(2) Telex System Plan

Double 16 lines in 1991 and fourfold 16 lines concentrator in 2001 will be installed by CAT at the new post office located within the business and commercial area.

The concentrator will connect with the existing Pattaya zone exchange running aerial cable along the Route 3. As for the local cable system, normal practice is to use local telephone cable system rented from TOT.

3.6.7 Land Preparation Plan (for Port Hinterland)

A large amount of earthwork is needed in the port area and a part of industrial estate to avoid flooding by high tide waves and heavy rain. It is needed to embank the low area up to E.L. 3 - 4 m that spread in the port area and industrial estate.

Earth work volumes were estimated as shown below.

	Area	(1) Short-Term	(2) Master Plan	(2) - (1)
1.	Industrial Estate	740,000	2,800,000	2,060,000
2.	Port Area	1,860,000	2,800,000	940,000
	- Port Wharf	(330,000)	(440,000)	(110,000)
	- Distribution & Storage	(1,120,000)	(1,800,000)	(680,000)
	- Business & Commercial	(410,000)	(560,000)	(150,000)
3.	Total	2,600,000	5,600,000	3,000,000

Materials for embankment can be supplied from the hilly place in the port area for the short-term development. And when materials from the port area is depleted, the adjacent mountain can be expected to supply the enough earth volume for the full development of the master plan.

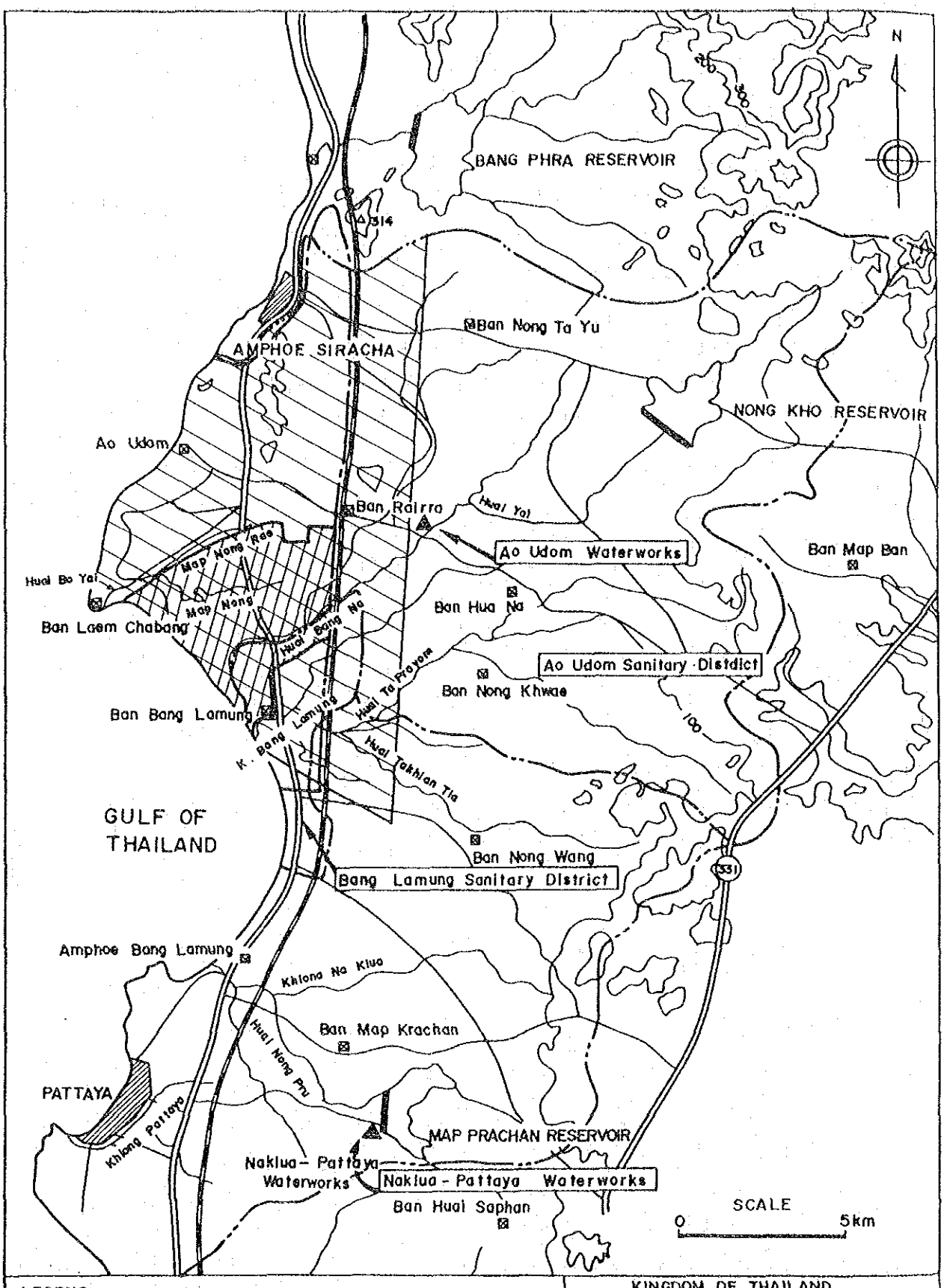
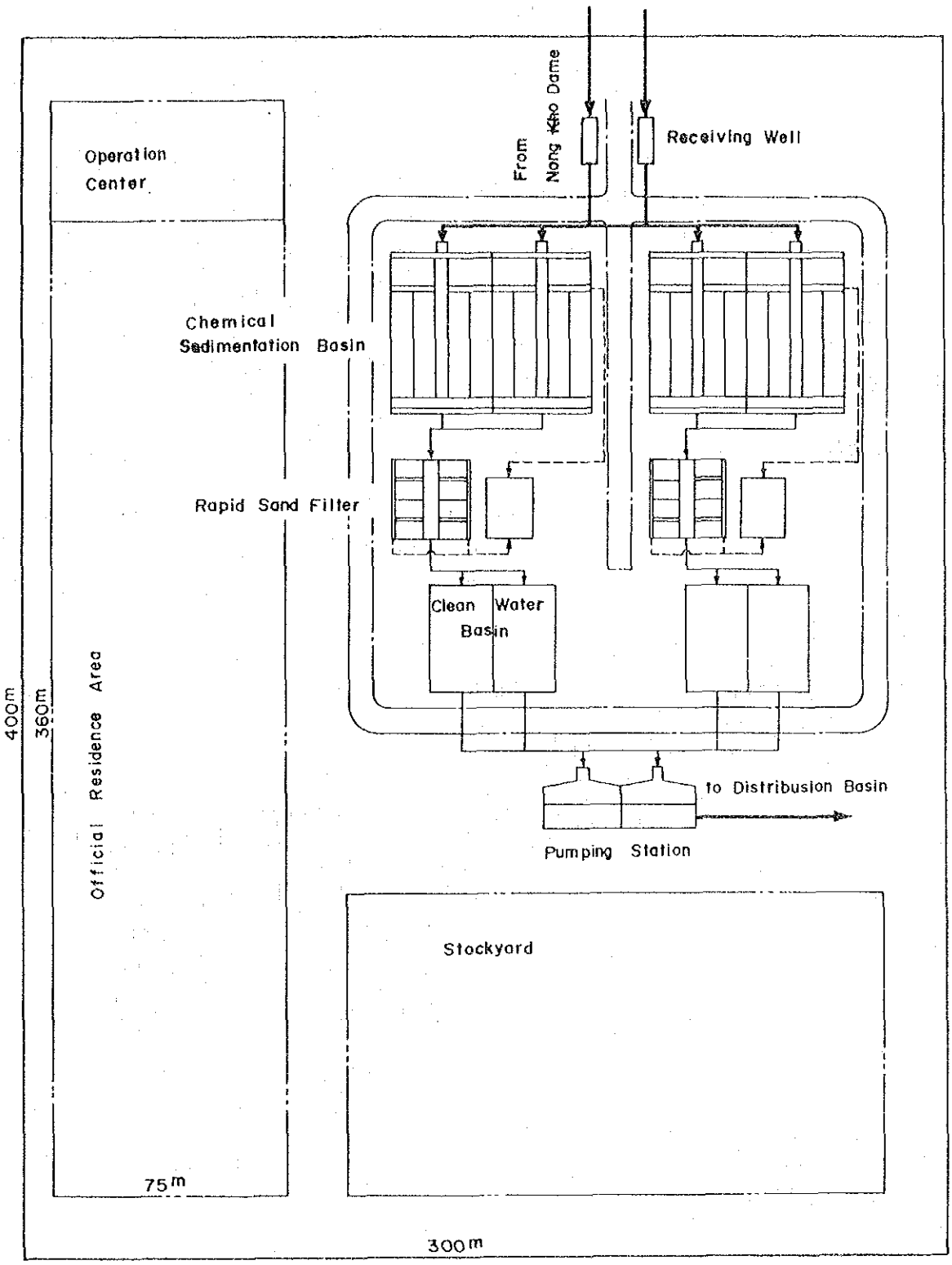


Fig. 3.6.1
Development Area and Laem Chabang Complex



LEGEND

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Fig. 3.6.2
Plan for Filtration Plant

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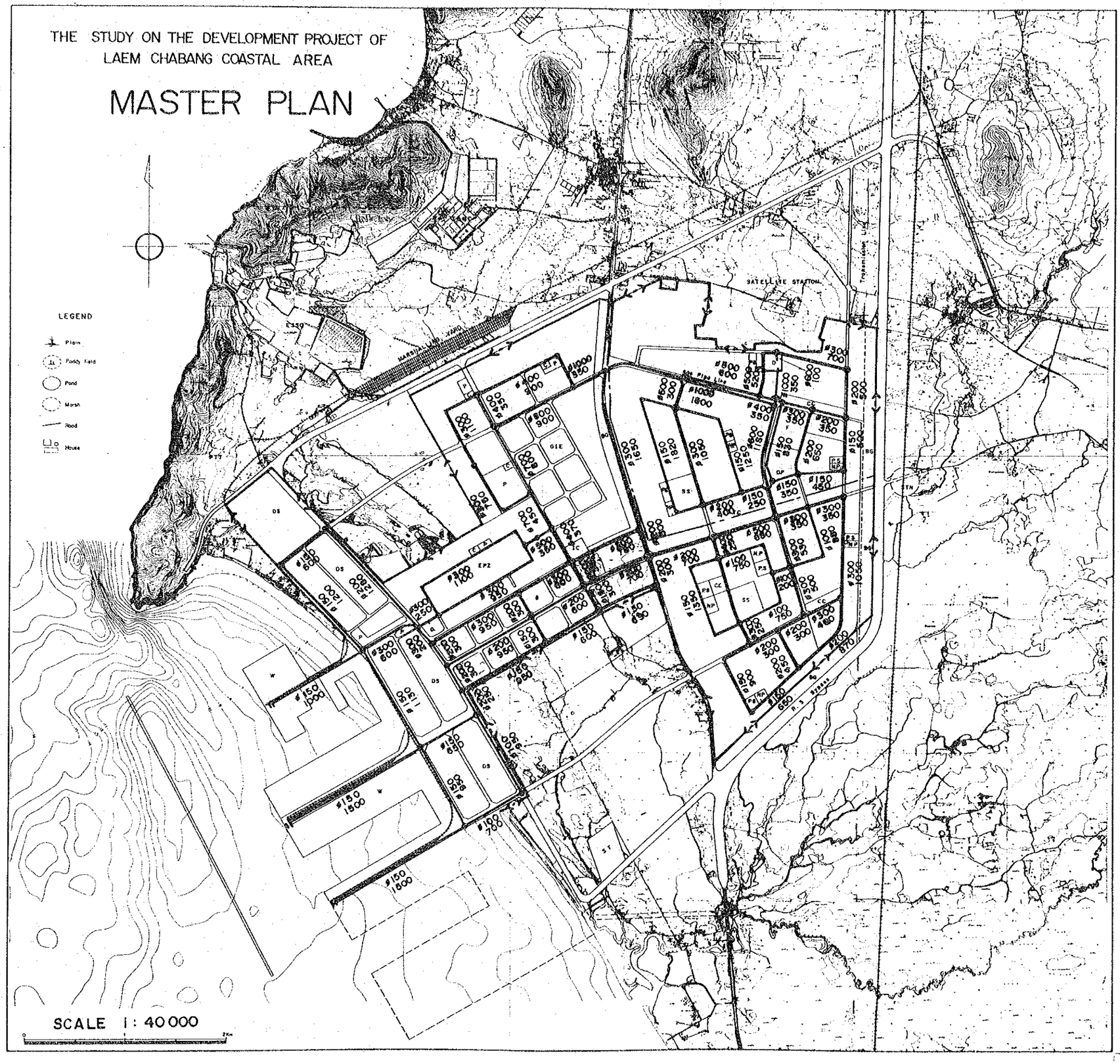
LAEM CHABANG COASTAL AREA

MASTER PLAN



LEGEND

- Boundary of Project Area
- Boundary of Zone
- ø 200 Diameter (mm)
- 1000 Length (m)
- D Distribution Basin

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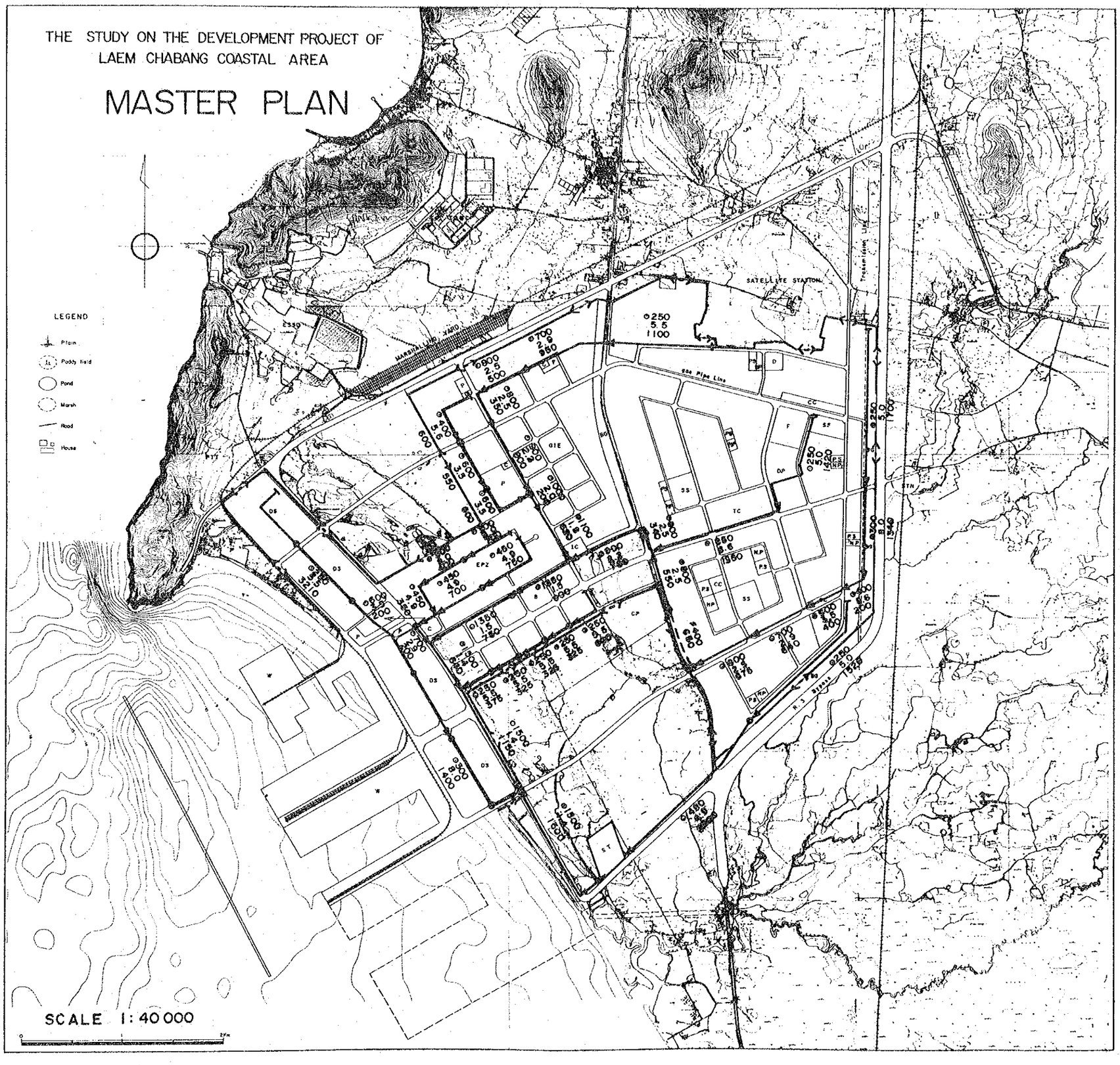
Fig. 3.6.3
Proposed Layout Plan for Water Supply System

THE STUDY ON THE DEVELOPMENT PROJECT OF
LAEM CHABANG COASTAL AREA

MASTER PLAN



LEGEND

—(-)—	Boundary of Project Area
⊛	Pumping Station
ST	Treatment Plant
——→	Trunk Sewer
- - - →	Force Main
⊙600	Diameter (mm)
3.5	Slope (‰)
400	Length (m)

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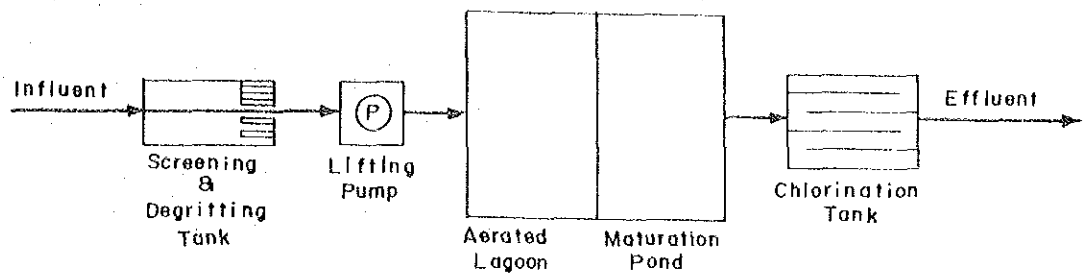
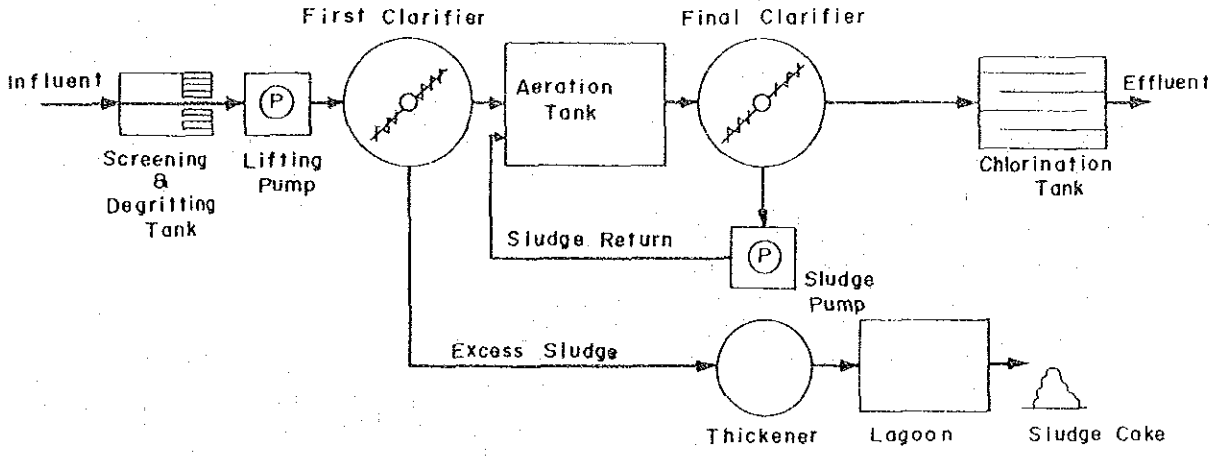
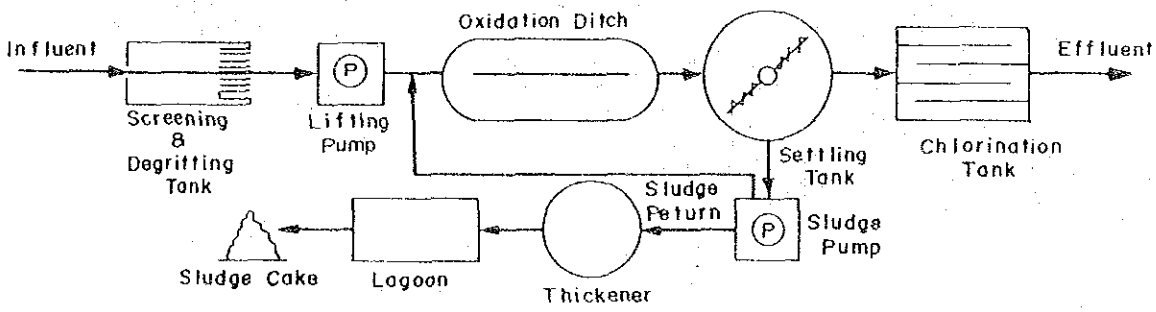
Fig. 3.6.4
Proposed Layout Plan for Sewerage System



(Aerated Lagoon)

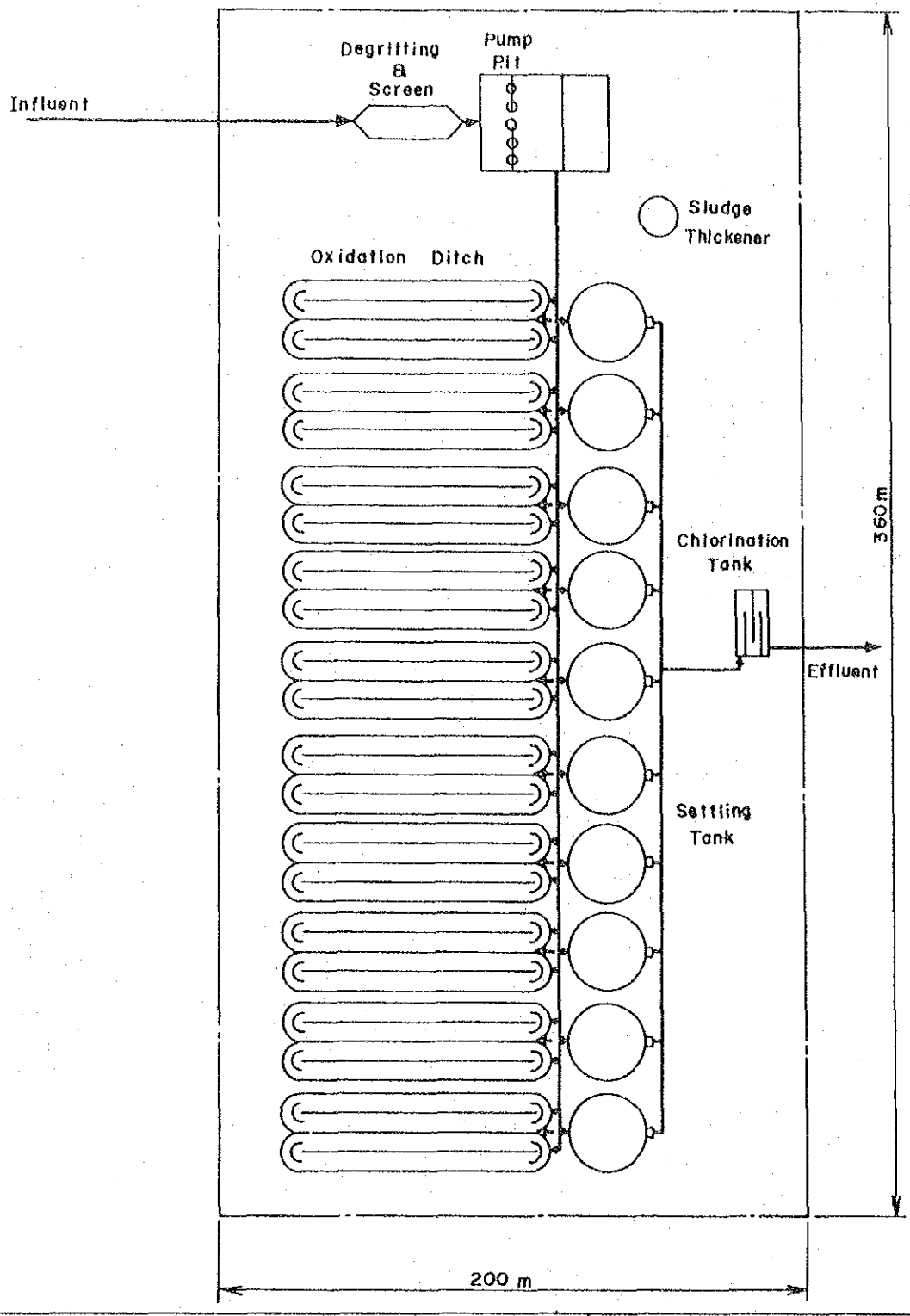


(Standard Activated Sludge)



(Oxidation Ditch)

LEGEND	KINGDOM OF THAILAND THE STUDY ON THE DEVELOPMENT PROJECT OF LAEM CHABANG COASTAL AREA JAPAN INTERNATIONAL COOPERATION AGENCY
	Fig. 3.6.5 Flow Sheets of Sewage Treatment Plants



LEGEND

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Fig. 3.6.6
Plan for Treatment Plant (Oxidation Ditch)

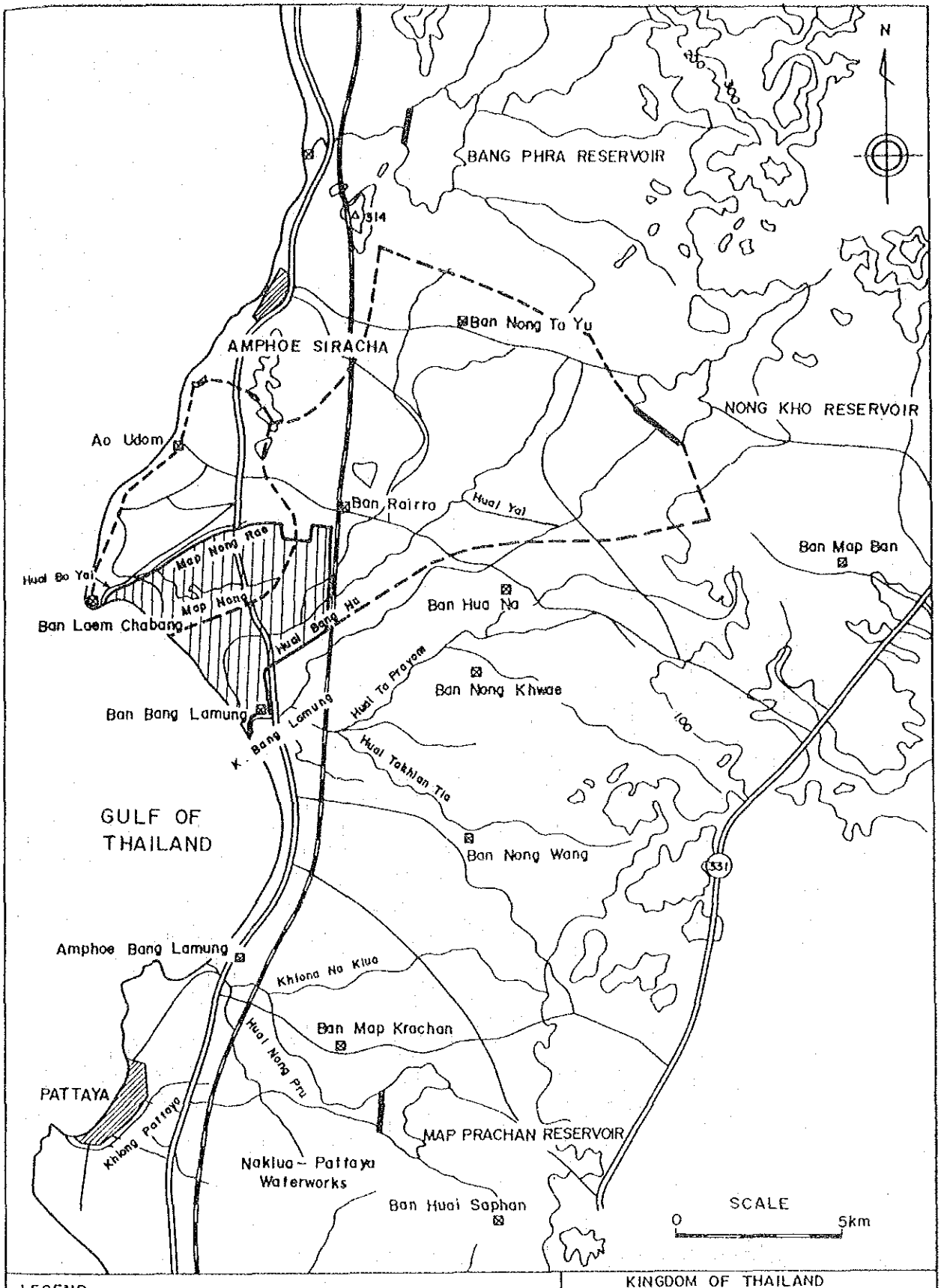

Fig. 3.6.7
Existing Main Drain and Drainage Basin

THE STUDY ON THE DEVELOPMENT PROJECT OF
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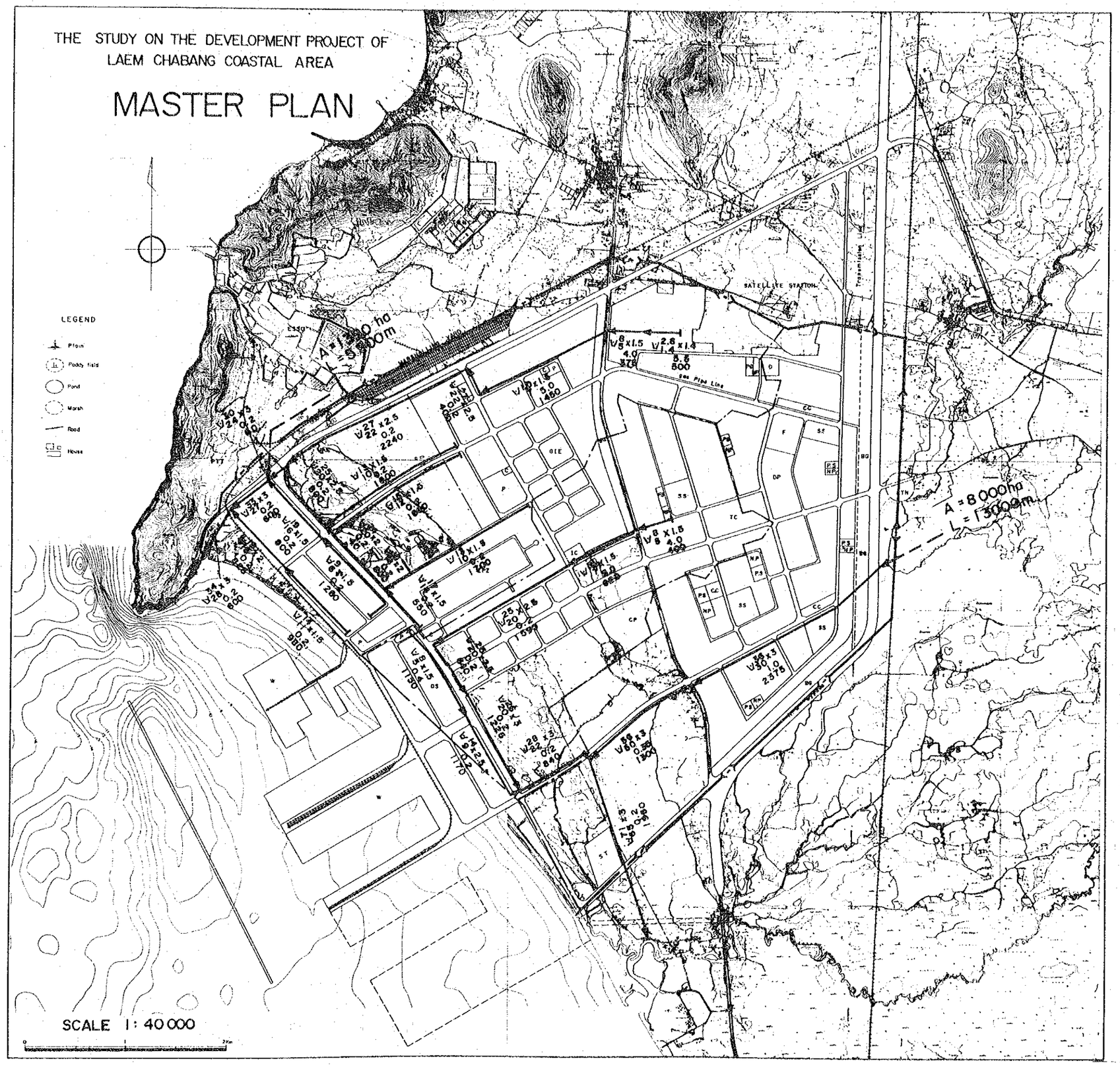
MASTER PLAN



LEGEND

—<->—	Boundary of Project Area
— - —	Boundary of Catchment
——→	Trunk Drain
V 14.0 / 10.0 x 2.0	Shape and Size (m)
0.5	Slope
500	Length

Where
Upper Width 14.0m
Bottom Width 10.0m
Depth 2.0m

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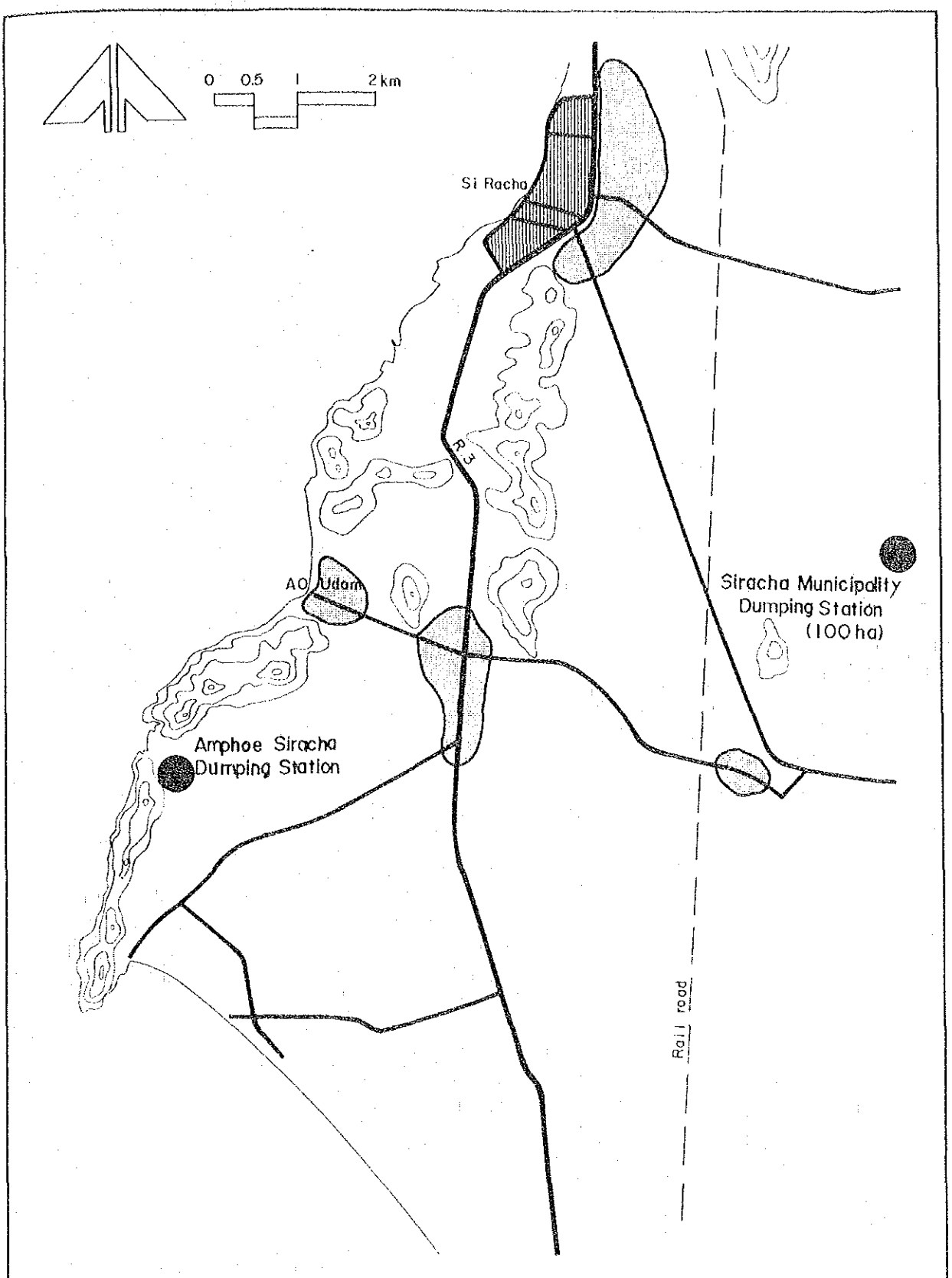
Fig. 3.6.8
General Plan of Proposed Drainage System



LEGEND

- Dumping Station
- Siracha Municipality Service Area
- Amphoe Siracha Service Area

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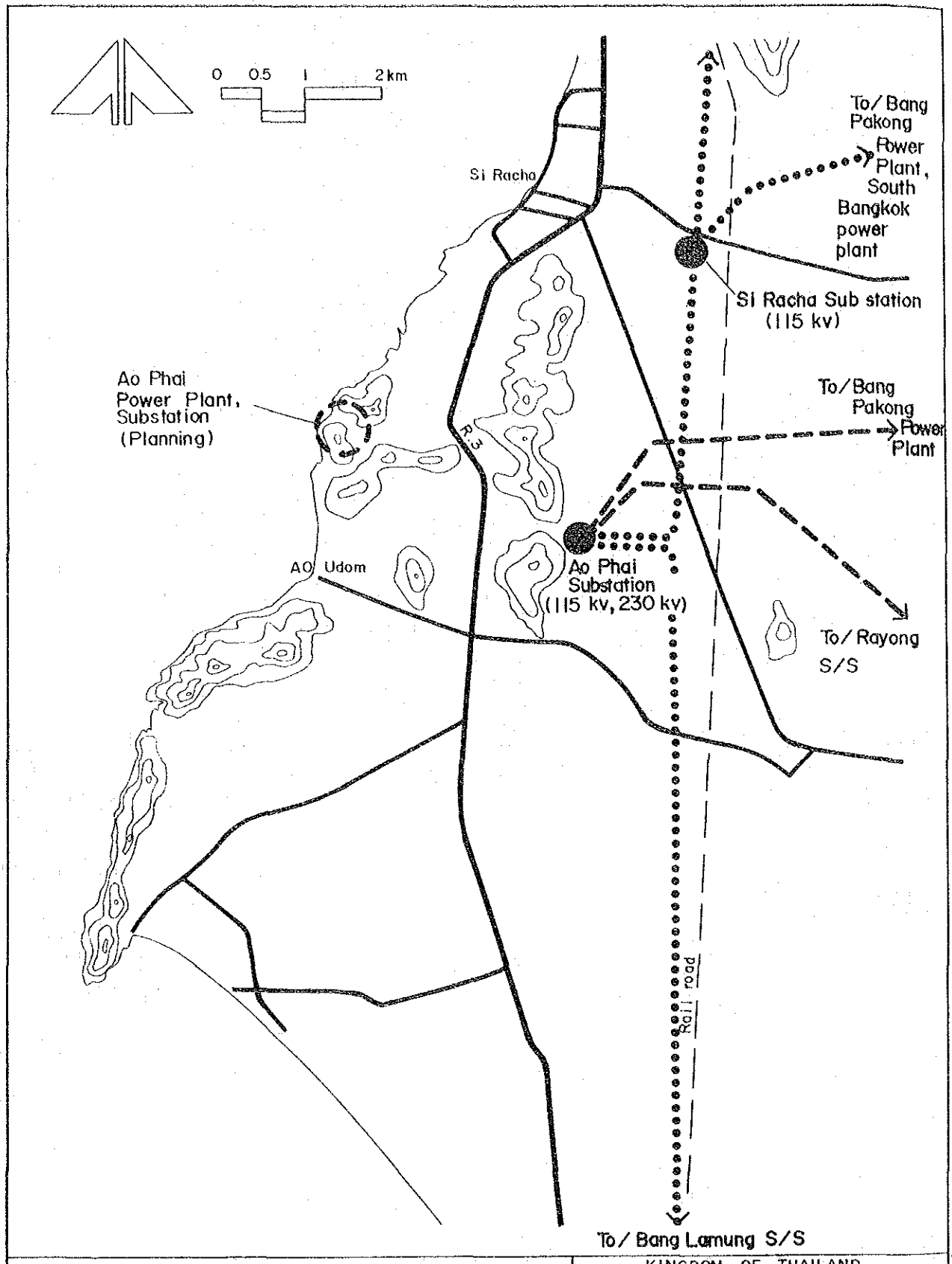
Fig. 3.6.9
The Existing Condition of Solid Waste Disposal System



LEGEND

Right of Way of 115 KV Transmission Line: 25m.

Ao Phai Power Plant planned to be constructed in 1993

230KV Transmission Line

115 KV Transmission Line

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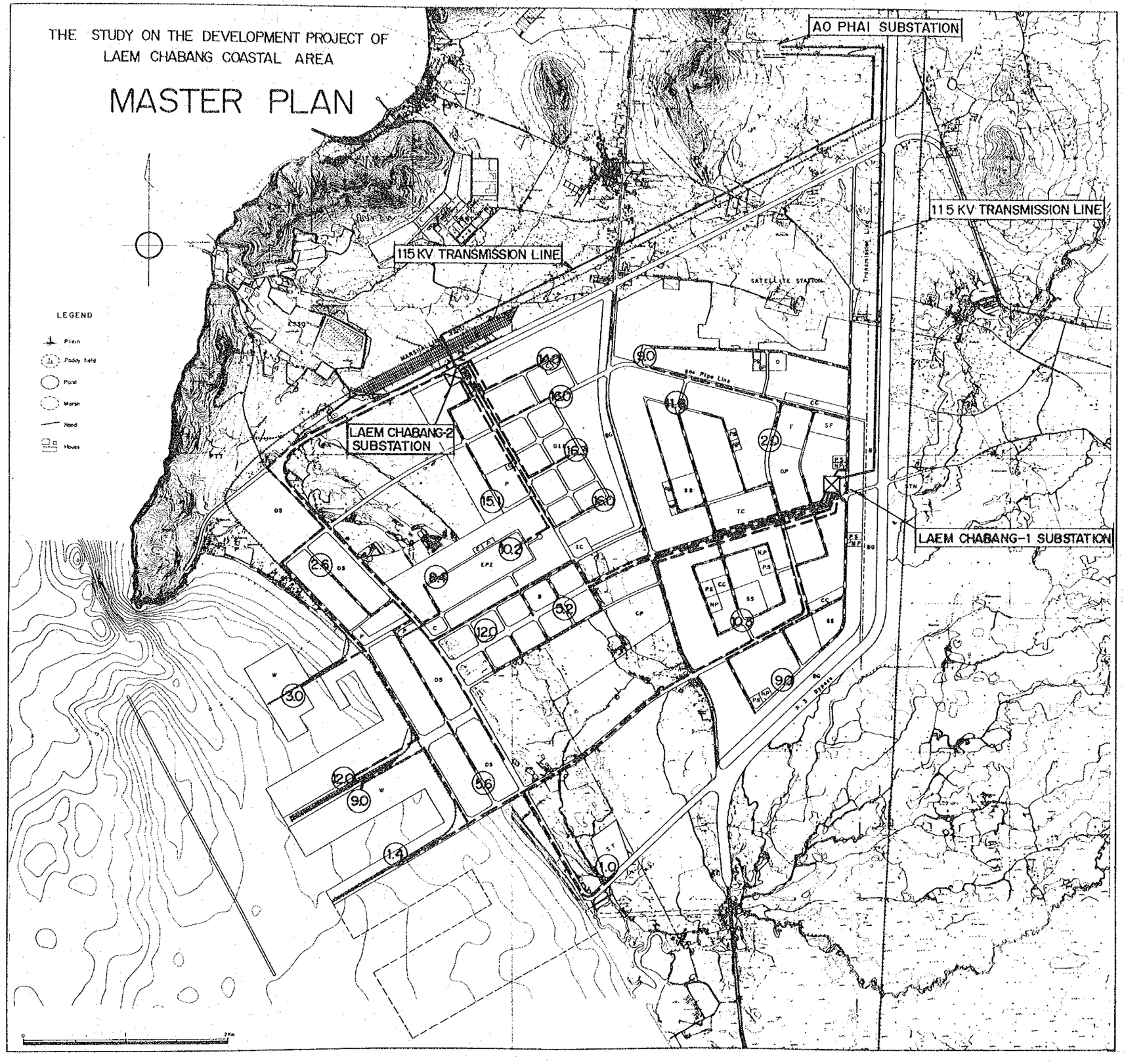
Fig. 3.6.10
Present and Proposed Power Supply System

THE STUDY ON THE DEVELOPMENT PROJECT OF
LAEM CHABANG COASTAL AREA

MASTER PLAN



LEGEND

115 KV TRANSMISSION LINE

VOLTAGE	: 115 KV
NO. OF CIRCUIT	: 2
TYPE OF TOWER	: 2-CCT STEEL
CONDUCTOR SIZE	: 477 MCM
LINE CAPACITY	: 100 MVA/CCT

22 KV DISTRIBUTION LINE

VOLTAGE	: 22 KV
MAX. LINE CAPACITY	: 300 A
KIND OF WIRE	: INSULATED ACSR
WIRE SIZE	: 120 SQMM
TYPE OF POLE	: CONCRETE

☒1 LAEM CHABANG-1 SUBSTATION

SUBSTATION CAPACITY : 80 MVA
MAIN TRANSFORMER :
3 PHASE, 115 / 22 KV
40 MVA x 2 SETS
115 KV INCOMING LINE : 2
22 KV FEEDER : 8
(Including One Spare)

☒2 LAEM CHABANG-2 SUBSTATION

SUBSTATION CAPACITY : 80 MVA
MAIN TRANSFORMER :
3 PHASE, 115/22 KV
40 MVA x 2 SETS
115 KV INCOMING LINE : 2
22 KV FEEDER : 8

Note :

Figures in circle indicate the power demand (MW) within each area.

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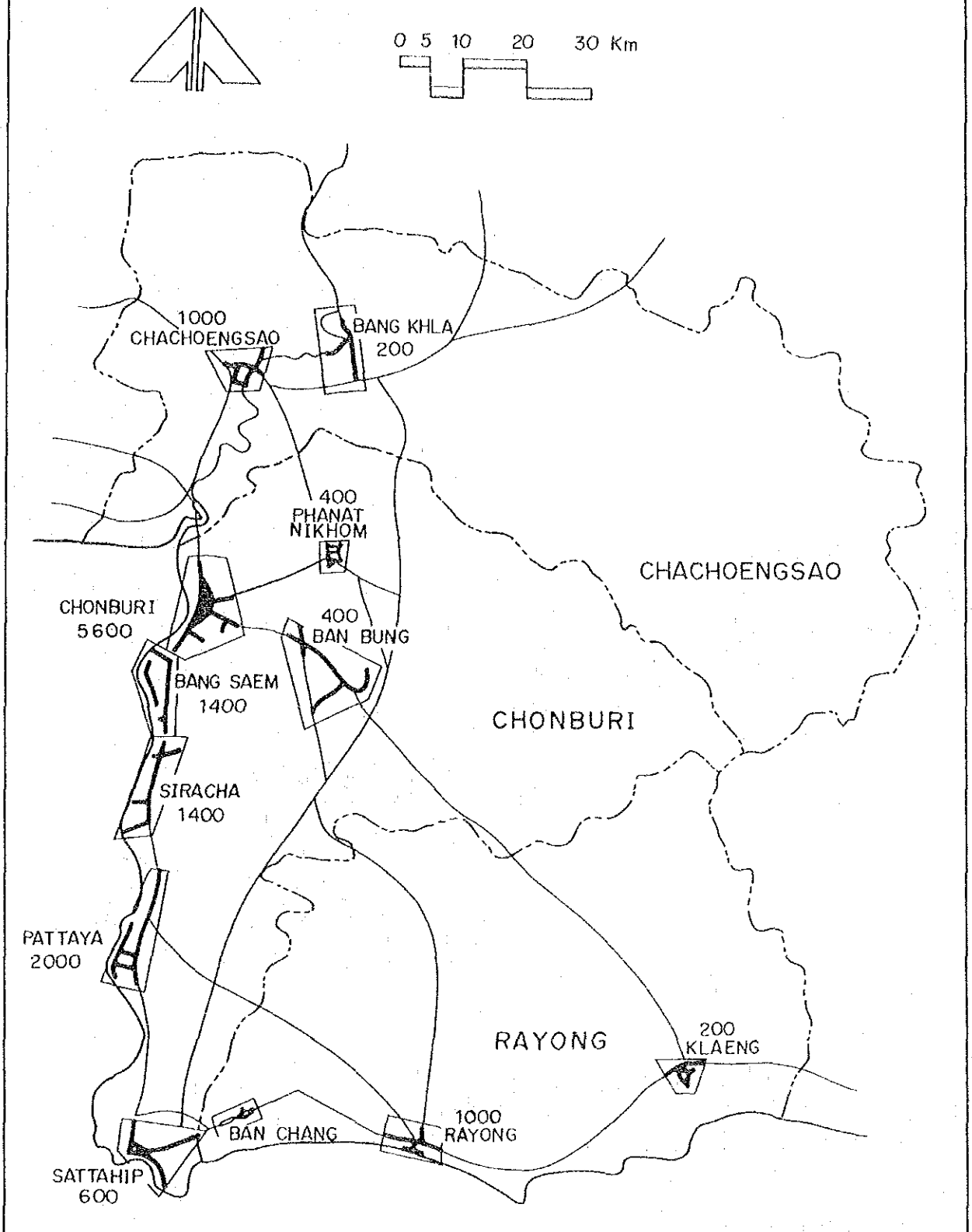
Fig. 3.6.11
Power Supply System in Master Plan



LEGEND

H — Location of Telephone Exchange

——— Major Road Network

– – – – Provincial Boundary

Note ; Figures indicate number of switching lines.

Source ; Ess

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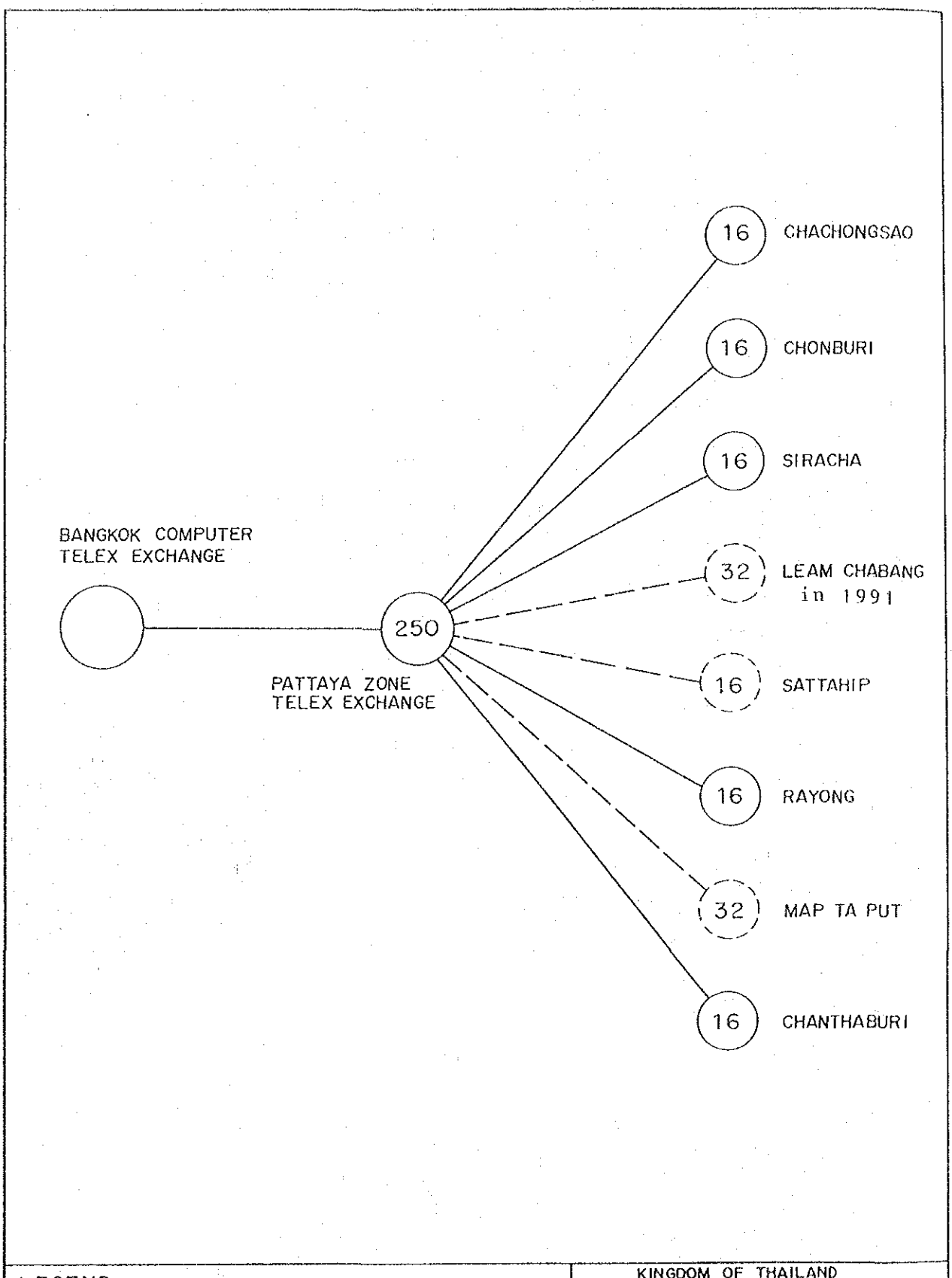
Fig. 3.6.12
Present Telephone Exchange



LEGEND

EXISTING LINE CONCENTRATOR

NEW LINE CONCENTRATOR IN NEAR FUTURE

NOTE : FIGURES INDICATE THE NUMBER OF TELEX TERMINALS

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Fig. 3.6.13
Telex Network in Pattaya Zone Exchange

3.7 Cost Estimation

3.7.1 General

1) Cost Categories

Cost categories considered are as follows:

a. Construction costs

b. Land acquisition cost in the new town area. Industrial and port areas has been already acquised.

c. Engineering service fee

d. Physical contingency

2) Construction Cost

Construction costs considered are as follows:

a. The labour cost

b. The cost of the construction equipments and materials for construction

c. Overhead and profit of contractors.

3) Conditions of Cost Estimation

Conditions of the cost estimation cosidered are as follows:

a. Price

The Price is expressed in Baht in 1984 prices.

b. Exchange rate

Exchange rate is calculated at US 1 $ = 22.90 Baht, US 1 $ = 236 ¥, 1 Baht = 10.3 ¥.

c. Duty and Tax

Duty for imported construction materials, equipments and plants are excluded from the cost estimate. Business tax and municipal tax are also eliminated from the cost estimates.

d. Engineering service fee

The engineering service fee includes detailed engineering, natural condition survey and supervision as well as government administrature fee.

e. Contingency

The contingency is considered to be 20 percent of the construction cost and the engineering services fee.

4) Foreign and Local Currency

(1) Foreign Currency

The components of the foreign currency costs are as follows:

a) Costs of imported equipments and materials such as steel products and others (CIF price).
b) A portion of the material cost for cement, asphalt and fuel.
c) A portion of labour cost.
d) A portion of the detalied engineering and supervision service fees.
e) A portion of the overhead, profit and contingency.

(2) Local Currency

The components of the local currency costs are as follows:

a) Purchase cost of domestic products such as crushed stone, sand, paint etc.
b) Transport cost in Thailand.
c) A portion of the material cost for cement, asphalt and fuel
d) A portion of labour cost
e) A portion of detailed engineering and construction sepervision fees
f) A port of overhead, profit and contingency
g) Cost of land acquistion.
h) Tax.

3.7.2 Investment Cost

Investment costs for the long term development were estimated on the basis of the above conditions as shown in Table 3.7.1 Detailed breakdowns of investment cost for each area are shown in the Sectoral Report VI "Cost Estimation".

Table 3.7.1 CONSTRUCTION COST ESTIMATES

(Unit: ฿ x 10^6 in 1984 constant price)

Area	Cost
1) Industrial Estate	2,101
2) Port Area	14,380
(2) Wharf Facility Area (Off shore)	(13,050)
(2) Port Hinterland (On shore)	(1,330)
3) New Town	6,618
(1) Land Preparation	(2,754)
(2) Housing and Common Facilities	(3,864)
4) Others (Connected Roads)	1,069
Total	24,168

1) Excluding acquisition costs of land which have already been acquired by IEAT and PAT.
2) The construction costs of the utility plants such as water filtration plant, sewage treatment plant, electricity substation, telephone exchange, solid waste tip were distributed to each area in proportion to demand.
3) Cost of railed spur in port area is included in the cost of Facility Area.

Note: Physical contingency of 20% and enginecring servie fee and administration cost of 10% are included in each item.

3.8 Phased Development Plan

3.8.1 Development Schedule

The first stage land formation of the industrial estate is to start in 1986 and the development is to continue thereafter until the final target year of 2001. It is assumed that it will take until 2001 to sell all the lots of GIE and EPZ (Fig. 3.8.1). Investment on infrastructure facilities is required to be made efficiently in accordance with the pace of land sale.

The deep sea port is planned to partly start operation in end-1987 to handle a part of cargo volume of 8.5×10^6 tons, which is projected to be handled in 1991.

The new town is to be developed in a stage-wise manner in accordance with the growth of workers, population and households.

Development schedule and phasing are as proposed in Fig. 3.8.2 and Fig. 3.8.3 respectively.

3.8.2 Short-term Development Plan

The initial development is to be proceeded under the following schedule to cope with the projected demand in 1991.

Industrial Estate

1986 - Start land formation and land sale

1987 - Partial completion of land formation

- Start construction of factories

1987 (end) - The first factory starts operation

Port

1987 (end) - Start operation

New Town

1986 - Start construction

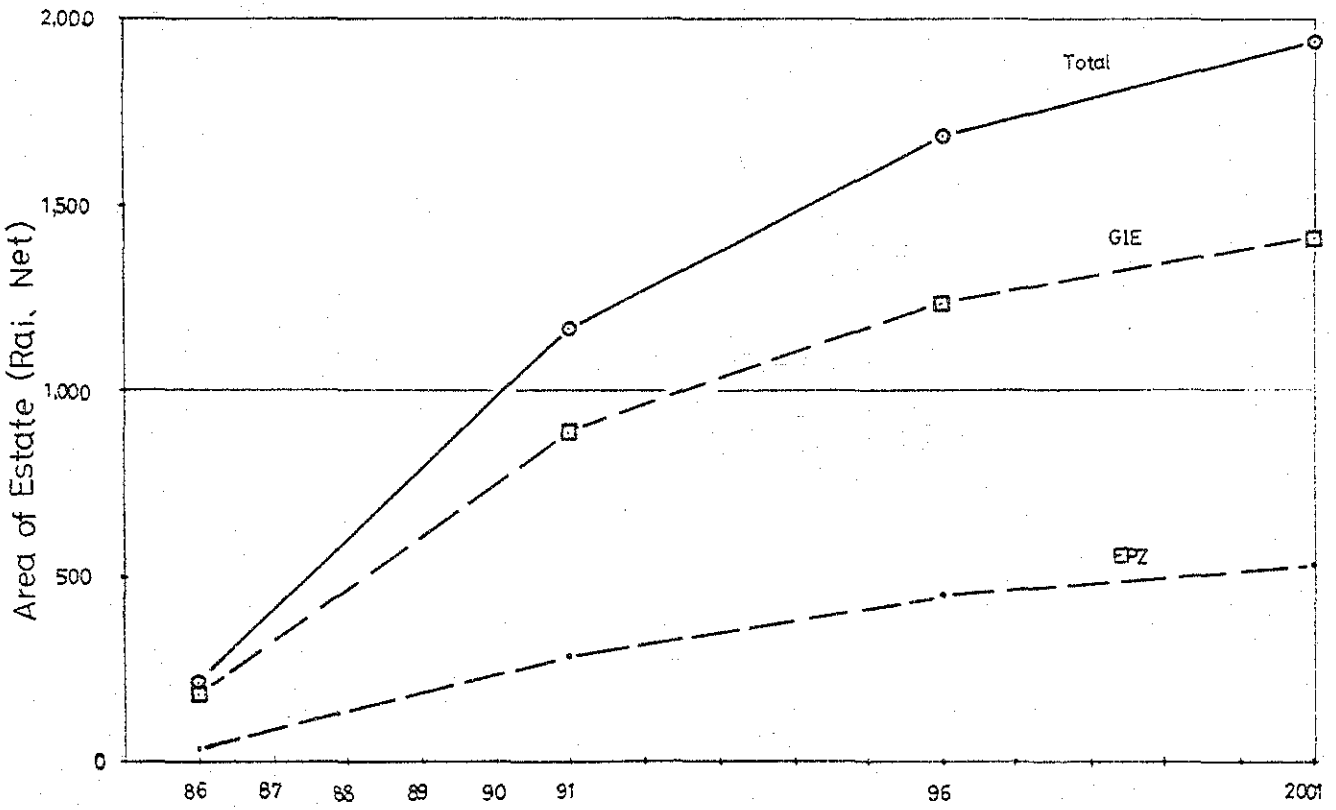
1987 end - Partial completion

The short-term development plan is prepared based on the following framework.

- Industrial estate Employment; 9,500
  Gross area; 290 ha (1,800 rai)

- Port area Employment ; 11,000
  Gross area (Wharf); 116 ha (725 rai)
  (Hinterland); 250 ha (1,560 rai)

- New Town Population; 24,000 (Two Neighborhood Blocks)
  Gross Area; 130 ha (820 rai)



(Unit: net rai)

Year	EPZ	GIE	Total
1986	27	186	213 (213)*
1987-91	261	757	1,018 (1,231)*
1992-2001	240	513	753 (1,984)*
Total	528	1,456	1,984

* Cumulative

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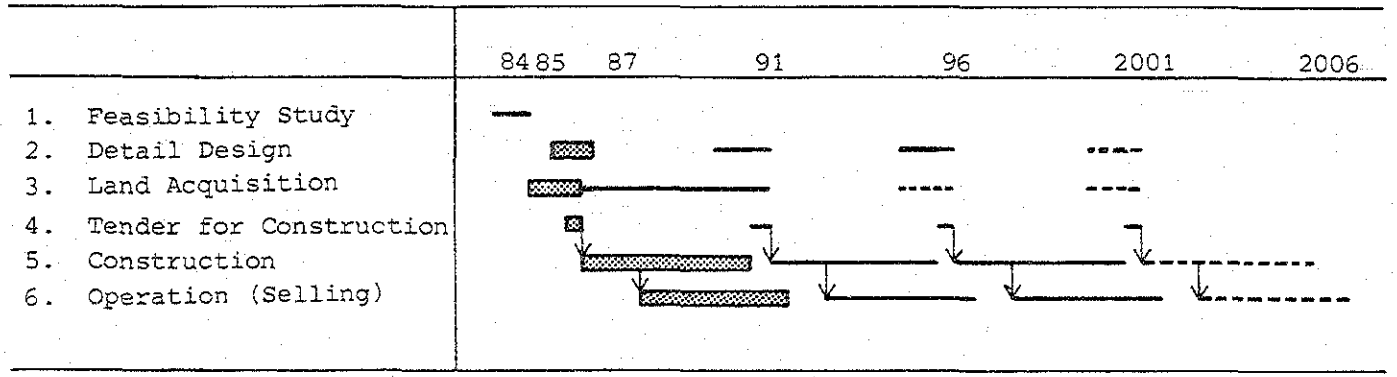
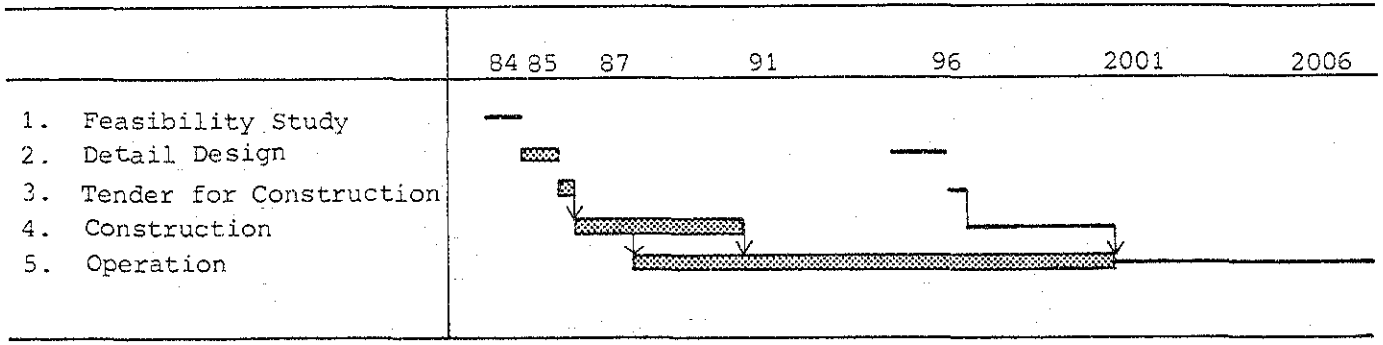
Fig. 3.8.1
Model of Selling Schedule of Industrial Estate

1) Industrial Estate, New Town



Note
1) ▒▒▒ : Short term development
2) Land Acquisition is needed only for New Town development.

2) Port



Note
1) ▒▒▒ : Short term development

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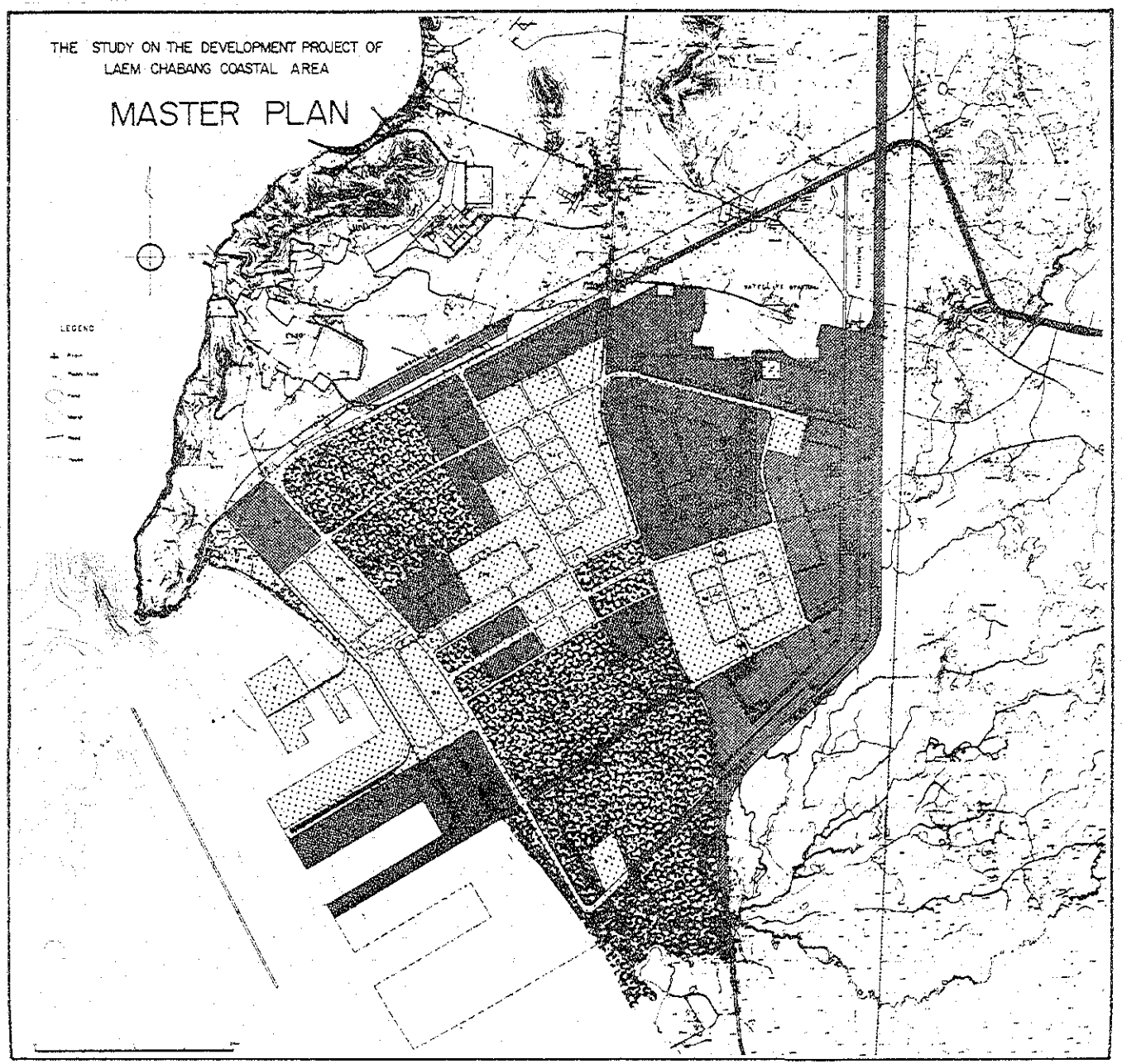
Fig. 3.8.2
Proposed Development Schedule



LEGEND

Short-term Development (1991)

Master Plan (2001)

Future Expansion

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Fig. 3.8.3
Phasing of Development

4. SHORT-TERM DEVELOPMENT PLAN

4.1 Land Use Plan for the Short-term Development

The integrated land use plan was prepared as shown in Fig. 4.1.1 on the principle of sub area coordination so as to eliminate duplication of facilities and to avoid scattered development as much as possible.

The land use plan for the short-term development was prepared particularly based on the following principles.

1) To pursue a compact land use plan of the industrial estate, the port and the new town

2) The direction of development is toward the potential area for future development, that is from the north to the south.

In the course of the work in Thailand, it was suggested by a working group that care should be taken for the existing legal constraints concerning purposes of land use. The Study Team, however, endeavored to prepare the land use plan purely from the technical point of view on the ground that legal aspects of land use would be duly taken care of by RTG in the later stage of the project implementation.

Area allocation for the short-term plan is presented in Table 4.1.1.

Table 4.1.1 LAND USE PLAN OF SHORT TERM DEVELOPMENT

Item	(ha)	(Rai)	(%)
1) Industrial Estate			
(1) EPZ (Net)	46.1	288.1	
(2) GIE (Net)	150.8	942.5	
(3) I.E. Centre	6.5	40.6	
(4) Road	39.4	246.3	
(5) Park	9.0	56.3	
(6) Canal	6.3	39.4	
(7) Green Belt	28.3	176.8	
Sub Total	286.4	1,790.0	35.4
2) Port Area			
(1) Wharf Area	116.0	725.0	
(2) Distribution & Storage Area (Net)	68.8	430.0	
(3) Business & Commercial Area (Net)	20.0	125.0	
(4) Road	91.0	568.8	
(5) Park	48.7	304.4	
(6) Railroad	7.8	48.8	
(7) Canal	12.4	77.4	
(8) Sewerage Treatment Plant	5.0	31.2	
Sub Total	369.7	2,310.6	45.7
3) New Town			
(1) Residential Use (Net)	61.0	381.2	
(2) Community Centre	4.3	26.9	
(3) Schools	15.6	97.5	
(4) Parks	8.8	55.0	
(5) Roads and Car Parking	40.4	252.5	
Sub Total	130.1	813.1	16.2
4) Total	786.2	4,913.7	97.3
5) Others			
(1) Water Filtration Plant	12.0	75.0	
(2) Water Distribution Plant	4.0	25.0	
(3) Road from N.T. to Water Distribution Plant	1.0	6.3	
(4) Road from Water Distribution Basin to R.3	1.0	6.3	
(5) Railroad from R.3 to Trunk Line	4.2	26.3	
Sub Total	22.2	138.9	2.7
6) Grand Total	808.4	5,052.6	100.0

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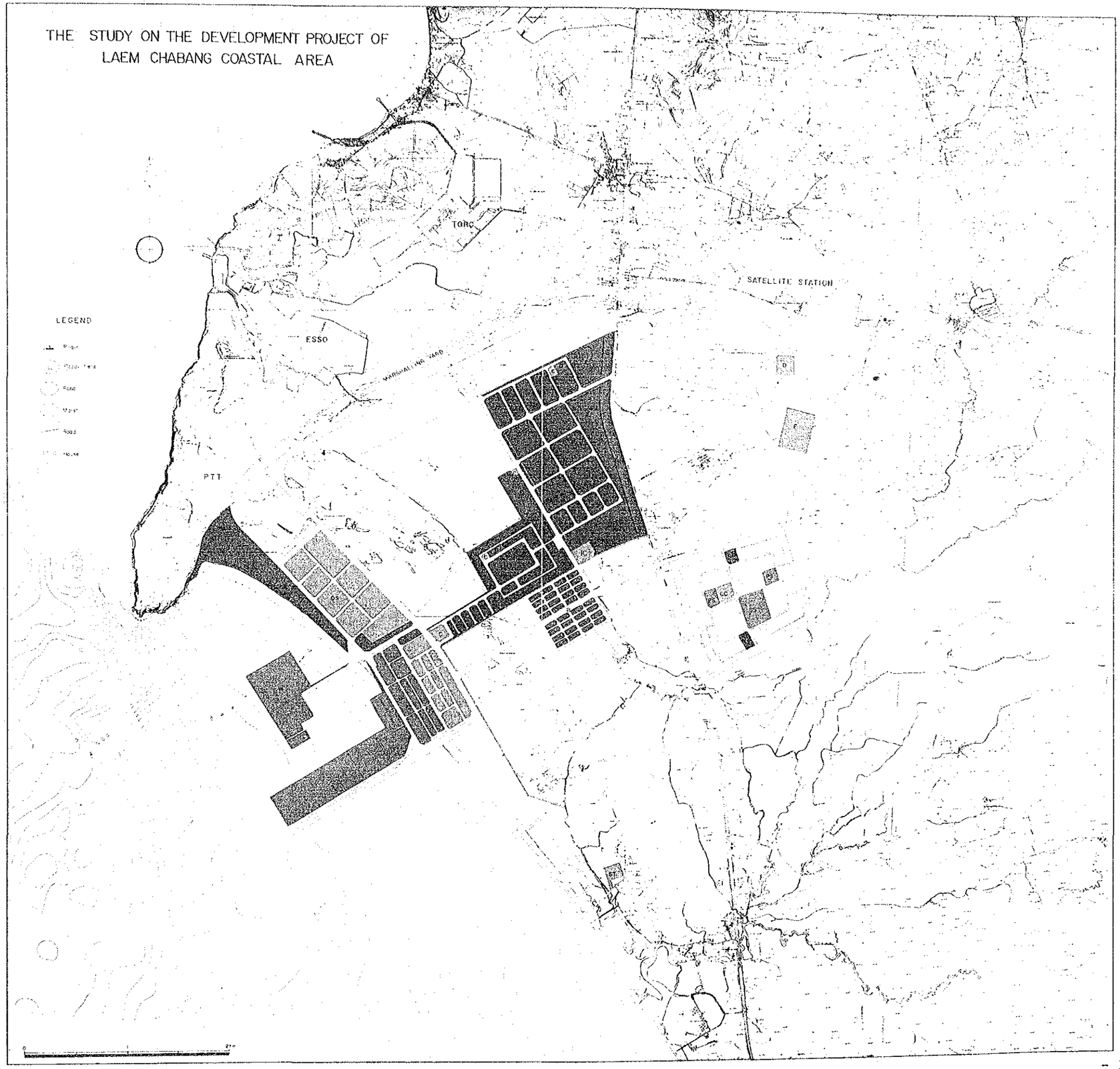

LEGEND

EPZ (Export Processing Zone)
GIE (General Industrial Estate)
WHARF AREA
DISTRIBUTION and STORAGE AREA
BUSINESS and COMMERCIAL AREA
RESIDENTIAL AREA
PARK
MAIN CANAL

NP NEIGHBORHOOD PARK

CC COMMUNITY CENTER
IC INDUSTRIAL ESTATE CENTER
C INDUSTRIAL SUB CENTER

SS SECONDARY SCHOOL
PS PRIMARY SCHOOL

ST SEWERAGE TREATMENT PLANT
F WATER FILTRATION BASIN
D WATER DISTRIBUTION BASIN

BG BUFFER GREEN

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Fig. 4.1.1
Land Use Plan (Short-Term Development)

4.2 Industrial Development Plan

4.2.1 Industrial Land Development Framework

Based on the planning framework established for the Long Term Plan and a number of discussions held between the officials of the concerned agencies of the RTG on the land sale projection presented at the Interim Report (see Fig. 4.2.1), it was agreed to set the short term industrial framework as shown below.

SHORT TERM INDUSTRIAL FRAMEWORK

Item	GIE	EPZ	Total
1. Area (rai)			
gross	1,367	423	1,790
net	900	288	1,188
2. Employment	9,900	10,370	20,270
3. Area in operation	40%	52%	
4. Workers (active)	4,040	5,430	9,470

Note: In compliance with the final comments made by the RTG, the rate of green belt in the land use was reduced by 5.8% in the short term plan and net factory area was increased to 960 rai. However the rate of change is considered within the planning allowance for number of employment and water demand, no revision is made on these figures.

4.2.2 Candidate Type of Industries (EPZ & GIE)

1) GIE

Though there is still uncertainty about location of the proposed car manufacturing plant in Laem Chabang, it is hoped to be realized in some way. Judging from the trend of market growth, type of activities, amount of investment, employment and its impacts on the related industries, it will become a nucleus factory in the GIE. Other types sounded to date with the concerned agencies are those manufacturers of welded steel pipes, electric home appliances such as washing machine, refrigerator and

air conditioner, prestressed concrete products and wooden furnitures. Also the result of the questionnaire survey conducted in last February indicates that non metalic minerals industry, electrical machinery, foods and textile industries are likely to locate in Laem Chabang for expansion and relocation.

2) EPZ

Among those industries stated in 3.2.6, the industry which deals with high technology products such as micro electronic devices and its related products is considered as one of promising industries in addition to the conventional type of EPZ industries. Their market is currently expanding rapidly world wide and the BOI has been emphasising on promoting this type of industry in Thailand. Another promising new type of industry is such information processing related industries as printing, coding, punching and programming which require labor intensive activities.

4.2.3 Facility Plan

The facilities of GIE & EPZ will have direct and indirect influence on the incoming companies, their employees and visitors. They are chiefly designed to provide a broad range of services required for GIE & EPZ.

1) Facilities of GIE

(1) Estate Center

The facility includes IEAT regional office, exhibition room, library, canteen, shop, repair workshop and others. The size of the land is 15,000m^2 with the total floor space of building of 1,400m^2.

(2) GIE Sub-center

The facility includes a small meeting room, a small hall, canteen and others. There are two sub-centers and each has 250m^2 of building floor space at 5,000m^2 of land space.

(3) Sports Park

The total space is 30,000m^2 which includes football ground, running track, swimming pool, tennis courts, basketball courts, Thai football courts and others.

(4) Buffer Green Zone

A green belt of 100 meters wide is placed along the Route 3.

(5) Green Belt along the Roads

A green belt of 25 meters wide is placed along intra urban primary road (V_2). A 15 meters wide green belt is secured along both sides of the main artery road.

2) Facilities of EPZ

(1) EPZ Center and Park

The facility includes a customs office, IEAT office, a meeting room,canteen, shop, tennis courts, basketball court and Thai football court. The total floor space of the building is 500m^2 in the land space of 21,000m^2.

(2) EPZ Sub-center

The facility includes a small hall, canteen and shop. The total floor space of the building is 250m^2 in the land space of 7,200m^2.

(3) EPZ Guard House

The area of 6,000m^2 includes 50m^2 floor space of building, parking, bus stop and others, as shown in Fig. 4.2.2.

(4) Warehouse

The floor space of warehouse building of 3,000m^2 at the land space of 8,500m^2.

(5) Standard Factory Building (SFB)

There are two types of the SFB. A-type SFB is a single storey building with 810m^2 floor space in the land space of 3,000m^2. Eight A-type buildings are planned to be built. B-type SFB is a three storey building with the total floor space of 2,430m^2 in the land space of 6,000m^2. Four B-type buildings are planned to be built.

(6) Green belt and perimeter road

A 12 meters wide green belt is secured along the EPZ boundary and perimeter road of 3 meters width is placed in this green belt, as shown in Fig. 4.2.3.

4.2.4 Land Use Plan

1) Basic Policy on Land Use Plan

The basic policy is to provide a good productive environment which is essential for formation of GIE & EPZ. In addition, an attractive work environment and scenic beauty should be created in the eastate itself. It is planned that the easte should have a high level of services with higher land utilization efficiency and less development costs.

2) Land Use Plan

Areas shown in Fig. 4.2.4 and 4.2.6 are selected to be developed in the short-term plan for GIE and EPZ respectively. In accordance with basic policy as described above, GIE with 1,367 gross rai and EPZ with 423 gross rai are planned to be utilized as follows.

GIE

Item	Area (m^2)	(Rai)	Ratio (%)
1. Estate Center & sub	40,000	25	1.8
2. Factory Land	1,508,195	943	69.0
3. Green Belt	248,280	155	11.4
4. Park	75,000	47	3.4
5. Road	282,075	176	12.9
6. Channel	33,450	21	1.5
Total	2,187,000	1,367	100.0

EPZ

Item	Area (m^2)	(Rai)	Ratio (%)
1. EPZ Center & sub	25,000	16	3.7
2. Factory Land	461,025	288	68.1
3. Green Belt	34,860	22	5.1
4. Park	15,000	9	2.2
5. Road	111,475	70	16.5
6. Channel	29,640	19	4.4
Total	677,000	424	100.0

Land use plans for GIE and EPZ are shown in Fig. 4.2.5 and 4.2.7 respectively.

4.2.5 For Realization of the Short Term Plan

The project is designed to develop a new population growth center in the Eastern Seaboard sub-region in order to promote regional development, to help restructure the country's industrial base and to contribute to help control the excessive growth of Bangkok. Development of commercial port, industrial estates and urban areas are all required to be integrated to synchronize effectively and efficiently to achieve the above goals. Industrial location as planned could not realize without a concerted efforts of all parties concerned. The followings are the actions to be

taken for promotion of industrial location in Laem Chabang in addition to the points stated in 3.2.10.

1) Periodical publicity of the plan and progress of the development to the members of Thai economic organizations such as Thai Association of Industries, Thai Chember of Commerce and resident foreign businessmen's associations.

2) To proceed to detailed engineering design to facilitate implementation as scheduled and to formulate a pricing policy with precise land sale prices.

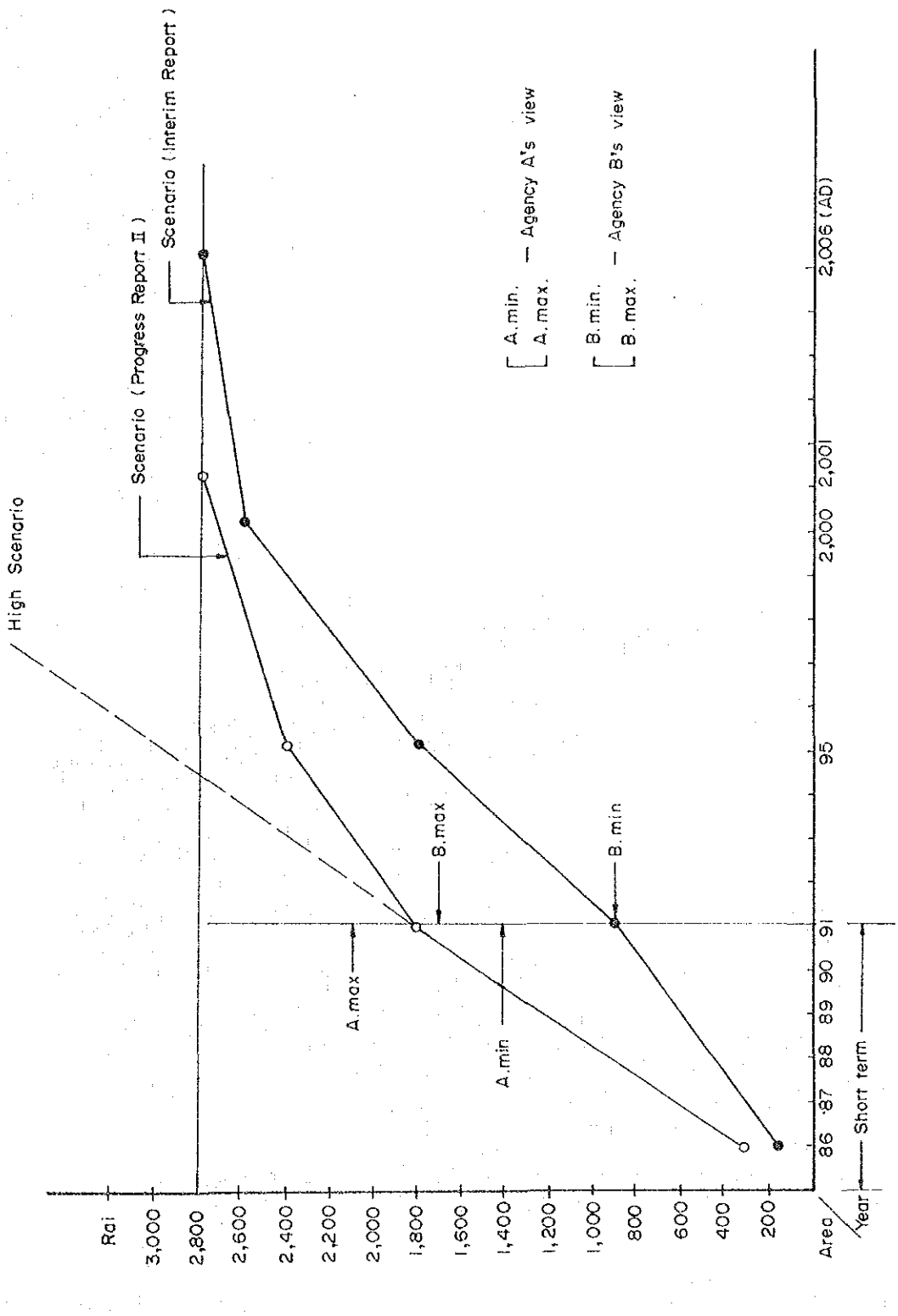
3) To establish a further incentive package if necessary after further studies on strategic types of industries for their location are made. Possible competition with the EPZ's in the other East Asian countries particularly with the China's Special Econimic zones.

4) Early announcement of the container terminal operators and new shipping tariff rates to convince the investors of the advantages and certainty of the Laem Chabang port operation.

5) Preparation of the inventory of the existing and potential labor resources showing quantity and quality that will become available around 1987 onwards.

6) Further study on viability of converting the Utapao airport into a regular international aircargo terminal to attract the multinational high technology industries.

7) In order not to miss opportunity to promote early settlement of the factories in Laem Chabang at pre-development and development stages, consideration should be given to allow those investors requiring small and medium plots for urgent occupancy. The area deemed appropriate to accommodate is the northern portion of GIE under the short term plan and the provisional infrastructures are required to be developed.



LEGEND

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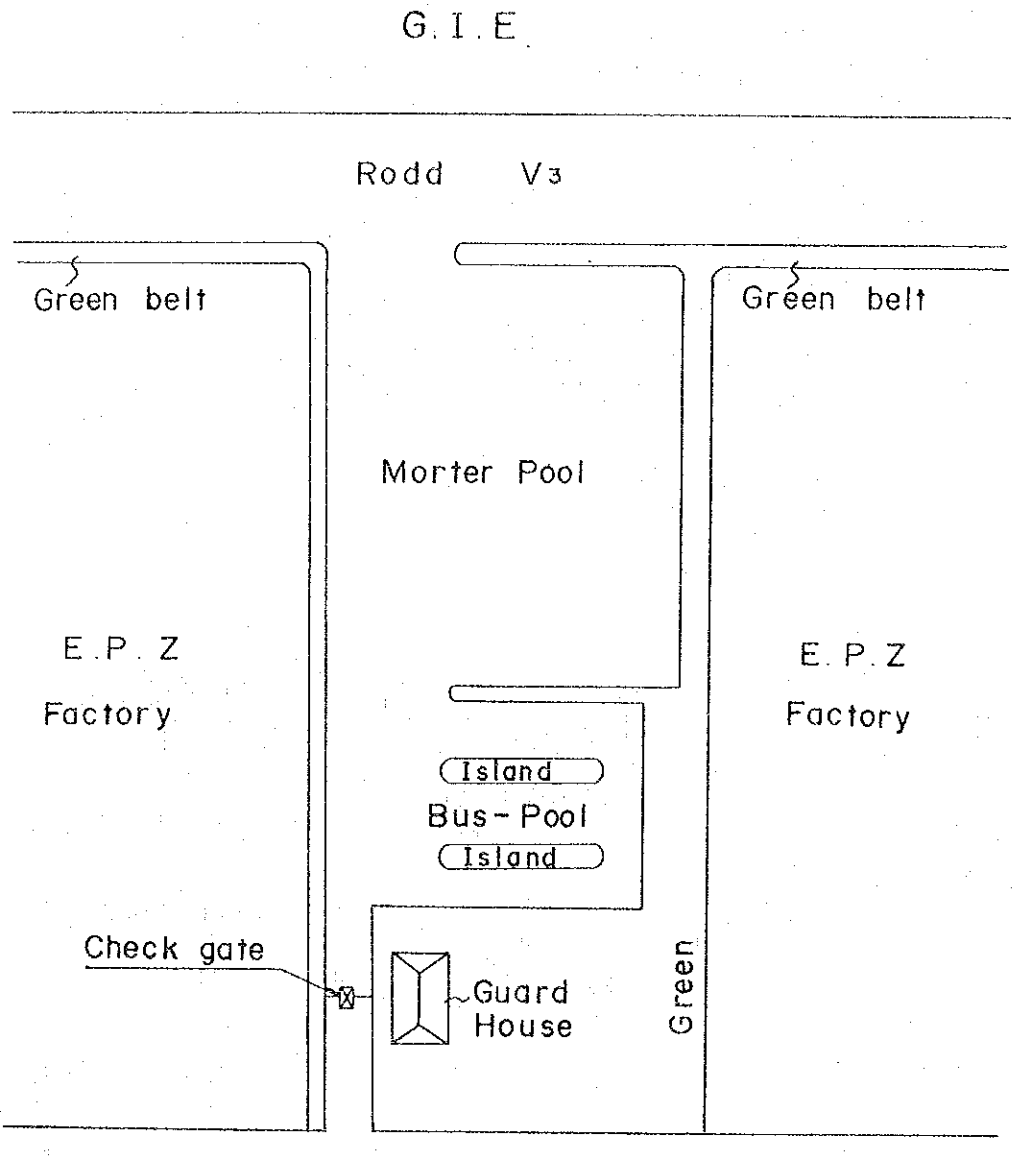
Fig. 4.2.1
Industrial Development Scenarios



LEGEND	KINGDOM OF THAILAND THE STUDY ON THE DEVELOPMENT PROJECT OF LAEM CHABANG COASTAL AREA JAPAN INTERNATIONAL COOPERATION AGENCY Fig. 4.2.2 Layout of Guard House

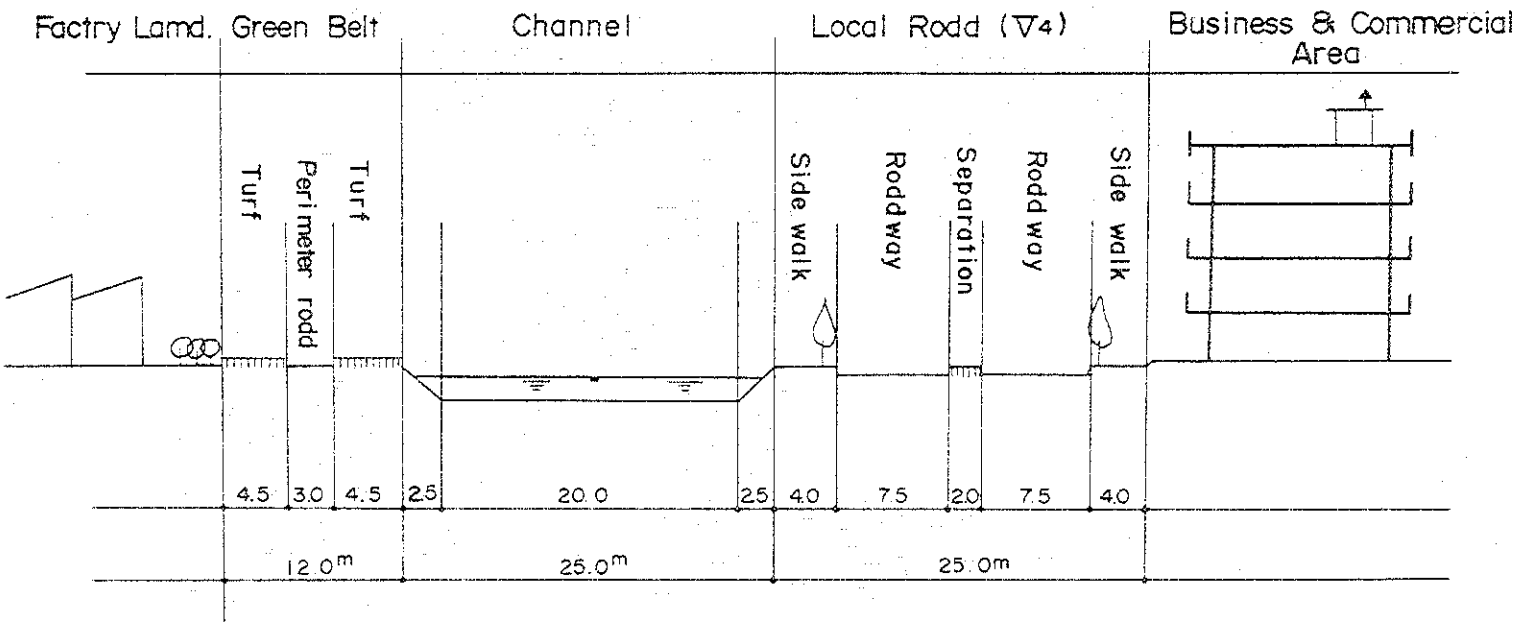


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Fig. 4.2.3
Cross Section (EPZ) Relation to Greenbelt, Channel and V4

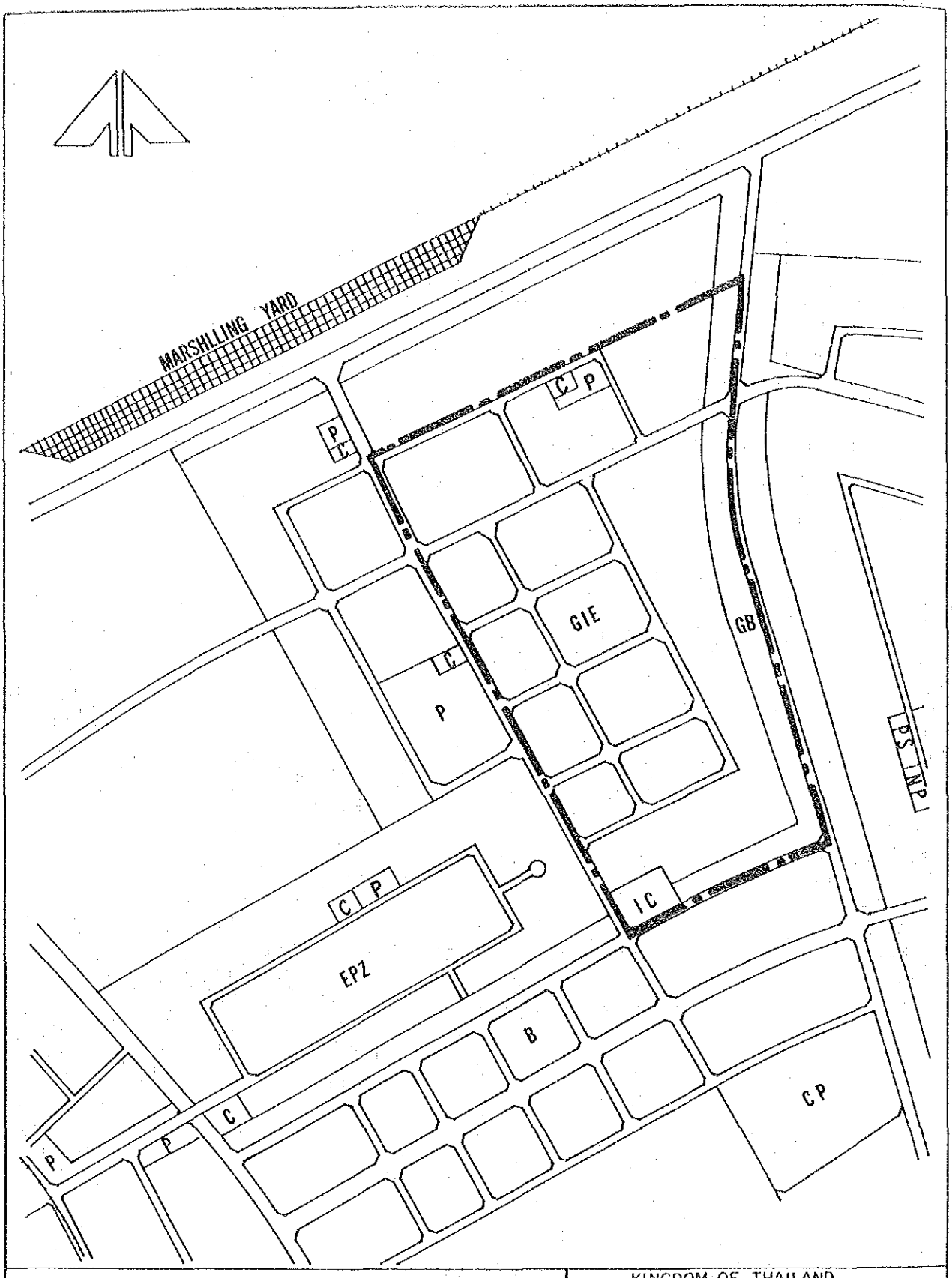

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Fig. 4.2.4
Selected Site for GIE

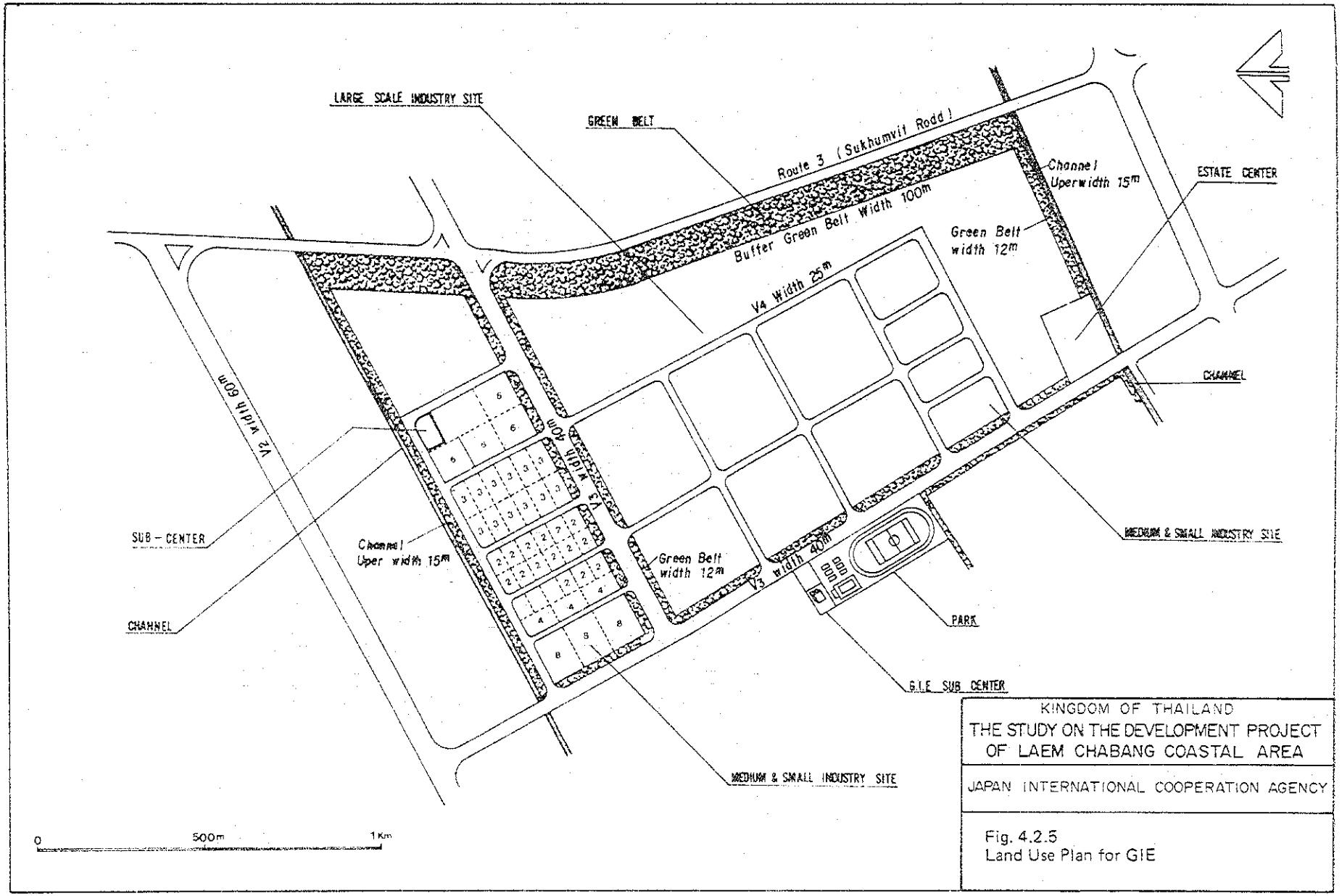

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Fig. 4.2.5
Land Use Plan for GIE

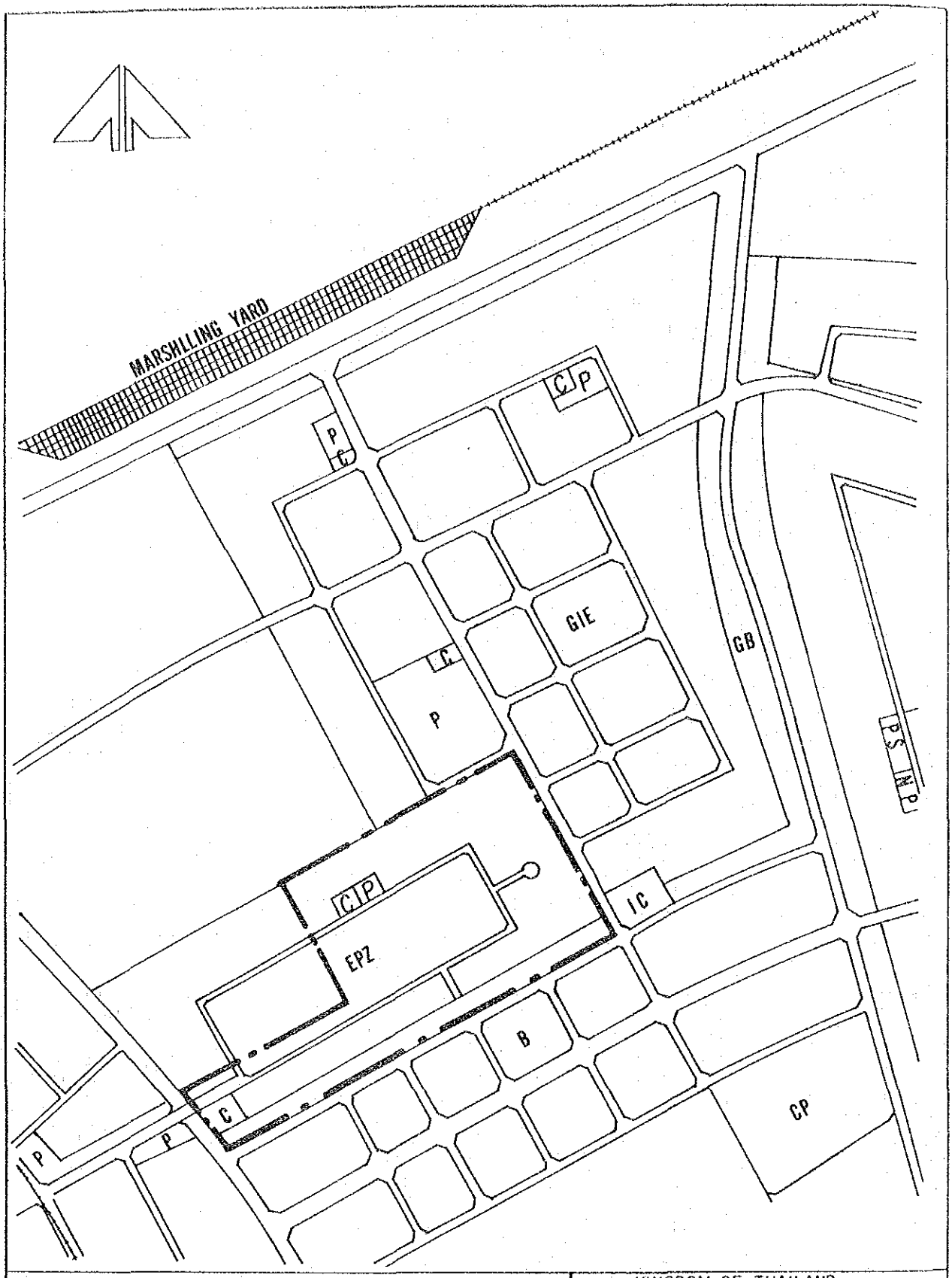

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Fig. 4.2.6
Selected Site for EPZ

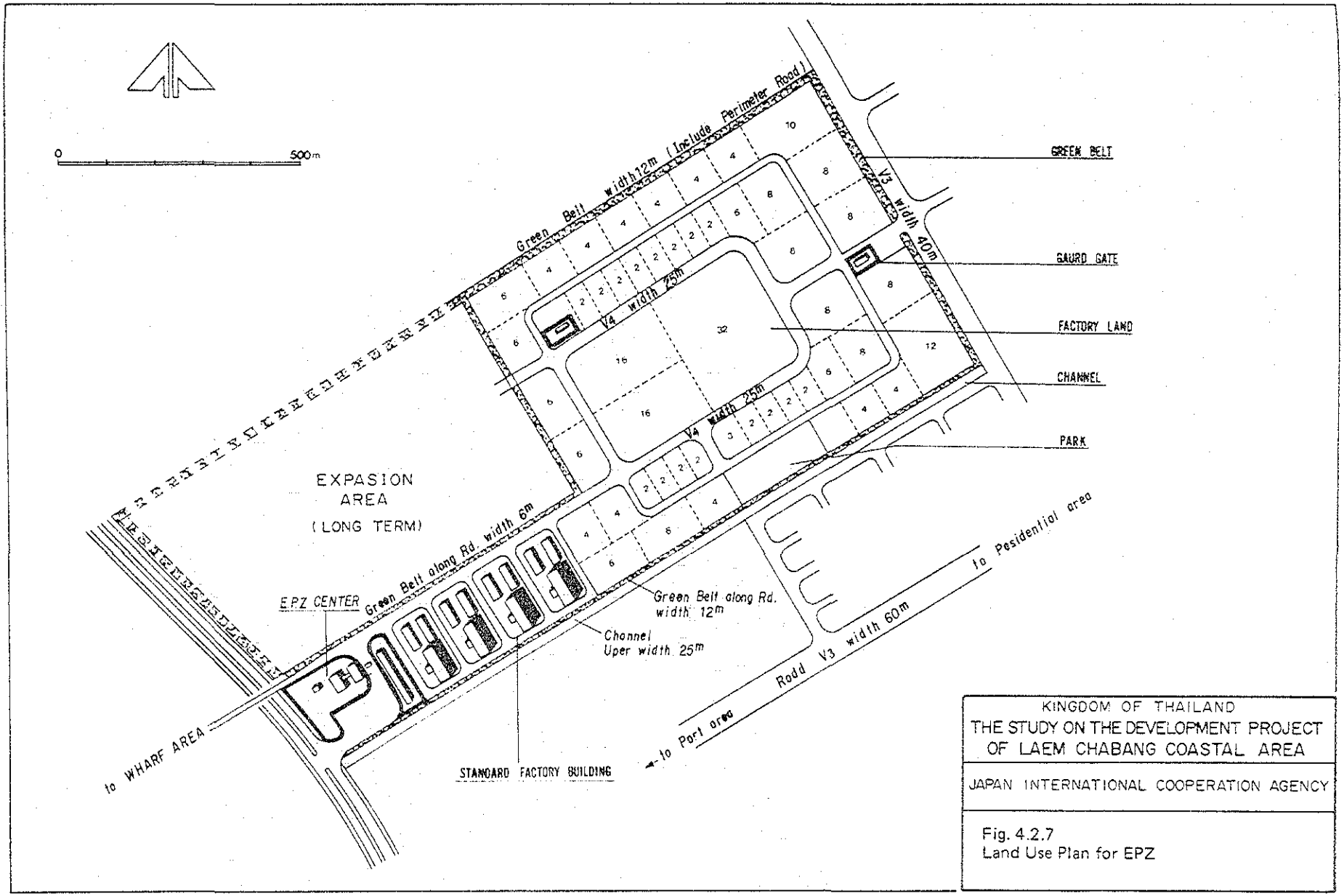

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Fig. 4.2.7
Land Use Plan for EPZ

4.3 Port Development Plan

Following are the key factors necessary for preparing layout plan and design in the short-term development plan.

1) Cargo Volume Forecast

Commodity		Total combined volume for Bangkok and Laem Chabang Ports 1991	Capacity of Bangkok	Potential Demand for Laem Chabang Port 1991
Container	Total	5.3 - 6.3	3.0	2.3 - 3.3
	Import	2.7 - 3.1		(2.8)
	Export	2.6 - 3.2		
Break Bulk	Total	4.7 - 5.0	4.5	0.2 - 0.5
	Import	4.4 - 4.7		(0.4)
	Export	0.3 - 0.3		
Break Bulk	Domestic	0.23		0.23
Tapioca	Export	7.0 - 8.1		4.5
Sugar	Export	2.3 - 3.0	2.2	0.1 - 0.7
				(0.4)
Molasses	Export	0.9 - 1.2	0.9	0 - 0.3
				(0.2)
Total		21.3 - 23.8		7.3 - 9.5
				(8.5)

2) Berth Requirements

Commodity	Traffic Demand (10^6 ton) 1991	Average Load/ Unload per ship	Ship Size	No. of Ship Calls/ Annum 1991	Handling Speed	Berth time (hour/ Ship)	No. of Berth 1991
Container	2.8	500 TEU	33,000DWT (2,000TEU)	564	20 TEU/h x 2	12.5 (15.5 including idle time)	3*
Break Bulk	0.4	3,000t	40,000DWT -15,000DWT	117	-	(-13m) 260mx2B (-10m) 185mx5B	1**
Break Bulk (Domestic)	0.23	-	15,000DWT	-	-		(280m)***
Tapioca	4.5	80,000t	142,000DWT	57	1,000 t/h	80	1
Sugar	0.4	20,000t	25,000DWT	23	1,000 t/h	20	
Molasses	0.2	20,000t	25,000DWT	9	500 t/h	40	1

* 1 TEU=10t. Four gantry cranes are to be installed for three berths. The average throughput is about 1.2 million tons per annum.

** 1,400t per meter per annum based on the throughput at the conventional berths of Kong Toei and others ports.

*** 800t per meter per annum.

/1: ρ = 0.40 (1991; 0.27) (= berth occupancy rate)
/2: ρ = 0.52-0.6
/3: ρ = 0.27-0.35 (1991; 0.1-0.13)

3) Water Front Demand

group	Depth (L.L.W.)	Water Front	Allowable Water Height
. Ship building and repair yard (Possibly private wharves for future factories)	(-5 m minimum) (-11 m desirable)	400 m	2.0 m /1
. Agri-bulk export terminal	(-13 m)	340 m	1.8 m /2
	(-12 m)	225 m	1.2 m
. Container terminal	(-13 m)	900 m	0.75 m /2
. Break bulk terminal	(-13 m)	300 m	0.75 m /2
. Quaywalls for domestic shipping	(-5 m)	280 m	0.3 m
. Basin for auxiliary port ships/3	(-3 - 5 m)	-	0.3 m

/1: The ship building facilities will not require a sheltered area if the wave height is less than 2 m, but the bulk carriers in the agri-bulk terminal are more sensitive to wave action.
/2: NEDECO Study, 1978.
/3: Such as tugs, pilotboats, water and bunker oil supply boats, lift barges and dredgers.

4) Land Requirement

Business/Commercial Area (Gross)	36 ha
Distribution/Storage Area (Net)	60 ha
Wharf Area (Gross)	116 ha

5) Port Layout and Design

On the basis of these key factors for port planning, the short-term port layout plan is prepared as shown in Fig. 4.3.1. Preliminary designs of port facilities are given in detail in the Sectoral Report.

6) Construction Cost Estimate for Short-Term Development

The construction cost for the short-term development is estimated as follows;

Cost Estimate for the Short-Term Development

(Unit: ₱10^6)

Item	Unit	Quantity	Local Portion	Foreign Portion	Total
1. Public Facilities and Wharves	L.S.	1	2,472	2,483	4,955
2. Private Facilities and Wharves			491	502	993
a. Agribulk Wharf	L.S.	1	178	215	393
b. Sugar/Molasses Wharf	L.S.	1	168	166	334
c. Ship Repair Yard	L.S.	1	145	121	266
Total			2,963	2,985	5,948

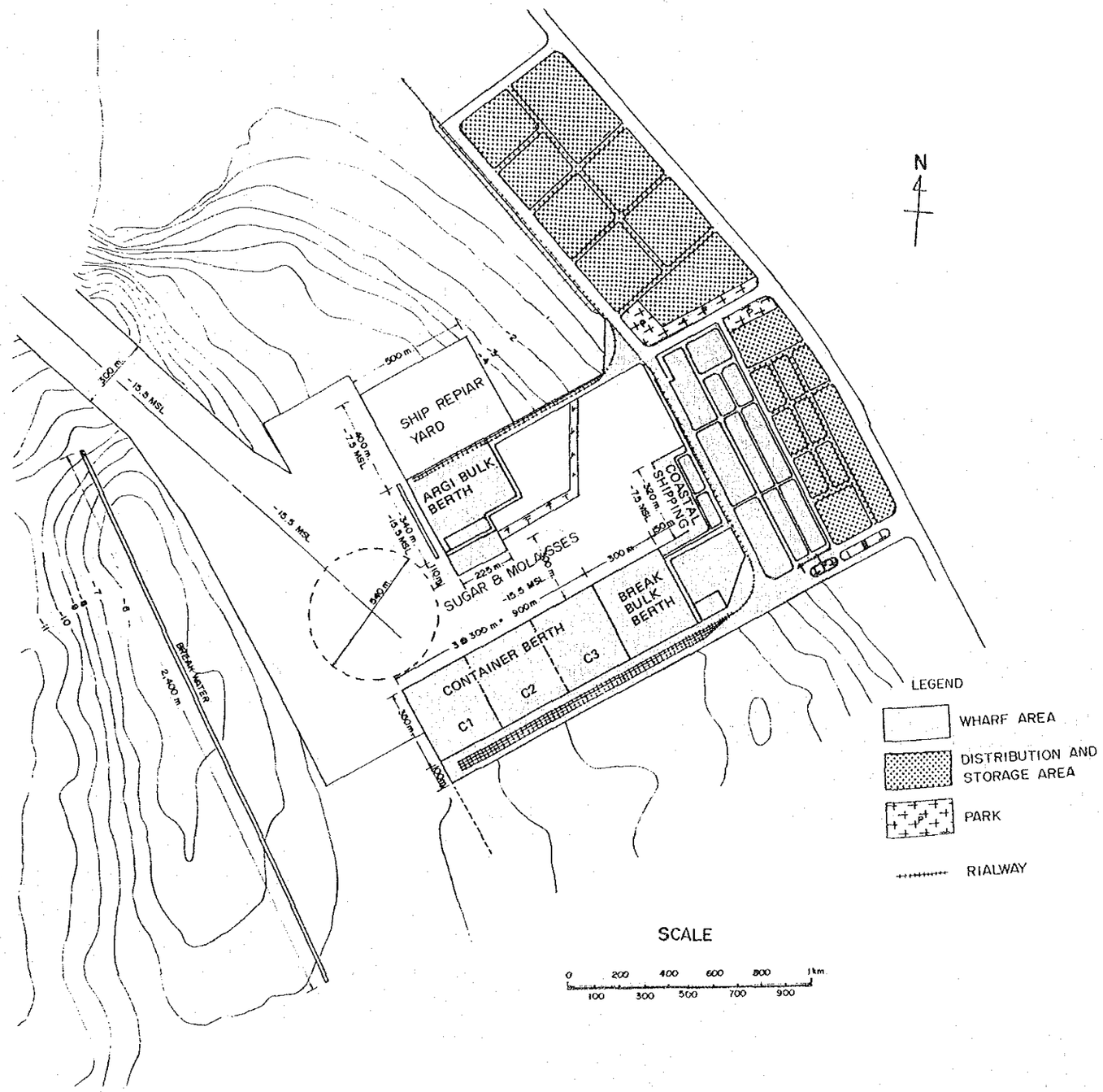

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Fig. 4.3.1
Port Layout Plan for Short-Term Development

4.4 Urban Development Plan

4.4.1 Population Projection

1) Employment Projection

Employment for short term development of Laem Chabang Complex is estimated as below.

(1) Direct Induced: 16,670
(EPZ): (5,430)
(GIE): (4,040)
(Port): (7,200)
(2) Multiplier effect employee: 8,130
Total 24,800

For multplier effect employee, detail is shown in the Sectoral Report. (The multiplier effects of the direct induced employment will not be fully expected in the short period.)

2) New Town Population Projection

Population in new town in calculated according to the procedure summarized in Table 4.4.1 and obtained as below.

Population in new town : 24,000
Population in other area : 8,100
(including business and
commercial area)

Population in the new town for the short term development is forecasted to be 21,400 persons as minimum case and 27,000 persons as maximum case. A planned population 24,000 persons in the new town is calculated as the mean of minimum and maximum numbers.

3) Age and Sex Distribution

(1) Male and Female Distribution of Migrants

Male and Female distribution of migrants is assumed to follow the same pattern as induced employments.

Following assumption was made to figure out the sex distribution of induced employments, as shown Table 4.4.2.

For age sex distribution of migrant population, there is no decent example exactly applicable to Laem Chabang Development Project. Considering that Laem Chabang is located in Changwat Chonburi, age sex distribution of Changwat Chonburi between 1975 and 1980 is basically applied to the new town population in this study with some adjustments required due to particular characteristics of the Laem Chabang development. Adjustments made are summarized as follows.

(i) Sex distribution

	Male	Female
Changwat Chonburi :	58%	42%
New Town :	54%	46%

These percentages for the new town are from male and female distribution of induced employments.

(ii) Male and female distribution of age groups 15-19 and 20-24 is adjusted, because large number of employments in EPZ will be female of these age groups.

The result of calculation is shown as follows.

Age Group	Total	Male (%)	Female (%)
0- 4	1,830	920 (7.1)	910 (8.2)
5- 9	1,930	970 (7.5)	960 (8.7)
10-14	1,890	960 (7.4)	930 (8.4)
15-19	3,540	1,770 (13.7)	1,770 (16.1)
20-24	6,780	4,060 (31.3)	2,720 (24.6)
25-29	2,950	1,530 (11.8)	1,420 (12.9)
30-39	2,700	1,470 (11.3)	1,230 (11.1)
40-49	1,290	720 (5.6)	570 (5.2)
50-59	620	350 (2.7)	270 (2.4)
60 over	470	210 (1.6)	260 (2.4)
Total	24,000 (100%)	12,960 (100) (54%)	11,040 (100) (46%)

4.4.2 Land Use Plan

1) Selection of the Site for the Short Term

The site for the short term development is selected considering following factors.

- Proximity to the short term development area of the port and industry
- Easy access from the route 3
- Suitability of topography for sewerage, drainage and flood control systems
- Avoiding the area of existing settlements (100 to 200 m from route 3)
- Avoiding the district distributor (V3, 40 m R.O.W) road to cut through school district.

Area to be developed in the short-term is proposed to be bounded by the south of the central west-east distributor road, the north of the southern east-west distric distributor road, the west of the north-south distributor road as shown in Fig. 4.1.1.

2) Area Allotmwnt by Land Use for Short Term Development

Area allotmwnt of the new town is planned as shown in Table 4.4.3 and model land use plan is shown in Fig. 4.4.1.

4.4.3 Community Facilities

1) Educational Facilities

The new town with a population of 24,000 is estimated to require one secondary school, two primary schools and eight kindergardens in the year 1991. At the beginning of the short term development, however, less number of schools would be required to be built considering the characteristics of the age structure of inhabitant of the new town. The total number of schools said above must be provided within several years after people start living in the new town. Area required for these schools are as follows.

Item	Kinder-garten	Primary School	Secondary School
No. of schools	7 ~ 8	2	1
Area per one school	0.32	2.5	8.0
Total Area (ha)	2.56	5.0	8.0

According to the population allotment by age, number of pupils and students in the short term development is assumed as follows:

Age	No. of person /1	No. of pupils	No. of pupils/school	No. of schools
4 - 5	752 + 31 /4	783 x 90% /2 = 700	250	3 Kindergarten
6 - 11	2,300 + 96 /4	2,396 x 82.6% /3 = 1,980	2,000 - 2,600	1 Primary School
12 - 17	3,258 + 136 /4	3,394 x 69.5% /3 = 2,360	2,400 - 2,800	1 Secondary School

Note: /1 See age structure in the New Town, 1991

/2 The assumed percentage of kindergarden attendance.

/3 The percentage of school attendance which is based on population of age by school attendance of "Population & Housing Census, 1980, Bangkok Metropolis, NSO".
Primary School is compulsory educational facility, so the capacity of the facility ought to have 2,300 - 2,400 pupils unless private school attendants etc. are expected.

/4 Pupils from the Business and Commercial Area (1,000 population)

For the higher education, the existing technical college in the Sattahip would be utilized after expanding the facilities in accordance with the future increasing demand for higher education, particularly related with industrial activities in the Complex.

A training school and a vocational school are proposed to be established in the business & commercial area for providing technical training related with port and industrial activities.

2) Community Facilities

(1) Neighborhood Center

Two neighborhood units are planned for short term development. One neighborhood unit comprises the following community facilities in the central area of each neighborhood to serve as the neighborhood center.

- Mail box, Telephone booth

- Retail shop and restaurant
  (shophouse: 110 shops x 64 m^2 = 7,040 m^2)

Based on the discussions with NHA, it is considered that a community center will be necessary for two neighborhoods, functioning as a core of the new town in the short term development.

(2) Community Center

The following facilities would be included in a community center. The area required for a community center is about 4.3 ha.

- Shopping center (private, 70 shops x 64 m^2 = 4,480 m^2)
- Health office (1,000 m^2)
- Post office (1,500 m^2)
- Police station (1,000 m^2)
- Municipal office (2,000 m^2)
- Banks (3,000 m^2)
- Service shops (barber, laundry, photographic, gas service, /1
  60 shops x 64 m^2 = 3,840 m^2)
- Restaurant (30 shops x 64 m^2 = 1,920 m^2) /1
- Hospital (private, 30 facilities x 200 m^2 = 6,000 m^2)
- Car park and others (18,260 m^2)

/1: Some parts of the business and commercial functions would be performed by providing more shophouses.

4.4.4 Parks and Open Space

Parks and open space are planned to be provided as follows in the short term development.

Item	Remarks
1) Neighborhood park	2 x 2 ha = 4 ha
2) Play ground	8 x 0.25 = 2 ha
3) District park	no development for short term
4) Play lot (tot lot)	0.04 ha per 40 - 50 dwelling units

No district park is planned in the short term plan. It will be planned in the later phase providing one district park for four neighborhood units.

The buffer area between the Sukhumvit Road (Route 3) and the new town will be provided to decrease noise from the route 3 as well as to avoid compensation for relocation of the inhabitants now residing along the Sukhumvit Road by leaving the area as it is.

4.4.5 Housing Development Plan

1) Procedure to figure out Housing Demand

Housing demand and supply for the short term development has been calculated according to the following procedure.

(1) Total employment to live in new town

(2) Classification of Occupation:

Group A (Unskilled & semi-skilled labor)

Group B (Skilled labor & technician)

Group C (Executives & managers)

(3) Family Types:

Single Family

Married Family

(4) Number of Households

(5) Number of Household by income groups

(6) Housing supply number and type of houses by income group and family type

2) Numbers of Total Employment in New Town

Number of the total employment to live in the new town were calculated by the following procedures. The proportion of employee types which is based on the characteristics of the manpower for each industry is as follows:

The numbers of employees to live in the New Town by work status for the short term development

(unit: persons)

Item	Total	Manager	Skilled Labor	Unskilled Labor
1. Direct Induced Employee				
1) Industrial Estate	5,420	130	407	4,883
	(100)	(2.4)	(7.5)	(90.1)
2) Port	4,120	82	906	3,132
	(100)	(2.0)	(22.0)	(76.0)
2. Multiplier effect	2,580	106	844	1,630
	(100.0)	(4.1)	(32.7)	(63.2)
2. SRI, TORC, ESSO*	480	12	36	432
	(100.0)	(2.4)	(7.5)	(90.1)
Total	12,600	330	2,193	10,077
		(2.6)	(17.4)	(80.1)

* Calculated using the proportion of work status in the industrial estate

Note (1): ( ) indicates percent
(2): Please refer to the Appendix of the Sectoral Report III for the figures for the number of the occupational groups shown in the above table.

3) Classification of Employment by Income level

Various kinds of employment are classified into the following three groups according to their income levels.

Group	Income level (฿/month)	Occupation
A	Low income (Les than 5,000)	Unskilled, Semi-skilled workers: Transportation Equipment operators, Craftmen, Production workers and Laborers Service workers
B	Middle income (5,001 - 9,000)	Skilled workers: Professional, Technical, Clerical and Sales workers
C	High income (More than 9,001)	Executive, Administrative, Managerial staffs and Government officials

Source: 1980, Population & Housing Census by NSO
1981, Labor Force Survey by NSO

4) Household Structure by Type of Family

Proportion of single and married family in Laem Chabang was assumed with reference to the current situation in Bangkok and Central Region as follows.

(Unit: %)

Area	Single	Married
Bangkok	43.5	56.5
Central Region (Municipal Area)	48.4	51.6
Laem Chabang	50.0	50.0

Source: Report of the Labour Force Survey, 1981

5) Types of Housing Units

After discussing with the NHA, the housing types with average plot sizes are classified into the following B to E groups which are corresponding to dweller's income levels.

Group		Types	Average plot size (m^2)
B.	B-1	Row House-1 storey	100
	B-2	Row House-2 storey	100
C.	C-1	Semi-Detached House-1 storey	200
	C-2	Semi-Detached House-2 storey	200
D.	D-1	Detached House-1 storey	300
	D-2	Detached House-2 storey	300
E.	E-1	Shop House-2 storey	64
	E-2	Shop House-3 storey	64

6) Number of Housholds by Gruop, Family Types

Number of Households is as calculated in Table 4.4.4.

7) Income Structure of Households (1991)

Number of households by each income group is presented with housing types for 1991 as below.

Income level (฿/month)	Number of Houses	Type
3,000 - 5,000	1,260 (25%)	a part of Row Houses
5,001 - 9,000	3,363 (65%)	a part of Row Houses and semi Detached Houses
9,000 over	510 (10%)	Detached Houses, Shop Houses and a part of semi Detached Houses and Shop Houses
Total	5,133 (100%)	

Table 4.4.1 PROJECTION OF EMPLOYMENT AND POPULATION IN NEW TOWN FOR SHORT-TERM

	GROWTH OF A. EMPLOYMENT	B. LOCALLY AVAILABLE EMPLOYMENT	ALLOCATION OF EMPLOYMENT	
			NEW TOWN	OTHER AREA
EPZ & GIE	9,470	3,450	5,420 /2	600
PORT	7,200	2,620	4,120 /2	460
MULTIPLIER EFFECT	5,700 (Min.) - 10,530 (Max.) /7	3,840	1,100 - 4,010 /3	760 - 2,680
	(mean = 8,130)		(mean = 2,580)	(mean = 1,720)
SRI, TORC, ESSO	3,000	1,090	480 /4	1,430
TOTAL	25,370 - 30,200 (mean = 27,800)	11,000 /1	11,120 - 14,030 (mean = 12,600)	3,250 - 5,170 (mean = 4,200)
POPULATION			21,400 - 27,000 /5 (mean = 24,000)	6,250 - 10,000 (mean = 8,100)

/1: 7.5% of Labor force in 30 km radius from Laem Chabang

/2: 90% of Migrant Employment = (A - B) x 0.9

/3: 60% - do - x 0.6

/4: 25% - do - x 0.25

/5: $\frac{\text{Population}}{\text{Employment}}$ = 1.92 (by ESS)

/6: For minimum case of multiplier effect, refer to Appendix II-1.

/7: Maximum case of multiplier effect is calculated based on ESS coefficient

Table 4.4.2 MALE AND FEMALE DISTRIBUTION OF INDUCED EMPLOYMENT FOR THE SHORT TERM DEVELOPMENT

Area	No. of Employee			Male		Female	
				%	No.	%	No.
Port	7,200	Wharf & Distribution	3,636	95	3,454	5	182
		Business/1 & Commercial	3,564	52	1,853	48	1,711
EPZ/2	5,430			15	815	85	4,615
GIE	4,040			58	2,343	42	1,697
Multiplier/3	8,120			59	4,791	41	3,329
SRI, TORC, ESSO	3,000			58	1,740	42	1,260
Total	27,790			54	14,996	46	12,794

/1: Based on the sex distribution of economically active population of Commerce; Services and Banks & other Financial Institutions, Insurance and Real Estate. (1980 Population & Housing Census, Changwat Chonburi.)

/2: Based on Lat Krabang EPZ.

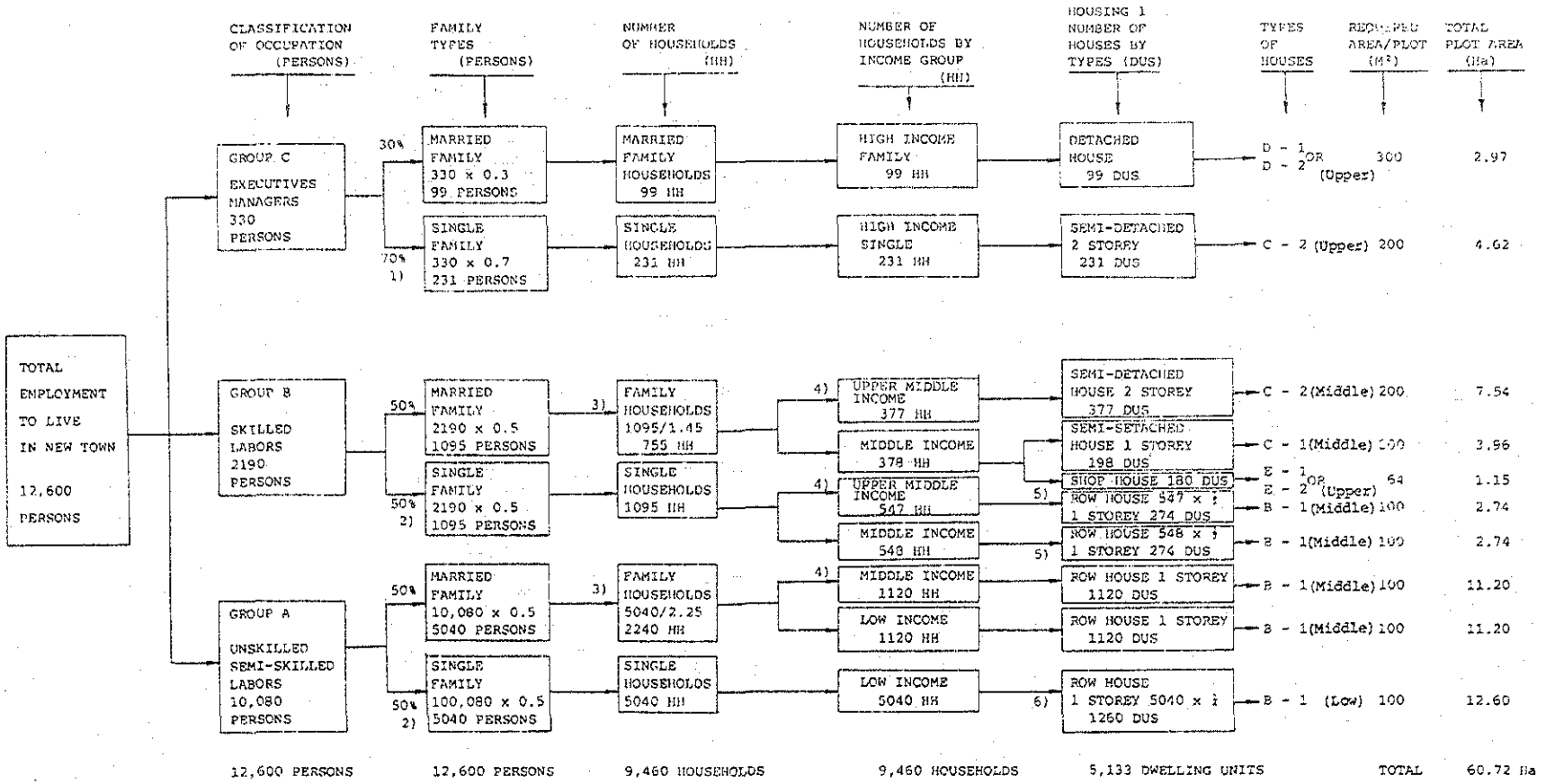
/3: Based on the sex distribution of economically active population of all industry excluding Agriculature, Forestry, Hunting & Fishing; Mining & Quarring and Activities not Adequately Described or Unknown. (1980 Population & Housing Census, Changwat Chonburi.)

Table 4.4.3 LAND USE OF NEW TOWN (SHORT-TERM PLAN)

Item	Area (ha)	(Rai)	Ratio (%)
1. Residential Use (net)	61.0	381	52.9
2. Community Center	4.3	27	3.7
(shop houses)	(2.0)	(13)	
(other community facilities)	(2.3)	(14)	
3. Schools	15.6	97	13.5
Secondary School (8 ha x 1)	(8.0)	(50)	
Primary School (2.5 ha x 2)	(5.0)	(31)	
Kindergarten (0.32 ha x 8)	(2.6)	(16)	
4. Parks	8.8	55	7.6
Neighborhood Park	(4.0)	(25)	
Play Ground (0.25 ha x 8)	(2.0)	(12)	
Play Lot (0.04 ha x 70)	(2.8)	(18)	
5. Roads and Car Parking	25.7	161	22.3
Roads Area /1	(21.7)	(136)	
Car Parking Area	(4.0)	(25)	
Total	115.4	721	100

/1: Area of V_3 road (14.7ha) surrounding new town is not included.

Table 4.4.4 TYPES AND NUMBERS OF HOUSES FOR SHORT-TERM DEVELOPMENT



NOTE) 1) The proportion of married & single for Executives; 30% : 70% was determined by discussion with NHA.

2) 50% : 50% for skilled & unskilled labors by the Report of Labor Force Survey in 1981 by N.S.O.

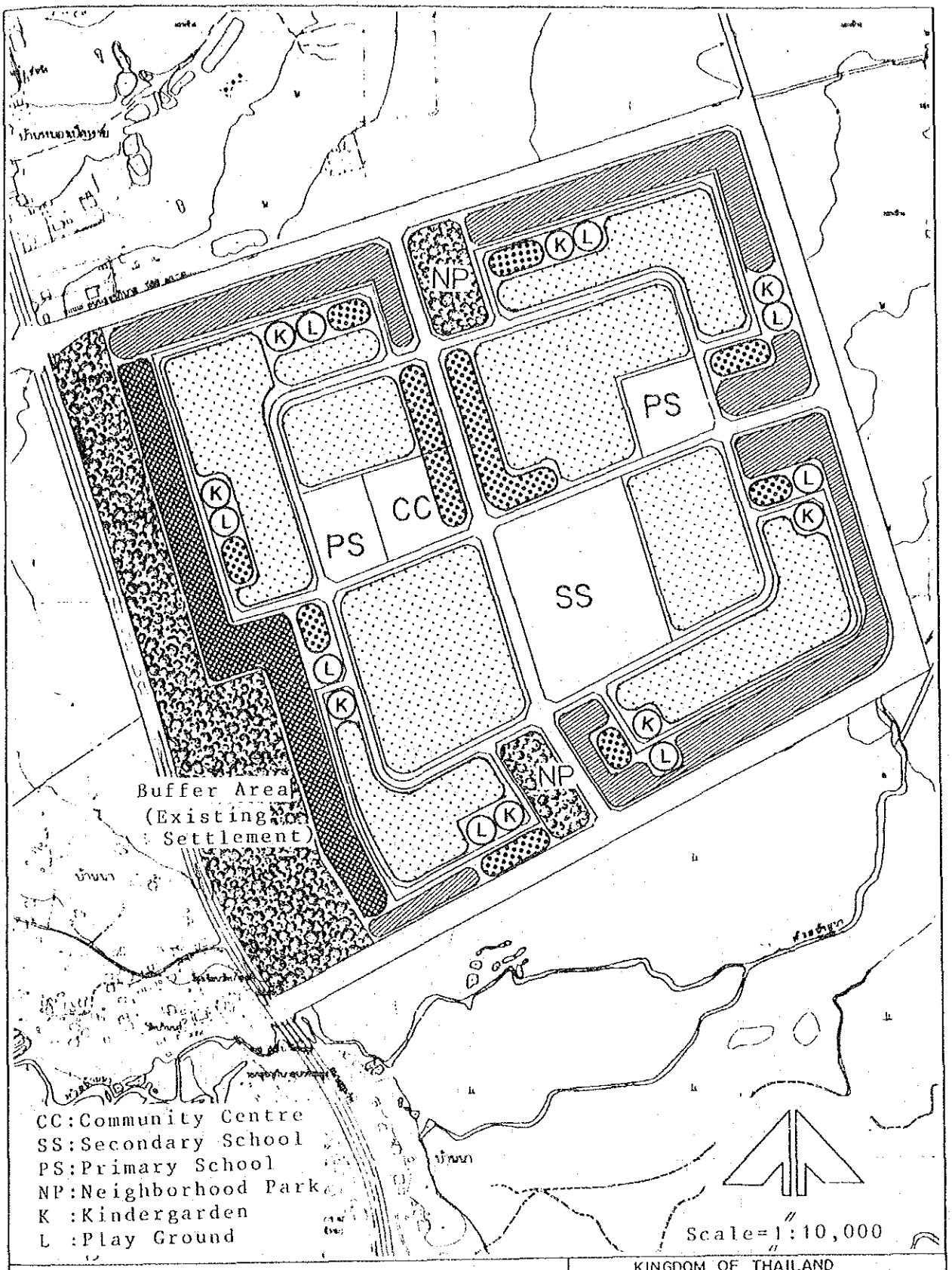
3) Number of earners in a household; 1.45 for skilled, Married family & 2.25 for Unskilled Married familywere determined by discussion with NHA.

4) The proportion of High & Middle or Middle & Low Income family; 50% : 50% was determines by discussion with NHA.

5) 2 people/unit.

6) 4 people/unit were determined by discussion with NHA.

7) Shop House is considered as High Income Housing.



LEGEND

- Row House
- Semi Detached House
- Detached House
- Shop House

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Fig. 4.4.1
Short-Term Residential Development Plan

4.5 Transportation Development Plan

4.5.1 Cargo and Passenger Transport Demand

Cargo transport demand for the short term plan has already been described in Section 3.5. Estimation methods and resulting volume estimates are presented in the Section.

Methods of passenger transport demand projections have been presented in Section 3.5. Table 4.5.1 shows origins and destinations of peak hour passenger traffic flows, and Figure 4.5.1 illustrates peak hour passenger movements in the form of desire line diagram.

Table 4.5.2 shows origins and destinations of morning peak hour vehicle traffic of private vehicles (passenger cars and motorcycles), and public transport (buses). Figure 4.5.2 shows peak hour oneway traffic volumes in PCUs on the short term plan road network in 1991.

4.5.2 Road Planning

1) Traffic Capacity

Traffic capacities of the planned roads were determined on the basis of characteristics of the road, conditions along the road and elements of the road cross-section including the number of lanes. Traffic capacites of the general section and intersection were calculated as shown in Table 4.5.3.

2) Number of Lanes

The number of lanes of each road was examined by a comparison between traffic capacity and forecasted future traffic volume, with due considerations to the possibility of stage construction.

(1) V_3 Road within the New Town

Future traffic volume in year 1991 on this road was forecasted to be about 1270 vehicles per hour (one direction) and the traffic capacity on this road per one lane was estimated to be about 1070 vehicles per hour. Therefore, a 2 lane dual carriageway is required in this stage (short term).

Taking into account the future traffic volume in year 2001, a 2 lane dual carriageway should be able to control the future traffic volume. After in year 2001, traffic volume will exceed the traffic capacity. In this a case, a 3 lane dual carriageway will be required after the year 2001.

(2) V_3 Road within the Business Area

As a result of the traffic projection for the year 1991. A 2 lane dual carriageway was adopted for the short term stage. However, by the year 2001, a 3 lane dual carriageway will be required.

(3) V_2 Inter Urban Primary Road

The future traffic volume in year 1991 on this road was forecasted to be about 500 vehicles per hour. From a view point of traffic volume, a 2 lane road on both direction should be able to accommodate the future traffic volume. But, taking into account the functions and characteristics of the road and traffic flow characteristics, a 2 lane dual carriageway was adopted for this stage.

Considering the land use along the V_2 road in the short term stage, frontage roads are not to be constructed. Frontage roads may be constructed depending upon the progress of industrial development.

The typical road cross-sections for short term development stage are illustrated in Fig. 4.5.3 to 4.5.7.

3) Road Network

The road network configuration for the short term stage development was examined against the development programs of the industrial estate and the port. The road network configuration for the short term is illustrated in Fig. 4.5.8.

4) Intersection Design

Design of intersections were carried out taking into account traffic flow, traffic volume, stage construction and economic considerations. Preliminary plans of main intersections are illustrated in the Sectoral Report IV. Main traffic flows of the main intersection on the existing Route 3 are found in the direction from Chonburi to the industrial and port development area. These intersections are provided with two right turning lanes.

Table 4.5.1 ORIGINS AND DESTINATIONS OF MORNING COMMUTERS
(SHORT-TERM PLAN)

Origin	Destination																			
	1 Port	2 EPZ West	3 EPZ South	4 EPZ East	5 GIE North	6 GIE South	7 Oil & Gas	8 SR IP	9 Commu-nity Center	10 Busi-ness Area	11 New Si Racha	12 Old Si Racha	13 Chonburi	14 Pattaya	15 New Town Block A	16 New Town Block B	17 New Town Block C	18 New Town Block D	19 New Town Block E	Total
10 Business Area	-	-	-	-	-	-	-	-	-	-	-	1,000	-	-	-	-	-	-	-	1,000
11 New Si Racha	223	106	105	105	193	193	75	742	-	599	-	-	-	-	452	-	-	-	-	2,793
12 Old Si Racha	465	220	220	220	402	402	156	1,547	-	1,229	-	-	-	-	944	-	-	-	-	5,805
13 Chonburi	263	125	125	125	228	228	-	-	-	696	-	-	-	-	418	-	-	-	-	2,208
14 Pattaya	265	120	120	120	219	219	-	-	-	668	-	-	-	-	403	-	-	-	-	2,134
15 New Town Block A	1,130	536	536	536	978	978	-	480	-	2,989	-	-	-	-	2,300	-	-	-	-	10,463
16 New Town Block B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17 New Tosl Block C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18 New Town Block D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19 New Town Block E	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	2,336	1,106	1,106	1,106	2,020	2,020	231	2,769	-	7,177	-	-	-	-	4,517	-	-	-	-	24,403

Table 4.5.2 ORIGINS AND DESTINATIONS OF MORNING COMMUTER VEHICLES (SHORT-TERM PLAN)

Origin	Destination																			
	1 Port	2 EPZ West	3 EPZ South	4 EPZ East	5 GIE North	6 GIE South	7 Oil & Gas	8 SR IR	9 Commu-nity Center	10 Busi-ness Area	11 New Si Racha	12 Old Si Racha	13 Chonburi	14 Pattaya	15 New Town Block A	16 New Town Block B	17 New Town Block C	18 New Town Block D	19 New Town Block E	Total
10 Business Area	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11 New Si Racha	32/2	15/1	15/1	15/1	28/2	28/2	11/1	109/7	-	87/6	-	-	-	-	66/5	-	-	-	-	405/28
12 Old Si Racha	67/5	32/2	32/2	32/2	58/4	58/4	23/2	224/15	-	178/12	-	-	-	-	137/9	-	-	-	-	842/58
13 Chonburi	38/3	18/1	18/1	18/1	33/2	33/2	-	-	-	101/7	-	-	-	-	61/4	-	-	-	-	320/22
14 Pattaya	38/3	17/1	17/1	17/1	32/2	32/2	-	-	-	97/7	-	-	-	-	58/4	-	-	-	-	309/21
15 New Town Block A	164/11	78/5	78/5	78/5	142/10	142/10	-	70/5	-	433/30	-	-	-	-	334/23	-	-	-	-	1517/105
16 New Town Block B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17 New Town Block C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18 New Town Block D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19 New Town Block E	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	339/23	160/11	160/11	160/11	293/20	293/20	33/2	402/28	-	896/62	-	-	-	-	655/45	-	-	-	-	3393/234

Note: PCU/Bus Figures in left corner are passenger cars and motorcycles in PCU.
Figures in right corner are number of buses.

Table 4.5.3 TRAFFIC CAPACITY

(V/H)

Road Class		General Section	Inter-section	No. of Lane
Inter Urban Primary	(V_1)	5,200	4,300	4
Intra Urban Primary	(V_2)	5,200	4,300	4
District	(V_3)	4,700	4,300	4
Local Road	(V_4)	1,300	900	2
Collector Road	(V_5)	1,000	900	2
Access Road	(V_6)	700	600	1

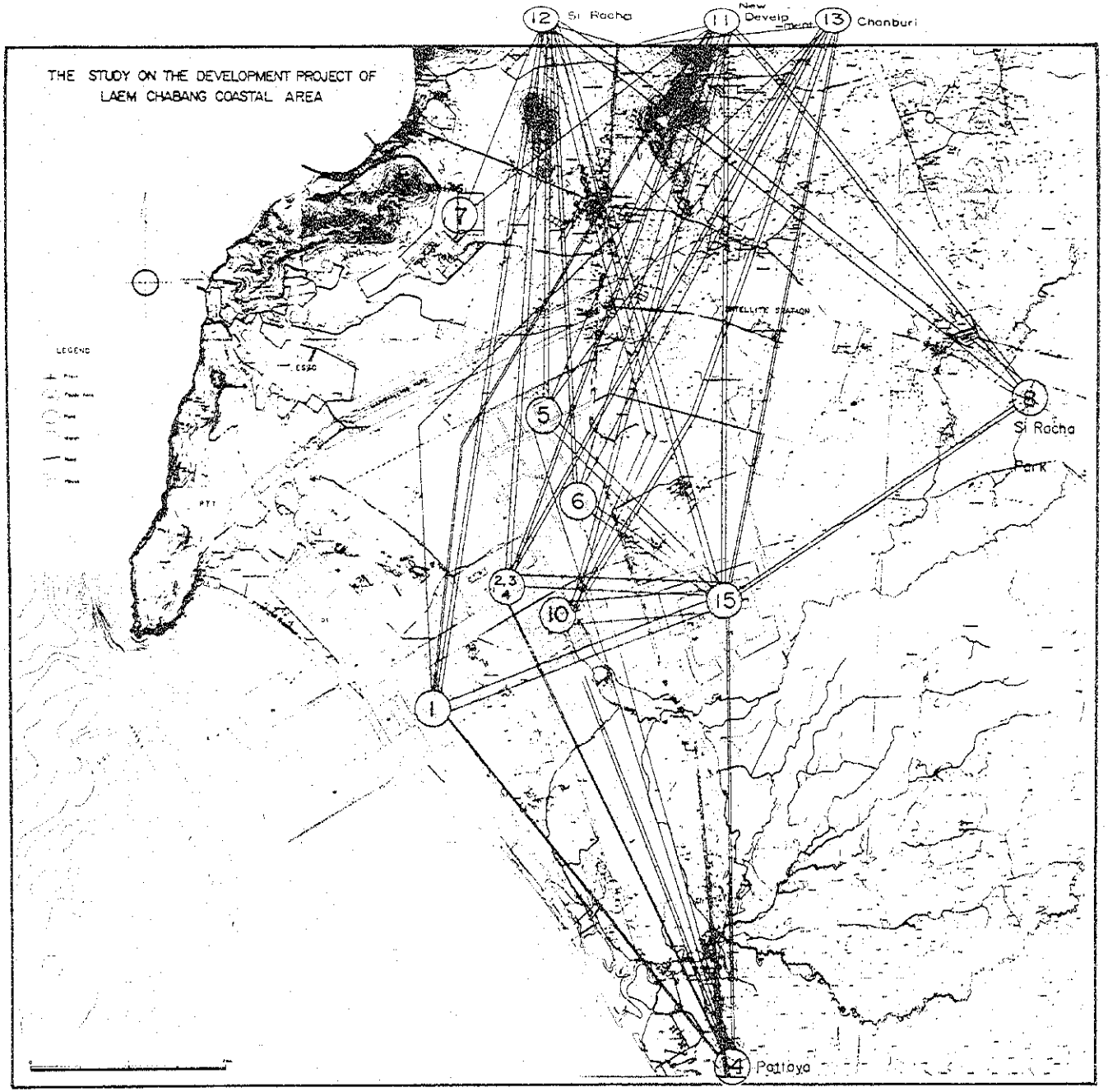

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Fig. 4.5.1
Commuter Flow Desire Line, Year 1991

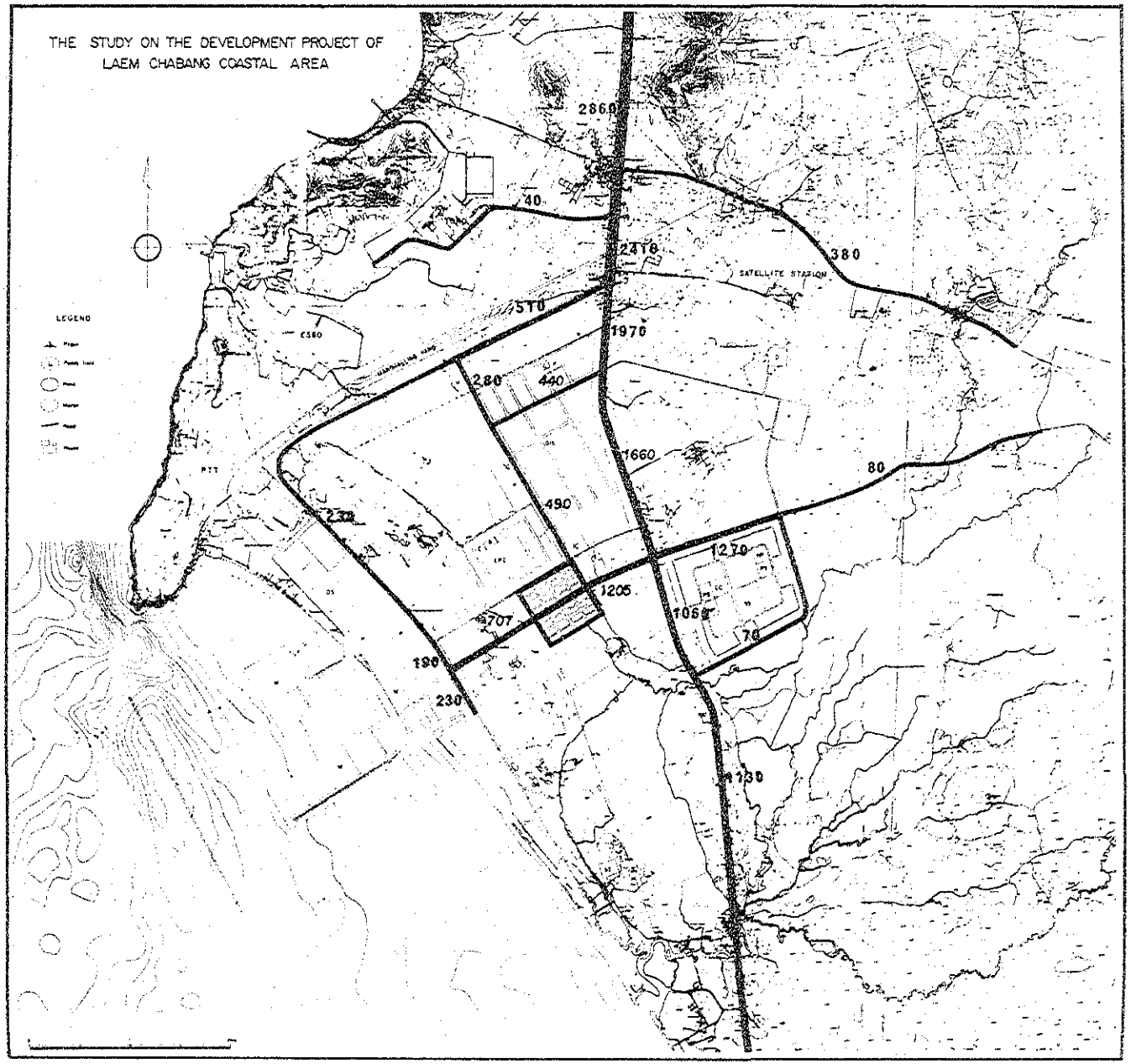

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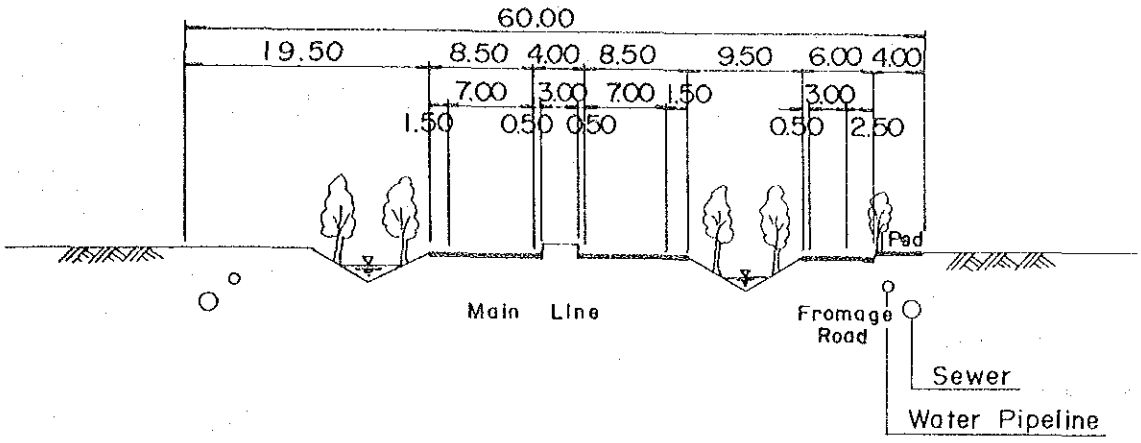
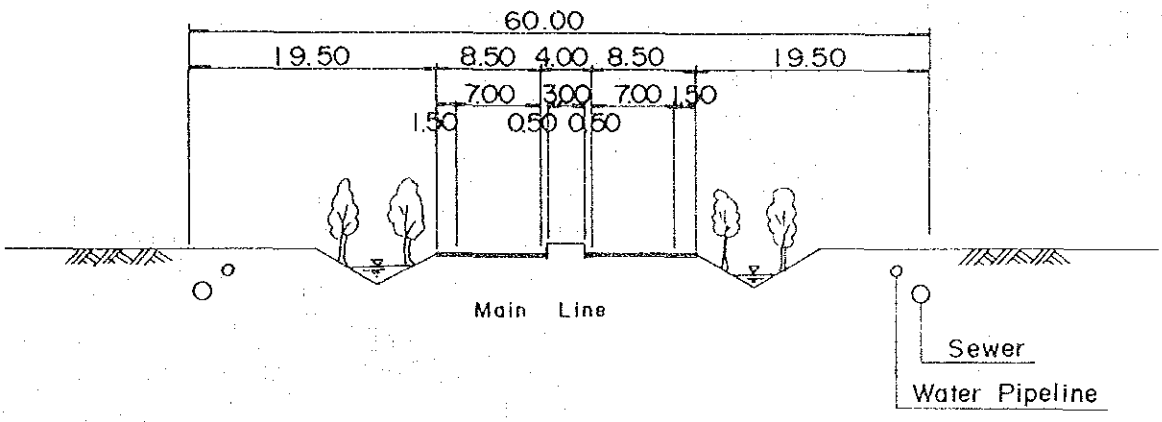
Fig. 4.5.2
Peak Hour Oneway Traffic Flow, Year 1991
(In PCU)

1) Intra Urban Primary Road (∇_{2-1})



2) Intra Urban Primary Road (∇_{2-2})



3) District Distributor (∇_{3-1})

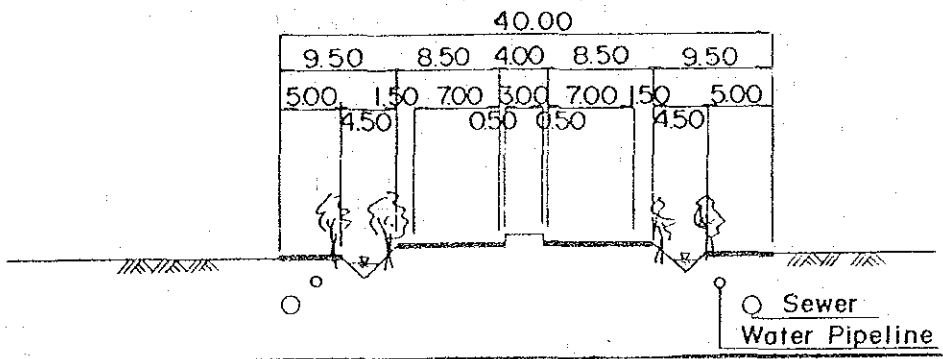


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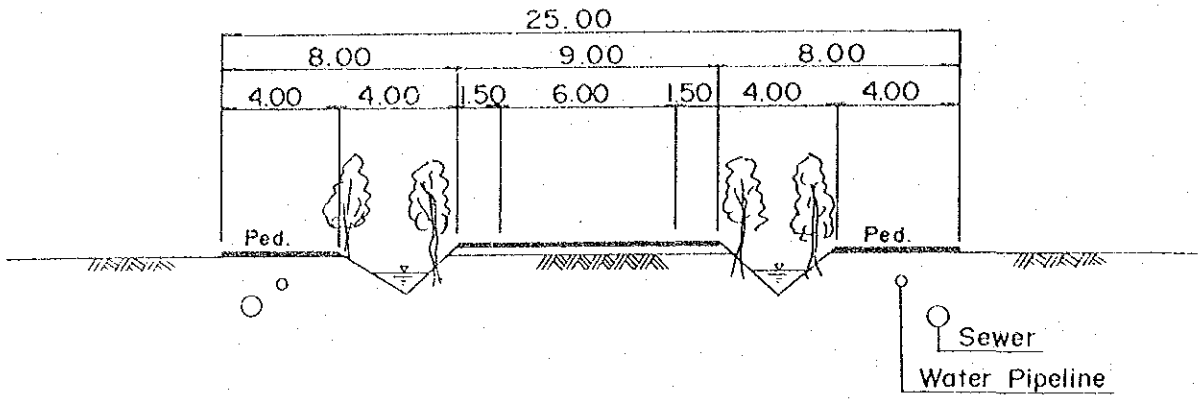
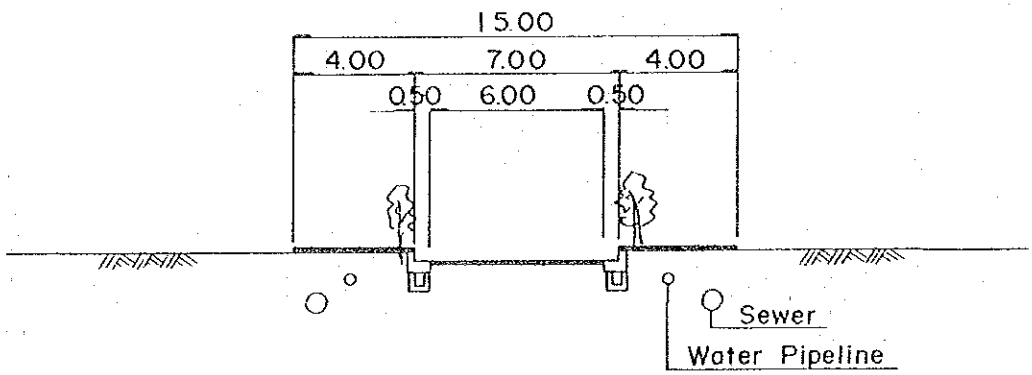
Fig. 4.5.3
Typical Cross-Section (Short-Term)

4) Local Road (∇_{4-1}) (For New Town Area)



5) Collector (∇_{5-1}) (For New Town Area)



6) Access Road (∇_6) (For New Town Area)

(∇_{6-1}) (∇_{6-2})

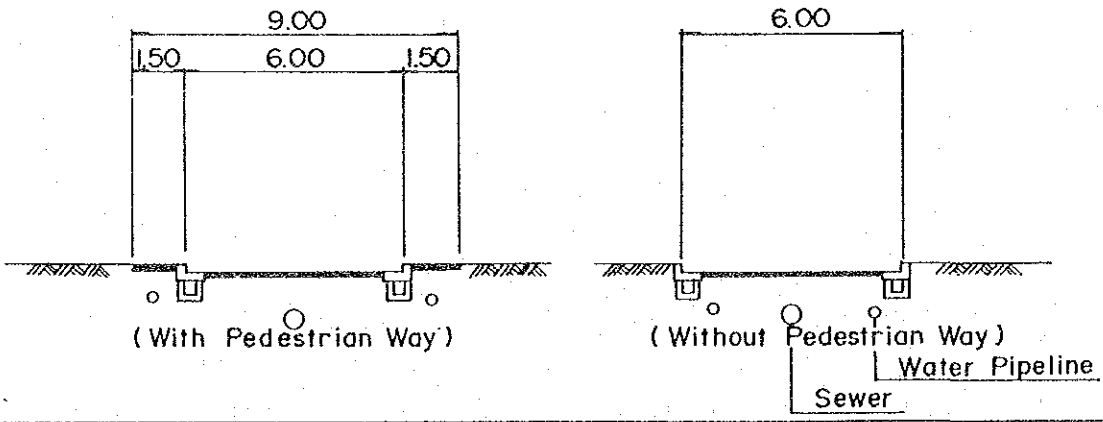


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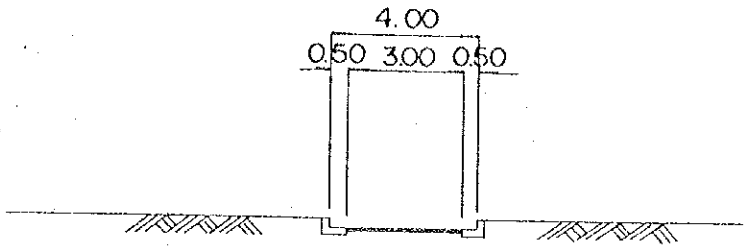
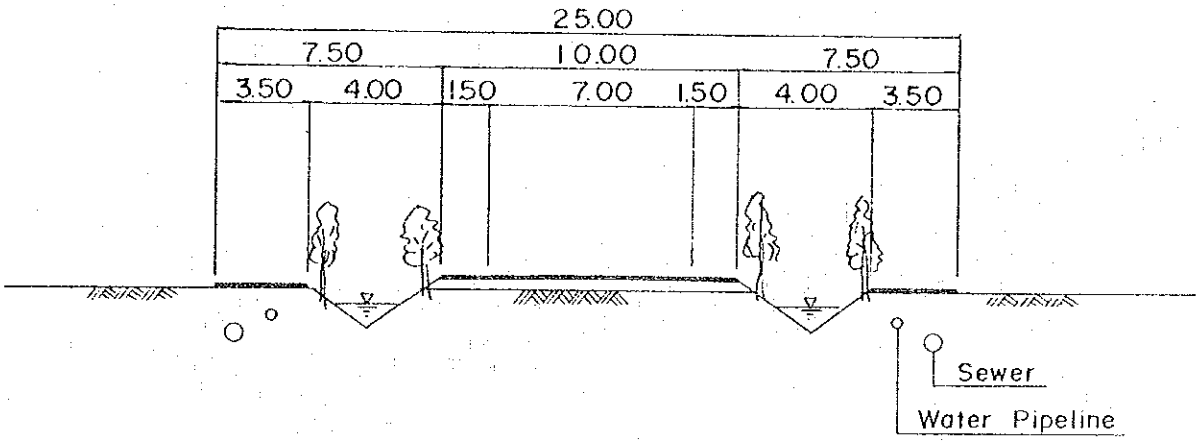
Fig. 4.5.4
Typical Cross-Section (Short-Term)

7) Access Road (V7) (For New Town Area)



8) Local Road (V4) (For Industrial Estate Area)



9) Collector (V5) (For Industrial Estate Area)

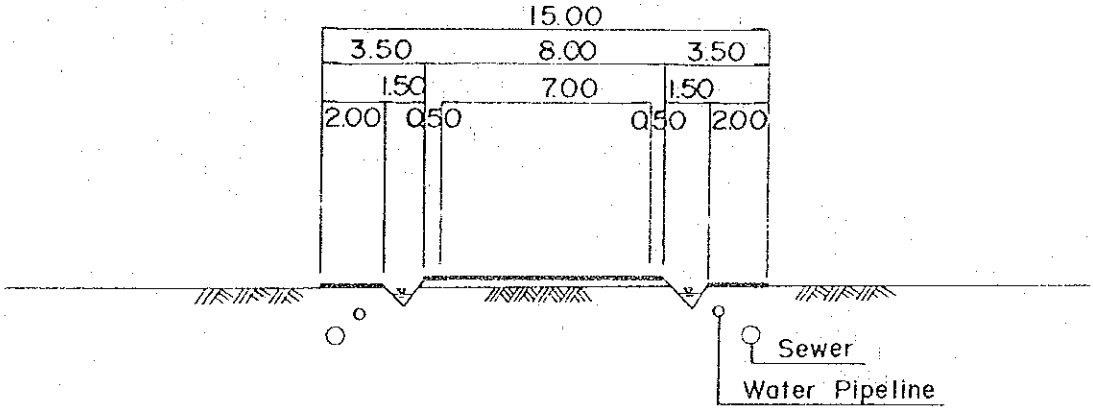


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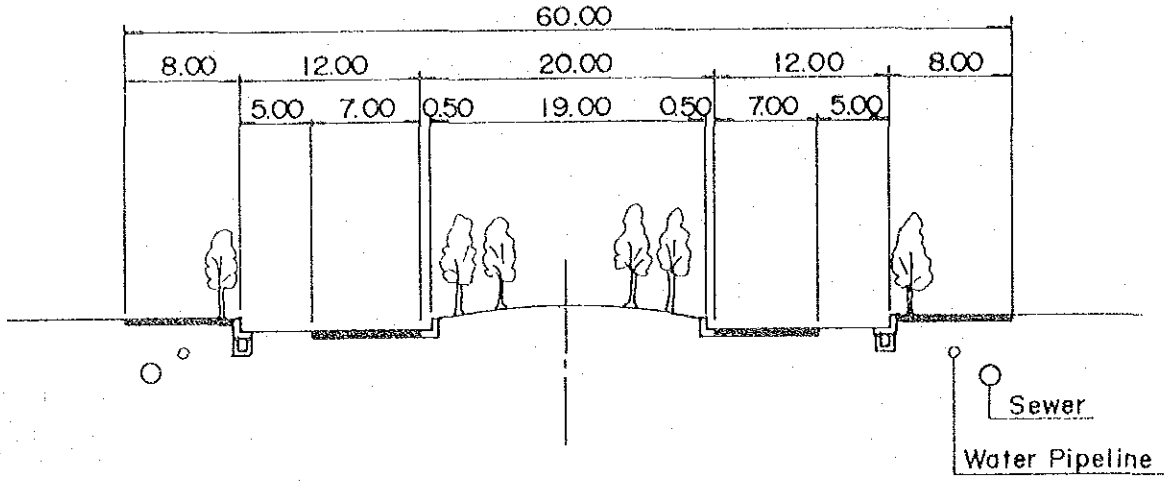
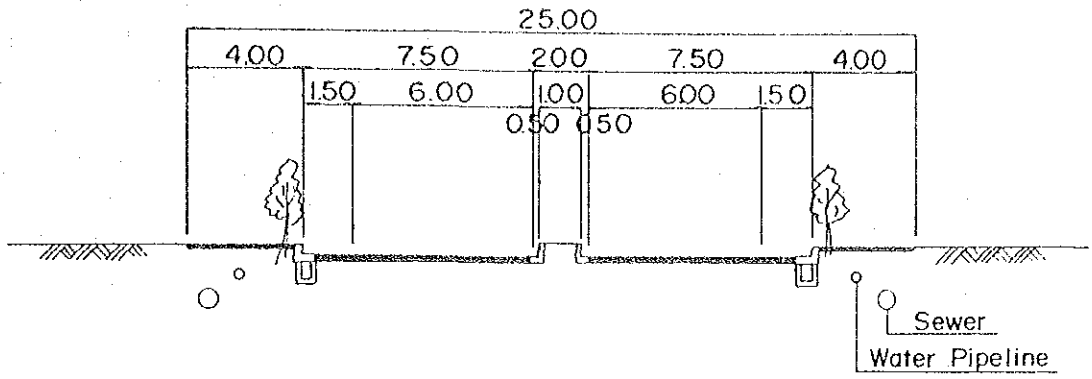
Fig. 4.5.5
Typical Cross-Section (Short Term)

10) District Distributor (∇_{3-2}) (For Business & Commercial Area)

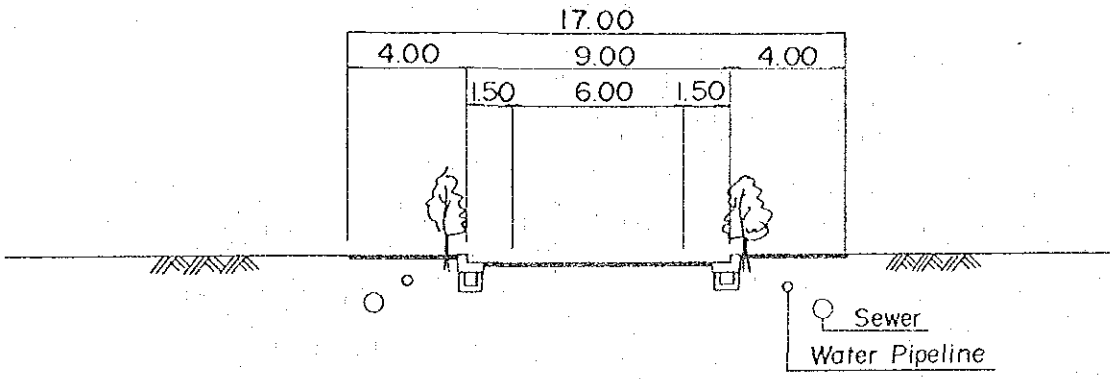


LEGEND	KINGDOM OF THAILAND THE STUDY ON THE DEVELOPMENT PROJECT OF LAEM CHABANG COASTAL AREA JAPAN INTERNATIONAL COOPERATION AGENCY Fig. 4.5.6 Typical Cross-Section (Short Term)

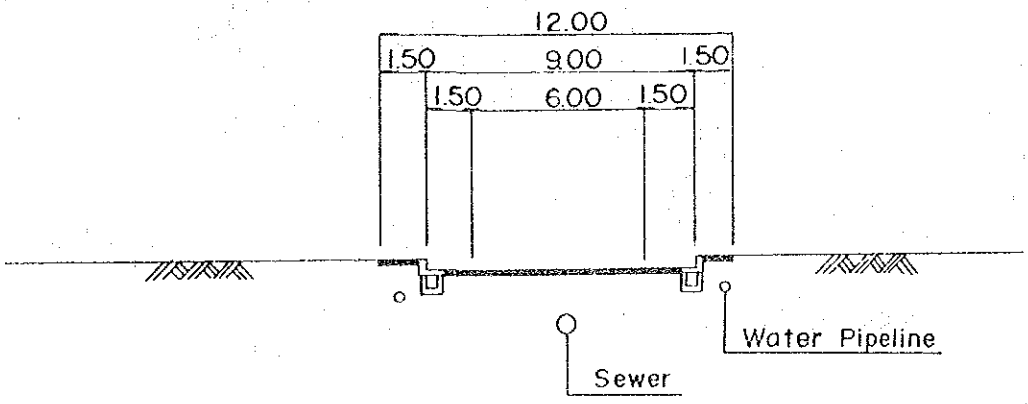
11) Local Road(V_{4-2}) (For Business & Commercial Area)



12) Collector (V_{5-3}) (For Business & Commercial Area)



13) Access Road (V_{6-3}) (For Business & Commercial Area)



LEGEND

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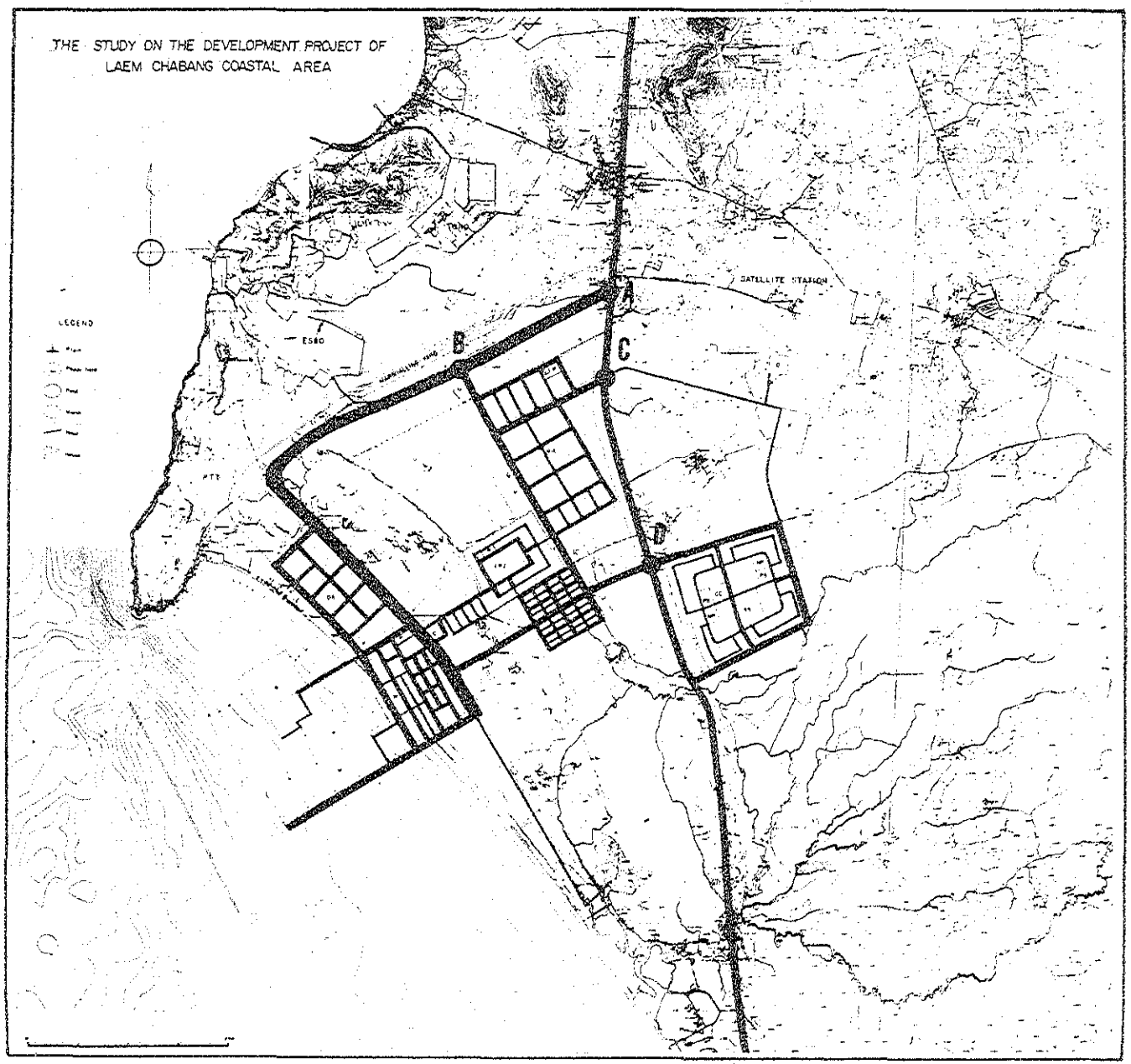
Fig. 4.5.7
Typical Cross-Section (Short Term)



LEGEND

V.2 ROAD

V.3 ROAD

V.4 ROAD

V.5-V.7 ROAD

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Fig. 4.5.8
Road Network Configuration (Short-Term)

4.6 Utility Development Plan

4.6.1 Water Supply

1) Water Demand

The target year shall be 1991. Estimation of the water demand for domestic, industrial, port and business and commercial use with respect to the short-term plan was made. Results are shown in the following table. Detailed computation for each items is described in the Sectoral Report.

Area	Water use	per day (m^3)	per year (x $10^6 m^3$)
	Domestic /1	4800	1.8
Laem Chabang	Industrial /2	23300	7.0
Complex	Business /1	1100	0.4
	Port /1	900	0.3
Others /1	Domestic /1	8200	3.0
Total		38300	12.0

/1: computed as 365 days per year

/2: computed as 300 working days per year

/3: Residencial development area except the Laem Chabang Complex

2) Identification of Pipeline Study

Total water demand in the short-term development plan is estimated to be 12.5 x $10^6 m^3$/year for purified water and 16.2 x $10^6 m^3$/year for raw water, supposing inclusion of unaccounted-for-water of 29% which corresponds to the rate in the long-term plan. According to the pipe-line study, water supply capacity of Nong-Kho reservoir is only 10.2 x $10^6 m^3$/year, therefore deficit of water for 6.0 x $10^6 m^3$/year must be conveyed from Nong Plai-Lai reservoir in the Rayong River Basin.

3) Water Supply Planning

As is described in the long-term plan, Laem Chabang Comprex is devided into high land distribution area and low land distribution area.

The short-term development area is situated in low land distributing area. Project water supply from the distributing basin in the short-term plan is shown in the following table.

(Unit: m^3/d)

	Mean daily	Max daily /1	Max hourly /2
Domestic	4800	6700	10,100
Industrial	23300	32600	48,900
Port	900	1300	2,000
Business	1100	1500	2,300
Total	30100	42100	63,300

/1: Mean daily x 1.4

/2: Daily Max x 1.5

(1) Filtration Plant

Water demand in the short-term plan corresponds to around 40% of water demand of the long-term plan. Filtration plant in the long-term plan consists of 2 sets with 8 systems. Therefore, filtration plant is proposed to be developed with 1 set in the short-term plan. The outline of filtration plant facilities is shown in Table 4.6.1.

4) Water Distribution System

Distribution facilities consist of distribution basin and distribution pipes. Capacity of the distribution basin is planned as 14500 m^3 equivalent to 8 hours volume of daily maximum water supply plus fire flow. Distribution pipes are planned according to the layout and diameter which are studied in the long-term plan. Proposed layout plan for water supply system is shown in Fig. 4.6.1.

4.6.2 Sewerage System

1) Quantity and Quality of Sewage

Project quantity and quality of the sewage in the short-term plan are obtained by the same method as long-term plan. The results are shown in the following table. Detailed computation is summarized in the Sectoral Report.

Sewage quantity (Unit: m^3/d)

Source	Mean Daily	Max Daily	Max Hourly	Ground Water
New Town	4300	6000	9000	1200
EPZ	3400	4800	7200	1000
GIE	17600	24600	36900	4900
Business & Commercial area	1000	1400	2100	300
Wharf	800	1100	1700	200
Total	27100	37900	56900	7600

Sewage quality (Unit: mg/l)

BOD	COD	SS	T-N	T-P
160	100	170	21	2

Note: Value of BOD, COD, SS are 20% higher than the results of computation

2) Sewerage System

(1) Sewers

Selection of cross-sectional measurements is done consequent to the decision of the long-term plan. In case that the system is designed according to the long-term plan, decrease of the velocity in the trunk sewer will be brought due to excessive cross-sectional capacity. However, additional sewer pipes must be constructed in

future when the system is designed only to meet the short-term demand, in order to fulufill large requirement of the rate of discharge. Therefore, from the economical view point, it is recommended to construct sewers with the capacity for long-term plan.

Layout plan for sewerage system for the short-term plan is shown in Fig. 4.6.2.

(2) Sewage Treatment Plant

Oxdation ditch process is proposed as the most suitable treating process in Laem Chabang Complex.

Treatment plant in the long-term plan consists of 10 sets. Four sets out of ten sets shall be constructed in the short-term plan to meet short-term demand. Outline for the treatment plant facilities and flow sheet are shown in Table 4.6.2 and Fig. 4.6.3 respectively.

4.6.3 Drainage System

Following items are indentified in the long-term plan.

(1) In the selection of distribution system, open channel system is prefererable to closed conduit system.

(2) 5 year return period is reasonable for the interval of storm recurrence.

(3) Proposed water elevation of the outlet as well as one at the port shall be M.S.L +1.75m.

(4) If the project is carried out using ground elevation as M.S.L +3.0 m in the project area except housing estate, it will not be affected from the sea water of which level is M.S.L +1.75 m.

However, the bottom gradient of the channels must be designed with the range from 0.2% (1/5000) to 0.5% (1/2000), so that the water velocity in the channel partially comes to approximately 0.5 m/sec.

The short-term plan has thus been formulated in line with these factors clarified in the long-term plan. The layout plan for the sewerage system in the short-term plan is shown in Fig. 4.6.4.

4.6.4 Solid Waste Disposal

A part of reserved area for the future expansion of port could be utilized as the solid waste disposal tip for Laem Chabang Complex for the short-term development.

Solid waste volume during 4 years (1988-1991) would be less than 200,000 m^3 which will need a tip of 10 ha with 2 m depth.

4.6.5 Power

Power demand in the Laem Chabang Complex was assumed at 88.5 MW in 1991.

Power demand of new town, industrial estate and port area are given as below:

Power Demand Area	Power Demand (MW)
New Town	9.1
Industrial Estate	58.6
Port Area	20.8
Total	88.5

As shown above, 66% of total power demand in the Laem Chabang Complex is concentrated in the industrial estate, and the other demand are distributed 24% in the port area and 10% in new town.