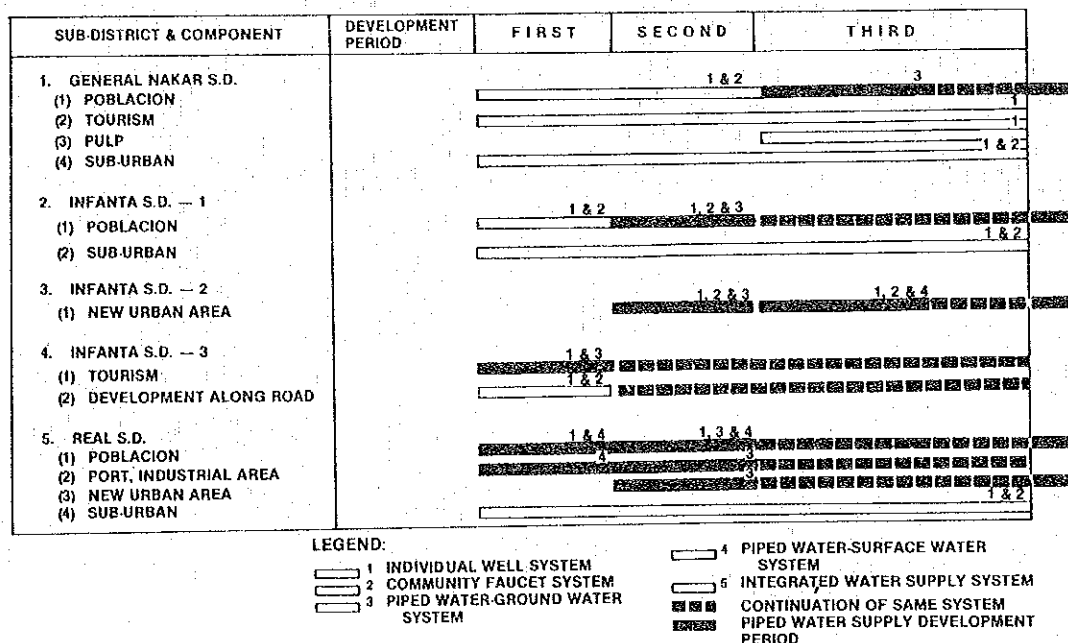


FIG. 6.1.29 WATER SUPPLY SCHEDULE DEVELOPMENT SYSTEM

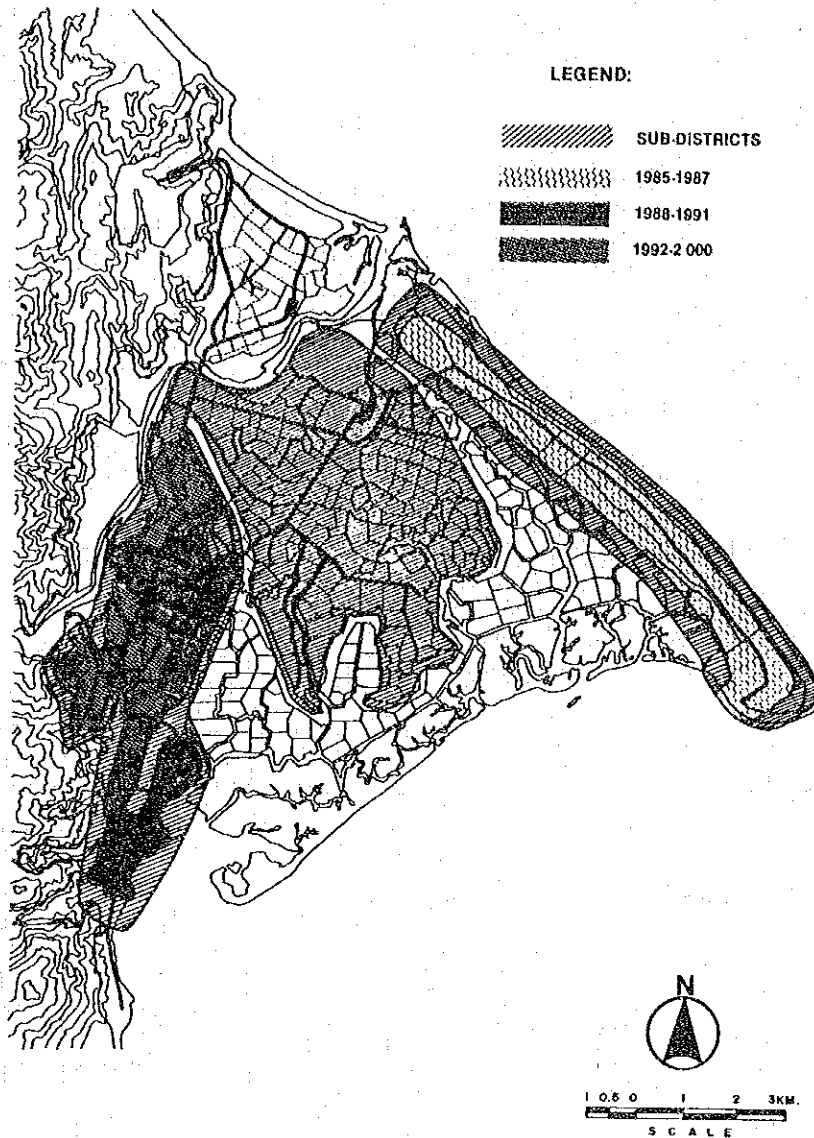


FIG. 6.1.30 WATER SUPPLY PLAN BY SUB-DISTRICTS

## Power Supply Plan

### 1) Planning Goals

IRM is already energized at about 50%, with an extensive power distribution network. Except some of the mountain areas (Minahan del Norte, Minahan del Sur, Pisa) which has a few problems.

However, upon consideration of the future development, several planning goals shall be considered as follows:

#### (i) Expansion of the Existing Facilities

In view of the future power demand, the existing 69 KV capacity of the

transmission line and the existing capacity of substations shall need expansion.

#### (ii) Adjustment of Existing Plan/Projects

The hydraulic power generating plant construction project formulated based on future demand projection on the past trend (that is, without considering the new demand to result from urban development) needs adjustment in accordance with the framework of this plan.

#### (iii) Securing Low Cost Power Supply

Some means of supplying low cost power (particularly to large consumers) such as small scale hydraulic generation plants is an essential condition to industrial development. It must be devised because to do so shall be less difficult than under the existing system of power purchase from NPC and QUEZELCO II supply system.

#### (iv) Securing Stable Power Supply

The purchase of power from NPC is naturally subject to the influence of power situation on the Luzon Grid (blackout in IRM during the peak load hours in Metro Manila, etc.), but in order to secure stable power supply, (particularly to large consumers) a new power source shall have to be developed separately from the Luzon Grid for IRM's requirements.

## 2) Existing Capacity

### (a) Transmission Capacity

The voltage of the existing transmission line is 69 KV and the conductor used is 3364 MLM ACSR. Its maximum transmission capacity is, calculated by transmission capacity coefficient method, at 25 to 30 MW. That is:

Formula:

$$P = K \cdot E^2 / L \\ = 600 \cdot (45)^2 / 45 \\ = 27,000$$

Where P (KW): Transmission capacity  
E (KV) : Receiving terminal Voltage  
L (KM) : Transmission distance  
K : Transmission capacity Coefficient

### (b) Substation Capacity

The substation is rated at 3.75 MVA. If the effective capacity is 80%, the tolerance is up to about 3 MW.

### (c) Existing Power Availability

The supply end of the transmission line for Infanta-Real area is presently Caliraya substation of Laguna province. According to NPC, the capacity of the substation is 50 MVA, and considering other loads (Baras, etc.), the available power shall be limited to a maximum of 25 MW.

### 3) Future Power Demand

#### (a) Unit Demand Value

Future power demand by sector is estimated based on average demand per unit (connection) in the target year 2000, but adjusting such average value, assuming that unit demand in IRM in the year 2000 shall be 60% of that in MERALCO service area in 1983, and assuming that the demand shall linearly increase from the present up to the year 2000 (Table 6.1.23).

#### (b) Demand Estimate

Using the unit demand, the total power demand, 30,000 KW in 1992 and 65,000 KW in 2000 was estimated as shown in Table 6.1.24 and Fig. 6.1.37.

The estimation was done under such assumption that demand peaks of domestic use and industrial/commercial use shall not coincide, and the peak load factor of 0.8 was used for the industrial/commercial use which shall be larger than the demand.

Table 6.1.23 POWER DEMAND BY CONNECTION

Sector	(in KW)		
	1983	1992	2000
Residential	0.15	0.46	0.72
Commercial	0.15	0.55	0.90
Industrial	3.0	10.92	18.0
Institutional	1.0	1.5	1.5

Source: JICA Study Team

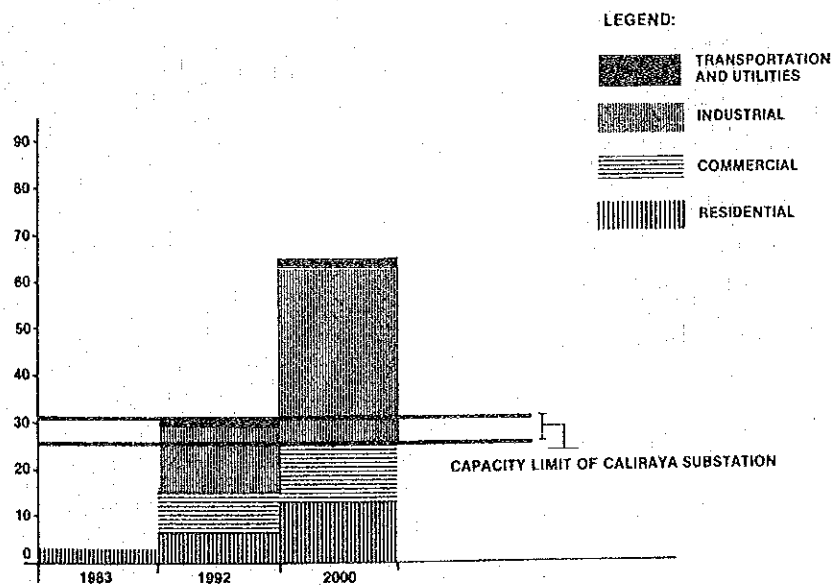


FIG. 6.1.31 FUTURE POWER DEMAND

Table 6.1.24 FUTURE POWER DEMAND

Sector	(in KW)	
	1992	2000
1. Residential	5,210	12,300
2. Commercial (including Institutional)		
General	1,150	4,400
Tourism	4,950	5,500
3. Industrial		
General	1,540	4,500
Fishery	10,500	13,000
Pulp	—	10,300
Prawn	1,200	1,500
4. Transportation and Facilities	1,000	3,000
Sub-Total of 2, 3, & 4 (S.T.)	20,340	42,200
(S.T. x 1/0.8)	25,425	52,750
<b>Total</b>	<b>30,635</b>	<b>65,050</b>

Source: JICA Study Team

### 4) Evaluation of Power Sources

The conceivable power sources for the IRM area are (i) Purchase from NPC; (ii) Agos River Hydro Power Generation; and (iii) Mini-Hydro power generation, and other local means (such as dendro-thermal).

These power sources were evaluated using such criteria as development cost; supply capacity; supply stability; power rate; and length of development (Table 6.1.25).

Based on this evaluation, the Agos River hydro-power generation shall necessitate a very large development cost and duration (and relatively low return as stated in NPC's Agos River Power Generation Feasibility Study Report) in order to meet the size of the future power demand. This large cost shall increase the initial capital investment of the urban development and consequently lower the return of the urban development as a whole. Therefore, this power source shall be unsuitable.

On the other hand, with purchase from NPC, there already exists basic qualities in the area based on this power source. This system can be easily improved and made suitable for the future power demand by expanding the existing facilities. The only problem shall be that the supply shall be limited to only about 25 MW due to the capacity of Caliraya Substation until the integration of the Luzon Grid.

Local power services are developed from mini-hydro power generation, dendro-thermal power generation, and coal-thermal power generation.

Coal thermal generation, due to the low quality of Pollilo coal, needs blending with good quality coal, thus proving that it is not so adaptable. On the other hand, mini-hydro and dendro thermal power generation have bigger advantages and likely to attain inexpensive power. However, the size of supply shall be inadequate for the future power demand. Therefore, these power sources shall be supplementary in nature.

**Table 6.1.25 COMPARATIVE EVALUATION OF CONCEIVABLE POWER SOURCES**

POWER SOURCES	CRITERIA	DEVELOPMENT COST	SIZE OF SUPPLY	SUPPLY STABILITY	POWER RATE	DURATION OF CONSTRUCTION
NPC POWER PURCHASE		○	△	△	△	⊙
AGOS RIVER HYDRO POWER		×	○	○	△	×
MINI-HYDRO OR OTHER LOCAL POWER SOURCE		△	×	○	⊙	△

Source: JICA Study Team 1983

### 5) Power Supply Plan

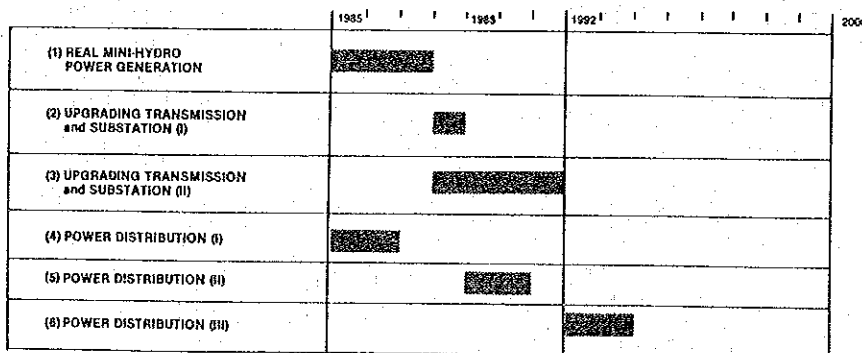
Based on the evaluation, the following policy was set for the formulation of the power supply plan:

(i) The power supply for the area shall basically depend on NPC purchase. Facilities development shall be done to expand the capacity responding to the increase of demand.

(ii) However, because of the transmission line capacity limitation (up to 25 MW) until the construction of a new transmission line of higher voltage level development of mini-hydro power generation shall be carried out as a supplementary power source in order to attain inexpensive and stable power supply, especially for the industrial demand.

(iii) By year 1992, the total demand shall exceed the capacity limit of the Caliraya Substation (the supply end). So, the existing 69 KV line shall be stepped up to 115 KV, and accordingly the Infanta substation shall be expanded.

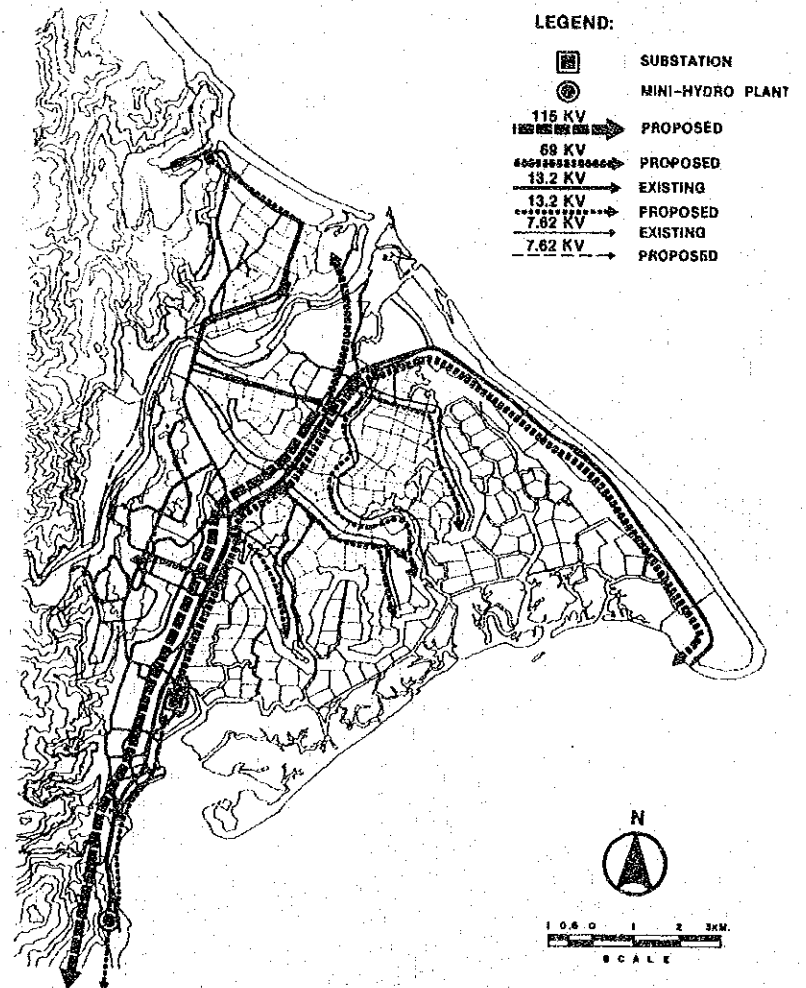
(iv) The energized rate shall be 100% by 1992, meeting the national target of NEA.



**FIG. 6.1.32 POWER DEVELOPMENT SCHEDULE**

Based on the above policy, with the steps of urbanization and industrialization taken into consideration, the power supply plan is formulated.

The power supply plan shall be further classified into the following six (6) plans (as illustrated in Figs. 6.1.32, 6.1.33).



**FIG. 6.1.33 POWER DEVELOPMENT PLAN**



(i) Real Mini-hydro Power Generation

A 5 MW mini-hydro power generation plant shall be constructed in the vicinity of Real Poblacion with Kiloloron River and Kinanliman River as the water source. The construction shall be carried out in the initial period of the urban development to support the power supply for industrial demand of the agro-fishery processing industry which shall commence its operation during the early period.

(ii) Upgrading of Transmission and Substation Capacity (I)

According to the growth of demand, a 5 MVA transformer unit shall be added to the Infanta substation by steps. When the demand becomes very large, a transformer unit such as a 20 MVA unit, shall start.

(iii) Upgrading of Transmission and Substation Capacity (II)

Because the total demand reaches the capacity limit of the Kaliraya substation around 1992, a 115 KV transmission line shall be constructed connecting the Infanta substation with the Dolores Substation, which has a larger capacity (300 MVA) and is connected directly with the Luzon Grid. The reconstruction of the Infanta substation shall be carried out accordingly.

(iv) Power Supply (I)

To meet the NEA's target of 100% energization, the construction of a distribution line for the mountainous area of General Nakar (7.62 KV), and the improvement of distribution lines (13.2 KV) for the prawn culture areas of Amolongin and Laggas/Silayan.

At the same time, construction of a 69 KV distribution line especially for the development of the marine research park area which needs a large power supply shall be carried out.

(v) Power Supply (II)

Step-up of the existing 13.2 KV line between the substation and Real poblacion, to 69 KV line for the early development of the port and industrial area, where the large demand shall occur. A small substation (20 MVA) shall also be constructed in the Real New Urban Area.

(vi) Power Supply (III)

Construction of distribution lines for Infanta New Urban Area (13.2 KV) and the pulp paper factory (69 KV) shall be carried out in the later period of urban development.

## Telecommunications Development Plan

### 1) Existing Conditions of Telecommunications

The existing conditions of the telecommunication facilities in the planning area is shown in Table 6.1.26. One telegraph office exists in General Nakar, two telegraph offices (private and public) and one radio telephone office exist in Infanta, and none in Real. There are no telex facilities anywhere in the planning area.

### 2) Basic Policy of Facilities Development

Among the telecommunication facilities, there exists two (2) public telegraph offices. Assuming that a new telegraph office is to be constructed by BUTEL in both Real and Infanta New Urban Areas, telegraph offices are not considered in this section (included in the Social Services Facilities Development Plan).

Telephone and telex facilities shall be basically developed in response to increase in demand. The demand can be classified into general demand, and industrial demand the characteristics of which is foreseen by the stages of the urban development as illustrated in Table 6.1.27. The estimation of demand was done in the following manner:

The circuit demand of both telex and telephone was estimated based on the average circuit demand per unit population derived from the average of Region IV cities at present.

One circuit for every 10,000 persons was used for telex. For telephone, 1 circuit/150 persons for cities with less than 100,000 population, and 1 circuit/80 persons for cities with more than 100,000 population have been calculated. Therefore, the former value was used for the initial and middle period and the latter value was used for the later period.

The circuit demands are shown in Table 6.1.28.

Considering the demand characteristics and the estimate results, the following policy shall be set to formulate the facilities development plan:

(i) The telephone demand is estimated at 450 circuits during the First Period. However, the urbanization is not yet activated at this Period, so that the general demand is not likely to reach that scale. With this, construction of a full scale telephone exchange and related network seems unrealistic in terms of both demand and investment cost. Therefore, during the First Period, a small scale telephone exchange and a telex office shall be constructed to satisfy the urgent telecommunication demand from the early development of the port area and the industries.

(ii) During the Second Period, the general telephone demand for outside communications shall grow as total population nears 100,000. Furthermore, individual demand increases rapidly. Therefore, in order to respond to those demands a telephone system with a proper service level shall be developed.

Table 6.1.26 EXISTING TELECOMMUNICATION FACILITIES, (IRM, 1983)

Municipality Facility Type	Gen. Nakar	Infanta	Real
Telephone	—	1 SSB Type Radio Telephone (Private)	—
Telegraph	1 Morse Type (BUTEL)	1 Morse Type (BUTEL) 1 RCPI (Private)	—

(iii) During the Third Period, the intra-urban telephone demand for a 150,000 city shall increase rapidly. In addition, based on the industrial development and the consequent urbanization, telecommunication demand centering on the tertiary industry, shall grow tremendously as the main industrial sector by then. Therefore, an integrated telephone system with comprehensive network covering the whole IRM area shall be developed.

### 3) Facilities Development Plan

#### (a) Telex Facilities Plan

Responding to the urgent demand of industries two telex offices in Real New Urban Area (near the port area - 5 circuits) and in the Infanta Central Urban area (2 circuits) shall be constructed during the Third Period when the commercial demand expands considerably. The expansion of the above offices and construction of new offices in Infanta New Urban Area and in General Nakar Central Urban Area shall be carried out.

#### (b) Telephone Facilities Plan

During the First Period, a small telephone exchange (20 circuits) shall be constructed in the Real New Urban Area in order to respond to the urgent industrial demand and the demand of the tourism industry. Five (5) circuits shall be extended to the Infanta Central Urban Area. The booth type service (such as IPTS) shall be provided for the general demand.

During the Second Period, the expansion of the above exchange (to 400 circuits - functioning as central exchange) and construction of a telephone exchange (300 circuits) in Infanta Central Urban Area shall be done, then the intra-urban telephone service shall be started.

During the Third Period, the expansion of these telephone exchanges and construction of new telephone exchanges in Infanta New Urban Area (900 circuits to function as central exchange), and in General Nakar Central urban Area (100 circuits) shall be carried out in order to finally establish an integrated telephone system with network connecting each district within the planning area.

The outline of telecommunications facilities development is shown in Fig. 6.1.34.

**Table 6.1.27 CHARACTERISTICS OF FUTURE TELECOMMUNICATION DEMAND**

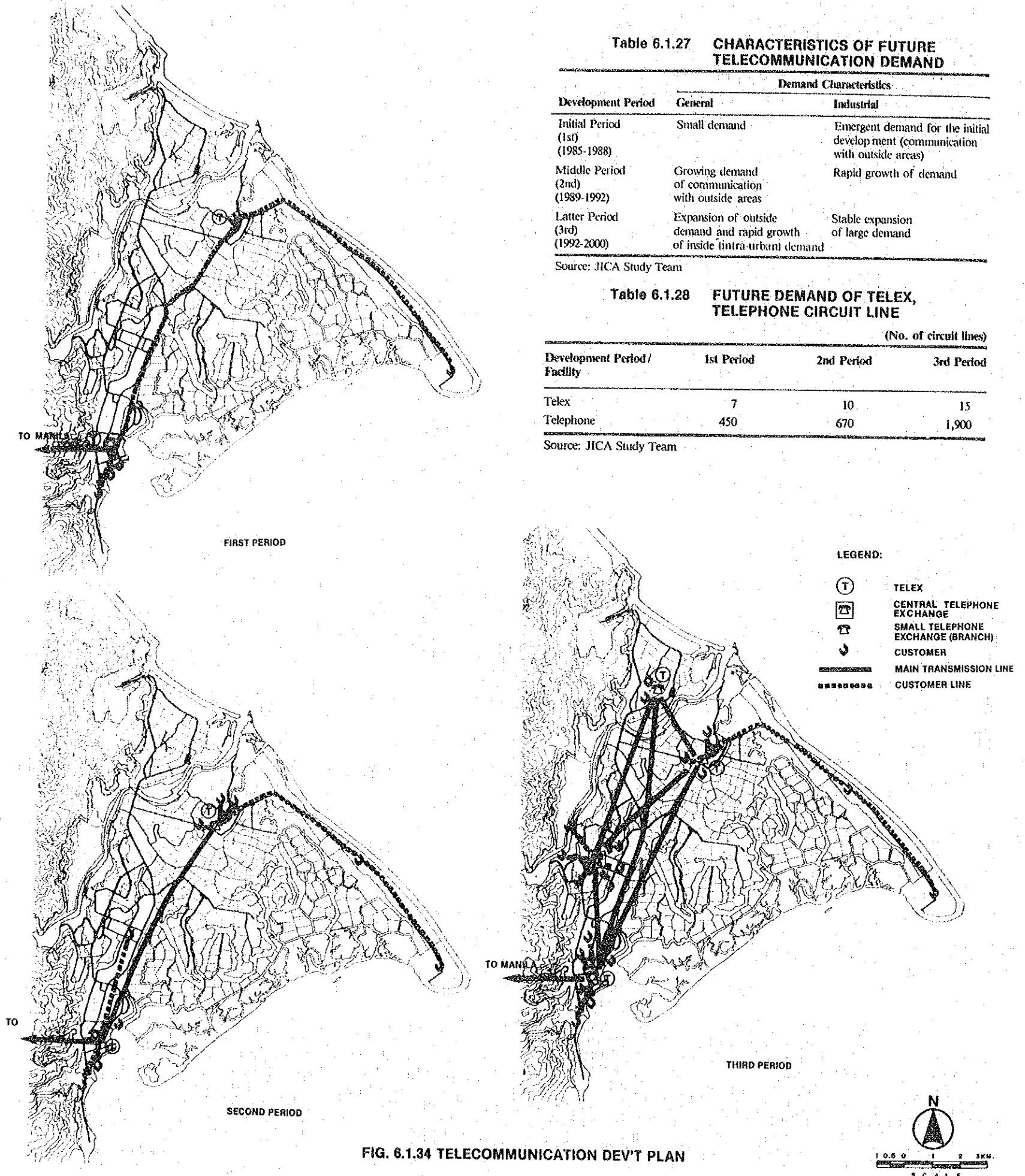
Development Period	Demand Characteristics	
	General	Industrial
Initial Period (1st) (1985-1988)	Small demand	Emergent demand for the initial development (communication with outside areas)
Middle Period (2nd) (1989-1992)	Growing demand of communication with outside areas	Rapid growth of demand
Latter Period (3rd) (1992-2000)	Expansion of outside demand and rapid growth of inside (intra-urban) demand	Stable expansion of large demand

Source: JICA Study Team

**Table 6.1.28 FUTURE DEMAND OF TELEX, TELEPHONE CIRCUIT LINE**

Development Period / Facility	(No. of circuit lines)		
	1st Period	2nd Period	3rd Period
Telex	7	10	15
Telephone	450	670	1,900

Source: JICA Study Team



**FIG. 6.1.34 TELECOMMUNICATION DEV'T PLAN**

## Drainage Plan

### 1) Existing Drainage Conditions

According to the classification of storm water and waste water drainage, the existing drainage conditions of the area can be outlined as shown in Table 6.1.29.

The existing drainage can be classified based on the water systems into five (5) drainage zones (catchment areas) as shown in Fig. 6.1.35.

### 2) Basic Policy of Facilities Development

Considering the land use plan, the process of urbanization, and the Philippine's facility standard, the following policy shall be applied for facilities development:

(i) The existing storm water drainage systems shall be utilized as much as possible. The drainage capacity of the main drainage channels shall be improved responding to urbanization;

(ii) The development of waste water drainage facilities shall be carried out in two (2) phases, in the former and the latter period, according to the following policies:

i) In the former period (1985 - 1992), the waste water shall be drained through the rainwater drainage systems after night soil is treated either by domestic septic tank or a centralized septic tank system;

ii) In the latter period (1993 - 2000), it shall be difficult to avoid the contamination of the rain water drainage system by domestic waste water and by the treated night soil of septic tank systems due to the rapid urbanization. Therefore, the separate sanitary sewer system with treatment facility (independent systems each drainage basin) shall be constructed. The waste water shall be treated collectively and drained to the main water drainage systems.

**Table 6.1.29 EXISTING CONDITIONS OF DRAINAGE**

Classification	Existing Conditions
Storm (Rain water) Drainage	Drained through the creeks and rivers to the ocean by each water system
Waste Water Drainage	
Domestic	Directly drained through the above system to the ocean without any treatment
Night Soil	Same as above or Antipolo-type pit treatment
Industry	Not existed

Source: JICA Study Team

(iii) The environmental standard shall be established for the waste water drainage. Then, specifically, the industrial waste water shall be treated to meet the standard on the responsibility of each industrial establishment and drained through the main systems or directly to the ocean.

The basic drainage system is shown in Fig. 6.1.36.

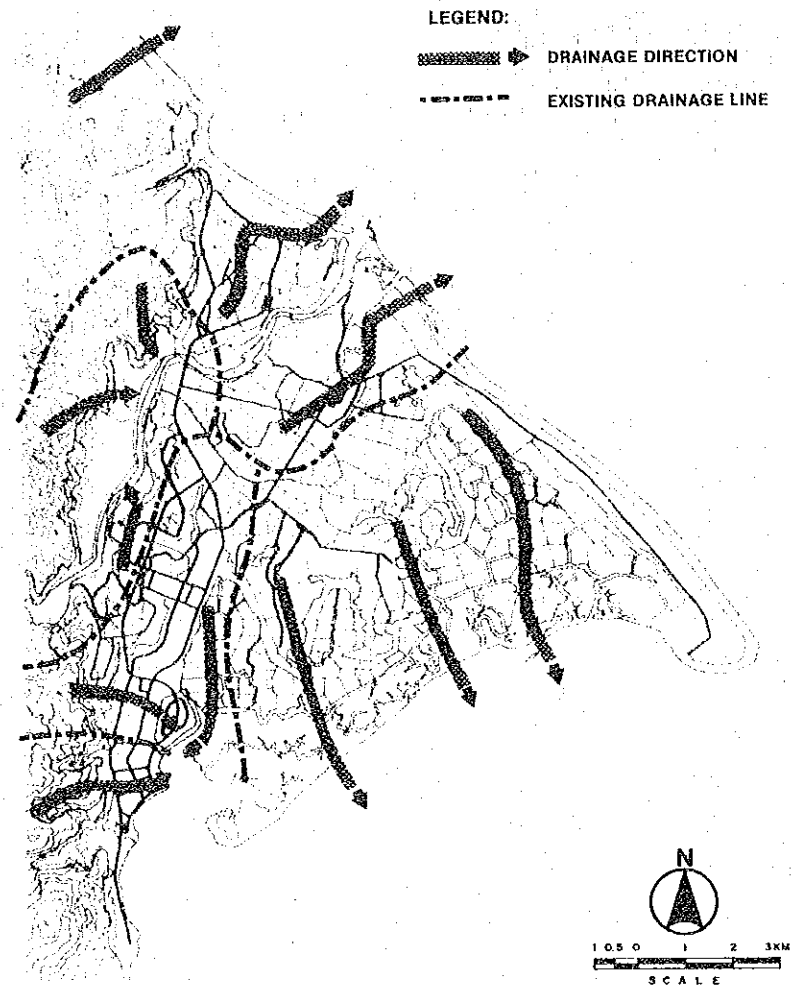
### 3) Rain (Storm) Water Drainage Plan

The main component of this plan shall be the development of main urban drainage channels. The development shall be phased by the following periods:

(a) The First Period (1985 - 1988)

(i) Real New Urban Area (I)

With the development of the port, and the industrial area, the existing drainage channels shall be improved and new channels shall be constructed foreseeing its future development.



**FIG. 6.1.35 EXISTING DRAINAGE SYSTEM**

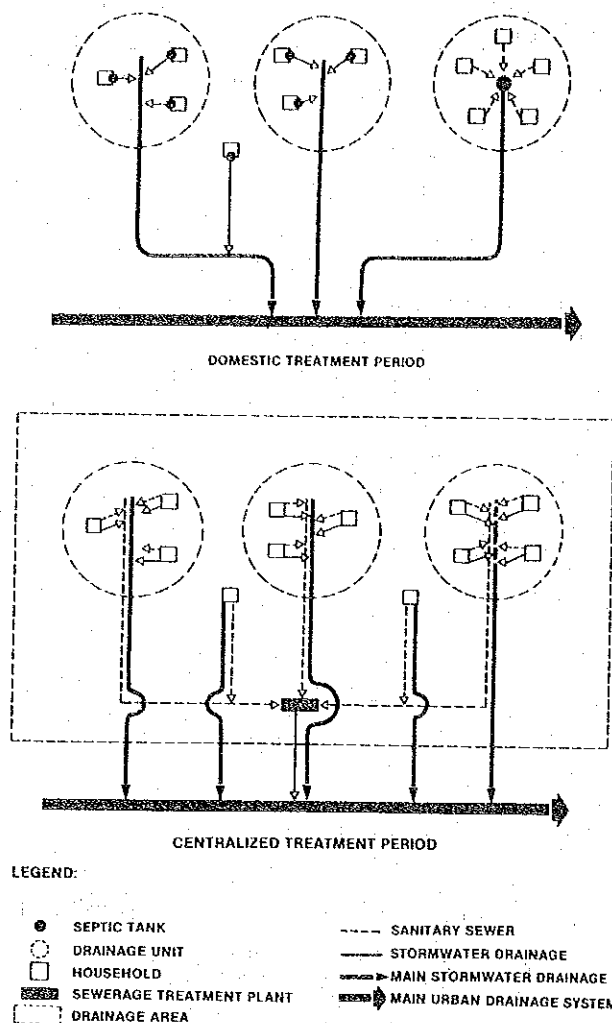


FIG. 6.1.36 BASIC DRAINAGE SYSTEM

(ii) Real Central Urban Area (I)

The population increase in the above area and the port shall at first be accommodated in the poblacion area during the early period. Therefore, the development and improvement of the drainage channels shall be simultaneous with the improvement of the urbanized area.

(b) The Second Period (1989 - 1992)

(i) Real New Urban Area (II)

The development of the drainage system is in relation to the residential area development of the distribution and agro-fishery processing area.

(ii) Real Central Urban Area (II)

The development of the integrated main drainage network shall be carried out for the Real Central Urban Area which shall be reaching the physical limit of population accommodation at this period.

(iii) Infanta Central Urban Area

The urbanized area shall grow up to 9 times the existing one during this

period. The improvement of existing rivers and construction of new main drainage channels shall be carried out.

(iv) Infanta New Urban Area (I)

The development of a drainage system for the new urban area (the commercial district and the lower flat residential area) shall be implemented (new drainage basin).

(c) The Third Period (1993 - 2000)

(i) Infanta New Urban Area (II)

The development of the drainage system for the entire Infanta New Urban Area including the Regional Center and the hillside residential area shall be carried out.

(ii) General Nakar Central Urban Area

The development of drainage channels for the expanded urban area due to the tourism and the pulp paper industry shall be carried out (including the improvement of existing river).

#### 4) Sanitary Sewer Development Plan

The development of separate sanitary sewer system shall be carried out in order to alleviate the expected contamination of the area's drainage system in the following: (i) Real New and Central Urban Area; and (ii) Infanta Central Urban Area, phased in two periods.

However, the development of the public sanitary sewer for the residential area on the hill of the Infanta New Urban Area shall be excluded from the plan, assuming that the system shall be provided by the private subdivision developer. In addition, the development of a sanitary sewer system for the General Nakar Central Area shall be carried out after the year 2000 because of its relatively slow increase in population.

(a) The First Period

(i) Public Sanitary Sewer Development in Real New Urban Area

The separate sanitary sewer system (main sewer) shall be developed after 1992 for the Real New Urban Area and the flat low land part of the Infanta New Urban Area which shall be included in the Real drainage basin. Construction of a treatment plant shall also be carried out at the southern end of the basin (service population: 30,000 persons, maximum daily treatment capacity: 7000 m<sup>3</sup>/day, length of main sewer: 13 Km).

(ii) Public Sanitary Sewer Development in Infanta Central Urban Area

The separate sanitary sewer system (main sewer) shall be developed after 1992 in the Infanta Central Urban Area which by then shall have become densely populated. Construction of treatment facilities shall be carried out at the same time (service population: 20,000 persons, daily maximum treatment capacity: 5500 m<sup>3</sup>/day, length of main sewer: 5 km).

(iii) Public Sanitary Sewer Development in Real Central Urban Area

The separate sanitary sewer system (including a treatment plant) shall be constructed in the Real Central Urban Area which shall have become dense due to the development thrust of the neighboring port and industrial areas (service population: 15,000 persons, daily maximum treatment capacity: 4000 m<sup>3</sup>/day, length of main sewer: 3 km).

The schedule and outline of Sanitary Sewer facilities development are shown in Figs. 6.1.37 and 6.1.38 respectively.

PROJECT TITLE	1985	1988	1992	1996	2000
(1) MAIN URBAN DRAINAGE DEVELOPMENT (I) REAL NEW URBAN AREA (I) REAL BUILT-UP AREA (I)	██████████	██████████			
(2) MAIN URBAN DRAINAGE DEVELOPMENT (II) REAL NEW URBAN AREA (II) REAL BUILT-UP AREA (II) INFANTA BUILT-UP AREA INFANTA NEW URBAN AREA (I)		██████████	██████████		
(3) MAIN URBAN DRAINAGE DEVELOPMENT (III) INFANTA NEW URBAN AREA (II) GENERAL HAKAR BUILT-UP AREA			██████████	██████████	
(4) PUBLIC SANITARY SEWER DEVELOPMENT (I) REAL NEW URBAN AREA			██████████	██████████	
(5) PUBLIC SANITARY SEWER DEVELOPMENT (II) INFANTA BUILT-UP AREA REAL BUILT-UP AREA				██████████	██████████

FIG. 6.1.37 FACILITY DEVELOPMENT SCHEDULE

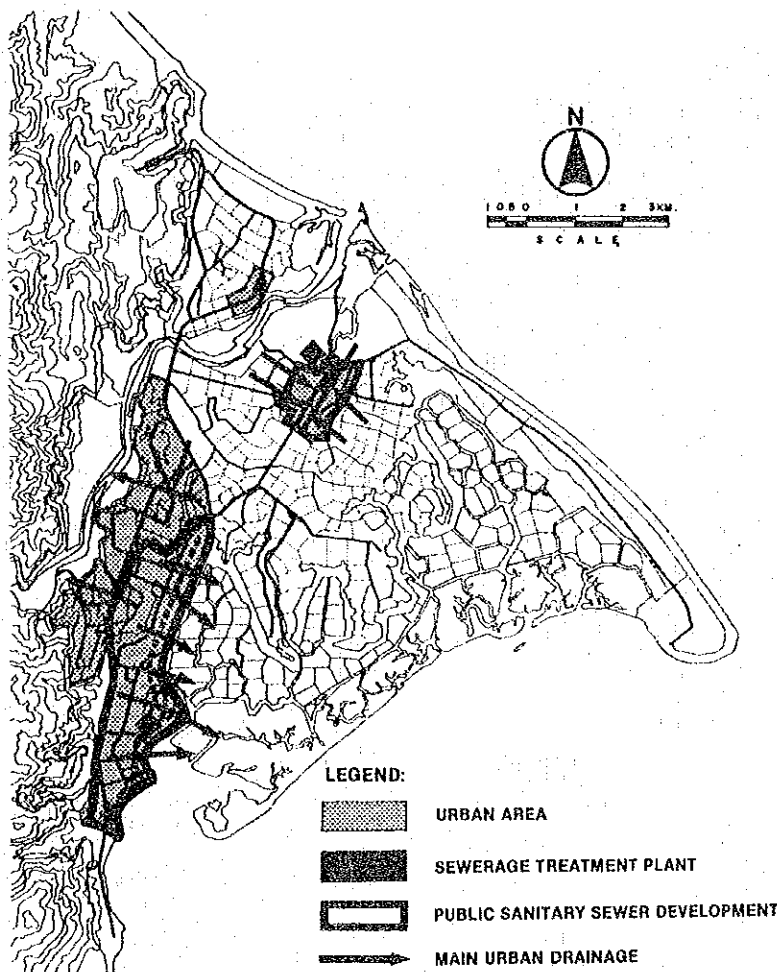


FIG. 6.1.38 DRAINAGE & PUBLIC SANITARY SEWER SYSTEM DEV'T PLAN (2000)

## Solid Waste Disposal Plan

### 1) Existing Solid Waste Disposal

The method of solid waste disposal practiced presently in the planning area are classified as follows:

- (i) Incineration or burying at individual lot premises;
- (ii) Dumping in nearby rivers;
- (iii) Collection by garbage truck or carabao cart and dumping in garbage yards.

Garbage collection service (iii) is being carried out by the municipal government in the part of the poblaciones of Infanta and Real. In other areas, the method (i) and (ii) are generally being practiced.

### 2) Future Solid Waste

The area's solid waste generation in the future shall be classified into general solid waste and industrial waste. The industrial waste shall be disposed of, in principle, according to the environmental standards. Therefore, in this section only the volume of general solid waste shall be estimated.

The present generation of urban solid waste is estimated at 400 grams/capita/day. The generation of solid waste is generally correlated to the area's GRDP. Therefore, the per capita generation shall be set 200 g/day for the initial period 300 g/day after 1992, and 400 g/day in 2000.

Based on the figure, the total generation is estimated as 6,200 kg in 1988, 19,800 kg in 1992 and 41,600 kg in 2000. There is no data on the composition of solid waste in the Philippines. However, based on data of other developing Asian developing countries, the composition is set at 90% (combustible), and at 10% (incombustible).

### 3) Solid Waste Disposal Plan

Assuming that all the industrial and agro-fishery waste are disposed of by each establishment, the solid waste disposal plan shall treat only the general solid waste generated by the urbanized areas.

The collection and disposal of solid waste shall generally become a burden on the local government finance so the low cost method shall be applied as much as possible.

The solid waste disposal plan shall be implemented in the following four (4) phases.

#### (a) The First Period ( 1985 - 1988)

The existing practice of the area shall be maintained during this period because the area's urbanization shall be proceeded to a minimal extent.

#### (b) The Second Period (1989 - 1992)

Establishment of a collection and transport system by each municipality (combined collection system by garbage truck - by household and centralized collection ) shall be done and the collection service for the entire urbanized area shall commence (utilizing the existing dump area).

#### (c) The Third Period (1993 - 1996)

During this period, the urbanization shall reach its full development and solid waste generation shall increase tremendously. Construction of a dump site in each municipality shall be carried out (including the treatment of septic tank sludge).

The full disposal system (collection by garbage truck-domestic and centralized system - burying) shall be established. When selecting the dump site, environmental impact (ground water contamination, surface water contamination, air pollution, etc.) shall be considered.

#### (d) The Fourth Period (1997 - 2000)

By this period, the GRDP and the generation of solid waste shall increase to a considerable extent. The dump sites of the former period shall be expanded by the earth dam method. Introducing compactor trucks and differential collection system, an effective collection and transport system shall be established.

The composting method shall also be examined and tested as an economic means for supplementing the demand of soil improvement materials and fertilizers.