

Chapter 4 Environmental Conditions

4.1 Introduction

This chapter presents the information on the current environmental conditions, which was collected in the early period of the Study in the survey areas described below.

As far as environmental considerations are concerned, two survey areas including two capitals of district and city (Phu My and Vung Tau) and three communes (My Xuan, Phuoc Hoa and Hoi Bai), which may be affected by the possible new port construction and its operation, have been designated as shown in Figure 4.1.1.

Throughout this period, the Study Team focused its effort on the following points in order to establish the baseline data for the next period of the Study.

- To summarize Environmental Laws and Regulations in Vietnam.
- To collect information on Socio-economic and Natural Conditions in the survey areas.
- To conduct field surveys on Sediment and Water Quality of river and sea in the survey areas.

4.2 Overview of the Survey Areas

Industrial development along the Thi Vai River has started since 1975 with a few numbers of enterprises, which were specialized in processing of agricultural products. Then, the number and type of industries have increased.

Since early 1990, the survey areas have been industrialized rapidly by the locating power plant, LPG distribution base, food processing plant and other industries accompanied by their loading and unloading facilities. Especially, some industrial zones and river ports were established, which have contributed to improve living conditions of local residents, including provision of infrastructure, electricity, water as well as new jobs.

In addition, the opening of National Road No.51 and the service of Jet Foil Ship between HCM City and Vung Tau City have stimulated the flow of several kinds of goods and many tourists around the survey areas.

Currently, the areas between the Thi Vai River and National Road No.51 in the Thi Vai / Cai Mep survey area have been designated as Industrial Zones (IZs) by the government.

In and around the IZs, especially in Phuoc Hoa Commune, the large extent of mangrove swamp has still remained. However, there is neither legal reserve nor legal protection area designated by the government.

The land utilization maps in different years (1992 and 1999) shown in Figure 4.2.1 imply that the urban, residential and plantation forest areas have expanded into the rice field and mangrove swamp areas for the seven years. Thus, the environmental conditions have been changing significantly at some part of the survey areas.

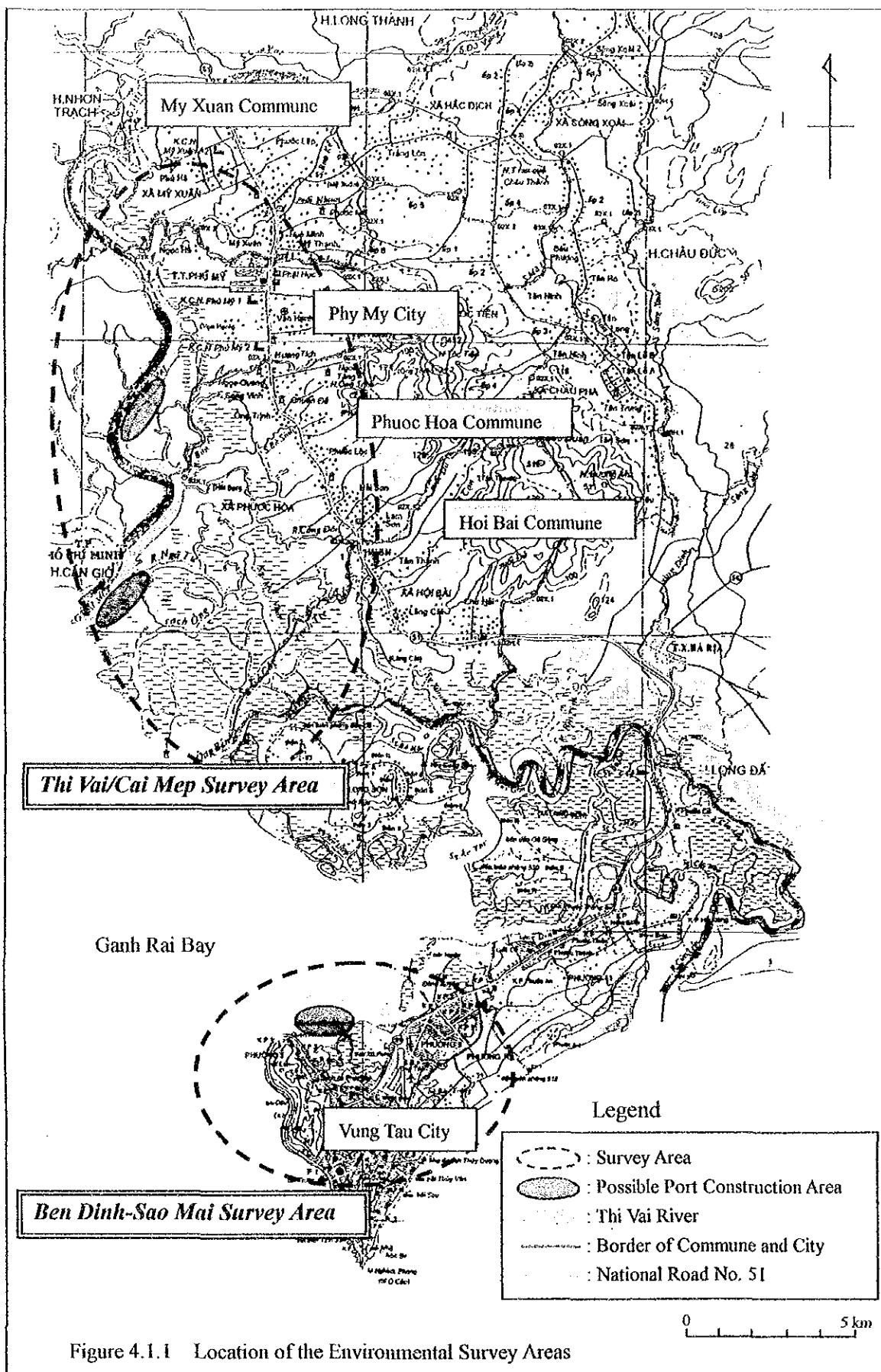
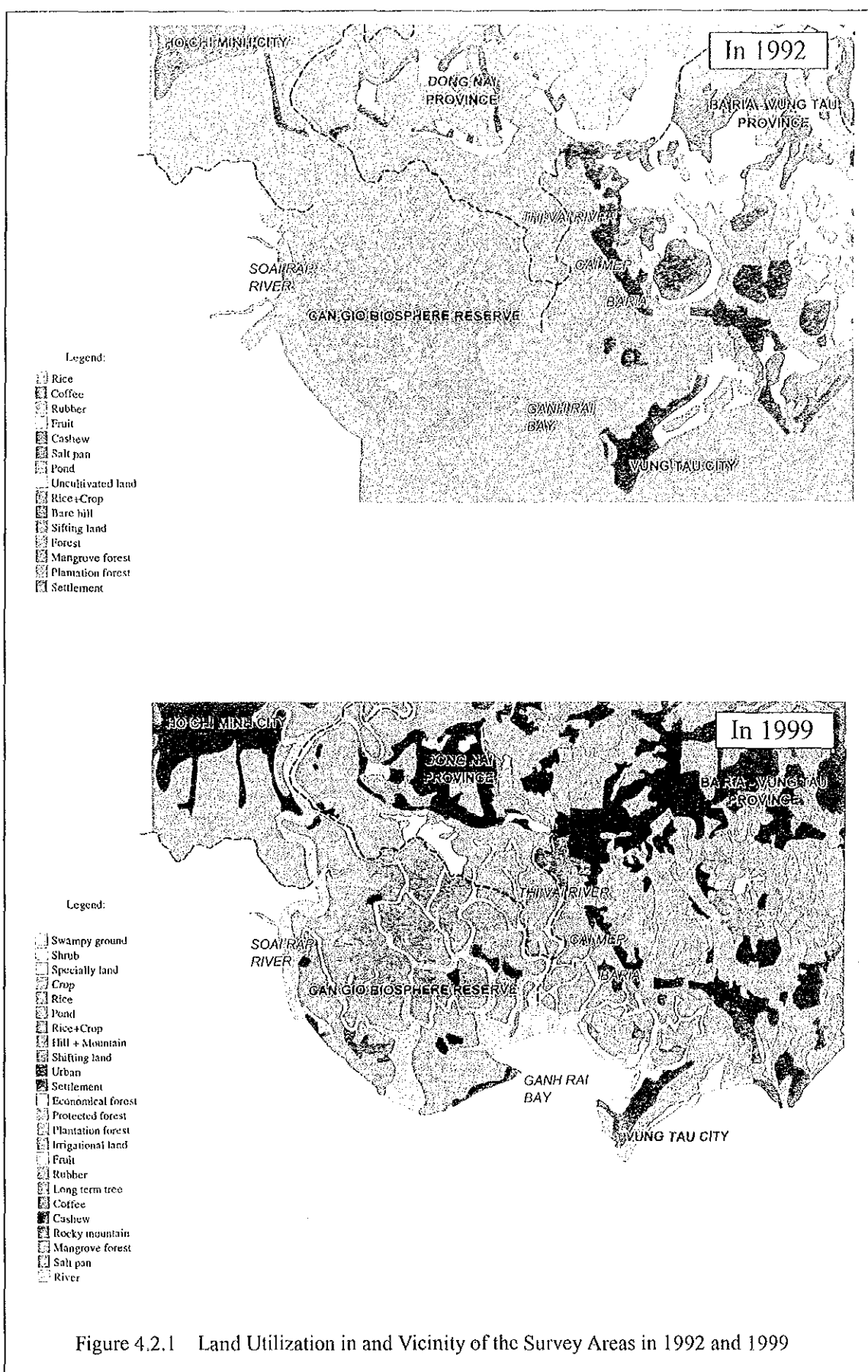


Figure 4.1.1 Location of the Environmental Survey Areas



4.3 Environmental Laws, Legislations on Environmental Impact Assessment (EIA) and Quality Standards in Vietnam

The Vietnamese Government promulgated the Decree No. 246/HDBT in 1985 to provide the requirement of implementation of EIA for under-going projects. However, it has been applied only a few projects and has not been propagated.

4.3.1 Environmental Protection Law

On December 27, 1993, the Environmental Protection Law has passed National Assembly and the President's Decision No. 29L/CTN has put it into effect on January 10, 1994.

It consists of 7 chapters and 55 articles enacting the policy and general aspect on Environmental Protection.

According to the article Nos. 17 and 18 of the law, all of organizations and individuals who manage the economic, scientific, technological, public health, cultural, social, security and national defense establishments in Vietnam have to prepare the EIA report of their establishments and submit it to the national environmental management agencies to receive the EIA Appraisal Decision.

4.3.2 Government Decrees

The Government Decree No. 175/CP has been issued on October 18, 1994 aiming at provision of the guidance for the implementation of the Environmental Protection Law.

The decree specifies the projects that require EIA and responsible organizations on appraising of it. According to the specifications of projects listed in the decree as shown in Table A4.3.1, the EIA of the port project exceeding 100,000 T/year in its handling capacity are appraised by the Ministry of Science, Technology and Environment (MOSTE), and rest are appraised by the provincial Department of Science, Technology and Environment (DOSTE).

4.3.3 Circulars on Guidelines and Decisions issued by MOSTE

Following the enforcement of the Environmental Protection Law, MOSTE issued several legal documents on EIA for new projects and existing facilities in Vietnam.

Those Circulars and Decision are summarized in Table 4.3.1.

4.3.4 Technical Standard on EIA

The Ministry of Transport set up a technical standard 22TCN 242 98 on March 27, 1998.

It specifies the requirements on EIA in the feasibility study stage for Highway, Railway, Bridge, Waterway and Port projects.

Table 4.3.1 Circulars and Decision Issued by MOSTE

Date of issue	Number of documents	Summary of content
November 26, 1994	Circular No.1420/MTg	Circular on guiding the environmental impact assessment of existing facilities
December 31, 1994	Decision No 1806-QD/MTg and Regulation No1807/MTg	Regulations on organizations and activities of EIA Appraisal Committee.
April 3, 1995	Circular No.714-MTg	Circular on issuing the EIA Appraisal Letter
April 17, 1996	Circular No. 812-MTg	Circular on issuing the application form and form of EIA Appraisal Decision (Forms: I-B, II-B, III, IV)
December 3, 1996	Circular No.2781/TT-KCM	Circular on guiding the formalities on providing, expanding time-limit and withdrawing the environmental license for existing industrial facilities after receiving the Appraisal Decision of EIA report or report on environmental impact activities.
March 6, 1997	Circular No.276/TT-MTg	Circular on guiding controlling pollution to enterprises after receiving the Appraisal Decision of EIA report or report on environmental impact activities.

Source: Study Team

4.3.5 Legal Documents on Protection of Rare Fauna and Flora

The documents listed below are released and effective.

- Red Book of Vietnam, 1992, providing the status of the animals to be treated
- Government Decree No. 18/HDBT, January 17, 1992, providing the lists of rare fauna and flora, and regulations on management and protection
- Introduction No. 359/TTg, May 9, 1996, providing urgent measures for protection and development of wild life animals

4.3.6 Environmental Quality Standards

(1) Principle

All facilities in the territory of Vietnam, after receiving the EIA Appraisal Decision or Certificate for securing the environmental standards, must apply the pollution control measures in order to meet the environmental standards issued by MOSTE or other ones issued by the Provincial People's Committees and the Ministry of Health which must be stricter than the environmental standards issued by the MOSTE.

(2) International Standard

In case, environmental standards need to be applied, but they have not issued by the MOSTE, the Ministry of Health and Provincial People's Committees, facilities owners may apply environmental standards, which are issued by other countries or international organizations, after receiving the approval letter from the Provincial People's Committee, where the existing facility is being operated. The Provincial People's Committee must report to MOSTE the agreement concerning with applying the foreign standards in the province. MOSTE intervenes the decision of the People's Committee, only if necessary.

(3) Vietnamese Standard to be applied.

Several permissible ranges on quality standards in Vietnam are shown in Table A4.3.2(1) to (19).

4.4 Environmental Conditions in the Survey Areas

4.4.1 Socio-economic Environment

(1) Major social indices in and around the survey areas

1) Regional inhabitants

The followings are summary of social indices related to the life of the local inhabitants.

Table 4.4.1 Population

Item \ Name	My Xuan	Phu My	Phuoc Hoa	Hoi Bai	Vung Tau
Population (persons)	15,221	8,500	15,210	17,776	183,726
Population density (persons/km ²)	41	274	183	333	1,034
Population growth rate (%)	1.45	1.46	2.00	1.74	1.65
Population of over 15 years old	10,624	5,861	10,372	11,855	104,104
Household (houses)	2,363	1,481	2,862	3,200	35,941

Source: ENTEC (January, 1999)

Table 4.4.2 Occupation

Unit: %

Item \ Name	My Xuan	Phu My	Phuoc Hoa	Hoi Bai	Vung Tau
Agriculture	80.0	80.0	90.0	64.0	2.4
Small business and Handicraft	15.0	14.0	2.7	5.2	5.1
Fishing and Aquatic Farming	3.1	3.2	3.7	4.2	3.2
Others	1.9	2.8	3.6	26.6	89.3

Source: ENTEC (January, 1999)

2) Economic Activity

Table 4.4.3 Land Use

Unit: ha

Purpose \ Name	My Xuan	Phu My	Phuoc Hoa	Hoi Bai	Vung Tau
Total natural area	3,391	3,100	8,300	5,328	17,766.3
Agricultural land	1,763	1,131	691	794	2,850.3
Handicraft factory	-	-	-	16	-
Office	-	89	-	-	1,675
Forestry land	-	364	85	605	906.8
Fish farming land	-	415	-	913	3,153.6
Salt field	-	59	-	-	188.5
National defense land	-	-	-	765	133.6
Religious land	-	191	-	-	4.0
Cemetery land	-	-	-	8	11.5

Source: ENTEC (January, 1999)

The main economic activities in the survey areas are agriculture, fishing and aquatic farming. About 80 – 90 % of households earn income from agriculture. However, since land in the survey areas is saline, productivity of land is not high. Annual turnover in the survey areas is shown in the following table.

Table 4.4.4 Annual Turnover

Unit: 1,000,000 VND

Item \ Name	My Xuan	Phu My	Phuoc Hoa	Hoi Bai	Vung Tau
Agriculture	25,800	6,000	12,200	11,209	23,267
Fishing and Aquatic Farming	2,900	2,000	1,675	5,025	254,037
Handicraft	10,600	6,000	-	8,703	435,838
Trade and Service	67,300	23,000	-	22,293	2,445,590
Transportation	-	-	-	4,134	902,812
Total	106,600	37,000	13,875	51,364	4,061,544

Source: ENTEC (January, 1999)

According to the statistic results in 1999, collected by the Study Team, monthly average incomes per capita in My Xuan, Phu My, Phuoc Hoa, Hoi Bai are 373,000 - 400,000; 200,000 - 800,000; and 200,000 - 600,000 VND, respectively.

3) Public Welfare

Table 4.4.5 Education

Item \ Name	My Xuan	Phu My	Phuoc Hoa	Hoi Bai	Vung Tau
Number of primary school pupils	2,004	-	2,389	2,521	7,475
Number of secondary school pupils	1,483	2,170	2,005	3,841	44,763
Number of university students	0	-	0	20	532

Source: ENTEC (January, 1999)

Because of the economic difficulties in the survey areas, there is only a part of the local children who can go to school and a few of them can go to university. The average education degree in the survey areas is secondary school graduate.

Table 4.4.6 Medical Treatment Station

Item \ Name	My Xuan	Phu My	Phuoc Hoa	Hoi Bai	Vung Tau
Number of station	1	1	1	1	1
Number of staff	4 Physicians	4 Physicians	2 Physicians	1 Doctor 2 Physicians	27 Doctors 1 Physician
Patients treated per year	Hygienic consultation only	Hygienic consultation only	3,383	2,244	1,478

Source: ENTEC (January, 1999)

Popular diseases in the survey areas were malaria, dysentery, cholera and petechial fever. Recently, the incidence of malaria has been reduced considerably by improvement of medical technique. Other diseases however, still have occurred among children, especially during the transitional seasons.

4) Culture

Table 4.4.7 Religion

Unit: %

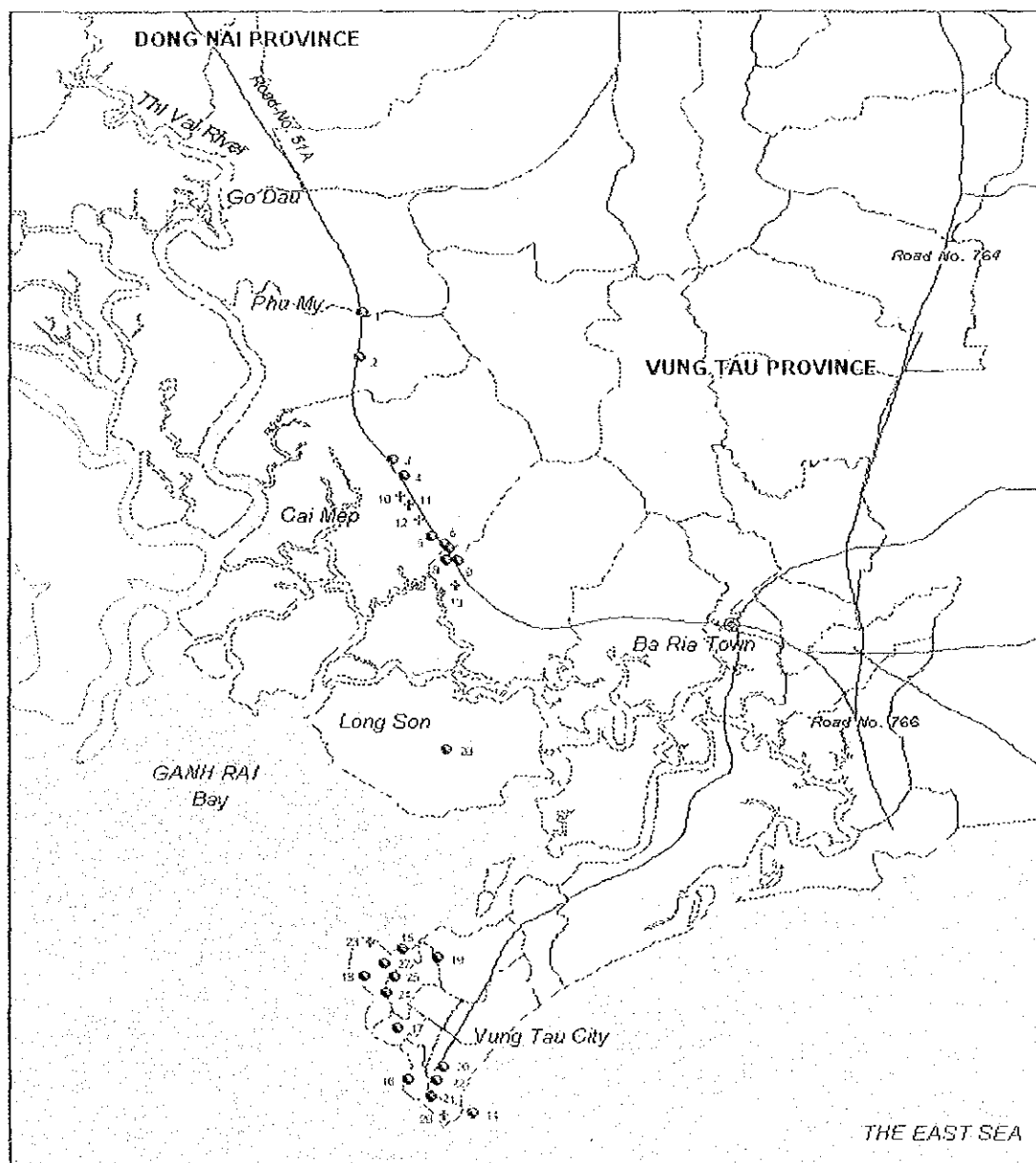
Item \ Name	My Xuan	Phu My	Phuoc Hoa	Hoi Bai	Vung Tau
Buddhism	40	70	40	35	30
Catholicism	25	30	40	60	50
Caodasim	--	--	--	5	--
Others include no religion	35	--	20	--	20

Source: ENTEC (January, 1999)

According to the statistics, most of the inhabitants in the survey areas follow Buddhism and Catholicism.

In the survey areas, mainly along the National Road No. 51, there are about 28 historical relics including pagodas, temples, churches, statues, etc., as shown in Figure 4.4.1.

However, all of the relics have been built since 1975 or later, and any one of them has not been conserved by the government.



Notes:

- | | | | |
|------------------------------|---------------------|--------------------------------|-----------------------------|
| 1. Dai Tang Lam pagoda | 8. Phuoc Hoa temple | 15. Hung Vuong pagoda | 22. Linh Son Co Tu pagoda |
| 2. Ho Phap pagoda | 9. Pho Quang pagoda | 16. Ngoc Bich pagoda | 23. Ben Da church |
| 3. Phap Hoa pagoda | 10. Religious house | 17. Nguyen Nghiem pagoda | 24. Tinh Do Cu Si pure land |
| 4. Dao Trang Phap Hoa pagoda | 11. Hai Son church | 18. Quan The Am Bo Tat pagoda | 25. Thich Ca Phat Dai altar |
| 5. Ho Dai temple | 12. Lam Son church | 19. Thang Nhi communal house | 26. George statue |
| 6. Pho Da temple | 13. Lam Cat church | 20. Thang Tam communal house | 27. Truc Lam monastery |
| 7. Minh Khiet temple | 14. Hon Ba pagoda | 21. Nhat Ban Tinh Xa monastery | 28. Temple of Tron sect |

Figure 4.4.1 Locations of Relics in the Survey Areas

4.4.2 Natural Environment

(1) Topography and Hydrography

The survey areas are located along the Thi Vai River and Ganh Rai Bay, and are divided by the following boundaries.

- Muong Canal, the boundary between My Xuan and Phu My
- Ong Trinh Canal, the boundary between Phu My and Phuoc Hoa
- Ong Ben Canal and Mo Nhat Canal, the boundaries between Phuoc Hoa and Hoi Bai

The Thi Vai River has a length of 76 km and a width of 400 – 650 m, flowing from Long Thanh District (Dong Nai Province), then passing through Chau Thanh district (Ba Ria – Vung Tau Province) and running into the South China Sea at Ganh Rai Bay. The Thi Vai River has a depth of more than 20 m with “U” or “V” shape bed and high slope.

The areas laying between the Thi Vai River and National Road No.51 consist of mud and agricultural land, having the elevations of about CDL+2m to +4m.

The hydrography of the Thi Vai River is mainly influenced by the semi-diurnal tidal regime in the sea. The part of river's basin with low terrain forms a large seawater reservoir when tide is rising.

As the Thi Vai River is affected by the high tidal regime, the transportation of wastes is much affected by the tidal current in the river.

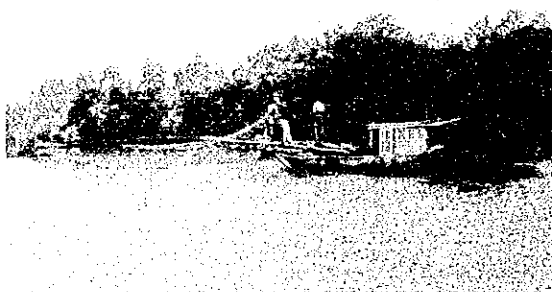
(2) Ecosystem

1) Aquatic Eco-system

The results of recent investigation in the Thi Vai River indicate that the aquatic system includes 46 species of zoobenthos, 27 species of zooplankton, 4 species of larva, 80 species of phytoplankton, 42 species of fish and 19 species of shrimp.

Since the water quality in the Thi Vai River has been polluted due to organic substance discharges from the industrial and human activities, new eco-system which is adoptable to the polluted underwater environment such as *Trachaelomonas armata*, *Leptocylindricus danicus* and *Caetoceros* has been established.

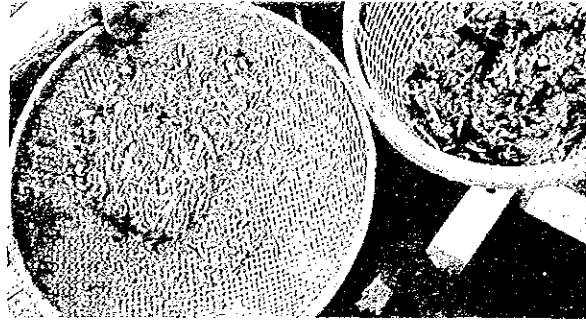
Another possible reason for the degradation in the aquatic eco-system can be a prevailing fishing method in the Thi Vai River.



Fishing Boat in the Thi Vai River

As shown in the right photograph, small boats equipped with fishing nets, which cannot allow releasing small fishes and shrimps have been used for long time.

This kind of fishing method will accelerate the degradation of fishery productivity in the Thi Vai River.



Fishes and Shrimps from the Thi Vai River

2) Mangrove Swamps

As mentioned in Clause 4.2, mangrove swamps lie between the Thi Vai River and National Road No.51 in the Thi Vai / Cai Mep survey area.

According to the survey results carried out by Environmental Technology Center (ENTEC) and Sub-Institute of Ecology and Biological Resources from August 1998 to January 1999, the vegetation in the survey area is:

- Total number of vegetation species are 24, including 11 families and 17 lines
- All families are representatives of mangrove forest
- Structure of vegetation are 4 species of bush trees, 17 species of wood trees and 2 species of herbaceous plants
- All kinds of plants are wild crop
- 7 species have been utilized as timber, fire wood, etc.

During this survey period, no animals and plants protected by regal documents mentioned in 4.3.5 were found in the survey areas.

Lately in the southern part of Vietnam, the erosion of mangrove swamp due to the waves generated by ships has been reported.

During the field survey work along the Thi Vai River, a lot of falling mangroves due to such waves were observed by the Study Team.

Typical example of the erosion is shown in the right photograph.



Falling Mangroves along the Thi Vai River

3) Can Gio Mangrove Biosphere Reserve

Being separated by the Thi Vai River and Ganh Rai Bay, the survey areas face Can Gio district (a district of HCM City).

In the southern part of the district, about 20 km apart from the survey areas, there is an environmental protected area (75,740 ha) which was designated by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) as the Can Gio Mangrove Biosphere Reserve in January 2000.

Although this reserve is not included in the survey areas and thought that the project activities hardly affect the reserve, a member of the Study Team visited the Can Gio District People's Committee Management Board for Protection (direct managing board of the reserve) in order to collect the information on the natural environmental conditions in the surrounding areas.

Director of the board explained the present state of the reserve as follows:

- There is Lan Vien Natural-Park managed by HCM Tourist Company. It welcomed 200,000 visitors for tourism in the year 2000.
- Mangrove deforestation for shrimp farming and animal hunting are prohibited.
- Recently continuous effort has been exerted such as application of new farming technique for protection of ecosystem and environment, mangrove forestation and construction of stone dyke for erosion control along the coastline.
- Solid waste, wastewater and bad smell discharged from private house and food processing enterprise are affecting on environmental quality.

The ecosystem in this reserve can be summarized as follows.

Flora

Flora system mainly consists of the followings:

- a) Mixed forests, mainly consists of the species of bamboo, which are being exploited.
- b) Mangrove forests of symbolic communities such as *Avicennia alba*, *Sonneratia alba*, *Avicennia officinalis*, *Rhizophoraceae*, *Rhizophora mucronata*, *Avicennia lanata*, *Lumnitzera racemosa*, *Phoenix padulosa*, *Acrosticum aureum*, *Sonneratia caseolaris*, *Nypa fruticans*, typically distributed in the tidal and low land areas.

There are no plant species subject to the laws or regulations of protections.

Fauna

- a) Vertebrate animals:

There are 337 species of vertebrate animals, including 137 species of fish, 9 species of Amphibians, 31 species of Reptilians. Among the Reptilians, 11 species have been listed in the Vietnamese Red Book as shown in Table 4.4.8.

Table 4.4.8 List of Reptilian subject to Laws or Regulation of Protection

No	Name	Scientific name	Threaten level
1	Tockay	<i>Gekko gekko</i>	T
2	Water Monitor	<i>Varanus salvator</i>	V
3	Burmese Python	<i>Python molurus</i>	V
4	Reticulated Python	<i>Python reticulatus</i>	V
5	Banded Krait	<i>Bungarus fasciatus</i>	T
6	Monocellate Cobra	<i>Naja naja</i>	T
7	King Cobra	<i>Ophiophagus Hannah</i>	E, PB01 – I
8	Green Turtle	<i>Chelonia mydas</i>	E
9	Hawskbill Turtle	<i>Eretmochelis imbricata</i>	E
10	Olive Ridley Turtle	<i>Lepidochelys olivacea</i>	V
11	Salt Water Crocodile	<i>Crocodylus porosus</i>	E, PB01 – I

Note : The threaten levels indicated in Red Books of Vietnam :

E	: Endangered	R	: Rare
V	: Vulnerable	T	: Threatened
PB01 – I	: Rare animals of group I according to Government decree No18/HNBT		
PB01 – II	: Rare animals of group II according to Government decree No18/HNBT		

b) Birds:

There are 130 species within 47 families and 17 geniuses, including 51 species of water birds and 79 species of non-water birds.

The birds listed in Vietnamese Red Book are shown in Table 4.4.9.

Table 4.4.9 List of Birds subject to Laws or Regulation of Protection

No	Name	Scientific name	Threaten level
1	Grey Pelican	<i>Pelecanus philippensis</i>	R
2	Painted Stork	<i>Mycteria leucocephala</i>	R
3	Lesser Adjutant	<i>Leptoptilos javanicus</i>	R
4	Milky Stork	<i>Mycteria cinerea</i>	V
5	Spotted Greenshank	<i>Tringa guttifer</i>	PB01 – II
6	Blak- billed Magpie	<i>Pica pica</i>	E

c) Mammals:

There are 19 species of mammals.

The mammals listed in Vietnamese Red Book are shown in Table 4.4.10.

Table 4.4.10 List of Mammals subject to Laws or Regulation of Protection

No	Name	Scientific name	Threaten level
1	Common Otter	<i>Lutra lutra</i>	T
2	Small-Clawed Otter	<i>Aonyx cinerea</i>	T
3	Fishing Cat	<i>Felis viverrina</i>	R
4	Leopard Cat	<i>Felis bengalensis</i>	PB01 – II

(3) Water and Sediment Qualities

The Thi Vai River flows into Ganh Rai Bay receiving a large amount of discharge from the industrial zones and residential areas. Therefore, the qualities of water and sediment in the River and the Bay should be sensitive indices on the state of pollution in the survey areas.

The previous and surveyed data by the Study Team are summarized as follows.

1) Previous data

a) Thi Vai River

① pH

Influenced by tidal water movement, pH is $\text{pH} > 7.5$ at flood tide, 7.0 or less at ebb tide in the survey area.

② Salinity

Because of small flow-in of basin water and infiltration of seawater due to high amplitude of tide ($> 3.0\text{m}$), salinity at the Thi Vai River is always higher than that at Saigon – Dong Nai river system.

Salt concentration fluctuates from 10 to 21‰. In the upstream, salt concentration is 10 – 16 ‰, or 18‰ at dry season. At Phu My, salt concentration is 30 – 33 ‰ at dry season and 15 – 24 ‰ at rainy season. Thus, if salinity is taken account, the Thi Vai River can be considered as a marine area rooted into mainland.

③ Transparency

Transparency at the Thi Vai River is higher than that at the Saigon – Dong Nai river system ranging from 30 – 120 cm in the rainy season to 170 – 208 cm in the dry season.

④ Suspended solid substances

The concentration of suspended solid substance changes along the river. It is the highest at Go Dau IZ, fluctuating 10 - 40 mg/l at upstream, 60 - 178 mg/l around the areas of Go Dau and Phu My IZs. As near Cai Mep, the suspended solid substance decreases by 13 - 30 mg/l.

⑤ Dissolved oxygen (DO)

The river segment with low DO level ($< 5 \text{ mg/l}$) or high organic concentration extend about 10 km length in summer season along the Thi Vai River. This segment is pushed up toward upstream during flood tide and go down during ebb tide.

⑥ BOD₅

In the dry season, BOD₅ along the Thi Vai River fluctuates from 10 to 22 mg/l. In the rain season, it fluctuates from 4 to 16 mg/l. At the areas near Cai Mep estuary, BOD₅ changes depend on the tide. However, this relationship weakens gradually at upper part of the river. The area that records the highest BOD₅ is near Go Dau IZ's discharge point.

⑦ Nutrients (N, P)

The result of annual investigation shows that concentration of total nitrogen increases year by year: 0.32 – 0.81 mg/l in 1997, which increased 4 times in 1989. Concentration of total phosphor also increased similarly. It fluctuates between 0.001 and 0.28 mg/l. The N: P ratio is very high (10 -30 : 1).

⑧ Heavy metals

The concentration of heavy metals in water are as follows:

- Cr: 0.02 – 0.035 mg/l
- Hg: < 0.0002 mg/l
- Pb: < 0.001 mg/l
- As: < 0.005 mg/l

Judging from the Vietnamese Standards for the surface water quality (TCVN 3942-1995 class B), the water quality in the Thi Vai River has not been polluted yet by heavy metals.

The concentration of heavy metals in sediment are as follows:

- Pb: 7 - 55 mg/kg
- Hg: 0.1 – 0.2 mg/kg
- Cr: 38 - 110 mg/kg

⑨ Pesticides

Organic chlor (DDT, Lindan) is discovered with concentration of 6 - 32 µg/kg in sediment and 0.002 – 0.01 ppm in water.

⑩ Oil and grease

Concentration of oil and grease fluctuates 0.11 – 0.16 mg/l, which is lower than standard. However, this becomes higher in the port areas.

⑪ Coliform

The number of coliform at the Thi Vai River fluctuates 900 – 24.000 MPN/100 ml. Areas of high value are Go Dau IZ, port areas and domestic wastewater discharged points.

b) Ganh Rai Bay and Vung Tau Offshore

① pH

Value of pH is stable or fluctuates only 7.9 – 8.1.

② Salinity

Salt concentration at Ganh Rai Bay fluctuates 10 - 25‰ (surface layer) and 21 - 31‰ (bottom layer).

③ Dissolved oxygen (DO)

The dominant values are 7.21 mg O₂/l at surface layer and 5.68 mg O₂/l at bottom layer.

④ Nutrients (N, P)

In Ganh Rai Bay, in surface layer, the concentration of total organic nitrogen and total phosphor in the summer season is 198.2 $\mu\text{g-atm/l}$ and 34.6 $\mu\text{g-atm/l}$, respectively. The concentration of total organic nitrogen in the rainy season is 243 $\mu\text{g-atm/l}$ and total phosphor is 18.4 $\mu\text{g-atm/l}$.

⑤ Oil and grease

In general, oil content in Vung Tau offshore does not vary much, although oil exploiting at the southeastern marine area has been developed. At 17 points, the concentration of oil was 0.030–0.100 mg/l in 1982, 0.010–0.170 mg/l in 1983, 0.07–0.12 mg/l in 1994 (investigated by Russian oil investor).

At Vung Tau – Binh Chau offshore, the seawater always contains oil substance. The concentration of oil at these areas is high, especially in December. At Thuy Van beach, the annual average concentration of oil is 0.09 mg/l and the largest is 0.16mg/l. The concentration of oil increases in the summer season and decreases in rain season. Oil pollution mainly caused by the activity of ships, ports and industrial wastes.

2) Surveyed data by the Study Team

In order to collect the data on the present qualities of water and sediment in the survey areas, field survey was carried out at 10 points in Thi Vai / Cai Mep survey area, and 5 points in Ben Dinh-Sao Mai survey area in May 2001.

The sampling points were selected as shown in Figure 4.4.2, in consideration of the configuration of waterside, location of structures on land, water depth, location of previous survey, etc.

The water samples were collected from three layers (1.0 m below surface, middle and 1.0 m above bottom) and sediment were collected from bed then kept in cool boxes appropriately for its transportation to the laboratory.

In order to detect several discharges from the land area, sampling of river water was carried out during the ebb tide period.

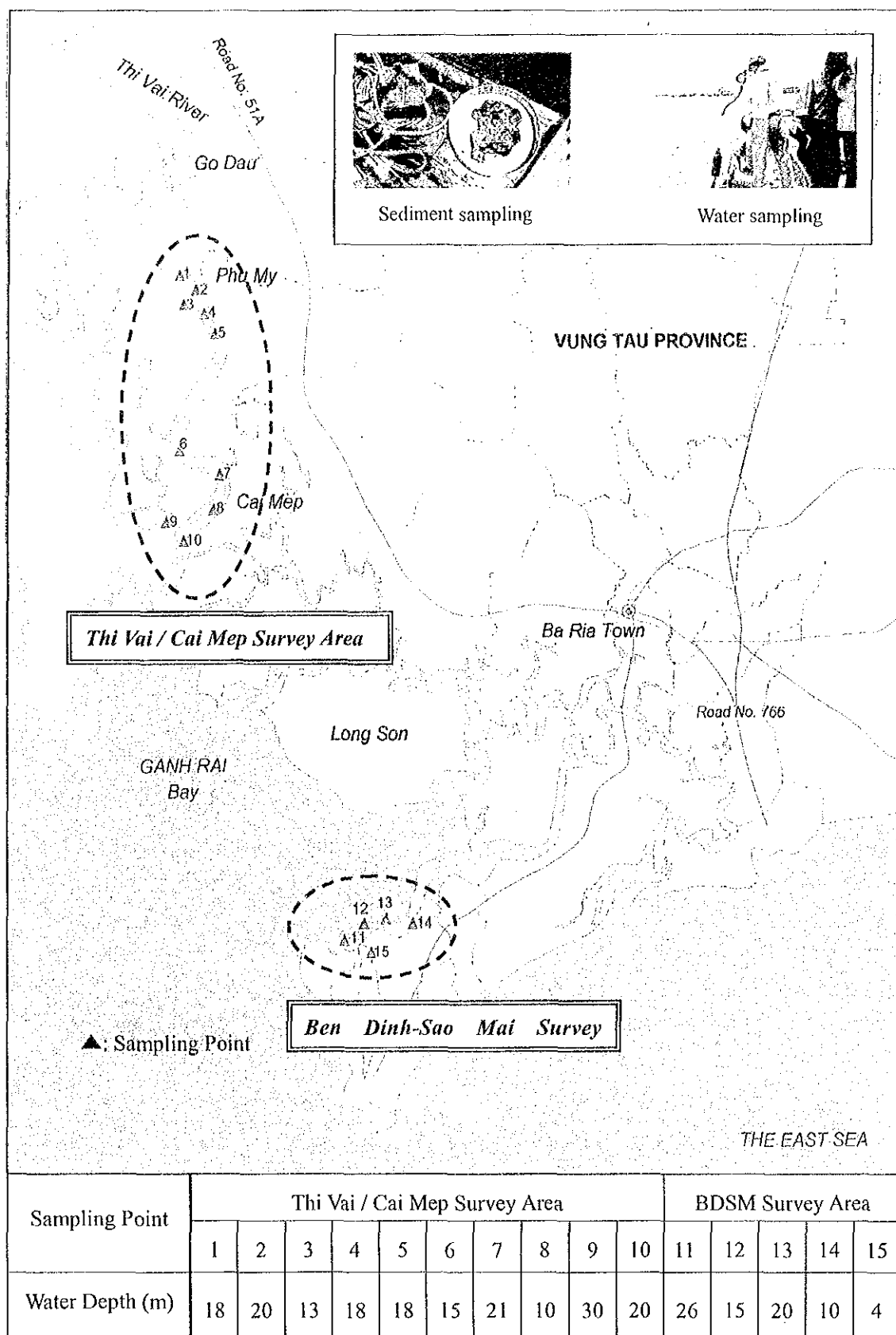


Figure 4.4.2 Locations of Sediment and Water Quality Survey

All results of the field measurements and laboratory tests conducted on sediment and water quality are summarized in Table A4.4.1 and 2.

After evaluation of the results in the tables, current conditions of sediment and water quality in the survey areas can be described as follows.

① Sediment quality

The lack in Vietnam of environmental codes and standards does not allow quantitative comparisons between the survey results and permissible levels.

However, all values of the results are smaller than the Clark Values, which are known as the possible range of contents that normally exist in the nature.

② Water quality

The results of Thi Vai and Ben Dinh-Sao Mai survey areas were compared with the Vietnamese Standard values of “B” category in the Table A4.3.4.5 and “Aquatic Cultivation Area” in the Table A4.3.6 respectively.

All of the results meet Vietnamese Standard except for following two items.

- Coliform contamination

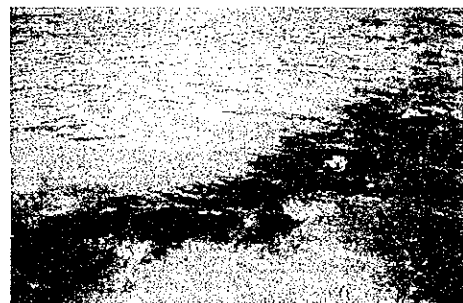
The results of samples collected at the sampling point No. 11, in front of Vung Tau Fising Port exceed the Vietnamese Standard, and are much higher than those of other sampling points.

- Oil and grease contamination of water

The value of oil suspension is not significant. However, at the time of sampling in front of Vung Tau Ship Building Yards, around the sampling point No. 15, oil film is observed frequently.



Vung Tau Ship Building Yards



Observed Oil Film

4.4.3 Maritime Traffic Accidents

Since the survey areas are located in the area receiving an intensive investment in Vietnam, the volume of maritime traffic has increased year by year.

The maritime traffic accidents in recent years, which occurred with oil spilling around the survey areas, are summarized in Table 4.4.11.

Table 4.4.11 List of Oil Spilling Incidents at Ba Ria – Vung Tau

No.	Name of ship	Date	Place happened	Quantity of spilled oil
1	Pan Harvest	09/93	$\varphi = 10^{\circ}15'00\text{N}$ $\lambda = 107^{\circ}18'00\text{E}$	300 t
2	Viking Carrier	10/93	$\varphi = 09^{\circ}50'3\text{N}$ $\lambda = 108^{\circ}07'3\text{E}$	380 t
3	Ham Rong 10	07/94	$\varphi = 10^{\circ}17'00\text{N}$ $\lambda = 107^{\circ}21'00\text{E}$	100 t
4	Lam Son 10	07/94	$\varphi = 10^{\circ}27'00\text{N}$ $\lambda = 107^{\circ}28'00\text{E}$	80 t
5	Phu Quoc 179	07/94	$\varphi = 10^{\circ}33'5\text{N}$ $\lambda = 108^{\circ}43'3\text{E}$	50 t
6	Gigek Extajo	10/95	$\varphi = 09^{\circ}21'07\text{N}$ $\lambda = 107^{\circ}58'00\text{E}$	400 t
7	Andhika Wanadharma	11/95	$\varphi = 07^{\circ}38'00\text{N}$ $\lambda = 107^{\circ}03'00\text{E}$	250 t
8	Sirithorn	11/95	$\varphi = 09^{\circ}46'7\text{N}$ $\lambda = 108^{\circ}09'2\text{E}$	200 t
9	Jenifer	12/95	$\varphi = 08^{\circ}56'00\text{N}$ $\lambda = 106^{\circ}20'00\text{E}$	160 t
10	Memeo Abashidze	12/95	$\varphi = 10^{\circ}16'1\text{N}$ $\lambda = 109^{\circ}41'8\text{E}$	500 t
11	Mearsk Retriever	7/96	Block 04 - 1	80 m ³
12	Formosa One hits Petrolimex 01	7/9/01	Buoy No. 8	900 m ³

Source : Vung Tau Shipyard

Oil pollution is caused by not only the ship accidents, but also the daily shipping activities described below are significant sources of it.

- Oil and bilge water discharged from the bottom of ships that are equipped no oil filter system.
- Popping oil to/from ships, oil can be leaked accidentally or rainwater may bring oil spills into the sea.
- Repairing ships and cleaning machines, oily waste may be thrown into the sea.

Chapter 5 Regional Maritime Trends

5.1 Cambodia

5.1.1 Overview of the Maritime Strategy

Phnom Penh Port and Sihanoukville Port are two major ports for international trade in Cambodia. These two major port authorities are financially independent from the central Government and undertake the majority of port activities. Due to the above, two ports have proceeded their own port development plan in order to improve port-related activities.

The Cambodian Government and the Vietnam Government signed an agreement on the transit of goods in September 2000 in order to develop the economy of two countries. Two countries allow the goods and commodities meant for export to or for import from a third country or for transfer from one locality to others of either country to be transited through the territory of their respective countries.

Based on the above, one Hong Kong company has signed an agreement with the Phnom Penh Port for the exclusive right to operate all containers lift on/lift off at Phnom Penh Port. It will be expected that transporting containers into Phnom Penh Port via Mekong River will create at least a 30% cost saving and 2~3 days time saving compared with the current routing via feeder from Singapore and truck from Sihanoukville. If the above services can be carried out successfully, a decrease in the container cargoes handled at ports in Vietnam may occur.

5.1.2 Phnom Penh Autonomous Port

(1) Administration

Phnom Penh Port, under the Ministry of Public Works and Transport (MPWP), is authorized to operate and administrate the port providing the services of berth allocation, pilotage, tug, cargo handling, delivery, storage and channel dredging. Maintenance dredging volume in Mekong River ranging from Phnom Penh Port to the border with Vietnam is 200,000~300,000m³/year.

(2) Cargo Throughput

Table 5.1.1 shows cargo volume in Phnom Penh Port. Main commodities imported in 2001 are fuel which accounted for 87% of the total, wheat, wheat flour, steel etc, while export commodities are veneer, log and rubber which collectively accounted for 93% of the total. The number of vessel calls in Phnom Penh Port was 820 in 2001, which included 782 international vessels.

Table 5.1.1 Cargo Statistics

(Unit: tons)

Year	Imported Cargo	Exported Cargo	Local Cargo	Total
1996	516,115	40,365	28,281	584,661
1997	485,300	151,148	21,946	658,394
1998	420,332	181,026	18,233	619,591
1999	390,501	57,683	10,513	458,697
2000	407,358	51,193	9,428	467,979
2001	462,473	33,684	7,165	503,322

Table 5.1.2 shows container cargo volume for the past decade in Phnom Penh Port. Due to the commencement of container handling in Sihanoukville Port, container cargo handling at Phnom Penh Port has been kept falling less than 1,000 tons for the past decade except year 1999.

Table 5.1.2 Container Statistics

(Unit: tons)

Year	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Cargo	816	68	163	129	7	0	0	1,306	0	156

(3) Facilities

Table 5.1.3 shows Major Facilities in Phnom Pen Port.

Table 5.1.3 Major Facilities in Phnom Pen Port

Port No.1	
-Berth length	300m
-Draft	5.2m(Rainy season), 4.2m(Dry season)
Mobile Cranc	(6.5T-70T) x 17 Units
Forklift	(2T-25T) x 18 Units
Truck & Trailer	(10T&24T) x 23 Units
Storage facilities	11 Warehouses (3,455m ²), Container yard (6,100m ² +3,800m ² for empty container),
Handling capacity per day	1,200 tons/day for Port No.1

(4) Port Development

Phnom Penh Port Autonomous has prepared "Five Years Plan (2003-2008)" in 2002 to improve the present situation of Phnom Penh Port. Five Year Plan has been formulated as follows;

- to improve administrative management efficiency and encourage human resources training
- to establish laws and regulations on public enterprise policy
- to exchange experience with other Asian countries on technical and business aspects
- to invest in loading/unloading and dredging equipment by formulating joint venture with private companies
- to establish development planning such as construction of new ports and rehabilitation of existing ports

Phnom Penh Port Autonomous forecasted future cargo volume and ship's movement as shown in Table 5.1.4 and 5.1.5 respectively.

Table 5.1.4 Future Cargo Forecast in Phnom Penh Port

(Unit: tons)

Year	Import	Export	Local Cargo	Fuel	Total
2003	163,500	78,000	11,500	361,000	614,500
2004	179,000	86,000	12,500	368,000	645,500
2005	196,000	94,000	13,500	371,000	674,500
2006	205,000	98,500	15,000	378,000	696,500
2007	215,000	103,000	16,500	383,000	717,500
2008	227,000	108,000	17,500	388,000	740,500

Table 5.1.5 Future Ship's Movement in Phnom Penh Port

(Nos. of Vessel)

Year	Foreign barge	Domestic barge	Local boat	Tanker	Total
2003	270	45	285	560	1,160
2004	280	50	310	570	1,210
2005	287	55	330	575	1,247
2006	300	62	350	585	1,297
2007	306	65	380	590	1,341
2008	315	70	400	600	1,385

5.1.3 Sihanoukville Port

(1) Administration

Port Authority of Sihanoukville (PAS) is a Public Enterprise Entity, which is primarily responsible for services related to offloading, loading, storage and delivery of cargoes. PAS is led by the board of Directors which consists of 7 members from Ministries concerned appointed by the Head of the Royal Government. There are 1,047 workers and employees in the port.

(2) Cargo Throughput

Table 5.1.6 shows cargo volume in Sihanoukville Port, where 1,763,593 tons were handled in 2001. The total cargo volume has increased from 1996 to 2001 at an average annual growth rate of 19%. Major commodities are cement, steel, salt and rice for import, and sawn timber and wood processing for export in 2001. The number of vessel calls at Sihanoukville Port was 825 in 2001, which included 471 container vessels.

Table 5.1.6 Cargo Statistics

(Unit: tons)

Year	Imported Cargo	Fuel (Imported)	Exported Cargo	Total
1996	546,066	90,516	104,421	741,003
1997	506,538	146,254	141,485	794,276
1998	521,735	223,774	139,442	884,950
1999	751,051	256,935	132,956	1,140,942
2000	1,185,286	301,602	154,877	1,641,765
2001	1,232,639	362,522	168,433	1,763,593

Container cargo has been handled in Sihanoukville since 1992. Container cargo of 145,292 TEUs was handled in 2001. The average annual growth rate of containers was 21% from 1996 to 2001. Major commodities in containers are consumer goods, electric household appliances, motorbikes, used cars, cigarettes, clothes & textile and so on. Major countries for container trade are Singapore and Thailand.

Table 5.1.7 Container Statistics

(Unit: TEUs)

	1996	1997	1998	1999	2000	2001
(Import)	28,929	30,732	37,250	50,289	65,811	72,741
-Full	28,929	30,732	37,250	44,163	57,303	60,181
-Empty	0	0	0	6,126	8,508	12,560
(Export)	26,805	30,258	34,339	44,571	64,624	72,551
-Full	4,544	9,007	13,118	17,454	26,287	33,391
-Empty	22,261	21,251	21,221	27,117	38,337	39,160
Total	55,734	60,990	71,589	94,860	130,435	145,292

(3) Facilities

Table 5.1.8 shows Major Facilities in Sihanoukville Port.

Table 5.1.8 Major Facilities in Sihanoukville Port

Old Port	
-Quay length	580m
-Draft	8.5m
-Warehouse	2 nos.
-Open Storage	12,000m ² + 35,000m ²
New Quay	
-Quay length	350m
-Draft	7.5m
-Warehouse	3 nos.
-Container yard	24,000m ² + 25,000m ²
Supper stackers	(7.5T&45) x 5 Units
Shore Crane	(10T-80T) x 8 Units
Forklift	(5T-50T) x 10 Units
Truck & Trailers	10 Units & 15 Units

(4) Port Development

To cope with the rapid increase of cargo volume, especially containerized cargo, in Sihanoukville Port, PAS plans to develop two major targets:

- In early 2004, PAS will have additional berthing facilities of 240m long and 9.5m deep. These facilities include 6.5 ha of container yard with 2 units of gantry cranes and other handling equipment for container services,
- In order to realize a port with international standards in the region and to increase additional volume of cargo throughput, PAS plans to develop a free trade zone within port development area. In first stage, an area of 50 ha will be developed while an area of 41 ha will be developed in the second stage.

5.2 Thailand

5.2.1 Overview of the Maritime Strategy

The Privatization Plan by the Port Authority of Thailand (PAT) is to promote competitiveness, increase efficiency of port services and reduce the government investment. Under the Plan, the business units and a holding company will be set up in the year 2002. The holding company will be listed on the stock exchange in 2004. Since 1997 PAT has been preparing for privatization. Once the privatization process is complete, the authority will consist of 4 agencies, namely the PAT/SRO, Bangkok Port Plc, Laem Chabang Port Plc and the PAT Holding.

In order to meet the future demand, the Laem Chabang Port Development Phase 2 with 6-8 terminals has been undertaken. The first terminal (C3) with capacity of 0.6 million TEUs/year was completed and is under the process of selecting the operator. Other Terminals are planned to be constructed and managed by BOT. These terminals can accommodate Post Panamax size vessel of 80,000 DWT with the capacity of 4,700 TEUs. After completion of the Phase 2, Laem Chabang Port's capacity will increase to more than 5 million TEUs/year.

LCP may aim at being not only a gateway of Thailand but also a hub port to distribute the cargoes to neighboring countries of Indochina and inner land of South China in future.

5.2.2 Administration

PAT is a state enterprise under the general supervision of the Ministry of Transport and Communication. It was established in 1951 to conduct the services of dredging and installing navigation aids in the port area, to provide services and facilities for the inbound and outbound vessels, and for loading and unloading of cargoes, cargo storage and delivery. In addition, PAT also functions to make supportive infrastructure available for the constant growth of export and import industry in particular and of national economy in general.

PAT currently manages two ports, the Bangkok Port and the Laem Chabang Port. Therefore, PAT can control cargo movement in Bangkok area unitarily, especially city traffic in Bangkok.

5.2.3 Bangkok Port

(1) Cargo throughput

Table 5.2.1 shows cargo volume in Bangkok Port, where 13,359,301 tons were handled in 2001. The total cargo volume has been sustained since 1998 with a volume of about 13 million tons. Major commodities are metal & steel, chemical products, machinery and plastic & rubber product for import, and vegetable products, textile products and plastic & rubber products for export in 2001. The number of vessel calls at Bangkok Port was 2,470 in 2001.

Table 5.2.1 Cargo Statistics

	(Unit: tons)				
	1997	1998	1999	2000	2001
(Import)	8,004,205	5,317,722	5,621,043	6,111,453	5,919,271
-Containerized	4,722,382	3,459,171	3,731,080	4,104,005	4,107,712
-General	3,281,823	1,858,551	1,889,963	2,007,448	1,811,559
(Export)	6,696,833	7,605,776	7,224,001	7,136,724	7,440,030
-Containerized	6,696,833	7,325,356	7,064,069	7,029,603	7,311,695
-General	0	280,420	159,932	107,121	128,335
Total	14,701,038	12,923,498	12,845,044	13,248,177	13,359,301

Container cargo volume is shown in Table 5.2.2. The number of handled containers has been maintained at about one million TEUs since 1997, based on the government policy.

Table 5.2.2 Container Statistics

	(Unit: TEUs)				
	1997	1998	1999	2000	2001
Inward	547,666	531,693	498,867	512,414	508,030
Outward	551,339	582,063	553,699	561,103	561,530
Total	1,099,005	1,113,756	1,052,566	1,073,517	1,069,560

(2) Facilities

Table 5.2.3 shows details of Berthing Facilities in Bangkok Port.

Table 5.2.3 Berthing Facilities in Bangkok Port

Name of Berth	Length(m)	Number of Berth	Water Depth(m)
East Quay for Container	1,528	8	8.23/4.57
West Quay	1,660	10	8.23
Klong Toey Dolphin	1,400	36	8.23
Bang Hua Sua Dolphin	1,520	25	7.62
Mooring Buoy	1,580	5	7.00

Table 5.2.4 shows details of Storage Facilities in Bangkok Port.

Table 5.2.4 Storage Facilities

Storage Area	Inside(m2)	Outside(m2)	Yard(m2)	Total(m2)
Transit Sheds(1-8)	37,120	59,553		96,673
Transit Sheds(9,11,13-17)	42,380	57,970		100,355
Additional Transit Sheds(4-5)	4,000			4,000
Open Yard for Stuffing			99,103	99,103
Empty Container Yard			98,235	98,235
Intransit Warehouse	7,800	18,324		26,124
Bonded Warehouse	6,434			6,434
Overtime Cargo Warehouse	11,400	1,200		12,600
Vehicle Warehouse	6,270	600		6,870
Dangerous Cargo Warehouse	2,204		10,698	12,902
Container Terminal 1			98,600	98,600
Container Terminal 2			49,000	49,000
Total	117,608	137,652	355,636	610,896

Table 5.2.5 shows details of Cargo Handling Equipment in Bangkok Port.

Table 5.2.5 Cargo Handling Equipment

Equipment	Capacity(Tons)	Quantity
Rail-mounted Shoreside Crane	32.5-40	14
Rubber Tyred Gantry Crane	30-40	36
Top Loader	40	35
Empty Container Reach Stacker	7	25
Mobile Crane	10/50	10
Tractor for Container	30-40	154
Container Chassis	30/45	151
Tractor for Trailer	30/20/5.7	9
Towing Tractor	10/5	28
Multi Purpose Trailer	5.7	11
Forklift	Various	222
Motor Truck	5.7	45

(3) Port Development

Bangkok Port has developed and modified a number of services in order to bring the efficiency of its services up to international standards, as follows:

- The port has introduced one-stop on-line services for the submission of service fee documents at a single point at the Revenue Division,
- The port has developed the ISO 9002 system in its services at the Help Desk for Port Users and dangerous cargoes services,
- The port abolished the requirement for Bank Guarantee for certain kinds of bonded cargoes,
- The port has installed a closed circuit television system at container service terminals 1-2 in order to ensure that the transfer of goods meets international safety standards.

In addition, following developments have been also planned by the port;

- Land use and land development such as a cold room, container yards, a CFS, bonded warehouses and other port related facilities with participation from private investors,
- The procurement of a number of handling equipment such as forklift, trucks, side shifters, rubber tired gantry crane etc,
- The development of information systems for staff training, management, marketing and public relations.

5.2.4 Laem Chabang Port

(1) Cargo Throughput

Table 5.2.6 shows cargo volume in Laem Chabang Port, where 19,995,740 tons were handled in 2001. The total cargo volume has increased from 1998 to 2001 at an average annual growth rate of 16%. Major commodities are machinery, electronic products, chemical products and IC base for import, and computer products, textile products, IC, rice and transportation equipment for export in 2001. The number of vessel calls at Laem Chabang Port was 5,133 in 2001 which included 3,676 container vessels.

Table 5.2.6 Cargo Statistics

(Unit: x1,000tons)				
Item	1998	1999	2000	2001
(General Cargo)				
Import	192	109	63	59
Export	1,005	710	1,135	1,310
Total	1,197	820	1,197	1,368
(Containerized Cargo)				
Import	4,009	5,013	5,979	6,767
Export	8,547	10,635	11,784	13,162
Transshipment	147	101	141	67
Total	12,703	15,748	17,904	19,996

Table 5.2.7 shows Container Statistics. Container cargo volume has rapidly increased at an average annual growth rate of 17.5% from 1998 to 2001.

Table 5.2.7 Container Statistics

(Unit: TEUs)				
	1998	1999	2000	2001
Import	690,016	841,974	1,019,488	1,146,194
Export	719,123	898,050	1,057,745	1,160,839
Transshipment	15,563	15,843	28,029	5,406
Total	1,424,702	1,755,867	2,105,262	2,312,439

(2) Facilities

Table 5.2.8 shows details of Berthing Facilities in Laem Chabang Port.

Table 5.2.8 Berthing Facilities in Laem Chabang Port

Terminal	Length (m)	Water Depth (m MSL)	Function
A-1	365	14	Passengers/RO-RO
A-2	400	14	Multi-purpose
A-3	350	14	Multi-purpose
A-4	350	14	Agri-bulk
A-5	225	14	Coal and General Cargo
B-1	300	14	Container
B-2	300	14	Container
B-3	300	14	Container
B-4	300	14	Container
B-5	400	14	Container
A0	250	10	Coastal

Table 5.2.9 shows details of Cargo Handling Equipment in Laem Chabang Port.

Table 5.2.9 Cargo Handling Equipment

Type	Capacity	Number
Gantry Crane	40t&35t	16
Transtainer	41t&40t	31
Reach Stacker	45t-8t	25
Top Loader	30.5t-8t	9
Container Shifter		1
Mobile Crane	50t&40t	2
Forklift	6t-2.5t	51
Yard Tractor		102
Trailer/Chassis	45FT&40FT	126
Flat Bed Semi-Trailer		4
Motor Truck	6T	9
Spreader	20'/40'	6
Container Ramp		3
Total Pallet		200

(3) Port Development

The cargo volume to be handled at Laem Chabang Port (LCP) will substantially increase in the future and soon exceed the existing capacity of LCP due to the following reasons;

- Rapidly increasing volume of Thailand's total sea transport requirement,
- Constrained capacity of Bangkok ports due to limited availability of berth and congested land transport infrastructure,
- Limited suitability of Bangkok ports for large vessels due to limitation of navigability (maximum vessel draft 8.2m).

In order to meet the future cargo demand until Year 2018, LCP has set out a Master Plan including Phase 2 and Phase 3 development. Under Phase 2 development, six container terminals and a passenger terminal with total length of 4,100m are to be constructed until Year 2008. Table 5.2.10 shows a step-wise development plan for Phase 2.

Table 5.2.10 Phase 2 Development Plan

Phase Development	Stage 1	Stage 2	Stage 3	Stage 4
Year to be completed	2000	2002	2006	2008
No. of Terminals	1 (C3)	2 (C2 & C1)	1 (D3)	2 (D1 & D2)
Total Berth Length (m)	500	1,200	500	1,200
Water Depth (m MSL)	16	16	16	16
Size of Terminal (m2)	500x450	500x450/700x450	500x450	500x450/700x450

Upon the completion of Phase 2 development in 2008 and Phase 3 development in 2018, LCP annual capacity will be boosted to 5 million TEUs and 8.5 million TEUs respectively. Double track railway and highway network development also will be considered in the future development program.

5.2.5 Inland Container Depot (ICD) at Lat Krabang

ICD at Lat Krabang is one of the largest logistics centers in Thailand where the eastern seaboard at Laem Chabang Port is linked by rail and road. The ICD is located 113 km from Laem Chabang Port, 38 km from Bangkok Port and a few kilometers from New International Airport, which will open in 2005. This logistics centers is fully equipped with modern CFS/CY facilities, control gate, office building, workshop, integrated computerized system and customs office.

(1) Background

Consequent to government Policy to ease up the notorious Bangkok traffic congestion, especially heavy congestion inside Bangkok, a big public ICD was planned and assigned to SRT (State Railway of Thailand) as supporting facility and promotion for the Laem Chabang Commercial Port. The total land used for ICD project is 960,000 m² and there are altogether 6 various size ICD Terminals.

It is the Government's policy to have private sector participation in the container cargo handling services to the greatest extent practicable in order to ensure economic efficiency. The ICD was constructed in October 1995 and ready for inauguration in April 1996.

(2) Facilities

The ICD has six container depots and each depot is furnished with a container yard, a office building, parking spaces etc. A handling volume of 800,000 TEUs per annum might be achieved by further development, while handling capacity for container cargoes was planned with 400,000 TEUs per annum.

Four Railways of 1,200 m in length have been laid inside ICD and linked to Laem Chabang Port. Railway services to Laem Chabang Port consist of 11 round trip per day and 68 TEUs per trip (34 wagons).

The ICD has been managed by SRT and each depot is operated by private sectors, which entered a leasing contract with SRT. Leasing income of approx. 60 million USD will be obtained by SRT up to 2006.

(3) Cargo Throughput

Table 5.2.10 shows Cargo Throughput at ICD. Cargo volume has rapidly increased with an average annual growth rate of 33%.

Table 5.2.11 Cargo Throughput at ICD

(Unit: TEUs)

	1997	1998	1999	2000	2001
(ICD)					
- Railway	174,000	231,000	291,000	297,000	262,000
- Road	117,000	206,000	291,000	521,000	651,000
- Total	291,000	437,000	582,000	818,000	913,000
(Laem Chabang Port)	1,036,000	1,425,000	1,756,000	2,200,000	2,312,000
Ratio of Utilization	28 %	31 %	33 %	37 %	39 %

Due to the rapid increase of handling cargoes, SRT plans to extend the ICD by 70 ha.

5.3. Conclusion

(1) Maritime Trends at the Ports in Asian Region

Malaysia is located along the east-west trunk shipping route. Consequently, 95% of Malaysia's trade relies on maritime transportation. Primary products and industrial products account for rapid increase of container throughput in Malaysian ports. Responding to the demand growth, large-scale port development is underway in some ports, such as Port Klang, Port Penang, Port of Tanjung Pelapas (PTP) as a new container hub port and so on. PTP is one-hour drive from Singapore with an excellent highway access linking PTP with various destinations in Malaysia and Thailand. Recently Maersk-Sealand and Evergreen shifted their container cargo handling bases from Singapore to PTP. This means that PTP has become a threat to Singapore as an alternative container hub in Southeast Asia.

In addition, Thailand and Indonesia also plan to develop deep sea ports with a depth of 15-16m. These countries are seeking to become regional hub ports in Asia by developing sufficient port and port-related facilities. This will increase competition among ports in the region.

These countries have the advantage of possessing solid base cargo volumes which allow them to maintain stable cargo throughput without relying on transshipment cargoes. On the other hand, a port with a high transshipment rate like Port of Singapore may suffer from unstable cargo throughput in future.

(2) Port Management System

PAT in Thailand currently manages two ports, Bangkok Port and Laem Chabang Port. This enable cargo movement at ports to be controlled unitarily. Consequently, cargo volume in the Bangkok Port has been reduced and traffic congestion in the city has been dramatically

curbed, while Laem Chabang Port has been rapidly developed as a regional hub port to supplement the constrained capacity of Bangkok Port.

The two major ports in Cambodia, Phnom Penh Port and Sihanoukville Port, are financially independent from the central government. They have proceeded with their own development plans in order to improve their own port-related activities. This may make it difficult to conduct port management in a comprehensive manner.

Considering the above, it is desirable to establish one single port management body under the Port Authority system in order to manage ports efficiently. In addition, a port management body should manage activities of each port carefully after due consideration of its role as an inland port or an outer port for a city.

(3) Establishment of Transportation Network

In Thailand, a big public ICD was planned as supporting facility for Laem Chabang Port. The eastern seaboard at Laem Chabang Port has been linked to the ICD by rail and road. Forty percent of the total container cargo has been handled by railway.

There are Free Trade Zones linked by road to ICD linked in the suburbs of Phnom Penh. Traffic congestion is still a big obstacle that hampers efficient transport between Free Trade Zones/ICD and the Sihanoukville Port.

Strong cooperation among the gateway port, ICD, the industrial zones and railways is indispensable in order to establish a well-conditioned transportation network especially for container cargo transportation.

(4) Practical Use of International Inland Water Transportation

The Cambodian Government and the Vietnam Government signed an agreement on the transit of goods in September 2000 in order to develop the economies of the two countries. This will enable practical use of infrastructure connecting the two countries, especially international road and inland waterways in the Mekong Delta.

It is expected that development of physical distribution between Cambodia and Vietnam will contribute greatly to the economic growth in this region. Simplified procedures of custom clearance and pilotage are also necessary to promote regional development.

Chapter 6 Present Condition of Ports

6.1 Overviews of Ports in the South of Vietnam

(1) The Port Groups in the South of Vietnam

Port groups in the South of Vietnam play important roles for the economic development not only in the South of Vietnam but also in all regions of Vietnam. The ports in the SFEA can be divided into three port groups as follows;

HCMC Port Group

Thi Vai Port Group

Vung Tau Port Group

The South of Vietnam, particularly the SFEA is the most developed area in Vietnam in the sense of economic activities. The hinterland of HCMC and Thi Vai-Vung Tau port group is the provinces in Northeast South and the South of Central Highlands. The ports in this area play roles as the junction of the import and export of commodities in the South of Vietnam, as well as serving as the entrance corridor to Cambodia. At present, the cargo from Northeast South and the South of Central Highlands is being transported through the port group of HCMC.

(2) Ho Chi Minh Port Group

The group consists of 28 ports along Saigon, Dong Nai, Nha Be, Long Tau and Soai Rap Rivers, of which 21 ports are specialized ports handling petroleum, wood chip, cement or like shipyard, and the remaining are general ports handling container and general cargoes. Out of seven (7) general ports, four (4) ports, which are Tan Cang, Sai Gon, Ben Nghe and VICT, handled 85 percent out of total general cargo throughput including containers in 2000 in the SFEA ports.

(a) Four Major Ports

	Item	Tan Cang	Sai Gon	Ben Nghe	VICT	Total
1	Number of Berths	5	18	4	2	29
	Total length	706m	2,667m	816m	303m	4,492m
	(Maximum depth)	-9.5m	-11.0m	-10.5m	-10m	-11.0m
	No. of Buoy Berths	2	25	7	0	34
	(Maximum depth)	-10.5m	-13.0m	-9.5m	0	-13.0m
2	Maximum size of Vessel	16000DWT at wharf	30000DWT at wharf	30000DWT	20000DWT	30000DWT at wharf
3	Available cargo storage area	19ha	30ha	28ha	8ha	85ha
4	Main cargo Equipment	Floating 1 RTG 9 Contai.C. 2 Other C. 9	RTG 2 Other C. 27	Mobile C. 7	Container Crane 2 RTG 4	

1) Tang Cang

Ninety percent of total cargoes are containers at this port. The capacity of the port will be reached in the near future. Accordingly, the port has prepared Cat Lai Terminal along the Don Nai River in addition to the existing terminal.

2) Sai Gon Port

There are four (4) terminals: Nha Rong, Khanh Hoi, Tan Thuan and Tan Thuan II Terminals. General and bulk cargoes are handled mainly at Nha Rong, Tan Thuan II Terminals and buoy berths, and container cargo at Khanh Hoi and Tan Thuan Terminals. More than 70 % of the total cargo throughput is general and bulk cargo, and the rest is containers at this port. Main general cargo is bagged cargo such as coffee, rice, fertilizer and cement. About 30 percent of the total cargo throughput is handled at buoy berths.

3) Ben Nghe Port

Cargo throughput in 2000 declined by three (3) percent compared with that in 1999. Sixty percent of the total cargo throughput in 2000 was general cargoes and the rest was containers. Thirty percent of the cargo throughput in 2000 was handled at buoy berths. This port has still enough capacity as far as current cargo throughput is seen, but it is desirable for the port to prepare a container yard and equipment as container storing port.

4) VICT

This port is the only pure container terminal in Vietnam. Based on the current rate of increase container throughput in 2001 is expected to reach 200 thousand TEUs (130 thousand TEUs in 2000). Port capacity will reach the maximum in the near future, unless the yard and berth areas can be expanded.

(b) Other ports

Other general ports such as Tan Thuan Dong Port, Bien Don Port, Vegetable Port and Lotus Ports also are handling general cargoes including liquid cargo, but in 2000, the ports occupied only about five (5) percent of the total cargo throughput of the above four (4) major general ports.

There are many specialized ports along Sai Gon, Nha Be, Dong Nai, Long Tau and Soai Rap River such as Ba Son Shipyard, ELF Gas Sai Gon, VITAICO, PETECHIM, Hiep Phuoc Power Plant, Hiep Phuoc Cement, Phu Dong, Phuoc Khanh and VICO WOCHIMEX Ports.

(3) Thi Vai Port Group

There are three ports along Dong Nai River, which are Dong Nai, SCTGAS-VN and VT GAS Ports and 18 other ports along Thi Vai River. This group consists of Dong Nai River Ports, Go Dau Port Area, Phu My Port Area and Cai Mep Port Area.

At present, in Go Dau Area, a dry cargo berth for 10,000DWT and a liquid cargo berth of 12,000 DWT of VEDAN Port, a specialized berth for 6,500DWT of UNIQUE GAS Port, a 3,000DWT berth of Long Thanh Super Phosphate Factory Port, a 2,000 DWT berth for Go Dau A Port and two (2) berths for 15,000DWT and a berth for 5,000DWT of Go Dau B Port are in operation.

Phu My Area drew the earliest attention of investors among port areas in Thi Vai River, because the river section has a deep riverbed and is able to accommodate ships of 30,000DWT with less investment. A pier for 10,000DWT oil tanker of Phu My Power Plant Port and a pier for 30,000DWT cargo ship of Baria Serece Port (Phu My Port) as the largest bulk port in this area were constructed and are in operation.

Cai Mep Area has a berth length of approx. 4km, river width of greater than 1,000m and riverbed depth of 30m in some sections. VINAFOOD Port and Sai Gon Petroleum Port are currently under construction while LPG Cai Mep Port has been completed.

(4) Vung Tau Port Group

There are five (5) ports along Dinh River inside the Vung Tau Peninsula and five (5) Crude Oil / Gas Fields (Sub Ports), about 63' to 125' off shore such as Bach Ho and Dai Hung Oil Fields. Main ports in Vung Tau are divided into two (2) port areas through Dinh River. One is the area along Cu Lao Channel consisting of PTSC, PTSC Gas Oil, Dau Khi (Vietsovpetro) Ports. Another is the area along Cat Lo Channel. Almost all ports are oil related ports. Other ports are naval.

FIGURE 6.1.1 LOCATION OF PORTS AND RIVER CHANNELS IN
VUNG TAU - THI VAI - HCM CITY AREA

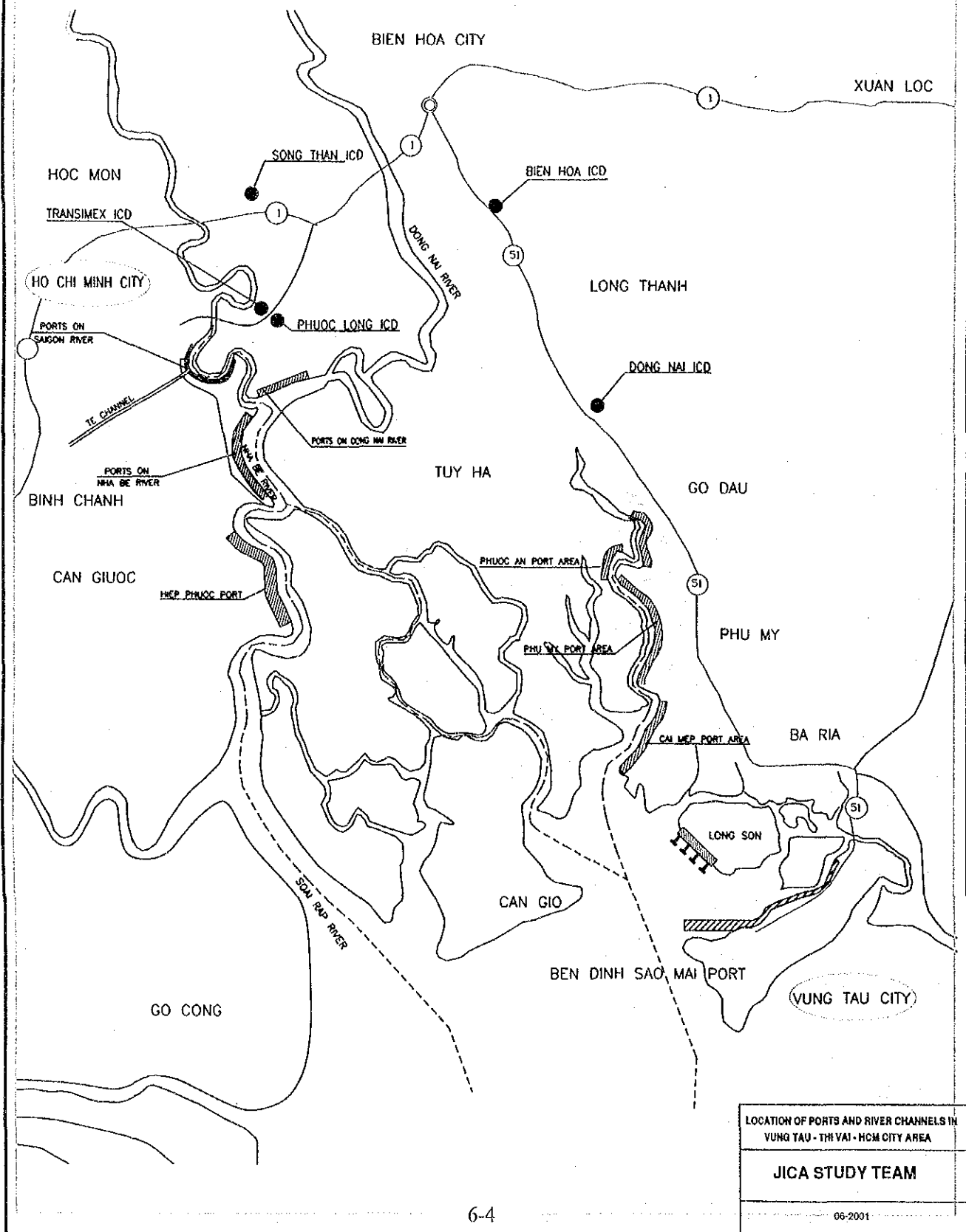
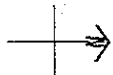
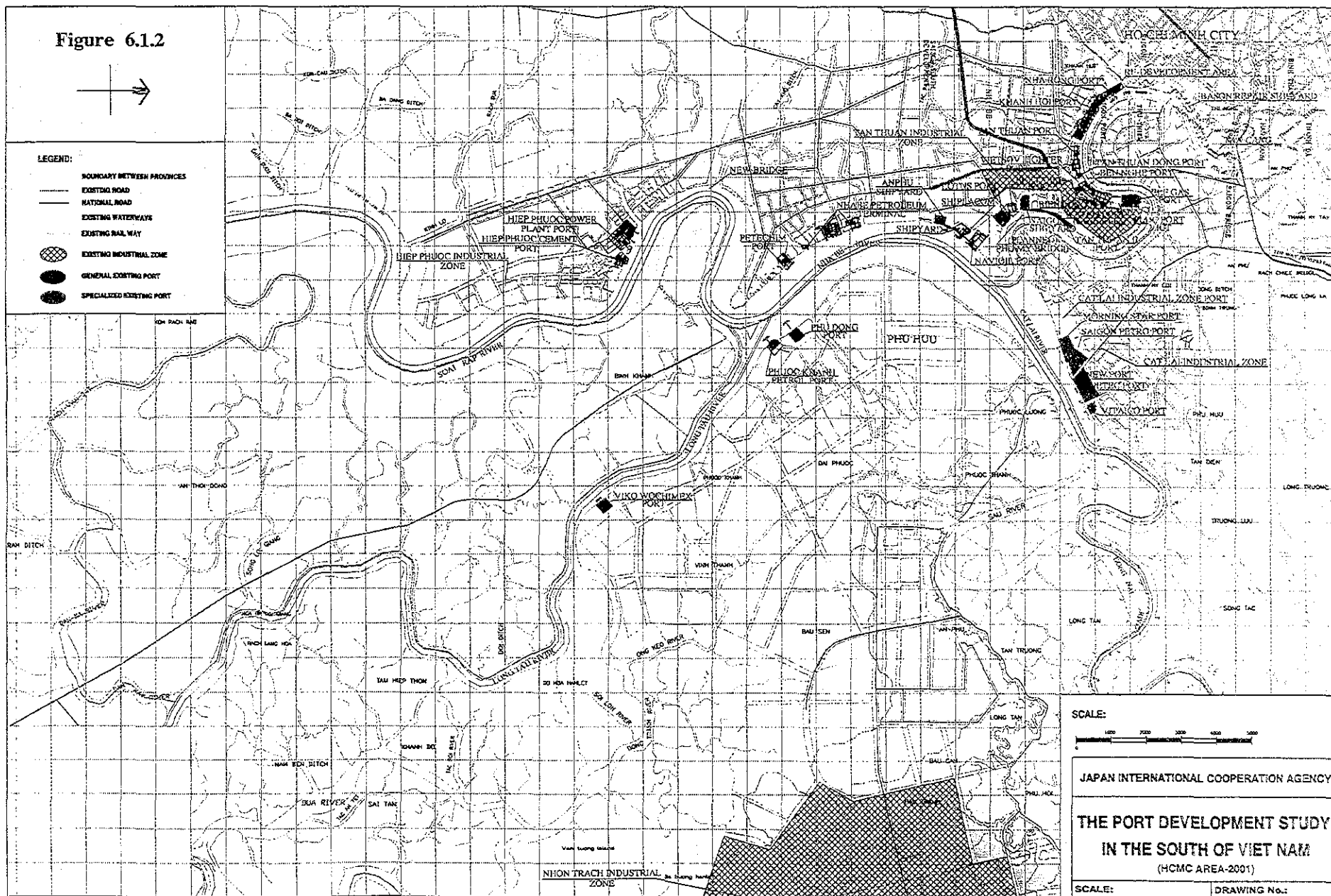


Figure 6.1.2



LEGEND:

- BOUNDARY BETWEEN PROVINCES
- EXISTING ROAD
- NATIONAL ROAD
- EXISTING WATERWAYS
- EXISTING RAILWAY
- EXISTING INDUSTRIAL ZONE
- GENERAL EXISTING PORT
- SPECIALIZED EXISTING PORT



SCALE:



JAPAN INTERNATIONAL COOPERATION AGENCY

THE PORT DEVELOPMENT STUDY
IN THE SOUTH OF VIET NAM
(HCMC AREA-2001)

SCALE:

DRAWING No.:

Table 6.1.1 EXISTING PORTS OF HO CHI MINH CITY PORT GROUP

		PORT NAME	TYPE	SUPERVISING ORGANIZATION	OPERATOR
	PORTS IN SAIGON RIVER				
S-1	NM AN PHU	AN PHU SHIP YARD	SHIP REPAIR	HCMC	
S-2	TAN CANG	NEW PORT	CONTAINER	MINISTRY OF NATIONAL DEFENCE	TAN CANG CO.
S-3	CANG NM BA SON	BASON SHIPYARD	SHIP REPAIR	MINISTRY OF NATIONAL DEFENCE	BA SON FACTORY
S-4	CANG SAI GON	SAIGON PORT	GENERAL	VINALINE	SAIGON PORT
S-5	CANG TAN THUAN DONG	TAN THUAN DONG PORT	GENERAL	MINISTRY OF TRANSPORT	MARITIME SERVICE CO.
S-6	CANG BEN NGHE	BEN NGHE PORT	GENERAL	HCMC	BEN NGHE PORT
S-7	CANG CONTAINER FLDC	VICT PORT	CONTAINER	MINISTRY OF TRADE	FIRST LOGISTICS DEVELOP. CO.
S-8	CANG ELF GAS SAI GON	ELF GAS SAI GON	GAS	HCMC	SAIGON PETROLEUM GAS JV CO.
S-9	TAN THUAN 2	TAN THUAN 2	GENERAL	MINISTRY OF TRANSPORT	SAIGON PORT
S-10	NM TAU BIEN SAI GON	SAIGON SHIPYARD	SHIP BUILDING	MINISTRY OF TRANSPORT	WATER TRANSPORT CORP.
S-11	BIEN DONG	BIEN DONG PORT	FISH	MINISTRY OF AQUA-PRODUCT	
S-12	RAU QUA TAN THUAN DONG	VEGETABLE PORT	VEGETABLES	MINISTRY OF AGR. AND RURAL DEV.	VIETNAM GROCER CORP
S-13	CANG BONG SEN	LOTUS PORT	GENERAL	MINISTRY OF TRANSPORT	BON SEN JV CO.
	PORTS IN DONG NAI (CAT LAI) RIVER				
C-14	CANG SAO MAI	MORNING STAR PORT	CEMENT	MINISTRY OF CONSTRUCTION	SAO MAI CEMENT
C-15	CANG SAI GON PETRO	SAIGON PETRO PORT	PETROLEUM	HCMC	SAIGON GAS AND OIL CO.
C-16	TAN CANG CAT LAI	NEW PORT CAT LAI TERMINAL	GENERAL	MINISTRY OF NATIONAL DEFENCE	TAN CANG CO.
C-17	CANG DAU PETEC CAT LAI	PETEC CAT LAI OIL TERMINAL	PETROLEUM	MINISTRY OF TRADE	PETECO CO.
C-18	CANG VITAICO	VITAICO PORT	WOOD CHIPS	HCMC	VITAICO JV
	PORTS IN NHA BE RIVER				
N-19	DAU THUC VAT	NAVIOIL	PLANT OIL	MINISTRY OF AGR. AND RURAL DEV.	VIETNAM COSMETIC PERFUME
N-20	SHIP MARINE(LACOM)	SHIP MARINE(LACOM)	SHIP BUILDING	HCMC	AN PHU SHIP BUILDING CO.
N-21	TANG KHO XANG DAU NHA BE	NHA BE PETROLIUM TERMINAL	PETROLEUM	VIETNAM PETROL	SECONDARY PETROLEUM CO.
N-22	CANG PETECHIM	PETECHIM PORT	PETROLEUM	VIETNAM PETROL	PETECHIM
N-23	NH TAU BIEN NAM SAI GON	SAIGON SOUTH SHIPYARD	SHIP BUILDING	MINISTRY OF TRANSPORT	
	PORTS IN LONG TAU RIVER				
N-24	CANG PHU DONG	PHU DONG PORT	WOOD CHIPS	DONG NAI PROV.	PHU DONG Co.
N-25	CANG PHUOC KHANH	PHUOC KHANH PORT	WOOD CHIPS	DONG NAI PROV.	
N-26	CANG VICO WOCHIMEX	VICO WOCHIMEX PORT	WOOD CHIPS	DONG NAI PROV.	WOOD CHIPS EXPORT Co.
	THE PORT IN SOAI RAP RIVER				
H-27	DIEN HIEP PHUOC	HIEP PHUOC POWER PLANT PORT	PETROLEUM	MINISTRY OF ENERGY	HIEP PHUOC ELECTROLIC CO.
H-28	XI MANG HIEP PHUOC	HIEP PHUOC CEMENT PORT	CEMENT	MINISTRY OF CONSTRUCTION	NGHI SON CEMENT CO.

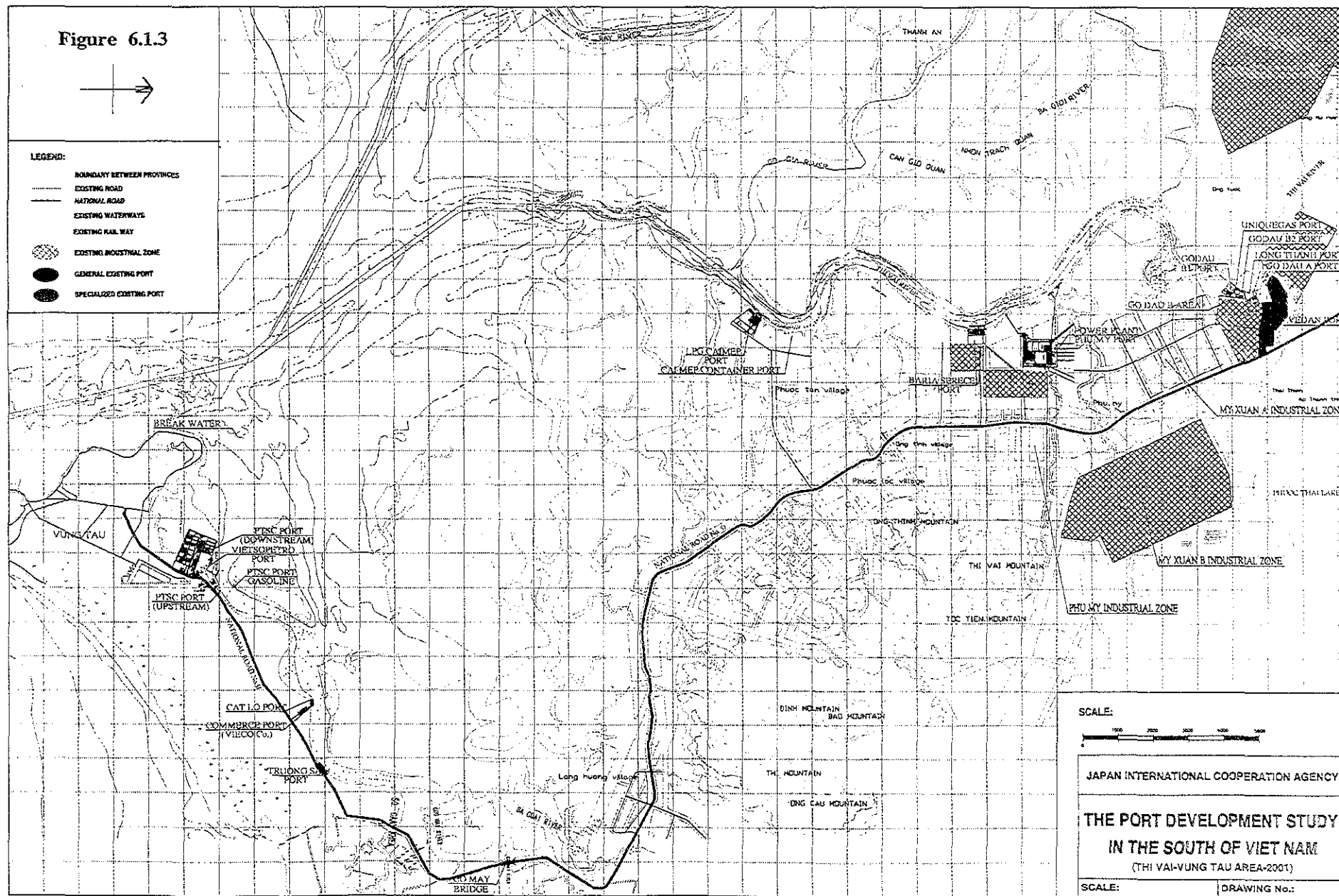
Figure 6.1.3



LEGEND:

- BOUNDARY BETWEEN PROVINCES
- EXISTING ROAD
- NATIONAL ROAD
- EXISTING WATERWAYS
- EXISTING RAIL WAY
- EXISTING INDUSTRIAL ZONE
- GENERAL EXISTING PORT
- SPECIALIZED EXISTING PORT

6-7



SCALE:



JAPAN INTERNATIONAL COOPERATION AGENCY

THE PORT DEVELOPMENT STUDY
IN THE SOUTH OF VIET NAM

(THI VAI-VUNG TAU AREA-2001)

SCALE:

DRAWING No.:

Table 6.1.2 EXISTING PORTS OF THI VAI-VUNG TAU PORT GROUP

		PORT NAME	TYPE	SUPERVISING ORGANIZATION	OPERATOR
	PORTS IN DONG NAI RIVER				
T-1	CANG DONG NAI	DONG NAI PORT	GENERAL	DONG NAI PROV.	DONG NAI PORT
T-2	CANG SCTGAS-VN	DONG NAI PROV.	GAS	DONG NAI PROV.	SCT GAS VIETNAM
T-3	CANG V.GAS	VT GAS.PORT	GAS	DONG NAI PROV.	VIETNAM GAS PRIVATE Co.
	PORTS IN GO DAU AREA				
T-4	CANG PHUOC THAI	VEDAN PORT	GENERAL	MINISTRY OF PLANNING & INVESTMENT	VEDAN Co.
T-5	CANG GO DAU A	GO DAU A PORT	GENERAL	DONG NAI PROV.	GO DAU PORT
T-6	CANG LONG THANH	LONG THANH PORT	GENERAL	MINISTRY OF AGRICULTURE & INVESTMENT	MIEN NAM PHOSPHAT Co.
T-7	CANG GAS.PVC	GAS.PVC PORT	GAS	MINISTRY OF PLANNING & INVESTMENT	UNIQUE GAS Co.
T-8	CANG GO DAU B1	GO DAU B1 PORT	GENERAL	DONG NAI PROV.	DONG NAI PORT
T-9	CANG GO DAU B2	GO DAU B2 PORT	GENERAL	DONG NAI PROV.	DONG NAI PORT
	PORTS IN PHU MY AREA				
T-10	CANG NM DIEN PHU MY	PHU MY POWER PLANT PORT	GENERAL	MINISTRY OF ENERGY	PHU MY 2-1 POWER PLANT
T-11	CANG PHU MY	PHU MY PORT		MINISTRY OF AGRICULTURE & INVESTMENT	BARIA SERECE Co.
	PORTS IN CAI MEP AREA				
T12	CANG LPG CAI MEP	LPG CAI MEP PORT	PETROLEUM	VIETNAM PETRO	GAS PRODUCTS PROCESSING Co.
	PORTS IN VUNG TAU AREA				
T13	CANG DAU K2	OIL K2 PORT	OIL	VIETNAM PETRO	BA RIA - VUNG TAU OIL Co.
T14	CANG DAU KHI	VIETSOV PETROL PORT	GAS	VIETNAM PETRO	VIETSOPETRO
T15	CANG PTSC (THUONG LUU)	PTSC PORT (UPSTREAM)	GAS	VIETNAM PETROL	PTSC Co.
T16	CANG PTSC (HA LUU)	PTSC PORT (DOWNSTREAM)	GASOLINE	VIETNAM PETROL	PTSC Co.
T17	CANG CTHS T.SA	CTHS T.SA PORT	GENERAL	MINISTRY OF NATIONAL DEFENSE	TRUONG SA FISH Co.
T18	CANG THUONG MAI	TRADE PORT	GENERAL	BA RIA VUNG TAU PROV.	VIECO Co.
T19	CANG CA CAT LO	CAT LO PORT	FISH	BA RIA VUNG TAU PROV.	VIECO Co.
	PORTS IN CON DAO AREA				
T-20	CANG CA BEN DAM	BEN DAM PORT	FISH	BA RIA VUNG TAU PROV.	
T21	BEN CAP TAU CON DAO	CON DAO PORT	PASSENGER	BA RIA VUNG TAU PROV.	