

### 2.3.3 PHYSICAL DEVELOPMENT FRAMEWORK

Further development of resort hotel accommodations and related tourism facilities should be expanded not only in the southwest coast of Phuket along the Patong, Karon and Kata beaches, but also along the Bang Tao and Chat Chai beaches, northwest coast of Phuket. The Thai Muang Beach in Phang Nga Province should also be developed to meet the future demands of the tourists in greater Phuket.

#### ● "A New Resort Development Zone"

The coastal area from Ban Tao in Phuket up to the southern boundary of the Hat Thai Muang National Park is designated as "a New Resort Development Zone" to promote planned tourism facilities development involving large-scale resort complex projects initiated by both the private and public sector. This will include public beach developments and the related community and regional development.

The major proposed projects in this zone are as follows:

1. Bang Tao Integrated Development Project
2. Hat Nai Yang Public Beach Development Project
3. Chat Chai Integrated Development Project
4. Khok Kloi Public Beach Development Project
5. Thai Muang Integrated Development Project

#### ● "Development Control Zones"

Other areas of the southwest coast of Phuket are designated as "Development Control Zones" to regulate further development of resort facilities and improve the services and infrastructure.

#### 1) REQUIRED NEW DEVELOPMENT AREAS FOR INTERNATIONAL RESORT HOTELS AND RELATED FACILITIES

At present, there are 1,380 rooms (24 hotels/bungalows) in Phuket City and 6,113 rooms (120 hotels/bungalows) in the southwest coastal beach areas of Patong, Karon, Kata and Rawai in Phuket province.

#### ● History of Hotel Development in Phuket

In Phuket city, since the first luxury urban-type hotel (Thavon Hotel, 200 rooms) was opened in 1964, mid to large international class hotels with 150-200 rooms have been developed in 1976, 1980 and 1984 respectively. This corresponds with the increasing demand for hotel accommodations especially from Singapore, Malaysia, Hong Kong and Taiwan tourists as well as domestic tourists and businessmen.

#### ● Town Hotels

Some new urban-type hotels are now under construction or in the planning stage, and it is expected that more and more hotels will be required to meet the demand for hotels to accommodate an ever increasing number of group tours from the market countries mentioned above.

For beach resort-type hotels and bungalows, most of the international class hotels (150-200) rooms have been developed since 1985, with nearly 5,000 rooms being built in the 3 years prior to 1987.

#### ● Patong Beach

In Patong beach, the most concentrated development area in the southwest coast of Phuket, the beach front area is almost totally developed and occupied by hotels and bungalows with 3,067 rooms (56 hotels and bungalows).

There are also many hotels and bungalows, some of which are already open or under construction, inside the beach front area. Many of the interior areas have already been subdivided into small pieces of land and sold to private hotel/bungalow and/or commercial investors.

#### ● Delay of Public Services

Public services such as roads, water supply and sewage facilities have been late for serving those areas where early development by private investors was undertaken without any coordination with government plans or programs.

#### ● Only Few Sites are Available in the South of Phuket

The best beaches suitable for resort hotels are concentrated in the southwest coast which has good accessibility to Phuket city, good swimming conditions and beautiful scenery with bay shaped beaches. However, most of the best sites have already been developed and there are few sites available for international resort hotels and related facilities development in the area which would meet the demands of increasing numbers of tourists especially from Japan and the West.

It is necessary to find new land for accommodating large-scale resort development to cope with these future demands. Careful consideration must be taken, not only with developing beach resort hotels but also with environmental conditions, land use of the hinterland and regional/community development of the area.

#### 2) UTILIZATION OF EXHAUSTED MINING AREAS

Although the tin mining industry has been a dominant economic activity in the area with a peak year in 1980, it has been declining because of a recession in the world tin market as well as other economic and technical reasons.

#### ● Declining of Tin Mining Industry

There are some 70 km (12.6% of the total area of Phuket province) of concession areas for tin mining in Phuket Province, but most of these areas have exhausted the tin mining potential but still retain licenses exclusively for tin concessions so that they cannot be used for other purposes.

#### ● DMR

The Department of Mining Resources (DMR) in the Ministry of Industry predicts that there will be no drastic change of status of the tin mining regions until 1992. However, one of the most important subjects for the DMR is how to revitalize these exhausted tin mining areas. Ideas on how to utilize ex-tin mining areas are listed below, as a result of interviews and coordination meetings with related governmental agencies.

- a. Residential Areas- Especially for urban expansion sites in the suburban area of Phuket City.
- b. Public Facilities- Parks, recreational sites, dumping sites, water reservoirs
- c. Agricultural Areas- Cashew nuts, fish farms (Commercial crops are difficult to grow because of a lack of top soil).
- d. Tourist Facilities Areas- Hotels, golf courses, swimming pools, gardens

● How to Utilize Ex-Tin Mining Areas

The government agencies concerned are very interested in having hotel developers utilize the exhausted tin mining areas in the above ways hoping to convert the existing tin mining areas into resort developments especially on the west coast of both Phuket and Phang Nga Provinces. (See Fig. 2-3-7)

● Resort Dev't in Ex-Tin Mining Areas

FIG. 2-3-4 TOURISM DEVELOPMENT ZONING

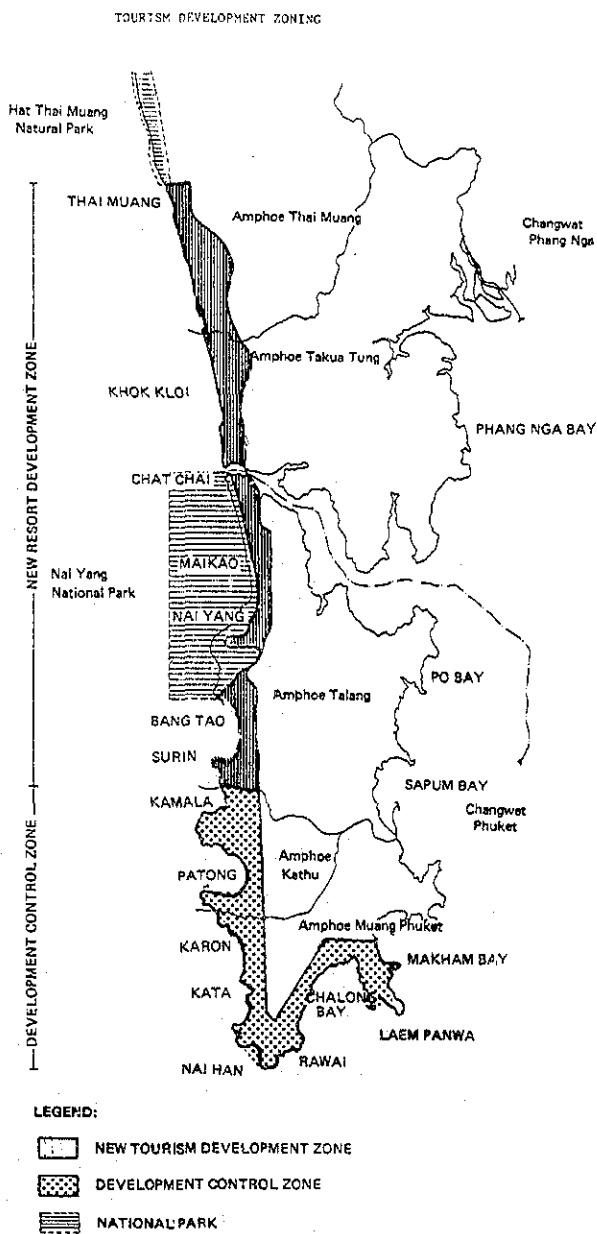


FIG. 2-3-5 DISTRIBUTION OF THE PRESENT TOURIST ACCOMMODATION IN PHUKET

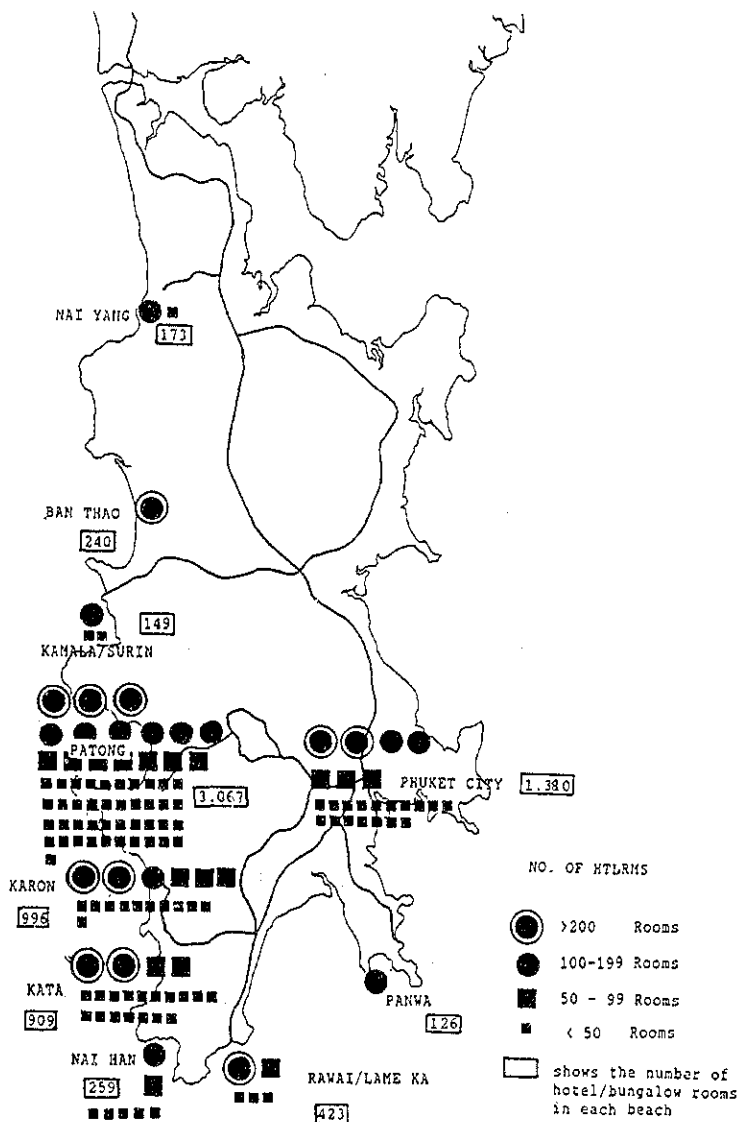
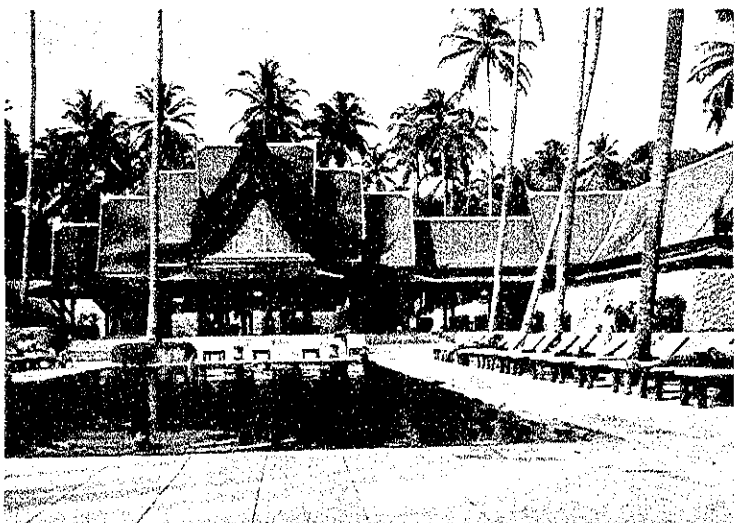
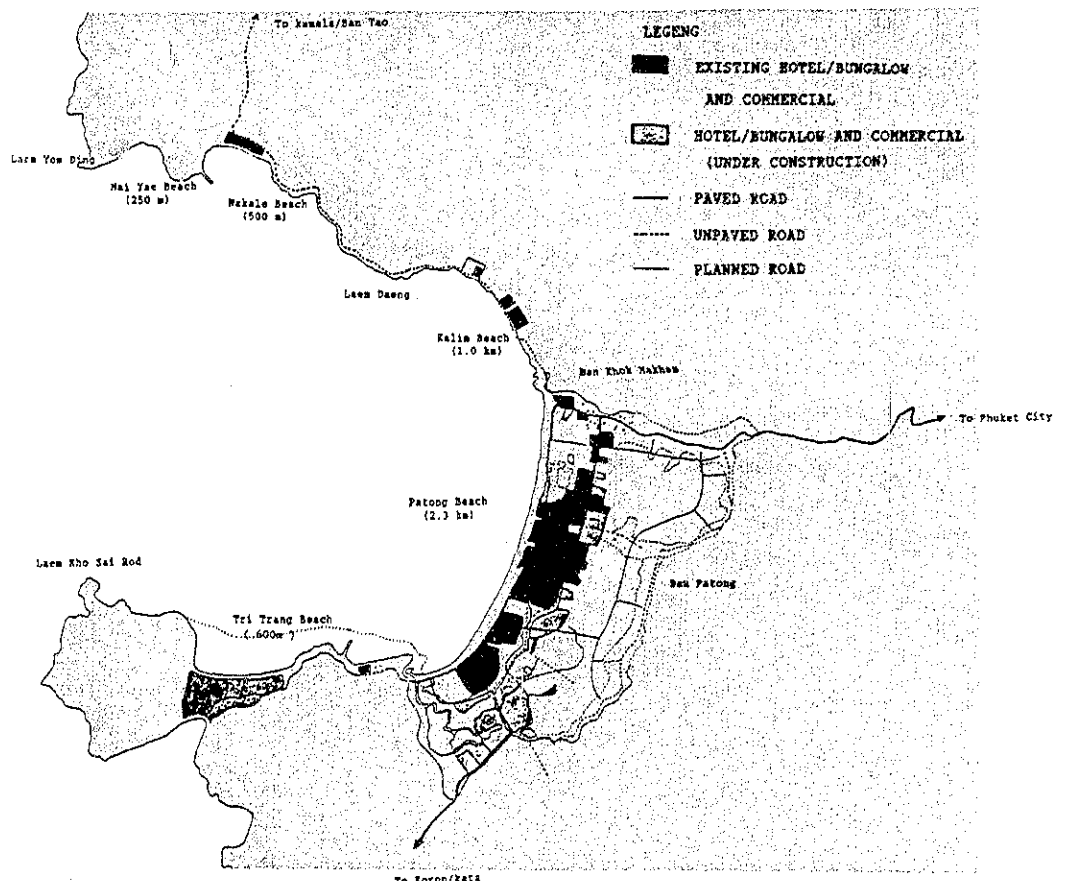


FIG. 2-3-6 TOURISM DEVELOPMENT OF PATONG BEACH



A Newly Opened Resort Hotel in Surin Beach

### 3) COORDINATION WITH TOWN AND COUNTRY PLANNING

#### ● DTCP and DOI

The general plans for 8 district covering all of Phuket Province formulated by the DTCP (Dept. of Town and Country Planning) at the Ministry of Interior are scheduled to be issued in October, 1988.

The plans indicate the future land use and development programs of city services and infrastructure facilities to serve a population of 3,329,000 in the year 2005 in Phuket Province.

The subject of the plan is focused on city and village development, giving less consideration to tourism development. Generally speaking, the land use pattern of the plan is very conceptual and different from the current land use pattern. (See Fig. 2-3-8)

#### ● Zoning Ordinance, MOI

According to the Zoning Ordinance (Dept. of Interior, June 14, 1985), the beach areas (0 km - 1 km behind the beach) of the west coast Phuket Province have been designated as a development control zone by Ministry of the Interior. The implementation of the zoning regulation will not be effective, especially in the southwest coastal beaches of Phuket where most of the areas have already been developed by private investors.

Close coordination and discussions on land use and future development should be made between TAT and DTCP/DOI which is the authority on land development and management of urban areas including tourism development areas.

### 4) CONSERVATION OF THE NATURAL ENVIRONMENT AND CULTURAL HERITAGES

#### ● RFD in MOAC

There are some 130 km (34.3% of the total area of Phuket Province) of forests and 30 km (5.5%) of mangroves. Most of these areas are under the management of the RFD (Royal Forestry Dept.) in the Ministry of Agriculture and Cooperatives. (See Fig. 2-3-9 and -10)

The study area, including Phuket and the Coastal areas of Phang Nga and Krabi is rich in natural Marine resources such as coral reefs and tropical fisheries and 6 out of 7 of the national parks in the study have been designated as marine parks.

The primary RFD policy in these areas is to preserve the resources. However, insufficient management capabilities and facilities have caused some serious environmental problems. Illegal settlement and development are also damaging to tourist attractions.

#### ● ONEB and CRMP

RFD and ONEB are implementing the CRMP (Coastal Resources Management Plan) with the assistance of USAID. The major study objectives of CRMP are as follows:

- a. Continuous economic development of the national resources base of Phuket
- b. Water quality management
- c. Coastal resources
- d. Management and planning for marine parks

#### ● NPD

NPD (National Park Division, RFD) intends to strengthen the management capability of the national parks stressing the following 3 points:

- a. Preparation of a management plan for each national park
- b. Tourism development program involving the private sector
- c. Establishment of a training center in Phuket for marine national parks staff instruction in the southern region of Thailand

#### ● FAD

FAD (Fine Arts Dept. - Ministry of Education) is conducting a survey in the study area to discover/ excavate historic and cultural assets which are unique to Thailand stressing the following three points:

- a. Conservation and tourism use of the historic buildings in Phuket City
- b. Conservation and tourism use of cave paintings in the coastal areas of Phang Nga and Krabi
- c. Establishment of an Andaman Cultural Resources Center in Phang Nga

### 5) RATIONALIZATION OF LAND TENURE SYSTEM

The type of land tenure in Thailand can be classified into the following 3 divisions:

#### ● DOL

- a. Most of the land under the jurisdiction of DOL including both public and private land, as follows:

- Sor Kor 1 (Claim Certificate) owned before 1954
- Sor Kor 2 or Bai Chung (Pre-emptive Certificate), temporary occupation
- Nor Sor 3 or Nor Sor 3 Kor (Certificate of Utilization)
- Nor Sor 4 or Chanode (Title Deed)

FIG. 2-3-7 TIN MINING OF PHUKET PROVINCE

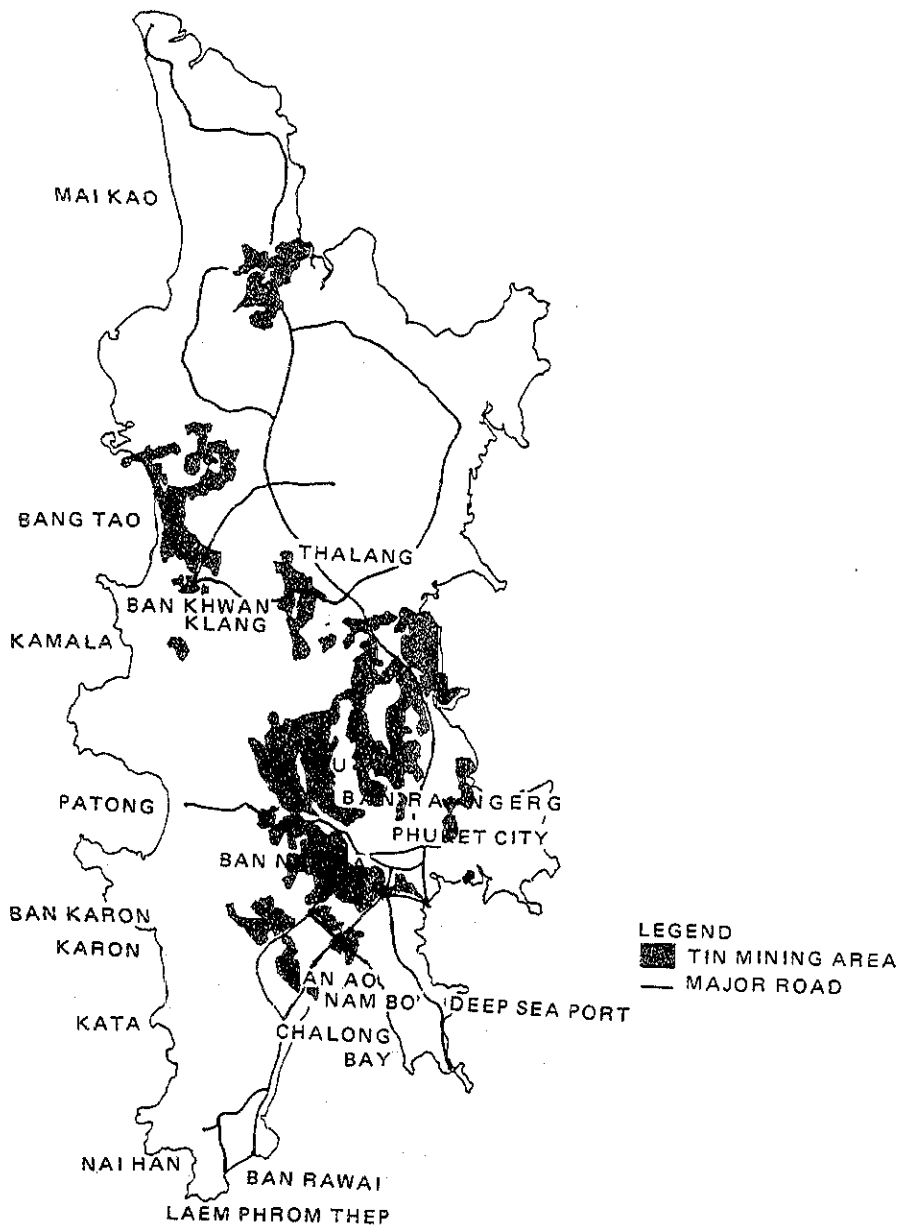
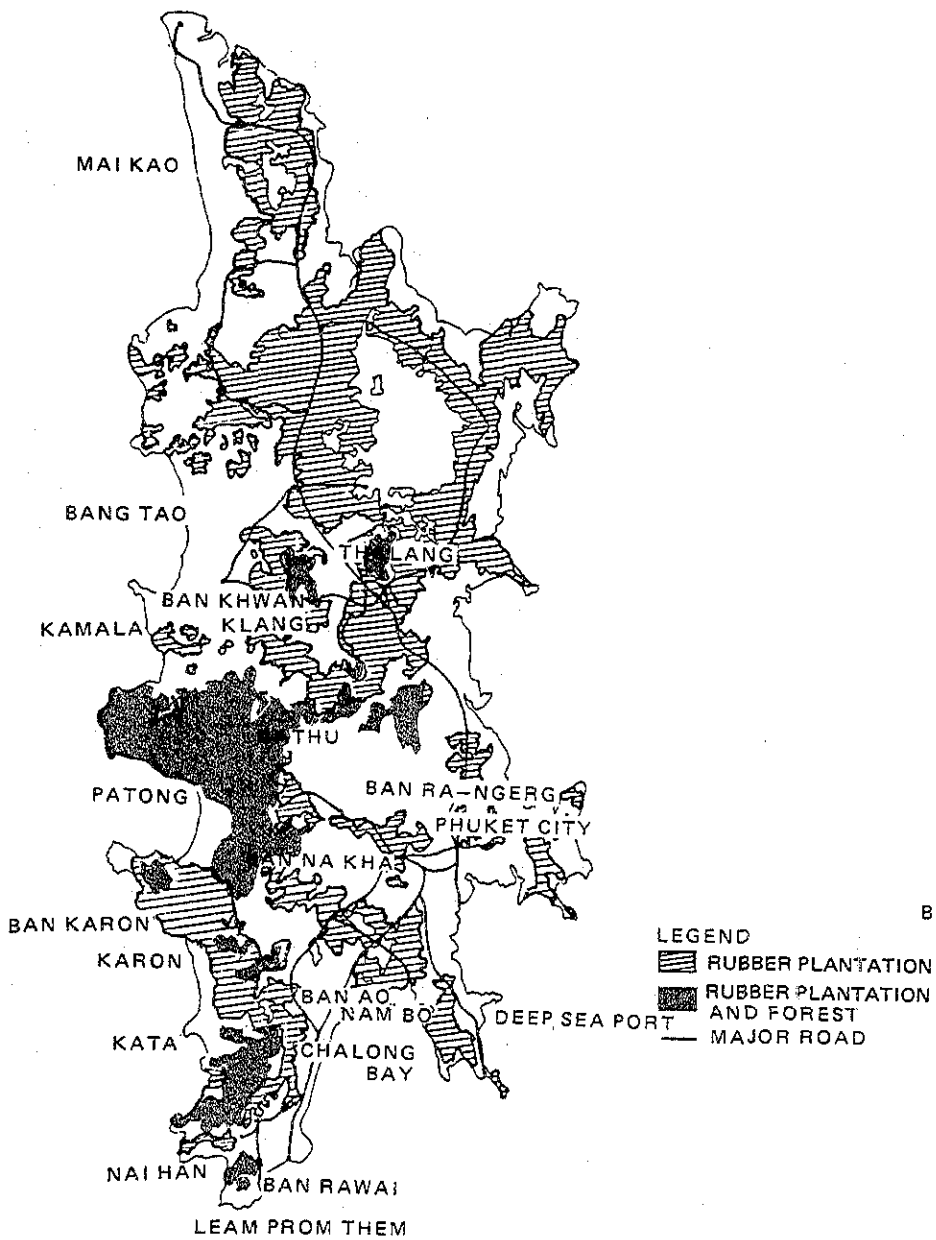


FIG. 2-3-9 RUBBER PLANTATION OF PHUKET PROVINCE



GENERAL PLAN OF PHUKET PROVINCE

FIG. 2-3-8 GENERAL PLAN OF PHUKET PROVINCE

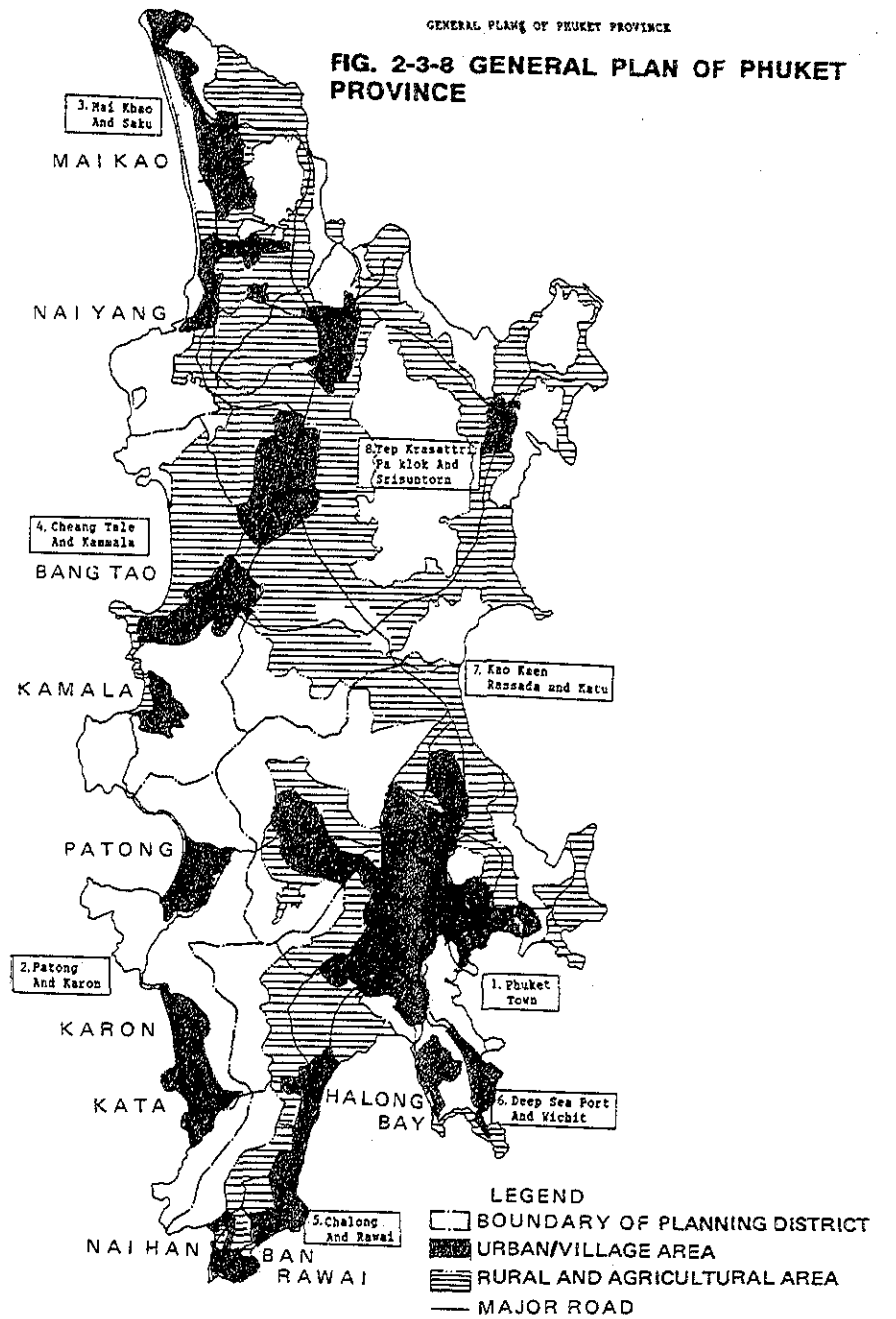
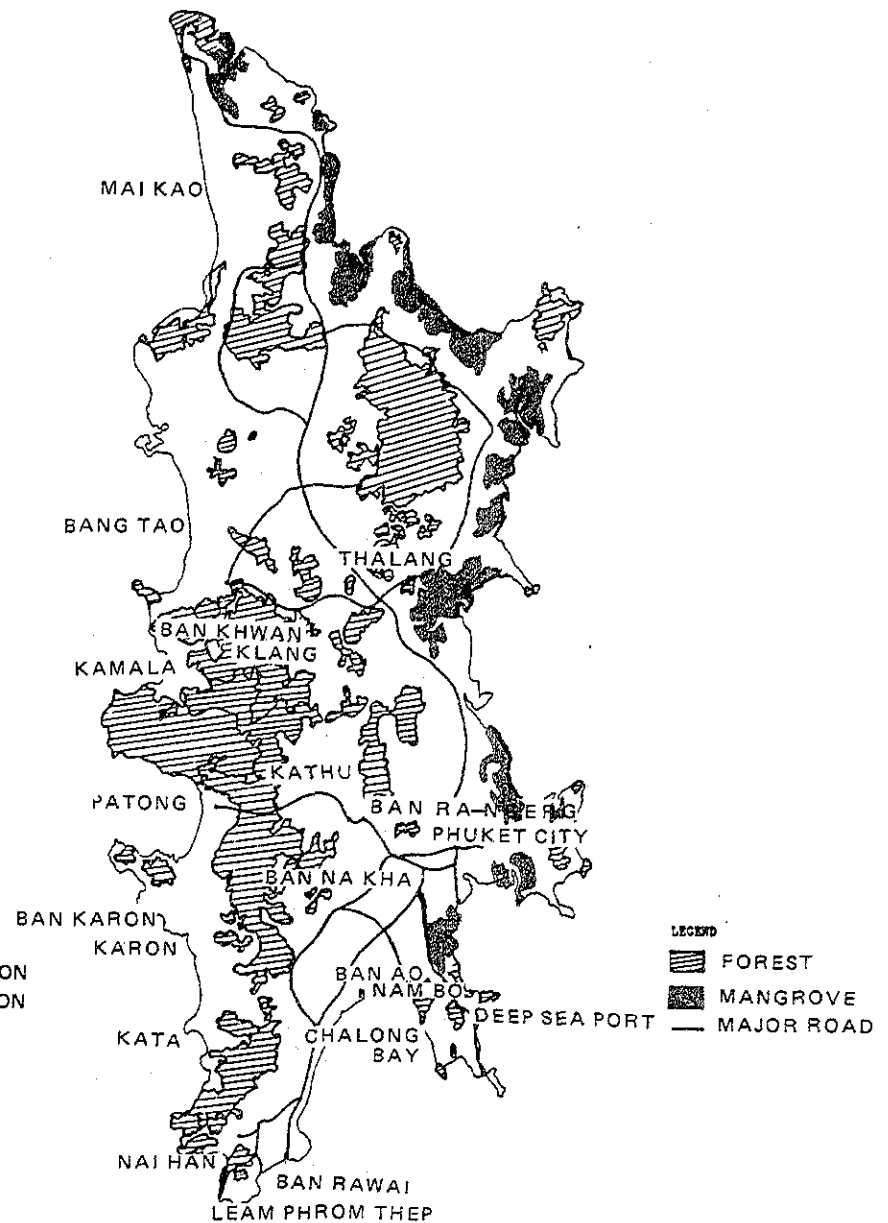


FIG. 2-3-10 FOREST MAP OF PHUKET PROVINCE



Normally, most of the hinterlands of beaches and rural areas are in the status of (a) or (b) and illegal settlements on government/public land is prevalent in many areas, and it is difficult to identify land which are not documented at DOL.

● Other Types of Land Tenure

- b. Lands for settlement according to the Land Settlement Act of 1968 are under the management of the following two government agencies:
  - Dept. of Public Welfare for self-help land settlement projects
  - Dept. of Cooperatives Promotion for cooperative settlement
- c. Lands for special settlement according to the Land Tenancy System is under the management of the following two government agencies:
  - RFD for Sor Tor Kor (STK) Program to permit squatters occupying land in the National Forest Reserve special settlement
  - Agricultural Land Reform Office for Sor Por Kor 4-01

As mentioned above, the concerned agencies on the land tenure system is very complicated and many more practical solutions to the occupy/use of land could be applied.

6) AVAILABLE LAND FOR TOURISM DEVELOPMENT

The issue in this section is how much land will be available for tourism facilities based on the evaluation of the present land use in terms of the regional economy and physical characteristics.

"Tourism facilities" involve here beach resort type hotels and related tourism facilities and "The lands" involve the following three (3) planning zones:

- a. Zone - 1 Beach Front ..... 0-3000 m along the beach
- b. Zone - 2 Interior ..... 300-1,000 m along Zone - 1
- c. Zone - 3 Hinterland ..... 1,000-2,000 m along Zone - 2

As mentioned in the section 2.3.3 and other sections, the evaluation of the present land use is made as follows:

Capability of present land use

- a. Most capable lands ..... Tin Mining, Idle Land, Open Forest
- b. Capable lands ..... Coconuts, Dry Farming
- c. Less capable lands ..... Rubber, Rice Fields, Villages
- d. Non-useable lands ..... Mangrove, Dense Forest

The Table 2-3-4 shows which land is most available for resort development.

TABLE 2-3-4 AVAILABILITY OF LAND

ZONE EXISTING LAND USE	TIN MINING	OPEN RESORT	COCONUTS DRY FARM	RUBBER	VILLAGE	RICE FIELD	MANGROVE	DENSE FOREST
ZONE-1; Beach Front (within 300 m area)	←-----							(Low)
ZONE-2; Interior (300-1,000 m)	(High)							
ZONE-3; Hinterland (1,000-2,000 m)	(Low)							

● Capable Land for Tourism Facilities Development

● Landsat Data

The present land use data is based on the Land Use Classification made by TRSC (Thailand Remote Sensing Center) using Landsat TM Data of Feb. 1988, for the Study. The result of the land availability analysis is shown in the Table 2-3-5.

TABLE 2-3-5 AVAILABLE LAND FOR RESORT ACCOMMODATION

	ZONE-1	ZONE-2	ZONE-3	Total
Phuket South	550.72	696.12	31.96	1,278.80
Phuket North	720.79	1,483.00	836.10	3,039.89
Phuket Total	1,271.51	2,179.12	868.06	4,318.69
Khok Kloi	380.00	627.46	1,402.1	2,409.67
Thai Muang	403.30	904.99	1,812.23	3,120.52
Phang Nga Total	783.30	1,532.45	3,214.44	5,530.19
Grant Total	2,054.81	3,711.57	4,082.50	9,848.88

Note: Unite: ha

## 7) APPROPRIATE DEVELOPMENT DENSITIES OF HOTEL ROOMS

There are no land use measures to control the type of hotel accommodations which vary by type of guest, such as international, domestic and business and also by class, such as executive, tourists, economy and budget. These are in the hands of developers. The practical measures to control the accommodation facilities in the land use study is therefor based on density control. In order to maintain a tropical Thai atmosphere in an international beach resort, an appropriate density of accommodation facilities is determined by putting the emphasis on environmental aspects rather than economical financial.

The Table 2-3-6 shows standard densities of accommodation facilities in the various beach resort areas:

**TABLE 2-3-6 HOTEL ROOM DENSITY**

CASE	NET (rooms/ha)	Gross (rooms/ha)*	Example
Low Density	25	16.25	Samui
Mid Density	50	32.50	Patong
High Density	100	65.00	Pattaya

Note:\*) Including service facility areas related to accommodation facility

Among the 3 levels of standard densities, mid to low density is recommended to control the density of hotel rooms development in Phuket and Phang Nga beach resort areas.

Mid density standard will be applied to the proposed development control zone i.e. Southwest Coast of Phuket including Patong, Karon, Kata and Rawai and low density standard will be applied to the proposed new development zone i.e. Northwest coast of Phuket and the Southwest coast of Phang Nga including Bang Tao, Chat Chai and Thai Muang.

## 8) DISTRIBUTION OF THE REQUIRED HOTEL ACCOMMODATIONS

The Table below shows number of the required hotel rooms given by the market study.

**NUMBER OF ADDITIONAL ROOMS REQUIRED**

(rooms)	1991	1996	2001	Total
Phuket South	4,841	851	1,058	6,750
Phuket North	1,676	2,906	923	5,505
Phang Nga	-	1,966	3,755	5,721

In this section, more detailed analysis are attempted to distribute those hotel rooms into each beach area for the physical planning purpose.

### a. Selection of the Competent Sites for the International Tourist Accommodations

The following are the major criteria to select the competent sites for the international tourist accommodations.

- The first priority should be given to the beach front zone and basically the hinterland should be avoid to use for those facilities.
- The land where the exhausted tin mining areas are concentrated should be prior to use for those tourism facilities and the land where the villages and agricultural areas are concentrated should be avoid to use.
- The attractions at the beach (sand, shallow water, landscape, shape of the bay, wind) to be considered
- The condition of the present land use
- Water availability and transportation accessibility are also essential factors.

Based on the above criteria, the following areas are selected as the competent sites for accommodating the additional required hotel and the related tourist facilities:

- Priority I : Bang Tao, Chat Chai and Thai Muang and Interior Zones of especially Patong, Karon and Kata in Phuket South
- Priority II : Mai Kao and Khok Kloi

● Density Control for Hotel Development

● Applied Standard Density

● See Tourism Market and Projection p.8 in this Volume

● Major Criteria to Select the Site for the International Tourist Accommodations

● Priority Development Areas

- b. Calculation of Additional Hotel Rooms Available in the Priority Areas  
The table below summarized the number of additional hotel rooms available in the priority areas;

**TABLE 2-3-7 NUMBER OF ADDITIONAL HOTEL ROOMS AVAILABLE**

	Front	Interior	Total
1 Phuket South (Patong, Karon and Kata Yai)	700	2,861	3,561*1)
2 Bang Tao/Nai Thon	1,330	3,609	4,939
3 Chat Chai	1,084	1,572	2,656
4 Thai Muang	*2)	5,010	16,245
<b>Sub total</b>	<b>3,114</b>	<b>12,727</b>	<b>16,245</b>
5 Mai Kao/Nai Yang	1,336	2,863	*3)
6 Khok Kloi	1,167	2,830	*3)
7 Other	2,936	*3)	*3)
<b>Grand Total</b>	<b>8,553</b>	<b>19,045</b>	

- Note: \*1) The rooms underconstruction are excluded.  
\*2) The beach front should be kept as open land to allow public use and to avoid the natural hazards such as erosion and flooding.  
\*3) Not Recommended to use the area for the International Resort Development.

● Recommended Sites for Resort Development

c. Recommended Sites for Resort Accommodation Development

From the land use planning point of view, it is recommended that the development of the resort accommodation should be located at the following areas;

- Large scale international resort complexes in Bang Tao, Chai Chai and Thai Muang
- Expansion of hotel rooms in the southwest coast of Phuket should be limited less than 1,000 rooms.
- Mai Kao and Khok Kloi beaches will be developed for economy and budget tourists with low class of hotel accommodations and are required public beach facilities for domestic and local people.

9) SELECTION OF PRE-FEASIBILITY SITE

The market projections in the Study indicate the need for continued development of international resort hotels on a large scale and that small, beach-side hotels will not suffice in coping with the projection, making it essential to construct a large hotel complex as the core. However, all beaches with beautiful inlets have already been developed. Thus, it will be necessary to select beaches less attractive as resort locations, but large enough for the development of hotel complexes with sufficient room for future expansion. Those conditions are satisfied by the following three sites.

● Tha Chat Chai Site

a. The site before the Sarasin Bridge (on the Phuket side) About 450 ha

Commonly called "Prem Resort" being developed by Inter-Maritime (Swiss), now much talked about. It is proposed that four or five international hotels be constructed for a total of 2,500 rooms, together with two golf courses, a marina, shopping center, etc., with the existing village and high-tension lines to be relocated. It has passed the Cabinet and is now under examination at the Ministry of Finance.

A problem is environmentally of low acceptability, since the site is adjacent to the Hat Nai Yang National Park and the place where sea turtles lay their eggs. It will also be difficult to relocate the village and other facilities.

An advantage is that the site is the last large area in Phuket owned by the Central Government. It also would be a merit in the area, if properly planned and coordinated with the New Sarasin Bridge Project, would become a transportation node near Phuket International Airport.

● Bang Tao Site

b. Bang Tao

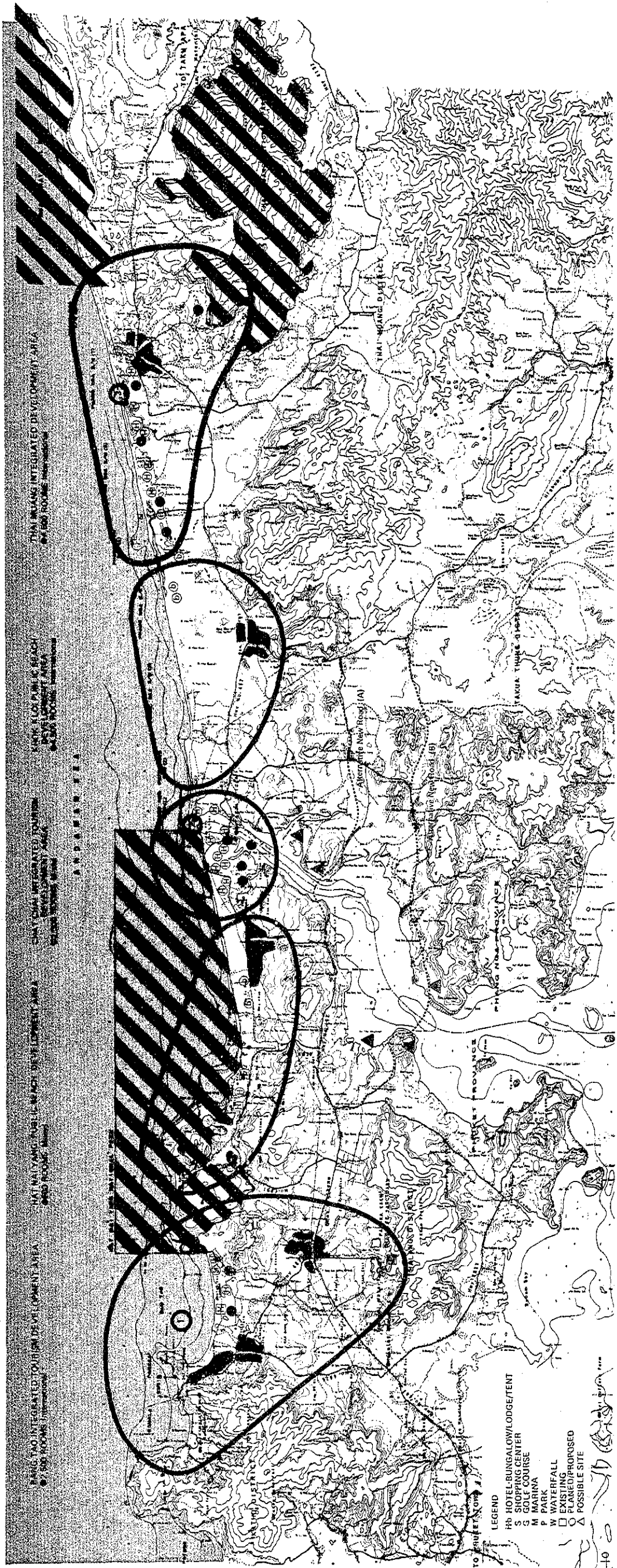
Bang Tao has an available development area for 1,300 rooms at the beach front and 3,600 rooms in the interior, in addition to the space for the Dusit Laguna Hotel. However, it has already been decided that the area be developed by several private companies, with the plan now being at the design stage. According to those plans, hotel accommodation of 2,500 rooms will be constructed by 1996, together with related facilities, such as a golf course, recreational areas, a shopping center etc.

● Thai Muang Site

c. Thai Muang Beach

The coastal area to the west of Phang Nga has a straight beach subject to strong winds and high waves at the time of the monsoon. Also, it has less shallows appropriate for swimming and is relatively far from the airport (48 km). Despite these interior conditions, however, the area, formerly a tin mine, constitutes a lagoon with splendid landscape. At the same time, the land price is still inexpensive and it is possible to develop a large hotel resort complex surrounding the lagoon to create a pastoral atmosphere, rather than the image of beach-fronted hotel.

FIG. 2-3-11 GENERAL LAYOUT PLAN OF NEW DEVELOPMENT ZONE



1 Bang Tao Beach



2 Tha Chat Chai Beach



3 Thai Muang Beach



FIG. 2-3-12 PRESENT STRUCTURE OF RESORT DEVELOPMENT IN PHUKET AND PANG NGA

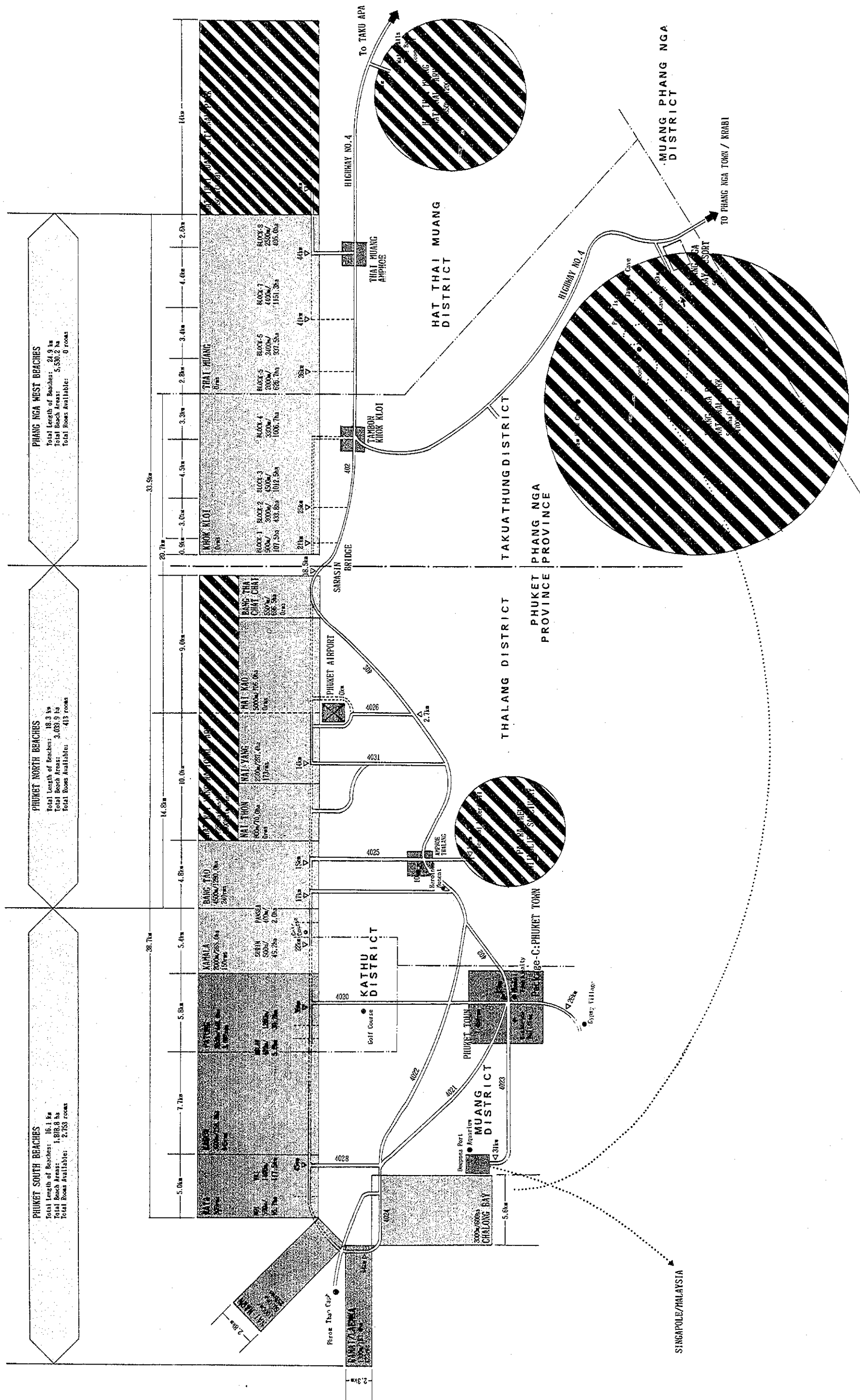


FIG. 2-3-13 FUTURE STRUCTURE OF RESORT DEVELOPMENT IN PHUKET AND PANG NGA

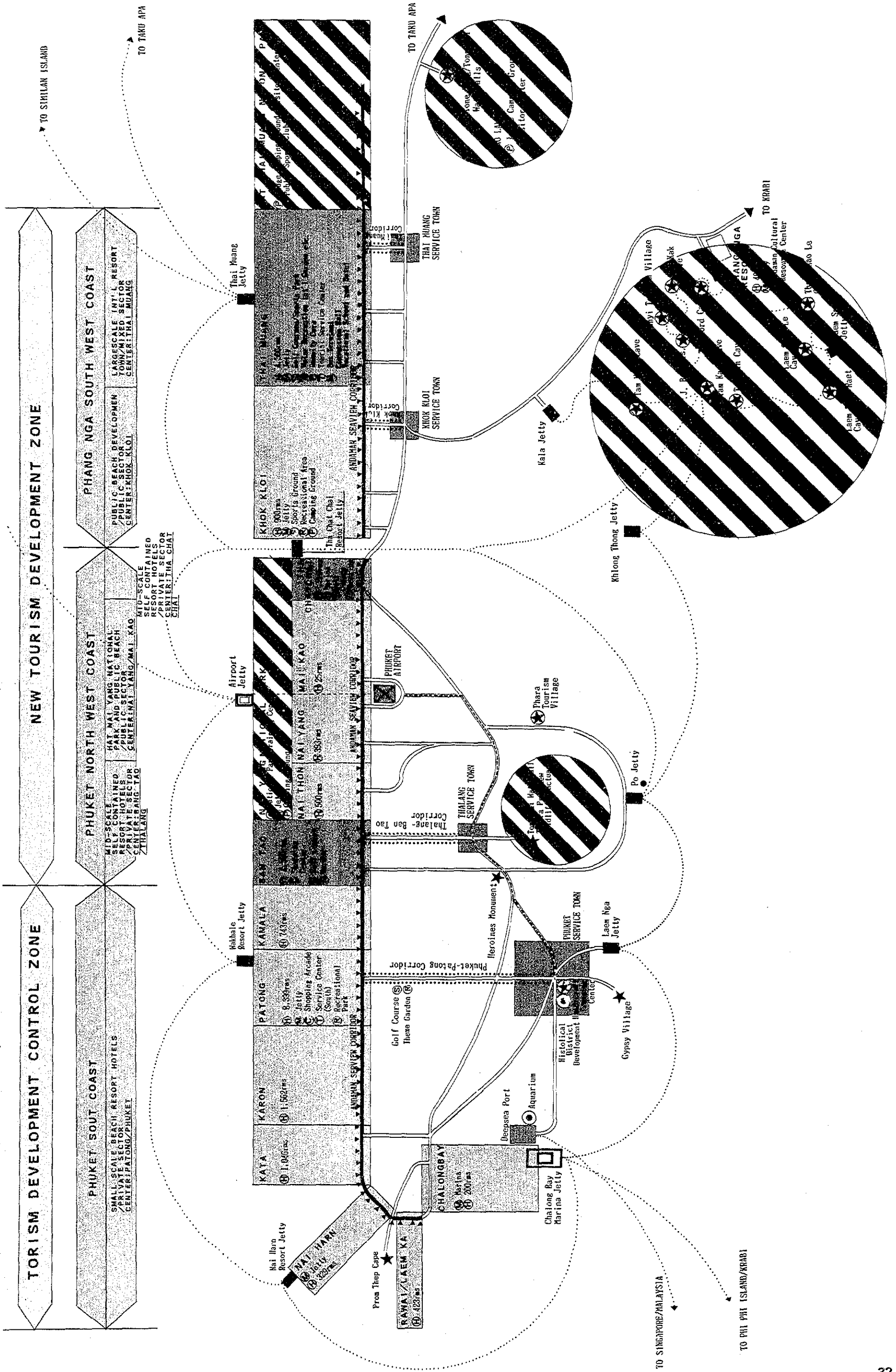
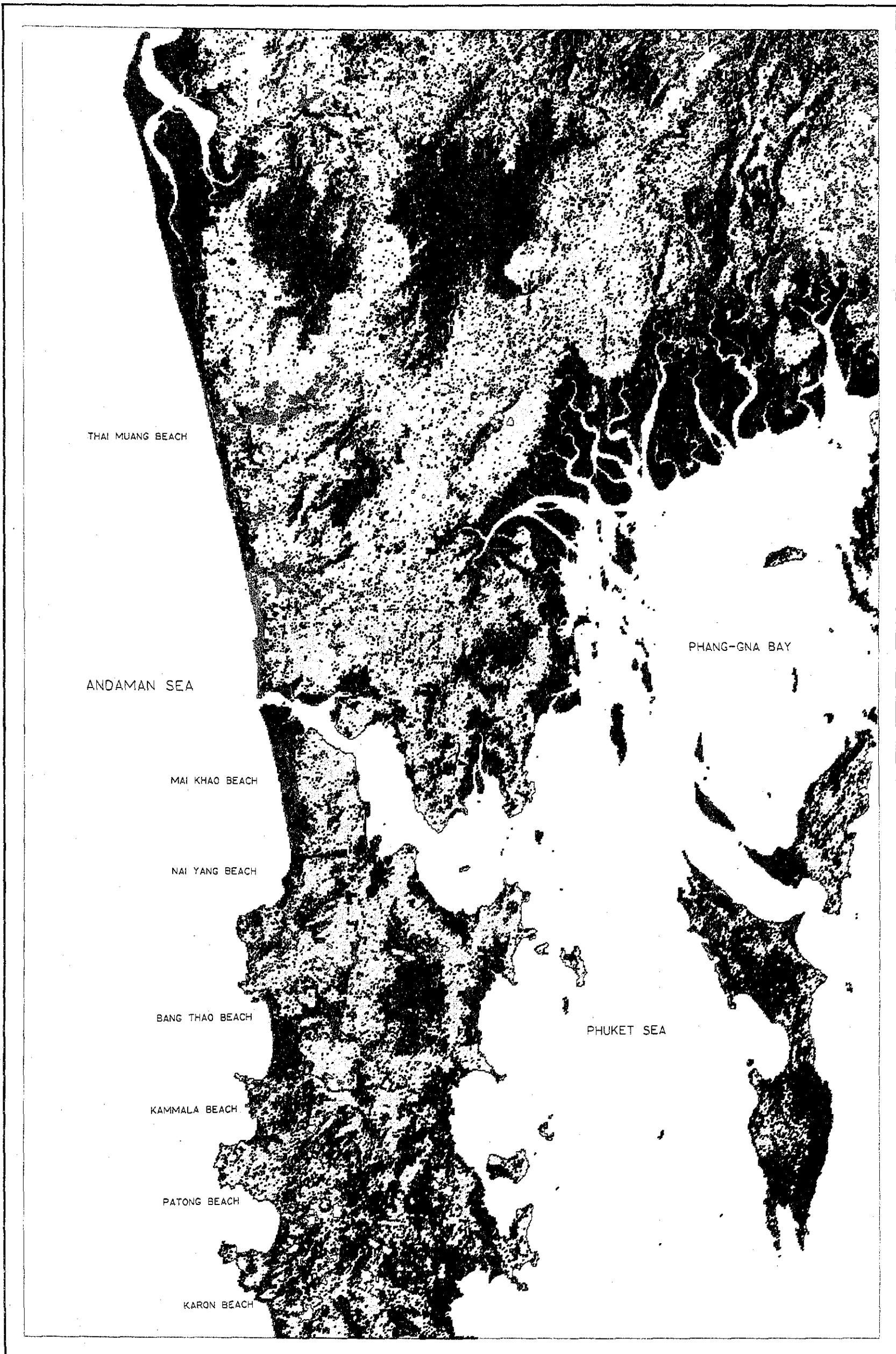


FIG. 2-3-14 LAND USE CLASSIFICATION - LANDSAT IMAGE (PHUKET/PHANG NGA)



SWAMP AREA	MANGROVE	MTRC	FOREST	PADDY LAND	WATER BODIES	POND-RIVER
SWAMP FOREST, MARSH						

PHANG-GNA AND PHUKET

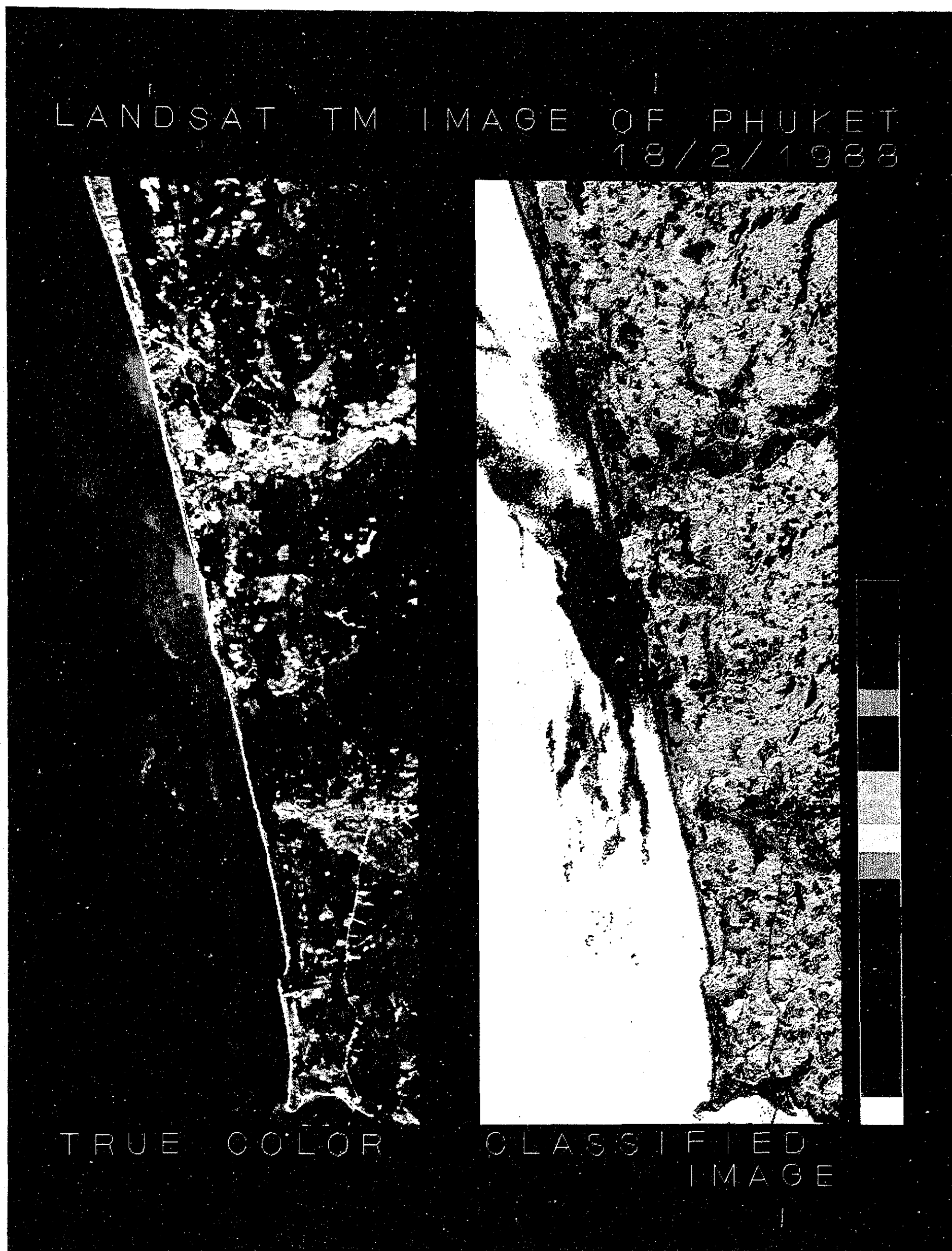
LAND USE CLASSIFICATION  
 LANDSAT-2 TM DATA ACQUIRED 12 FEB 1985  
 PRODUCED BY RS0/ARCT  
 26 AUGUST 1988

SCALE 1:100000

MULTICLASSIFIED UNCLASSIFIED

ROAD	RICE PLANTATION	ORCHARD, ORCHARD
BUILT-UP AREA	TOWN, VILLAGE	OPEN LAND
RUBBLE PLANTATION	OLD LAND	SAND BEACH

FIG. 2-3-15 LANDSAT IMAGE (KHOK KLOI/THAI MUANG)



## 2.3.4 LOCAL COMMUNITIES DEVELOPMENT

### 1) PHUKET COMMUNITIES TO SUPPORT BEACH RESORT DEVELOPMENT

For planning of the local communities involved in the tourism development, Phuket and its vicinities can be and should be zoned as follows:

- Tourist Zone 1 - Phuket City zone
- Zone 2 - Zone of rapid growth beach fronts (Patong - Kata and Karon)
- Zone 3 - Extension of west beach fronts (Kamala - Bang Tao & Mai Kao)
- Zone 4 - Old beach fronts (Rawai - Nai Han and Promtep)
- Zone 5 - Industrial Zone (Deep-sea Port and Thai Saco)
- Zone 6 - North-East fishing village
- Zone 7 - Northern Island - Crown Property concession (2,600 rai)
- Zone 8 - Future site development of Phang Nga west beach front (Khok Kloi)
- Zone 9 - Extension of future site of Phang Nga to the north (Thai Muang)

#### ● Patong, Kata and Karon Zone

Out of these 9 tourist zones, Zone 2 is the most essential because of the rapid growth of population as well as hectic tourist activities which are beginning to resemble of Pattaya. Measures should be applied to improve the physical environment for this rapid-growth beach area. Land use, and zoning and environmental controls are two main issues to consider in developing these beaches.

#### ● Phang Nga West Beach Zone

Zone 8, involving the Phang Nga west beach front area, has great potential for future tourism development. The long beach with white sand can be a new location for nature lovers. The relationship between these two zones 7 and 8 could open a new channel for Greater Phuket tourism development.

### 2) URBAN FACILITIES TO SUPPORT BEACH FRONT DEVELOPMENT

The linear beach front development can be visualized as a golden mile of ribbon like strip of hotels. They need urban communities to back-up and develop "beach-town communities". Supplies of urban facilities and utilities have to be planned to back-up the linear beach front development. Beach town communities can be classified and planned as follows;

#### ● Phuket Center

Community A : Urban Phuket Center, a city size tourist community to serve Zones 1, 2, 3, 4, 5 and 7;

#### ● Thalang Sub-center

Community B : Sub-center of "Thalang" to serve Zones 3, 6, and 7;

#### ● Khok Kloi Sub-center

Community C : New sub-center of "Khok Kloi" to serve Zones 7 and 8; and;

#### ● Thai Muang Sub-center

Community D : Possible future sub-center of "Thai Muang" to serve Zone 9

Of the above, the function of Khok Kloi is noted, because if Zone 7 and 8 are developed, a new sub-center of "Khok Kloi" may be a future potential center and expand to serve the new development zones. Khok Kloi is now a small local center, a "Sanitary District", with well-equipped public facilities: banks, police station, markets, post office, gas stations, etc, are already established. Moreover, electricity supply, fresh water, and communication systems already exist.

However, main facilities such as a better road system, "inner beach roads" should be developed here. Moreover, a "town square" should be equipped with a bus terminal, a shopping center, police and post offices renovated, modern communication systems, a community hospital, water supply and sewage treatment facilities, and expansion of the electricity supply system and so on.

The people of Khok Kloi are mostly involved in the agricultural sector, rowing rubber trees and pineapples. Tin is not available anymore on land. The land along the beach is newly occupied by local entrepreneurs and is ready to be developed. Soil fertility of the Khok Kloi beach front is low, and only coconut trees and rice paddies are in existence. Most of the land has been consolidated by Bangkok and Phuket businessmen. Speculation of these beach front areas is extremely popular and may raise the price of land up make development more difficult in the near future.

Reserved land is ready to be transacted and developed immediately without serious problems by local people. Especially, the village leaders in Kam Nan as well as the Sanitary District leader are willing to see the promotion of Khok Kloi.

"Land use planning and zone control" is urgently required, and must be taken place before development starts. Budget programs should also be introduced into the land use plan. A better sanitary organization will be needed to be expanded and equipped with efficient technical experts and authorities (the district functions of this tourist urban center should be laid out).

The development of urban areas associated with tourism development in Phuket and its vicinities should be undertaken in accordance with the following priority;

- A - Phuket City (Changwat Land Use Plan)
- B - Patong District (Specific Land Use Plan)
- C - Khok Kloi/Thai Muang District (Specific Land Use Plan)
- D - Thalang District (Specific Land Use Plan)

● Priority of Community Development

**3) PROJECT PREPARATION FOR PHUKET COMMUNITY DEVELOPMENT TO SUPPORT TOURISM-INTEGRATION**

● Outline of the Study on Community Development

Tourist Centers and Community : Phuket and Pang Nga

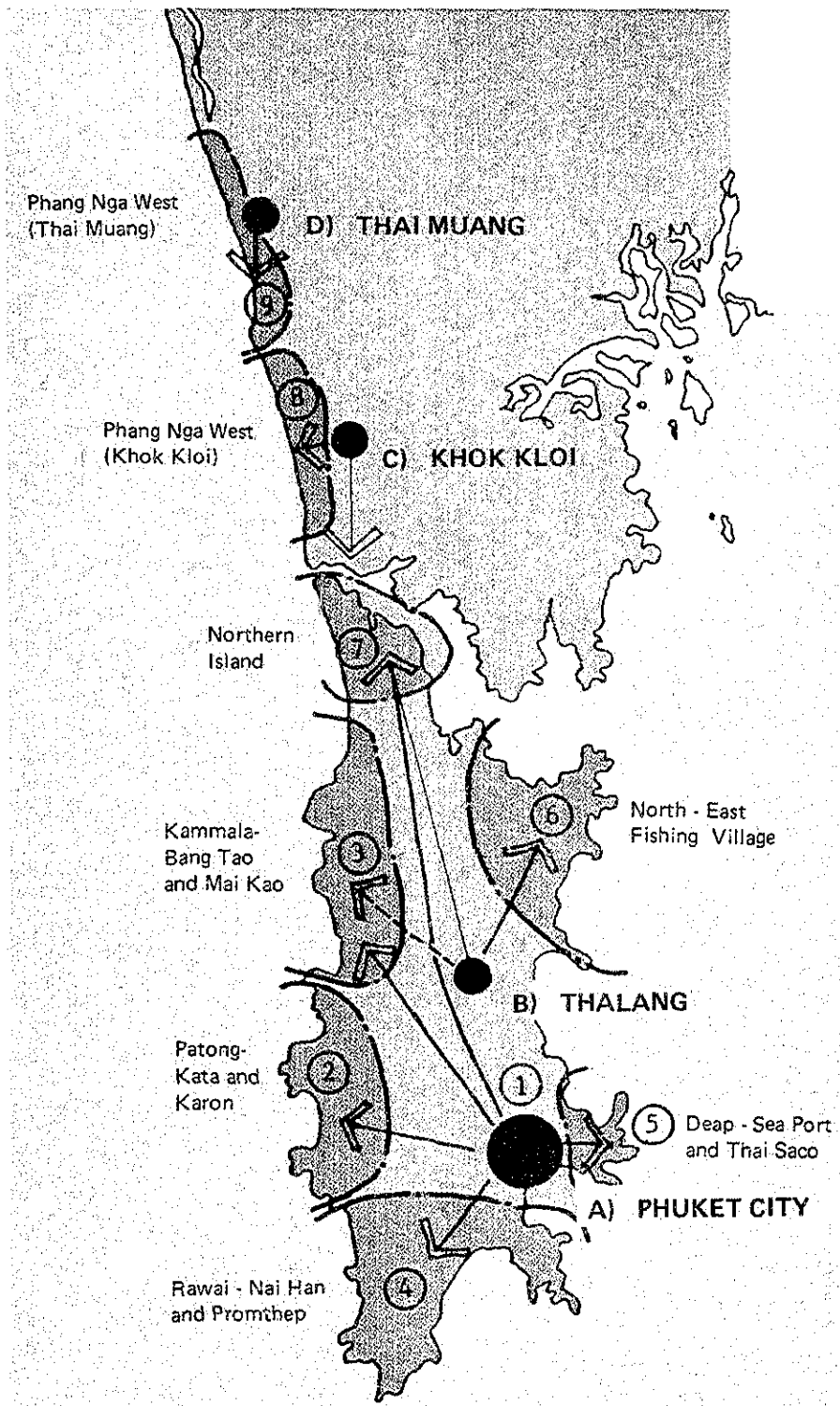
- Project Objectives :
1. To propose the community hierarchy of Phuket.
  2. To classify and to structure the relationship among Phuket communities.
  3. To adopt and select sub-tourist centers to support beach-front development.
  4. To plan and set up physical plans for each sub-center.
  5. To design and to set the priority programs and projects to support the development of new areas of beach development.

Areas of Study :

- level. 1. Phuket municipality - tourist town center
- level. 2. Thalang sanitation district - cultural center
- level. 3. Khok Kloi & Thai Muang - new sub-tourist centers

- Scope of the Study :
1. To survey the existing land use, infrastructures and urban conditions
  2. To survey tourism business and tourism functions in relation to urban development.
  3. To analyze and to set alternatives the future needs of tourism amenities to support tourism development.
  4. To propose projects & programs for 3 levels of tourist centers.

**FIG. 2-3-16 LOCAL COMMUNITIES AND TOURIST CENTERS**



**LEGEND**

- Local Communities
- Tourism Zone



Thai Muang



Khok Kloi

## 2.3.5 ENVIRONMENTAL CONDITION

### 1) ENVIRONMENTAL ISSUES

A system balancing development and environmental preservation is essential to maintain the value of Phuket tourism in the long run. Attention should be paid to the environment as well as to development. Issues to be tackled vary and cover broad areas, and therefore, require inter-governmental coordination. They are:

- a. Protection from natural deterioration caused by socio-economic activities:
  - exposure of bare ground after tin mining;
  - drainage without treatment in offshore tin mining;
  - sewage discharge without treatment;
  - tar and oil ball in the sea;
- b. Protection from erosion:
  - man-made erosion caused by road/building construction;
  - natural erosion (coastline corrosion);
- c. Natural resources preservation:
  - national parks preservation;
  - mangrove/coral protection;
  - sea turtle egg-laying protection.

### 2) ENVIRONMENTAL POLICIES REQUIRED

Formation of definite environmental policies and a well-functioning control system are required, based on the following aspects:

#### a. Preservation:

At present, there is no system supervising environmental preservation, are even where preservation laws have been enacted, no one takes responsibility for damage. Therefore, some legislative may be necessary to strengthen law enforcement.

In addition, an environmental consciousness has not yet developed among the people, especially the developers. Therefore, an educational program to increase environmental awareness is important and an appropriate authority should be made responsible for this kind of public relations activity.

The people of the area must be educated to understand that no more cutting down of mangrove forest by new development should be accepted, and that sea turtle nesting beaches and coastal reefs must all be preserved.

#### b. Environmental Impact Statement:

Although investor who wish to develop a hotel with more than 80 rooms is legally required to submit an environmental impact statement (EIS), in practice, their buildings are often not built with the equipment mentioned in the EIS report. Therefore, a more organized monitoring system needs to be established.

The NEB is now considering a new regulation requiring that any hotels with more than 40 rooms should submit an IES before commencing for its construction. This action is encouraging.

There is no regulation requiring the submission of an EIS for the construction of roads, except for express highways, even if the planned road is likely to have a substantial impact on the environment. A revision of the regulation requiring that the execution bodies carry out an EIS for roads construction projects running through mountainous or preserved areas may be necessary.

#### c. Environmental Standard for Effluent:

The following amendments are recommended regarding the environmental standard for effluent:

- The existing effluent standard has been regulates average water quality, not at peak-time. Accordingly, as the treatment facilities, even which approved, do not seem to function in the desired manner, the regulation should be amended so that the standard may be applied to effluent at peak-time.
- A strict standard level, the "D" rank, should be applied to all hotels, and the "A" rank to large restaurants.
- To protect nature and tourism resources, at least the SS standard should be kept for off-shore tin mining activities.

#### d. Coastal Water Quality Control Guidelines :

At present, coastal water quality control has been the undertaken only in Karon Bay as shown in Table 2-3-8 and Fig. 2-3-17. NEB is now considering the possibility of broadening the application of a control standard as shown in Table 2-3-9. It is recommended that the existing coastal water quality standard be effective in all potential tourism beaches located on the west coast of Phuket Island in that the areas are signifi-

#### ● Inter-Governmental Coordinations on Environmental Preservation

#### ● Enforcement of Environmental Preservation Laws

#### ● Education for Local People

#### ● Environmental Impact Statement

#### ● Environmental Considerations of Road

#### ● Effluent Standard at Peak-Time

#### ● Standard A and D

#### ● SS Standard

#### ● Present Guideline of Karon Bay

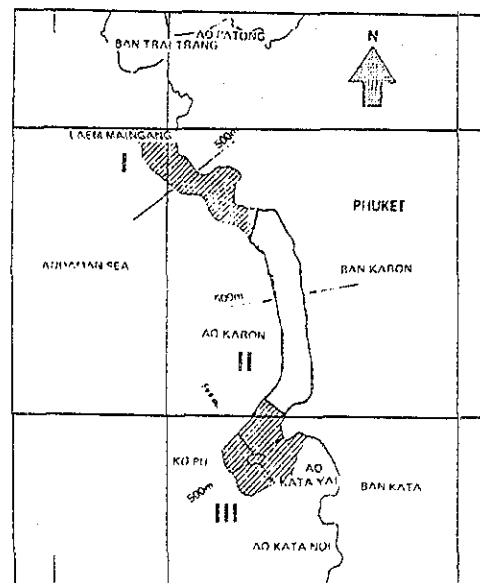
cant from a natural and tourism resources management point of view. Especially, Bang Tao Beach, is designated as an industrial zone as shown in Fig. 2-3-18, should be re-designated to be in the water quality control area, so that the area is physically consistent with the national park located next to it.

As for the standard items, as shown in Table 2-3-10, there is no regulations on SS to A<sub>1</sub> class. It is also recommended that a standard of not more than 10 mg/l. of SS be stipulated, the same as the standard being applied in the Karon Bay.

TABLE 2-3-8 COASTAL WATER QUALITY STANDARDS FOR KARON BAY, PHUKET

Parameters	Units	values of coastal water use for	
		Swimming	Coral Reef Conservation
1 Temperature	C	23 - 33	23 - 33
2 pH	-	6.5 - 8.3	7.5 - 8.9
3 DO	mg/l	Not less than 4.0	Not less than 5.0
4 Salinity	ppt.	-	29 - 35
5 Transparency	m.of	Not less than 10	Not less than 15
6	Secchi Depth		
7 S.S.	mg/l	Not more than 20	Not more than 10
8 Oil & Grease	mg/l	Non detectable	Non detectable
Coliform bacteria	MPN/100 ml	Not more than 1,000	-
Control Areas (500 m from lowest sea water line)		II. Karon bay	I. Laem Mai Ngang III. Ko Pu

FIG. 2-3-17 MAP OF KARON BAY



### 3) RECOMMENDED ENVIRONMENTAL PRESERVATION PROJECTS

Besides the above institutional arrangement, the following five projects are recommended with an aim at putting the environmental preservation policy into action.

#### a. Link Road Erosion Protection Project

A "Link Road" is being constructed between Rawai Beach and Surin Beach for tourist and regional transportation. It has a total length of about 43 km, but since some existing roads are to be utilized, the newly constructed section is only about 29 km long.

The plan for the road was carried out despite the CRMP's recommendation that its be re-considered. Part of the new section (about 18 km) running through evergreen areas divides vegetation and the adoption of the "destruction method" of has resulted in the dumping of many large boulders which have caused extensive damage to the surrounding evergreen areas considerably in excess of the damage caused by clearing simply clearing the road.

Meanwhile, the excavated section, which has been steep slopes whose faces are not protected, has already been subject to gully erosion immediately after completion (July 1988). Such a construction method, disregarding tropical conditions, has led to the collapse of the road, with the dumped rocks and erosion of excavated face substantially devaluating the coral reef and beaches as tourism resources in marine resorts. Furthermore, the exposure of red laterite ruins the scenery.

In terms of tourism promotion, the road is intended not only to be the entrance to the resort but also to enhance the tourists' expectations on their way to the resort. Thus the road should be repaired by removing the dumped rocks and replanting the exposed area to rehabilitate the natural environment.

In reviewing this project with an emphasis on grass-planting on the slopes and other forms of environmental protection, the necessary measures can be divided into emergency ones and more fundamental ones for environmental protection in the long-run, as follows:

- Study of grass-planting;
- Removal of dumped rocks;
- Redevelopment of slope face; and
- Temporary face protection.
- Grass-planting; and
- Management.

The study on grass-planting is required to examine face protection methods most suitable for the local conditions. In areas appropriate for grass-planting, proper slope pitches are to be considered to match the soil conditions. The possibility using for concrete protection or grass-planting blocks must be examined for steep slopes of where long slopes are required to obtain stable pitches. Studies must be made to select appropriate species of plants (and tress) according to the soil conditions, the climate and the vegetation patterns. Planting of shrubby must also be considered where possible.

The removal of dumped rocks should be carried out to prevent disasters and erosion. Unremovable rocks are to be destroyed on the spot.

● Phuket "Link Road"(Rawai-Surin)

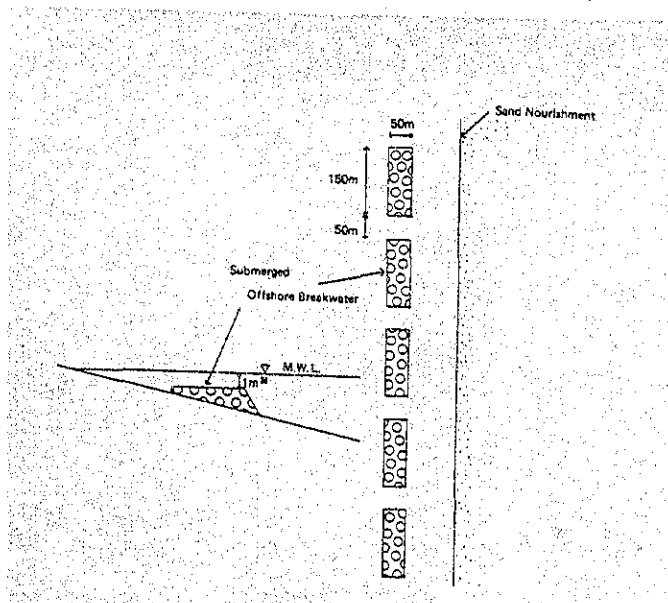
● "Destruction Method"

● Environmental Deterioration

● Recommended Measures for Environmental Protection



**FIG. 2-3-23 ENGINEERING MEASURE FOR PROTECTION FROM COASTAL CORROSION**



Redevelopment of slope face should be put forth so that grass-planting makes stable inclination pitches on 1:1 for cut-faces, 1:1.5 for fill-up face; and 1:2 for slope faces. The current slope face has been badly eroded by gulling and must be re-cut and re-filled. Also required are drainage ditches, rounding and banquette.

Temporary face protection must be made with soil cement in the exposed area.

Grass-planting on sloped-faces should be undertaken according to the above plans. Mulching will be required prior to planting.

Finally, management and technical assistance must be continued for at least a year until local staff master plantation techniques including watering, fertilization and chemical application.

An image of the recommended project is as illustrated on Fig. 2-3-21.

**b. Coastal Protection**

There is an erosion problem in the northern part of Phuket Island and the western coastal areas of Phang Nga.

These areas are inherently susceptible to the high waves of the Andaman Sea due to the straight coastal line. However, it would be possible to protect the beautiful coastline against erosion using engineering techniques.

To maintain the wide beaches and the calm billows, the following engineering methods may possibly be applied:

- Shore protecting works;
- Provision of breakwater;
- Provision of offshore breakwater ; and
- Sand replenishment.

Since each of these methods have both advantages and disadvantages, it is necessary to use a method suitable for the conditions of the damaged coasts. For instance, from a landscaping point of view, a submerged off-shore breakwater might be suitable in some places, but not in others.

It is recommended that a 1 km long coastal at erosion control pilot be carried out in the Phang Nga west coastal area as shown in Fig. 2-3-23.

**c. Ex-Tin Mining Land Rehabilitation**

Tin mining often results in exposed red soils or unsightly ponds. Several attempts at utilizing the ex-tin mining land have included:

- Residential use : especially as urban expansion sites in Phuket Town;
- Public facilities : parks, recreation facilities, solid waste dumping site, water reservoir;
- Agriculture : fish farming, cashew nut growing;
- Tourism : hotel, golf course, swimming pools.

It is strongly recommended that the exposed red soil be rehabilitated with plants, utilizing the technique to be developed for the cut-slope protection project. Large-scale erosion problems should be solved with high priority.

On the other hand, this project aims at encouraging these activities in a proper manner, taking into account the environmental impacts. In order to pursue the possibility of storing water in the ex-tin mining ponds, a preliminary sampling survey was carried out to check the water quality especially in terms of heavy metal content, with the cooperation of NEB experts.

Eleven (11) sampling stations were selected in the Phuket and Phang Nga west coast areas. The water was collected from various depths and the surface in August 1988, and the arsenic, copper, cadmium, manganese and iron. The results of the survey are shown in Table. 2-3-12 content determined.

Compared with the existing standard for drinking water as shown in Table 2-3-12, the contents of arsenic, copper and cadmium contents are low at all stations. On the other hand, the water at Stations 3, 4, 5, and 8 is not necessarily suitable for drinking, because of a high iron content. However, it is assessed that generally the water stored in ex-tin mining ponds should have no problems in terms of quality if it is aerated before using, because the water contains iron and manganese, but no heavy metals.

Based on the above result, it is recommended that the ponds be utilized as reservoirs for consumption or recreational purposes. However, that it is recommended a more detailed survey be conducted before implementing.

**d. Environmental Monitoring System**

it is very important to maintain natural environment in Phuket and a critical to this policy is effective sewage treatment. After the construction of hotels, the ONEB staff inspect the treatment facilities, however, it is pointed out that, in practice, few hotels have the facilities as planned.

It is recommended that a public relations program be conducted to enlighten the people about the importance of keeping nature as it is.

FIG. 2-3-21 PROPOSED PHUKET LINK ROAD SIDE TREATMENT SCHEME

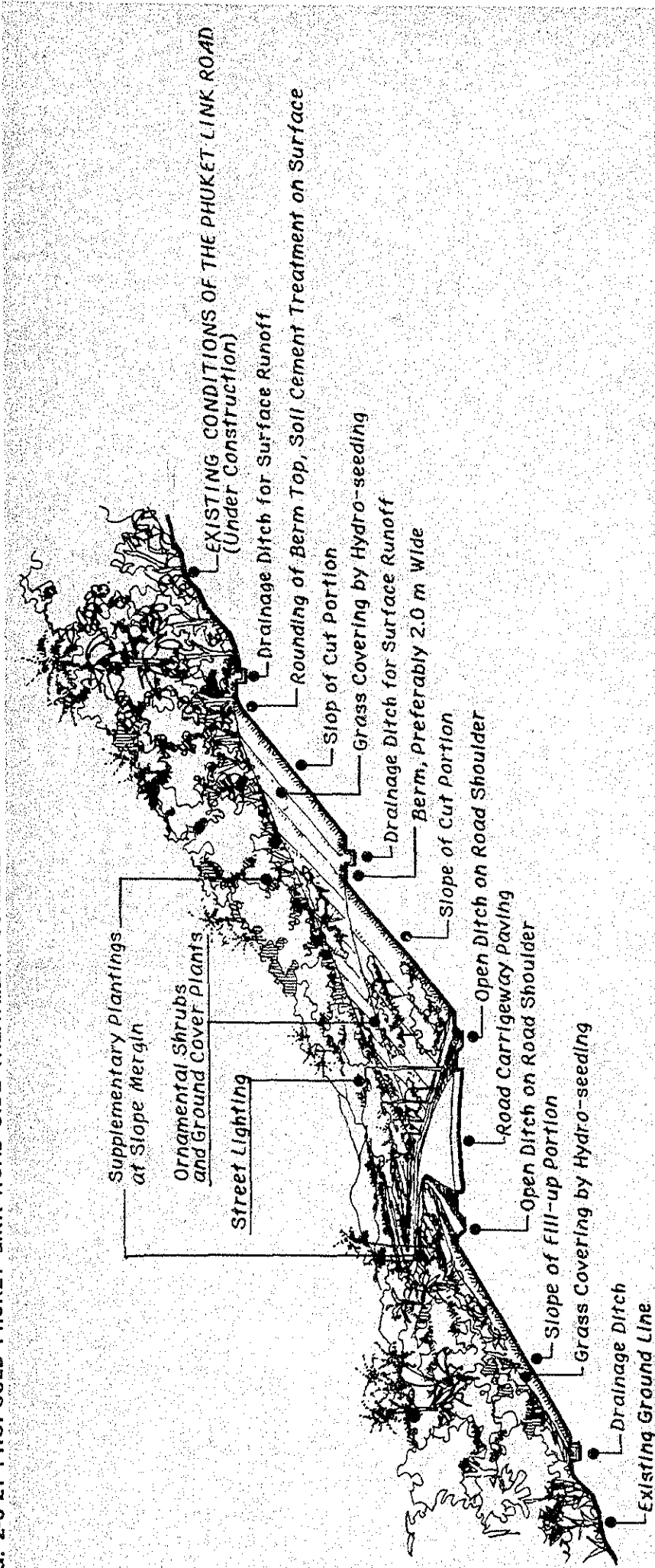
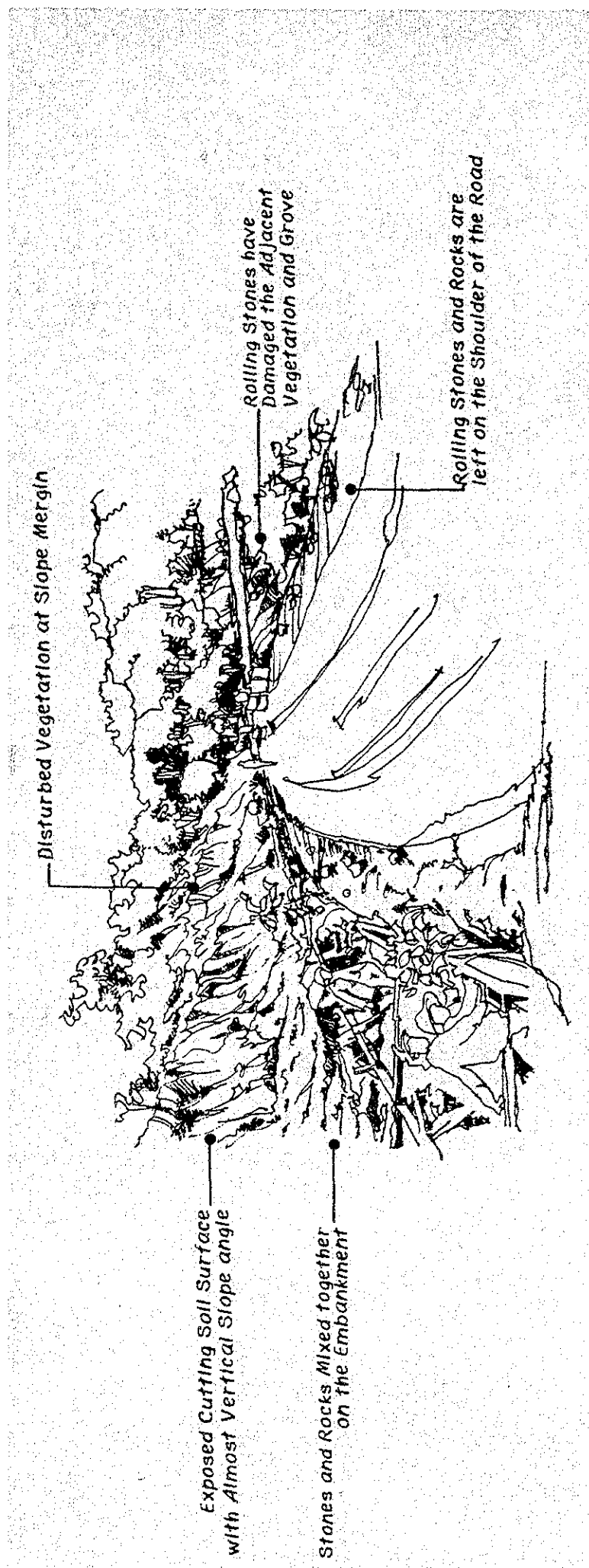


FIG. 2-3-22 EXISTING CONDITION OF THE PHUKET LINK ROAD (UNDER-CONSTRUCTION)



At the same time, a well-organized monitoring system should be developed. This project aims at forming a responsible organization for supervising and directing projects work involving environmental changes at the local level under an inter-governmental coordination. The private sector should be involved in this organization in the sense that the private sector has to maintain the invaluable natural assets under to control in good condition for the perpetual benefit of all.

e. National Park Management Project

As tourism resources, the national parks have great potential to attract tourists. This project includes the development of their facilities necessary for both attracting tourists and protecting them from pollution brought by mass tourism.

This project is recommended to be put forth in collaboration with relevant agencies with the following three components:

- Conducting of a comprehensive study for the national park management in Greater Phuket area;
- Establishment of "Marine Park Management and Training Center", which functions as not only an administrative center for managing the assets/resources located in the national parks, but also an educational, training and information center for promoting the public relation. The administrative personnel for the national park management is trained at this center as well.
- Strengthening of researching capability for all marine natural resources existing in Greater Phuket such as mangrove and sea turtles, with a close coordination with Marine Biological Research Center.

TABLE 2-3-9 CLASSIFICATION OF COASTAL WATER QUALITY STANDARD (1)

Parameter	Natural Conservation/Preservation			Propagation of Marine Life		Recreation		Industry
	Preservation	Conservation of Coral Community	Conservation of Natural Area	Aquaculture	Shellfish	Water-contact sport	Water-proximity sport	
CLASS	AA	A1	A2	B1	B2	C1	C2	D
Floatable Solids	n	NOB*	NOB*	NOB*	NOB*	NOB*	NOB*	NOB*
Floatable oil/grease	n	NV	NV	NV	NV	NV	NV	NOB
Color/Odor	n	-	-	NOB	NOB	NOB	NOB	NON
Temp (C)	n	32	32	32	32	-	-	3
pH	n	7.5-8.9	7.0-8.5	7.0-8.5	7.0-8.5	-	-	**
Salinity (ppt)	n	29-35	10%	10%	10%	-	-	**
Transparency (m)	n	10%	10%	10%	10%	10%	-	**
SS (mg/l)	-	-	-	-	-	-	-	-
DO (mg/l)	n	4	4	4	4	-	-	**
Total Coliform (MPN/100 ml)	-	-	-	1000	n	1000	-	-
Fecal Coliform (MPN/100 ml)	n	-	-	-	ne	-	-	-
NO3-N (mg/l)	n	n	n	n	-	-	-	**
PO4-P (mg/l)	n	n	n	n	-	-	-	**
Hg (mg/l)	-	-	-	0.0001	-	-	-	0.0001
Cd (mg/l)	-	-	-	0.005	-	-	-	0.005
Cr (mg/l)	-	-	-	0.1	-	-	-	**
Cr, hex (mg/l)	-	-	-	0.05	-	-	-	0.1
Pb (mg/l)	-	-	-	0.05	-	-	-	****
Cu (mg/l)	-	-	-	0.05	-	-	-	**
Mn (mg/l)	-	-	-	0.1	-	-	-	**
Zn (mg/l)	-	-	-	0.1	-	-	-	**
Fe (mg/l)	-	-	-	0.3	-	-	-	**
F (mg/l)	-	-	-	1.5	-	-	-	**
Residue Cl2 (mg/l)	-	-	-	0.01	-	-	-	**
Phenols (mg/l)	-	-	-	0.03	-	-	-	**
NH3-N (mg/l)	-	-	-	0.4	-	-	-	**
Sulfide (mg/l)	-	-	-	0.01	-	-	-	**
CN (mg/l)	-	-	-	0.01	-	-	-	**
PCB (MG/L)	-	-	-	n	-	-	-	**
Total Chlorinated Pesticides (Ug/l)	-	-	-	0.05	-	-	-	**
Radioactivity	-	-	-	-	-	-	-	**
-Gross (Becquerel/l)	-	-	-	0.1	-	-	-	**
-Gross (Becquerel/l)	-	-	-	1	-	-	-	**

TABLE 2-3-10 CLASSIFICATION OF COASTAL WATER QUALITY STANDARD (2)

Classification	Condition for Principal Beneficial Uses
Class AA	Preservation of natural area; the following non-consumptive USCS are allowed - Scientific research and education such as demonstration, observation and for monitoring - aesthetic enjoyment - inactive management/preservation activities
Class A	A1) Conservation of Coral Community A2) Conservation of natural area such as mangrove, wildlife habitat and marine spawning, nursing and feeding grounds
Class B	B1) Aquaculture B2) Shellfish
Class C	C1) Water-Contact Sport C2) Water-proximity sport
Class D	For protection of natural water resources used as a receiving water body for industrial waste discharges

Note  
NOB = not objectionable  
NV = not visible  
n = natural condition  
= change from natural condition  
= \* not include natural floatable solids  
= \*\* may be established as necessary  
ne = natural condition until enough information  
= not more than  
= not less than

TABLE 2-3-12 ARSENIC, COPPER CADMIUM, MANGANESE AND IRON CONTENTS IN PHUKET AND PANG NGA WEST COAST (Refer to Fig. 2-3-20)

(Units: mg/lit)

Sampling Stations	Arsenic	Copper	Cadmium	Manganese	Iron
St. 1	0.000	0.001	0	0.004	0.40
St. 2	0.000	0.001	0	0.003	0.30
St. 3	0.001	0.001	0	0.004	8.00
St. 4	0.000	0.005	0	0.009	10.00 (0.1)*
St. 5	0.000	0.004	0	0.170	4.00
St. 6	0.000	0.001	0	0.007	0.07
St. 7	0.002	0.008	0	0.006	0.03
St. 8	0.000	0.001	0	0.005	5.00 (1.0)*
St. 9	0.000	0.000	0	0.004	0.01
St. 10	0.000	0.000	0	0.010	0.09
St. 11	0.000	0.000	0	0.085	0.03

TABLE 2-3-11 DRINKING WATER STANDARD

(Unit: mg/lit.)

Parameters	Standard values (max. allowance)
Arsenic	0.05
Copper	1.00
Cadmium	0.01
Manganese	0.05
Iron	0.50

Source: NEB

0: blow 0.001 mg/lit.  
\*: filtered

FIG. 2-3-18 CLASSIFICATION OF COASTAL WATER QUALITY IN PHUKET WEST COAST

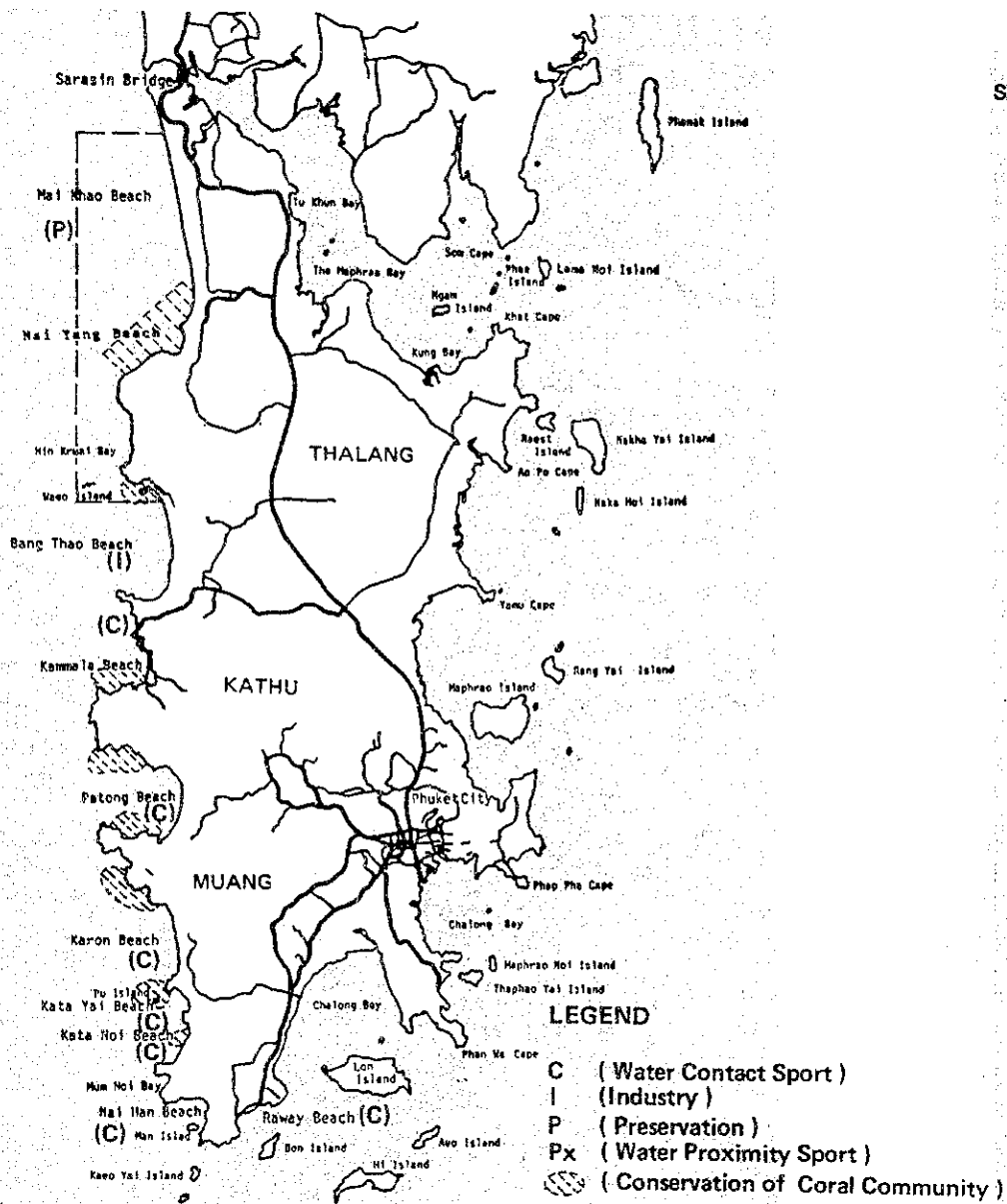


FIG. 2-3-19 COASTAL PROTECTION

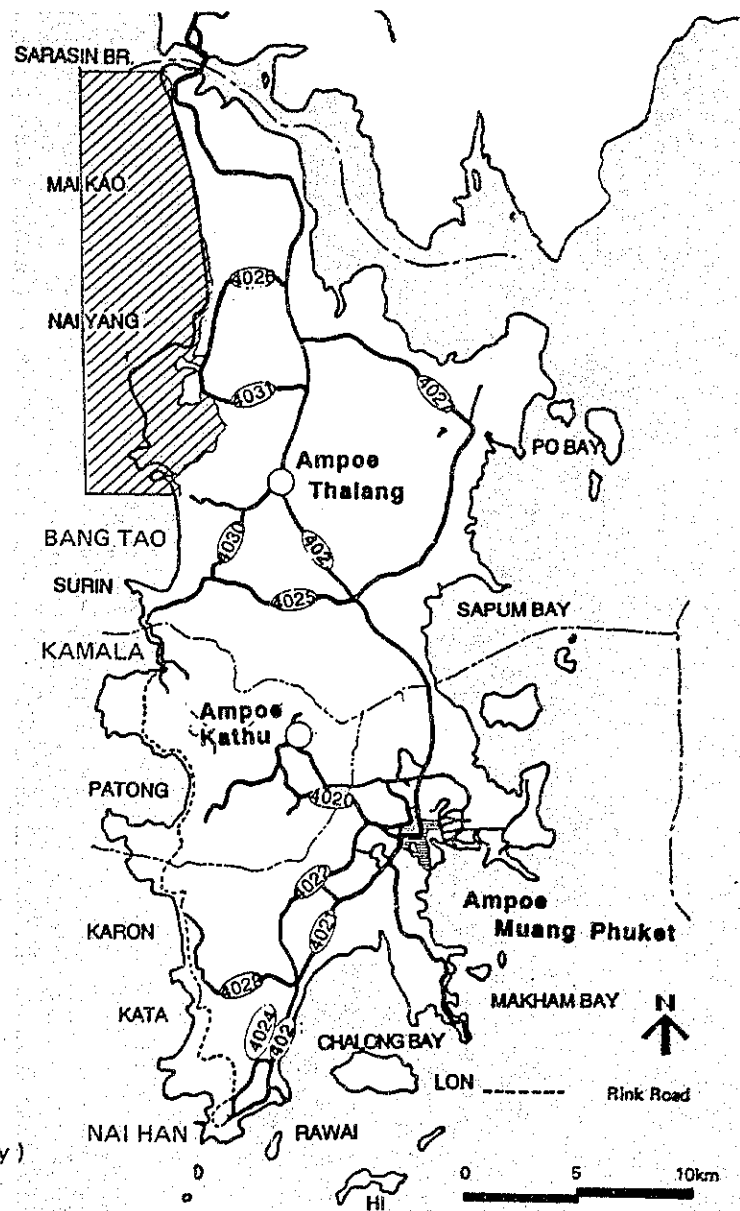
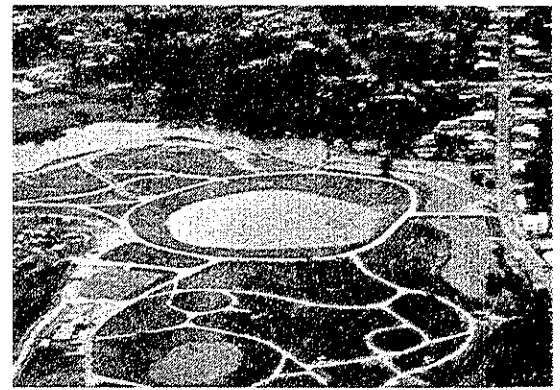
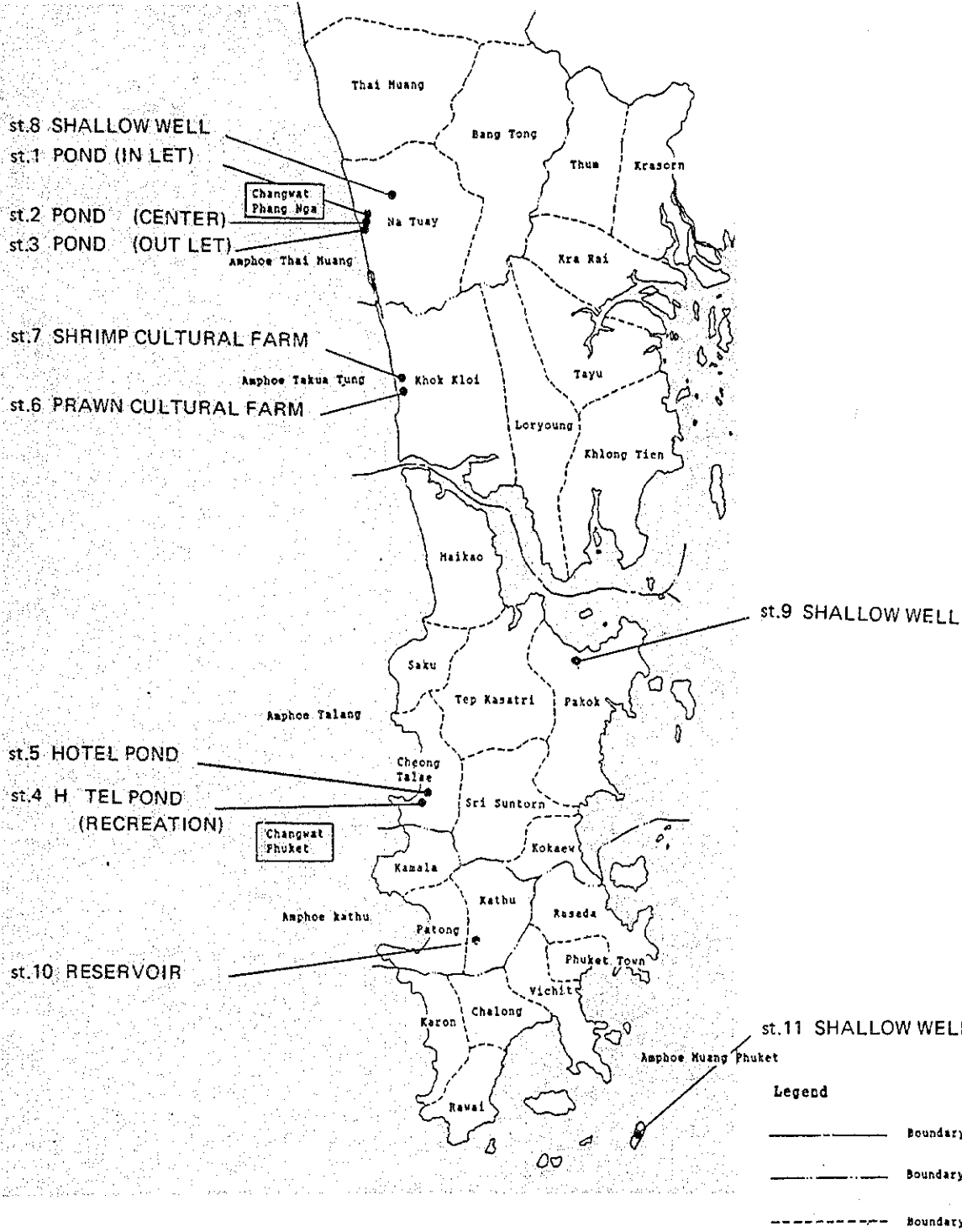
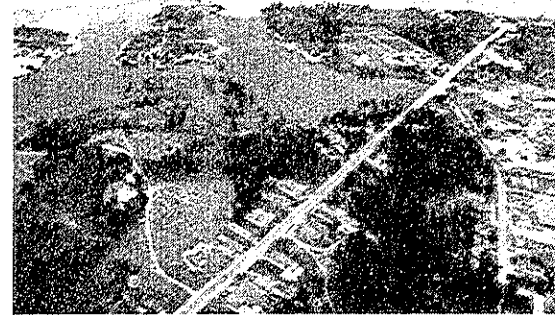


FIG. 2-3-20 LOCATION OF WATER SAMPLING STATION



Park Development in Ex-tin Mining Area, Phuket



A Potential Area for Resort Development, Phang Nga



Golf Course Development in Ex-tin Mining Area, Phuket

## 2.4 INFRASTRUCTURE DEVELOPMENT

### 2.4.1 AIR TRANSPORT

- 48% of Tourists Coming by Air

"Air" is the primary transportation mode for Phuket tourists. It is assumed that about 48% of tourists coming to Phuket use air-transportation. The carrying capacity of air transport needs to expand to a considerable extent so as to meet the anticipated future demand. "A safe airport" meeting the international standard should be realized as well. These are the most critical issues to facilitate Greater Phuket tourism.

#### 1) AIR TRANSPORT DEMAND

- Schedule Flight Increases by 1.7 times

The annual numbers of passengers at Phuket International Airport (PIA) during the last decade are as shown in Table 2-4-1. It is noted that the numbers increased at growth rates of 35 to 45%. The number of international passengers coming directly to/from the foreign countries by scheduled flight in 1987, as shown in Table 2-4-2, increased to be 1.7 times as many as that in 1986. This was affected by the new operation of air flights to/from Hong Kong by Thai Airways International and Dragon Air.

- The demand Will Become 3 Times Within the Decade

A total number of air passengers at PIA accounted for about 763.9 thousand, including the charter flight passengers. It is estimated that the numbers of tourists arriving by air transport will be 1,119 thousand in 1996 and 1,486 thousand in 2001, which means that air transport passengers at PIA will account for approximately 2,238 thousand in 1996 and 2,972 thousand in 2001. The demand within the coming decade, therefore, will become 3 times as large as that at present, as shown in Table 2-4-4.

#### 2) ASSESSMENT OF THE ON-GOING PROJECT OF PHUKET INTERNATIONAL AIRPORT

At present, the following projects are going on at PIA.

- On-going at PIA

- Construction of new terminal facilities including an apron (2 spots for B747), car parking, and roads being due to complete in September, 1988;
- Construction of a new terminal building with a passenger handling capacity of 2,050 for international and 1,683 for domestic passengers during peak-hours which is to complete in March, 1989;
- Installation of a PSR/SSR radar and ILS facilities, and construction of a new control tower.

The above on-going projects are expected to improve the PIA's capability to accommodate large aircraft (B747s) and increase terminal capacity. The safety level will be improved to some extent at the same time because of installation of the radar and ILS facilities.

From an engineering point of view, it is assessed that a maximum passenger handling capacity of the terminal and the apron space after completion of the on-going projects will be able to meet the future demand even in 2001. The capacities of these facilities are computed to be:

- the terminal (inc. the existing) : 4.5 mill. passengers/yr;
- the apron : 4.8 mill. passengers/yr.

- Critical Problem on Supply Side

The critical problem is the one on the supply side, i.e., the availability of aircraft movements. Reviewing the purchase schedule of aircraft of Thai Airways International up to 1996, it is anticipated that the carrying capacity of the aircraft in 1996, which will be proportionally allocated for the Phuket route, will be about 1.3 million passengers, or 1.8 times as large as that at present. Given that international air carriers increase the capacity at a growth rate of 8% per annum, about 300 thousand passengers will be added in 1996. Therefore, about 1.6 million passengers could be transported. Obviously, this will result in a shortage in the supply for the demand, 2.2 million. Emphasis, therefore, needs to be placed on pushing the air carrier to arrange a more frequent aircraft movement to the Phuket route, and at the same time, on inducing new international routes from potential markets.

- Another Issue on Safety Measure

Another important issue still remain on the inadequacy of the facilities to increase the air transport capacity associated with up-grading of the safety-level. No existence of a parallel taxiway and insufficiency in the width of runway strip will be a critical constraint. Although the runway has been developed to be an international class, the runway strip still remains at 150 meter wide which is below the international standard. In addition to these problems, the terrain surrounding the airport inhibits aircraft operations. In fact, the part of the hill located south of the airport is within the transition surface to be cleared. These problems should be eliminated as soon as possible.

#### 3) DEVELOPMENT PROJECTS RECOMMENDED FOR PHUKET INTERNATIONAL AIRPORT

- ICAO's Standard

Towards the year 2001, further development of PIA is necessary to increase the air transport capacity and to upgrade the navigational safety level so as to meet at least the requirements of the ICAO's standard for international airports. The following projects are recommended to be executed for this purpose:

- Development of Parallel Taxiway:  
The runway without a parallel taxiway inherently limits the flight capacity. Although the runway has been developed to be international class, the runway capacity is still limited at a low level, due to the lack of parallel taxiway. Even if carriers make efforts to increase their transport capacities so as to meet the anticipated demands, the present runway capacity is thought to be around 1.5 million passengers per year at maximum, because of no having a parallel taxiway. But the new terminal building capacity is to be 4.5 million passengers as shown above. Obviously there is a great difference between the capacity of the runway and that of the new terminal. In order to mitigate such a large imbalance, a parallel taxiway should be developed as early as possible.

**TABLE 2-4-1 ANNUAL PASSENGERS CARRIED AT PHUKET INTERNATIONAL AIRPORT**

YEAR	TAC	THAI	DRAGON AIR	TOTAL	GROWTH RATE
1978	81,735	-	-	81,735	-
1979	118,226	-	-	118,226	44.6%
1980	143,022	-	-	143,022	21.0%
1981	159,501	-	-	159,501	11.5%
1982	183,503	-	-	183,503	15.0%
1983	214,794	5,541	-	220,335	20.1%
1984	267,198	68,034	-	335,232	52.1%
1985	292,090	89,838	-	381,928	13.9%
1986	371,645	143,602	-	515,247	34.9%
1987	537,274	203,784	14,540	755,598	46.6%

Source : Department of Aviation

Note - These figures indicate the passengers carried by schedule flights and the total of international and domestic

- TAC: Thai Airways
- THAI: Thai Airways International

**TABLE 2-4-2 INTERNATIONAL PASSENGERS DIRECTLY TO/FROM PHUKET INTERNATIONAL AIRPORT**

Carrier	to/from City	1986	1987
TAC	Kuala Lumpur	6,946	8,586
	Penang	8,425	9,393
	Total	15,371	17,979
THAI	Hong Kong	3,158	22,476
	Singapore	55,781	71,956
	Total	58,939	94,432
Dragon Air	Hong Kong	-	14,540
<b>Total</b>		<b>74,310</b>	<b>126,951</b>

Source : Department of Aviation

Notes : TAC stands for Thai Airways;

THAI, Thai Airways International.

TAC has been taken over by THAI in March, 1988.

**TABLE 2-4-3 PASSENGERS CARRIED BY CHARTER FLIGHTS AT THE PHUKET AIRPORT**

	MOVEMENTS	PASSENGERS		NO. OF PASSENGERS TOTAL PER FLIGHT
		DEPARTURE	ARRIVAL	
1986	24	1,267	962	2,229
1987	74	4,145	4,168	8,313
1988(Jan.-Apr.)	56	3,533	2,378	5,911

Source : Department of Aviation

**TABLE 2-4-4 AIR TRANSPORT DEMAND FORECAST**

	1991	1996	2001
<b>(Premises)</b>			
A. Accommodation Rooms	14,216.0	18,755.0	24,905.0
B. No. of Guests (thousand/year)	1,474.7	1,945.6	2,583.6
C. Total Arrival Tourists (thousand/year)	1,696.0	2,237.4	2,971.1
D. Air Arrival Passengers (thousand/year)	848.0	1,119.0	1,486.0
E. Air Passengers (thousand/year)	1,696.0	2,238.0	2,972.0

Notes: A : derived from the framework

B : calculated by the following formula and assumptions,

$$B + A \times \text{POR} \times \text{ORH} \times 365 / \text{LOS},$$

where A : No. of accommodation rooms;

POR : No. of persons staying at a room (=1.8);

ORH : Occupancy rate of accommodation (=0.6);

LOS : Length of Stay (=3.8)

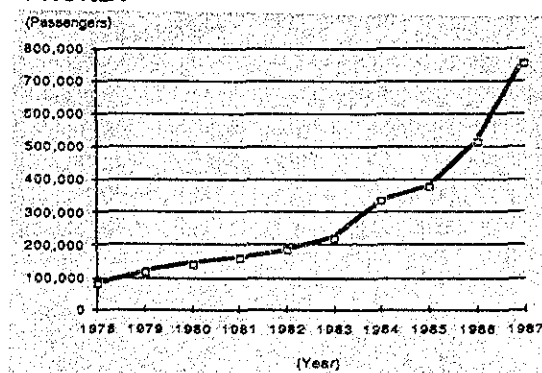
C : calculated by B x 1.15

D : calculated by C x 0.5, based on the following pattern of transport model split in terms of percentage, which is discussed in Appendix.

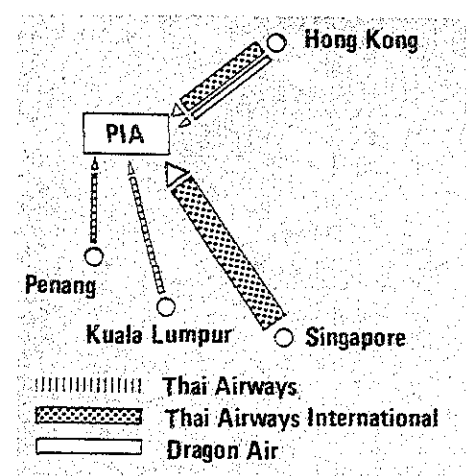
By Air	: 50%
By Bus (Fixed Route)	: 20%
By Non-Scheduled Bus	: 15%
By Private Car	: 14%
By Ship	: 1%

E : calculated by D x 2.

**ANNUAL PASSENGERS CARRIED AT PHUKET**



**DIRECT FLIGHT TO PHUKET**



● **MLS(Microwave Landing System)**

- b. **Expansion of Runway Strip:**  
International airports with an ILS facility are normally required to have a runway strip 300 m in width (ICAO Standard); because of navigational safety and precision approach. On the other hand, at present, the transition surface is not completely cleared, because of the partial obstacle of a hill located near the runway. Given a runway strip with 300m wide, these two problems are to be mitigated. Hence, the expansion of runway strip from 150 m to 300 m is urgently needed.
- c. **Improvement of Navigational Aid System:**  
The forthcoming ILS facility with offset localizer is regarded as a temporary facility. It is recommended that this ILS should be replaced for a MLS (Microwave Landing System) facility between 1998 and 2000. The MLS is to be a standard facility regulated by ICAO, as shown in Table 2-4-5.
- d. **Clearance of Obstacle Limitation Surface:**  
The Laem Sai hill exists just on the axis of the runway in the eastern side. The difference between the height of this hill (138 m) and the necessary height of the obstacle clearance surface (a 3% gradient) at top of the hill is calculated to be 4.5 m only, as shown in Fig. 2-4-1. This condition is very sensitive in a sense of safe navigation. Tall trees on the top of the hill might be over the obstacle surface. Based on this fact, some actions would be needed: for instance, replacement of the tall trees by low trees at the top of the hill is recommended.
- e. **Creation of "Sense of Arrival":**  
The access road to PIA, Route 4026, should be improved with emphasis on its landscape in order to create a "Sense of Arrival" at the international gateway. The intersection of Route 402 should also be improved so as to make the traffic more smooth in response to the anticipated heavy traffic in future.

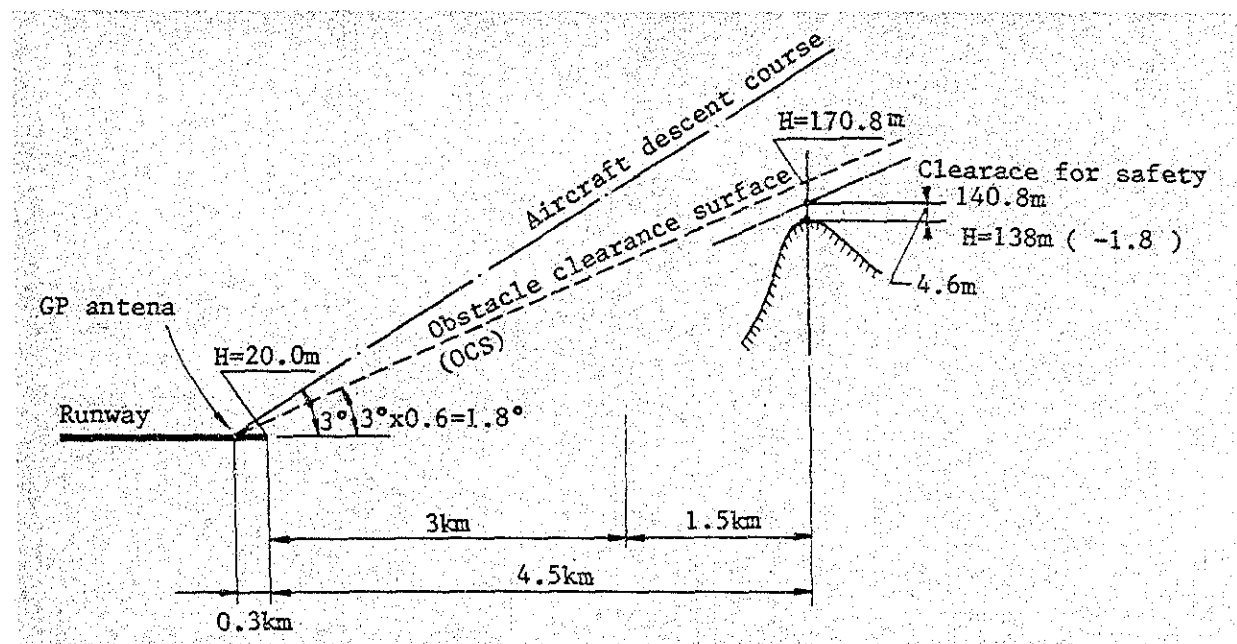
● **"Sense of Arrival"**

Based on the above recommended projects, the New Phuket International Airport, is depicted as illustrated on Fig. 2-4-2.

**TABLE 2-4-5 SCHEDULE ON THE IMPROVEMENT OF THE LANDING SYSTEM BY ICAO**

YEAR	LANDING	SYSTEM
	ILS	MLS
1989	primary	option
1990 - 97	primary	recommendable
1998 - 99	option	primary
2000 -	note taken care by ICAO	only standard system authorized by ICAO

**FIG. 2-4-1 RELATION BASED ON THE ANGLE OF DESCENT OF AIRCRAFT**

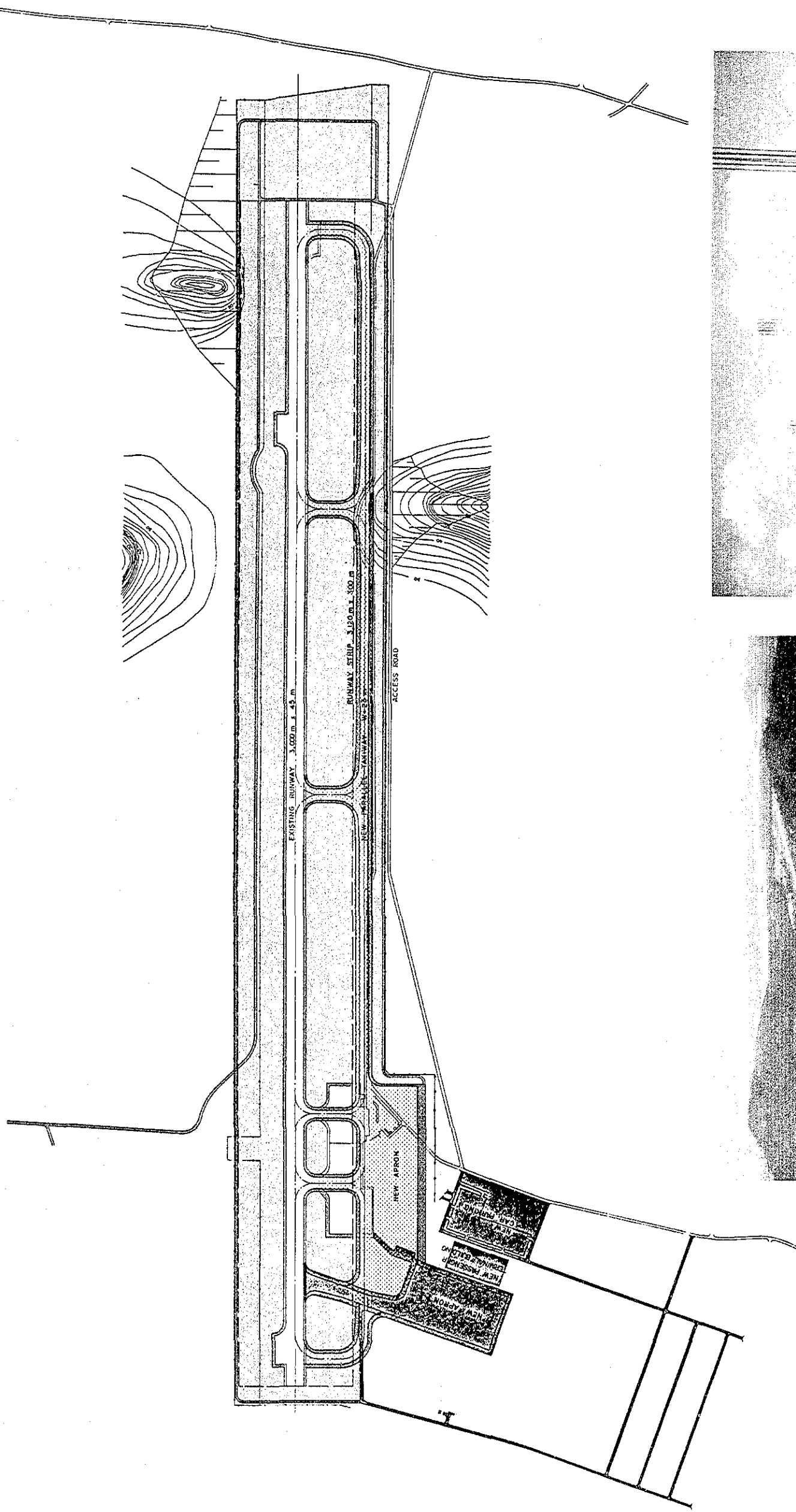


**4) FEEDER AIR TRANSPORT SYSTEM DEVELOPMENT**

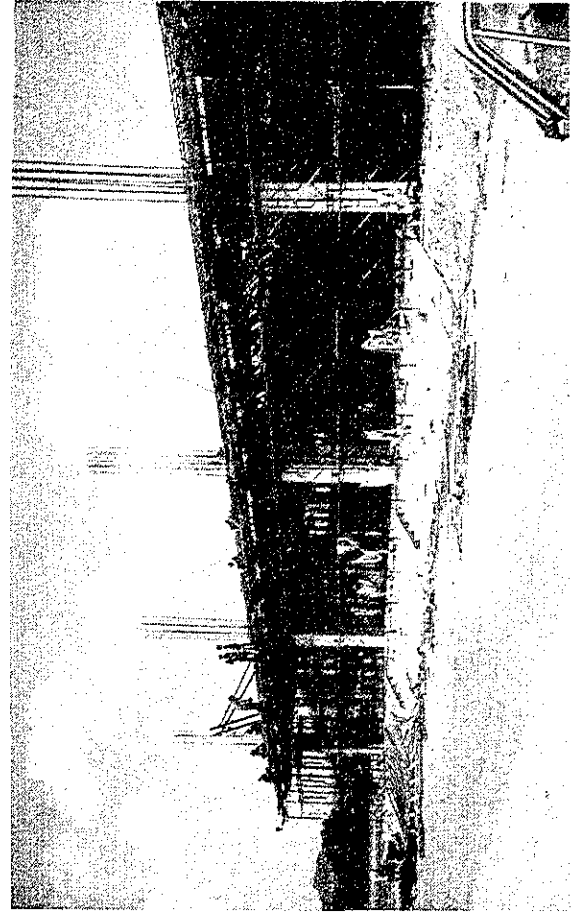
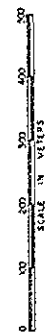
● **Krabi Airport**

Krabi Airport has a runway 1,200m long and 12 m wide. Bangkok Airways had operated flights to/from Bangkok three times a week, but has stopped since 1987, because the airport facilities are not sufficient for safe operation and the demand was not sufficient to maintain the operation of flights.

FIG. 2-4-2 ON-GOING PROJECT OF PHUKET INTERNATIONAL AIRPORT



LEGEND	
	ON-GOING PROJECT
	FUTURE PLAN



New Terminal Building (Under Construction)



Airport Area



However, in order to develop tourism as well as the local economy, the provision of a rapid transportation system would get more important. Krabi Airport can provide with such a necessary transportation, given a little additional investment. It is thought to be an efficient measure. Krabi Airport was initially constructed by the Krabi provincial government, and no additional investment has been put into the airport since then. In October, 1986, the responsibility for the management of the airport was handed over to the Department of Aviation. Hence, improving Krabi Airport, the central government can incorporate it into the national air transport network in Thailand.

In this sense, Krabi Airport should be utilized as one of the feeder airports in the South. The small scale aircraft may provide transport services to/from major cities, such as Phuket, Surat Thani and Hat Yai.

Considering the positioning of Krabi Airport, the following projects are recommended with emphasis on upgrading the safety level:

● Proposed Projects for Krabi Airport

- Widening of the runway from 12 m to 30 m, including improvement of the existing runway;
- widening of the runway strip to 150 m;
- improvement of the access road to the terminal; and
- renovation of the terminal building.

#### 5) HELIPORT DEVELOPMENT FOR AIR EXCURSIONS

In order to promote air excursions, helicopters may be introduced into Greater Phuket tourism. Since any possible air excursion routes in Greater Phuket will not be a long trip, helicopters may be more suitable than small aircraft.

The heliports are expected to be developed at several transportation nodes and tourist spots such as Phuket Marine Center (planned), Phuket Town (Sapanhin Area) and Phuket International Airport, Krabi Airport, Phi Phi Island, and Similan Island. A main heliport equipped with full facilities for workshop is located at PIA.

However, since the helicopter transport system needs a considerable amount of initial and running investment and skilled personnel, the project should thoughtfully be examined in terms of its financial feasibility.

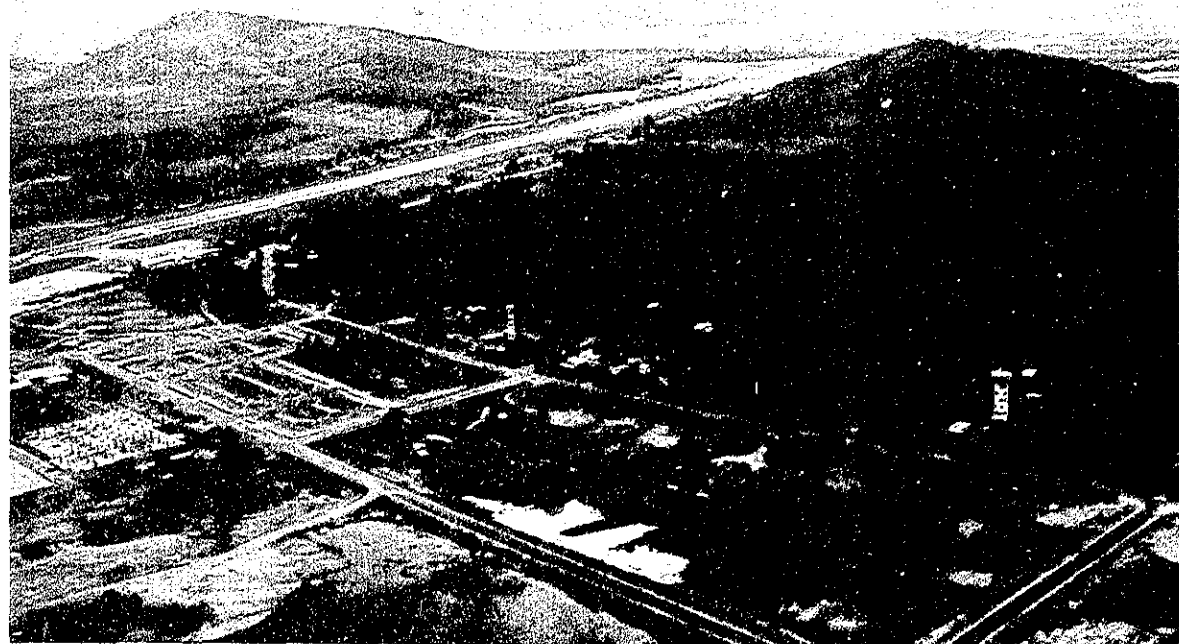
#### 6) IMPLEMENTATION

The costs for the three recommended projects, i.e., the development of a parallel taxiway, expansion of the runway strip to 300 m wide and installation of MLS, are estimated at about 222.7 million Baht in 1988 prices. Adding the costs for related facilities such as replacement of the access road and landscaping, the total costs will be 227.8 million Baht in 1988 prices, including the engineering services fee.

A construction schedule is recommended as shown in Section 2.7 PLANS AND PROJECTS TO BE IMPLEMENTED in this volume. Taking into account the nature of these projects that they will greatly affect the safety level of aviation, these projects should be put forth as soon as possible, except for the installation of MLS.

● The Project Will Be Quite Feasible

The feasibility, from a financial point of view, is argued in Section 2.7. As a result, it is found out that this project will financially be quite feasible.



Phuket International Airport and New Terminal (Under Construction)