

## CHAPTER II

### SOCIO-ECONOMIC BACKGROUND AND FUTURE DEVELOPMENT PROSPECTS OF THE AREA

Thailand is among the countries with relatively high population growth rate of the world. From 1960 to 1979, the population of Thailand had double increased from about 24,900,000 to 45,200,000. By the year 1990, the population would range from about 57,500,000 to 68,500,000 according to alternative projection for slow and rapid growth. Besides, the moderate growth anticipates a population of about 63,000,000.

Obviously, the natural resources are directly affected by the population growth, exponentially. The more rapid of population growth, the more natural resources are consumed and destroyed. For this reason, natural environments will be worsely changed year after year if this great problem is overlooked. Consequently, the society will face greater barrier in solving any problems regarding natural resources management.

#### 2.1 Population

The eastern part of Thailand is divided on the basis of physical condition into 2 parts, namely, the upper eastern part which includes Nakhon Nayok, Prachinburi and Chachoengsao; whereas the lower eastern part includes Chon Buri, Rayong, Chanthaburi and Trat. The study area is located in the lower eastern part covering the total area of 16,763 square kilometers.

Generally, the population growth in the lower eastern part of Thailand has been significantly increased as compared with the upper one. The total population of the whole eastern part of Thailand had increased from 1,575,107 in 1960 to 2,708,267 in 1977. During the same period, the population in lower eastern part had increased from 763,869 to 1,446,371.

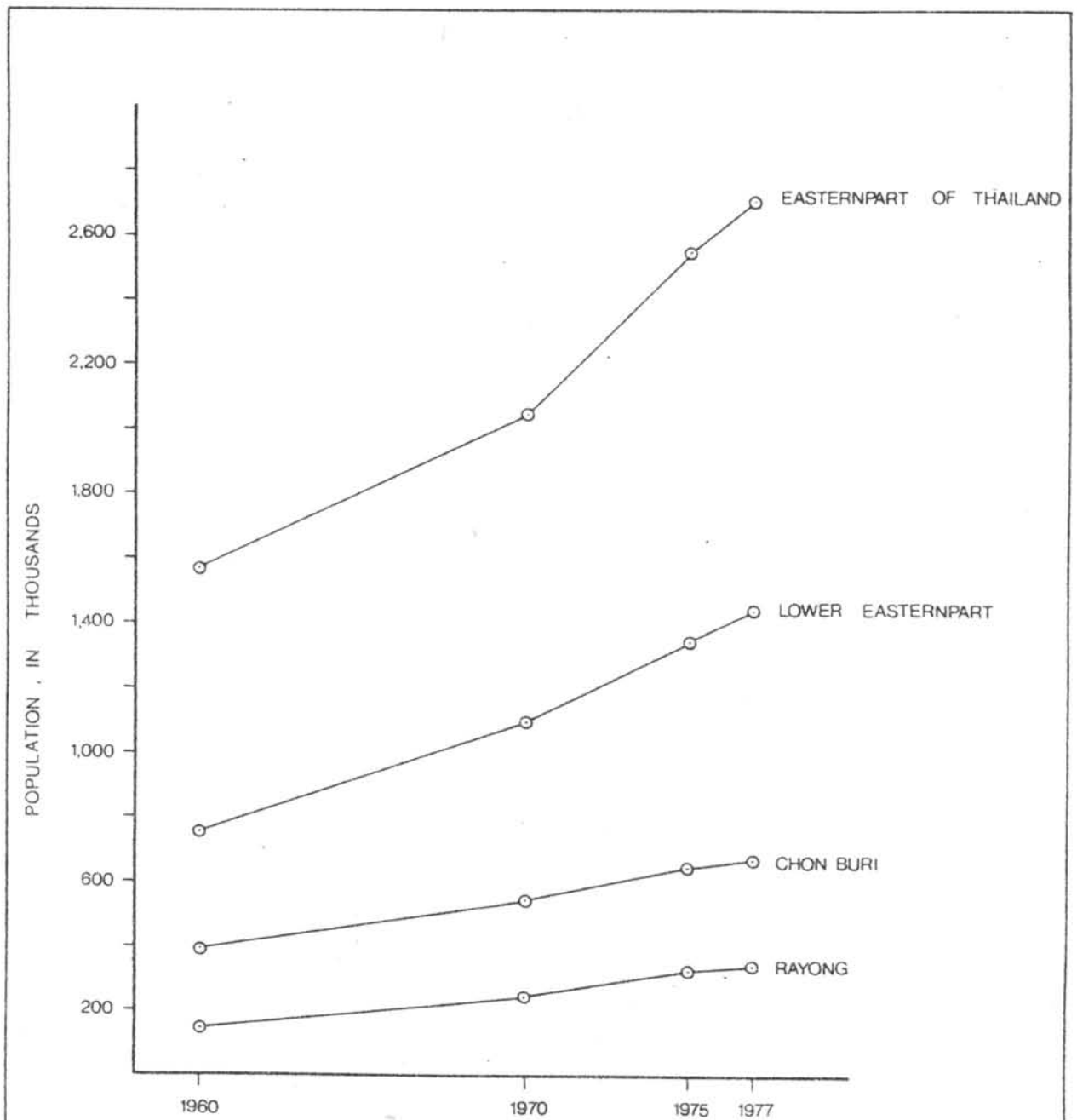
Considering Chon Buri and Rayong the population had increased during 1960-1977 from 392,025 to 681,232 and from 147,713 to 338,481 respectively. It is apparent that the problem of population growth in this area is crucial and will undoubtedly intensify in the future. Factual information regarding the population of this area is summarized and presented in Table 2.1 and Figure 2.1.1

Table 2.1 The population of eastern part of Thailand

Area	Year				Rate of growth from 1960-1977 (%)
	1960	1970	1975	1977	
Eastern part	1,575,107	2,044,196	2,544,939	2,708,267	71.9
Lower eastern part	763,869	1,102,829	1,355,860	1,446,371	89.3
Chon Buri	392,025	541,695	644,052	681,232	73.8
Rayong	147,713	250,671	312,845	338,481	129.1

Sources: Registration Division, The Local Administration Department,  
Ministry of Interior.

The population density of the whole eastern part of Thailand is 56 persons per square kilometer in 1970 and this figure had increased to 74 persons per square kilometer in 1977. During the same period of time,



HISTORICAL POPULATION (1960 -1977)  
OF EASTERNPART OF THAILAND .  
LOWER EASTERNPART , CHON BURI AND RAYONG

ENVIRONMENTAL GEOLOGY OF AN AREA ALONG THE  
EASTERN COAST , UPPER GULF OF THAILAND

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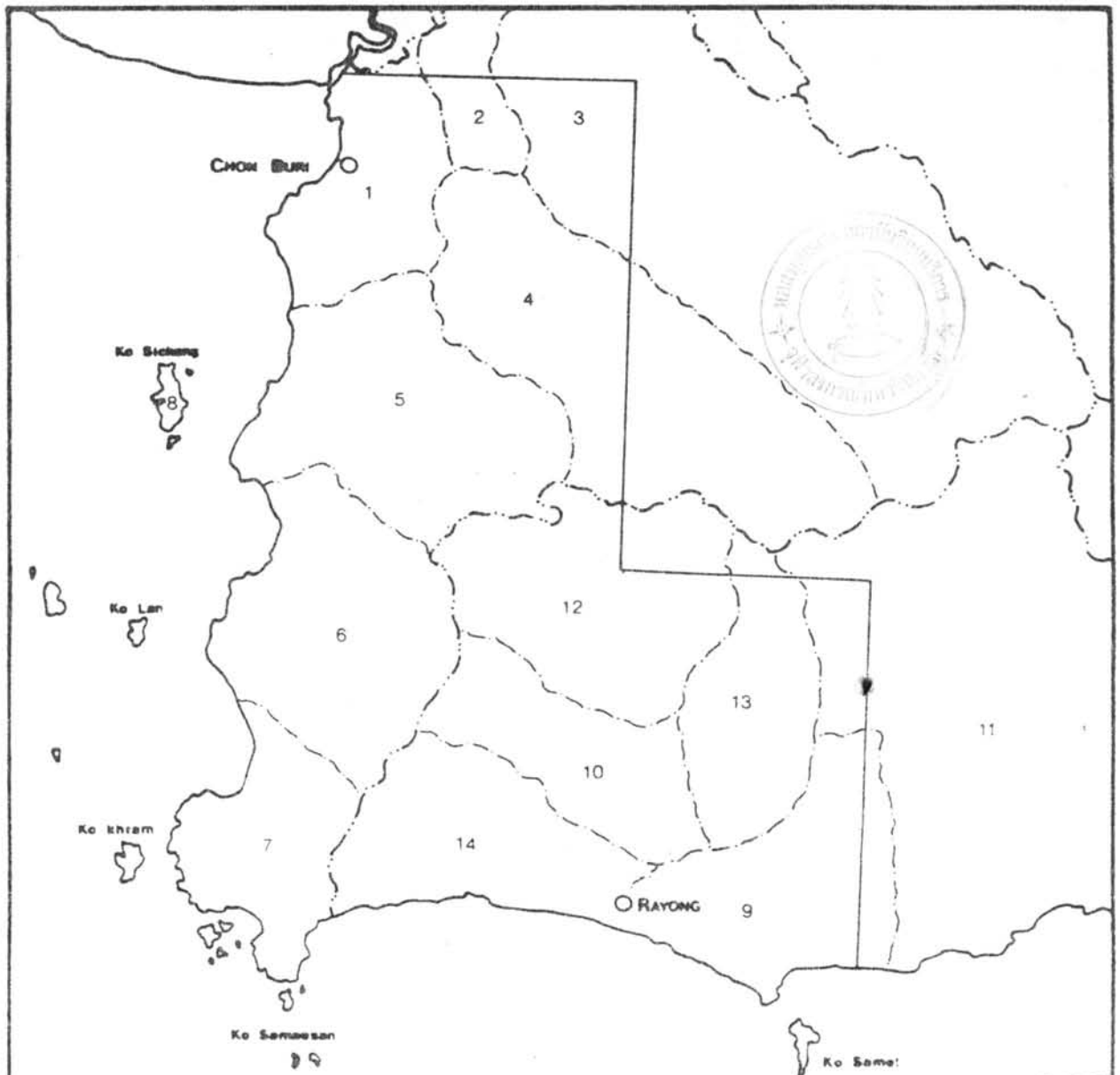
SUNYA SARAPIROME

FIG. 2.1.1

the population density of the lower easternpart, which is higher than the upper eastern part, increased from 66 to 86 persons per square kilometer. Chon Buri, the province of the highest population density within the easternpart of Thailand, has the population density of 121 persons per square kilometer in 1970 to 152 persons per square kilometer in 1977 whereas this figure for Rayong had increased from 76 persons per square kilometer in 1970 to 102 in 1977. (Figure 2.1.2 and 2.1.3)

## 2.2 Economics

Fortunately, the settlements of Chon Buri and Rayong, on the basis of geographical feature, are at the area of high advantage for economic development. They are not far from Bangkok. Approximately half of the area is contact with the sea providing the good opportunity for fisheries and tourism development. Besides, the areas have suitable land for rice and crops cultivation especially cassava which is the main crop of the area. It is well known that this area is the center of tapioca production of Thailand. The aforementioned factors indicate that industrial raw materials are available, notably, natural resources, agricultural resources and tourist resorts. Therefore, the industries are relatively well developed, particularly the agro-industry, for instance, industries of cassava processing, sugar industry, vegetable oil industry and silo. In addition, the heavy industries namely, petroleum refinery industry has long been established in the area while others are scheduled to be developed in the near future. Broadly speaking, the economic structure of the area is mainly consisting of 3 aspects, namely, agricultures, retail and whole-sale trades, and industries.




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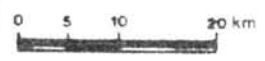
CHANGWAT CHONBURI

CHANGWAT RAYONG

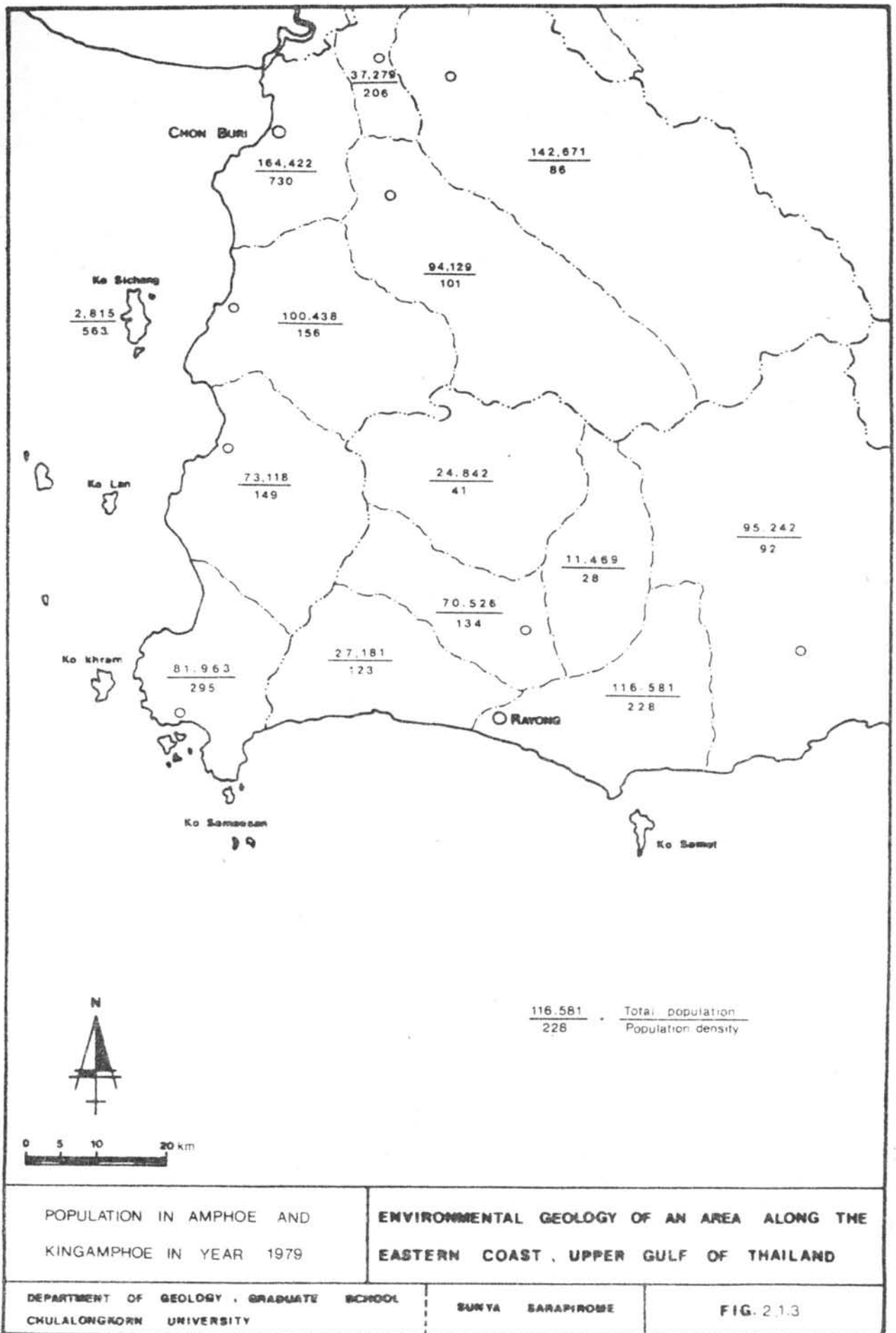
- 1 Amphoe Muang Chonburi
- 2 Amphoe Phan Thong
- 3 Amphoe Phanat Nikhom
- 4 Amphoe Ban Bung
- 5 Amphoe Si Racha
- 6 Amphoe Bang Lamung
- 7 Amphoe Sattahip
- 8 King Amphoe Ko Si Chang

- 9 Amphoe Muang Rayong
- 10 Amphoe Ban Khai
- 11 Amphoe Kiaeng
- 12 King Amphoe Pluak Daeng
- 13 King Amphoe Wang Chan
- 14 King Amphoe Ban Chang

--- Boundary of Changwat  
 --- Boundary of Amphoe  
 Study area



ADMINISTRATIVE BOUNDARIES OF CHANGWAT AND AMPHOE	ENVIRONMENTAL GEOLOGY OF AN AREA ALONG THE EASTERN COAST . UPPER GULF OF THAILAND	
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POPULATION IN AMPHOE AND  
KINGAMPHOE IN YEAR 1979

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FIG. 2.1.3



### 2.2.1 Agricultures

This is the main economical activities of the area that yield the highest revenue as compared with other aspects. These activities include economic crop cultivation, fisheries, animal husbandry and lumbering.

#### 2.2.1.1 Economic Crops

The cultivated area of Chon Buri and Rayong is about 2,573,638 rai or about 52.7 % of the total area. In Chon Buri, 90 % of cultivated area is obviously dependent on rain water for cultivation. This is due to the fact that there is no big river and enough irrigational supply for the cultivated area. Nevertheless, there is some floods in the rainy season especially at Amphoe Phanat Nikhom and Phanthong. The problems of soil, namely, acid and basic soils, and soil condition deterioration, continuously exist in both provinces. Recently, cultivated area are expanded landward from the present coastal plain into a deeper area of stream head. Subsequently, the problem of deforestation have been intensified both in magnitude and intensity. The important crops cultivated in the area are cassava, sugar cane, rice and fruit. Cassava and sugarcane have particularly covered more than half of the cultivated area. Both of them are easy to grow, easy to take care, and require less water. The agricultural produces have been sent to the local processing manufacturers for changing form before appearing to the markets. In the easternpart of Rayong, the rubber is an important plant of an area owing to the high precipitation of the area. The basic

problems for farmers are unfaired price and limitation of the volume of goods required by the manufacturers. The crop productivity of the years 1973-1976 is shown in the Table 2.2.1.1.

#### 2.2.1.2 Fishery

Fishery of Chon Buri and Rayong in the foregoing discussion includes marine and fresh water fisheries. However, marine-fishery is more important and profitable than fresh water-fishery in this region due to the very long coastal zone of approximately 257 kilometers as well as many islands in the off-shore area. The total revenue from fishery is so high that it is in the second order rank whereas the economic crop is the first. The quantity of marine and fresh water animals that can be harvested from this area during 1968 to 1976 are summarized in the Table 2.2.1.2.

Nevertheless, there are many problems that obstruct the marine fishing activities and have undoubtedly caused the reduction of revenue. These problems are the international off-shore law that limited the area of fishing, over-fishing, with the higher cost of fisheries due to the increase of gasoline price and fishing equipment including the problem of pirate, and finally, the problems of marine pollution particularly caused by industrial wastes as well as the environmental deterioration of mangrove forests, the habitat of the early stage of aquatic life.



Table 2.2.1.1 Crops productivity of Easternpart of Thailand, Chon Buri and Rayong between 1973-1976.

Crops and Locality	Production (tons)			
	1973	1974	1975	1976
<u>Cassava</u>				
Easternpart	4,162,038.3	4,638,434.4	5,127,280.9	5,389,489.6
Chon Buri	1,348,526.2	1,510,043.6	1,530,756.8	1,208,247.5
Rayong	1,754,544.7	1,745,785.4	2,134,913.4	2,058,572.0
<u>Sugar cane</u>				
Easternpart	3,633,088.1	2,906,575.2	4,326,193.2	3,831,375.6
Chon Buri	2,876,309.5	2,168,407.0	3,276,812.1	2,617,904.0
Rayong	730,210.3	699,196.4	983,263.3	1,158,428.0
<u>Rice</u>				
Easternpart	1,356,823.0	1,032,147.0	1,240,904.2	1,491,714.4
Chon Buri	118,212.0	103,815.3	135,430.4	142,101.2
Rayong	64,795.0	40,479.3	76,555.7	76,680.0
<u>Maize</u>				
Easternpart	39,646.4	53,654.1	72,182.4	81,080.5
Chon Buri	4,811.7	3,887.2	2,544.7	3,153.6
Rayong	604.8	256.5	356.6	861.8
<u>Pineapple</u>				
Easternpart	102,590.9	115,532.1	243,115.4	748,975.7
Chon Buri	65,110.2	63,631.4	191,911.1	528,366.0
Rayong	3,882.5	13,892.5	16,913.8	169,750.0

Source: Department of Agricultural Extension,

Ministry of Agriculture and Co-operatives.

Table 2.2.1.2 The quantity of marine and fresh water animals that can be fished in the area from the year 1968 to 1976.

Type and Locality	Quantity (tons)								
	1968	1969	1970	1971	1972	1973	1974	1975	1976
<u>Marine animal</u>									
Eastern part	160,984	183,894	201,264	190,795	239,706	264,657	285,595	316,520	375,700
Chon Buri	17,615	36,472	47,389	48,792	49,158	58,121	80,922	85,150	135,270
Rayong	42,989	44,068	45,228	50,663	64,587	64,767	69,384	48,179	77,080
<u>Fresh water animal</u>									
Eastern part	13,915	17,050	19,809	18,421	17,118	13,947	13,544	18,146	19,154
Chon Buri	83	58	63	125	209	236	150	230	226
Rayong	638	800	813	599	858	580	370	219	-

source: Department of Fishery, Ministry of Agriculture and Co-operatives.

### 2.2.1.3 Livestocks

Generally, the animal farms in Chon Buri and Rayong are of poultry and swine. There are limited number of cattle due to lacking of the pastures. Table 2.2.1.3 shows the statistics of livestock in the year 1976.

Table 2.2.1.3 Livestocks of Chon Buri and Rayong (1976).

Locality	ox	Water buffalo	swine	duck	chicken	goose
Easternpart	73,572	238,998	277,785	2,511,518	5,901,323	21,692
Chon Buri	6,828	35,119	60,298	1,166,489	726,879	12,240
Rayong	11,503	18,100	14,924	46,892	263,592	999

Source: Office of the provincial livestock.

The unfavorable conditions of the livestock are the lacking of pasture, high initial investment cost, mechanical and electrical power are more favorable than animal power, domestic animal trades are of monopoly or oligopoly in character, the breeding problem and robbery.

### 2.2.1.4 Forestry

At the present moment, the actual forest area of Chon Buri and Rayong is much lower than the forest reserved area officially located by the government. Most of the forest area has been illegally and consistently destroyed. Eventually, the deforested area is transformed to be cassava and pine

apple cultivated area. Besides, there are some forest leases to be allowed in the area. Table 2.2.1.4 is the comparison of actual forest area and forest reserved area.

Table 2.2.1.4

Locality	forest reserved area (km <sup>2</sup> )	actual forest area (km <sup>2</sup> )
Easternpart	17,069.2	9,214
Chon Buri	1,444.0	500
Rayong	1,488.9	30

Source: Local Forestry Offices, Eastern Part of Thailand.

However, there is an accelerated project of "forest wood-lodge" to promote the reforestation. Concurrently, the forest leases to private sector has been canceled.

#### 2.2.2 Wholesale and Retail Trade

The main exports of Chon Buri are petroleum products, cassava products, sugar, fish source, sea food, matches, and duck eggs. The main imports are liquor, cigarettes, electric wares, construction materials, clothes and medicine.

The main exports of Rayong are cassava products, sugar, sea food, shrimp paste, fish source, fruits and rubbers. The main imports are fuel oil and other similar items to those of Chon Buri.



### 2.2.3 Industries

In the Easternpart of Thailand, industries have been ranked second in terms of the economic structure. Records of 1977 indicate that there are altogether 3,128 industrial plants in the whole region, out of these 994, 639 industrial plants are located in Chon Buri and Rayong respectively. These industries can be classified into three categories, namely, production industry, mining industry, and tourist industry. Generally, the production industry includes numerous agro-industrial plants and many existing large-scale industry, notably, petroleum refinery industry, drying and silo industry. These large-scale industries are so capital intensive industries that they are limited in number.

#### 2.2.3.1 Production Industry

Those are agro-industry oriented include the rice-mill industry, cassava processing industry, etc. In 1977, there are altogether 1,395 rice-mill industrial plants in the whole eastern part of Thailand, out of these 289, 190 rice-mill industrial plants are located in Chon Buri and Rayong respectively. For cassava processing industry, there are 136 and 35 plants in Chonburi and Rayong respectively in the year 1977, whereas in 1979 the number of plants has been drastically increased to 450 for Chon Buri area alone.

It is interesting to note that heavy industries are entirely located only in Chon Buri. These include one drying and silo industry of Ma Boon Khrong Co.Ltd. with 335,000,000 Baht capital investment

and productivity of 420,000 tons per month. In addition, there are two petroleum refinery plants, namely, Thai Oil Refinery Co.Ltd. with 1,874,000,000 Baht capital investment and productivity of 60,000 barrels per day and the ESSO Standard of Thailand Co.Ltd. with 1,100,000,000 Baht capital investment and productivity of 35,000 barrels per day. However, the Thai Oil Refinery Co.Ltd. has been recently granted a permission from the government to expand the productivity and construction of additional plant is in the process.

#### 2.2.3.2 Mining Industry

Numerous mineral deposits have been reported in the areas of Chon Buri and Rayong, some deposits have been exploited. Both active and abandoned mines in the area have produced iron, dolomite, antimony, manganese, tin, ilmenite and silica sand. The iron deposits are located at Khao Chi-On, Amphoe Sattahip, Chonburi and Amphoe Klaeng, Rayong. The only dolomite deposit is reported at Ko Si Chang, Chon Buri. Antimony deposits are found at Tombol Bo-Thong, Amphoe Phanat Nikhom, Chon Buri and Tombol Kong-Din, Amphoe Klaeng, Rayong, whereas the deposit at Chon Buri has been so far exploited in 1980. The manganese deposit has been reported at Ban Nam-Yen, Amphoe Klaeng, Rayong whereas tin deposit is found along the Rayong coastline particularly at Tombol Noen Phra and Tombol Map Taphud. Besides, ilmenite has been found associated with tin deposit. Silica sand deposit is at Amphoe Klaeng, Rayong. The mineral productions in Chon Buri and Rayong from 1969 to 1980 are summarized and presented in Table 2.2.3.2.



Table 2.2.3.2 Mineral productions in Chon Buri and Rayong from year 1969-1980.

Types of Mineral	Province	Production (Tons)											
		1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Iron ore	Chon Buri	-	-	9,900	3,140	-	10,961	1,900	900	2,518	-	19,344	2,180
	Rayong	-	-	-	-	-	-	-	360	-	-	-	-
Antimony ore	Chon Buri	-	-	-	-	-	-	-	-	-	-	-	4,473
	Rayong	-	-	-	-	57	258	177	118	280	344	102	3
Manganese ore													
Battery Grade	Rayong	-	-	-	-	200	640	33	12	-	-	-	-
Metallurgical Grad	Rayong	5,200	3,300	1,800	750	9,040	-	-	-	-	2,000	-	-
Silica Sand	Rayong	-	-	-	-	-	13,040	20,710	13,345	107,218	170,227	157,076	171,000
Ilmenite	Rayong	-	-	-	-	-	-	-	200	-	482	780	-
Tin ore	Rayong	-	-	-	-	-	8	12	-	-	44.5	44.0	-

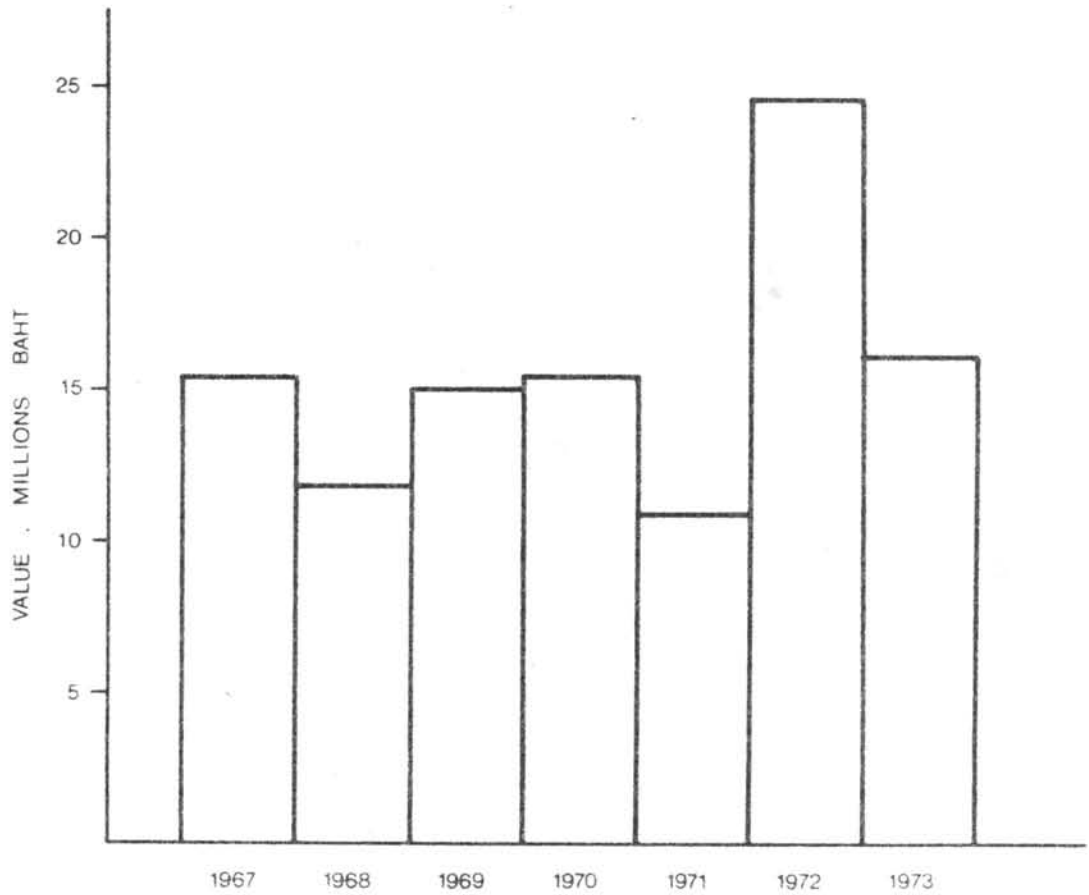
Source : Department of Mineral Resources.

Problems of mining industry in the area of Chon Buri and Rayong are: inadequacy of capital investment, lack of know-how, difficulty in obtaining mining concession within the area of forest reserve, etc.

In addition to the previously mentioned ores, there are various type of construction materials which have been found in this region, notably, crushed rock, construction sand and other fill materials. These construction materials have a significant role on the local economy. Economic values of crushed rock in Chonburi area during 1967-1973 are summarized and presented in Figure 2.2.3.2.

#### 2.2.3.3 Tourist Industry

Fortunately, this area has plenty of beautiful sceneries, landscapes, beaches and islands. Besides, transportation and accessibility from Bangkok are convenient. Numerous recreational facilities are available, namely, Bang Saen, Pattaya, Bang Lamung, Wang Kaew and etc. Water-related sports such as fishing, boating, water skiing and swimming are enjoyed by residents and tourists. Outdoor recreations include camping, golf, national park, private parks, and zoo. Indoor recreational facilities include bowling lanes, swimming pools, assembly hall, auditorium and marine aquariums. Therefore, tourist industry in this region have considerable high potential for development owing to its ever-increasing of revenue yielding. Pattaya is among the most attractive tourist resource for foreigner and Thais. The number of tourists of various nationalities, visiting Pattaya in year 1973-1975, are presented in Table 2.2.3.3.



VALUE OF CRUSHED ROCK  
PRODUCE IN CHON BURI (1967-1973)

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FIG. 2.2.3.2

Table 2.2.3.3 The number of tourists with various nationalities which visit to Pattaya in year 1973-1975

Nationality	1973	1974	1975
Japanese	53,427	58,628	27,801
German	51,315	39,568	24,132
Swiss	28,403	22,580	3,363
Australian	23,767	29,612	12,057
American	21,840	39,466	31,039
French	20,443	13,668	5,480
English	15,975	12,806	8,284
Italian	11,869	12,704	9,826
Swede	10,082	7,261	5,717
Scandinavian	-	11,454	12,002
Chinese (Hong Kong)	-	8,376	9,468
Taiwanese	6,647	5,858	4,500
Finnish	-	1,178	1,507
Others	20,511	76,635	73,751
<b>Total</b>	<b>264,281</b>	<b>339,843</b>	<b>228,927</b>

The general items regarding the development of tourist industry should be considered for the future planning are: providing adequate infrastructures and public services, the architectural buildings that will be built up in the recreational area should be designed in harmony with the aesthetic science, amending and protecting the natural environment, and finally, the government should appropriately contribute the investment to private sectors in both of local and regional level.

### 2.3 Social Conditions

#### 2.3.1 Institutions

The pattern and hierarchy of administrative unit within Chon Buri and Rayong are similar, and this can be classified into 3 categories, notably, provincial administration, central administration and local administration.

The provincial administration is further classified into 4 levels, namely, Changwat, Amphoe, Tombol and Mooban in their decreasing scale respectively. Chon Buri is subdivided into 7 Amphoe, 3 KingAmphoe, 81 Tombol and 597 Mooban, while Rayong is subdivided into 4 Amphoe, 2 KingAmphoe, 45 Tombol and 249 Mooban.

The central administration is characterized by setting up changwats' branches of many central administrative bodies. These branches are generally technical operation in nature, namely, water supply, post and telegraph, telephone, electricity, irrigation etc.



The local administration is also further classified into 3 categories, notably, municipality, provincial administrative organization, and sanitary district. Chon Buri is divided into 3 municipalities, 1 provincial administrative organizations and 14 sanitary districts while Rayong is divided into 1 municipality, 1 provincial administrative organization, and 6 sanitary districts.

It is remarkable to note that there is a special local administration within Chon Buri area called "Pattaya City" formerly Tombol Pattaya belonging to Na Klua sanitary district. The Pattaya City is operated on the basis of city manager in order to improve and facilitate the economically rapid growing area of Pattaya which has become the world famous tourist resort.

### 2.3.2 Educational and Health Services

Like the rest of rural Thailand, Chon Buri and Rayong have a range of educational and health services. For educational service Chonburi appears to have a relatively expansive and advanced programme as compared with that of Rayong. Information regarding the government educational service for Chon Buri and Rayong at different level are summarized and presented in Table 2.3.2.1.

For health service within Chon Buri and Rayong in 1978, data and information are summarized and presented in Table 2.3.2.2.



Table 2.3.2.1 Number of school and university, students, teachers and instructors of Chon Buri\* & Rayong\*\*

Educational level	Number of school		Number of teachers and instructors		Number of students		student-teacher ratio	
	A	B	A	B	A	B	A	B
Kinder Karten	21	-	454	-	12,692	-	28	-
Primary school	378	186	4,193	1,778	105,918	47,602	25	27
Secondary school	60	4	1,360	171	28,335	4,659	21	25
Vocational school	4	1	158	-	1,980	+	13	-
Colleges	46	X	258	X	3,216	X	12	X
University	1	X	149	X	3,285	X	22	X

A - Chon Buri

B - Rayong

- not available

+ Productivity + 400/year (Finished study)

X none

\* Chon Buri, data in year 1978

\*\* Rayong, data in year 1975

Table 2.3.2.2 Numbers of Hospitals and Health service centers of  
Chon Buri and Rayong in year 1978.

Type	Chon Buri	Rayong
Public hospital	7	4
Private hospital	-	4
Health centers	10	3
First class health center	77	2
Second class health center		
Mid wifery center	9	10
Disease unit	1	-
Malaria control unit	1	-
Clinic	102	-

- not available

### 2.3.3 Transportation and Communication

Rural Thailand has experienced a revolutionary change in transport over the past 20 years. It is very fortunate for Chon Buri and Rayong areas which have a very high development potential, that transportation and communication system for almost all levels both intercity and intracity are in good condition including deep seaport and airport. However, additional transportation and communication system has been planned to meet the ever-increasing demand of various development programmes within this area in a very near future.

#### 2.3.3.1 Road and Highway

##### a. Chon Buri

The total length of road and highway within the area of Chon Buri is approximately 1,500 kilometers. This is further classified into 3 types, namely, standard asphaltic road of totally 300 kilometers, sub-standard asphaltic road of totally 200 kilometers, and unpaved road of totally 1,000 kilometers. It is interesting to note that almost all of the asphaltic road/highways are categorized as national and provincial highways. Whereas almost all of the rural road are the unpaved one. Besides, there are two highways underconstruction, notably, Ban Bung - Ban Khai highway (Standard asphaltic, total length 72.20 kilometers) and Ban Bung - Amphoe Klaeng highway (standard asphaltic, total length of 88.60 kilometers).

## b. Rayong

The total length of road and highway within the area of Rayong is exceeding 2,837 kilometers. Among these, they are asphaltic road/highway of totally 337 kilometers, and the rest are unpaved rural roads with can be seasonary used. There are more than 8 routes of national and provincial asphaltic highways and approximately 272 routes of unpaved rural road.

### 2.3.3.2 Air Port and Air Field

The only commercial airport in the Eastern part of Thailand is located at Ban U-Tapao, King Amphoe Ban Chang, Changwat Rayong. In addition, there is a small Airfield No.7 of the Royal Thai Air Force at Sattahip and abandoned sea plane Anchorage of the Royal Thai Navy at Laem Thong Lang, Ao Chuk Samet, Sattahip, Chon Buri.

### 2.3.3.3 Seaport

Within Chon Buri area there are 2 jetties for loading and/or unloading cargoes, namely, Ma Boon Khrong Jetty at Ban Pha Daeng, Siracha and Ko Si Chang Jetty. The only big commercial deep-seaport, Sattahip Deep-Seaport, is located in the vicinity of Khao Chuk Samet, Amphoe Sattahip. Besides, there are 2 naval seaports, one of them belonging to Sattahip Naval Base is located at Laem Thian, the other one belonging to the Operation Fleet is located at Ao Sattahip. For fishing, passanger and freight piers, there are numerous at Amphoe Siracha, Amphoe Bang Lamung of Chon Buri, Amphoe Muang and Amphoe Klaeng of Rayong.

#### 2.3.3.4 Domestic and International Telecommunication Facilities.

For Chon Buri there are post and telegraph office in every Amphoe and King Amphoe including at Ban Bang Pla Soi, Bang Saen, Bang Phra, Ao U-dom, Ban Hua Kun Chae and Ban Nong Yai. For Rayong area the post and telegraph office are restricted to Amphoe and King Amphoe.

Considering the telephone service in Chonburi, there are centers located at Amphoe Muang, Bang Saen, amphoe Ban Bung, Amphoe Siracha, Pattaya, Amphoe Phanat Nikhom of totally 5,669 numbers. For Rayong the telephone service is restricted to Amphoe Muang of a totally 1,000 numbers.

Besides, in Chon Buri there are 3 official radar stations, namely, Khao Mon and Khao Chong Khaeb in Sattahip, and Khao Chalak in Siracha. Within the Sattahip Naval Base there is 1 radar tower. At Khao Nong Ang north of Laem Chabang there is 1 military telecommunication station belonging to the Directorate of Joint Communications, Supreme Command Headquarters. For international telecommunication facility, there is one satellite signal receiving station located at Siracha.

#### 2.3.4 Electricity

The electricity supplies of Chon Buri are widely distributed to almost all of the rural areas due to the demand of numerous factories located in those area including the people living there. There are electricity supplies in every Amphoe including Tombol Klong Kiew and



Tombol Ko Phoe - Tha Boon Mee. In 1979, there are 57,825 consumers in 295 villages out of the total number of 568 villages.

For Rayong area the electricity supplies are distributed in every Amphoe with the total number of consumers of 15,072. The number of villages with electricity supplies is approximately 30.24 per cent of the total number of villages in Rayong.

### 2.3.5 Water Supply

The most important water resource of Chon Buri is Bang Phra reservoir where raw water is used in the water supply system of Chon Buri, Bang Saen and Siracha. The total capacity introducing total supply to these 3 areas is approximately  $1,000 \text{ m}^3/\text{hr}$  or  $24,000 \text{ m}^3/\text{day}$ . Besides, there are another 3 local water supply centers, namely, Phanat Nikhom, Ban Bung and Na Klua where raw water used are coming from Huai Yai Khaeg, Huai Ma Phai and Huai Nong Phreau, respectively.

For Rayong area, the water supply within the Rayong Municipality has served the area of 4.356 square kilometers with the capacity of  $7,680 \text{ m}^3/\text{day}$  to 2,988 consumers. The raw water is drawn from Bung Si-Phet, Khlong Yai and Ban Khai. In addition, there are 4 local water-supply centers, notably, Thang Kwien, Ban Chang, Pleauk Daeng and Ban Khai. However, these 4 centers have water deficient problem particularly in the dry season. Most of the people in rural area have to rely on private water wells and ponds.



### 2.3.6 Occupation and Life Style.

Both Chon Buri and Rayong are considered to be big provinces with relatively highergrowth rate in agricultiture, industry, business and finance. Nevertheless the social conditions of these two areas are mainly rural society type with tradition-directed in character. However, within the centers of these two provinces, the social conditions have inclined to change towards the urban society type. It is believed that the dynamic local economy might have a strong influence in deviate the social structure. For most of the rural areas where there are sufficient natural resources and sufficient incomes, the social conditions generally remain unchanged.

Most of the people in these two provinces are Bhuddists. The numbers of christian and muslem are very limited. Information regarding monasteries, priests and novices in these two areas are summarized and presented in Table 2.3.6.

## 2.4 Future Development Prospects

### 2.4.1 Infrastructure Projects

#### 2.4.1.1 Road and Highway

The feasibility study regarding the development of road and highway system has been carried out by the government. This primarily aims at establishing the connection of road and highway system between Sukumvit road and Bang Lamung - Rayong road passing through industrial

Table 2.3.6

Number of monasteries, priests and novices of Chon Buri and Rayong

Type	Location	
	Chon Buri <sup>*</sup>	Rayong <sup>**</sup>
Buddhist monasteries	232	117
Priests	4,710	2,792
Novices	864	514
Christian Church	10	-
Islamic mosque	11	-

- not available

\* Data collected until 1979

\*\* Data collected until 1974

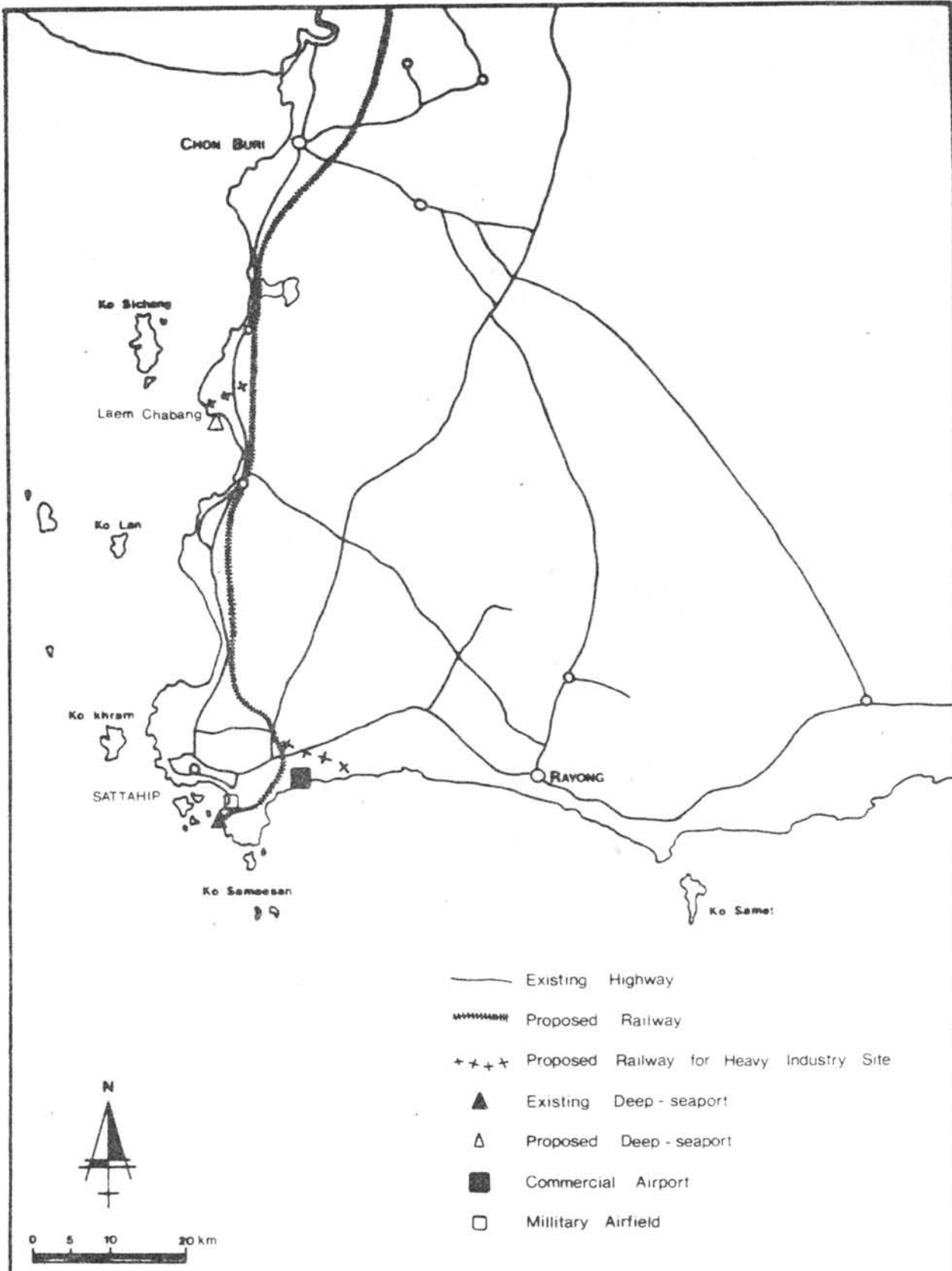
site and populated area. Besides, the road and highway system must be able to accommodate the future growth of industry and community including accessibility to the seaports and rail roads. (Figure 2.4.1.1)

#### 2.4.1.2 Rail Road

Originally, the State Railway of Thailand has planned to install a single track rail line connecting Chachoengsoa, Siracha, Pattaya, Laem Chabang and terminating at Sattahip. This rail road is expected to be in use in 1982. In addition, the feasibility study regarding the construction of extended railroad from Khao Chi Chan Station, Sattahip to Map Ta Phut has been carried out. It is expected that this extension will be complete in 1984. The rail road link between the northern route, northeastern route and eastern route via Ban Pha Chi junction and Chachoengsoa will be completed in 1985. These rail roads will provide easy access for cargoes, raw materials, agricultural products and passengers to and from Chon Buri and Rayong. Besides, there is a plan to extend the rail road system to all other provinces in the eastern part of Thailand.

#### 2.4.1.3 Electricity

The construction of the gas turbine and thermal power at the Bang Pakong Plant which is divided into 2 phases, namely, the diesel type of upto 360 MW will be finished in 1981 and the thermal type using natural gas of upto 550 MW will be finished in 1983. At the present moment there are two main transmission line in the area, one is the



- Existing Highway
- - - - - Proposed Railway
- + + + + Proposed Railway for Heavy Industry Site
- ▲ Existing Deep - seaport
- △ Proposed Deep - seaport
- Commercial Airport
- Military Airfield

TRANSPORTATION SYSTEM

ENVIRONMENTAL GEOLOGY OF AN AREA ALONG THE EASTERN COAST, UPPER GULF OF THAILAND

230 KV transmission line from Bang Phli to Ao Phai and another one is the 115 KV transmission line from Bang Kapi to Chachoengsoa. The additional 230 KV transmission line between Ao Phai and Chachoengsoa is under construction and expected to finished in 1983. The existing and purposed transmission line are summarized and presented in Figure 2.4.1.3.

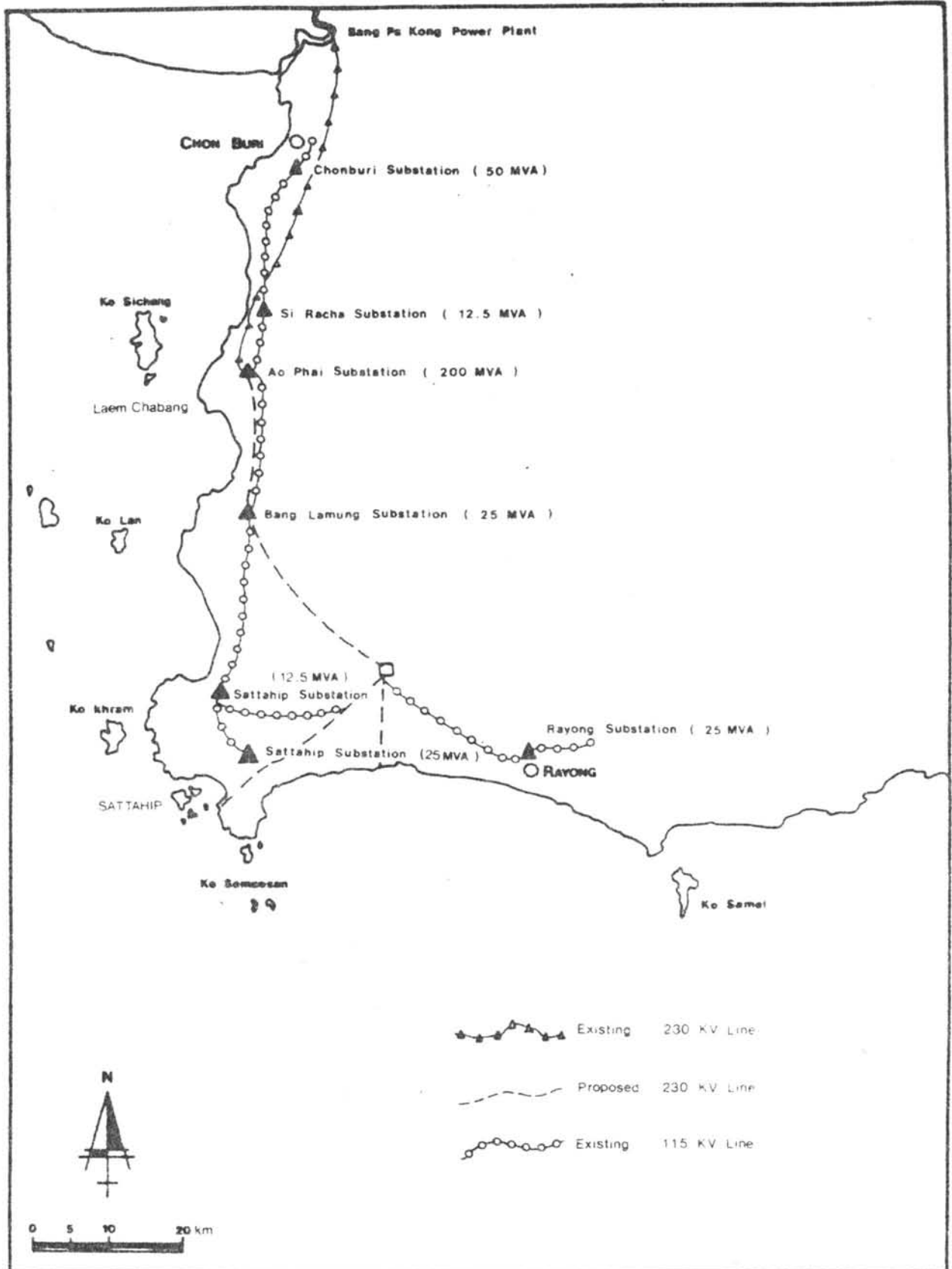
#### 2.4.1.4 Communication System

At the moment there are altogether 19 telephone centers in the eastern part of Thailand of totally 17,800 numbers. In 1983, the telephone number will be increased to 33,000. Besides, services on the teleprint have been expanded 4 stations at Chachoengsoa, Pattaya, Siracha and Chanthaburi are available at the present moment. In 1981, the automatic telephone center with the capacity of 250 number has been installed at Pattaya, and there is a plan to install automatic telephone center with minimum capacity of 12 dial-figures to every province in the eastern part of Thailand. The installation of telephone centers and teleprint in the industrial and populated area will be finished in 1985.

#### 2.4.1.5 Water Pipeline

The feasibility study including the survey and design of water pipe system from Dok Krai Reservoir passing through Map Ta Phut to various industrial sites and Sattahip Deep-Sea port have been carried out. The capacity of the water pipe line is at least  $60 \text{ m}^3/\text{minute}$  in order to meet the demand in the vicinity of Map Ta Phut, populated area and





ELECTRICAL POWER SYSTEM

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FIG. 2.4.13

Sattahip Deep-Seaport including the Sattahip Naval Base. The first phase of construction of water pipe line system from Dok Krai Reservoir to Map Ta Phut will be completed in 1983 for the use in gas separation plant. In addition, the feasibility study for the extension of water pipe line system to Laem Chabang will be carried out. (Figure 2.4.1.5)

#### 2.4.1.6 Deep-Seaport

##### a. Sattahip Deep-Seaport

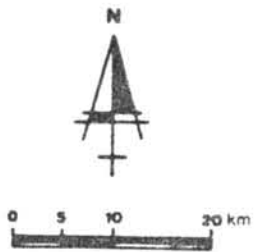
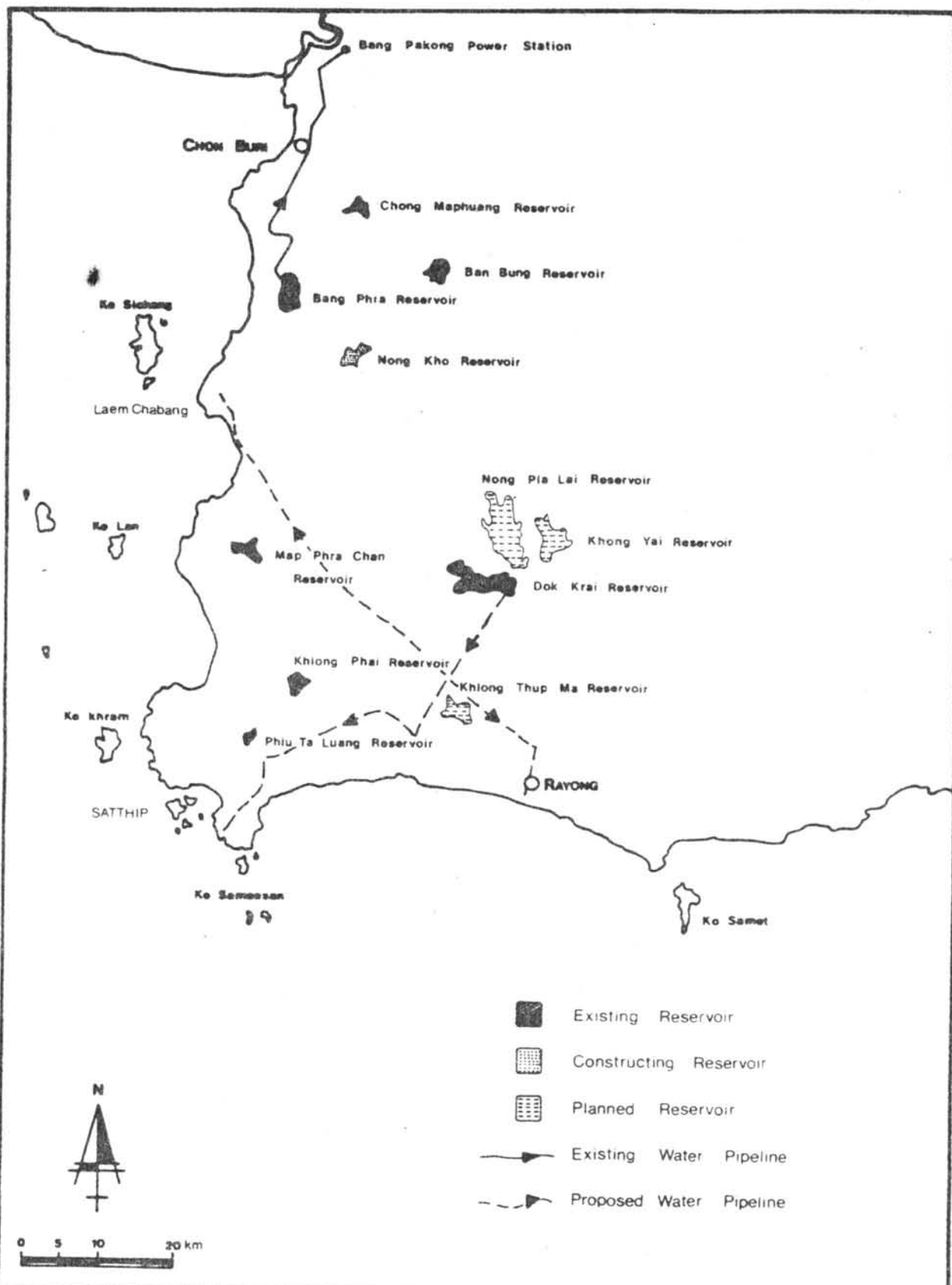
It is decided that the expansion and improvement of existing deep-seaport at Sattahip should be completed in 1985 in order to accommodate the cargo ship with displacement of 120,000 tons. This program will be able to cope up with import-export cargoes for the next 35-50 years.

##### b. Laem Chabang Deep-Seaport

It is decided that the preparation of Laem Chabang Deep-Seaport particularly on the land ownership should be carried out for future construction. The survey and design of this port should be finished in 1988 and deep-seaport should be in service from 1995 onward. It is planned that 90 per cent of the cargoes for this deep-seaport will be the container type.

##### c. Ko Si Chang

Reservation of the deep-sea area around Ko Si Chang will be made for the unloading of bulk cargoes, petroleum product and dangerous



- Existing Reservoir
- Constructing Reservoir
- Planned Reservoir
- Existing Water Pipeline
- Proposed Water Pipeline

RESERVOIRS AND WATER PIPELINES	<b>ENVIRONMENTAL GEOLOGY OF AN AREA ALONG THE EASTERN COAST, UPPER GULF OF THAILAND</b>	
DEPARTMENT OF GEOLOGY, GRADUATE SCHOOL CHULALONGKORN UNIVERSITY	SUNYA SARAPIROME	FIG. 24.1.5

including toxic cargoes into the coastal lighters. The navigation system within the vicinity of Ko Si Chang should be better organized and regulated.

#### 2.4.2 Industrial Proposed Projects

The Thai Government has decided on the sites of heavy industry development projects for the Eastern part of Thailand to be located on the plain between U-Tapoa Airport and Map Ta Phut, Rayong. The heavy industries concerned are soda-ash, sponge iron, fertilizer, steel and petroleum industry. Besides, the area of Laem Chabang, Chon Buri will be prepared for the industrial estate development. At the present moment, numerous feasibility studies on technical, socio-economic as well as environmental aspects have been carried out under the responsibility and coordination of the Eastern Seaboard Authority, Office of National Economic and Social Development Board. Information regarding the project descriptions are summarized and presented as follows:

##### 2.4.2.1 Soda Ash Project

The soda ash project is one of the ASEAN industrial project. The soda ash project has been decided to be located in the vicinity Ban Nong Yai and Ban Khanamrai in the valley opposite the Royal Navy Base, north of Sukhumvit Road or cluster around the natural gas separation plant at Map Chalood Rayong. Construction of this project is expected to be completed in the year 1985.

#### 2.4.2.2 Fertilizer Project

The project aims at producing various types of fertilizer, namely, uria, monoammoniam phosphate, diammonium phosphate, ammonium phosphate, NP and NPK. The site of the fertilizer project has been decided to be located at Ban Map Chalood, Rayong. The feasibility study of this project excluding the economic and environmental impact aspect, has been completed and construction of the project requires 3 years.

#### 2.4.2.3 Sponge Iron Project

The project aims at producing sponge iron for domestic consumption in place of imported scrap iron. The feasibility study of this project as well as the economic consideration excluding the environmental impact study have been completed. The construction phase of this project requires 3 years period upon the approval from the government.

#### 2.4.2.4 Steel Project

The project aims at producing hot and cold steel sheets for domestic industries. It is expected that approximately 3 million tons of iron ore will be imported which requires an area of approximately 250 rai near the deep-seaport. The steel plant must also be located near the deep-seaport and requires an area of approximately 3,000 rai as well as electricity of 400 MW. At the present moment, the feasibility studies and the environmental impact study have been carried out, the construction of this project requires 7 years.



#### 2.4.2.5 Petroleum Industry Projects

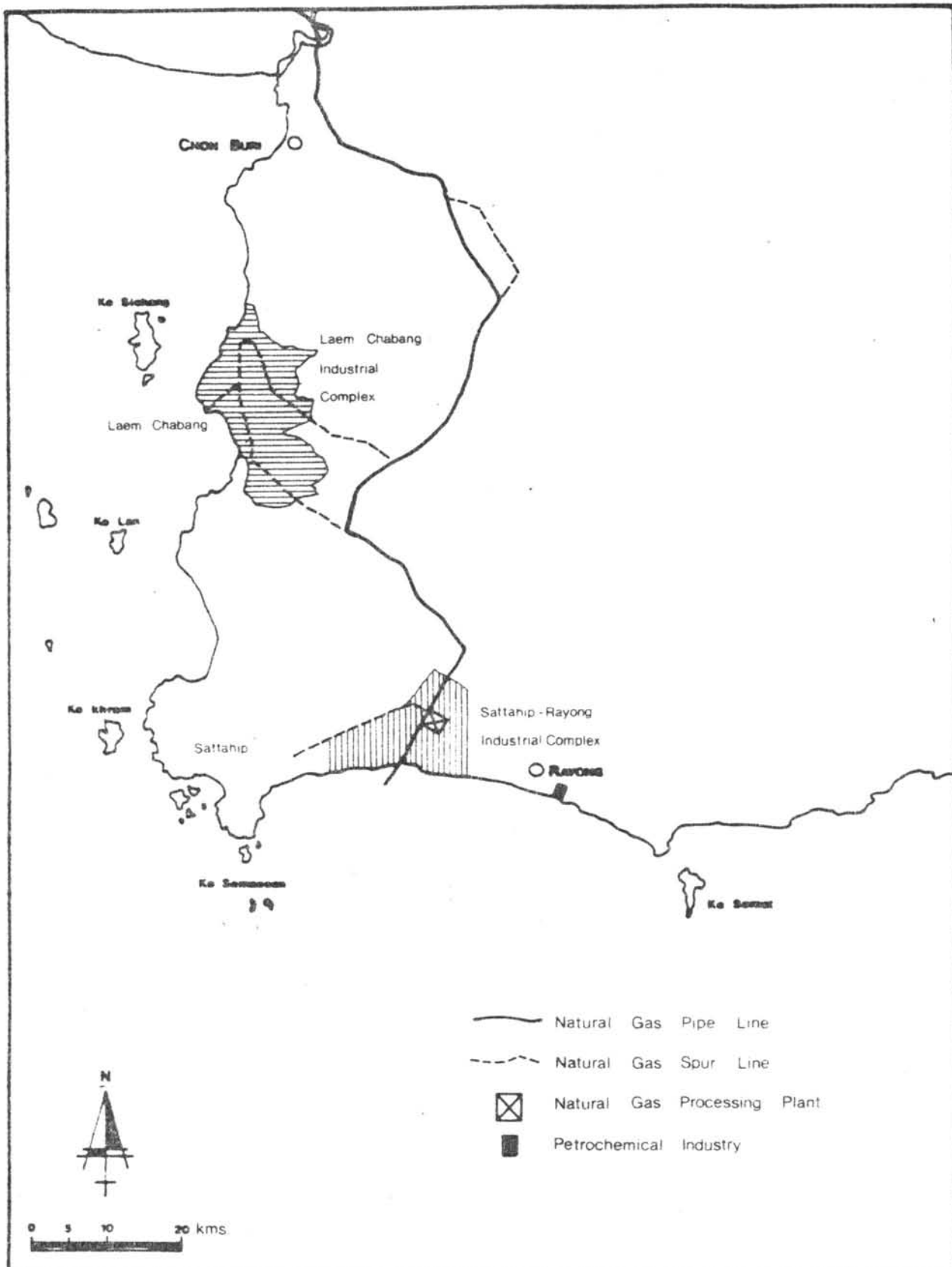
The separation plant for natural gas from the Gulf of Thailand of the Petroleum Authority of Thailand is located at Map Ta Phut, Rayong and is due to be completed in 1983. In addition, jetty and storage as well as propane distillation tower which are parts of the separation plant will be located at Khao Bo-Ya, Siracha, Chon Buri. It is expected that other petrochemical complex will be developed along Sattahip-Rayong coastline. (Figure 2.4.2.5)

#### 2.4.2.6 Industrial Estate

The area of Tombol Thng Sukhala, Siracha, Chon Buri has been decided to be industrial estate for light industry and export processing zone. Special consideration is given upon the pollution problem in this area for Pattaya tourist resort is only 10 kilometers far away from Laem Chabang.

#### 2.4.3 Tourism or Recreation Projects

Tourism Authority of Thailand has the proposed project to develop recreation sites at Pattaya and Ko Samet. Infrastructure system, such as waste disposal facilities and waste-treatment, flood control, water supply, road etc., is planned for Pattaya to improve these tourist resorts into international standard. This development project is estimated to cost 1,200 million Baht. Ko Samet is decided to be a recreation area under the aspect of environmental conservation services regarding fresh water supply, piers, bungalow, water closet, etc. will be provided.



PETROLEUM INDUSTRY

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FIG. 2.4.2.5

Besides, the private sectors are actively participated in the service industry for tourism in this region.

For Pattaya, the most important tourist resorts of Thailand, the capital investment at the present time is approximately 6,500 million Baht. The total number of rooms in first class hotels are about 3,000 which attract approximately 600,000 foreign tourists per annum. The total incomes from tourist industry is estimated to be about 5,000 million Baht.

#### 2.4.4 Water Resources Proposed Projects

The drought is the main problem in this area despite the fact that reservoirs and irrigational canals are available, namely, Bang Phra reservoir ( 100 million  $m^3$ ), Dok Krai reservoir ( 48 million  $m^3$ ), Map Phrachan reservoir ( 14 million  $m^3$ ), Phlu Ta Luang reservoir (2.8  $m.m^3$ ), Chuk Samet reservoir, Ban Bung reservoir, Nong Takhian Reservoir. Therefore, several projects concerning water management are alive. These proposed projects are Klong Yai project ( 45 million  $m^3$ ), Nong Phla Lai project ( 100 million  $m^3$ ), Pra Sae project, Klong Phai project ( 12 million  $m^3$ ), Klong Thupma project including Nong Kho project which is under construction. Nong Kho project is the water storage programme for household and industrial uses in Chon Buri province. Water will also be channelled to assist cultivation of 7,500-rai area in Siracha district.

The proposed projects involve the construction of water pipeline from reservoirs to supply industrial estates and urban areas as well as

sites of heavy industries. Sub committee on Water Resources Planning has planned to divert the water from Dok Krai reservoir to supply Pattani and Sattahip areas particularly for tourism and deep-seaport development. Besides, the private-own petrochemical industry at Rayong will be supplied with water from Dok Krai reservoir by means of pipe line.

The prospect of ground water development along an area of the eastern coast is not promising considering from the geological point of view. Besides, any additional plan for water resource development in this region, care must be taken on the environmental impact aspect.